



PROCEEDINGS

THE 2ND MEETING OF THE 3RD PHASE OF CHINA COUNCIL FOR INTERNATIONAL COOPERATION ON ENVIRONMENT AND DEVELOPMENT

China Council for International Cooperation on Environment and Development
State Environmental Protection Administration



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Proceedings

The 2nd Meeting of the 3rd Phase of
China Council for International Cooperation on
Environment and Development

(Oct. 30 - Nov. 1, 2003)

China Council for International Cooperation on Environment and Development
State Environmental Protection Administration

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Second Annual General Meeting of CCICED Phase III

Oct. 30 - Nov. 1, 2003

Beijing

AGENDA

1. Opening Ceremony
2. Keynote Speech, Special Guest Speech and General Debate
3. Issues Paper, Policy Recommendations and Discussion
4. Work Report of CCICED and Discussion
5. Report on the Task Forces Co-Chairs' Coordination Meeting
6. Work Reports and Policy Recommendations by Task Forces
7. Discussion on the Themes of Following AGMs and Task Forces to Be Established
8. Discussion and Adoption of the Council's Recommendations to the Chinese Government
9. Meeting with Premier Wen Jiabao
10. Closing Ceremony

Second Annual General Meeting of CCICED Phase III

Schedule

<u>Day One</u>	Oct.30 (Thursday)
Morning	
Section 1	Chaired by Xie Zhenhua
09:00 - 09:40	Opening Ceremony Adoption of Agenda for the Second Meeting of CCICED Phase III Approval of New Executive Vice Chair, Secretary-General, Vice Secretary-General, Council Members and Task Force Co-Chairs Opening remarks by Mr. Xie Zhenhua, Mr. Thibault, Mr. Liu Jiang, Mr. Qu Geping and Mr. Lönnroth
09:40 - 09:55	Keynote speech by Mr. Borge Brende, Minister of Environment, Norway Chair of the United Nations Commission on Sustainable Development (CSD)
09:55 - 10:10	Keynote Speech by Mr. Xi Jinping, Secretary of Zhejiang Committee of Communist Party of China (CPC) (represented by Vice Governor Bayin Chaolu)
10:10 - 10:30	Issues Paper by Lead Experts
10:30 - 10:50	Coffee Break
Section 2	Chaired by Liu Jiang
10:50 - 11:05	Special Guest Speech by Mr. Töpfer, Executive Director of UNEP
11:05 - 11:20	Special Guest Speech by Mr. Zhu Qingsheng, Vice Minister of the Ministry of Public Health
11:20 - 11:35	Special Guest Speech by Mr. Dietmar Nissen, President of East Asia Regional Headquarters, BASF Ltd.
11:35 - 11:50	Special Guest Speech by Mr. Tang Fuping, Vice President of Anshan Iron and Steel Group
11:50 - 12:30	General Debate on <i>Establishment of a Well-off Society and New Sustainable Industrialization Mode</i>
12:30 - 14:00	Lunch

Afternoon

Chaired by Paul Thibault

- 14:00 - 14:30 General Debate on *Establishment of a Well-off Society and New Sustainable Industrialization Mode* (continued)
- 14:30 - 15:30 Discussions on the Council's Recommendations to the Chinese Government
- 15:30 - 15:45 Work Report of CCICED by Mr. Zhu Guangyao, Secretary-General of CCICED
- 15:45 - 16:00 Report on TFs' Co-Chairs Coordination Meeting by Dr. Hanson and Professor Sun Honglie
- 16:00 - 16:20 Coffee Break
- 16:20 - 16:50 Work Report by Co-Chairs of Task Force on Enterprises' Development and Environment
- 16:50 - 17:50 Discussion on Enterprises' Development and Environment and Related Recommendations

Evening

- 19:00 - 20:30 Reception Hosted by the Council Bureau

Day Two

October 31 (Friday)

Morning

- 08:15 Shuttle Bus Departs to the People's Hall
- 09:30 - 10:00 Premier Wen Jiabao Meets with Council Members, Task Force Co-Chairs and International Keynote Speaker
- 12:00 - 14:00 Lunch

Afternoon

Chaired by Qu Geping

- 14:00 - 14:30 Work Report by Co-Chairs of Task Force on Energy Strategies and Technologies
- 14:30 - 15:30 Discussion on Energy Issues and Related Recommendations
- 15:30 - 15:50 Coffee Break
- 15:50 - 16:20 Work Report by Co-Chairs of Task Force on Development of Environmental Protection Industry
- 16:20 - 17:20 Discussion on Development of Environmental Protection Industry and Related Recommendations
- 17:20 - 18:00 Discussions on the Themes of Following AGMs Suggestions and Comments on Task Forces to Be Established

Evening

- 18:30 - 21:00 Banquet Hosted by the Chinese Government

Day Three

November 1 (Saturday)

Morning

Section 1

Chaired by Måns Lönnroth

08:00 - 08:30 Work Report by Co-Chairs of Task Force on Financial Mechanism for Environmental Protection

08:30 - 09:20 Discussion on Financial Mechanism for Environmental Protection and Related Recommendations

09:20 - 10:00 Coffee Break

Section 2

Chaired by Zeng Peiyan

10:00 - 10:30 Work Report by Co-Chairs of Task Force on Strategy and Mechanism Study for Promotion of Circular Economy and Cleaner Production in China

10:30 - 11:00 Discussion on Circular Economy and Cleaner Production and Related Recommendations

11:00 - 11:30 Closing Ceremony

11:00 - 11:15 Closing Remarks by Xie Zhenhua

11:15 - 11:35 Closing Remarks by Vice Premier Zeng Peiyan

11:35 Closing

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Remarks of Leaders

Premier Wen Jiabao's Remarks during His Meeting with Participants of the 2nd Meeting of the 3rd Phase of CCICED

Oct. 31, 2003

I welcome you once again to come to attend the 2nd Meeting of the 3rd Phase of CCICED. During the 12 years of existence of CCICED, international friends from many countries have come to China every year to discuss issues related to China's environment and development. It shows your enthusiasm and concern for China's environment and development. On behalf of the Chinese government, I want to express my sincere thanks to all governments and friends that have supported CCICED. I also look forward to more recommendations by CCICED on China's environment and development.

The Chinese government pays high attention to recommendations of CCICED. These recommendations are very helpful for China to promote economic and social development and environmental protection. Having been tested by the challenges posed by the outbreak of SARS, the new government of China now has a newer and deeper understanding of what China's future development should be like, and has adopted a comprehensive, coordinated, sustainable, and scientific development mode. In summary, a new development mode should coordinate between urban and rural development, among the development of various regions, between economic and social development, between human activities and nature, and between domestic development and opening to the outside world. We stress the importance of coordinating these aspects because we want to solve the problems that are caused by lack of coordination in these aspects. Without such coordination, sustainable development is out of the question. As a large country with a population of 1.3 billion, China must avoid the old growth pattern of "taking treatment measures only after pollution has already occurred". The importance of natural resources like land and water to economic development, and their sustainability, should be fully recognized. A new industrialization mode should be one of resource and energy conservation. Capacity building for environmental protection is very important to China. The change in the water quality of the Three Gorges Reservoir is a general concern. During the construction of the Three Gorges Project, 4 billion yuan was invested in treating water pollution. So far the water quality in the reservoir area has been good.

China encourages the development of small and medium-sized enterprises. These enterprises can

provide a lot of employments. However, they also create serious environmental problems. If insufficient attention is given to them, they can become big polluters. There is a need to regulate their development and establish environmental requirement and standards for them. Solving the problems caused by these enterprises is not easy. We showed our determination by shutting down some small coal mines, small coking plants, and small iron and steel plants, but in the mean time we also need to address the problem of unemployment caused by such measures. Recently, some small enterprises, such as small coal mines, small iron and steel plants, and small cement plants, have reappeared. There are two ways to address this problem. The first one is to strengthen government regulation, especially with respect to market access. The second is to use financial measures, namely, not to approve loans to small and medium-sized enterprises that cause serious pollution or damage to the environment. China has made visible progress in its legal institutions, but not all laws are enforced in the way they should be. Some laws are not enforced well. For example, we still have problems like illegal land use, illegal operation of small coal mines which cause pollution to water sources and the environment. Such activities are forbidden by the law, but they continue to exist despite of repeated injunctions. This indicates that law enforcement is not strict enough, and should be strengthened.

CCICED holds meetings once a year. Council members and experts are invited to go to different places in the country to gain better understanding of China's problems, and make recommendations to the Chinese government. This is a very good approach to helping China solve its environmental problems, and should be continued. It is beneficial to the sustainable development of China's economic and social development that so many foreign friends have been supporting and helping us with development and environment issues. I hope CCICED will become better and better in the future.

Closing Speech at the 2nd Meeting of CCICED Phase III

Zeng Peiyan, Vice Premier

Nov. 1, 2003

In the deep autumn of Beijing, the 2nd Meeting of the 3^d Phase of CCICED is being held. On behalf of the Chinese Government, I would like to extend my greetings to all Council Members, experts and guests for coming to Beijing, and my sincere thanks to all of you for being concerned about and supporting China's environment and development.

A moment ago, the Minister of SEPA Mr. Xie Zhenhua gave a summary of the past two days' meeting. This is a very successful meeting. You have had good discussions of the theme *Establishment of a Well-off Society and a New Sustainable Industrialization Mode*, and made many constructive recommendations. During the meeting, Premier Wen Jiabao met with participants of the meeting and listened to the Recommendations by the Council. The Recommendations that come out of this meeting will be carefully studied and considered in the government's policy making. I am in charge of environmental protection in the current administration of the Chinese Government, and am privileged to serve as the Chairman of this distinguished Council. I would be happy to work with you for new progress in China's pursuit of sustainable development. Now I would like to emphasize three points.

1. Policies should be integrated to promote coordinated development of human and nature

Building a well-off society and promoting socialist modernization is an important choice made by the Chinese Government and people in their efforts to realize a great rejuvenation of their nation in the 21st century. The main objectives of a well-off society are: (1) to achieve economic growth based on optimizing economic structure and improving economic efficiency, and quadruple its GDP between 2000—2020; (2) to further improve socialist democracy and legislation; (3) to improve the overall moral, scientific, and health quality of all China; and (4) to enhance the capacity for sustainable development, so as to improve the ecological environment, raise resource utilization efficiency, foster harmony between human and nature, and promote a new civilized development mode that is characterized by economic development, well-off living standard, and

good ecological environment. The well-off society that we aim to build is one that is economically developed, politically civilized, and culturally prosperous, and is also a sustainable one that is characterized by ecological optimization, environmental soundness, and resource conservation.

In order to realize the goal of a well-off society, we need to grasp opportunities and speed up development. However, China is a big country with 1.3 billion people. Traditional development modes are not good because of limited natural resources, environmental capacity, and ecological carrying capacity. Therefore, the old economic growth mode must be changed to a new industrialization mode characterized by science and technology, economic efficiency, low resource consumption, low environmental pollution, and full utilization of human resources. Such a new industrialization mode requires major effort in promoting the information industry. Better information promotes industrialization, which in turn improves information. In order to promote the upgrading of economic structure, attention must not only be paid to economic growth rate, but also to economic structure, quality, and efficiency. The strategy of revitalizing the country through science and technology should continue to be implemented, and economic development should rely on scientific and technological progress as well as the capacity building of human resources. Science and technology education must not be sacrificed to pursue economic growth rate that is based on outdated knowledge. The strategy of sustainable development should also continue to be implemented. Family planning, energy conservation, environmental protection, and ecological conservation should be actively promoted. Short-term growth must not be sacrificed at the cost of the environment.

As we have entered the new century, China's industrialization has also entered a phase of rapid development. Our guiding principle is that we must integrate environmental considerations into development policies, and promote harmony between human and nature. Public environmental awareness has been promoted visibly; environmental protection has been more effective; green production/products, ecological agriculture, and circular economy have gradually surged up; and ecological conservation is regarded as a key task for economic and social development. Although the implementation of environmental protection policies is not uniformly effective across the country, and environmental pollution and ecological degradation are not being controlled everywhere, it can nevertheless be said that environmental protection has entered the phase of social production and reproduction, and that environment and development are starting to be coordinated. This has laid a good foundation for the integration of environment and development.

2. International cooperation should be promoted to protect global environment

It should be recognized that environmental problems are never isolated. Solving China's environmental problems will be an important contribution to the world's environment and

development. With increasing economic globalization, solutions to environmental problems have become more and more reliant on the rational use of world resources and the dissemination of environmental technologies and management know-how. It has become increasingly important and urgent to promote international cooperation in order to achieve development in all countries. Our view is as follows:

(1) Environmental protection and economic development should be integrated. Economic development mode must be chosen with respect to resource and environmental constraints. Sustainable use of resources and ecological health should become key development objectives. Environmental policies of various countries should be based on their respective local conditions, and should not only take into account the need to improve environmental quality, but also their feasibility and economic and social impact. The modes of sustainable development chosen by different countries, which are based on their own national conditions and development stage, should be respected. On the one hand, coordinated and concerted actions are needed to solve global or regional environmental problems; on the other hand, the various development modes of different countries should be respected. Only in this way can coordinated development of environment, economy, and society be achieved.

(2) The responsibilities of protecting global environment should be shared in a rational way. Currently, the global environmental situation, especially the environmental situation of developing countries, is still worsening. Protecting the global environment and achieving sustainable development across the world requires efforts made by all countries. At the same time, the principle of “common but differentiated responsibilities” should be implemented. Industrialized countries should actively and voluntarily shoulder responsibilities, and play a greater role in solving environmental problems of globe and those faced by developing countries. Developing countries should combine solving environmental problems with improving the quality of economic growth, and promote the integration of environment and development.

(3) Barriers to environmental technology exchange should be eliminated. Sustainable development relies on technological progress. Development of information, biological, and energy technologies is important for the promotion of resource utilization efficiency and environmental protection. As far as developing countries are concerned, technology and management know-how are as important as monetary investment. Governments of various countries and relevant international organizations should play a key role in promoting international cooperation in technology exchange. Intellectual property rights and rational technology transfer mechanisms should be established to promote international dissemination and exchange of relevant technologies.

(4) A good international cooperation environment should be cultivated. In order to expand

international cooperation in environment and development, good international economic and trade order should be established. This requires the concerted efforts of all countries. Developed countries should further open up their market, reduce or even eliminate trade barriers caused by too high environmental standards, and promote the simultaneous development of environmental protection and international trade. Developing countries should strengthen their efforts in environmental protection, improve their capacity for sustainable development, and actively participate in international cooperation and competition.

China is a developing country, and also a responsible country. The Chinese Government has been attaching great importance to environmental protection, and has clear awareness of the environmental problems that accompany economic development. We will base our effort on solving domestic environment and development problems, actively protect and improve the environment, and promote the quality and level of development. At the same time, we would like to join other countries in the world in their efforts in solving global environment and development problems.

3. The role of CCICED should be fully utilized

As a policy advisory organization of the Chinese Government, CCICED has done a great deal of effective work during the past 10 years or so, and played an important role in promoting China's sustainable development. The 3rd Phase of the CCICED coincides with the key period of China's drive to build a well-off society, which is also an important time for China to promote harmonized development between human and nature. I hope that Council Members could continue to join their efforts in order for the Council to play an even more important role. Concerning the future work of the Council, I want to make a few points:

First, the quality of the Council Meeting should be further improved. The Council Meeting is held once a year. A theme is identified for each meeting. In-depth discussions of the theme are held at each meeting, and policy recommendations are made drawing on worldwide expertise and experience. This is a good approach, and should be continued. In the mean time, certain adjustments and improvement may be made on the substance and format of the meeting in light of changing situations, so as to enliven the atmosphere and increase the quality and effectiveness of the meeting. The Secretariat should further increase their capacity and improve their work so as to provide better service for Council Members and further improve organization and coordination for the Council Meeting.

Second, the Council's policy advisory role should be strengthened. The Council's role in giving policy recommendations should be attached high importance, and Council Members' recommendations should become the symbolic achievement of each Council Meeting. Before

each meeting, relevant experts should be organized to carefully prepare for the policy recommendations; and research and exchange should be strengthened for the purpose of making highly targeted and practical recommendations. The worth of good recommendations lies in their succinctness and practicability. In making policy recommendations, attention needs to be paid to the feasibility of their implementation.

Third, in-depth research should be done on key subjects. A key area of work by the Council should be research on key subjects. High attention should be paid to key issues related to the integration of environment and development, such as energy efficiency and resource efficiency, resource recycling system, reduction of the pollution discharge intensity by various industries, environmental protection financing mechanisms, ecological systems management methodology, and development strategy of the environmental service industry. Research on these issues should be organized as soon as possible. Further efforts should be made on key environmental issues such as agriculture, coordinated development of rural economy and environment, urbanization and environment, international trade and environment, protection of water environment, biodiversity and genetic resource conservation, etc. Relevant agencies should promote the dissemination and application of the results of these researches.

The China Council has attracted an outstanding body of Chinese and international experts. You have long been concerned about China's environment and development, and have outstanding research ability. Some reports that have been submitted to the meeting for discussion, such as those on financial mechanisms for environment protection, and the development of environmental industry, etc, have important and practical significance for us. The relevant government agencies and governments should study carefully and put in practice the relevant policy recommendations. We welcome international Council Members to come to China often for research or visit and increase exchange with their Chinese colleagues, and contribute their expertise and experience to China's environment and development.

I am confident that the fruitful result that will be produced by the 3^d Phase of CCICED will make greater contribution to China's sustainable development.

Opening Speech at the 2nd Meeting of CCICED Phase III

Xie Zhenhua, Executive Vice-Chairman

Oct. 30, 2003

It's a great pleasure for us to meet again in Beijing. Please allow me to extend warm welcome and sincere thanks to all Council members and experts.

First, let me brief you on the changes in the Bureau's membership and Council's membership. We are privileged to have his excellency Mr. Zeng Peiyan, Vice Premier of the State Council, as our new Chairman. Vice Premier Zeng has always been highly concerned about issues related to China's environment and development, and has a high opinion of CCICED's achievements in the past. He looks forward to working with us and doing a great job for the Third Phase of CCICED. Vice Premier Zeng will join us and speak at the closing ceremony.

There have also been some changes in the Council's membership, either due to the need of the Council or because some Council members changed their positions within the organizations they represent. Former Council's international executive Vice-Chair Dr. Good has taken the position of the Chairman of Global Environment Facilities and is no longer the President of Canadian International Development Agency. The Canadian Government has recommended that Mr. Thibault become the new international executive Vice-Chairman of the Council, and Chairman Zeng Peiyan has agreed to it. Mr. Wang Guangya (Vice Minister of Foreign Affairs), Mr. Xie Xuren (former Vice-Chairman of the State Economic and Trade Commission), and Mr. Wei Jianguo (Former Vice Minister of Foreign Trade and Economic Cooperation) no longer serve as the Council's Members due to changes in their positions/responsibilities within the Chinese Government. Shen Guofang (Assistant Minister of Foreign Affairs), Yi Xiaozhun (Assistant Minister of Commerce), Shao Ning (Vice-Chairman of the State Asset Management Commission), Zhu Guangyao (Vice Minister of State Environmental Protection Administration), Wang Luolin (Vice President of Chinese Academy of Social Sciences), and Shen Guofang (Vice President of Chinese Academy of Engineering) have been invited to become new Chinese Council Members. Mr. Diabre (Vice Executive Director of the United Nations Development Program), and Ms. Catherine Day (Director General of the Environment Directorate of the European Commission) have been invited to become new international Council Members. Mr.

Zhang Kunmin no longer serves as the Secretary-General of the Council. The Bureau has approved the nomination of Mr. Zhu Guangyao, who is also a new Council Member, as the new Secretary-General. Mr. Xu Qinghua (Director General of the Department of International Cooperation of SEPA) and Mr. Peng Jinxin (Director General of the Department of Policy and Law of SEPA) will serve as Deputy Secretaries General to assist the Secretary-General. In order to prepare for future Council meetings, the Bureau has approved the establishment of some new Task Forces. A list of candidates for the Chairmen of the new Task Forces, which has been proposed by the Lead Experts and the Secretariat, has been circulated before the meeting. These new members to the community of the China Council will add new vitality to our dynamic organization. I am confident that, under the leadership of Chairman Zeng Peiyan and with the concerted effort of everyone concerned, the China Council will play an even more vital role in promoting China's environmental protection and economic development.

Since the last Council Meeting, China has maintained its strong development momentum. In the first half of this year, China's economic development was impacted to some extent by the outbreak of SARS. However, under the correct leadership of the CPP Central Committee and the State Council, the Chinese people are tightly united, and not only achieved a great victory in the battle against the SARS, but also rapid economic growth. During rapid economic growth, strategic structural adjustments to the economy were actively promoted, the quality of economic development was improved, and environmental protection and ecological conservation were strengthened.

Through the fight against the SARS, governments at various levels become more aware of the importance of the coordinated development of economy, society and environment. The central government has increased investment in medical and environmental infrastructure. The National Plan for the Disposal of Hazardous Waste, which includes plans for the disposal of medical wastes, has been approved by the State Council, and various kinds of disposal facilities are being actively constructed. During the outbreak of SARS, certain laws and standards were formulated or improved in a timely manner, and valuable experience was obtained in dealing with public health emergencies and environmental accidents.

During the past year, some new environmental laws and regulations were formulated. Three important laws were put into effect: *The Law on the Promotion of Cleaner Production*, *The Law on Environmental Impact Assessment*, and *The Law on the Prevention and Control of Radioactive Pollution*. *The Law on the Promotion of Cleaner Production* embodies the principle of "prevention first", and requires that prevention measures be taken at pollution sources, and that pollution control be implemented during the whole production process instead of end-of-pipe treatment only. This law has created a legal condition for promoting circular economy in China. *The Law on Environmental Impact Assessment* requires that environmental impact

assessment be conducted for planning and construction projects, and lays a good foundation for implementing comprehensive decision-making that integrates environment and development. *The Law on the Prevention and Control of Radioactive Pollution* sets forth management and safety requirements for the prevention and control of radioactive pollution. The State Council also reformed the pollution fee system. According to the new system, fees are levied according to the total amount of pollution discharged. Enforcement of environmental laws has been further improved. SEPA, NDRC and four other agencies jointly launched a campaign to “crack down on firms that discharge pollution illegally, and safeguard public health”. The names of these firms are publicized on the media for public supervision.

During the past year, environmental concerns related to the country’s key construction projects were given high attention. Four billion yuan were invested to build urban wastewater and garbage treatment facilities in the Three Gorges Reservoir area, and to clean up solid waste in the bottom of the reservoir, so as to ensure the quality of the water in the reservoir. The South-North Water Transfer Project gives even more focus to water conservation, pollution treatment, and ecological conservation. According to the principle that “water transfer is considered only after water conservation measures fall short; pollution must be treated before water can be transferred; and the environment must be protected so as to ensure the safety of water use”, measures were taken to adjust the industrial structure along the water transportation lines, prevent and control pollution, and build environmental facilities so as to ensure that the water being transferred complies with quality standards.

Various levels of local governments actively explored sustainable development patterns that suit local conditions. Hainan, Jilin, Heilongjiang, Fujian, Zhejiang, Shandong and Anhui provinces aim to build themselves into “ecological provinces”. Liaoning Province implemented the principles of circular economy in its social and economic development, and actively explored a development pattern that integrates economy, society and environment. The principles of sustainable development have been increasingly accepted and implemented in practice. Many local governments, firms, schools, or communities have proposed that they build themselves into ecological cities, ecological counties, ecological demonstration zones, environment model cities, environmentally friendly firms, green schools, green communities, or ecological industrial parks. For this meeting, we have invited Zhejiang Province to introduce their efforts in building an ecological province.

The theme of this meeting, which is “establishment of a well-off society and a new sustainable industrialization mode”, is of particular significance. The goal of building a well-off society encompasses economic, political, social, and environmental progress, the achievement of which requires coordinated development and sustainable development. For this goal to be achieved, a scientific development mode, which integrates economic development, social development, and

environmental protection, must be established. China's current development trend is such that economic development is rapid, but the conflict among resources, environment and growth is become increasingly outstanding. Our objective for economic growth is to quadruple the GDP in the first 20 years of the century, and achieve basic industrialization. While maintaining rapid economic growth, we have become increasingly aware that, if we are to follow the traditional extensive economic growth mode of "high input, high consumption, heavy pollution, and low output", then rapidly increasing consumption and pollution will further aggravate the scarce resources and the ecological environment. In order to achieve our objective, we must change our development mode in a fundamental way. Our country has decided to adopt a new industrialization mode, which stresses the role of science and technology, economic efficiency, low resource consumption and environmental pollution, and full utilization of human resources. The transformation from traditional to a new industrialization mode is a key fundamental task for the achievement of a well-off society and sustainable development.

As a high-level advisory organization, the China Council is paying close attention to the key issue of transforming economic development mode and implementing the sustainable development strategy. This meeting will discuss how China should transform its development mode and adopt a new industrialization path, and propose countermeasures and recommendations. This is a significant and challenging task. This year is the first year since the goal of "building up a well-off society" was put forward. Our deliberations and recommendations will have significant impact on the decision-making of the Chinese government. These recommendations will be considered and some will be applied in practice by governments at various levels, and therefore will have direct impact on China's development. I hope that our meeting can utilize this rare opportunity to make valuable recommendations on how China can achieve rapid development, a well-off society, and well-conserved ecology by drawing on the successes and lessons of all countries in the world.

I wish the 2nd Meeting of the 3rd Phase of CCICED a complete success.

Opening Speech at the 2nd Meeting of CCICED Phase III

Paul Thibault, Executive Vice-Chairman

Oct. 30, 2003

I am honored to be appointed to the China Council for International Cooperation on Environment and Development. Although I am a newcomer, I am already aware that this is a unique institution which began as an experiment in the early 1990's and has evolved into a highly successful environmental and development policy forum.

What strikes me most is that the success of this Council is that it has been very responsive to the Chinese priorities and emerging conditions that would have direct implications on environment and development in China.

This year, the China Council has chosen a particularly daunting theme but, after reviewing the excellent work of the Lead Experts and of the Task Forces reporting this year, I am confident that the Council has the potential to again produce policy recommendations which will be of immediate value to the Government of China as it continues its efforts to create a well-off society in a way which does not compromise China's environmental future.

The topics examined by the Task Forces reporting this year, namely the sustainable use of coal, environmental investment, circular economy, sustainable business practices, and the development of environmental protection industries, have been well chosen and no doubt have already generated many additional ideas in the minds of Council Members.

Despite this positive note, I am aware that many experts, both Chinese and international, sense that China is entering a critical period of its development where incorrect growth strategies now could soon lead to irretrievable damage to the environment. I am also aware that there is a debate in China over the extent to which industrial growth should at this time be influenced by environmental considerations. I look forward to hearing the debate on these issues over the next three days.

Fortunately, the Government of China, with the strong support of SEPA, is keenly aware of the environmental challenges now facing China.

Although the challenges are daunting, there is reason for optimism. China has already achieved a great deal in the area of sustainable industrialization which I am sure will become readily apparent when later this morning we hear the presentations from Zhejiang Province and from the Anshan Iron and Steel Group.

These tangible domestic experiences in the area of sustainable industrialization, when combined with the wealth of knowledge of Council Members and Task Force experts on the subject, further strengthens my optimism that this China Council meeting will make a very positive contribution to the Government of China's decision-making in this important area.

Before closing, I would like to congratulate Minister Xie as co-winner of this year's prestigious UNEP Sasakawa Environment Prize. I am sure you all agree that this is well deserved given the leadership he has provided to this Council over the past decade.

Opening Speech at the 2nd Meeting of CCICED Phase III

Liu Jiang, Vice-Chairman

Oct. 30, 2003

Since its establishment in 1992, the China Council for International Cooperation on Environment and Development (CCICED) has been engaged in a significant amount of work with remarkable achievements and played an important consulting role in the promotion of sustainable development in China. In all these past year, the CCICED has adhered to the approach of combing the work of task forces with council meeting discussion and put forward a lot of valuable policy recommendations. Relevant departments of the Chinese Government attach great importance to these policy recommendations, some of which have been studied and adopted promptly.

For instance, the Economic Planning and Environmental Protection project, a joint effort between the former State Development Planning Commission and the European Union, promoted the implementation of the sustainable development principle on all fronts in the Tenth Five-Year National Plan.

The Task Force on Forests and Grasslands in Western China suggested that efforts should be made to strength organization and coordination in ecological construction and improve relevant policies and the efficiency of projects. This policy recommendation is in line with the guideline put forward by the national Development and Reform Commission (NDRC), which reads “to consolidate projects, strengthen coordination, delegate power to a lower level and intensify monitoring and supervision”. Since 1998, the central government, in accordance with *the National Plan for Ecological Construction and Environmental Protection*, has not only increased investment in existing projects of shelter forests building, soil conservation and grassland cultivation, but also launched other key ecological projects, including natural forestry protection, the conversion of cultivated land back into forestry and pasture, controlling the source of sandstorm in Beijing and Tianjin and the restoration of natural pasture. Lack of coordination occurred in the implementation of some of these ecological and environmental projects. In this connection, the central government has strengthened coordination for relevant departments’ annual plans and key projects and intensified project inspection and supervision and performance

verification through the inter-ministry meeting on national ecological construction and environmental protection. Provincial governments have been granted specific responsibilities in terms of investment, tasks and management for ecological projects, and it has improved the initiatives and enthusiasm on the part of local governments and project participants. The NDRC commissioned China International Engineering Consulting Corporation (CIECC) to conduct a midterm review of ecological projects in March this year. The NDRC will adopt measures for further improvement on the basis of the result of the review.

The Task Force on Environmental Economics put forward a recommendation to increase sewage and waste treatment tariff by an appropriate margin and promote industrialization in sewage and waste treatment. This recommendation responds to the progress of our work. In the past years, relevant departments of the central government jointly issued a number of guiding documents on the tariff for urban sewage and waste treatment and its industrialization. When allocating subsidiary treasury bond funds to sewage and waste treatment projects, the NDRC imposes a condition precedent, i.e., sewage and waste treatment tariff has been put in place in the areas where the project in question will be constructed and the project will be managed as a corporate entity.

In addition, the Task Force on Financial Mechanism for Environmental Protection made a policy recommendation on improving the diversified financing for the development of urban environmental infrastructure. This recommendation provides us with good reference for the next step of work.

Since its establishment, the CCICED has played a great role in China's sustainable development and provided China with policy advisory in connection with the reality of sustainable development. With the progress in implementation, China has put in place a policy framework for the implementation of the sustainable development strategy. At the beginning of this year, the State Council approved *China's Program of Action for Sustainable Development in Early 21st Century* and further clarified on priority areas and safeguarding measures. The National Leading Group for the Implementation of the Sustainable Development Strategy will spend one or two years in organizing relevant government departments to study and carry out all these measures one by one. We hope the CCICED will continue its support in this regard. The CCICED should not only ask questions but also cooperate with relevant government departments in search of answers. Representatives from relevant departments of the central government and local governments come to attend CCICED meetings not as guests but as partners voicing needs and seeking cooperation. For instance, in the current phase of the CCICED, relevant departments of the NDRC put forward a suggestion on the establishment of a Task Force on Regional Sustainable Development. Specifically, the suggestion focuses on the case study of regional sustainable development in the ecosphere around Beijing and the traditional industrial bases in

Northeastern China, and it is proposed that the Task Force study and promote concepts and approaches such as coordinated regional development, participatory decision making and scenario planning.

Finally, I sincerely hope that the CCICED can maintain the momentum and attain more achievements under the guidance of Vice Premier Zeng Peiyan.

Opening Speech at the 2nd Meeting of CCICED Phase III

Qu Geping, Vice-Chairman

Oct. 30, 2003

Building a well-off society, which is the grand blueprint for China's modernization in the 21st century, provides the direction where the great Chinese people are heading, and defines China's long-term goals and tasks for the cause of sustainable development.

In order to achieve the goal of a well-off society, we must hold on to the strategy of sustainable development, realize the unity of the speed, structure, quality, and efficiency of economic development, and coordinate economic development with population, resources and the environment.

Experience of the last decade has demonstrated that the strategy of sustainable development fits in well with China's national situations, namely a large population, low per capita resources, and a fragile ecological environment. China's rapid economic development is to a certain extent a reflection of the effect of the sustainable development strategy. Experience also shows that protecting the environment requires the participation of the government, the private sector, and the public. They are the three key players in the implementation of the sustainable development strategy. Therefore, we need to establish and improve our social and economic mechanisms, especially an integrated decision-making mechanism, a market mechanism, and a public participation mechanism, so as to ensure that the three key players could actively and effectively play their due roles.

How should we integrate decision-making mechanism, market mechanism, and public participation mechanism be established and improved?

Firstly, *the Law on Environmental Impact Assessment* should be enforced more vigorously, so as to accelerate the establishment of an integrated decision making mechanism for sustainable development.

The source of many serious environmental and resource problems during China's modernization

process is that the government didn't take environment and resource considerations into full consideration in formulating/implementing economic and social policies/ plans. *The Law of the People's Republic of China on Environmental Impact Assessment (EIA)*, which was put into effect in September this year, will play a significant role in promoting the implementation of the sustainable development strategy and integrated decision-making by government agencies. It requires the government to take environmental and resource conservation considerations into full consideration during their planning or decision making process, with a view to helping prevent environmental pollution and ecological degradation. This law provides a very important legal basis for the realization of the sustainable development goals required by a well-off society. Government agencies at various levels should fulfill their obligations and responsibilities to conduct EIA for their planning according to the law. For that purpose, they need to adjust their planning methodology and process, design new EIA techniques and methods; and, based on the results of EIA, make planning more in line with the requirements of environmental and resource protection. This will help governments at various levels establish integrated decision making mechanism for sustainable development.

Secondly, a market mechanism for sustainable development, which is in line with the requirements of market economy and provides incentives for participation by the private sector, should be established to meet the needs of the reform and the social market economy.

Application of economic incentives should be promoted for environmental and resource protection. A market participation mechanism, which serves the interests of all stakeholders including non-governmental enterprises, should be established gradually. The role of market should be brought into full play for environmental and resource protection. During their pollution control and ecological conservation efforts, governments at various levels should adopt policies to gradually establish a mechanism characterized by pluralistic investment patterns, market operations and business-style management. A new model should be established to integrate the roles of the government to support, serve and supervise with the market, namely, "the government supervises, the polluters pay, and the enterprises operate." In support of such a model, appropriate financing mechanisms, pricing mechanisms, compensation mechanisms, and taxation mechanism for environmental and resource protection should also be established. Economic instruments should be utilized to provide incentives for the private sector to participate in environment and resource protection, so as to make the business management model more effective and promote the development of environment and resource industries.

Thirdly, public awareness of sustainable development should be promoted, and the establishment of a public participation mechanism should be accelerated.

It is an important trend for sustainable development that the public should participate in

environment and resource protection more extensively and vigorously so as to promote solutions to environmental and resource problems. The media and public education & training should be utilized consistently to promote public awareness of sustainable development and environmental & resource protection. It is desirable that the public have high awareness of environmental protection and resource conservation in their daily lives, and have “green” life styles, consumption habits, and values. The rights of the public for information, participation and supervision granted by China’s Constitution and laws should be safeguarded. A public participation mechanism, which includes public appealing, letters-of-complaints system, public hearing, public participation in EIA, media supervision, and public participation in the supervision of law enforcement, should be established and promoted. Such a mechanism should be able to encourage, guide and support public participation. The public should become an active force to protect the environment and resources through this mechanism.

Opening Speech at the 2nd Meeting of CCICED Phase III

Må ns Lö nnroth, Vice-Chairman

Oct. 30, 2003

First, let me thank the secretariat for the very successful organisation of this year's side visit. I have now made four side visits out of the five years that I have been a member of the council. These side visits are very interesting, enlightening and rewarding. I recommend all foreign members to participate in these side visits.

I will make three quick points.

First, 8% growth rate year after year, decade after decade, is a truly astounding achievement. It translates into two China's in 2010 compared to the year 2000 and four China's in 2020 compared to 2000.

But this is not all. The US investment banking company Goldman Sachs recently published a report on the BRIC's: Brazil, Russia, India and China. Based on economic and demographic data, the company estimates that China's GDP will overtake Germany's around 2010 and that of Japan's around 2015.

But China is not alone. Goldman Sachs estimates that India's GDP will overtake Germany's in some twenty years.

Now, Germany, France, the European Union, my own country, Japan and the US can hardly be said to be on a path of sustainable development. This puts great pressures on all of us, from all countries, to move towards a less and less unsustainable path towards a more and more sustainable path.

Second, the implication of the 8% growth rate for China.

This is a very rapid rate of growth. It is like riding a tiger. It leaves one with precious little time to think.

Moreover, each sector tends to develop in its own way. Each sector is a tiger of its own, running in its own direction.

There is an urgent need for coordination and integration in order to avoid to get locked into unsustainable paths of development both in terms of the environment and in social terms, maintaining a more or less permanent underclass.

Let me just mention two issues that are key to avoiding being locked up

- ❖ Transport. Only a low price, high quality public transportation system will give low income people access to a large enough labour market.
- ❖ Social security. I will come back to this.

The Chinese government has published a report that I urge all foreign members of the Council to study carefully: Program of action for sustainable development in China in the early 21st century.

It is a very thoughtful report, which stresses all three dimensions. Let me just take out one sentence of this report: “Social security. Build a standardised social security net independent of enterprises and institutions and with multiple sources of income.”

I would like to emphasise one element of particular importance for coordination and integration: Regional sustainable development.

What is perfectly rational and eminently logical from a sectorial point of view frequently turns out to be totally inconsistent as well as glaringly irrational from a regional point of view.

This is true for urban development as well as rural development, and it is particularly true for such a huge country as China with its vast and immensely varied regions.

There is an urgent need for regional sustainable development.

My third and last point concerns the Core Funding.

I am very glad as international vice chairman that the China Council now is on a firm financial footing and that the Council now is, so to speak, master in its own house.

I am also very glad that the secretariat is on the way to establish a core funding mechanism with appropriate mechanisms which will make it possible for donors to contribute funds directly into the secretariat. It is not there yet, but it is well on its way.

Summary Speech at the Closing Ceremony of the 2nd Meeting of CCICED Phase III

Xie Zhenhua, Executive Vice-Chairman

Nov. 1, 2003

The 2nd meeting of the 3^d Phase of CCICED is coming to a close. The meeting had in-depth deliberations on the theme “establishment of a well-off society and a sustainable industrialization mode”, and made many valuable recommendations to the Chinese Government. Yesterday morning, Premier Wen Jiabao met with Council Members and experts, listened to the Council’s recommendations to the Chinese Government, and praised the positive role played by the Council. Today, Vice Premier Zeng gave an important speech with respect to the work of the Council and this meeting. Now, please allow me to give a brief summary of the meeting.

The meeting first examined and approved the membership changes for the Council and Task Forces. Some of the Council’s members and experts will no longer be able to serve the Council directly due to change of their positions in the organizations they represent, but we would like to give our sincere thanks to them for the work and wisdom that they have contributed to the Council. We are also pleased to welcome new Council Members and Task Force experts to join us. We are privileged to have Vice Premier Zeng as our Chairman. Vice Premier Zeng has been a national-level leader in charge of macro economic issues for a long time, and has always been concerned with environmental protection and sustainable development. He is a great leader with tremendous amount of experience. We are confident that, under his leadership, the Council will play a greater role in promoting China’s sustainable development.

The meeting invited Mr. Borge Brende, the Chairman of UN Council for Sustainable Development, to give a keynote speech. He introduced to us the global situation on environment and sustainable development, and hoped that the governments of all countries would be politically willed and determined to promote sustainable development. He affirmed China’s strategy to adopt a new industrialization mode and build a well-off society. Mr. Tö pfer, Executive Director of UNEP, gave a special speech to the meeting. He stressed the importance of establishing sustainable production and consumption patterns, because they are a prerequisite for both economic development and environmental protection. At the meeting, Zhejiang Provincial

Government and Anshan Iron and Steel Company introduced their efforts in building an ecological province and reforming an old industrial enterprise based on principles of circular economy. The Ministry of Health briefed the meeting on the lessons they learned in the battle against the SARS and future countermeasures. The BASF Ltd. of Germany gave a presentation on energy conservation and environmental protection. These presentations gave us a better understanding of sustainable development trend in the world and its practices in China.

The meeting also listened to the work reports of 5 Task Forces: Enterprises' Development and Environment; Energy Strategies and Technologies; Development of Environmental Protection Industry; Financial Mechanism for Environmental Protection; and, Strategy and Mechanism Study for Promotion of Circular Economy and Cleaner Production in China. The meeting had heated and in-depth discussions of the recommendations by these Task Forces. It was generally felt that the Task Forces proposed valuable policy recommendations based on their research despite of their short period of existence. Some constructive comments were made by the Council Members during the discussions. The recommendations were still being discussed by the meeting just a moment ago. The Lead Experts and the Secretariat will summarize these recommendations and present them formally to the State Council. But here, I would like to give a preliminary summary of these recommendations:

(1) It is the right direction for China to pursue a well-off society by transforming its development mode and adopting a new industrialization mode characterized by high technology, economic efficiency, low resource consumption, low environmental pollution, and full use of human resources. circular economy, which is based on effective resource utilization and environmental protection, embodies the requirement of the new industrialization mode and should be actively promoted and implemented on a step-by-step basis. China has great potential for raising the efficiency of resources such as coal, land and water; urgent efforts should be devoted to taping such potential.

(2) Participation of small and medium enterprises in the new industrialization process should be widely encouraged. Economic, legal, and administrative instruments should be integrated. Market mechanism should be used to phase out enterprises that are not competitive on the market but cause heavy pollution. Industrial structural adjustment should be promoted.

(3) High attention should be paid to research on energy development strategies. In light of the Chinese situation, it is recommended that modernized use of coal focusing on coal/gas co-generation should become an important national energy development strategy. Council members also recommended factors to be considered for such a strategy, such as economic cost, technical feasibility, and environmental protection.

(4) The environmental protection industry market should be fostered and regulated. Localism should be done away with. Technology development and transfer should be encouraged. High attention should be paid to the development of environmental service industry.

(5) The principle of “polluter pays” should be adhered to. Multiple environmental input mechanisms should be established. High attention should be paid to funding channels such as bank credits and loans, and municipal bonds. Environmental financing policies that are conducive to sustainable development objectives should be formulated. Risk fund should be established. A key focus should be the construction of environmental infrastructure and the prevention and control of pollution by small and medium enterprises.

(6) Coordination of cross-sectoral policies should be strengthened. Efforts by different sectors need to be better coordinated in formulating policies and plans and in implementing key projects; and economic, social, and environmental considerations need to be integrated. Government procurement and government investment through fiscal or financial policies should embody the requirements of sustainable development.

(7) Environmental education and training should be promoted. The pace of information modernization should pick up speed, the transparency of information should be improved, public environmental awareness should be promoted, and a public supervision and participation mechanism should be established for environmental protection. Environmental legislation should be improved, and law enforcement should be strengthened. The capacity of local governments, enterprises, and social organizations for sustainable development and environmental management should be promoted.

During the meeting, Premier Wen Jiabao met with the Council’s Members and experts. After hearing the Council’s recommendations presented by two Vice-Chairs Thibault and Lönnroth, the Premier affirmed that China will adhere to a scientific development mode that is comprehensive, coordinated and sustainable, will correctly coordinate between development and environment, between the rural and urban development, among the development of various regions, between economic and social development, between human and nature, and between domestic development and opening to the outside world, and realize the goal of building a well-off society. He also thanked the Council for its recommendations, and pointed out that the outstanding work of the Council in its 12 years of existence has made useful contributions to China’s sustainable development, and hoped that the Council would continue for long term and do an even better job in the future. I hope the Secretariat will make available the speeches made by Premier Wen yesterday and Vice Premier Zeng today as soon as possible.

The Bureau Meeting held on Oct. 29 thinks that the theme of the each annual Council Meeting

should be in line with the priority areas of the Chinese Government. Given the fact that the Chinese Government is currently formulating the 11th Five-Year Plan, it has been tentatively decided that the theme of the 2004 Council Meeting will be “Coordinating Agriculture, Rural Economy, and the Environment”, and the theme of the 2005 Council Meeting will be “Urbanization and Environment”. After the meeting, the Secretariat and the Lead Experts will propose to the Bureau new Task Forces according to the Instructions made by Vice Premier Zeng today as well as the themes of future meeting.

Thanks to the joint efforts of all Council Members and experts, the meeting is coming to a successful close. I hope that the Secretariat and the Lead Experts will edit the Recommendations by the Council to the Chinese Government as soon as possible, and that various Task Forces will work out their reports based on their research. Both the Council’s recommendations and the Task Forces’ special reports will be submitted to the State Council. The Task Forces’ special reports will also be distributed to relevant Chinese leaders, government departments, and local governments. I would like to take this opportunity to congratulate and sincerely thank the Task Forces and their experts who have completed their tasks.

The Bureau Meeting has tentatively decided that next year’s Council Meeting will be held in October in Beijing. After the meeting, a field trip to a local place of interest will be arranged so as to give Council Members and experts an opportunity to gain better understanding of China’s local situations. I look forward to your active participation. The Secretariat will send out notice six months before the meeting so that you can arrange your calendar in advance.

If there is any thing in this summary that I forget to mention or is not appropriate, I hope other Vice-Chairs would add or correct.

The success of the meeting can not be achieved without the meticulous preparatory and organizational work by the Chinese and Canadian staff of the Secretariat and the Lead Experts. On behalf of all Council Members and experts, I would like to give sincere thanks to all the Secretariat staff, the Lead Experts, and all other working staff.

Meeting Documents

Recommendations of CCICED to the Government of China

Oct. 30 - Nov. 1, 2003

This year's CCICED Annual General Meeting examined sustainable industrial development and China's goal of *Xiaokang*—an “all-round, well-off society.” With careful discussion and debate, we hold that, unless there is much greater attention to environment and social needs, China may not be able to manage impacts of the desired four-fold economic growth over the coming two decades.

For example, projections in Jiangsu Province are that for a quadrupling of industrial production by 2020, water consumption could increase 1.6 times, and chemical oxygen demand (COD) could increase 2.6 times. Sulphur dioxide released into the atmosphere might increase 1.8 times. There is a real danger within China of slipping into conventional industrialization models based on “rapid growth now, clean-up later”, although the governments at various levels in China is aware of the serious shortcomings of the conventional industrialization models.

We care about the future directions of China's economic growth and development and worry about their consequences. Two decades of compound growth in use of energy, water, and environmental resources have placed China among the planet's top polluters and importers of oil. Scarcity of water, timber and other natural resources is already evident. Efficiency in use of energy and materials, even for many new industrial operations, is below international benchmarks. Environmental impact per unit GDP will have to be reduced to a sixth or a tenth of current levels for there to be acceptable levels of environmental quality.

China can build for its future, not simply retrofit the past—the very expensive route of already-industrialized countries.

With so much of the new industrial, energy and transportation infrastructure having a lifespan of 30 to 50 years, more efficient and environmentally friendly options and technologies, and the change of unsustainable production and consumption patterns are of utmost importance on future options.

We are encouraged this year to learn of further progress towards a good basic framework for sustainable development action—the *Cleaner Production Law* and a new *Legal Framework For Environmental Impact Assessment*; practical application of Circular Economy ideals in provinces such as Zhejiang, and leadership provided by major companies like the An’shan Iron and Steel Group. These and other examples provided by several CCICED task forces demonstrate that vigorous and successful action is possible. The problem is not the lack of good models for sustainable development. It is their concrete widespread application across all provinces and in all regions. It is recommended:

1. Sustainable Consumption Patterns. The rush to build economic growth strategies around the private automobile is an example of how good sustainable development intentions may be sidelined, and unsustainable consumption and special consumption groups encouraged. Smog from cars will wipe out current gains in urban air quality. Land for roads will consume agricultural lands. There is risk of being more dependent on oil and gas imports.

2. Circular Economy. There is now an urgent need for a much greater commitment to reduction in material and energy use, recycling and reuse, through a combination of law and incentives, education and action in all parts of the country. Full participation by industry of all scales is needed. The information society and new patterns of sustainable industrialization need to become mutually supportive.

3. The 3E Strategy. Currently, the relationships among the three elements are poorly developed. Indeed they are threatened by the rapidity of change, and by a heavy infusion of conventional approaches that have not led to sustainable development elsewhere in the world.

4. Advanced Science and Technology Will be Needed to Support a Society Dedicated to Xiaokang. Advanced technologies such as modernized use of coal offer the opportunity for meeting environmental and energy security goals at lower costs. It is very encouraging that China is becoming one of the world’s leaders in research and development investment. Much more is needed in human capacity development in order to maximize the value of this investment.

5. Better Policy Environment for New Patterns of Sustainable Industrialization. The commitment to sustainable industrialization by the 16th Party Congress needs rapid follow-up to fundamentally transform Chinese industry at all scales from SMEs to large multinational operations. Sustainable industrialization requires: a “level playing field” on which all industries, whether state-owned enterprises or not, can compete fairly; consistency in application of regulations; full participation in environmental protection by enterprises of all sizes. Currently, these conditions are not being met. Government’s role should be to provide an enabling

framework of well-enforced laws and regulations, to correct market failure, and, selectively, to provide incentives for businesses of all sizes to engage in cleaner production. In addition, government needs to support innovation strategies for new products and eco-efficient industrial processes. It also means carrying out reforms in the financial sector so that banks and investment bodies can be part of the solution.

6. Better Interaction and Cooperation Between Government and Business is Crucial to Make Environmental Protection Work Well. Environmental protection and social responsibility are part of the business philosophy of successful enterprises, as evidenced by leading multinational corporations such as members of the World Business Council on Sustainable Development. Yet, with some exceptions, this view has not taken hold among the majority of Chinese private sector and state-owned enterprises.

7. Public Participation in Environmental Protection and Management. The goal of *Xiaokang* requires a healthy environment, and fulfillment of multiple needs. The lifestyle implications of a *Xiaokang* society in China may be quite different from those found in western industrialized countries. Public awareness and debate can help to shape behavior. Public participation will help to keep the process of sustainable industrialization and other elements of sustainable development on track.

8. Indicator System for Sustainable Development. The current indicator needs to be corrected for environmental damage and improvements. For example, public health and environmental damages arising from air pollution alone could rise from 7% of GDP to 13% of GDP by 2020. For the future development of China, we need show more concern on the green GDP increments that support *Xiaokang*. China is studying the accounting system of green GDP. Efforts need to speed up the study and formulate operational measures to promote the green GDP.

There are many ways in which the above-mentioned recommendations on *Xiaokang* and sustainable industrialization are closely related and supportive of each other. In the coming two decades, lots of work need to be carried out, and better measures need to be taken in China so as to constantly raise the awareness of the government, enterprises and communities, and create sound environment of internal and external policy and economic incentives to include the government, enterprises and citizens involved in the new pattern of sustainable industrialization and well-being society.

RECOMMENDATIONS OF CCICED TASK FORCES

Five task forces reported to the CCICED Annual General Meeting this year:

- ❖ Enterprise Development and Environment.

- ❖ Circular Economy and Cleaner Production.
- ❖ Energy Strategies and Technology - Transforming Coal for Sustainability.
- ❖ Development of a Chinese Environmental Protection Industry.
- ❖ Financial Mechanisms for Environmental Protection in China.

The task forces have laid sound foundation for the General Debate of AGM and formulated detailed policy recommendations. The following is the general recommendations of the Task Forces:

GENERAL RECOMMENDATIONS

1. Develop High Efficiency of Material Use and Energy for Sustainable Industrialization.

Chinese enterprises of all sizes need to become among the most efficient industrial operations in the world if they are to supply growing domestic markets and serve export markets sustainably. There should be full participation of industries from all sectors and all parts of the country. This effort should follow the polluter pays principle and more fully utilize already proven approaches such as eco-efficiency and cleaner production.

Circular Economy

Efficiency in resource and energy use has to be increased to the point where economic growth targets are fulfilled without expanding material or energy use, and with continuous environmental improvement. China should adopt the concept of a Circular Economy based on reuse, recycling and reduction in energy and material requirements. Consideration should be given to a new law for promoting Circular Economy, broader in scope than the existing cleaner production law. There is a need to integrate circular economy implementation into national development plans, with participation by all relevant departments.

Scale of Industrial Enterprises

Enterprises of all sizes should participate in environmental protection. But for some manufacturing sectors, including four reviewed by CCICED (cement, refineries, forest products, and sugar), even China's larger operations are small by comparison to international standards. The size of operations is insufficient to support adequate pollution control investments and necessary economies of scale. There is a need to undertake structural changes for more efficient pollution management, and to increase manufacturing facility size. Accompanying these changes is a need for improved corporate governance, good performance indicators, and capacity building.

Modernization of Coal in a Sustainable Energy System

Coal's enhanced role in a national strategy for energy efficiency, conservation and cleaner production requires a shift away from conventional combustion to a polygeneration system. Modernization of coal utilization involves large scale gasification of coal and co-production of liquid fuels (e.g. methanol, dimethyl ether), plus other value-added chemicals and electric power. China needs a strategy for polygeneration now-delay means costs from air pollution, energy security issues and higher costs of reducing Greenhouse Gas (GHG) emissions. Most significantly, the large investments planned for electricity in this decade will lock in the mode of coal use in China through 2020 and for a long time after.

Coal modernization should proceed in stages, based on performance and research results. Research and development needs include development of large-scale, high efficiency coal gasifier; efficient engines for methanol and DME; manufacture of large advanced gas turbine; and economic feasibility of polygeneration systems. The electricity grid must purchase polygenerated electricity at a reasonable price that takes into account internalizing of environmental costs. Consideration should be given to designation of Eco-energy regions where experimental applications of polygeneration could take place.

Technologies for Sustainable Production and Consumption should be encouraged through research and development, green governmental procurement, and other measures.

Now, cost-effective and efficient environmental technologies must be developed and applied. These should be adapted to Chinese enterprise needs, and for urban environmental and transportation infrastructure.

For pollution prevention, sustainable energy systems, and new industrial processes, the commitment to environmental science and technology research and development should be increased substantially. Key areas for investment include:

- ❖ High efficiency technologies for resource and energy use.
- ❖ Advanced, environmentally friendly manufacturing technologies.
- ❖ Green design, selection of materials, construction and operation of buildings and infrastructure.
- ❖ Environmentally friendly transportation.
- ❖ Byproduct synergy to reduce waste.

These areas can be supported by emerging fields such as biotechnology, nanotechnology and, of course, various information technologies.

China's growing Environmental Protection Industry (EPI) sector and commitment to a Circular Economy needs to be supported more vigorously by expanding demand, especially through more

consistent environmental enforcement, through market incentives, and through stimulation of demand by government's green procurement. China's EPI sector is still relatively small, employing 3 million. Based on the experience of countries such as Japan and Germany, the contribution of EPI to GDP should rise.

Government procurement power is a powerful tool that can be used by China for supporting the adoption of new technologies and sustainably produced goods. Procurement policies should be reviewed so that environmental criteria are given a clear place in decisions. The criteria can include restricting bids to enterprises following best practices in production of goods, recognizing companies meeting standards such as ISO14000, and purchasing materials with a high recycled content. Procurement should avoid direct product subsidies and be compatible with WTO agreements. Environmentally sound procurement policies should operate in conjunction with market reforms such as subsidy reform and environmental taxes.

2. Make SMEs Full Participants in Sustainable Industrialization.

Small and medium-sized enterprises contribute immensely to China's economy (60% of exports, 75% of industrial jobs, new technology incubators) but also account for more than half of China's industrial pollution. Few are capable of self-financing environmental protection costs, awareness and technical capacity is limited, and they are disadvantaged under current environmental policies. SMEs throughout the country need to become full participants in China's sustainable industrialization strategy. This will require a different management approach than might be applied for large business enterprises.

The following measures will help to bring about this participation by SMEs:

- ❖ Set guiding principles:
 - Polluter pays principle for all SMEs.
 - Realistic, operational and financially attainable goals.
 - Fair but firm enforcement policies.
- ❖ Develop an environmental strategy for SMEs that can be applied in all parts of the country.
- ❖ Integrate policies for SME development with China's environment and sustainable development policies, for example by supporting SME environmental action through the SME Development Fund created under the Law for Promotion of SMEs.
- ❖ Leverage SME efficiency and access to technology and knowledge through supply chain relationships involving larger businesses-multinational firms, Chinese private sector and progressive state-owned enterprises.
- ❖ Encourage full participation of SMEs in regional activities such as Eco-Provinces and various demonstration and pilot projects for cleaner production.
- ❖ Establish limited incentive programs to foster SME environmental activities, and for

the development of SME environmental protection industries, including soft loans, commercial loan guarantees, paying premium prices for goods and services from SME bidders that conform to environmental laws and meet green standards.

- ❖ Promote more use of centralized waste treatment facilities by SMEs, especially in industrial parks.
- ❖ Give more attention to the needs of SME environmental protection needs in China's science and technology policies and activities
- ❖ Support capacity building for SMEs including on-site "learning by doing", building awareness of regulations and compliance needs, fostering peer learning opportunities, ISO 14001 implementation, eco-efficiency training.
- ❖ Monitor progress of SME participation in sustainable industrialization in order to determine the need for additional measures.

3. Strengthen Environment and Sustainable Development Governance Frameworks.

Governance of sustainable industrialization requires improvement in governance relationships between government, private enterprises and the financial sector. Government needs to strengthen the enabling frameworks for sustainable production and consumption behavior and greatly improve enforcement of environmental law and regulations. Enterprises need to improve corporate governance generally and develop a commitment to sustainable industrialization that starts in the boardroom and carries through into plant operations and all aspects of business. Financial institutions, as part of their reform, need to bring environment and sustainable development into decisions, for example on loans, and investment policies.

Commitment to Safety, Health and Environment (SHE)

SHE commitments should be developed as an integrated package in any well-managed business enterprise. There is a need to bring these elements more closely together within government regulatory and enforcement bodies. Laws and regulations require review on how they can be consolidated to address these three subjects effectively for businesses of all scales.

Reduce Local Protectionism

There needs to be a more uniform and consistent level of environmental regulation and enforcement in all provinces of China. In local governance particularly, economic success often is considered more important than environmental quality, health and safety. A predictable, tough but fair regulatory system is urgently needed to overcome regionally-lax enforcement of environmental laws. This system needs give environmental protection and local economic development the same weight. Increasingly, China should be considered as a one-market country rather than a fragmented system of markets.

The existing environmental protection system needs review to clarify local responsibilities for

providing supervision and relevant services to support environmental action. The performance assessment system of these government officials needs to place more emphasis on environmental protection. And at municipal levels consideration should be given to setting up independent corporations, operating on commercial principles, for sewage and waste protection. Consideration should be given to the establishment of independent environmental regulatory authorities if the reform measures noted above are inadequate.

4. Improve Financial Mechanisms for Environmental Investment and Diversify Sources.

In the 9th Five Year Plan there was a shortfall of at least 10% for environmental investment and there is concern that without new financial mechanisms in place, the shortfall could worsen by the 11th Five Year Plan. In China some 70% of total environmental investment is via the public sector, while in market economies 60% of pollution abatement is done via private sector sources. Also, there is low efficiency in many of the Chinese environmental investments; SMEs are not attracting funds for environmental protection, especially from commercial sources; and urban environmental infrastructure is not getting enough funding attention. Benchmarks for investment in sustainable industrialization suggest not enough being spent (Japan 20% spent for environmental protection in the 1970s).

The situation will be improved considerably by changing and diversifying financial mechanisms as noted below.

- ❖ Remove non-performing and obsolete industrial elements within sectors.
- ❖ Remove funding and investment in non-performing state-owned enterprises.
- ❖ Broaden range of instruments (corporate bonds, bank credits, trust investment funds, loans).
- ❖ Create special funds and incentives for SME environmental protection strategies, as noted in Recommendation 2.
- ❖ Through financial sector reform, introduce sustainability criteria for bank loans and insurance guarantees; encourage commercial financial mechanisms for environmental protection.
- ❖ Take risk mitigation measures such as loan guarantees to protect banks and creditors.
- ❖ Review depreciation policy and other tax measures that may stimulate Environmental Protection Industries and environmental protection investments by enterprises.
- ❖ Use foreign direct investment as a more major source of capital for modernization and sustainable industrial development.
- ❖ Address underfunding of public investments that are essential for achieving *Xiaokang* (e.g. health, education and environmental protection).
- ❖ Diversify the financial mechanisms to fund urban environmental infrastructure.
- ❖ Link urban environmental and non-environmental projects so developers can do both

and therefore spread environmental costs.

- ❖ Authorize use of municipal bonds to meet environmental infrastructure funding needs.

5. Build Awareness and Capacity for Sustainable Production and Consumption.

China's efforts for sustainable development and for *Xiaokang* should become mutually supportive. Awareness is still lacking, on the part of consumers and on the part of industrial producers, about the broad range of possibilities for achieving a society of modest consumption but well-off living. And the capacity of industry to engage in sustainable production must be built, almost from scratch.

Awareness-raising

Public awareness will create demand for improved environmental conditions and services, and possibly also to align purchasing decisions with *xiaokang* ideals and sustainable consumption. There are several key mechanisms that can be employed by the state, including some with private sector cooperation. Among these are:

- ❖ Public disclosure of industrial and governmental performance. The periodic publication of a province-by-province national toxic release inventory is an example based on experience from Canada, USA and Mexico.
- ❖ Further development of product labeling/certification programs that can guide consumer choice.
- ❖ More media attention to better living possibilities through sustainable consumption.
- ❖ Educational curriculum development for all grades in schools and for all university students on the linkage of *Xiaokang* and sustainable consumption.

Capacity Building for Industry and Government

The substantial effort at education and training for eco-educated managers in both government and industry is yielding some impressive results with pilot projects for cleaner production and special activities such as eco-provinces. As well, considerable learning has occurred through multinational enterprises operating in China. Various industrial associations, industrial park managers and others have built capacity to deal with environmental protection.

But capacity building is really still at an early stage. Training needs will grow more complex as new technologies and more stringent standards are introduced. Government officials, particularly those operating at local levels need to be continuously upgraded in order to strengthen both enforcement and market-based regulation.

Several areas of capacity building deserve very high priority in national plans:

- ❖ Development of an action plan for sustainable industrialization capacity-building within enterprises and local government in each province.

- ❖ Management training for private sector senior and middle-level enterprise staff that includes environmental protection and sustainable development topics as an integral part.
- ❖ Community engagement training for corporate staff.
- ❖ Inspection and enforcement training for government staff operating at central and local levels of government.
- ❖ “Training of trainers” via capacity building of industry association staff.

6. Improve Indicators and Monitoring of Industrialization

Business believes that “what gets measured gets done.” Yet not everything can be measured. Therefore there is an urgent need to develop widely accepted Performance Indicators for use by enterprises and government. Some indicators must relate to specific needs such as eco-efficiency measurement, and some to a more comprehensive indicator and evaluation system for sustainable development, including economic growth, material consumption, environmental quality and people’s welfare. China’s statistical system should be modified to incorporate this sustainable development approach. The current reliance on GDP growth as a key indicator for *Xiaokang* needs to be modified to account for environmental and social indicators.

Progress towards sustainable industrial development can be assisted by the use of enforceable performance contracts that can be monitored, using environmental indicators.

There is a need for independent institutions to conduct measurement and information studies and public disclosure such as a toxic releases inventory.

Address Consequences of China’s Rapidly Expanding Impact upon Global Environmental Resources

China’s growing dependency on imported oil and natural gas, on imported timber and certain other natural resources raises significant concerns about security of supply, competition with other major importing nations, and international environmental perceptions of China as a resource importing nation. These are matters that relate directly to efficiency issues as discussed throughout these recommendations, and also to *Xiaokang*. China will be far less vulnerable to negative international perceptions and to other factors such as pricing extremes if it is possible to curb growth in imports through domestic strategies of conservation and ultra-efficient use.

These issues can be examined in various ways, for example: modeling to reveal circumstances where projected energy needs can and cannot be met; identifying situations where industrial demands by China might have impact on habitat and resources within other countries, either by imports of raw materials, or through long-range transport of pollutants from China; and vulnerability analysis of trade protectionism, import of invasive species or other impacts. While some of this analysis takes place now, it is not being linked very well to either sustainable

industrialization or to *Xiaokang*. It should be. And attention is needed to examine how these aspects fit into China's broader strategic positioning within a globalizing world.

CONCLUSION

These recommendations reveal a need for a more coordinated approach to decision-making on environment and development, and strengthening regional sustainable development. It will permit better approaches to land and water resource issues that constrain industrialization.

Reliable statistics, with overall social, economic and environmental indicators, are needed so that China can determine whether it can manage the consequences of a four-fold economic growth.

There is a need for a stronger relationship between private sector enterprises and government bodies. Out of this relationship could come operational ways for improving corporate social responsibility, and for improved use of market-based incentives.

The success of sustainable industrialization will depend upon a lot of factors. It will be most valuable if the goal of a *Xiaokang*, a well-off society, stimulates the full realization of a Circular Economy.

We must recognize that we do have the opportunity to achieve both sustainable production and consumption in China, to the benefit of the whole world.

Minutes of the 2nd Meeting of CCICED Phase III

The Second Annual General Meeting of Phase III of China Council for International Cooperation on Environment and Development was held on October 30-November 1, 2003 in Beijing. 34 Chinese and international Council members, 19 co-chairs of task forces, 7 special guests and 39 observers participated in the meeting.

On the morning of October 31, Premier Wen Jiabao met with the Chinese and international Council members and co-chairs of the Council. He listened to the recommendations to the Government of China reported by Mr. Thibault and Mr. Lönnroth, two international vice-chairs of the Council on behalf of the Council, and delivered important speech, in which he expatiated on China's comprehensive, coordinated and sustainable scientific development approach. He emphasized that the relation of the development and environment, urban and rural development, regional development, economic and social development, harmonious development of human being and nature, domestic development and opening up to the world should be coordinated and handled with in an integrated way so as to achieve the target of well-being society. He also pointed out that the capacity building of environmental protection should be enhanced; attention should be paid to the development of medium and small enterprises and the legislation building of environmental protection. Premier Wen Jiabao fully affirmed the recommendations of CCICED. He expressed his thanks to the Council for the Recommendations, and pointed out the excellent work of the Council for twelve years made helpful contribution to the sustainable development in China. He hoped that CCICED could continue its work and make greater contribution.

Mr. Zeng Peiyan, Vice Premier of State Council and Chair of CCICED presided the morning session on November 1 and delivered important speech, in which he expressed that the Government of China would have serious study on the opinions and recommendations of the Council Meeting, and take them into consideration in the actual work. He emphasized that overall plans should be made and all factors taken into consideration; the harmonious development of human being and nature should be promoted; the economic growth approach should be changed fundamentally; a new path with high science and technology component, sound economic benefits, low resources consumption, little environmental pollution and full exertion of human resources should be taken; the international cooperation, the coordinated development of environment and economy should be promoted; the obligation of global environmental protection should be shared reasonably; the barriers to the exchanges of

environmental technologies should be removed so as to make sound cooperation situation. CCICED should further improve the quality of the Annual General Meeting, strengthen policy researches, and focus on the study of important topics, so as to make greater contribution to the sustainable development in China.

Before the meeting on the morning of November 1, Vice Premier Zeng Peiyan met with the international members of the Bureau of CCICED. He introduced to them the situation of the economic development in China; and pointed out that Chinese government pays high attention to CCICED and has been paying attention to the issues in the field of energy and has noted CCICED's recommendation on energy. There are a lot of domestic and international experts in the Council. The recommendations of the Council based on the discussions are of utmost importance to the future development in China. On behalf of Chinese government, he expressed thanks to CIDA for the financial support to the Council, and hoped to join efforts and make contribution to the environment and development in China and the world.

The meeting reviewed and passed the adjustment scheme of the Bureau membership, and domestic and international membership and task forces of the Council. The Council members were encouraged by the fact that Vice Premier Zeng Peiyan acts as the chair of the Council, and were confident that under his leadership, the Council would play a greater role in promoting the sustainable development in China.

The meeting had in-depth discussion on the theme of "Establishment of a well-off Society and a New Sustainable Industrialization mode", and put forth a lot of valuable opinions and recommendations. Council members pointed out that in the process of achieving well-being target, we should not only pay attention to the indicator of GDP, but also pay more attention to environmental protection, democracy and legislation, the transit of production and consumption pattern, and other indicators so as to promote development on full scale. Otherwise, it will restrict the achievement of well-being target. We should pay attention to cross-sector issues and could learn from the advanced experiences of the international community concerning this issue. We should define and emphasize the ecological environment component of the well-being society and new industrialization path and clarify their relationship. We should, in line with the comprehensive, coordinated and scientific development approach, have correct and comprehensive understanding of well-being target and new industrialization path.

During the meeting, Mr. Brende, Chairman of UNCSD made a keynote speech on the situation of global environment and sustainable development. He expressed his hope that the governments of the countries show political willingness and determination on promoting sustainable development, and affirmed the strategic choice of the new industrialization path and well-being society in China. Mr. Töpfer, Executive Director of UNEP made a special speech at the meeting.

He emphasized the importance of establishing sustainable production and consumption pattern. Only in this way could we promote economy development and improve the environment. Mr. Zhu Qingsheng, Vice Minister of Public Health introduced the experiences and future measures in combating with SARS. Mr. Baying Chaolu, Vice Governor of Zhejiang Province and Mr. Tang Fuping, Vice President of Anshan Iron and Steel Corporation introduced to the meeting the experiences of setting up eco-province and renovation of old enterprises in line with the concept of circular economy. Mr. Dietmar Nissen, President of East Asia Region of BASF introduced to the Council experiences of reducing energy consumption and developing economy, protection the environment. These speeches enabled the Council members to have more comprehensive understanding on the trend of the sustainable development in the world and the experiences in China.

The meeting listened to the Issues Paper and report on the co-chair meeting by the LEs, and had in-depth discussion. Five task forces reported to the meeting - Enterprise Development and Environment, Energy Strategy and Technologies, Environmental Industry, Financial Mechanism for Environmental Protection, and Circular Economy. The meeting had wide range and in-depth discussion on the policy recommendations of the task forces. The main policy recommendations of the task forces are as follows:

1. The circular economy is based on the most effective utilization of natural resources and environmental protection, and fits in with the requirements of new industrialization path. It should be promoted actively step by step. There is great potential in improving the efficiency of energy, land and water resources. Relevant work should speed up;
2. The small and medium sized enterprises should participate in the process of new industrialization. Attention should be paid to the use of economic, legal and administrative instruments. Marketized mechanism should be used in phasing out enterprises with low competition capacity and with serious pollution so as to promote the industrial restructuring;
3. Attention should be paid to the study of energy development strategy. According to the situation in China, advanced coal technology with the use of poly-generation technology as the core is an important choice of national energy development strategy. In the meantime, various factors such as economic cost, technical feasibility and environmental protection should be taken into consideration;
4. The environmental industry market should be promoted and regulated. The legislation should be enhanced and local protectionism should be avoided. To encourage technology development and transfer, and pay attention to the development of environmental services sector;
5. To follow the principle of polluter pays, and set up multi-channels of environmental

investment mechanism. To pay attention to the financial channels such as bank loans and bonds of municipal infrastructure construction. To formulate environmental financial policies preferential to sustainable development, set up risk funds and pay high attention to environmental infrastructure construction and pollution prevention in small and medium enterprises;

6. To enhance the cross-sector policy coordination. In the process of formulating policies, programs and construction of key projects, various sectors and departments should strengthen coordination and cooperation, and take comprehensive consideration of the economic, social and environmental factors. Requirements of sustainable development should be integrated into governmental procurement, and the financial input of the financial system;

7. To enhance environmental education and training, speed up information modernization, increase transparency of information, improve public environmental awareness, and set up public supervision and participation mechanism. To improve legislation and enhance enforcement, and raise the sustainable development capacity of local governments.

At the closing ceremony on the morning of November 1, Mr. Xie Zhenhua, Vice Executive Chair of CCICED made a summary of the meeting on behalf of the Bureau, and announced that according to the decision of the Bureau meeting: in accordance with the principle that the theme of the AGM should focus on the prioritized fields of the government of China; the theme of the AGM in 2004 is preliminarily identified as *Coordinated Development of Agriculture, Rural Economy and Environment*; and the theme for the AGM of 2005 is *Urbanization and Environment*. The AGM of 2004 will be held in Beijing in October. Local side-visits will be organized for Council members and experts so as to have further understanding of the situation in China. He requested the Secretariat and the LEs to further revise the policy recommendations to the government of China. The five task forces reporting to the Council should formulate reports based on the research results of the task forces. The reports will be submitted to the State Council and delivered to relevant leaders, departments and local governments.

On October 22 - 29, the Secretariat organized a side-visit to Hubei, and Sichuan Provinces, Chongqing and Beijing. Mr. Lönnroth, Vice Chair of the Council and Mr. Auken participated in the side-visit. The international Council members had further understanding of the situation of regional environmental protection and economic development in China, and highly appreciated the measures and achievements of the sustainable development strategy in these areas.

On the afternoon of November 1, Ministry of Commerce and CIDA co-chaired the project coordination meeting of CCICED. Mr. Xu Qinghua, Deputy Secretary-General of CCICED participated in the meeting. Representatives from Canada, Sweden, Switzerland, Germany, UK,

and Japan participated in the meeting. At the meeting, the progress of CCICED was reviewed and information on donation of the funds was released. Reports on the finance in 2003 and budget for 2004 were made. The core funding mechanism and other issues were also discussed at the meeting.

Work Report of CCICED

Zhu Guangyao

Oct. 30, 2003

First of all, I would thank the Bureau to appoint me as Secretary General of China Council for International Cooperation on Environment and Development (CCICED). I am personally grateful to the confidence you all put in me. I feel deeply big responsibilities on my shoulder. I will work together with all members of CCICED and contribute my efforts to the work of CCICED, building on the good foundation laid for China Council by my predecessor.

In the first half of this year, China suffered from the outbreak of SARs. Under very difficult circumstances caused by this unexpected situation, we all worked together in common efforts to proceed orderly with the work of CCICED and various task forces established under it. We had achieved considerable progress. Now please allow me to report briefly on the work of CCICED in the past year.

I. Studies and Adoption of the CCICED Recommendations by Relevant Central Government Departments and Local Governments

By the end of September 2003, the Secretariat had received feedbacks concerning the studies and adoption of the CCICED recommendations, respectively from 20 relevant departments under the State Council and their associated institutions, and 8 provinces and province-level municipalities. The central government departments that had provided feedbacks include the Ministry of Foreign Affairs, the State Development and Reform Commission, the Ministry of Science and Technology, the State Defense Science and Industry Commission, the Ministry of Finance, the Ministry of Construction, the Ministry of Railways, the Ministry of Transportation, the Ministry of Water Resources, the Ministry of Commerce, the State Customs Administration, the State Quality Supervision Administration, the State Environmental Protection Administration, the State Forestry Administration, the State Council Office for Legal Affairs, the Chinese Academy of Sciences, the State Council Center for Development Research, the State Meteorological Administration, the State Oceanographic Administration, the National Company for Marine Oil. The provinces and province-level municipalities that had submitted feedbacks include Beijing, Tianjin, Jilin Shaanxi, Chongqing, Guizhou, Jiangxi and Guangdong.

The feedbacks received were encouraging. Below are some examples of this:

A range of laws and regulations designed to promote environmental protection and sustainable development in China have begun enactment and implementation from this year. These laws and regulations include *Cleaner Production Promotion Law of the People's Republic of China* (January 2003), *Environmental Impact Assessment Law of the People's Republic of China* (September 2003), *Regulation for Returning Cropland to Forestry* (January 2003), and *Regulation Concerning Levying, Use and Management of Pollution Discharge Fees* (July 2003). The State Council had promulgated the “*Recommendation for Strengthening the Prevention of Introduction of Alien Invasive Species*”, which aims to prevent the introduction of alien invasive species into China.

The National Inter-Ministerial Coordination Meeting for Environmental Protection and the National Inter-Ministerial Coordination Meeting for Protection of Biological Germplasm Resources had been established as mechanisms to strengthen the decision making related to sustainable development and improve the coordination about environmental protection among relevant government departments.

The relevant CCICED recommendations had been considered and adopted in formulating *the Programme of Implementation of Sustainable Development in the early 21st Century* as well as relevant plans and programmes for environmental and resources pricing, promoting cleaner production, forest and grassland conservation.

Support to environmental protection and ecological conservation had been achieved through adjusting the existing tax categories in the current taxation system. Thus various taxation measures will be used to enhance environmental protection and ecological conservation.

Measures had been taken to encourage various forms of funds and capital to invest in the municipal and public utilities. The operation across regions and sectors is encouraged as well so as to establish gradually the system of licensed operation of the municipal and public utilities.

The analysis and assessment of the ecological, economic and social benefits from the projects of returning cropland to forest had been undertaken so as to further improve the policy for returning cropland to forest and grassland.

Local governments had also actively studied and adopted some recommendations. For example, Beijing had established a mechanism for environment management which aims to achieve long-term benefits. Beijing had also identified goals by phases for controlling air pollution in which considerable progress had been achieved. Chongqing organized a survey on biosafety issues.

The survey was focused on the distribution and scale of alien species introduced into the city and their impacts on local ecosystems.

Clearly, there were much content and many areas covered in the feedbacks provided by various departments and local governments. The above is only part of the actions implemented in response to the CCICED Recommendations. To give a full account of these feedbacks, the Secretariat has compiled all these feedbacks which will be available to all of you as an annex to this report so that you could have more information in this regard.

II. Personnel Adjustment of CCICED

Following the approval of the State Council, Vice Premier Zeng Peiyan acts as Chairman of China Council for International Cooperation on Environment and Development.

The adjustments of the International Executive Vice Chair, the Secretary General, and the Deputy Secretary General are proposed as follows:

Following the approval of the Chair of CCICED, Mr. Paul Thibault, the new President of Canadian International Development Agency (CIDA) will be the International Executive Vice Chair. I myself will be the Secretary General and a member of CCICED. As required by the work of CCICED, it is proposed that Mr. Xu Qinghua, Director General of the Department of International Cooperation of SEPA and Mr. Peng Jinxin, Director General of the Department of Policies and Regulations of SEPA, would work as Deputy Secretary General to assist with the work of the Secretary General, which has been approved by the Chinese Executive Vice Chairmen Xie Zhenhua.

The adjustments of Chinese members are as follows:

Mr. Wang Guangya, the former Vice Minister of Foreign Affairs, Mr. Xie Xuren, the former Vice Chairman of the State Economic and Trade Commission, Mr. Wei Jianguo, the former Vice Minister of the Ministry of Foreign Trade and Economic Cooperation will not be members of CCICED, due to the Chinese government restructuring and changes in their positions. It was proposed that the following candidates would be considered as new Chinese members of CCICED: Mr. Shen Guofang, Assistant Minister of the Ministry of Foreign Affairs, Mr. Yi Xiaozhun, Assistant Minister of the Ministry of Commerce, Mr. Wang Luolin, Vice President of the Chinese Academy of Social Sciences, Mr. Shen Guofang, Vice President of the Chinese Academy of Engineering, Mr. Shao Ning, Vice Chairman of the State Commission for Supervision and Management of State-owned Assets.

The adjustments of international members are as follows:

It was proposed that two new international members would be invited to join the CCICED. One is Mr. Diabre, Associate Administrator of the United Nations Development Programme. The other is Madame Catherine Day, Director General, Division of Environment of the European Commission.

The resumes of the above new Executive Vice Chair, the Secretary General and the Deputy Secretary General as well as the new Chinese and international members had been circulated to you all this morning. The related proposals for personnel adjustment of CCICED had been adopted at the session this morning. While welcoming the new International Executive Vice Chair and new Chinese and international members, we would like to express sincere appreciation to the outgoing International Executive Vice Chair, Chinese and international members and the Secretary General. We will always remember the contributions they had made to the work of CCICED.

III. Innovating the Work of CCICED

To ensure that various task forces will organize and undertake studies on relevant topics in time, it is necessary to identify and adopt as early as possible the themes for the Annual General Meeting of CCICED of the next few years. With this, the Lead Experts Group and relevant sides will be able to select topics more oriented at the new themes and establish new task forces to work on these new themes. Since the CCICED Bureau required that the theme selected for the AGM of CCICED must take into consideration priority areas identified by the Chinese Government, the Lead Experts Group had undertaken serious discussion and proposed the following areas and range of themes for consideration at the AGM of CCICED of the next three years: *Agriculture and Rural Development for the AGM of 2004; Urbanization/Development of the Eleventh Five-year Plan for the AGM of 2005; and Social Progress and Xiaokang Society (An All-round, Well-off Society) for the AGM of 2006*. The proposed theme for 2006 is intended to provide relevant recommendations to the development of the Eleventh Five-year Plan. Mr. Xie Zhenhua, the Chinese Executive Vice Chair, has approved in principle the recommendations made by the Lead Experts Group. The meeting of the Bureau held yesterday had also discussed about this subject and adopted in principle the proposed range of themes. I would like to welcome your comments on these proposed themes.

To upgrade the quality of the recommendations of CCICED to the Chinese Government and improve the traditional approaches of CCICED to disseminate its recommendations, the Lead Experts Group suggested ways to innovate the work of CCICED. It was suggested that the future AGM of CCICED would not produce general policy recommendations. Instead various task forces

will present their reports directly to the State Council as recommendations, following the format agreed for all the reports. Such reports will contain a 3-page copy of policy recommendations that are extracted and refined from their work reports and will be presented for discussion at the AGM. After the discussion and adoption at the AGM, the 3-page copies of policy recommendations of various areas (with the detailed work report of respective task forces as annex to this 3-page copy of policy recommendations) will be presented to the leaders of the State Council accordingly. The presentation of the Issues Paper prepared by the Lead Experts Group will basically follow this approach. As recommended by international and Chinese members and experts at the second meeting of Phase III of China Council, the recommendations (3 pages or so) will be extracted and refined as well from the Issue Paper and discussed at the AGM. This approach will make it possible to report our research results directly to the State Council. This is also a requirement to us from the objectives and the mission of China Council. The Lead Experts Group had requested various task forces to undertake pilot work in this regard before this meeting was convened. It is hoped that this approach will be supported by you all and succeed.

IV. The Work of the Lead Experts Group

The establishment of the Lead Experts Group is one of the innovative measures adopted by the CCICED. From the practical benefits, this reform has proven successful and effective. The Lead Experts Group has seriously fulfilled their responsibilities. They had convened three meetings to review the proposals made by new task forces, and provided their comments and recommendations, which had provided a scientific basis for the Bureau to approve the establishment of new task forces. To prepare for the AGM this year, the Lead Experts Group invited the Chinese group leaders of five task forces that will present their reports at the AGM this year to make the pre-meeting presentations. The Lead Experts Group discussed these reports and provided comments and recommendations for improvement. The benefits for doing this are: (1) to facilitate and strengthen exchange and communication among the Lead Experts Group and the group leaders of various task forces for further mutual understanding and support, which lays a good foundation for working together; (2) to synergize the research content of various task forces to avoid duplications and overlaps so that various task forces will have more focused research areas and the quality of their work reports will be much improved.

V. The Work of Task Forces

This year, the Task Forces on Energy, Enterprises, Industry, Circular Economy, Financial Mechanism, had actively undertaken their work. A total of 6 international workshops and conferences were convened. The task forces had 13 working meetings. 5 domestic study tours and 1 international study tour were organized. The review of relevant plans formulated by Shenyang and Guiyang was organized. The key enterprises in four sectors had been selected for

specialized surveys and studies to address the problems they faced. The detailed information concerning these surveys and studies is contained in the work reports of relevant task forces.

The Bureau has approved the establishment of the Task Forces on Integrated River Basin Management, Non-point Agriculture Pollution Control Prevention, WTO and Environment, Environmental and Natural Resources Pricing and Taxation, Sustainable Transportation, Protected Areas, and Agricultural and Rural Development Policies. These task forces made best use of their time to proceed with their work. They had 1 international workshop, 10 working meetings, 1 domestic study tour and 1 international study tour. They had demonstrated some new styles of work. They paid more attention to the synergy among various task forces and undertook more exchanges among the task forces to benefit from the strengthen of other groups to avoid their own weakness. 9 out of 14 Chinese group leaders of these newly established task forces are new, and their resumes had been circulated to you all for information.

Currently, we are considering establishing some new task forces to undertake studies on the themes possibly selected for the AGM of 2005 and 2006. Considering these possibly selected themes, relevant international institutions and domestic departments proposed establishing the Task Forces on Environment Management, and Environment and Health. It is hoped that you all provide comments and recommendations concerning the areas where a task force should be established or studies should be undertaken, taking into consideration the above-proposed range of themes. This morning, relevant comments on establishing new Task Forces proposed by Vice Chair Liu Jiang should be considered.

VI. The Work of the Secretariat

With the leadership of the Bureau, the Secretariat had done the following work in addition to its routine work.

1. Preparation was made for the adjustment of the Bureau and members, following the guidance and instruction of the Bureau.
2. Coordination and advice were provided to the establishment of task forces and their work. The Secretariat also participated in the working meetings, seminars, study tours and relevant activities of various task forces. The Secretariat provided information to various task forces to facilitate the cooperation of various task forces with relevant international organizations and promote the cooperation among the task forces. The Secretariat also provided support to the conduct of research activities by various task forces and promoted the dissemination of their research results.

3. Efforts were focused on the compilation of the feedbacks to the CCICED recommendations. The feedbacks from various departments and local governments had two characteristics. The first is that the number of feedbacks was bigger than that received in the previous years. A total of 26 provincial departments had submitted their feedbacks in writing. The situation of receipt of feedbacks is improving year after year. The second is that some departments not directly involved in the work of CCICED had also studied and adopted relevant recommendations of CCICED, from the perspectives of achieving sustainable development. Some departments had even pointed out some inappropriately-expressed content in the recommendations after careful studies of them. The CCICED Recommendations are being disseminated and implemented in a broader range and at various levels. The central government departments and local governments pay more attention to sustainable development in the process of decision making, which indicates that the implementation of the strategy for sustainable development is winning more and more support and actions.

4. The Secretariat had been making preparations for the AGM this year. The first task was to identify the theme for the AGM. The Sixteenth National Congress of the Chinese Communist Party had set the goal for establishing an all-round and well-off society in China. Following the discussion with the Lead Experts Group and the approval of the Bureau, the theme for the AGM this year is: *Establishment of a well-off Society and a New Sustainable Industrialization Mode*. The second task was to invite keynote speakers from both the Chinese and international sides and the speakers for special presentations, following the guidance of the Bureau. This morning you all had a chance to hear their speeches and presentations.

5. Efforts were also made to strengthen the capacity of the Secretariat itself, including organizing training on project management, financial and time management for project management. As a result, the overall project management level of the Secretariat had been considerably improved.

6. The Secretariat had updated the website of CCICED, redesigned the structure of the website, added new items for navigation and set up a safe, very reliable email system. In addition, an electronic forum was established on the website of CCICED. A database that pooled all the results of CCICED in its history was put on the website to allow interested audience to find relevant content any time, which had set a new platform for information exchange and dissemination. You are welcome to access the website of the Convention (www.cciced.org) for relevant information.

7. The Secretariat had also strengthened the coordination among task forces and guidance to their routine work. The Secretariat staff had also participated in some seminars, working meetings, study tours and relevant activities organized by various task forces. The Secretariat actively provided information, facilitated the cooperation of various task forces with relevant

international organizations, promoted the cooperation among various task forces and supported the conduct of research activities of various task forces and the dissemination of their research results.

VII. Core Fund Mechanism

Following the guidance of the Bureau that a Core Fund Mechanism should be established for the third phase of China Council, the Secretariat and the CCICED Secretariat Canadian Office had discussed many times about this issue and reached consensus on this. A draft of the *Principles for Core Fund Mechanism of CCICED Phase III* was prepared with the help of the Stockholm Environment Institute of Sweden. The Secretariat had convened a workshop on core fund mechanism. The representatives from the embassies of main donor countries and international organizations were invited to this workshop to discuss the draft document. I would like to take this opportunity to brief you about the proposed basic principles, the range and percentage for use of fund.

1. Co-management Principle. The donor country could choose the Secretariat or the CCICED Secretariat Canadian Office as a unit to manage the fund. The CCICED Secretariat and its Canadian Office will discuss and identify the amount and scope of use of the fund for the activities of various task forces and relevant activities of CCICED. The Secretariat and its Canadian Office will exchange on a regular basis the information concerning the donation and the expenditure.

2. Principles for Use and Management of Fund for Task Forces. The task forces can accept the donation only after it is approved by the Bureau. The application for fund for a task force will be discussed by both the Chinese and international group leaders of that task force and the budget must be signed by both group leaders. The budget of task forces will be presented for approval by the Executive Vice Chairs of the Bureau, and relevant information will be provided to relevant donors. With all the above procedures completed, the Secretariat or its Canadian Office will allocate the fund to the task forces concerned.

3. Principles for Auditing and Supervision. The CCICED Secretariat and its Canadian Office will open a specialized account to receive the donation into the Core Fund. The fund will be managed and used in accordance with relevant international standards and rules. The third-party auditing agency will be invited to audit the use and the management of the Core Fund in accordance with relevant international standards and rules.

By now, the countries and institutions that had agreed to participate in the Core Fund include China, Canada, Sweden, Norway, Germany and Shell Company. The total amount of the fund is

about 10.67 million USD. 80% of the core fund was used for the activities of various task forces and 20% for relevant activities of the CCICED. The meeting of the Bureau held yesterday had discussed and adopted in principle the basic principles and the range of use of the core fund. I would like to invite you all to give comments on these principles.

VIII. Overall Situation of Funds for CCICED

Regarding the funds for CCICED, please find and review the Financial Report and Budget provided by Secretariat Canadian Office according to the actual situation, which is included as the Annex II to this report.

Annex

A Summary of Responses by Various Departments of the State Council to the Recommendations of the 1st Meeting of the 3rd Phase of CCICED

The Recommendations of the First Meeting of the Third Phase of CCICED to the Chinese Government covers 8 areas in 2 parts. By the end of September 2003, the Secretariat had received feedbacks from 20 departments of the State Council and 8 provinces/municipalities. The 20 departments of the State Council are: the Ministry of Foreign Affairs, the National Development and Reform Commission, the National Defense Science and Technology Commission, the Ministry of Finance, the Ministry of Construction, the Ministry of Railway, the Ministry of Transportation, the Ministry of Water Resources, the Ministry of Commerce, the State Customs Administration, the State Quality Supervision Administration, the State Environmental Protection Administration, the State Forestry Administration, the Law Office of the State Council, the Chinese Academy of Sciences, the Development Research Center of the State Council, the China Meteorological Administration, the National Oceanic Bureau, and the General Ocean Oil Corporation. The 8 provinces/municipalities are: Beijing, Tianjin, Jilin, Jiangxi, Guangdong, Chongqing, Guizhou, and Shaanxi. Their responses are summarized as follows.

Part 1: Responses to the Council's Recommendations on the Transition to Sustainable Development

1) On Improving Governance for Environment and Development

The National Development and Reform Commission (NDRC): *The Action Guides for Sustainable Development in the Early Stages of the 21st Century*, revised under the leadership of NDRC, has been approved by the State Council and put into effect. It provides the direction for China to promote the implementation of sustainable development in many years to come. The National Economic and Social Development Plan for 2003 included detailed measures about economic structural adjustment, ecological conservation and environmental protection, public

health and public environmental improvement, and sustainable agriculture. It also kicked off preliminary research on key issues for the 11th Five-Year Plan, which included sustainable development issues as key items. It is also drafting the Regulations for Plan Making, which will highlight the strategic importance of sustainable development. Jointly with other departments, it formulated and promulgated the Regulations on Pollution Fee Levying Standard, which formalizes the levying of waste water treatment fees and aims to promote the industrialization of waste water treatment and garbage treatment. It also drafted the Circular of the State Council on Using Price Lever to Promote Water Resource Conservation, which is expected to be approved by the State Council and issued soon. Jointly with the State Environmental Protection Administration, the Ministry of Public Health, the Ministry of Finance, and the Ministry of Construction, it proposed a Hazardous Waste Treatment Fee System in order to promote the treatment of hazardous waste treatment. This proposal is expected to be implemented once it is approved by the State Council. It also devoted major efforts to water pricing reform, and will increase water resource consumption fee, promote water supply pricing reform in cities, implement a waste water treatment fee system, encourage water recycling and the construction of water recycling infrastructures, and improve the agricultural water pricing system.

The National Defense Science and Technology Commission (NDSTC): NDSTC thinks the Council's recommendations are highly valuable to the development of national defense sciences and technologies, and has integrated sustainable development principles into the development policies of its industries, namely, the national defense sciences and technologies should take the lead in adopting a new industrial development model with high technology, economic efficiency, low resource consumption and environmental pollution, and effective utilization of human resources.

The Ministry of Finance (MOF): MOF is continuing to fulfill its obligations as a member of the National Inter-Ministerial Meeting on Environmental Protection and the Joint Inter-Ministerial Committee on the Protection of Biological and Species Resources. Jointly with other departments, it issued the Circular on Promoting Water Supply Pricing Reform in Cities, and the Circular on Implementing the Urban Household Garbage Treatment Fee System to Promote Waste Treatment Industry. It is actively promoting the urban waste water treatment industry and the municipal waste treatment industry according to the Regulations on Pollution Fee Levying and Use. It has also established an innovation fund for small and medium sized enterprises to encourage their research and development of cleaner products.

The Ministry of Construction (MOC): MOC will further strengthen its early-stage participation in the application and approval process for the plans of various industries, and promote information exchange and functional coordination with other relevant departments. It issued Comments on Speeding up the Development of Municipal Utilities through Market Mechanism

to encourage enterprises to participate in the construction and operation of waste water and garbage treatment facilities.

The Ministry of Railway (MOR): MOR is formulating a plan for constructing green railways with a view to promoting the greening of railroads. It is also formulating the relevant regulations on the health environment of railways. It has organized demonstration projects of new toilet equipment on trains, and made new progress on the management of solid wastes in railway stations.

The Ministry of Transportation (MOT): MOT is improving the environmental protection network, the monitoring network, and the environmental information network for the transportation sector. It has strengthened pollution prevention and control, and increased efforts of science and technological development for the environmental aspect of the transportation sector, including research on ecological conservation for roads, ports, and airways, and on cleaner production. It is also actively implementing environmental impact assessment for transportation planning.

The Ministry of Water Resources (MWR): MWR is exploring on modern water conservancy and sustainable water conservancy, and regards water resource management/protection, water use efficiency, and building a water saving society as its most basic missions.

The State Quality Supervision Administration (SQSA): SQSA encourages the research and development of cleaner products. For example, it has decided to replace CH₃Br₂ with SF₂, which is more effective and less toxic. It is actively implementing supervision on the quality of the food products included in the Classification and Coding of National Industrial Agricultural Products, and discloses the supervision results to the media, such as CCTV and China Quality News, on a regular basis.

The State Environmental Protection Administration established and promoted the Joint Inter-ministerial Meeting on Environmental Protection to promote coordination and cooperation among government departments on environmental protection. It also devoted efforts to promote new partnership among government, enterprises and the public. It took comprehensive measures to encourage enterprises to protect the environment. It coordinated the relevant government departments in carrying out research and formulating a new pricing system for electricity generated by networking coal-fired power plants, established an equitable competition mechanism for electricity prices, and encouraged power plants to build desulfurization facilities. Jointly with the National Development and Reform Commission and the Ministry of Construction, it formulated the Regulations on Municipal Waste Water and Garbage Treatment Fees. It set up 5 national associations to promote public participation in environmental

protection. It is implementing a Daily Air Quality Forecast and Public Reporting System, and a weekly public reporting system for the quality of sea bathing waters. It also reports on the environment of offshore sea areas and the water quality of various sections of river basins. It plans to publish new progress on pollution prevention and control of the “Two Controlled Areas”, as well as the air and surface water qualities of 113 key cities. It also plans to disclose information to the public about the environmental behaviors of enterprises and the water quality of drinking sources for cities.

The Law Office of the State Council played a key role in the formulation and implementation of the Regulations on Converting Cropland Back to Forests and the Regulations on the Management of Genetically Modified Organisms and Bio-safety by the State Council. It is also actively involved in the formulation of the Regulations on the Levying and Use of Pollution Fees by the State Council, which makes specific stipulations about how to levy and use pollution fees.

The Development Research Center (DRC) of the State Council thinks that the Council’s recommendations are valuable to their research, such as the recommendations on structural adjustment and sustainable development, transportation and sustainable development, conversion of cropland back to lakes in the middle reaches of the Yangtze River, circular economy, and energy conservation management by the government under a market economy. DRC has conducted research on the sustainable development of industries, cleaner production, and poverty alleviation jointly with the former State Planning Commission and the former State Economic and Trade Commission.

The China Meteorological Administration strengthened capacity building for sand storm monitoring and pre-warning, and is implementing the “Phase I Project of the Sand Storm Monitoring and Pre-warning System”, and developing integrated sand storm forecasting models and optimal pre-warning models. It also kicked off an ecological environmental monitoring and information service program in order to implement mobile monitoring of the resource and ecological conditions of all nation but especially the key areas, and to publish reports of monitoring results and forecast.

The National Oceanic Bureau organized ocean environmental monitoring, and established red tide monitoring zones for red tide prevention and control. It strengthened supervision and management of waste dumping into oceans and offshore petroleum exploration and development activities. It established new protected ocean areas to protect the ecology of oceans. It also established an ocean information system and implemented a disclosure system for administrative information.

The General Ocean Petroleum Corporation paid special attention to the development and use of

cleaner energy and the sustainable development of ocean petroleum. In cooperation with Guangdong Province and Fujian Province, it constructed liquefied natural gas receiving stations, and imported liquefied natural gas to replace coal as fuel for power generation and household use.

Beijing Municipality regards sustainable development as a basic strategy for urban development. It established a “3-level management and 4-level supervision” guarantee system that covers the various levels of government and applies to various areas from administration, law enforcement to public participation. It formulated and implemented air pollution control measures in 9 phases, and established a “coordination meeting” mechanism for various local departments and the central government branches that are located in Beijing. It gradually increased urban waste water treatment fee level, started to collect garbage treatment fees, adjusted SO₂ fees and its application scope, lowered the price of electricity used for heating single-story houses, adjusted the price for heating supply, reduced fees that used to be required for shifting to cleaner energy sources, provided compensation for shifting from coal-fired boiler to cleaner energy sources, and granted preferential policies for polluting industries to move to other locations. The municipal service industries were also being reformed. BOT and TOT have been adopted for the construction of public utility facilities. An environmental quality reporting system has also been established, and the administrative information disclosure system has been further promoted.

Tianjin Municipality set up a hazardous waste treatment and disposal center, which has an annual treatment and disposal capacity of 30,000 tons. It has also established an environmental industry park in Jinghai to process and utilize wastes imported from other countries.

Jilin Province devoted active efforts to implementing the National Guidelines for Ecological Conservation. Various municipalities/prefectures have formulated ecological conservation plans. The province strengthened the protection of nature reserves, and built some ecological demonstration regions. It also utilized ecological capital to build organic food production bases. It actively promoted the construction of environmental infrastructure in cities and key ecological environmental engineering projects. It also aims to integrate environmental policy making with development policy making. In cities above county level, zoning was implemented for drinking water source areas.

Jiangxi Province established a provincial-level lead institution for implementing sustainable development strategy. Its purpose is to streamline environmental management mechanism, promote legislation for environmental protection, unify planning, management and supervision, and further improve the coordination system among various departments.

Guangdong Province requires all levels of governments within its jurisdiction to establish

“environment and development coordination meeting” system, and organize relevant government leaders and experts to examine key environment related policies. Key social and economic development policies must give priority to ecological conservation, and environmental impact assessment must be conducted for such policies. Guangdong Province has also conducted studies on economic policies for desulfurization by coal-fired power plants.

Chongqing Municipality has established a preliminary system of integrated decision making for sustainable development. The municipal government is required to listen to the opinions of the environmental protection department whenever it makes key policies or before it launches key projects. The No. 1 heads of counties/cities will be held accountable for the environmental performance of their counties/cities. Environmental responsibility goals were set up for various government departments. Waste water and garbage treatment fee standards were adjusted to promote their development under market mechanisms. Environmental labeling system has been established, and some environmental label products and green food products were publicized. Development of civil environmental protection organizations was encouraged. Transparent environmental information disclosure system was established. The status of the environment is being reported on a regular basis. Also established were a Daily Air Quality Reporting System and a Weekly Drinking Water Source Quality Reporting System. Public environmental information screens were erected to publicize environmental quality data and relevant legal and policy information.

Guizhou Province formulated a series of local environmental laws and government regulations, such as the Regulations on Environment Protection of Guizhou Province. The Environmental Goals Responsibility System was established. Key environmental projects were integrated into local and sectoral economic and social development plans. The province utilized the “International Market Promotion Fund for Small and Medium Enterprises” to provide financial support for small and medium enterprises that had been ISO14000 certified. Waste water treatment fees will be levied before the end of 2003, and garbage treatment fees will be levied on a gradual basis. The development of waste water and garbage treatment industries will be sped up. Municipal public utilities will be developed through market mechanisms. Disclosure system for administrative information, such as project approval, examination, and pollution fee levying, will be established.

Shaanxi Province has implemented an environmental quality responsibility system in which the heads of various levels of governments are held accountable. An integrated decision making mechanism for environment and development has been established, and the functions of the various departments in that regard have been clarified. Relevant policies for garbage treatment fees were formulated. Cropland reclamation from lakes and invasion into river bank areas were banned. An agricultural meteorological monitoring network has been established, and a monitoring and pre-warning service system for meteorological disasters is being planned.

Development of biomass energy will be a focus of energy conservation in rural areas. In the northern regions, wind power will be more widely used. Use of mines and mining rights will be paid. Water conservation in agricultural areas will be carried out in light of local conditions. Gasification projects of natural gas, central heating projects and clean energy projects will be carried out in cities. Power generation projects using natural gas will be kicked off, and the share of power that is generated by natural gas shall be increased.

2) On Sustainable National Economy

The National Development and Reform Commission formulated relevant policies and regulations to promote cleaner production. Jointly with the State Environmental Protection Administration, it promulgated the second Directory of Cleaner Production Technologies for Key Industries. An “Energy Efficiency Labeling System” was launched to promote recycling and reuse. It would, jointly with the State Quality Supervision Administration, promulgate Regulations on Energy Efficiency Labeling with a view to guiding consumers to buy and use products that are labeled as energy efficient, promoting the development of resource reuse industries, and promoting recycling and reuse.

The National Defense Science and Technology Commission, in its formulation of civil aeronautic development policies, has decided to develop meteorological satellite series, resource satellite series, ocean satellite series, and environmental and disaster monitoring and forecasting satellite series in order to provide advanced, reliable and effective technological support for meteorological, oceanic, and land resource departments.

The Ministry of Railway established a cleaner production assessment indicator system according to the Law on Cleaner Production to promote cleaner production within the railway sector. In response to the reality that China lacks oil and gas resources, it will promote the construction of electric railways.

The Ministry of Water Resources sticks to the principle that humans and nature should be harmonized. During their anti-flooding efforts, they held on to the principle of comprehensive treatment. While making effort to strengthen and take other measures for flood control, they adopted such measures as converting cropland back to lakes/river, and dismantling embankments to smooth water flow. As regards water use, they give high priority to ecological water use. They have also taken measures like converting cropland back to forest/grassland, closing mountains for forest protection, recuperating grassland by banning grazing for certain periods of time and grazing rotations.

The State Environmental Protection Administration carried out pilot projects in 5 industries (which were paper making, fermenting, food, pharmaceutical, and cement) to phase out out-

dated technologies, products, and production capacities. The focus of environmental law enforcement by SEPA has shifted to breaking up local protectionism and preventing polluting enterprises that were forced to shut down or stop production lines from resuming their polluting behaviors. SEPA devoted major efforts to promoting cleaner production in enterprises, promoting certification of the ISO14000 environmental management system, and establishing recycling economy zones. National-level demonstration ecological industry parks have been established in some provinces. SEPA also implemented environmental labeling certification and cleaner production auditing, accelerated EMS certification, and promoted mutual international recognition of certification for organic food and environmental labeling products so as to promote export of these products.

Beijing Municipality integrated environmental protection into its social and economic development plans. It adjusted its economic structures accordingly, encouraged proper consumption, and promoted public environmental education. It devoted major efforts to developing modern manufacturing industries, and circular industries that were highly resource consuming and heavily polluting. It continued to implement cleaner production, circular economy, and ISO14000 certification in industrial enterprises. It also paid high attention to building civilized communities and green communities, and promoting the wide use of green products and green food.

Tianjin Municipality clearly pointed out in their response to CCICED Secretariat that it would promote circular economy and implement sustainable development strategy. The notion of circular economy is clearly reflected in the implementation of Tianjin's 10th Five Year Plan for Environmental Protection. While adjusting its economic structure and reforming its enterprises, Tianjin promoted cleaner production and the transformation of economic growth mode. It introduced advanced technologies, especially the cleaner production technologies and best applicable pollution prevention and control technologies. It organized efforts in Tianjin Economic and Scientific Development Zone (ESDC) to compete for the honor title of National-Level Ecological Industrial Park. Within the Tianjin ESDC, a symbiotic network has been formed, and a complete industrial ecology system will be established. By utilizing its convenient transportation and the advantage provided by the Beijing-Tianjin Economic Zone, it hopes to be built into a circulation hub for Northeast Asia within 10 years.

Jilin Province promoted the phasing out of enterprises that use out-dated technologies, are highly energy- and resource-consuming and heavily polluting through industrial structural adjustment, and devoted major efforts to promoting cleaner production.

Jiangxi Province combined their efforts of mountain treatment, river treatment and poverty alleviation in order to establish a sustainable ecological system consisting of mountains, rivers

and lakes. During its economic structural adjustment, it advocated circular economy, supported enterprises to carry out technological innovation, reduce energy use of resource consumption, implement all-process pollution prevention and control, and reduce pollution discharge during production. It also promoted cleaner production, conducted cleaner production demonstrations, and implemented ISO 14000 certification and eco-labeling certification.

Guangdong Province helped enterprises implement cleaner production. It is trying to build a contingent of cleaner production experts. Its effort has resulted in some cleaner production demonstration enterprises. Guangdong Province also carried out relevant research on cleaner production technologies and products, and formulated local policies and laws on cleaner production.

Chongqing Municipality regards sustainable development as a key strategy for economic development. It promoted the construction of waste water and solid waste treatment plants in the reservoir areas of the Three Gorges. It intensified efforts to adjust the structures of industrial enterprises, and completed the cleaning of solid waste on the bottom of the Three Gorges Reservoir area. It promoted cleaner production and recycling of waste. It also formulated cleaner production guidelines and implemented pilot projects to promote circular economy.

Guizhou Province will build the capital city of Guiyang into an ecological city characterized by circular economy. Based on that, it aims to establish a sustainable economy. The *Guidelines for Planning and Research for the Construction of Guiyang into An Ecological City Characterized by circular Economy* has been approved, and the first circular economy demonstration projects have been identified. So far Guiyang City has established the nation's first circular economy website. The province plans to carry out pilot projects in Bijie region to explore ways of sustainable development in karst mountain areas, including poverty alleviation, ecological conservation, and population control.

3) On Education and Knowledge for Sustainable Development

The Ministry of Transportation utilized various forms and means to publicize the importance and necessity of sustainable development and promote public environmental awareness of sustainable development.

The State Environmental Protection Administration organized a large amount of environmental education activities. It organized journalists to report on key environmental events, assisted schools and education departments to promote environmental education, and held training workshops for school headmasters and teachers. Jointly with the Ministry of Education, it advocated "Green Schools". It also promoted "green communities", "green hotels", and "green offices", etc.

Beijing Municipality paid high attention to sustainable development education and information

dissemination. The municipality's CCP Party School offers courses in environmental protection; and environmental protection is included in the syllabus of training sessions for government leaders. Environmental trainings were provided to the leaders of key enterprises on an irregular basis. It also devoted effort to disseminating information about environmental protection and sustainable development.

Tianjin Municipality based their environmental education efforts around the implementation of the Law on Environmental Impact Assessment of the People's Republic of China. Public environmental education columns were opened in some media for almost 3 months, and experts were invited to these columns to speak on the Law. This has achieved good effect.

Jilin Province increased publicity on its effort to build an ecological province. The relevant departments of the province compiled textbooks for primary & middle schools and colleges to promote public awareness of their efforts to build ecological province. They also compiled Public Education Textbook: Building Jilin into An Ecological Province. Jilin TV opened a column called "Window on Ecological Province Building", and filmed a public education series called " Ecological Jilin".

Jiangxi Province effectively promoted the awareness of local governments to implement sustainable development strategy by building sustainable development experimental zones. The province also established green schools to promote the environmental awareness of students.

Guangdong Province utilized the media to give publicity to their key environmental protection activities. They organized environmental education campaigns and such activities as "South Guangdong Environmental Century Travel", "Environmental Protection Month", "Green Schools", and "Green Kindergartens", etc.

Chongqing Municipality utilized the World Environment Day to conduct major environmental education activities. They conducted trainings on sustainable development theories in party schools at various levels and administration colleges. They also organized "green school" activities in primary & middle schools and universities, as well as "green community" activities.

Guizhou Province held the first Training Workshop on Environmental Management for county and city mayors.

Shaanxi Province organized environmental education activities and dissemination of sustainable development knowledge and basic environmental science and laws. It encouraged civic activities to build green schools, green communities, and green enterprises. It also advocated green consumption and sustainable life patterns.

4) On Role of China in the Global Community

The Ministry of Foreign Affairs (MFA) thinks that the Council's recommendations are valuable to them in their formulation of foreign policies. MFA will continue to assist various domestic institutions in their exchange with other countries so as to increase understanding, learn from the experience of other countries, expand cooperation channels, and provide favorable conditions for China to participate in international environmental cooperation.

Part 2: Responses to the Recommendations of the Task Forces

5) On Environmental Economics

The Ministry of Finance formulated a series of economic policies to prevent and control environmental pollution and ecological degradation. These policies include pollution fees, fees for dumping wastes into the ocean, water resource fees, mineral resource compensation fees, forest land compensation fees, tree planting fund, etc.

The Ministry of Science and Technology is planning to launch research on the methodologies and techniques of strategic environmental impact assessment, green accounting system for national economy, green barrier and trade, and environmental taxation and compensation, so as to provide scientific and technological support for environmental protection and social and economic development.

The Ministry of Railway holds on to environmental impact assessment, and the "3 Simultaneousness" management system in order to coordinate railway construction and environmental protection.

The State Environmental Protection Administration has recommended for a number of times that, based on the existing national income accounting system, a satellite account should be established for environmental resources as a complement to the current GDP accounting, and that natural and environmental resource depletion be quantified. SEPA organized research on the designing of China's environmental tax, and has completed *Recommended Preliminary Policy Framework for Establishing Environmental Tax (Draft)*.

Beijing Municipality has been implementing an inter-departmental coordination meeting mechanism, a scientific examination system and an information disclosure policy for the planning of key economic policies and urban development. They stress the participation of experts and the public. They have started to carry out research on "Green GDP". They have strengthened research on environmental economic policy system, so as to streamline the pricing

systems for water, gas and heating, improve the ecological conservation compensation mechanism and the ecological conservation investment mechanism, continue to implement clean energy utilization and comprehensive use of wastes.

Jilin Province carried out in-depth research on strategic environmental impact assessment. They held training workshops on environmental impact assessment, and attempted research on environmental and ecological assessment for major development plans.

Jiangxi Province requires all industrial parks to conduct environmental impact assessment, and check the environmental qualification of new enterprises before they can enter the parks. It requires that, during the construction of industrial parks, environmental impact assessment and the “3 Simultaneousness” requirement must be strictly fulfilled, and that construction projects must pass environmental protection requirements before they can be approved.

6) On Trade and Environment

The Ministry of Commerce (MOC) agreed with the policy recommendations by the Council on trade and environment but suggested some changes. It suggested that, after the sentence “*The Government of China should require that... a strategic environmental assessment be performed on the impacts of China’s accession to the WTO and... trade policy*”, the following words be added: “China should carry out trade impact assessment on the impacts of the changes of environmental policy as a result of its accession to the WTO, as well as the impacts of other important changes of environmental laws or policies. An effective mechanism should be established to coordinate China’s foreign economic and trade policies and environmental policies, so as to make foreign trade and environmental protection support each other and contribute to China’s sustainable development”. MOC also suggested that the original recommendation “*China must strengthen the capability of its negotiators to negotiate trade and environmental issues in order to play a more active role in the Doha Round*” be changed to “China should actively participate in WTO negotiations on trade and environmental issues, and safeguard China’s own interest”, and further suggested that the following words be added after that sentence: “Given the fact that the WTO trade and environment negotiations were initiated by EU and other industrialized economies and had been listed into the new round of negotiations as a result of a package deal, these negotiations will not be advantageous to developing economies in general. They are very likely to lead to even more green trade barriers, which would serve as more obstacles to the exportation of products over which developing economies have comparative advantages. Therefore, China needs to actively participate in these negotiations, and safeguard its own interests and strengthen cooperation with other developing economies. At the same time, given the extensive scope and complexity of trade and environmental issues, various departments within China should increase exchange and coordination, and an expert supporting system should be established to assist in formulating China’s negotiation positions and strategies to safeguard China’s national interest.”

The State Customs Administration will cooperate with other competent agencies to adopt relevant measures to find out potential green trade barriers at their early stages, and assist related sectors to adjust their policies.

The State Environmental Protection Administration set up a work team for WTO trade negotiations to conduct research on trade issues related to the UN Framework Convention on Climate Change, and their impact on China's export, to provide expertise support for China's participation in WTO environment and trade negotiation, and to carry out research on WTO and eco-labeling. SEPA has also been actively participating in the coordination meetings for the new round of WTO negotiations.

The State Forestry Administration, in response to the requirement by China's accession to the WTO, is planning to revise the Regulations on the Protection of New Plant Species of the People's Republic of China, and the Detailed Implementation Rules for the Regulations on the Protection of New Plant Species of the People's Republic of China. They will establish and improve certification and recognition mechanisms, and establish a system that is in line with WTO rules. They will compile guidelines and training textbooks for forest certification and recognition, and improve forest certification standard system.

Beijing Municipality increased relevant environmental standards to make them compatible with international ones through gradual economic structural adjustment, which provided motivation and support for the establishment of a sustainable consumption pattern and greater competitiveness of enterprises.

Guangdong Province organized research on WTO and environment, including pollution control, transformation of economic development patterns, improvement of legal framework, cleaner production, ISO14000, and environmental industries, etc. Such research increased their preparedness to meet new challenges.

7) On Forest and Grassland

The National Development and Reform Commission aims to promote the adjustment of forestry policies in cooperation with other departments. They have been implementing the Decisions on Speeding up Forestry Development by the CCP Central Committee and the State Council. They emphasized on key projects to optimize forestry structure, deepen institutional reform for forestry, increase policy support, stress the role of science and technology, and utilize and protect forest resources according to relevant laws. They adjusted and improved policies for the Slope Land Conversion Program (SLCP), and the Natural Forest Protection Program (NFPP). They contracted the China International Engineering Consulting Company to conduct mid-term assessments on the progress and problems on these two programs. The results of these assessments served as a basis

for relevant policy adjustments by the SDRC and other relevant departments.

The Ministry of Finance established “Forest Cultivation Fund”, “Forest Ecological Benefits Compensation Fund”, and “Forest and Vegetation Restoration Fund” based on the *Forest Law*. They will continue to improve taxation system, and utilize taxation lever to promote environmental protection and ecological conservation. They don’t agree to the Council’s recommendation that “the logging ban should be lifted for collectively-owned forests where appropriate”, and the Council recommendation “to rationalize taxes and improve identification of authority to tax within various sectors”.

The State Environmental Protection Administration conducted research on the problems that arose out of SLCP, and reported the research results to the State Council to promote solution to these problems.

The State Forestry Administration organized assessment of the ecological, economic and social benefits of SLCP with a view to improving relevant policies and promoting the benefits of land conversion. SFA established a legal and policy guarantee system for the sustainable development of natural forests, and established a forest ecological benefit compensation system. It deepened reform on forest management, and implemented management rights. It improved the quota logging system, and implemented property disposal rights. It reformed irrational taxation policy, and implemented benefit rights. It also improved ecological compensation system, and implemented compensation rights. It conducted research on the value of forest landscape and property ownership, and implemented user rights for forest landscape.

The Law Office of the State Council formulated specific regulations on various aspects of SLCP, such as planning, tree planning, forest management and inspection, monetary and in-kind compensation, etc. It was responsible for examining the Natural Forest Protection Regulations submitted to the State Council by the relevant departments.

Beijing Municipality devoted major efforts to tree planting, concerting slope land back to forest/grassland, adjusting agricultural structure, promoting environmentally friendly tillage practices, and strengthening ecological restoration in mine areas. During the process of converting slope land to forest/grassland and the construction of green belts, they established a basic ecological compensation and ecological investment mechanism.

Jilin Province increased their efforts on ecological conservation. They organized research on the construction of ecological conservation zones and the protection of wetland resources. In the middle and eastern economic zones, they took effective measures to prevent resource development activities from degrading the ecological environment. In the eastern forest/ecological economic

zones, they intensified management for Changbaishan National Nature Reserve to protect forestry resources and biodiversity.

Jiangxi Province increased their efforts to close mountains for forest cultivation, convert slope land back to forest, protect natural broadleaf forests, and reform artificial coniferous forests. It sped up the construction of the protective forest system in Boyang Lake area, Yangtze River area, and the western section of Pearl River area. All cropland with slopes of steeper than 25 degrees within the province will be converted back to forest/grassland. Cropland with slopes less than 25 degrees steep will be gradually transformed to terraced crop fields. During the land conversion program, the policy was such that “those who stop growing crops on slope land shall be responsible for planting trees, and those who are responsible for the forest management shall benefit from what they do”.

Shaanxi Province aims to save and protect Qinling National Ecological Conservation Region during the 10th Five-Year Period. It will adopt coercive measures to protect the ecological environment of key resource development areas, and promote environmental protection in rural areas. It has devoted efforts to prevent and control pollution from livestock sources, and promote biomass energy use. It will devote major effort to development ecological agriculture, green products, and organic food. It will also carry out environmental baseline surveys using remote sensing technologies and mobile monitoring and assessment, with a view to providing technical support for the land conversion program.

8) On Eco-Security

The Ministry of Railway conducted more research on the migration routes of wild animals during the construction of Qinghai-Tibet Road. It utilized local grass species to conduct vegetation restoration experiments on how to prevent invasion by foreign species.

The State Quality Supervision Administration established and led the “National Committee for Assessment of Risks Posed by the Import and Export of Plants and Animals”, whose members consist of the Ministry of Agriculture, the Ministry of Commerce, the Ministry of Foreign Affairs, and the Chinese Academy of Agricultural Sciences, etc. It drafted *Comments on the Prevention of Invasion by Harmful Alien Species*, which has been approved by the State Council and promulgated.

The State Environmental Protection Administration promulgated *Circular on Strengthening the Prevention and Control the Invasion of Alien Species*. It also promulgated China’s first directory of invasive alien species. It is China’s leading agency for the implementation of the *Convention on Biological Diversity*. It organized relevant Chinese institutions to participate in international negotiations for the *Bio-Safety Protocol*, *the Guidelines for the Acquisition and Benefit Sharing*

of Genetic Resources, and the Guiding Principles of Preventing, Introducing, and Alleviating the Impacts of Invasive Alien Species. It formulated and implemented a number of national guiding reports, such as the *Action Plan for Biodiversity Protection*, the *National Report of China on Biodiversity*, and *China's National Bio-Safety Framework*. It also devoted great effort to in-situ and ex-situ biodiversity conservation.

The State Forestry Administration paid great attention to preventing the invasion of alien species in order to ensure China's bio-safety. They stressed the importance of effective management and technology for the purpose of preventing the invasion of alien species from the source.

The Law Office of the State Council promulgated the *Management Regulations on the Bio-Safety of Genetically Modified Agricultural Products*, which provided specific rules for research, experiment, production, processing, sales, and import/export of genetically modified agricultural products.

The Chinese Academy of Sciences started a number of major research projects, such as “the ecological impacts of the invasion of important alien species, and technologies for tackling these impacts”, “the islanding of Bio-environment and their ecological impact”, and “analysis of the survivability of rare and endangered land vertebrate animal species and their habitats”.

Beijing Municipality formulated *Comments on the Implementation of the National Guidelines for Ecological Conservation*, which put forward short- and long-term objectives and tasks for ecological conservation. It has also started to formulate a municipality-wide ecological conservation plan.

Chongqing Municipality formulated the *Ecological Function Zoning for Chongqing Municipality, and the Plan for Protecting the National Ecological Function Reserve in the Chongqing Section of the Three Gorges Reservoir Area*, which designated key protected biodiversity areas. It strengthened supervision and management of nature reserves, organized a special research project on bio-safety, compiled a directory of invasive alien species, and strengthened supervision and management of invasive alien species.

Shaanxi Province conducted a survey of invasive alien species, which clarified the distribution of alien species within the province. Management measures were proposed based on that survey. It is formulating relevant countermeasures for controlling invasive alien species, including risk assessment, total social cost-based pricing, “users pay”, and monitoring and pre-warning, etc.

Annex II

Report on Finances

Introduction

The Rules of Procedure make several references to funding including the following points:

1. *The funding for the Council comes from contributions of the Chinese government and international donors.*
2. *The Council will set up a core funding mechanism to finance activities that are unable to obtain financial support.*
3. *The Secretariat and the Secretariat Canadian Office will administer core funding funds that enter their respective accounts according to their respective financial regulations and rules.*
4. *The core funding funds will be audited annually by a third independent auditing agency.*
5. *The Council will actively seek contributions from organizations who are interested in cooperation with the Council. The Council will also make specific arrangements to ensure systematic, continuous financial and other support necessary for carrying out the Council's activities.*

The foregoing references to “core funding” were explained in the following excerpt from the Project Implementation Plan for CCICED Phase III agreed to by China and Canada and made available to other donors:

*Two types of funding are described below: **core financing** and **dedicated financing**. For the purposes of this document, core financing is defined as funding which supports the Council's core operations: its Annual General Meeting, Task Forces, Lead Experts and Secretariat; core financing is not tied to any specific purpose. Dedicated financing is defined as being provided to the Council for a specific purpose, for instance the funding of a particular TF.... Untied core funding will ensure that the Council has sufficient funds with which to plan its activities, as well as to ensure Task Forces operations.*

There is no annual assessment or burden-sharing formula applied to Members of the Council. All contributions are voluntary.

As in the past, income forecasts are reported on a calendar year basis. They are reported in American dollars because that is the unit of account for the Council, even though most contributions are made in a variety of other currencies.

Contributions

To date, the following pledges have been made to CCICED Phase III.

- ❖ Chinese contribution over the five-year period will amount to RMB 10.0 million in cash for core funding, plus the provision of staff, facilities and local costs estimated at RMB 22.0 million.
- ❖ Canadian CIDA contribution will be Cdn\$ 8.0 million for core funding over 5 years.
- ❖ Norwegian NORAD has pledged 10.0 million kroner for core funding over 5 years.
- ❖ Swedish SIDA has pledged 2.5 million USD for core funding over 5 years.
- ❖ The total German contribution for phase III amounts to 2.0 million EURO, over 5 years out of which an average of 19% will be provided as a financial contribution toward the costs of “core operations” such as annual meetings and other activities as soon as the related bilateral agreement is signed.
- ❖ In the case of Japan, GISPRI has pledged 19.9 million Japanese Yen to support the Task Force on Promotion of Circular Economy and Cleaner Production and the Ministry of Environment, Japan (MOEJ) has pledged 14 million Japanese Yen to the TF on Financial Mechanism for Environmental Protection. In addition, a contract for another 8.5 million Japanese Yen has not signed.
- ❖ The Netherlands Government pledged 600 000 Euro over 5 years, of which 190 000 Euro to support the TF on Enterprises Development and the Environment in 2003.
- ❖ Swiss SECO has pledged \$992 000 during 2003 and 2004 to support the TF on WTO and Environment.
- ❖ British DFID has pledged \$938 000 over 3 years to support the TF on Environmental and Natural Resource Pricing and Taxation.
- ❖ WWF has pledged approximately \$400 000 to support the TF on Integrated River Basin Management
- ❖ Chinese Academy of Sciences (CAS) has promised RMB 1 800 000 (about \$220 000) to support TF on Non-point Agriculture Pollution Prevention
- ❖ Asian Development Bank has offered \$85 000 to support activities not yet specified
- ❖ Shell Foundation has offered \$70 000 to the Secretariat.

Attached is a table entitled “CCICED 2003 Indicative Budget”. It shows (by purpose and donor) the approximate value in US\$ of all cash commitments that are expected during calendar year 2003. It also makes a distinction between core funding and dedicated funding. Page 2 gives details of China’s in-kind contributions.

The financial support from all sources is of great importance to CCICED and much appreciated, as are the many in-kind contributions made, not only by China, but also by NGO's, institutions and many individual experts. These are too numerous to mention here but are acknowledged in the Task Force Reports.

Expenses

There are currently 9 Task Forces (TF) being financially supported by CCICED that are scheduled to report to the Council either this year or in subsequent years. They are listed on page 1 of the attached table. Very recently another three Task Forces (Agriculture and Rural Development TF, Transportation TF and TF on Protected Areas) were approved in principle and will probably start drawing down funds before the end of this year but not in time to be recorded in this report.

The following five TFs will report to the 2003 AGM: "Strategy and Mechanism Study for Promotion of Circular Economy and Cleaner Production"; "Development of Environmental Protection Industry"; "Financial Mechanism for Environmental Protection"; "Enterprises' Development and the Environment"; "Energy Strategies and Technologies".

The amount of future Task Force activity will be limited by two main considerations: time and money. At each Annual General Meeting during Phase III, it is planned that the Council will receive and discuss only 4-5 TF final reports. By dropping the requirement to hear many TF reports annually, the Council aims to optimize the time available for discussion of urgent issues. The other relevant factor in this Phase is the new rule that normally each TF will have no more than two years to complete its work program. In a few cases however, the Bureau may decide to extend the work period of a TF because it has proposed to do new work that would meet a priority need for China.

The other limitation will be the financial resources to support these Task Forces that are budgeted at approximately US\$300 000 each annually. Even the latter figure is very tentative until we have more experience in operating short-term Task Forces and it may have to be adjusted from time to time.

Although several key donors have not made firm five-year commitments to Phase III, we are hoping that eventually CCICED should be able to support a five-year budget to finance approximately 45 years of Task Force activity.

Most other expenses are easier to estimate. The following annual costs which are forecast for this year should continue to be about the same in future years:

Council meetings (including travel costs) = \$215 000

Headquarters Secretariat	= \$150 000
Canadian Secretariat	= \$200 000
Lead Experts	= \$170 000

Core and Dedicated funding

CCICED 2003 Indicative Budget (US\$K)

CCICED 2003 Purpose/Donor	CF total	*Core Funding (CF) Commitments					Dedicated Funding Commitments					Total
		1 CIDA	2 NORAD	3 Sida	4 China	5 UK	6 GTZ	7 Neth	8 Japan	9 SECO	others	
Non-point pollution TF	311	150	51	99	11							311
River Basin TF	311	150	51	99	11							311
Environment & Natural Res. TF	77	33	11.22	21.78	11	312						389
Trade/WTO TF	11				11					450		461
Energy TF	311	150	51	99	11							311
Circ Econ & Cleaner Production TF	11				11				150			161
Financial Mechanisms TF	11				11				150			161
Enterprise Development TF	11				11			221				232
Environment Industry TF	11				11		200					211
TF sub-total	1 065	483	164.22	318.78	99	312	200	221	300	450		2 548
Council Meetings	215	152	16	32	15							215
Headquarters Secretariat	150	27	8	15	100							250
Lead Experts & Consultants	168	80	24	46	18							168
Canadian Secretariat	200	200										200
*core operations sub- total	733	459	48	93	133	0	0		0			733
*Core funding total	1 798	942	212.22	411.78	232	0	0		0			1 798
Core & Dedicated funding total	3 281	942	212.22	411.78	232	312	200	221	300	450	0	3 281
% share of each core donor		0.5239	0.1180	0.2290	0.1290							

Note:

- 1) *CIDA pledged CDN\$ 8.0M over 5 years (or 5.3M US\$ @1.5) - all for core funding
- 2) *NORAD pledged \$1.3m core funding over 5 yrs (with 85% for TFs).
- 3) *Sida pledged \$1.1m core funding for 2003 and 2004 and pledged 2.5 m core funding 5 yrs (with 85% for TFs)
- 4) China pledged core funding of RMB 10M in cash and RMB 22M in-kind over 5 years (see page 2 for breakdown of in kind support).

5) British DFID pledged UK £ 630k over 3 yrs for TF on Environmental and Natural Resource Pricing and Taxation .

6) German GTZ pledged 2.0 M Euro (US\$2.34M) over 5 years. An average of 19% will go to “core operations” when bilateral agreement is signed.

7) Netherlands Embassy’s indicative budget for CCICED is 200K EUR for 2003; 180K EUR for 2004; 162K EUR for 2005.

8) Japan: GISPRI pledged 19.9 M Yen to TF on Circ. Econ. & Clean Prod; MOEJ has pledged 14 million Japanese Yen to the TF on Financial Mechanism for Environmental Protection.

9) Swiss SECO pledged \$992k over 2003 & 2004 for WTO TF.

“others” include WWF=400, CAS=220; Shell=70, ADB=85 but it is too early to predict their specific annual commitments.

*Core Donors (CD) pledged the following amounts for Phase III covering years 2002-2006: CIDA5.3 m + NORAD 1.3 m + Sida 2.5 m + China 1.2 m = 10.3 m. Of that amount, only \$.158 m of CIDA funds was used in year 2002. The remainder of 2002 budget was financed from unused Phase II funds. Thus the CD total funds available for the remaining 4 years = US\$ 10.15 m or circa 0.25375 m annually.

Breakdown of In-kind Support from Chinese Side for CCICED Phase III (on an annual basis)

RMB Yuan

Secretariat	750 000	including salary and insurance for Secretary - General and operational costs for his office; rental for the office for the Secretariat, expenditure for water, electricity, daily communication, transportation, office facilities and other supporting logistic back ups
9 Task Forces	3 150 000	including office rental, office facilities, water and electricity, daily communication, transportation, cost for supporting research fellows and logistic back ups
Lead Expert and assistants	200 000	including office and meeting rental, water and electricity, daily communication, transportation, depreciation of office facilities and logistic back ups
Preparation for AGM	350 000	including the personnel input from parties related
Supporting cost for the Secretariat, TFs and Lead Expert and his assistants from local governments, enterprises, research institutes, universities and colleges for the following activities: side visits, investigations, meetings, demonstration projects and etc	800 000	
Total	5 300 000	

Summary Record of the 2nd Meeting of the 3rd Phase of CCICED

Beijing Hotel, Beijing

Oct. 30, 2003

I . INTRODUCTION

1 . The China Council for International Cooperation on Environment and Development (“the Council”) was established by the State Council of the Chinese Government in April 1992 to facilitate cooperation between China and the international community in the fields of environment and development.

2 . The Council is a high-level advisory body that puts forth recommendations for the Chinese Government’s consideration on the integration of environment and development. It has so far held five annual meetings in the First Phase, five annual meetings in the Second Phase and two meetings in the Third Phase. The Council supports the development of an integrated, coherent approach to environment and development and encourages close cooperation between China and other countries.

3 . The Council is a non-governmental body but with strong government involvement. At present the Council comprises 25 Chinese Members and 21 International Members, all chosen for their expert knowledge and their experience.

4 . The Members of the Council attended the 2nd Meeting of the 3rd Phase at the invitation of Zeng Peiyan, Vice Premier of China’s State Council.

5 .The host institution was the State Environmental Protection Administration (SEPA). SEPA has been made responsible for inter-ministerial coordination and for supporting the activities of the Council. It has established a Secretariat Head Office to maintain and develop international and domestic contacts and to ensure follow-up within China to the recommendations made by the Council, as well as to deal with the routine work of the Council when not in session. The Secretariat is assisted by the Secretariat Canadian Office which is directed by Professor Earl

Drake. It is located at Simon Fraser University in Vancouver and is funded by the Canadian International Development Agency (CIDA).

6 . This Summary Record of the 2nd Meeting of the 3rd Phase of the Council was prepared for the Secretariat Canadian Office by Ms Lucie McNeill on the basis of more detailed notes recorded during the Meeting. The Summary Record represents the Secretariat Canadian Office's interpretation of the discussions and not necessarily the views of all participants. To ensure frank and direct exchanges it has been agreed that the Summary Record of the Meeting should present an overview of the discussions without attribution to individual speakers.

II . AGENDA ITEMS

ITEM 1. ADOPTION OF THE AGENDA

7 . On behalf of Chair Zeng Peiyan, Vice-Chairman Xie Zhenhua presented the theme of the Meeting—the Establishment of a Well-Off Society and a New Sustainable Industrialization Mode. The agenda for the 2nd Meeting of the 3rd Phase was adopted as presented.

ITEM 2. APPROVAL OF NEW COUNCIL MEMBERS AND TASK FORCES

8 . Paul Thibault, recently appointed as president of CIDA, replaces Len Good as Vice-Chair of the Council. A number of new Chinese and international Council members, as well as new Task Force (TF) Co-Chairs were announced. Zhu Guangyao, Vice-Minister of SEPA, becomes the new Secretary General of the Council. Members approved the changes by acclamation.

ITEM 3. OPENING CEREMONY

9. With Vice-Chair Xie Zhenhua presiding on behalf of Chair Zeng Peiyan, the following participants addressed Council members to open the Meeting:

- (1) Vice-Chair Xie Zhenhua, Minister of SEPA
- (2) Vice-Chair Paul Thibault, President of CIDA
- (3) Vice-Chair Liu Jiang, Vice-Chairman of the National Development and Planning Commission (NDRC)
- (4) Vice-Chair Qu Geping, Former Chairman of National People's Congress (NPC) Environmental and Resources Protection Committee
- (5) Vice-Chair Måns Lönnroth, Former State Secretary, Ministry of the Environment; Managing Director of the Foundation for Strategic Environmental Research, Sweden.

10. In the course of these remarks, the following points were made:

11. The government and the people of China were faced with a major challenge over the past

year: Severe Acute Respiratory Syndrome (SARS). While the disease had an impact on economic activity initially, the country has resumed its rapid growth path. The fight against SARS taught the government of China (GOC) how to respond to a public health threat where coordination is key; in addition, the GOC has realized there needs to be increased investment in health and environmental protection - more specifically the disposal of medical and dangerous waste. The GOC has also enacted the *Cleaner Production Law*, the *Environmental Impact Assessment Law* and the *Law on the Prevention of Radioactive Pollution*. The government has paid attention to waste management in major projects such as the Three Gorges Dam in order to ensure adequate water quality in the reservoir. The provinces of Hainan, Fujian, Jilin, Heilongjiang, Anhui, Shandong and Zhejiang are experimenting with sustainable development as a guiding principle, promoting the “Eco-province” and “Circular Economy” concepts. These approaches have also been adopted by selected municipalities and counties.

12 . The realization of a well-off society (*Xiaokang*, in Chinese) and of sustainable industrialization will require complex economic, environmental and social interactions. For China to quadruple its Gross Domestic Product (GDP) by 2020, it will not be possible to pursue classic extensive economic growth models involving high pollution and unsustainable resource use. China needs a paradigm that results in sustainable development.

13 . Recognized experts agree that China is now entering a critical stage of its development. Incorrect growth strategies adopted or adhered to now, could cause irretrievable damage to the environment. There is a debate in China over the extent to which industrial growth should at this time be influenced by environmental considerations. Fortunately the GOC, with the support of SEPA, is aware of the environmental challenges facing China. Already, encouraging results have been achieved in the area of sustainable industrialization - as will be illustrated during this Meeting by presentations made by Anshan Iron and Steel Group and the province of Zhejiang.

14 . The Council congratulates Minister Xie Zhenhua on winning this year’s United Nations Environment Programme (UNEP) Sasakawa Prize—a well deserved recognition of his work, including his leadership of the Council over the past decade.

15 . The GOC has been paying close attention to the Council’s recommendations since its inception. Suggestions to strengthen the organization and coordination of “ecological construction” projects have been adopted; investments have been increased in the areas of reforestation, soil conservation, rangeland restoration and combating desertification. The annual plans and key projects are now better coordinated among responsible authorities. Some of the Council recommendations relative to the fees charged industry for sewage and waste treatment have been adopted. The National Development and Reform Commission (NDRC) is using

Council work in the area of financing for municipal environmental projects such as water treatment plants. The Council's work contributed to the design of China's *Program of Action for Sustainable Development in the Early 21st Century*. GOC representatives attend Council meetings not as guests but as partners voicing needs and seeking cooperation.

16 . Sustainable development is a strategy that is appropriate for China, with its large population, low per capita resources and fragile environment. The participation of the government, the private sector and the public is required to put this in action; integrated decision-making, market mechanisms and public participation are needed to ensure the three key partners each play their role. Progress needs to be made on several fronts: *The Law on Environmental Impact Assessment (EIA)* needs to be rigorously enforced and government agencies at all levels should fulfil their obligations to carry out EIAs prior to project approval; economic incentives based on market mechanisms need to be put in place to encourage the private sector to adhere to pollution control and resource conservation; the public needs to become more informed and a mechanism needs to be established to encourage involvement of the media and of civil society to strengthen environmental supervision.

17 . The quadrupling of China's economy by 2020 has serious implications. New York City's Goldman Sachs Bank estimates that China will overtake the economy of Germany by 2010 and of Japan by 2015. Even with much lower growth rates, western countries are not on a sustainable development path. This kind of rapid growth for China and other Asian countries is bound to put great pressure on all countries to develop in a more sustainable fashion. The pace of growth makes it hard for China to control the process or for the GOC to have much time to think. It implies each sector develops in its own way—further stressing the need for integration and coordination so China can avoid getting locked into unsustainable growth options. Further, there needs to be sustainable regional planning in order to ensure that regions do not choose unsustainable paths that could affect negatively the rest of China.

18 . A Core Funding Mechanism has been initiated by the Council. It is putting the Council on a firm financial footing, ensuring that Task Forces (TF) can be funded and their efforts better coordinated.

ITEM 4. KEYNOTE SPEECHES AND PRESENTATION OF ISSUES PAPER

19. Council Vice-Chair Xie Zhenhua presided over a keynote speech by Mr Borge Brende, Chair of the UN Council for Sustainable Development (UNCSD). During his presentation, Mr Brende made the following points:

(1) One year following the World Summit on Sustainable Development (WSSD), several challenges are emerging. Commitments have been made to achieve measurable progress on

“time bomb” problems, but implementation still lags behind. At the WSSD, then Premier Zhu Rongji stated he was aware of the responsibility on China’s shoulders; if China succeeds, this will help the world achieve sustainable development.

(2) The UNCSO is selecting key commitments on water, sanitation and human settlement to achieve over the coming three years; monitoring will be conducted and a score board kept. For example, by 2005 there should be integrated water management plans ensuring sustainable water use. For less developed countries (LDC), this need not be an expensive process but it involves more optimal, efficient use of existing water resources.

(3) Developed countries bear the responsibility to assist LDCs in leapfrogging technologies and adopting the more sustainable solutions. To eradicate poverty, it is essential to de-couple economic growth and environmental damage. The former Eastern Europe has learned that charging real costs for resources is key in promoting efficiency, productivity and competitiveness, while reducing environmental damage. Pursuing this strategy also opens new business opportunities in recycling industries, waste management and others. Perverse subsidies are paid out of public coffers; these funds are better used in poverty reduction. Similarly, it should be cheaper everywhere to use the least harmful options (such as unleaded gas). Patterns that China chooses will show the world the future face of development; this is why the world is hoping China will provide a “best practices” example.

20. Council Vice-Chair Xie Zhenhua presented keynote speaker Mr. Bayin Chaolu, Vice-Governor of Zhejiang province speaking on behalf of the Secretary of Zhejiang’s Committee of the Communist Party of China, Mr. Xi Jinping. The following issues were emphasized during the speech:

(1) Zhejiang is a populated and industrialized province on the south-east coast of China. It has achieved rapid growth averaging 13% over the past 20 years; it also plans to quadruple its 2000 economy by 2020. Pollution, waste and resource depletion risk cramping this growth and perhaps reverse it. This has prompted Zhejiang to explore the concept of becoming an “Eco-province”.

(2) The main tasks involved in achieving “Eco-province” status are: adopting new forms of production and consumption that embody the principles of the Circular Economy and of resource conservation; providing the legal and regulatory enabling environment to promote optimal resource utilization; strict enforcement of pollution control and the protection of biodiversity; enforcing the national Family Planning Policy; acceleration of the development of science and technology to support the “Eco-province” model.

(3) The provincial authorities have established a Leading Group to supervise the implementation of the “Eco-province” project and promote the concept of “green GDP”, ensuring local plans, projects and budgets meet certain criteria. Zhejiang is also considering the adoption of a “green accounting system”. Cleaner production and concepts of a Circular Economy are being promoted; more environmentally friendly and high-tech industries are actively supported; market-based approaches have been adopted to support the development of the “Eco-province” project. Model or demonstration zones are established in order to experiment and promote successful approaches. The participation of civil society is encouraged.

21. Vice-Chair Xie Zhenhua invited Lead Experts (LE) Arthur Hanson and Sun Honglie to present the Issues Paper on Sustainable Industrialization and a Well-Off Society (*Xiaokang*) prepared for this Meeting of the Council. The following points were highlighted during the presentation:

(1) The future of China lies not with retrofitting the kind of development that has taken place elsewhere in the world, but rather with genuine experimentation on new forms of growth. *Xiaokang* and the levels of growth needed to achieve it will be difficult to obtain, especially considering the broad material and social meaning given to *Xiaokang* by the GOC. The drivers of this process will be industrialization, production, trade patterns and domestic consumption. These will lead to growth in employment, efficiency, equity, inclusiveness and sustainability.

(2) Following conventional growth models would lead to an accumulated environmental debt and would lock China in costly choices of development and infrastructure. For example, promoting private car ownership in order to develop the auto industry as an engine of growth will have severe consequences: arable land will be lost to roads, air pollution will increase, there will be greater dependency on imported energy, the population’s health and safety will be compromised and consumption will be unsustainable.

(3) Ten issues have been identified in order to achieve *Xiaokang* and sustainable industrialization:

Limits of industrial contribution to a well-off society in China: there is a need to examine the extent to which enterprises can contribute to *Xiaokang*, allowing enterprises to be profitable but while also reducing China’s environmental debt;

Interdependence of China’s sustainable development strategies: there is a need to improve the inter-sectoral cooperation and communication on sustainable development in order to realize the full potential of sustainable industrialization;

Fiscal and financial sector reforms: these are needed not only for sustainable development but also for the achievement of sustainable industrialization;

Scale of individual enterprise development: there is a need to consider whether or not China should restructure its industrial base towards larger-scale operations which are more capable of

addressing sustainable industrialization; it is also advisable to consider the sectors where it would be key to foster small and medium enterprises (SME);

Industrialization laws: the tendency is to have a proliferation of laws, but it is necessary to consider the critical gaps existing in the area of implementation and enforcement;

Access to environment and sustainable development technologies: it is necessary to determine how this sector can be stimulated so it supports the needs of sustainable industrialization and actually promotes leapfrogging to improved technologies; yet there is a danger to put too much hope in technical innovation;

Need for good measures of progress: it is key to monitor and measure the process of sustainable industrialization, in terms of its own performance and for the contribution it is making to *Xiaokang*; the choice of indicators is critical and the information must be reliable;

Capacity-building within industry, the financial sector and government: the critical capacity gaps must be identified and action taken to close these gaps during the existing and coming Five Year Plans;

Sustainable consumption: it is important to determine how sustainable patterns of consumption could be adopted through legislation and education;

International decisions and their consequences for China: China needs to reduce its vulnerability to potentially damaging events and to perceptions that may affect its international markets.

22. With Vice-Chair Liu Jiang presiding, the Executive Director of UNEP Mr. Klaus Töpfer addressed the Council and emphasized the following issues:

(1) Vice-Chair Xie Zhenhua told the UNEP governing council this February, “If we follow the conventional production and consumption patterns, the Earth we live on will not be able to bear with us and the environment we rely on will face much greater threat. We must change the unsustainable production and consumption pattern and develop the recycling economy, building up a recycling society and thus achieving sustainable development, relying on scientific and technological advances, and on the saving and efficient use of energy resources.” This is also the leitmotiv for the China Council.

(2) China has achieved great economic growth, thereby achieving the first Millennium Development Goals (MDG) of reducing extreme poverty by 50% by 2015. The ecosystem approach endorsed at the WSSD demonstrates how important environmental capital is. Wetlands are not only bird habitats but also key to water storage, flood protection and the stabilization of aquifers. There is an economic value to the services performed by ecosystems.

(3) The first MDG - poverty reduction - and the seventh MDG - sustainable development - must be achieved. But the old Club of Rome motto “Limits to Growth” is not an option; we must

ensure there can be “growth of the limits”. Where we lose environmental stability, we lose economic potential. Nature is the wealth of the poor - they live interdependently with it. The concept of *Xiaokang* where the economic, social and environmental spheres are integrated, is pivotal. Poverty is the most toxic of all pollutions. And while we cannot have zero growth, we can achieve zero emissions.

(4) Human capital is the most infinite resource we have. UNEP is involved in education and awareness raising for young people in China; a strategic partnership has been developed with China’s business sector to bring this about. UNEP is also working with China on cleaner production (CP); as China grows and invests in new capital, and if the investment is in CP technologies, windfall profits can be reaped in the future. The clean development mechanism (CDM) under the Kyoto Protocol will also support the vital cooperation and technology transfer that China needs. UNEP is assisting China in developing a national bio-safety framework with Global Environment Facility (GEF) funding.

23. Vice-Chair Liu Jiang introduced special guest Mr. Zhu Qingsheng, Vice-Minister of the Public Health Ministry. During his speech, he underlined the following issues:

(1) China has put in place an up-to-date system to deal with public health emergencies; this system has been devised as a result of the experiences gained during the SARS crisis. SARS affected people in 24 provinces, 266 cities and counties; over 5,000 people were infected and 349 died. China has learned that with globalization, public health crises spread beyond national borders.

(2) The lessons learned from SARS are: the need for coordinated and decisive action on the part of the central government; the involvement of all personnel dealing with health care and disease prevention; an enabling legal and scientific environment to support the fight; openness and transparency; international cooperation and exchange.

(3) The public health emergency mechanism now established encompasses a variety of quick response mechanisms, solid public health administrative measures and a public mobilization mechanism. Protocols for responding to public health emergencies have been drawn up; a system of prevention and control of infectious diseases has been set up; emergency medical treatment centres have been designated for every municipality; medical emergency response teams have been named; and international exchange and cooperation on these issues is deepening.

24. With Mr. Liu Jiang acting as Chair, special guest Dietmar Nissen, president of the East Asia Regional Headquarters of BASF, made the following points before Council:

(1) BASF is demonstrating sustainable industrial practices in China; the company's focal point is in the Yangtze River delta, in Nanjing and Shanghai. BASF is part of the Global Compact initiative, a founding member of the World Business Council for Sustainable Development and is listed in the Dow Jones Sustainability World Index. It subscribes to the voluntary Responsible Care Commitment of the chemical industry, aiming to achieve improvement in environment and human health. BASF is convinced that only by adhering to sustainable development can it be financially successful in the long run.

(2) In 2002, BASF averaged 6.3 kg of emissions for every metric ton of product sold; this represents a 27% reduction from 1996. A few months ago, new long term safety goals in water and air emissions, on occupational safety and in product stewardship were announced. A further 10% cut in greenhouse gas emissions is set for 2012; further targets are planned for other waste products.

(3) BASF plants in China are equipped with state-of-the-art technology and easily meet the local environmental and safety standards. BASF has pioneered a new styrofoam process which reduces waste water by 30% and organic waste content in effluent by 80% ~ 90%; this styrofoam process has been introduced in the Nanjing plant. This material will be used as insulation in China's building industry, thereby contributing to energy conservation.

(4) BASF is increasingly being recognized for its environmental, as well as worker health and safety record; it is setting standards for corporate citizenship in China. It supports educational projects for children as well as grants for students and research.

25. With Vice-Chair Paul Thibault presiding, Mr. Tang Fuping of the Anshan Iron and Steel Group (Angang) in Liaoning Province addressed the Council on behalf of President Liu Jie. During the course of his presentation, Mr Tang made the following points:

(1) Anshan has become China's second "Clean City", just behind Dalian; this title was awarded to the Group in recognition of its efforts to clean up the Angang industrial processes and support environmental improvements in the city itself. All of Angang's steel products now meet ISO 14000 certification. In order to achieve these results, Angang took the following steps.

(2) Angang updated its production processes and its equipment, thereby adopting CP mechanisms. Major capital investment was committed during the 9th Five-year Plan (FYP) in order to achieve substantial energy and productivity savings. This process of investment leading to increased productivity, lower energy consumption and cleaner processes continued during the 10th FYP with the installation of a new blast furnace, coke ovens and power plant boilers.

(3) The Group's major wastes are being re-used. Waste water is now recovered, treated and recycled. Secondary resources are being used more efficiently and air pollution has been reduced. Solid wastes such as steel slag and slag powder are being recycled in products such as cement and aggregate.

(4) Angang has also invested heavily in restoring the environment; its open-pit mines have been reclaimed and the areas replanted extensively. The plant itself has been beautified with gardens and trees. Angang is now implementing a plan to become a Circular Economy enterprise by 2010.

ITEM 5. GENERAL DEBATE ON THE ESTABLISHMENT OF A WELL-OFF SOCIETY AND SUSTAINABLE INDUSTRIALIZATION

26. Vice-Chair Paul Thibault presided over the Council debate on the AGM's theme. During the discussion, the following points were put forward by Members:

27. The Council should not avoid controversy; a major one is the restructuring of energy and industry in China. Small coal-fired power plants were to be decommissioned, but reports in the international press indicate that many of the closures have not been implemented - putting in doubt some of the official statistics on energy consumption issued. Is it possible to believe that economic growth and coal consumption can be de-coupled. Rapid growth affords China the advantage of phasing out inefficient firms while encouraging others to adopt technologies that allow for greater energy efficiency. China is not making full use of these options. One idea omitted in the presentations before Council is the idea of an energy tax, the proceeds of which could be used to promote cleaner technologies and energy efficiency.

28. Public awareness has been brought up during the presentations. There is the European Union (EU) and UN Aarhus Convention which enshrines the public's right to information on the environment, as well as the public's right to participation, access to a complaints mechanism and to legal review. While some aspects of this Convention may not be appropriate to China, others could be implemented.

29. The ten issues flagged by the Lead Experts (LE) in the Issues Paper are all key to ensuring China develops along a sustainable path, but identification of these issues must be followed by a discussion of practical measures necessary to tackle them, many of which can be drawn from international practice. The financial mechanisms issue identified is key to ensuring China adopts a sound growth pattern. In the long run, economic development will not be sustainable if financial instruments do not provide incentives for environmental protection. A reform of the financial sector is necessary, with identification of main actors and taking into account the specific conditions of the country and its institutions. It will be important to establish a system to

protect investors and a social safety net; these are not in contradiction with a market system.

30. While many of the problems raised and the solutions outlined are similar to what the Council has heard before, the mood now is more radical. Action is needed urgently. The root of the problem has to do with economic approaches. Markets readily determine prices but cannot recognize costs. In China as elsewhere, there is little agreement on how to determine true costs. Our economies are rife with perverse subsidies and price fixing for short-term goals. In China, there is the potential for the government to put the public first - and for this, it will be crucial to correctly identify costs and “internalize the externalities”. Economic growth must be redefined in terms of national well-being.

31. The Issues Paper underlines the need for improved inter-sectoral coordination and communication in order to realize sustainable industrialization. Most cities in China already face water shortages; the shortage affects the growth prospect of industries; pricing is key to conservation and future growth. The TF on Environmental Economics last year recommended that the price of water and waste water treatment be increased; Vice Minister Liu Jiang indicated that China had adopted this recommendation. It would be interesting for the Council to be informed in greater detail on the issue of water price increases and their impacts on consumption. It would also be useful to understand what are the employment impacts of the adoption of sustainable industrialization options in key industries studied. China has generated more jobs in the service sector than in industry over the past decade; most of this employment growth occurred in the SME sector. The Council must weigh the repercussions on employment of its recommendations carefully.

32. At the WSSD, the EU was insistent on the need to work on sustainable production and consumption. But a key issue is how to achieve this. One contribution of the EU to China is to ensure studies and findings are shared for common learning. Stakeholder involvement is key in ensuring policies and programs are enforced. The “reduce, recycle, re-use” concepts are good, but one forgets waste management; waste is a necessary by-product, no matter how clean the process. It is missing from much of the discussion so far. Channelling theoretical concepts in the discussion by focusing on a sector such as water would bring forward needed consideration of practicalities.

33. A few suggestions based on the Netherlands’ experience with the integration of environmental considerations in the economy are of relevance to the Council. In developing a sustainable growth policy, it is key to take a “whole-of-government” approach—Holland did not task the Environment Ministry with this, but rather made it a cross-cutting issue for all ministries. This results in a strategy that is perhaps less ambitious, but one that is better supported by all. Use of appropriate language is also important; economic wording and arguments are powerful. It is key to project 30 years ahead, taking the whole life of capital stock into account. On

financial incentives, action on a broad front is needed: economic incentives, technology policy, pricing and investment. Capacity building is key if government wants industry to adopt certain measures; energy programs in Holland only took off when government provided technical advice to individual companies. Finally, without enforcement, most measures will not be implemented.

34. Fast economic growth presents opportunities and challenges - but it would be unrealistic to expect the development of an economy with zero emissions and full recycling. Most decisions involve trade-offs - by solving one problem for air quality say, others are exacerbated. In order to make wise choices, solid information is key; there can be good collaboration between Chinese and international scientists. The plans to reduce coal use and CO₂ emissions are ambitious, particularly considering the discrepancy between official and actual emissions statistics.

35. The goal of the 16th CPC Congress of achieving *Xiaokang* for the whole society is inspiring; this would lead to domestic improvements and imply that China can make a greater global contribution. However, environmentalists are concerned that following the Congress, the official discourse has focused mostly on the target of quadrupling GDP by 2020. Some local governments are now setting this target for 2016. As for other components of the *Xiaokang* goal, not all local authorities are monitoring relevant indicators and yet they claim to be achieving these already. The environment is getting lost in this debate. There is a need to link directly the achievement of *Xiaokang* with the adoption of sustainable industrialization measures. In addition, the definition of sustainable industrialization found in the deliberations of the 16th CPC Congress is comprehensive and should be used in the Issues Paper.

36. The Issues Paper presents desirable results for China to achieve; this has been known in China for some time, therefore the discussion should focus on the “how to”. The Council is now focusing on underlying policies which will allow China to achieve *Xiaokang*; these are financial reform, environmental industries and the coordination and processing of policies. Two other issues deserve focused attention: the first is a strategy for the development of science and technology, the second is education in order to have trained and proficient people in areas critical to sustainable development, and in order to raise public awareness and promote public participation. In addition, the consequences of China’s rapid growth needs to be more closely examined by the Council; these consequences encompass impacts on international resource flows including labour, on trade and on the value of the currency. It is critical to recognize that China faces practical problems and pressures to deliver on employment and growth, which may trump the environment.

37. It is important to focus on practical measures that will force behavioural change and thus support sustainable industrialization. There are companies such as BASF and Angang which are

fast adapters but they are in the minority. More common are laggards who resist change. Without regulations and enforcement, there is no level playing field and this has a corrosive effect on all companies' performance. For companies in the middle of the pack, green taxation is too blunt an instrument; emissions caps and emissions trading are powerful measures. Transparent benchmarking and performance reporting can be strong incentives for companies not wanting to end up in the bottom quartile. Finally, on the issue of scale, economic and employment growth in China will require the development of innovative SMEs; ensuring this sector adheres to sustainable development guidelines and rules is key; incentives can be provided to smaller suppliers by larger firms through contracting and procurement.

38. The Issues Paper identifies the complex interlinkages that must be taken into consideration as the Council moves towards policy recommendations. It also reveals a tension between the urge of experts to deal fully with fundamental and urgent issues on the one hand, and on the other hand with the need to distill a set of priorities with a plausible and realistic timetable for senior policy makers. It would be of value if Council recommendations could be more specific about an action program based on near-term, medium and long-term priorities. There are policy interventions that support economic growth and broader environmental objectives while being consistent with poverty reduction. Higher quality information to the public and a transparent policy making process are key, and so is the clarification needed of the various administrative levels of authority - center, province and municipality or county.

39. There is a need for greater rigour in public expenditure choices and the basis on which they are being made. The analysis leans heavily on a financial, accounting approach. This leads to an underfunding of public investments that have high public good value or positive externalities - such as rural health and education - and overfund those that have negative externalities - such as loss-making and environmentally unsustainable state owned enterprises (SOE). Our recommendations ought to point to these broader issues. It is key that we find a message and a language to speak to a broader group of public policy officials - not just those who are already converted to environmental issues, but also the indifferent and the hostile.

40. Sustainable industrialization should be cross-cutting for all industries in China. In the past decade, there has been a focus on certain industries when it comes to pollution control; there has been little coordinated, integrated or systematic action. In future, there is a need to include in our efforts all industries and stakeholders; this would lead to improved implementation of Council recommendations. It is key for China to learn the methodologies that are powerful in other countries - the ones that provide incentives for business, that support greater coordination and integration, the ones that produce consumer behaviour change.

41. *Xiaokang* is a comprehensive concept and needs to be understood fully. It incorporates

improvements in education, in democracy, in science and technology, in the environment and in the economy. The Council AGM must focus on the environmental aspects of *Xiaokang*; this involves a consideration of ecosystems and diminishing natural resources. Understanding the implications of this for *Xiaokang* will enable the Council to make more productive contributions to its achievement. Sustainable industrialization must also be understood in context. This is now an inevitable option for China due to the diminishing returns of trying to develop industry according to traditional models. Sustainable industrialization means understanding the constraints imposed by limited resources.

ITEM6. REPORT ON THE WORK AND FINANCES OF THE SECRETARIAT

42. With Vice-Chair Paul Thibault acting as chair, CCICED Secretary General Zhu Guangyao presented to Council the report on the work of the Secretariat, Head Office and Canadian Office. During his report, the following points were emphasized:

43. The Secretariat has received feedback on the 2002 Council recommendations from 20 concerned departments under the State Council, as well as six provinces and municipalities. This included reports on legislation which is now being implemented, namely the *Cleaner Production Promotion Law*, the *Environmental Impact Assessment Law*, and other regulations and statutes. CCICED recommendations were also incorporated in China's new *Programme of Implementation of Sustainable Development in the Early 21st Century*. Some green taxation measures have also been adopted.

44. Aside from announced changes to the membership of the Bureau and of the Council, there have also been changes with Secretariat staff. SEPA's Directors General of International Cooperation and of Policies and Regulations will become Deputy Secretaries General.

45. Themes for the Council AGMs of the coming three years have been chosen. For the 2004 AGM, the theme will be *Agriculture and Rural Development*; in 2005, the theme will be *Urbanization/Development and the Eleventh Five Year Plan*; and in 2006, the theme chosen is *Social Progress and Xiaokang*. Thus in 2005, Council recommendations will be submitted in time for the finalization of the 11th FYP. It has also been decided that future Council AGMs would not produce general policy recommendations, but rather that relevant Task Forces would present their reports directly to the State Council; these reports would now include a 3-page précis of relevant recommendations.

46. The Bureau has approved the formation of the following Task Forces: *Integrated River Basin Management*; *Non-point Agriculture Pollution Prevention*; *World Trade Organization (WTO) and Environment*; *Environmental and Natural Resources Pricing and Taxation*; *Sustainable Transportation*; *Protected Areas*; and *Agricultural and Rural Development Policies*. Further TFs

are being considered in order to report to the Council at the AGMs of 2005 and 2006.

47. Over the past year, the Secretariat focused on working with the TF Co-Chairs and staff, compiling feedback from relevant government bodies, preparing for the 2003 AGM, implementing capacity building activities with staff and updating the CCICED website.

48. Efforts have also been made to put in place and formalize the Core Funding Mechanism to ensure Council stability and timely work through multi-donor, multi-year, untied funding commitments. Donors contributing to the Mechanism are China, Canada, Sweden, Norway, Germany and Shell Company. The total core fund now stands at US\$ 10.67 million; 80% of the fund is dedicated to TF operations. Financial statements for the CCICED have been provided by the Secretariat Canadian Office.

ITEM 7. REPORT ON THE TF CO-CHAIRS' COORDINATION MEETING

49. With Vice Chair Paul Thibault presiding, Lead Experts Dr. Art Hanson and Professor Sun Honglie briefed Council on the TF Co-Chairs' Meeting held the previous day. They outlined the following issues during their presentation:

50. There is some tension surrounding the review and suggestions provided by the LE to each TF; some TF Co-Chairs felt the LE were adding to complications and confusion. The LE are trying to ensure there is synergy among the groups that will be reporting to Council, in order to improve the consistency, coherence, scientific rigour and impact of the recommendations put forth to the GOC. Ideally, the LE would be provided with TF recommendations some six months prior to an AGM, allowing for a more measured pace for this review work to take place. This year, there will be a meeting of all TF Co-Chairs who will be reporting to Council in 2004 in order to start this coordination and integration process as soon as possible.

51. Despite SARS and the disruptions it caused for various TF operations, all five groups were able to complete their work this year and provide the Council with their reports. Continued communication among TFs is needed and some of this will be done through the TF on Environmental and Natural Resource Pricing and Taxation (ENRPT); it is also necessary to ensure that all groups take into account economic and poverty dimensions of their work. The ENRPT TF will devote a proportion of its budget to working with other groups.

52. The LE would like to develop an assessment process whereby the Bureau and the Council could judge the quality and results achieved by funded TFs. This matter is complex but important. On the other hand, it is also important for TF participants, once their work is completed, to find out the extent to which their input has been taken into account by Chinese authorities.

ITEM 8. REPORTS BY THE TASK FORCES

53. Vice-Chairs Paul Thibault, Qu Geping and Chair Zeng Peiyan presided over the presentation of the Task Force reports and ensuing Council discussions.

a) Task Force on Enterprise Development and Environment

54. Task Force Co-Chair Björn Stigson and Emeritus Co-Chair Professor Pan Chenglie presented the group's findings to the Council and underlined the following points:

55. The TF members were involved in desk and field study work, including a study tour to Europe. The work focused on four sectors - cement, oil refining, sugar and pulp and paper - and assessed the situation in China as well as international best practice; lessons were then drawn based on comparative analysis. The study tour went to Finland, Denmark, the Netherlands and Switzerland. Chinese participants were surprised at the extent to which international businesses had integrated environmental protection in their operations; they were also surprised at the positive interaction between government and business. It was useful to have prominent members of the Chinese business community exposed to these realities through the study tour. This underscores the need to include a greater number of Chinese business leaders as members of Council.

56. Five overarching themes were identified: the need to rationalize business scale because Chinese companies operate on a smaller scale than equivalent international firms; the need for capacity building in both knowledge and implementation skills for the general areas of management, environment and law; the need for strengthening governance frameworks, more specifically the enforcement of safety, health and environment regulations; the need for special SME programs; and the need for the development and use of performance indicators.

57. The World Business Council for Sustainable Development started its Sustainable Cement Initiative three years ago; it encompasses the ten largest cement producers globally, providing the group with good knowledge on the industry. Chinese cement plants are smaller in size; many use outdated and polluting technology; their efficiency levels are lower. Plant dust emissions in China vastly exceed standards; limestone quarrying practices are damaging and there is virtually no reclamation done; product quality is below international standard; the size of plants is insufficient to support investment in pollution control equipment. Power consumption is substantially higher in China; labour productivity is much lower as well.

58. In the cement sector in China, there needs to be continued closure of small vertical shaft kiln plants; there is a need to consolidate plants in units large enough to justify pollution control investments; personnel protective equipment and clothing needs to become compulsory and

widespread; key performance industry standards need to be developed in order to monitor individual plants (energy use, dust emissions, safety). Clean plants, safe plants are also efficient plants.

59. In the pulp and paper sector, China's production is characterized by small mills using agricultural waste as primary feedstock; internationally, the primary feedstock is wood fibre and the plants are large. In China, equipment is outdated, few sustainable forest management tools are used, there is no infrastructure to recycle paper and the technology is not designed to use such feedstock. Similar to the cement industry, the TF finds the pulp and paper sector in China to be characterized by low energy efficiency, higher pollution, lower overall product quality due to the feedstock, and lower labour productivity.

60. For pulp and paper plants, it is recommended that China continue the closure of smaller plants, consolidate production in larger units enabling an investment in improved technology, and adopt the use of performance indicators adapted to the sector. Foreign direct investment (FDI) would be a channel for bringing in improved approaches for all the sectors studied.

61. Oil refining was found to be different because of the presence of foreign firms - although there are many small and inefficient facilities to be found.

62. Recommendations relate to the five overarching themes. Increase manufacturing facility size for each sector, restructuring to a scale that allows adoption of sound business, environmental and quality practices. Make industry structural changes that encourage and promote stronger environmental performance. Develop a strategy, tactics and institutional capacity for improving performance of SMEs. Strengthen governance frameworks. Develop key performance indicators for specific industries and for China's key social, environmental and economic goals. Speed up capacity building within a broad spectrum of business, management, legal systems and social institutions.

63. There is not sufficient SME support for pollution control; simple administrative means are not effective in dealing with the problem and often lead to reductions in production. A better approach might involve providing management expertise support to SMEs in order to help them meet efficiency and quality objectives. More competitive SMEs could then survive and others could be eliminated through competition. Merger and acquisition strategies could also assist in the process of increasing SME efficiency and the scale of industry. Administrative measures are not effective in controlling undesirable SMEs; regional protectionism undermines central directives in some cases because of local concerns over fiscal revenue and employment.

Discussion

64. In the past, SEPA resorted to administrative means to shut down polluting enterprises; as five were shut down, four re-opened. If administrative means were combined with market-based mechanisms, the results would be more satisfactory. In Jiangsu the pulp and paper sector is composed mostly of SMEs; thousands were shut down but they have re-emerged. The government determined to encourage the growth of larger scale, clean and profitable paper mills; this has led to the bankruptcy of smaller, less efficient and polluting SMEs, or their relocation to western China. There needs to be better inter-provincial coordinating mechanism to deal with larger firms operating in several areas and flouting the laws; making business news more transparent will also put greater pressure on the management of larger firms in order to avoid a sellout of shares on the markets.

65. Business and government need to develop real partnerships. Successful examples are: the development of eco-business parks where one company's waste is another's resource, and where wastes are treated collectively; in Guangdong, polluting SMEs are subsidized by government to stop production but also to develop a new business line. Comments have been made on the reliability of statistics in China; but Members should be assured that published, official statistics are accurate because to do otherwise leads to another set of problems the government wants to avoid. However, the data provided by less developed areas could be questionable.

66. It is crucial for energy and capital-intensive industries to restructure. It involves massive investment and this needs to be encouraged; it is also important to shut down plants that do not meet standards and exceed limits. If this happened more rigorously, there would be more investment and a more rapid pace of change. Pan-industry benchmarking for key indicators, and the requirement that certain benchmarks be achieved as a condition for licensing, are also powerful tools for change.

67. The leverage that SOEs can put on the performance of SMEs by adjusting their procurement practices can be enormous; SOEs and other large buyers can have significant impacts on their supply chain in terms of environment as well as health and safety conditions. This is the single most powerful measure to take in order to improve SMEs. Similarly, assessing and rewarding managers not only for their economic performance but for their performance on environment and human resources management can also lead to substantial behavioural changes.

68. Based on Danish experience, there are changes that could be made to the recommendations dealing with capacity building and governance. Denmark was the first country to compel businesses to keep "green accounts"—ecological statements that can be audited as financial reports are. Industry was initially opposed to this measure but are now in favour; they have

realized savings as a result and public benchmarking became a powerful tool for management and shareholders. While management training is an important component of capacity building, employee training should not be neglected. Worker participation and education is key to improving company performance; it is surprising that in this context, trade unions are not mentioned in this TF report. As for restructuring for scale in China, one key barrier is the human and social costs of workers losing their jobs and local authorities losing their tax base. The imposition of an energy tax contributing to a restructuring fund could ease the process.

69. Japan's experience with SMEs is relevant. In the early 1960s prior to entry into the Organization for Economic Co-operation and Development (OECD), Japan enacted its SME Law. SMEs were lagging behind and needed to be modernized; after 30 years, the change is radical. SMEs are now a source of dynamism and job creation in the Japanese economy.

70. Experience dealing with firms that want to invest in ethical businesses or funds is instructive. Such investments often occur without direct field investigation, but surveys are done by assessment companies hired by potential ethical investors. Such monitoring and assessment in China could be useful; advice on how to comply to ethical or environmental standards is given in the process and can lead to improved performance for companies, their subsidiaries or suppliers. Were Chinese firms to be subject to such independent reviews, this would encourage investment as well as environmental performance. This would check the tendency to "green-wash", to fudge information given to environmentally-concerned investors.

71. The report raises issues that the Council should consider at later AGMs. In Sweden, the most significant environmental improvements occurred from the mid-70s to the mid-80s due to enforcement of environmental regulations and to an economic recession. These factors forced old inefficient companies out of business; local authorities had no say on the survival of these firms. Were local authorities to be more shielded from the health of local enterprises, it would be preferable; depending on personal income tax as opposed to corporate tax helps. The enforcement of environmental legislation should be removed as far as possible from local authorities.

72. It is important to make the business case for the environmental efficiency of companies - that profitability can go hand in hand with environmental efficiency and with improved social practices. Key indicators should be used to demonstrate this. Performance of industry should encompass the downstream impacts of the production chain. In the case of cement, the impacts of the industry on housing quality and heating efficiency or other factors should be included. To promote enforcement of regulations, it is key to have a predictable system; objectives must be set medium and long-term, and inform business of these upcoming changes. A study of the system of enforcement that is best adapted to the Chinese situation is perhaps advisable.

73. The first recommendation advocates the closure of SMEs. But if there is a demand for the product at a price that people like, this may not be realistic. Standards and their enforcement are needed to effect the changes we want; capacity building and financial incentives can also help firms bring their personnel and capital up to date; performance commitment contracts signed between companies and government can also be useful.

74. The report finds there are good practices being followed even by SMEs in China, but it does not explain what lies behind such good practices. Large size does not always improve environmental performance or corporate responsibility or energy efficiency. In fisheries, traditional fishers use 90% of the catch while industrial fishing operations generate by-catches of 30% ~ 40% that are thrown overboard. In forestry, large monoculture reforestation practices did not lead to ecological forests. The report focuses on production processes and output, but does not look at supply chains and inputs. Economies such as Germany are based on SMEs which are both economically profitable and in some cases are at the cutting edge of environmental technology.

75. Capacity building of SMEs works best when it is direct and site-specific. It is no good imposing regulations from above - SMEs must be shown in situ how to do things better. This requires personnel, technical know-how and budgets. Improvements done with one SME can lead to demand from neighbouring SMEs, leading to a positive cycle. When discussing benchmarking, information and transparency, it is important to be selective in the kinds of indicators one requests - information overload can lead to unproductive monitoring to no avail. The information provided needs to be usable and should allow the reader to compare one company's performance to another. More work is needed on the development of such indicators.

76. In heavy industry or in industry that requires large scale processing, investments are such that small scale firms cannot be players - scaling down the technology does not work. The nature of the industry determines whether or not small scale operations that are environmentally friendly are possible. For China, it is useful to approach this on a sector-wide basis. There should be consideration of setting up sectoral funds to assist with upgrading and with re-adjustment of some firms. There is a trade-off and jobs will be lost in the process - these decisions are for the GOC to make.

77. China's specific conditions must be considered when discussing the shutdown of SMEs. The closures were based on a set of well-defined criteria - they were not based on size only. Profitability in some cases was based on pollution so they had to be shut down - the market alone would not have effected this result in such cases. In fact, legal, economic and administrative means must be used together to produce the desired results.

b) Task Force on Energy Strategies and Technologies

78. The Task Force report was presented by Co-Chairs Thomas Johansson and Professor Ni Weidou. The report is the fruit of one year's work and is entitled Transforming Coal for Sustainability - A Strategy for China. The Co-Chairs underlined the following points during the presentation:

79. This report builds on previous work done by the former Working Group; findings are to be also published in several issues of the journal Energy for Sustainable Development. The starting point of the work is China's "3 E's Strategy": Economy, namely the quadrupling of the GDP by 2020; energy security, namely trying to avoid an over-dependence on imported oil; and environmental protection, encompassing public health, ecosystem protection and combating climate change.

80. Projected oil consumption in China goes from 200 million tonnes per year to 400 million tonnes per year by 2020. Domestic oil production is stable, therefore a considerable increase in oil imports is projected. Similarly, the projected coal power plant capacity will go from some 200 gigawatts to over 500 gigawatts; most of the capacity projected for the year 2020 has yet to be built - representing an opportunity for environmentally sound investments.

81. The strategy for the modernization of the coal sector in China advocated by the TF includes the use of coal gasification technologies to produce synthetic gas for power and clean fuels for transportation, cooking and heating both in domestic and industrial applications. The result foreseen is the replacement of coal combustion and oil imports with energy carriers derived from gasification of coal.

82. Coal is an inherently dirty fuel while gasification allows for effective and relatively inexpensive cleaning of the coal. It also allows the use of gas turbines in combined cycles to produce greater efficiency in power generation. Synthetic gas (syngas) is also the starting point for high quality fuels - methanol, dimethyl ether (DME) or other energy carriers and a number of other chemicals. By using oxygen-blown gasification and separation techniques, one can obtain exhaust gases that are nearly free of greenhouse gases, if the CO₂ co-product of hydrogen manufacture is stored underground at low marginal cost. Power production and fuel synthesis can be economically combined in a poly-generation plant with a "once through" cycle. In the end, the process produces liquid fuels and electricity for export to the power grid. The cumulative world-wide capacity and growth of coal gasification has now reached 60 gigawatts - and 9 gigawatts of this is now produced in China, mostly in the fertilizer and chemical sectors. China has the expertise and the necessary industries to pursue this option.

83. Using the Markal model on China's situation, the TF examined whether or not the

technologies presently in use could be combined in such a way as to alleviate the concerns over energy sufficiency - for economic growth, for energy security and for pollution control. The model generated two main scenarios: a base case scenario where coal is used in direct combustion technologies, and an advanced technologies scenario where poly-generation technologies for coal and biomass, high efficiency industrial processes, advanced renewable energy technologies, urban residential demand technologies, hybrid electric and fuel cell vehicles, and carbon sequestering options. Constraints have been imposed on the models: a four-fold growth in the economy, sulphur emissions are constrained and reduced by 2050, oil imports are kept at below 30% any given year, and a carbon constraint is imposed to reflect global commitments in greenhouse gas emissions controls.

84. The two resulting scenarios reveal that the base case situation cannot satisfy the requirements of China as reflected in the imposed constraints. Energy would not be available for the desired economic growth of China. However, the advanced technologies scenario does provide China with the energy it needs while satisfying the key constraints - and at a lower cost for both energy and CO₂ emission reduction than the “business as usual” approach. This scenario shows traditional coal combustion starting to decline in 2010, while coal gasification increases exponentially from 2005 to 2050. There are also appreciable energy streams provided by renewables and efficiency gains, while the proportion of energy obtained through oil imports starts declining after 2025. To realize this advanced technologies strategy, coal use must shift from combustion to gasification to produce clean fuels.

85. Modernization of coal is necessary for realizing China’s “3E’s Strategy”. Coal will continue to provide more than 50% of China’s energy needs to 2050. The technologies required are known and proven in China. They offer the opportunity to meet near-term environmental and energy security goals, at lower cost than “business as usual” approaches. And they provide a path to limiting carbon dioxide emissions.

86. Selecting these energy options is urgently needed in China because investment plans for satisfying capacity needs over the next decades are now being made. Coal power will increase by a scale of 30 Three Gorges projects; if wrong decisions are made, coal power plants have a useful life of 30 years - not investing in new technologies now will make these options prohibitively expensive in the future. China’s need for liquid fuels and for independence from imported oil add to the appeal of the options presented by the advanced technologies case.

87. The TF therefore recommends the following: a detailed plan should be prepared under the guidance of the central government; the feasibility study of two demonstration plants in two distinct areas (east and west) should be conducted; based on results obtained from the demonstrations, the GOC would define the capacity and proportion of coal gasification to total coal consumption to be

implemented to 2050; the implementation of a poly-generation system should be started, with close cooperation with the power sector; in the near term, there should be widespread utilization of 15% methanol blended gasoline in motor vehicles and in the medium term steps should be taken to promote the use of DME as an alternative to diesel fuel; promote the close cooperation of Chinese and international research teams to do more research and development (R&D) on poly-generation systems. The GOC should consider financial and tax incentives to support these efforts.

Discussion

88. It is correct to advocate the modernization of coal technologies for China. Modern coal gasification is a proven technology and has demonstrated clear advantages; Shell is involved in 8 such projects in China at present - in fact were the naphta-based fertilizer plants of China converted to modern coal gasification, this would help the country cut CO₂ emissions by 10 million tonnes per year. The production of liquid fuels from coal gasification comprises methanol, DME and Fischer-Tropsch (F-T) liquids - but it is key to understand their characteristics. DME and methanol have cost disadvantages due to their toxicity which have impaired their global development and utilization to date. F-T liquids replicate much cleaner fuels that can be used in today's infrastructure and engines; they represent a more promising option. Poly-generation - the generation of power as liquid fuels are being produced - has good potential; but it should not overshadow the need to push ahead with natural gas based generation as the first and more economic step to take along this road.

89. The work conducted by this TF should continue because it is critical to urban transportation and power in the context of the urban theme that will be examined at a future AGM.

90. Renewable energy technologies should be more strongly emphasized. Wind energy has already been found to be highly feasible for the Inner Mongolia Autonomous Region. There are questions about the efficiency of coal gasification - best cases in some countries is 52% efficiency in coal utilization, and if heat and power are co-generated the efficiency increases to 95%. The TF should provide more information on CO₂ sequestration and on the possible impacts of China's high sulphur content coal on the use of gasification technologies. The TF should also discuss the impact that the power sector liberalization planned for 2005 would have on the options advocated.

91. There appears to be some discrepancy between the facts presented in the report and the recommendations put forward by the TF. While the report states the strategy proposed is built on 4 pillars, only coal modernization is outlined; the energy efficiency, natural gas and renewable energy pillars are not discussed. Coal gasification is a complex issue, with plants costing twice as much as conventional power plants; the price of coal would have to be much lower for gasification to be feasible. It is therefore necessary to advocate other options as well.

92. When advocating options that involve disposing of CO₂, it is important to be realistic about the magnitude of this problem. There have been numerous studies on the methodologies to accomplish this but none is likely to be feasible in the short term. It is then necessary to consider options such as smokestack capture or combining it with other chemicals - however these options could themselves create other undesirable effects. The TF needs to be conservative in stating its conclusions and recommendations.

93. There should be more focus on the demand side of the energy equation. Energy efficiency needs to be considered more carefully since there are significant gains to be realized there. In addition, as disposable incomes rise in China, people will buy more cars; this is already happening. It is therefore difficult to consider seriously a scenario where carbon dioxide emissions peak and then fall. One conclusion to underline in this report is the fact that carbon-based energy carriers should be minimized.

94. The guest speaker from BASF showed the energy savings to be realized from properly insulating buildings; there has been a long debate in western countries on the savings to be realized through energy efficiency. The scale of China's economic growth leads one to question whether or not China can adopt radically different options, but the TF should put more effort on working on demand-side savings through energy efficiency.

95. The report provides ample food for thought for the GOC. More specific work is called for on coal utilization, on given scenarios and on policies and their effects. Once this additional work is done, recommended options can be put forward to the State Council. The China Council may be asked to do additional work in this area.

96. The TF discusses the co-generation of power in plants that are located near coal mines but far from the cities where the power would be consumed. Yet there is significant power leakage along transmission lines. Carbon sequestration is at present very expensive, although the technology is improving. The advanced scenario proposed in the TF report advocates locking China to using coal as 50% of its energy source. By 2050, China may have targets to meet under the Climate Change Convention, and cheap options to reduce CO₂ may have been exhausted. Has the TF considered the wisdom of wedding China to a 50% coal use scenario?

97. There are cost and climate change implications to the carbon sequestration option proposed. The report does not make it clear whether or not this is feasible in the near term. In addition, the TF report is strong on technological issues, but weaker on economic analysis. This aspect needs to be strengthened.

98. The TF is delighted to hear more work would be required from the GOC on these issues and

feels there is a good base from which to start. China can look more closely at DME as a liquid fuel, which burns cleanly in diesel engines, while producing no soot or particulates - the fuel is used in daily life in aerosol cans, is non toxic and efficient. The coal strategy proposed for China by the TF is not built on coal, but on a combination of coal, modernized coal, energy efficiency and renewables - all these components will require the proper enabling policy environment. The other pillars of the strategy proposed have been examined in earlier Working Group reports. Coal sequestration is an important issue on which much important work is now conducted in China; many options are now under consideration and this work should help bring down the costs.

99. In looking at comparative costs of various options, it is important to “internalize the externalities” in the cost structure; often technologies are deemed expensive only because the environmental and health costs of the status quo have not been factored in. The TF recognizes that the liberalization of the Chinese power sector will pose a challenge for new technologies; temporary support would be needed to enable start-up and market entry as well as capacity building; subsidies could eventually be replaced by market-based instruments. The issue of toxicity of liquid fuels and of length of transmission for power generated are not as serious as implied during the discussion. On the final point of economic feasibility, the price of coal in China is already down in many areas, making gasification a sustainable option.

c) Task Force on the Development of the Environmental Protection Industry

100. With Vice-Chair Qu Geping presiding, Task Force Co-Chairs Wang Yangzu and Professor Rudi Kurz presented the report from the Task Force on the Development of the Environmental Protection Industry (EPI) to Council. The Co-Chairs drew the following issues to the attention of Members:

101. The TF’s work started in April 2002 in Beijing; three workshops were held dealing with China’s policies on EPI, and on the EU’s legal framework and the development of its EPI. Participants included EPI representatives from several Chinese provinces as well as experts from Japan, Germany and the Republic of Korea. TF meetings were also held to deal with the report and draft recommendations; the draft recommendations were distributed to members of the China Association of EPI for comments. Further plans include holding an international EPI Trade Fair combined with an international symposium.

102. The TF report identifies the most important factors to support the development of a thriving EPI in China: stricter regulations and enforcement; more intensive monitoring and accounting; correcting the price system by applying eco-taxes and subsidies; raising the technological level of the industry; promoting free market entry and competition among EPI, as well as eliminating local protectionism; emphasizing the service sector of EPI; and enhancing people’s awareness of environmental problems and their solutions.

103. EPI is defined by the OECD as the industry which produces goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems. This definition includes end-of-pipe solutions as well as integrated solutions such as cleaner processes and products. This implies a heterogeneous, cross-cutting industry with numerous market segments and niches - and therefore an industry for which it is difficult to compile statistics. In developed countries, EPI has a 3% share of GDP and of employment; in China EPI accounts for less than 2%. Closing the gap could increase employment from the present 3 million to 4.5 million EPI jobs. EPI can be an engine of the economy's modernization by promoting innovation and know-how, although these effects are harder to measure. The structure of the EPI in China is concentrated in the areas of equipment manufacturing, especially for the reduction of air and water pollution, and on waste management services.

104. The TF analyzed how best to foster the development of EPI in China. A market-based framework was adopted to identify the factors that are relevant to this development. The three major factor groups are: demand, supply and market organization; each identified factor can become a bottleneck in EPI growth. This analysis led to key recommendations which are predicated upon China's need to develop a coordinated strategy addressing the three factor groups, namely supply, demand and market organization.

105. A fast growing demand is the single most important driver for EPI growth in China; the challenge is to transform huge potential demand into actual demand. In order to increase private demand, it is necessary to make polluting options more expensive; government has to change relative prices by eliminating perverse subsidies - for instance making energy and resource efficient household appliances more attractive. Eco-labels for green products can help create and increase consumer demand, and hence contribute to the growth of EPI. However, government has to avoid overburdening the poor during the transition period when perverse subsidies are being removed.

106. In order to stimulate demand from industry and investors, the TF recommends tighter enforcement of environmental regulations as well as the implementation of market-based instruments such as the polluter pay principle and a reduction of perverse subsidies; in government procurement, preference should be shown to suppliers who are certified under the ISO system.

107. In the area of public demand stimulus, government should take the lead by purchasing green products even if they are marginally more costly; this would support EPIs by providing them with critically needed time to learn, adjust and become more competitive. Transparent and fair bidding procedures should be ensured. In addition, the imposition of eco-taxes would

provide funds to finance government spending on environmental projects such as public transport, repairs to public sewer systems, as well as the organization of waste collection and recycling systems.

108. In order to stimulate foreign demand for China's EPI, the GOC could help Chinese firms participate in foreign trade fairs in order to overcome barriers of entry; direct product subsidies should be avoided since they contravene the WTO.

109. On supply side issues, it is key to improve competitiveness by improving the quality of all inputs: labour, machinery, capital and technology. China's EPI sector has both very large firms and SMEs; they require different approaches. More skilled engineers and eco-educated managers, familiar with international practice and able to adapt these to the Chinese situation are needed. This requires more investment in high-level training. Incentives for investment such as favourable depreciation periods and rates, for R&D, for innovation and access to capital markets are needed as well. Conditions for FDI need to be improved, international property rights need to be respected and protocols developed for know-how transfer from universities to companies. Government is not in a position to specify an industrial strategy for the EPI sector, but highly visible demonstration projects could increase information and awareness, and could publicize new solutions throughout certain sectors while improving the reputation of Chinese EPIs.

110. On market organization, market entry should be absolutely free, although the specification of certain standards is necessary. Private organizations such as the EPI Association could assist with certification and monitoring. Exploitation of economies of scale will only be possible if China becomes a large single market; local protectionism must be overcome and this could be accomplished through firm enforcement of the Competition Law. Eco-labeling would also improve market transparency.

111. EPI is the product of a society willing to deal with pollution and where people show their preference for options that are environmentally friendly; it is generally fostered by increasing incomes and wealth. However, government can play a role in supporting the EPI development process; it can embrace the vision of sustainable development and it can develop and implement concrete programs to bring this about. A national strategy should be formulated, with indicators and time targets specified so the expectations of investors and consumers can change, thereby further accelerating the necessary structural change.

112. There is a need for new institutions that can push for the new priorities and consolidate the reform efforts; these institutions can be at the forefront of strengthening environmental protection, including research, monitoring, reporting, investigation, planning and enforcement. The institutions need to be independent bodies with clearly defined competencies, and answering

only to parliament and the courts. Existing institutions such as SEPA should be granted more responsibility and independence. Motivating and integrating private initiatives for environmental protection is vital; non-governmental organizations (NGO) can also play a role in increasing consumer awareness of problems but they need access to information and involvement in public hearings and consultations. There needs to be an intensive public debate on the concept of *Xiaokang*, examining implications in terms of lifestyle choices for people; education is essential if China is to avoid unsustainable choices. It is the belief of the TF that achieving the *Xiaokang* objective will not be possible without an effective and competitive EPI.

Discussion

113. Early EPIs were involved with “end-of-pipe” technologies; these were considered necessary evils by industry, and were driven largely by legislation and enforcement. But another type of investment involves finding production efficiencies, representing an opportunity for industry to reduce costs. Companies that are efficient and don’t pollute are the ones that generate greater profit; pollution is a sign of poor and inefficient management. There is a need to look at environmental protection investment in an integrated way. China should consider the efficiencies gained by investing in new, clean and efficient coal gasification plants rather than investing in end-of-pipe desulphurization treatment for conventional thermal power plants.

114. Much is expected of green consumerism. When surveyed, people say they are willing to pay more for green products, but when faced with real choices the majority picks the cheapest alternative. The demand-side push that was to be created by green consumerism is not happening in western countries. The starting point must still be effective legislation and enforcement.

115. China is poised to make significant investments in the near future and this represents a real opportunity to choose the environmentally sound technologies; it is much cheaper to do so at the outset rather than to retrofit polluting technology after the fact. The experience in Europe is that a requirement must be imposed to choose best available technology in new investments; this is advantageous to the EPI sector and to the environment.

116. Chinese EPI development will require a massive transfer of know-how and technology from developed countries. If projects are of a sufficient scale and if the bidding is open to international firms, the GOC could stipulate that joint ventures be formed in order to assist with the technology transfer and capacity building process.

117. It is important to understand the kind of demand that has been a driver for EPI. The TF provides examples in the case studies which are tightly focused on technology issues. Know-how, particularly in terms of ecosystem management, is an important aspect of EPI; this is the kind of service provided in ecosystem restoration work that happened for the Rhine and Thames

rivers in Europe and that is now being considered on a large scale in China. Wetlands need to be restored so they can fulfil their ecological and economic functions (including flood control); large dams will need to be decommissioned and reservoirs need to be properly managed. The TF should take a broader view of EPI encompassing such services.

118. An earlier TF of Council worked on related issues; it came to similar conclusions on the key role EPI can play in ensuring China can grow in a sustainable manner. This importance of this work was acknowledged by the GOC in that EPI was included in the 10th FYP; the Plan stated that government was to provide the enabling environment for EPI rather than direct its development. At present, there are inconsistent EPI standards, products and product quality across China; the GOC could harmonize this. The GOC could also help improve the information flows about best available technology across the country; it could help support the development of SMEs in this sector - since in many cases large scale enterprises are not feasible.

119. The demand side driver of EPI development in Europe is clearly the strong enforcement of existing laws and regulations. It is therefore important for China to understand that it needs to invest in independent regulatory authorities which have very clear terms of reference; the TF should provide China with a list of countries and institutions that best demonstrate this. The TF should also be careful in recommending that government select green procurement options even if they are more costly; concrete examples would be helpful to China.

120. China needs to examine what will happen if its population adopts western lifestyles that could have environmentally disastrous impacts. International media reports indicate that in a few decades, every Chinese family will own a private car - with severe consequences for the world's climate. This theme is critical for China to debate in terms of the development of the economy and its place in the international community.

121. The EU and the US have introduced eco-friendly products that are certified and labelled as such; these products include fish and timber. Often there is a lag between supply and demand - for instance, consumers demand a product before industry can supply it, and vice-versa; the initial introduction period for such products is critical. Although it is tempting to say legislation should precede market creation, in fact the existence of a market is necessary to allow government to make legislation palatable to industry and fine tune eventual regulations. Awareness building is critical to consumer adoption of eco-products; this is why environmental education through the school system is so important in China. The World Wide Fund for Nature (WWF) has initiated a project on the development of an environmental curriculum with the Ministry of Education.

122. Broadening the EPI definition to include ecosystem management services will also require

the development of instruments; depending on the structure of each EPI sector - its scale, number of competitors and nature of its market - it might be possible to determine if the appropriate instruments to promote this EPI sector should be demand or supply-driven. It is necessary for the TF to go beyond generalities in order to be of assistance to Chinese policy makers. Depending on the nature of the market, and if there is a small number of actors, demand can play a big role in determining the adoption of more environmentally friendly technologies and fostering EPI growth. This is how progress happened in the lumber sector. Public-private partnerships (PPP) should be considered in cases where public funds help private companies apply new technologies.

123. In the 1970s, Japan saw investment in environmental protection reach 20% of total investment; market organization is key to fuelling this investment. The TF does not seem eager to advocate incentives such as preferential depreciation rates for this kind of investment, although there is mention of soft loans. In fact, depreciation policy could well be one of the more effective tools, given China's present situation. Over the past five years, there has been considerable investment in waste water treatment facilities in urban areas; this should provide the TF with ample material to delve deeper into the kind of policies necessary to foster the growth of the EPI sector.

124. There seems to be a negative consensus emerging, that one can trust neither government nor the consumer. In fact, consumers have been a powerful force in the growth of EPI in Europe - demand for organic milk has risen from 0% to 40% of the market despite the fact it is more expensive; similar demand was generated for green lumber. In addition, public procurement can be a powerful tool, as has been demonstrated in Europe; this allows green products a foothold in the market.

125. The TF found that in China, the EPI players are mostly end-of-pipe products; management and consulting services are a very small part of this industry as yet. With China presently engaged in an intensive investment phase, it is timely to push for eco-efficiency, which will then foster greater demand for EPI goods and services. The growth of EPI in China is something the GOC favours; it also projects exporting EPI goods and services.

d) Task Force on Financial Mechanisms for Environmental Protection

126. With Vice-Chair Qu Geping presiding, Co-Chairs Zhang Kun and Professor Hidefumi Imura briefed the Council on the results of their work. They underlined the following issues during their presentation:

127. Insufficient investment is one of the bottlenecks still affecting environmental protection in China despite significant increases in recent years; in addition, investments tend not to be productive.

Recent changes enshrined during the 16th CPC Congress have laid the groundwork for improvements in this area. The objectives of the TF were to identify key problems affecting environmental investment, develop innovative approaches to help government set priorities for investment, and draw up strategic recommendations for the GOC. The TF combined theoretical analysis and case studies, with consideration of both the domestic situation and international experience.

128. Starting in 1991, China has been increasing its total investment in environmental protection, but this lags behind the increase in overall investment. During the 9th FYP, there was a shortfall of 90 billion yuan in planned investment; during the 10th FYP, the planned investment is to reach 700 billion yuan; but in the water pollution control area alone, the investment shortfall is expected to reach 40 billion yuan. Such shortfalls are expected to continue.

129. Environmental investment is especially inadequate for urban environmental infrastructure (UEI) projects and for pollution control in the SME sector. UEI investment lags behind the pace of urbanization; 37% of China's population is now living in cities and this is expected to grow to 46% in 2010 and 55% in 2020. UEI investment is not keeping pace with the resulting increasing demand for sewage and waste treatment; at present, only one fifth of the cities' solid and liquid wastes is treated. In order to reach the targets set in the 10th FYP, China would have to invest 150 billion yuan.

130. The focus of the TF was the absence of commercial financing mechanisms and of financiers other than government in this area; public funds account for 70% of total environmental spending in China - in countries with developed market economies, this percentage is closer to 40%. The other focus was the special barriers faced by SMEs (99% of China's firms, accounting for over 50% of GDP); SMEs are estimated to generate 55% of total industrial pollution in China, yet they are dispersed and find it difficult to get financing for any investment, let alone in pollution control.

131. Public investments in environmental protection is inefficient due to leakages in construction, operation and management of urban waste facilities. Marketization of the UEI area would mean breaking up government monopoly in the financing, construction and operation of waste treatment plants. In industrial pollution control, enterprises are generally responsible for treating their own waste or contract to specific firms to perform this service.

132. In designing financial mechanisms for environmental protection, the TF recommends that China stick to its polluter-pays and user-pays principles; efficiency of financial investments should be given priority; and equity issues and risk mitigation should also be taken into account. The roles of various actors in the financial sector should be clearly defined - and government has a lead role to play. But investors other than government and the polluters themselves should also be encouraged to take part in these opportunities - therefore commercial financial

mechanisms must be improved.

133. The government's role would be to consolidate and enforce environmental laws and regulations in order to increase investment demand; it has to increase environmental investments and finance them from its fiscal budget; it can raise funds on the markets through instruments such as trust funds, municipal bonds and even an environmental protection lottery.

134. The TF puts forth key recommendations on financial mechanisms. The first one deals with commercial banking; measures put forward include policy changes to open to environmental projects all financing avenues (bonds, investment funds, loans, etc.), changes to collateral rules, methodologies for risk management and others. The second recommendation deals with municipal bonds; these are widely used instruments to finance UEIs in developed countries and China's financial system could now better support such a market; however, the GOC will need to study the feasibility of this option, amend relevant laws and regulations, and test the concept in selected pilot projects.

135. A series of recommendations focuses on SME support by government including the establishment of a SME Development Fund to provide loans for pollution control investments; organizations should be established to assist SMEs with both pollution control technical assistance and financing issues; and innovative approaches to utilize commercial bank credit should be developed. Support structures for SMEs also need to be tested in pilot projects and could be the subject of future Council work.

Discussion

136. Issuing municipal bonds is complicated in China, due to the legal statutes that apply; there is a decree that only the central government can issue bonds. This is due to concerns around the possibility of "overheating" of the economy and the tendency of local authorities to get into "bubble projects" - projects for which there is no real need or demand - or to divert funds to other uses. China has to first solve the problem of control over infrastructure planning and budgeting in the regions; only then can the central government delegate to local governments the authority to issue bonds.

137. The TF focused mostly on waste and waste water; in future it might be advisable to look into investments needed for prevention and shifts to cleaner production processes. When looking at non-point pollution control, it is not clear whether or not the TF advocates disincentives such as green taxes on fertilizers and pesticides. When the TF proposes favourable tax treatment for the pollution control sector, similar treatment should be extended to companies that use environmentally friendly technologies.

138. When examining water sanitation and waste, the TF proposes a form of PPP through build-

own-transfer frameworks; it is important to pay attention to the terms of reference of such contracts. In order to foster a sustainable development approach that goes beyond environmental considerations, it would be necessary to look into the pricing of the services produced, keeping in mind equity considerations arising from the accessibility of the service for the poor. While it is possible to find ways to get funds for the desired investments, at the same time it is important to impose conditions in order to ensure the desired service will be provided under acceptable terms. In discussing risk management for such financing mechanisms, it is important to define responsibilities; insurance schemes can be useful to internalize the cost of risk.

139. It is advisable for China to start with a fairly simple model. Government can play a lead role in infrastructure construction, but there could be market-based approaches for the operation and the maintenance of those facilities. If municipal bonds are not feasible in China for policy considerations, perhaps other financing vehicles are possible. International financial institutions and international donors could play a role; Germany has offered concessionary loans to twenty Chinese cities for waste treatment and drinking water plants. PPPs could be supplemented by overseas development assistance. There is a need for more information in China on the modalities of PPP.

140. Caution is needed when advocating grants be offered to SMEs for pollution control investments. These programs tend to be complex to administer and they do not lead to a change in the behaviour of polluting enterprises; indeed, enterprises can become grant-dependent. Support for SMEs should take the form of capacity building efforts focusing on regulation awareness and compliance, implementation of ISO 14000 and eco-efficiency. Long-term change would be better served by raising the bar on government and major SOE procurement so higher prices can be paid to SME bidders who satisfy certain environmental quality criteria.

141. Financing environmental protection under the conditions of a transition economy is complex. There are two different cases. If cost recovery can be imposed, then the environmental service can be privatized. If this is not the case, because the fee charged then would be prohibitive and would lead to inequities, financing through public budgets becomes necessary. Public revenue is generally raised through taxes; but this leads to government debt issues which may burden the public purse in ways that are not sustainable. Changes to income tax systems allowing for income streams flowing to local authorities and municipalities may be advisable.

e) Task Force on the Circular Economy and Cleaner Production

142. With Vice Premier Zeng Peiyan presiding as Chair, TF Co-Chairs Professors Qian Yi and Tsugio Ide presented their report to Council. They outlined the following issues during their talk:

143. The TF has been working for the past 18 months, conducting surveys in three provinces and visiting Japan twice on study tour; in addition, five workshops were held, corresponding with field visits to Jiangsu and Guizhou. The TF believes that in order for China to achieve *Xiaokang*, it is imperative to adopt the principles and modalities of a Circular Economy. *Xiaokang* is seen as an ambitious and popular project by Chinese people. However, natural resources per capita are severely limited, there are already shortages emerging and yet for many industries in China, the slogan is “Growth comes first!”. China’s priority must be sustainable development - it must focus on reducing environmental impact per unit of GDP - and therefore government must promote drastic increases in efficiency.

144. The TF has studied the experience of Guiyang (capital of Guizhou province) and of Jiangsu province. Continuing on present growth paths, Guiyang and Jiangsu would both see their economies grow rapidly until 2020, at the expense of rapid increases in resource use. This conventional growth path is not sustainable. What is needed is a change in patterns of production and consumption. Whereas the conventional economy is linear - with inputs leading to outputs and waste - the Circular Economy (CE) is a closed loop wherein the waste, by-product, output or used product of an industry can be used as the input for another. CE encompasses three key principles, the 3-Rs: reduce resource use, recycle waste and re-use products; of these three, the first is a priority.

145. CE needs to be implemented at the micro level of the factory or shop floor, then at the industrial or group level, and finally with consumers. China already has a Cleaner Production Law and it should be implemented - this is an important first step.

146. The experience of Germany was studied by the TF; this demonstrates the need to enact strong legislation which can then motivate the general public and set economic development on a different footing. Since the 1990s, Japan has been promoting CE; there are now eco-cities and towns which function according to CE principles; there are laws dealing with packaging, appliances, construction materials, food and the recycling of cars. UNEP figures demonstrate that for both Germany and the US, while GDP growth is up, the consumption of natural resources is down; Chinese figures show a massive increase in resource use corresponding with GDP growth.

147. Several key measures have been adopted by some of China’s municipalities and provincial governments. In Shanghai, the mayor himself chaired the Environmental Protection and Construction Committees to ensure improved coordination of development. In Liaoning, Anshan Iron and Steel Group is putting CE principles in practice by using waste as inputs for other products. Guiyang is to become an eco-city by implementing the 3Rs.

148. The TF has put forward five key recommendations: CE principles should become a strategic goal for China and there should be an action plan for implementation; legislative means should be used to promote and support the adoption of CE; indicators and data monitoring systems need to be developed to track progress; green consumption should be promoted through green procurement; technical innovation that serves the development of CE should be supported by government.

149. CE is a new international movement; Germany and the EU are taking the lead. In Japan, the awareness that growth needed to be established along a new paradigm grew in the 1990s. The challenge for China is to take this on, while it is still at a relatively early stage of economic development; but given its ambitious growth plans and the shortages it faces in key resources, China has little choice. Taking the CE road requires the participation of a range of stakeholders. A major role is that of businesses that supply products and services to the market; they must consider the entire life-cycle of the product or service. Consumers who are themselves creating waste must make the right choices in the market and use products in a responsible way.

Discussion

150. The TF report is extremely relevant. But caution should be exercised in using the Kuznets curve in the analysis, since this methodology has been mostly discredited; it failed to take account of material flows of imports and exports that occur in trading economies. When considering sustainable development, it is key to account for both goods and waste that are exported, and of the importation of raw materials and products. There are growing concerns over economies that import unsustainably-produced timber from countries while claiming to have sustainable domestic forestry practices.

151. The Circular Economy paradigm fits very well with considerations of quality of growth, rather than simply quantity. Quadrupling China's GDP will be of little benefit if it leads to the destruction of ecosystems and resources, and to a decrease in the quality of life for the people. China has to tackle head on the issue of private car ownership; with higher per capita incomes, people will naturally choose to own automobiles.

152. One key enabling factor for the adoption of the CE paradigm is information. Here, the UN-EU Aarhus Convention can serve as a model for building public awareness; its three key pillars are access to information, public participation in environmental decision making and the right to legal recourse. The other key enabling factor for CE in China is the fact that the country is now rapidly increasing its investments in capital and new technologies. In order to ensure this process is optimal from a sustainable development point of view, it is imperative to ensure information on the best available technologies is widely dispersed and that companies are required to choose best options and best practices.

153. The right terminology must be used to promote certain concepts. Clearly, the term “cleaner production” is not one that is generating much enthusiasm; it is more easily associated with end-of-pipe techniques and higher production costs. It would be more potent to talk about production efficiencies - this implies savings and greater profits which are the best motivators for business.

154. A key condition for the promotion of CE is product design. For instance, if a government wants cars to be recycled, cars must be designed in such a way that they can be disassembled; this is not the case at present in China but it is being done in Japan and Germany. Similarly, due to the feedstock used in China paper cannot be recycled; this requires wood fibre instead of crop residues as an initial feedstock. In the case of electronics recycling which is now required by law in Europe and in Japan, products have to be designed so components can be taken apart to be recycled. Recycling can be increased without investing in new technologies necessarily, but it is necessary to change the products themselves and their design. But considering that a car fleet has a twenty-year life cycle, it is necessary to move promptly in order to initiate recycling in the automotive sector. There will be a necessary time-lag before China can truly say it has achieved CE.

155. The relevance of the time frame of decision processes, of investment and of product life-cycles becomes obvious in this discussion; there is perhaps an opportunity for additional work on this by the TF at a future date. It is imperative for decision makers to understand the timeliness of certain decisions and measures, in order to avoid being locked into unsustainable growth scenarios.

156. What captures the attention of decision makers in exporting economies such as China is the issue of market access. When the EU started to consider legislating CE, it became plain to exporters that they would be made responsible for the end of their products' life. Entry in the EU market is only available now to producers who can meet stringent CE requirements. CE therefore becomes vital to China if it wants to continue exporting to Europe and Japan. Regulators in the EU and Japan have not left this to the vagaries of the market, but rather have defined goals, targets, products and sectors. In Sweden, industry was initially reluctant to embark on CE programs, until the government enacted a waste disposal tax law stipulating standards for incineration and disposal as well as taxation rates for the activities.

157. The NDRC agrees fully with CE. As preparations are underway for the drafting of the 11th FYP, it would be useful for this and other Task Forces - particularly the ones dealing with coal modernization and financial mechanisms - to brief NDRC on their work and recommendations. The suggestions could prove very timely and have a wide impact.

158. The history of this earth is that of CE on a global scale. With six billion people and most of the land area occupied or modified by social and industrial activities, all natural cycles are out of

balance. Among relevant examples are carbon which is being mobilized twenty times faster than natural cycles can dispose of. Similarly, logging is now banned on the upper reaches of the Yangtze river, but China's lumber imports are leading to deforestation in southeast Asia. We need a clearer understanding of the impact humans are having on ecosystems; we need solid, credible data to accomplish this. For information to be effective, it must be made public. In western countries, politicians tend to be lawyers and have an insufficient appreciation of the complexities of technical issues; snap judgement decisions can be very damaging. In China, the leadership is literate on scientific and technical issues; there is an opportunity for leadership here in thoughtful decision making.

159. In Germany, adopting CE principles was a complex undertaking. The public first had to be convinced of the differences between the conventional economy and CE. The approach taken was to stimulate a public debate on CE and the "3Rs", and to combine this with pilot studies and demonstration projects. It was also important to make distinctions between CP and CE. CP is not of great interest to the public since it happens inside factories or plants; CE is a broader concept where the public has a clear role to play. People can be mobilized to take responsibility for cutting down on resource use, re-using products and recycling waste. The success is largely due to the efforts of the public and of NGOs, and thanks to the role played by key stakeholders such as industry and the media. For instance, the German paper industry made a voluntary commitment six years ago to increase its use of recyclable paper stock; recycled paper is now 65% of all paper sold in Germany.

160. CE can be thought of as a life-cycle for products, from the cradle to the grave; but companies will only adopt this view if they can be shown this is also good for profits. Legislation will only be effective if the business case has first been made with industry. The EU has just launched a major review of how best to achieve sustainable resource use and will be happy to share the resulting findings with China.

161. China will need to study CE further and pilot projects will need to be conducted before it can commit to this path. Some work on this has already been done over the past two years, including the adoption of CP concepts as opposed to end-of-pipe approaches to pollution control. CP is now proven to reduce resource use and increase profits through efficiency gains. China is also experimenting with eco-industrial parks in Guangxi, Inner Mongolia and Liaoning where one factory's waste becomes another's input. The results achieved during these pilot projects need to be widely disseminated.

ITEM 9. DISCUSSION OF THE RECOMMENDATIONS

162. Vice-Chair Måns Lönnroth presided over the presentation and discussion of the Council's recommendations to the State Council.

163. LE outlined for Council this year's drafting process. Due to disruptions caused by SARS, no initial draft could be circulated prior to the AGM; this was made available at the outset of the meeting. In addition, general recommendations could not be discussed in advance of the meeting with China's Premier Wen Jiabao due to scheduling problems. The second part of the recommendations is to be a distillation of the measures advocated by the five TFs reporting to Council this year; this will require additional work on the part of each TF. The process leading to finalization of the recommendations this year has yet to be approved by the Bureau.

164. During the discussion, members made the following points:

165. It is difficult for Members to comment on a document that has yet to be produced and it is not possible to produce a draft during the present session. In meeting with the Council, Premier Wen confirmed that "growth first, clean-up later" is not an option for China. There have been useful remarks made by Council members during TF report discussions that could be integrated in the final document, namely the need to use a full range of financial instruments to fund environmental protection projects, and that a company-by-company approach to capacity building is productive.

166. The recommendations need to highlight that China now needs to tackle the challenge of bringing environmental protection into the information technology age. This could be a powerful information diffusion, capacity building and monitoring tool. China has already laid the foundations for much of this; inter alia, there is a network of monitoring stations to deal with possible disasters. But this needs to be systematized and better integrated.

167. The document outlining the presentation to the Premier needs to be integrated with the draft general recommendations that members were given on the first day of the AGM. It would be desirable for Council members to have a draft of this merged document before the end of the proceedings.

168. The presentation to Premier Wen can serve as an introduction to a fuller discussion of recommended actions. It is also necessary to reflect the urgency that China faces at this moment in time. This seems to be very much the mood of China's leadership at present. It is therefore useful for the Council to send a message that the moment for making policy and infrastructure decisions is now. Wrong choices of development models could hobble China. The use of market instruments to promote behaviour change should be stressed.

169. Members want to ensure they will have input in the final document that will be produced; the present agenda does not seem to allow for this. Yet wording is often critical in putting forth recommendations - small changes can be significant.

170. Energy efficiency in China has been discussed at length - but it is largely absent from the two documents that are before the Council. One point to be emphasized would be that the high level of new investment that China will see in the coming years presents the opportunity of benchmarking and of stipulating “best available technology” investment requirements. When presenting recommendations on new coal technologies and access to the power grid, there is a need to advocate the use of prices that reflect true costs - otherwise new technologies will not be deemed competitive.

171. Discussions that have already taken place in the Council are not reflected in the documents presented to members for this session. The final document should be cast in a form that will be immediately recognizable by Chinese authorities and that can provide guides for action. The document also lacks a discussion on the measurement of wealth and well-being; true costs must be reflected and must be at the centre of the discussion. Perverse subsidies are rife throughout the economy and transparency is key to change.

172. The final recommendations should reflect the theme of the meeting: *Xiaokang* and sustainable industrialization.

173. LE conclude that a more detailed version of the presentation to Premier Wen will form the introduction to the recommendations; TFs will re-cast their recommendations based on the theme of the meeting and the debate in Council. LE will then re-draft the document in Chinese; an English translation will be produced afterwards. This final draft will then be submitted to the Bureau for approval.

ITEM 10. CLOSING CEREMONY

174. With Chair Zeng Peiyan presiding, Vice-Chair Xie Zhenhua and Chair Zeng Peiyan addressed members of Council during the closing ceremony of the Second Meeting of the Third Phase. During their remarks, the following points were stressed:

175. The theme of the AGM, *Xiaokang* and Sustainable Industrialization, was discussed in depth and important recommendations have been made. Premier Wen Jiabao met with Council members, heard their views and recognized the role the Council plays. The GOC appreciates the efforts made by past and present Council members and experts. Vice Premier Zeng has been responsible for much macro-economic work and his appointment as Chair of the Council heralds an era of greater influence.

176. The five TFs reporting this year have proposed feasible policy recommendations; these will be combined with comments made by members at the AGM, and passed on to the State Council. The Central Party Committee and the government have made the correct choice by setting the

achievement of *Xiaokang* as a goal for China; it incorporates concepts that have been discussed in Council, namely high technology, sound economics, low resource consumption, low pollution and best use of human resources. Other important policy areas where Council has made a contribution are the support of SMEs and a more strategic development of the energy sector - including coal gasification and poly-generation. The GOC is also noting the following: it is advisable to develop the EPI sector by ensuring a sound legal framework and helping to break down local protectionism; it is important to stick to the “polluter pays” principle, diversify financing mechanisms for environmental protection and look into instruments such as municipal bonds and risk mitigation funds; it is critical to ensure government coordinates policy across all relevant sectors and agencies. Government procurement should also reflect commitments to sustainable development.

177. The Council Bureau has met and agrees that the themes chosen for the AGMs should respond to China’s priorities; these will be finalized with the Chair’s approval. It is also imperative that all TF and LE members ensure the timely production of a document to submit to the central government as well as relevant provincial and local authorities. The AGM for 2004 will be held in Beijing in October; it is also suggested that the Meeting be followed by a field trip to different localities. Members will be notified by the Secretariat on logistics. The Secretariat staff is recognized for the efforts contributing to a successful AGM.

178. The GOC thanks all members and experts for their active participation, their interest and their support of China’s efforts towards sustainable development. Three points need to be emphasized:

(1) It is important to take a holistic approach to development; *Xiaokang* embodies this in that it implies a social as well as an economic modernization. Growth and efficiency need to be optimized, but it is also imperative to improve democratic and legal processes, as well as people’s education, health and ethics; resources must be used efficiently and economic growth must be done in harmony with the environment. The kind of growth that is needed for China’s 1.3 billion people cannot follow conventional models. There is increasing awareness in China of the link between environment and development, the need to protect the environment and the need to adopt CE.

(2) International cooperation is key to the achievement of China’s goals. China has a large impact on the globe; as economic globalization accelerates, economies are increasingly interdependent. But the world community has to accept that some countries will adopt policies that suit their own conditions, while at the same time promoting global cooperation. The environmental status of developed countries is deteriorating; yet sustainable development entails the efforts of all countries. Developed countries should play a more active role on issues that

are challenging LDCs. In order to improve the quality of growth taking place in LDCs, rich economies have a responsibility to eliminate barriers of trade in environmental protection technologies and LDC products. China is committed to improving matters on the domestic front, but is also willing to join international efforts so it can contribute to solving global environmental problems.

(3) The CCICED should play a greater role. The Third Phase of the Council corresponds to China's adoption of *Xiaokang* as a development goal; the timing is opportune. In order to fulfil its responsibilities, the Council's AGM debates should be more productive - the selection of a theme for each will help focus the discussion. The content of this discussion should be more substantial and the pace more dynamic. The Secretariat will need to improve the quality of the services it provides and the coordination of Council activities. The policy recommendations will need to be strengthened - an issue of crucial importance to the GOC.

179. The GOC respects the depth of expertise that members contribute to Council. The reports submitted by TFs are important for China's future development. The central government's ministries as well as local governments need to take note of their contents and absorb their lessons. The Council in the initial years of its Third Phase is already making a significant contribution.

III. MEETING WITH PREMIER WEN JIABAO

a) Council presentation:

180. During the meeting with Premier Wen Jiabao, two Members of Council addressed the Premier and emphasized the following issues:

181. The Council cares about the directions of China's growth and development. It is encouraged to see progress towards a good basic framework for sustainable development action - the *Cleaner Production Law*, practical applications of the Circular Economy in eco-provinces such as Zhejiang, and leadership of companies like Anshan Iron and Steel Group. With the goal of *Xiaokang* China is taking the right approach by trying to include all citizens in a journey towards prosperity.

182. Many tools are in place but they need to be applied consistently, more fully and urgently. Action is required in the following areas: enforcement of environmental laws in all provinces; applying incentives to correct market failures; getting prices right; and above all, strong and consistent signals from the leadership for successful implementation at local levels.

183. The Council makes five recommendations on this year's theme of *Xiaokang* and Sustainable Industrialization:

- (1) Ensure SME participation in sustainable industrialization;
- (2) Use government procurement power to create demand for a Circular Economy;
- (3) Through financial sector reform, introduce sustainability criteria for bank loans and insurance guarantees;
- (4) Diversify the financial mechanisms to fund urban environmental infrastructure;
- (5) Develop an action plan for capacity building within enterprises and local government.

184. The biggest risk for China is to become locked into unsustainable development paths, with a permanent underclass of discontented citizens. Sustainable industrialization will enhance competitiveness and open new pathways for growth and employment. Conventional technologies and industrialization will not be enough. For example, conventional energy technology will increase China's dependence on imported fossil fuels. Through innovative coal gasification, China could meet its transportation and fuel needs in an environmentally sound way from domestic sources.

185. A coordinated approach in decision making is essential. Strengthening regional sustainable development is part of this. It will permit better approaches to land and water resource issues that constrain industrialization. Reliable statistics, with overall social, economic and environmental indicators, are needed so that China can determine whether it can manage the consequences of a four-fold economic growth. An educated informed public will be an outcome of *Xiaokang*. Public participation will help keep the process of sustainable industrialization on track.

186. China has some unique advantages. One is the history of a strong state. Therefore it should be far easier than in some other countries to control unsustainable production and consumption. China can build for its future, not retrofit the past - the expensive route of already-industrialized countries. But it must do so urgently.

b) Premier Wen Jiabao's response

187. The CCICED is now twelve years old. The number of foreign countries and foreign guests who take part in its work, discussing China's environmental issues and devoting themselves to this cause shows they care about environment and development in China. The views, insights and recommendations of the Council are useful to the government.

188. SARS has taught China an important lesson which is also relevant to the environment: we have a new and deeper respect for the scientific approach. We have developed a new conception

of development comprising of five areas where greater coordination and harmonization are needed. They are: the city and the countryside; the economy and society; the different regions of China; domestic and international areas; humanity and nature. We have titled this the Coordinated, Comprehensive and Sustainable Development Concept. Coordination is important because of existing imbalances - similar to a person who would attempt to walk on legs of different length.

189. You emphasize that during the industrialization of its economy, China should avoid the model of “growth first, clean up later”. Indeed, you highlight the importance of natural resources conservation. China has a population of 1.3 billion people; its development depends on the conservation of resources such as energy, land and water. You also emphasize that China has to push capacity building in the area of environmental protection.

190. One relevant example has to do with the water quality in the Three Gorges Dam reservoir. By investing in waste water treatment facilities and investing 4 billion yuan in environmental protection measures, the water quality in the reservoir is rated second class - a good result.

191. Another point emphasized by Council has to do with ensuring the SME sector contributes to environmental protection. In China, the growth of SMEs is directly related to the growth in employment. But SMEs have poor capacity in terms of pollution control and waste management. This is causing serious problems. We recognize we need strict enforcement otherwise pollution problems will get out of hand.

192. It is difficult for China to close down smaller polluting enterprises; there is an immediate impact on employment and people bear the brunt of that. The government has shut down some 20,000 small coal mines, coke and steel mills - many are opening their doors again. There are two ways of resolving these issues: first, strengthen government regulations and tighten up market access; secondly, stop providing loans and credit lines for polluting enterprises.

193. The Council also emphasizes the importance of the rule of law. China has distinct advantages. In the fight against SARS, we used the rule of law and we won because of this weapon. However, China faces the challenge of efficient enforcement of laws and regulations. For instance, land use is regulated in order to prevent the loss of agricultural land and the random encroachment by developments of all kinds. But despite this, we have failed to halt the loss of farmland. Law enforcement needs to be tightened up.

194. China values the views of Council and takes them seriously. Council is welcome each year to visit, look around, find out more about China at first hand and reflect its views back to the government. This is a good way to improve environmental protection.

Keynote Speeches

Keynote Speech at the 2nd Meeting of CCICED Phase III

H.E. Mr. Borge Brende, Minister of Environment, Norway Chairman of
the United Nations Commission on Sustainable Development (CSD)

Oct. 30, 2003

Thank you very much for this opportunity to touch upon some of the major challenges that we all are facing - one year after the World Summit for Sustainable Development in Johannesburg.

It is indeed an honour to address the China Council for International Cooperation on Environment and Development. During the past decade, the policy recommendations of this Council have played an active role in promoting the sustainable development strategy in China.

Needless to say, if we are to deliver on our commitments from Johannesburg and the UN Millennium Summit, the substantial progress with regard to sustainable development in this country will constitute a major contribution.

It is therefore heart-warming to learn about the great achievements that this Council has contributed to - in particular with regard to support for cleaner production programmes and the comprehensive treatment of the urban environment and transportation, that has taken place in a number of Chinese cities (Shenzhen, Dalian, Qingdao and Kunming).

I had the opportunity to listen to the speech that Mr. Xie gave at the UNEP Governing Council earlier this year on sustainable production and consumption. I also know that the China Council has done a most impressive job in giving advice to the Chinese Government on how to address this complex, but important issue. Let me share with you a few of my thoughts on this matter.

Time and again we are told that development in developing countries are/is going in the wrong direction. This is too simplistic an assessment. There has been significant social and economic progress, both in developed and developing countries during the last decades.

Within the last 25 years, life expectancy in the developing countries has increased with 8 years,

whereas in OECD-countries it has increased by 6.

The last 30 years, the child mortality rate is about halved in developing countries.

As a group, developing countries have experienced significantly stronger economic growth than developed countries. China has been a lead country in this regard, having two decades of very high economic growth.

However, huge differences exist among developing countries. Whereas Asia has experienced the strongest growth, Africa remains a challenge. We have to find out what has worked - what has not.

In my opinion, developed countries bear a special responsibility to assist developing countries in “leapfrogging” some of the unsustainable choices that the developed countries have made - and go directly to profitable, but more sustainable solutions taking due account to the environment.

The challenge is to achieve more growth with less use of land, resources, energy, harmful chemicals and waste. It is essential to decrease economic growth from environmental damage in order to protect nature. It is also essential in order to eradicate poverty. In short - it is essential to sustainable development.

In my opinion, it is a prerequisite for sustainable development that we:

- (1) Apply the polluter-pays principle
- (2) Eliminate harmful subsidies
- (3) Create new markets
- (4) Focus on cleaner production
- (5) Let consumers make informed choices

We need to apply the polluter-pays principle.

Pollution is not free. Pollution leaves the bill for cleaning up to our neighbours, and it leaves the costs of lost species to our grandchildren. Therefore, a company must not only pay for the internal cost of production. The company should also pay the external costs for its impact on nature and society.

Our experiences have shown that countries should apply licensing policies, taxation and resource pricing to make real costs visible. This does not necessarily impose long-term competitive disadvantages, making companies less profitable. On the contrary such measures may encourage business and industries to produce in ways that are both more cost effective and less damaging to nature.

Moreover, environmental protection might provide new business opportunities. Waste from one company can become economic input for recycling industries. We have several examples of such business opportunities in the paper and pulp industry, in the aluminium industry, and in the waste management industry.

We need to: eliminate harmful subsidies.

This means for example that it should not be cheaper to buy subsidized fuel rather than adjusting the car engine for reduced consumption, or it should not be cheaper to let the subsidized water pipe stay open rather than installing water-efficient washing machines. Governments should not encourage the degradation of environment by paying for it!

Harmful subsidies waste money regardless of need - money that could have been targeted to give the poor a better life.

We must continue to create new markets.

The most important is not how strong environmental regulations are, but that businesses have a level playing field. Environmental regulations not only make some harmful products unprofitable. They also open new markets for innovative businesses.

Leaded gasoline is one example. Leaded emissions are extremely harmful to children, interfering with the brain and other organs. Poor air quality causes 3 million deaths each year. Most OECD countries have eliminated leaded gasoline and phased down sulfur in diesel and gasoline fuels. Everywhere, it should be more profitable to sell “healthy” fuels than harmful fuels - and we do have the means to ensure it.

We should focus on cleaner production.

Decisions on materials, purchases and design are important to determine product life, lifetime resource use and whether the product can be easily repaired, recycled or disposed. Both costs and environmental impact can be minimized through applying the cleaner production concept.

Such programs may not solve all environmental problems at a facility, but they will reduce the need for end-of-pipe equipment and create less toxic waste to treat and dispose of. They reduce workers’ exposure to hazardous chemicals and usually the number of accidents that can harm the surroundings. Products designed with cleaner production in mind are often less harmful for consumers and produce less waste.

Let consumers make informed choices.

If someone sells toxic goods that damage health, the law will catch the producer, consumers will be scared and sales will drop. If you buy goods where the emissions in the production process damage your health and environment, you may not even know it until your tax bill increases to pay for the cleanup.

Consumers have a right to know how their purchases will affect them. They have a right to choose not to buy if they are aware that their purchases will harm others. Life-cycle analysis is well established as a valuable design tool. Eco-labels already give consumer guidance Green purchase is rapidly spreading.

Sustainability is not only a precondition to ensure that the natural capital is not used up or damaged, but may also be the source of sustainable production tomorrow. Only strong certification, labelling and international cooperation can stop the trade in illegally mined diamonds and illegally logged timber. Most countries have laws that prohibit the sale of stolen goods. But we still lack sufficient laws that prohibit the sale of stolen natural resources!

Eco-labels must, however, be applied in a non-discriminatory fashion by having transparent criteria for labelling and the necessary information and competence. The EU-countries have their own label. The Nordic countries have another label providing good public relations for business and industries.

These points are but some important elements related to this issue of sustainable production and consumption. At the upcoming 12th Session of the Commission on Sustainable Development, we will discuss this issue in relation to water, sanitation and human settlements - the three focus areas of the Commission for the coming two years.

The World Bank has estimated that some 500 million of this region's 1,8 billion people do not have safe water, and 900 million are without safe collection of sewage. The gap between rural and urban areas remains extremely wide, especially in Eastern and South-central Asia, where coverage in rural areas is only about one quarter of the population, while urban coverage is 70 percent.

It is time to stop being defensive. What is needed is political courage.

You are all aware of the challenges:

More than 1.2 billion people around the world lack basic water supplies.

More than 2.6 billion people do not have access to adequate sanitation.

The global goals on water require that safe drinking water be delivered to another 270 000 people every day for the next 12 years.

The sanitation goal means that basic sanitation must be made available to another 370 000 people every day for the next 12 years.

Although a daunting task, I believe it can be done. We owe it to ourselves, and most of all to our children, and their children.

The targets are ambitious - they demand the best of us - all of us.

How are we doing so far? What are the prospects of reaching the targets?

China, with 1.3 billion people, will probably achieve most of the Millennium Goals. India, with one billion people, is on track to meet the overall poverty goal. In South Africa, free access to basic water supply is well in reach.

In 1994, 15.2 out of South Africa's population of 40 million lacked access to basic water supply. Last summer, President Thabo Mbeki attended the celebration of the 9th million new receiver of free water since the program was initiated. At this rate of progress, access to basic water supply will be universal by 2010.

At the same time, let us not forget that Sub-Saharan Africa, with 600 million people, is lagging far behind. With current projections, the number of people living in absolute poverty will increase, not decrease. This requires an increased effort by all of us.

We must encourage alliances and partnerships to drive the process forward.

Governments set the tone of action. They must lead the way and provide the necessary resources. But governments can not do it alone.

The goals may be global in character, but they must be implemented locally, where people live and where shelter and services are required.

Here, the role of local governments is crucial.

So is the role of private enterprises and civil society. We need private actors who can accelerate growth and provide affordable and sustainable technological solutions.

Equally important is having good examples of how market mechanisms can play an important role in the field of environment and development. In this regard, the China Council has led the way, by carrying out policy and project demonstrations on major and urgent issues in the field of environment and development in China.

We also need civil society to carry out valuable work on the ground.

The WSSD was a summit where the necessity of such partnerships was underlined. Let us all take pride in ensuring that the partnership idea of the WSSD will come to be seen as the beginning of a process, rather than the end of one.

Your Excellencies, Distinguished Delegates, the CSD has been challenged to assist in transforming the ambitious goals of the Johannesburg Summit into viable action for our common future.

But, the CSD is not supposed to - or equipped to - do the job alone. There is no single agency, nor country that actually can. But everyone can give a small contribution in order to get the job done.

We must mobilise the political will to provide additional resources and we must encourage alliances and partnerships to drive the process forward. We must get business and industries stronger involved to increase the volume of investments.

As Chairman for CSD12, I see the transformation of words into action and focusing on implementation as our main challenge.

We must deliver on our commitments from Johannesburg, and we must demonstrate results in the fight against poverty and environmental degradation. Collective efforts are needed and we all have a responsibility to do our utmost to help the world achieve the targets to give the poor people the services they require and a life with dignity and respect.

Constructing Eco-Province and Building Green Zhejiang

Xi Jinping, Secretary of Zhejiang Committee of
Communist Party of China (CPC)

Oct. 30 - Nov. 1, 2003

Mr. Chairman, Council Members and Experts, Ladies and Gentlemen,
I am very glad to have the chance to take part in the 2nd Meeting of the 3rd Phase of CCICED. According to the meeting arrangement, I would like to present you a brief introduction on ecological construction and sustainable development in Zhejiang province.

I. Constructing eco-province is an inevitable choice for Zhejiang to accelerate building well-off society in all-round way and achieve modernization basically in advance

Zhejiang province is located in the southern part of the Yangtze River Delta on the southeastern coast of China. The province covers a total continental area of 101,800 square kilometers and is one of the smallest provinces in China. The permanent population of Zhejiang amounts to 46.47 million. In year 2002, provincial GDP, per capita GDP and financial income reached 779.6 billion RMB, 16,838 RMB and 116.7 billion RMB respectively. The above three indexes all ranked 4th among the provinces and municipalities in China. Therefore, Zhejiang is a province with small area and limited continental resources as well as big population and tremendous economy. Meanwhile, Zhejiang has very limited environmental capacity and unbalanced industrial distribution. About 70% of population is concentrated in plains and industries are also relatively clustered in coastal and plain area.

Zhejiang has achieved sustainable and rapid economic development since opening-up and reform over the past 20 years, with average annual GDP growth rate at 13%. Rapid economic development has yielded pressure on resources and environment. Especially after entering the new century, our province has marched into a new phase of speeding up industrialization, urbanization, informationization, marketization and internationalization, building well-off society in all-round way, and achieving basic modernization in advance. Economic and social development has put forward higher requirements for ecological environment. Our province has

made the target for quadrupling GDP from 2000 to 2020. Without fundamental transformation in the way of economic development, more serious resources waste and environmental problems will be unavoidably resulted in, which will, in reverse, restrain substantially economic and social sustainable development. Therefore, we have to establish new concepts of development, which will attach more importance to ecological construction and environmental protection and pay more attention to harmonious and sustainable development among economy, society, population, resource and environment. We have to explore new ways of development, which will transform the main approach from extensive growth to intensive one, promote the shift of economic development from quantity expansion to quality improvement and make great efforts to achieve new quantity expansion based on quality improvement.

It was according to the provincial basic characteristics and development concepts that Zhejiang Committee of CPC and Provincial Government mastered the rules, considered the current situation, took the important thought of “Three Represents” and the spirit of 16th National Congress of CPC as our guide and finally based on previous work, made the significant strategic decision so-called “Further Utilizing Ecological Advantages of Zhejiang, Constructing Eco-province and Building Green Zhejiang”. Authorized by State Environmental Protection Administration (SEPA), Zhejiang has become the 5th Eco-province Construction Pilot Province after Hainan, Jilin, Heilongjiang and Fujian province in China.

II. General target and main tasks of eco-province construction in Zhejiang

Eco-province is a provincial-level administration region in which harmonious development has been achieved among economy, society and ecological environment and every field is basically in accordance with the requirements of sustainable development. Constructing eco-province means to uphold sustainable development strategy, apply the principles of ecology and concepts of recycling economy, take transformation of economic development way and improvement of environmental quality as the precondition, give full play to the advantages of regional ecology, resources, industries and mechanism, make big efforts to develop ecological economy, improve ecological environment, cultivate ecological culture, make overall planning and implementation of environmental protection, social development and economic construction, and realize harmonious and sustainable development among regional economy, society, population, resources and environment.

The general target of eco-province construction in Zhejiang is that after making efforts for nearly 20 years, we will basically realize the adaptability of population scale and quality to the requirements of productivity development, and economic and social development to the resources and environmental carrying capacity. Zhejiang will be built up into a province with

relatively developed ecological economy, beautiful ecological environment, harmonious ecological residency area, prosperous ecological culture and comparatively strong sustainable development power. We will lead the whole province in a civilized development way of “developing production, wealthy life and sound ecology”.

The main tasks of eco-province construction in Zhejiang are making tremendous efforts to establish Five Systems and giving highest priorities to develop Ten Key Fields. Five Systems are as follows:

1. Ecological Economic System with Circular Economy as the Core. We should take a new road to industrialization, adjust and optimize economic structure, cultivate and develop circular economy, flourish eco-agriculture, eco-industry and modern-service industry, make big efforts to advocate green consumption, and search for one economic development way featuring science orientation, resource saving, cleaner production, ecological protection and circular economy.

2. Natural Resource-guarantee System with Sustainable Utilization. We should further improve the laws, regulations and resource management system, strengthen reasonable exploitation, utilization and protection of natural resources, and increase resource utilization efficiency and comprehensive utilization level. Meanwhile, we will make the best use of domestic and international resources and strengthen resource-guarantee capacity for economic and social sustainable development.

3. Ecological Environment System with Beautiful Mountains and Rivers. We should control strictly and reduce gradually the total volume of pollutant discharge. Practical and effective solutions should be developed to settle the problems of water pollution, air pollution, sea pollution and agricultural area pollution. We should work hard to satisfy the requirements for environmental quality of function regions. Protection of bio-diversity will be carried out thoroughly. Anti-disaster and disaster-alleviation capacity will be improved obviously. Environmental supporting capacity will be promoted increasingly for economic and social development.

4. Ecological System of Population with Adaptability to Resource and Environmental Carrying Capacity. We will implement the basic national strategy for Family Planning, combine the population issues closely with ecological construction, and achieve step by step the population with suitable scale, optimized structure and reasonable distribution. At the same time, we should learn the lessons from SARS disaster, strengthen construction of public sanitation system and residency environment, advocate civilized and healthy life-style, and facilitate broad personal development in all-round way.

5. Scientific and High-efficient Capacity Supporting and Guarantee System. We will accelerate innovation in system, mechanism and management related to Eco-province Construction. The science and education support for Eco-province Construction will be reinforced. We will broaden the demonstration effects of ecological pilot zones and sustainable development test area. We will improve the forecasting and alerting system of ecological and environmental security. Scientific decision-making and evaluation mechanism concerning Eco-province Construction will be established.

Under the framework of Five Systems, we will give highest priorities to develop Ten Key Fields, i.e. Eco-industry and Cleaner Production, Eco-agriculture Construction, Ecological Public Welfare Forest Construction, Ten-thousand-miles Clean River Program, Eco-environmental Treatment, Eco-town Construction, Comprehensive Treatment of Rural Environment, Eco-construction of Blue Sea, Poverty Eradication by Leaving Mountains and Prosperity Built-up with Assistance, Support by Science-Education and Management of Decision-making. Through above work, we will integrate all kinds of resources and organize and promote the realization of economic and social sustainable development.

III. The main work and results of eco-province construction

With strong support from SEPA, our province has started the concrete work concerning Eco-province Construction in all-round way. Regarding environmental protection and ecological construction in recent years, the work we have done and the results we have accomplished are mainly focused in the five aspects as follows:

1. Strengthen the Role of Leadership, Allocate Responsibilities and List Environmental Protection and eco-construction as the important work of CPC committee and government at various levels. Provincial Committee of CPC and Government have set up the Leading Group for Eco-province Construction Work. Standing Committee of Provincial People's Congress has approved the Decision on Constructing Eco-province. Provincial Government has worked out the "Outline for Eco-province Construction Plan of Zhejiang". Construction plan and implementation scheme of eco-city and eco-county have been also developed by local governments across Zhejiang based on specific situation. Furthermore, we have integrated tasks of Eco-province Construction into the Work Target and Responsibility System for Chief Executive of Government at all levels. System of One-ticket-veto Played by Environmental Protection and Eco-construction has been adopted in the process of assessing leaders and cadres. Leaders at various levels are required to build up the concept of "Green GDP". Now we are exploring actively the Green Accounting System.

2. Actively implement strategic industrial restructuring and develop circular economy.

According to the requirements of new-pattern industrialization, we have combined construction of advanced manufacturing base and Eco-province. Cleaner production has been promoted. On the one hand, we have upgraded traditional dominant industries with high-and-new, advanced and applicable technologies. The high-and-new technology industry has been boosted. We have accelerated the development of environmental equipment manufacturing industry and environmental service industry, sped up elimination of out-of-date process, equipment and production capacity, promoted restructuring of key industries with resource consumption and pollutant discharge such as chemical and textile industry, and treated structural pollution. On the other hand, we have adjusted industrial distribution according to ecological conditions and environmental carrying capacity. A group of industrial parks have been planned and constructed in order to muster industrial companies into the parks and realize co-construction and share of infrastructure and pollution centralized treatment facilities. In recent years, our province has closed, stopped, incorporated and transformed nearly 3000 “Fifteen Types of Small Enterprises”, among which 230 small cement kilns have been dismantled. Moreover, we have boosted strongly green and pollution-free agriculture. Eleven Provincial-level Agricultural Hi-tech Demonstration Zone (AHDZ), over 2200 Modern Agriculture Demonstration Zone (MADZ) and 1000 Pollution-free Agricultural Products Base (PAPB) have been established across Zhejiang.

3. Emphasize the combination of governmental leadership and market-oriented operation, and promote industrialization of pollution treatment. We have magnified the leading role of governmental fund and utilized the advantages of abundant private capital in our province. By adoption of market-oriented operation mechanism, we have encouraged and supported social capital to invest in Eco-province Construction. Multi-investment mechanism so-called “Government Leading, Market Promotion and Public Participation” have been established and improved. From the year 1998 to 2002, provincial financial budget at a total amount of 130 million RMB had been allocated to promote the construction of 1250 industrial pollution treatment projects in terms of interest subsidy, which had stimulated total project investment over 14 billion RMB. The whole province has invested in environmental protection area at the average rate of over 2% GDP in recent years. Modes of multi-investment and professional operation, which have been practiced in Shaoxin Round-city River Treatment, Ningbo Fenglin Domestic Waste Incineration Plant, Jiaxing Xiuzhou Honghe Wastewater Treatment Plant and Pinghu Pollution Treatment Facility, are typical examples of industrialization of pollution treatment.

4. Make overall planning for urban and rural harmonious development and propel the drive for urban and rural environmental comprehensive treatment. Our province has implemented urbanization development strategy at an early stage. At current time, according to the requirements of coordinating urban and rural economic and social development, the integration of cities and rural area has been accelerated. In this process, on the one hand, we

have strengthened urban environmental protection and construction. 36 municipal wastewater treatment facilities have been constructed. Smoke and dust control area and urban up-to-standard environmental noise area has reached 2 300 km² and 1000 km² respectively. On the other hand, we have attached importance to rural environmental comprehensive treatment. “Demonstration of One-thousand Villages and Treatment of Ten-thousand Villages” project has been carried out. A number of Well-off Demonstration Villages have been planned and built. Treatment of domestic pollution produced in rural residency area has been strengthened in all-round way across the whole province. At the same time, we have enhanced the management and construction of Ecological Demonstration Zone (EDZ), Natural Protection Zone (NPZ) and Key Ecological Function Zone (KEFZ). In our province, 46 NPZs and 67 Forest Parks above provincial-level have been established. Forest coverage rate has reached 59.4%. Many cities and counties, such as Hangzhou, Ningbo, Shaoxing and An’ji, have been entitled to either National Ecological Demonstration Zone (NEDZ) or National Environmental Protection Model City (NEPMC). We have also guided and encouraged farmers living in remote mountain area to come down and move out. At the end of last year, 323 small immigrant living area with over 50 families have been built up. About 80,000 families and over 300,000 immigrants from mountain area have been accommodated, which has contributed not only to poverty eradication and prosperity built-up but also protection of ecological environment of mountain area.

5. Strengthen propaganda and establish sound mechanism of public participation. We have made the best use of news media to disseminate widely the importance of environmental protection and eco-construction. Activities like building Green Enterprise, Green Community and Green School have been carried out to cultivate public environmental awareness. We have introduced the Reward for Environmentally Illegal Behavior Tip-offs activity and established the channels for public participation in supervision on environmental management. The common sense has been developed that protection of eco-environment is to protect productivity and without attaching importance to eco-environment, government is not a clear-minded government, leader is not a qualified leader, enterprise is not a promising enterprise and citizen is a citizen without modern civilization awareness.

Zhejiang Committee of CPC and Provincial Government will lead the people of whole province to implement conscientiously the spirit of the 3rd Plenary Session of 16th Central Committee of CPC, build up the concepts of all-round, coordinated and sustainable development, make overall planning of harmonious development between mankind and nature, establish the mechanism of promoting economic and social sustainable development, and make unremitting efforts to implement sustainable development strategy and promote Eco-province construction. We will work hard, year by year and term by term, to turn our province into a Green Zhejiang with prosperous economy, beautiful nature and civilized society.

CCICED has contributed significantly to the undertaking of ecological environment and sustainable development in our country and yielded positive influence in international communities since its foundation. Under the guidance from CCICED, we will further strengthen international communication and cooperation in the fields of environment and development and promote the undertaking of environment and development in Zhejiang at a higher level.

Finally, Mr. Chairman and Members, you are warmly welcome to visit and have a look at Zhejiang. I sincerely hope the next meeting of CCICED could be held in Zhejiang.

Issues Paper

Sustainable Industrialization in China and a Well-off Society

Discussion Paper

Prepared for the Annual General Meeting of CCICED

Oct. 30~Nov.1, 2003

CCICED Lead Experts*

EXECUTIVE SUMMARY

This paper reviews major points related to China's efforts for sustainable industrialization and a well-off society, the theme of the 2003 CCICED Annual General Meeting. The purpose is to provide background on both international and Chinese experience and to set the stage for discussion and development of recommendations by the Council. The paper complements the reports of five Task Forces being presented to CCICED this year, each on a particular area related to sustainable industrialization. The link to *Xiaokang*, an "all-round, well-off society", places emphasis on equity and various concerns related to quality of life, using the wealth creation, knowledge and products created by industrial development.

Sustainable Industrialization

Sustainable industrialization is a process of development that (1) sets and meets wealth generation and production objectives that support Chinese and, when appropriate, international sustainable development goals; (2) builds capacity and sets conditions for enterprises of all sizes to meet "triple bottom line" financial, social and environmental objectives; and (3) provides for institutional reform and commitment to innovation in order to meet these objectives. It depends upon the interplay of government and business, community, and other interests, including those of international organizations to set objectives, guidelines, regulations and incentives. New metrics will be needed in order to adequately understand and communicate progress on achieving both sustainable industrialization and its link to a well-off society.

China is drawing upon globally-recognized concepts such as eco-efficiency, polluter pays, Cleaner Production, Eco-industrial parks, as well as some that are more specific to various

* This paper has been prepared by Arthur J. Hanson, O.C. who serves as Lead Expert and CCICED Council Member. This version is based on views discussed by the CCICED Lead Experts. The section on Chinese data is to be completed by Hu Tao, a assistant of the LEs. The views expressed are those of the authors and do not represent official views of institutions or governments.

countries, such as the idea of the Circular Economy. These ideas, while very important, provide only part of the picture of an emerging new approach. Sustainable industrialization depends very much on overall structural reform of industry, regulation based on a broader array of instruments and voluntary measures, and both fiscal and financial reform.

As individual sectors and enterprises move along their “Sustainability Journey” the role of innovation becomes important in order to develop new material and energy-efficient industrial processes and environmentally and socially sustainable products. China is encouraging investment in new sectors such as environmental technology, alternative energy, information technology, biotechnology and nanotechnology that should help achieve advanced objectives, including those involving a commitment to technology leapfrogging.

Urban planning and development, government procurement policies, and the tremendous need for new installed capacity of various industrial infrastructure offer many very significant opportunities for making choices in favour of sustainable industrialization. Balanced against these largely positive elements are some major difficulties, for example, the uneven performance of provinces in enforcement of environmental regulations, the issues of old industry including some obsolete state enterprises, the technical and financial difficulties of the very economically important small and medium-size enterprises, and extensive policy and institutional reform needs. China also faces international competitive pressures, trade and environmental negotiations, and growing expectations internationally for improvement of corporate social responsibility, and higher environmental and social performance levels.

Chinese Data Trends

This section of the paper, to be completed for the CCICED AGM will provide additional information that illustrates areas of progress and also some dilemmas.

Ten Issues for Discussion

The purpose of this paper is not to identify specific recommendations. But a number of issues and questions arise. The ten themes summarized below are a starting point for general discussion on how to improve China’s sustainable industrialization efforts, and strengthen the linkage to a well-off society. They are discussed in somewhat more detail in Section III of the paper.

1. The link between sustainable industrialization and a well-off (*Xiaokang*) society goes beyond issues of wealth creation and distribution, and these broader dimensions need considerable attention. How much and how broadly should sustainable industrialization be expected to contribute to a well-off society in China? Can this be done in a way that actually improves the profitability and right to operate of individual enterprises, while also reducing rather than contributing to China’s overall environmental debt?

2. The success of sustainable industrialization will depend upon how well other components of sustainable development are implemented within China. How can intersectoral communication and cooperation on sustainable development be enhanced so that the full potential of sustainable industrialization is realized, including its contribution to other processes such as sustainable urbanization?

3. Fiscal reform and financial sector reform are necessary to achieve sustainable industrialization. Given a need for both fiscal reform and financial sector reform in order to achieve general development goals within China, which reforms are most likely to be useful in achieving sustainable industrialization, while at the same time contributing to a well-off society?

4. The appropriate scale for individual enterprise development and its relationship to both sustainable industrialization and urbanization require policy attention. Should China restructure its industrial base to encourage development of larger-scale industry that may be more capable of addressing sustainable industrialization? And, if so, are there strategic sectors to start this process, and sectors where it is still particularly important to foster SMEs?

5. The legal framework for sustainable industrialization is still incomplete, but there are real tradeoffs between adding new laws and enforcing existing laws and regulations. Are there critical gaps in legislation and regulations to support sustainable industrialization, and if so, what should be the appropriate balance between adding new rules and improving enforcement of existing ones? How can enforcement be made more consistent at provincial and municipal levels? As well, more attention needs to be given to incentive-based approaches to industrial regulation. What are the most important areas to address using this approach?

6. China is not achieving an optimal transfer of environment and sustainability technology from abroad, and the rate of technology leapfrogging is less than would be desirable. There is a need to speed up the development of a Chinese environmental protection and sustainable development industrial sector. How can environmental protection and sustainable technology sector development be accelerated so that it can adequately support the needs of sustainable industrialization? And can the sector be developed in a fashion that stimulates innovation within industry, leading to useful, environmentally sound products that will contribute to a well-off society?

7. Measures of progress for sustainable industrialization in China are weak, and even less well developed for the linkage between this new style of industrialization and a well-off society. How can sustainable industrialization progress be monitored and measured in relation to its own performance and for its contribution to a well-off society? Which sustainability indicators are likely to be most useful, and can they utilize existing statistical information?

8. Capacity-building is highlighted by many sources as a high priority need within virtually all segments of the industrial sector, in regulatory systems at national and local levels, within the management structure and board room of individual enterprises, and in financial institutions. The gap between skills required for sustainable industrialization and their supply is already large, and likely to increase over time unless there is concerted action and considerable foresight. What are the most critical actions that can be taken during the existing and coming Five Year Plans, and within the private sector to address the gap?

9. China's domestic market potential attracts attention from those who ask the question of whether the world's ecosystems can support Chinese consumption at levels anywhere near those of western society; and others who see this emerging market as the most significant place in the world to stimulate consumption and, therefore, demand for their product, whether or not the product truly improves well-being or sustainability. What actions are needed within China's domestic marketplace to develop and reinforce sustainable consumption patterns, and how might such efforts improve both sustainable industrialization and the achievement of a well-off society?

10. Chinese efforts for achieving sustainable industrialization and a well-off society are taking place at a time of evolving international views towards globalization and development. Almost certainly there will be surprises (e.g. SARS) leading to international responses that may threaten progress. How can China reduce its vulnerability to potentially damaging events and perceptions that may affect its international markets, sustainable industrialization progress, and capacity to be fully engaged in a globalized world?

Conclusion

China's best efforts could be derailed by a convergence of problems, with only some directly controlled from within the country. Therefore it is important for the international community to support the Chinese sustainable development effort in various ways, even where there may be issues of industrial competition. Within China it will be more and more important to build dialogue, partnership and action across major sectors, for sustainable development demands this type of exchange.

No one yet knows how different China's approach will be compared to international norms, and to industrial development in other countries that developed along lines now considered to be unsustainable.

China has surprised the world with its rapid and dedicated efforts for economic development. With this same degree of dedication directed towards sustainable industrialization and *Xiaokang*, we can hope for an interesting and globally significant business and sustainable development transition.

Sustainable Industrialization and a Well-off Society

PURPOSE

China faces massive challenges and major opportunities during the decade ahead-when the nation makes a transition to becoming one of the leading industrial producers in the world, operating within the rules of the World Trade Organization. Through a series of policy statements and bold action, China has signaled its intent to use this export-driven industrialization process as a key means to achieve sustainable development. The industrialization effort is intended to take into account the need for distribution of economic and social opportunities throughout the country. The outcome should be the achievement of a *Xiaokang* society, i.e. a well-off society built in an all-round way that pays attention to progress in five dimensions-economic development, material life, population quality, cultural life and environment. These views were reinforced at meetings of the National People's Congress and the Political Consultative Conference held in March 2003.

This discussion paper is intended to focus attention on pathways that might be considered in order to achieve these dual objectives of sustainable industrialization and a well-off society, and some of the barriers that may have to be overcome. It explores relevant international and Chinese experience, and provides recommendations for discussion at the CCICED Annual General Meeting 30 October - 1 November 2003.

DEFINING SUSTAINABLE INDUSTRIALIZATION

While much has been written on the subject of business and sustainable development¹, and on individual "sustainable enterprises"², sustainable industrialization as an overall process contributing to a country's sustainable development is less well understood, although there are a variety of views.³ A reasonable definition of sustainable industrialization should take into account transformation in the structure of industrialization, including scale, the ways enterprises use natural resources and human resources, the role industry can play in fostering sustainable urbanization and livelihoods, and other key linkages of industry with society.⁴

¹ See, IISD's business website (www.BSDglobal.com) for a comprehensive set of concepts and linkages relating to leading business and sustainable development practices.

² A widely recognized early definition is *For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining and enhancing the human and natural resources that will be needed in the future.* (from IISD and Deloitte and Touche. 1992. Business Strategies for Sustainable Development.)

³ See, for example, Wallace, D., 1996. Sustainable Industrialization. Earthscan, London; also, World Bank, IFC, ADB, and WBCSD approaches.

⁴ David Wallace. Sustainable Industrialization. Issue No. 16. Energy and Development Program. ECSSR.

In China's Tenth Five Year Plan, structural adjustment of industry is addressed as a key theme. More than a dozen industries are given priority attention in this adjustment, including: machinery, automobile, metallurgy, nonferrous metal industry, petroleum, petrochemical, chemical industry, medicine, coal mining, building materials, light industry textiles, electric power and gold. This eclectic list demonstrates a considerable focus on heavy industries, often considered as among the "dirty industries" of the past in OECD nations. The list of *industries, products and technologies currently encouraged by the State* as of 2000 included some 28 areas of industry, with over 526 products, technologies and services. There is a strong interest in developing high technology approaches, with a major emphasis on information technologies.

Structural adjustment of Chinese industrialization involves several policies⁵:

- ❖ Supporting and upgrading industries, products and enterprises that can improve China's competitive power through capital investment, bond issues, debt swaps, etc.
- ❖ Encouraging the reform of traditional and strategic industries through tax reduction and remittance.
- ❖ Creating a competitive environment for business through: a fair investment tax policy, strict technology and quality standards, anti-monopoly laws and regulations, and rapid market information services. Importantly, not all industries are covered, for example, those related to national security, "natural monopoly", and new "high-tech" industries.
- ❖ Restrictive industry policy designed to eliminate industries where supply exceeds demand and where there may be a low technical content and/or major environmental pollution.
- ❖ Protective policies to cover agricultural, service and "young" industries considered vulnerable to international competition. Such policies need to take into account China's accession to WTO.

These structural changes are reinforced by several mechanisms, including preferential loans and fund-raising via banks such as the China Import and Export Bank, the State Development Bank and the China Agricultural Development Bank.

As well, decisions about industrial development are informed by several principles, including conformity with the national sustainable development strategy, contributing to energy efficiency and improving ecological conditions. Another set is related to technological advancement, including expanding domestic technology contributions to industrialization, with new opportunities for economic growth. A third is to address domestic market needs and to contribute to fast, sound development of the national economy. All of these concepts, of course, could contribute to sustainable industrialization.

⁵ See, china-asean business net (www.china-asean.net/china_biz/country_econ/china_econ_overall6.html)

The above paragraphs have introduced China's efforts to modernize industry, and how such efforts can be related to sustainability and a well-off society. When we examine the pattern of China's industrialization in more depth, it is clear that the challenges of sustainability will indeed be great. No other country has embarked upon transformation at such a scale, and at a time when so many options for the future are available. China's industrialization is taking place in a period when many OECD nations are engaged in, or entering a post-industrial phase, with a current emphasis on an information economy. And, beyond that, there are new directions emerging in these richer nations, for example, the new biological economy, based on many advances, for example, in genomics, new industrial enzymes and ecological services such as carbon sequestration. Thus China's policies towards industrialization must be extraordinarily sensitive to new opportunities beyond the heavy industries and manufacturing typically profiled within industrial strategies.

To conclude, sustainable industrialization for China might be defined as noted in the box.

SUSTAINABLE INDUSTRIALIZATION IN CHINA

A process of industrial development that (1) sets and meets wealth generation and production objectives that support Chinese and, when appropriate, international sustainable development goals; (2) builds capacity and sets conditions for enterprises of all sizes to meet "triple bottom line" financial, social and environmental objectives; and (3) provides for institutional reform and commitment to innovation in order to meet these objectives.

XIAOKANG —AN "ALL-ROUND, WELL-OFF SOCIETY"

Xiaokang, an ancient concept for a social ideal within China⁶, has been solidly endorsed in recent months. In past years it was applied as Deng Xiaoping's vision of modernization in China at the time opening to markets began. It was envisioned as a process where first subsistence, then higher levels of wealth were to be created—a quadrupling of GDP between 1980 and 2000 to achieve a basic *Xiaokang* society. The further modernization process was to be until 2050, at which time Chinese per capita income levels would reach those of mid-income countries. By 2000 the term "well-off" covered a considerable range, from survival to affluence.⁷ The target set by Jiang Zemin was to further quadruple GDP between 2000 and 2020. However, a measure such as GDP says nothing about equity, and that is the concern being addressed by the use of the term "all-round, well-off society."

⁶ In the *Li Yun* of the *Li Ki*, *Xiaokang* is described as a society where people had self-interests, with governance through rites or institutions; see Chi Hung Kwan. 2003. Building an All-round Well-off Society – The Shift from Efficiency to Equity. China in Transition www.rieti.go.jp/en/china/03042401.html

⁷ Hu Angang. March - April 2003. How Will China Build a Well-Off Society for All of Its Citizens. The China Business Review. pp50-55. Hu Angang suggests that four useful indicators for a society where wealth is evenly distributed among all citizens are: per capita income, Engel coefficients, UN Human Development Index and poverty rates.

The 30 million or more Chinese living more or less in absolute poverty, without access to sufficient food and clothing, fall far below a stage of *Xiaokang*. And as expectations continue to rise, perhaps the term itself will be redefined from the modest levels originally envisioned. Will it mean an automobile for most households? Travel abroad at regular intervals? The line between well-being and affluence in China may well blur, just as has happened in many other societies. And income alone is not the only consideration. Well-being also needs to be defined by factors such as living conditions that promote good health, access to education and training, good standards of accommodation, amenities for recreation, the means to be creative, and a good quality of environment. Fairness, transparency and consistency in addressing citizen needs and concerns is important element for societal and individual well-being. Social security is a major concern. Thus, citizens should enjoy “well-off lives in the broadest of senses, not only materially, but socially.”⁸ All-round *Xiaokang* is to be met by 2020 according to current strategy.

Xiaokang is important in the regional distribution of benefits of development, including those derived from sustainable industrialization. In particular Western Development, central region development and re-development strategies in parts of northern China will demand special attention. Reduction in the agricultural workforce from 50% to 30% over the first two decades of the 21st Century focuses attention on both industrialization and urbanization policies and priorities, since both livelihoods and location of where people live will be affected.

Employment strategy is, of course, essential to *Xiaokang*. Of paramount importance is the creation of job opportunities for those being displaced from agriculture (about 1.7 million per year). The role of sustainable industrialization is important, but not necessarily the most critical component of job creation. The World Bank estimates that between 1990 and 2002 China generated many more jobs in the service sector (7.6 million jobs annually) compared to 1.6 million annually within industry.⁹ These figures do not tell the whole story, of course, since the quality of future jobs will depend upon technology choices that are yet to be made, and many service jobs are dependent upon wealth generation from export-oriented industrial production.

Hu Angang (see footnote 8), Director of the Center for China Study at the Chinese Academy of Sciences, indicates that reality today is *one China, four worlds*: 2.2% in cities such as Shenzhen, Shanghai and Beijing with a *high-economy*; 21.8% in coastal regions such as Guangdong, Zhejiang, Jiangsu, and Liaoning with *upper-middle economy*; 26% in Hebei, Jilin, Heilongjiang, and parts of central China with a *lower-middle economy*; and 50% in central and western China living under *fourth world* economic conditions, paralleling the poorest regions of the world. This view is oversimplified. Nevertheless, it dramatically conveys the magnitude of

⁸ China Daily. Tuesday, January 14, 2003, p3. Beijing, Guangdong, Sichuan and Tibet Discuss *Xiaokang* Society.

⁹ People's Daily. September 9, 2003 and World Bank, Beijing.

the challenges ahead for achieving *Xiaokang*.

The World Bank's multiple capitals approach seems particularly relevant to this discussion. Overall, there is a need to consider both social and human capital plus the built capital of infrastructure and natural capital. And the strategy of sustainable industrialization is important for providing the future financial capital needed for *Xiaokang*.

Finally, while equity is a key consideration in the new strategy for "getting rich together", it is also clear that it is not necessarily at the expense of greater efficiency in the industrialization process. At least that would appear to be the case. Thus, efforts in China will intensify to reduce support for obsolete industrial firms, and for at least some of the state-owned enterprises that are not capable of operating efficiently. Much of the future investment will be in high-technology industries that may not employ as many people but will produce much more output with lower levels of energy and material flow-through.

Sustainable development relies in large part upon the outcomes arising from macroeconomic policies, and other national-level policies that shape the relationship between industrialization, urbanization and other factors such as agricultural land use and social services. There appears to be no existing framework within China that defines the relationship between sustainable development and *Xiaokang*. This is an important priority. Are they one and the same? What differentiates them? How do they reinforce each other? And can they be adequately measured? China's Agenda 21 probably comes closest to providing a framework. But it is very comprehensive and complex, and subject to many interpretations.

One interesting effort to provide a social and ecological accounting matrix (SEAM) for China has been provided by Xiaoming Pan from the Institute of Systems Science in the Chinese Academy of Sciences.¹⁰ It is an attempt to build a simpler accounting system than that proposed by the UN Commission on Sustainable Development. Still, some 60 indicators are involved. Pan has produced a useful summary table with information on some 30 indicators divided into five categories: DEMOGRAPHIC, e.g. net growth rate; ratio of urban residents; ECONOMIC, e.g. GDP per capita, inflation rate, ratio of foreign investment, ratio of tertiary industry, ratio of R&D to GDP; SOCIAL, unemployment, social security coverage; RESOURCE, cropland per capita, energy intensity; ENVIRONMENT, water pollution index, air pollution index; EDP reduction (estimated net loss of natural resources and environmental assets).

Pan concludes with the good news that industrialization has proceeded to the point where less

¹⁰ Xiaoming Pan.. Social and Ecological Accounting Matrix: an Empirical Study for China. 13th International Conference on Input-Output Techniques. Macerata, Italy. 2000.12 pp.

ecologically intensive tertiary industry is now over 30% of all industry, and that the trend towards urbanization should help with implementation of family planning. However, Pan notes that major sustainability obstacles exist: low ratio of R&D expenditure, unemployment arising from the transition to a market system, limited coverage of the social security system, shortage of cropland, relatively low energy efficiency, and worsening pollution arising from rapid industrialization and urbanization. And, the Ecological Domestic Product (EDP) calculations suggest that China's GDP should be reduced by about 3.4% when the net losses of natural resources and environmental assets are considered.

The 10th Five Year Plan provides the short-term guidance that will help move Chinese society towards sustainable development, including sustainable industrialization and *Xiaokang*. Longer term guidance is provided by the 20 Year Plan discussed in the Party Congress.

ENTERPRISES, SUSTAINABILITY AND SOCIETY

The Sustainability Journey

Two decades ago, environmental action on the part of industry focused mainly upon compliance to prescriptive laws and regulations, generally based upon point source pollution control, best available technology and zoning. This was true for OECD nations as well as for developing nations. Many were still in the early stages of creating national legislation and environment units within government departments. The strengths and shortcomings of this approach became clear, along with the realization that compliance alone falls short of sustainability.

Risk assessment, often driven by concerns over right to operate and corporate liability, became commonplace by the mid-1980s. Driven by insurers' concerns over toxic wastes, bankers' concerns about providing loans for firms and properties with environmental problems, and the realization that "pollution prevention pays", industrial sectors and individual enterprises engaged in more proactive, often voluntary, action. A very successful example is the Responsible Care Program of the chemical production industry in North America and Europe.¹¹ This program dramatically reduced the production of many toxic wastes by fundamental changes in manufacturing methods, rather than relying mainly upon end-of-pipe pollution control. Since then, Responsible Care has been implemented in other sectors throughout the world. Yet sustainable industrialization could not be achieved through addressing risk and compliance.

A missing element gradually emerged during the 1990s when leading businesses, especially some multinational corporations, redefined their performance around a *triple bottom line*

¹¹ See www.americanchemistry.com/rc.nsf for information on Responsible Care, and www.chinacp.org.cn for information on applications in China.

through practices that are good for the environment, for people, and for the financial performance of the firm. Instead of a net cost to business, addressing environment and development concerns in industry could be seen as a means of enhancing the profitability and, ultimately, the shareholder value of the firm. The triple bottom line is today's best effort to create a definition of sustainable industry that works for both business and society.

Much of the impetus for this approach came from the corporate members of the World Business Council for Sustainable Development (WBCSD), which also pioneered the concept of eco-efficiency as well as more comprehensive reviews of particular industrial sectors such as pulp and paper and mining; UNEP's Cleaner Production initiative; from management consultants such as Sustainability; and from visionary individuals and organizations (e.g. Karl Heinrich, The Natural Step; Amory Lovin, The Rocky Mountain Institute).

The common thread from these and other sources of inspiration for sustainable industrial development is a focus on innovation - to produce products fulfilling genuine need; to create 100% product via byproduct synergy and elimination of manufacturing methods that produce pollutants; to reduce by ten-fold the amount of energy and material flow-through of industrial products and processes ("Factor 10 Club"); and to create a circular economy with a "cradle to grave" stewardship approach during a product's life cycle.

This transition of thinking and action is often referred to as the "Sustainability Journey". The idea of a journey is that on-going opportunities for improvement exist, objectives can be re-defined, and new pathways to sustainability can emerge. It is certainly not a journey for industry alone. Governments play a vital role: through the signals sent in terms of expenditure, tax and subsidy policies; through the mix of economic and command-and-control environmental and other regulations; and through planning decisions, especially at local levels where zoning, land and water restoration and controls over watersheds, groundwater and airsheds are critical elements. Civil society institutions throughout the world also play an important role through their influence on consumers, on international negotiations in both trade and environmental agreements, and on performance monitoring. Still, few would argue that any final destination on the Sustainability Journey has been reached-in any country, or for any industry. Indeed, the goals of industrial sustainability can be continuously refined, and new opportunities to address these goals arise with new knowledge and experience.

Individual enterprises around the world and in China are found at all stages of their Sustainability Journey. Unfortunately many do not even come close to the most basic levels of compliance. In theory, and often in actual practice, such firms, whether SMEs, large state-run enterprises, or some MNCs, are highly vulnerable-lacking in domestic or international competitiveness, and perhaps unable to raise money for needed improvements. Their liabilities,

however, may be left for the broader society to cover, often in the form of increased health problems arising from pollution, expensive restoration of urban brownfield sites, or option foreclosure including loss of new livelihood opportunities. A key concern, therefore, is how to simultaneously improve the sustainability performance within entire sectors, including the full range of individual enterprises, large and small.

Certainly sustainable industrialization must be considered in the context of the broader directions of sustainable development of a nation. This is particularly important for China, given the country's efforts to develop a socialist market economy that will lead to moderate affluence for most people. This will require an on-going commitment to very high levels of economic growth. Can these levels be maintained while substantially improving the environment rather than causing further harm? Tough decisions will be needed in order to focus investment in industrial pathways that champion innovation. Considerable progress has been made, but the steps are small compared with what lies ahead. Indeed, most of China's investment on sustainable industrialization is yet to come.

In the world of the 21st Century, expectations in the countries where China markets many of its products are that ever-greater levels of corporate social responsibility should form an important part of sustainable industrialization. There are international expectations about levels of transparency and openness on the part of both government and industry that are beyond those found at present on the part of most Asia-based enterprises.

These are issues that will have to be faced by China, especially now that it is subject to the rules of the WTO, and to those of international environmental agreements, and to non-compulsory but important tools such as green certification and eco-labeling. Trade and sustainable development are subjects that are now interlocked in ways hardly conceivable a decade ago.

Cleaner Production (CP) - A Cornerstone of Chinese Environmental Action

Internationally, through the efforts of UNEP, the concept of Cleaner Production¹² is becoming a mainstream effort to make the transition from conventional pollution control methods. It is an approach that has become a cornerstone for China's efforts, now that the country's *Cleaner Production Promotion Law* is in force (as of January 2003.) Cleaner production depends upon continuous innovation that should lead to:

- ❖ *Processes and production systems* that are more profitable and less wasteful of materials and energy; and with less dependence upon non-renewable resources.
- ❖ *Products* that will have better performance and durability, are less toxic, more durable,

¹² CP is defined by UNEP as "the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase overall efficiency and reduce risks to humans and the environment."

and recyclable or biodegradable, with lower greenhouse gas emissions and other pollutants.

Cleaner Production should convert thinking away from waste disposal and towards 100% product from industrial processes.

While CP is certainly important for achieving sustainable industrialization, the terms are not synonymous. As noted by OECD¹³, *Sustainable means clean enough to meet the needs of the present without compromising the ability of future generations to meet their own needs. Making the distinction between ‘cleaner’ and ‘sustainable’ requires the tools to assess and compare the performance of different technologies used for industrial production.* In general, today’s Cleaner Production approaches fall short of the qualitatively different types of sustainable industrialization called for by the Factor 10 Club¹⁴, proponents of Biomimicry¹⁵, The Natural Step¹⁶, and other leading edge initiatives.

What Cleaner Production can do is reach out to the vast majority of businesses that are still at early stages of environmental strategies and provide insight and examples on how they can move beyond the most obvious forms of pollution control compliance, environmental risk assessment and other reactive measures.

China claims to have the “first law in the world to establish Cleaner Production as a national policy, and to lay out a strategy for its promotion and implementation.”¹⁷ This Law defines CP as:

the continuous application of measures for design improvement, utilization of clean energy and raw materials, the implementation of advanced processes, technologies and equipment, improvement of management and comprehensive utilization of resources to reduce pollution at source, enhance the rates of resource utilization efficiency, reduce or avoid pollution generation and discharge in the course of production, provision of services and product use, so as to decrease harm to the health of human beings and the environment.

The CP Promotion Law is being implemented by a combination of local administrative units (provinces, autonomous regions and municipalities) and national bodies (including environmental

¹³ OECD. The Application of Biotechnology to Industrial Sustainability. A Primer.

¹⁴ See the Alliance for Global Eco-Structuring (AGES) www.factor10-institute.org

¹⁵ Janine M. Benyus. 1997. Biomimicry. Innovation Inspired by Nature. Quill, William Morrow, New York. 308 pp.

¹⁶ The Natural Step notes four principles such that “ In a sustainable society, nature is not subject to systematically increasing: Concentrations of substances extracted from the earth’s crust; Concentrations of substances produced by society; Degradation by physical means;and, in that society; Human needs are met worldwide.”

¹⁷ Extensive information on China’s Cleaner Production effort is available at www.chinacp.org.cn . This website is maintained by the National Development and Reform Commission (NDRC), one of two key government partners steering CP implementation (SEPA is the other partner).

protection, planning, science and technology, agriculture and construction). The Law involves a blend of “carrot and stick.”

Inducements include recognition and rewards for success stories, product labeling, an SME fund, and technology innovation funding, funding for public education and professional training, exclusion from value-added tax (VAT) for products and materials produced or reclaimed from wastes, recognition of training and CP auditing as enterprise operating costs. As well, governments at all levels are encouraged to use their purchasing power to “buy green.”

The planning and enforcement side includes incorporation of CP within regional economic blueprints, adjustment of industrial structures to a recycling economy, and promotion at local levels of increased cooperation on the part of industry. *The “teeth” of the new Law are in the power to eliminate obsolete and obsolescent production technology, processes, equipment and also products that are “wasteful of resources” or “gravely hazardous to environment.”* The penalties of non-compliance to the Law are, however, quite moderate, with fines of up to 100,000 yuan.

The potential range of CP implementation tools identified by the NDRC is very extensive: Life Cycle Assessment (LCA); Public Environment Reporting; Environmental Indicators; Industrial Ecology; Codes of Practice; Environmental Audits; Environmental Management Systems (EMS); Environmental Accounting; Design for Environment; Environmental Labeling; Performance Based Contracting; Eco-Efficiency and Environmental Taxes. Certainly there are important choices to be made on which of these are likely to be the most effective, and on how they can be implemented in an integrated fashion within the overall system for sustainable industrialization.

Implementation guidelines for the CP Promotion Law identify ten cities (Beijing, Shanghai, Tianjin, Chongqing, Shenyang, Taiyuan, Jinan, Kunming, Lanzhou and Fuyang) as demonstration sites. The guidelines also identify five priority sectors: the petrochemical industry, metallurgic industry, chemical industry (nitrogen fertilizer, phosphate fertilizer, chlor-alkali and sulphuric acid), light industry (pulp and paper, fermentation and beer-making), and ship building. SEPA has identified five rivers (Huai He, Hai He, Liao He, Chang Jiang (Yangtze River) and Huang He (Yellow River) and three lakes (Tai Lake (Tai Hu), Chao Lake (Chao Hu) and Dian Chi which have high priority for CP initiatives.

China is building on a full decade of experience with training and promotion of Cleaner Production. Much of this experience was thoughtfully reviewed at the 2001 Chinese International Conference on Cleaner Production¹⁸. Several major implementation barriers have been identified, including the following:

¹⁸ See www.chinacp.org.cn

- ❖ Market failure that results in a relatively weak supply and demand for CP.
- ❖ “Industrial indifference” to the concept.
- ❖ Inadequate CP knowledge and support mechanisms, especially for SMEs.
- ❖ Inadequate enforcement of environmental laws, including low fines that become **part** of conducting business.
- ❖ Lack of an overall operative system for CP that can engage Chinese industry at various scales including the level of individual firms, relations between firms within or between sectors, and at regional to global levels.

Hopefully, the new CP Law will reduce the barriers. The question is at what rate?

Corporate Social Responsibility (CSR)-Business and *Xiaokang* Intersecting

Corporate governance, including mechanisms for both encouraging and monitoring corporate sustainability, is emerging as a key element of globalization. Chinese firms do not fare well by comparison to global leaders in business. The recent trend internationally is to bring together a number of governance considerations under the title of “Corporate Social Responsibility”¹⁹. The shift engendered in the CSR approach is that license to operate is not a given, but something that is earned. Increasingly performance is measured by a range of local, national and international organizations that use market tools and information campaigns to alter poor corporate behavior. China’s corporations-whether the “Top 500” Chinese firms or SMEs-may feel somewhat removed from these pressures. But they are not, especially given China’s accession to the WTO. Thus, developing a Chinese-based business case for sustainability and CSR is very important. Presumably this business case will blend both international approaches, and China’s concern for equity and a social market economy.

The WBCSD’s business case for CSR is stated as follows²⁰:

We believe that a coherent CSR strategy based on sound ethics and core values offers clear business benefits. These accrue from the adoption of a broader world view, which enables business to monitor shifts in social expectations and helps control risks and identify market opportunities. Such a strategy helps to align corporate and societal values, thus improving

¹⁹ See World Business Council for Sustainable Development (WBCSD). 2002. Corporate Social Responsibility. The WBCSD’s Journey. (www.wbcsd.org) The WBCSD uses a 12 point ‘Navigator’ for CSR: determine your ‘magnetic north’, build-in the strategic business case, focus on individuals, determine desired legacy, put employees first, know your neighbor, community and culture, debate and dialogue, pursue smart partnerships, reputation matters, be a good guest, measure and account for what you do, handle with care information, knowledge and technology.

²⁰ Stigson, B. 2003. The Business Case for CSR. pp. 85-89 in Responding to the Global Challenge. Corporate Responsibility. Entico Corporation Ltd. 128 pp.

reputation and maintaining public support.

Chinese enterprises, especially those directly or indirectly controlled by the state, are subject to many governmental influences, and therefore decisions often appear to be taken for them, rather than by them. This approach probably works against the development of CSR along the lines described above. OECD²¹ and others point out the need for strong corporate governance in which decisions are taken directly by the enterprise and its board, with accountability and transparency.

Stigson (see footnote 21) raises important questions about how far a company or industrial sector should be expected to serve societal needs: *What are the respective roles of business versus that of government in providing social, educational, and health services? How far along the supply chain does a company's responsibility extend? How should it adapt to local cultures? How far into the future should a company plan?* These questions are important in a number of ways in the Chinese context. Two will be discussed here: the role of state corporations in the social security net, and supply chain dynamics building upon China's role as a key player in global outsourcing of industrial production.

The first is important since the national social security net, an important component for overall societal well-being in most western nations, is still weakly developed in China. State-owned enterprises have provided a considerable element of personal security for many people. And now, it is difficult to restructure some of these enterprises since there are few social security alternatives for affected people (employees are considered as privileged creditors, therefore state commercial banks have little incentive to call loans and thus transform industry). The problem is made more acute since much of the control of these state industries actually lies at provincial or local levels. Poorer regions, for example, in the northeast and western regions have little in the way of financial resources to address this problem²². It clearly is an issue where expecting corporations to bear the full burden on an individual basis will not only be inefficient, but also delay necessary restructuring for some of the least environmentally-sensitive enterprises.

The supply-chain issue is important for Chinese exporters and for large Chinese firms working internationally (there will be many more of these in the future), and also for some Chinese domestically-oriented business, for example, the automobile industry. In the international marketplace, and in some developing countries as well, there is growing interest in having raw material and component suppliers to the final industrial assemblers operate in an

²¹ Chapter 5, Industry Reorganisation and Restructuring: Prospects, Problems and Policy Priorities, in OECD. 2002. p. 185. China in the World Economy. The Domestic Policy Challenges. OECD, Paris. 813 pp.

²² OECD, 2003. p.186. Attention is needed to develop a broad array of social security funding, including, medical expenses, pensions, job retraining and unemployment insurance benefits.

environmentally sustainable manner. Many auto companies such as General Motors and Toyota already require this of their suppliers-wherever they may be located in the world.

Some companies expend considerable effort in capacity-building so that suppliers develop reliable levels of sustainability compliance. This is a means for technology transfer, and for assuring that sustainability performance moves steadily upwards, rather than globally downwards, as companies decentralize production. It is also a means for a country like China to brand particular sectors as being “green” or “sustainable”, since, ideally, the whole life cycle of products can be covered, including the extraction of raw materials and use of energy at each stage.

Corporate social responsibility in China is still at an early stage by comparison to leading edge enterprises in Europe or some other industrial regions. Perhaps there is a residual positive benefit from some state enterprises in their commitment to providing social goods for workers and local communities. Also, there are lessons to be learned from the more progressive multinational companies operating in China. Overall, however, it is likely to be a long-term challenge for China to re-shape enterprise governance, and to ensure that broadly defined societal needs are addressed as part of the corporate business model. The *Xiaokang* approach, if interpreted by leaders in a fashion that is actionable by business enterprises, could become a key component of future Chinese corporate social responsibility.

Transparency, Accountability and Benchmarks

Internationally, the effort to build an environment and sustainability accountability system is becoming much more sophisticated, covering several key elements of corporate behavior. The effort includes:

- ❖ Corporate sustainability reporting in which individual corporations set objectives and describe their performance in achieving them. Such reports²³ can be rigorous and independently audited, or they can be little more than “greenwash”.
- ❖ Codes of conduct or Guidelines such as the CERES Global Reporting Initiative; the OECD Guidelines for Multinational Enterprises; and the UN Global Compact. None of these very useful guidelines for corporate behaviour²⁴ are legally binding, but they are shaping both expectations of business and actual business conduct.
- ❖ Certification processes including ISO 14001, the Forest Stewardship Council, and many others operating at national, international and sectoral levels. By certifying that products are produced sustainably, or that the entire corporation, or even clusters of businesses (e.g. within an industrial park) is managed sustainably, certifiers are

²³ See the Global Reporting Initiative (www.globalreporting.org)

²⁴ See www.unglobalcompact.org; www.ceres.org; www.oecd.org

providing at least some level of assurance that a business takes environment into account. There are various levels of credibility with such processes.

- ❖ Development of specialized corporate indexes, including the Dow Jones Sustainability Index, the Domini 400 Social Index (DSI), and the FTSE4Good benchmarks. Such indices²⁵ are meant to inform investors and provide an understanding of how share value can be influenced by environmental and sustainability performance.
- ❖ Ethical trading initiatives opening markets for marginalized groups, and guaranteeing good return for sustainably-produced goods. This movement, started by a number of civil society organizations opens options for consumers in rich countries to buy products that have been produced in an environmentally appropriate way, and with a reasonable share of the retail price actually being received by the producers in developing countries. Shade-grown, organic coffee is one example of a successful ethical trading effort now widespread in Latin America.
- ❖ Watchdog organizations examining corporate performance including governance and corruption, human rights, and environmental stewardship. The Internet has opened important communications channels for acquiring information on corporate and governmental actions, and rapidly disseminating that information to consumers and non-governmental organizations world-wide.

Despite this progress, a reality is that internationally-accepted benchmarks for industrial sustainability are still in short supply. Many corporations-even within the northern European countries considered to be the hotbed of concern for corporate responsibility-are wary of investing substantially in processes that may not be backstopped by official recognition in trade agreements, regulations or other instruments normally employed by governments.

But another reality is that consumers and non-governmental organizations hold considerable power within the marketplace. And analysts concerned about a company's performance are beginning to take note of measures such as the Dow Jones Sustainability Index. Chinese business enterprises should be considering how to engage in these voluntary, market-driven approaches. Such approaches certainly will be of growing significance domestically and internationally. It is to China's advantage to influence the nature and extent of benchmarks that might be applied to its industries in the future. There is a need to define clearly what is reasonable, and what is not.

At present, most Chinese firms operate without very clear guidelines on how well they are

²⁵ See www.sustainability-index.com for the most established of the environmental benchmarks, the Dow Jones Sustainability Index; www.kld.com/benchmarks/dsi for the US-based Domini social index established in 1990; www.ftse4.com for information on FTSE4 corporate social responsibility. This measure focuses on three areas, environmental sustainability, a positive relationship with stakeholders, and support for human rights.

performing with respect to either environment or sustainable development. A growing number of firms and industrial estates are engaging in the ISO 14001 certification process. But signals sent by governments are not consistent, despite major improvements in recent years. Nationally, the coordinating function among governmental ministries is weak. Thus, individual sectoral policies prevail, to the net detriment of cross-sectoral sustainable development strategies.

The problem is exacerbated by the important role local government plays in attracting industry to a region or municipality, and then in regulating its activities. Local governments sometimes are in a conflict of interest as they struggle with sustainable development strategies and industrial implementation. It is believed that environmental considerations are frequently downplayed, even to the extent of returning fines to industries found guilty of pollution. The desire to retain industry at any cost cannot be overstated, at least within poorer areas. Such observations are well understood by both the Chinese government and international agencies²⁶.

These considerations cannot be dealt with in isolation from broader issues of industrial reform. Corporate governance within China is neither strong nor very independent, swayed as it is by local political interests, on-going support for some non-competitive state enterprises, and by the influx of foreign direct investment from sources in other regions of Asia where transparency and accountability are weak.

URBANIZATION AND SUSTAINABLE INDUSTRIALIZATION

Urbanization accompanied the rise of industrial societies throughout the world, but in China's case there is an unprecedented transition ahead. By 2020 it is anticipated that only 30% of the labour force will be engaged in agriculture, instead of the current level of 50%. Urbanization over the coming two decades could bring as many as 300 to 400 million more people into cities. Most will be attracted away from agriculture and into industrial and service occupations. But industry will be the driver. Location of industry is therefore a key determinant.

Fostering of town and village enterprises (TVE) has been a major strategy to spread industrial development into the countryside. And the current drive to locate additional industry in areas beyond the east coast should spread at least some of the opportunities and impacts of such development. In the drive for equitable sharing of economic benefits, and for enhancement of human and social capital, it is likely that the most significant gains involving industrial contributions will be in the cities rather than the countryside.

Sustainable industrialization strategies in China have to focus on the quality of life, the balance

²⁶ e.g. see Chapter 17, Environmental Priorities for China's Sustainable Development. OECD. 2003; World Bank. 1997. China's Environment in the New Century: Clear Water, Blue Skies; World Bank. 2001. China: Air, Land and Water: Environmental Priorities for a New Millennium.

between creating rural and urban opportunities, and the economic, social and environmental impacts of industrialization on urban development. Industrialization provides much of the financial wealth for both infrastructure and human development needs in cities. But for many industrial areas of the world, urban decay, including abandoned factories and contaminated “brownfield” sites²⁷, declining condition of infrastructure and inner city poverty, has been the consequence of the last century’s industrial development.

There are some good reasons why China should be able to do better than simply repeat this unfortunate saga of “industry first, address problems later.” These reasons include: China’s well demonstrated ability to learn from existing experience elsewhere; the national commitment to sustainable development; some very positive environmental improvements within cities as a consequence of existing policies and planning; monitoring and reward systems that recognize the achievements of individual cities; and the relatively small per capita ecological footprint of urban Chinese residents (although consumption is increasing dramatically with income).

Yet it is apparent that some of the worst urban pollution in the world is found in several Chinese cities. In the mid-1990s, the WHO rated 8 Chinese cities as being among the 10 most polluted in the world.²⁸ Most cities are caught in a complex transition involving transportation networks that are likely to become overburdened supply routes for industrial suppliers and products as well as for burgeoning populations of private automobiles. Supplying the physical needs for urban infrastructure, such as cement and steel, in an environmentally sustainable fashion is, and will continue to be, a major challenge for Chinese industry. Of great significance is the competition on the part of industry for land and water in urban and suburban areas.

Urban and Industrial Planning

China is probably the most exciting country in the world in which to be currently engaged in urban planning and development. Some cities such as Beijing and Shanghai are competing for the world’s recognition as outstanding urban centres, just as Singapore did two decades ago. Others such as Dalian are determined to build a reputation based on environmental quality. In the region of the Pearl Delta a very large scale proposal exists to create two “metropolitan rings”, formed by Hong Kong-Shenzhen and by Guangzhou-Foshan. These “rings” have enormous infrastructure and environmental implications, but also would have important benefits to the region for industrial innovation. We can expect to see urban design carried out at a scale no other country in the world is prepared to even contemplate.

²⁷ A brownfield is an area previously used for industry or commercial use, often with residual contamination or other environmental problems that might make the site expensive to redevelop. A greenfield is a site not previously developed.

²⁸ Cited by Minister Liu Xiaoming at the first Mayors’ Asia Pacific Environmental Summit. (www.csis.org/e4e/mayoropliu.html)

Much of the future industrialization, however, will be tied to smaller centres-cities that might have significant constraints such as water shortages, airshed characteristics that retain pollutants, and fragile environmental conditions such as significant biological conservation needs in nearby ecosystems. These problems are already evident and an important consideration in western development plans, and there are successful experiences to draw upon from existing development, for example, Hainan Island and the City of Dalian.

Urban planning also has to take into account impacts of industrial development on the countryside, especially suburban development and transportation corridors that include road and railway networks, river transport, and energy transmission corridors for pipelines and electrical lines. The advent of just-in-time industrial production systems will place considerable stress on reliable transportation networks.

Urban environmental planning interlocks with sustainable industrialization in a number of ways:

- ❖ Sophisticated physical planning tools (e.g. GIS) are readily accessible within China and widely used. These can be further refined and used to build scenarios of the impacts of industrial growth and alternative patterns leading to both sustainable industrialization and sustainable cities.
- ❖ Incentive approaches as well as command and control instruments such as zoning are important for planners to consider. This is particularly important for pollution control, water conservation, and for development and maintenance of green spaces.
- ❖ There will be increasing demands from urban residents for a voice in planning decisions. Planning will need to be done in a transparent fashion, particularly concerning environmental impacts and social matters.
- ❖ Opportunities to incorporate industrial ecology considerations are already being taken within urban planning, but not always systematically. Much more can be done along these lines.
- ❖ Urban pollution control strategies are broadening to consider strategies such as reduction of carbon dioxide emissions, the interaction of pollutants across the three media (land, water and air), and the need to drastically reduce solid and hazardous wastes. Cities that can plan in this fashion become important contributors in the Circular Economy.
- ❖ Clean environment is a marketable component of urban attractiveness when it comes to business location, tourism, and movement of skilled labour. Enhancing or creating such attributes so that cities have a well-recognized identity of environmental and social quality is an important task for planners working in concert with Chambers of Commerce, industrial leaders and others.

These topics will be covered in more detail at the 2005 CCICED AGM when the theme is anticipated to be sustainable urbanization. Here we will focus on several matters pertaining to sustainable industrialization.

Water and Land

Addressing Water Scarcity and Quality

Water is an increasingly scarce resource that affects development in urban and industrial centres throughout the world, including those located in some of the wealthiest countries. Industry tends to pay for water at a level much closer to real costs by comparison to agriculture. Even so, the cost of water levied to any user rarely reflects the range of environmental benefits that might be lost through its use, especially if water quality is degraded. These issues have been explored exhaustively by international agencies, national governments and in a series of global water forums²⁹. Pricing of water has been a topic of concern for some time in CCICED, with useful observations from several Working Groups in the past, especially the Working Group on Environmental Economics.

Solutions proposed include both structural (e.g. water control means such as dams) and non-structural (e.g. conservation measures and land use zoning) elements. Together, the range of solutions is considered as integrated water management, a theme promoted globally, but with limited success in applications to date within either rich or poor nations.

Another topic of broad concern being explored internationally is public-private sector partnerships for delivery of water services, including building of infrastructure, water supply and sanitation. This is an area where private sector efficiency can be coupled with governmental supervision to ensure the public trust is maintained and equity issues are addressed. Industrialization strategies may include development of water resources for multiple purposes, so that communities may benefit as well as industry. Despite the attractive nature of public-private partnerships, they can be controversial, especially when profits are seen to be derived from a public good.

According to the World Resources Institute,³⁰ 300 of the 640 major cities in China already face water shortages, with consequent losses of about 120 billion yuan per year in industrial output. Human health impacts multiply this figure. Furthermore, the very limited per capita supply of water may be on the decline in a number of cities, since groundwater depletion and contamination have occurred at a large scale. The discharge of toxic industrial wastes into water that ultimately becomes used for drinking or irrigation, undoubtedly contributes to high rates of certain types of

²⁹ Global water forums have been held in Kyoto (2003) and the Hague (2000).

³⁰ See, www.wri.org/wr-98-99/prc2watr.htm; China's Health and Environment: Water Scarcity, Water Pollution, and Health.

cancer, for example in Qidong and Fushun regions. China's water demands are expected to grow by 2 to 3 % annually over this decade, with a demand increase of about 120 million m³. Much of the demand will come from industry, and it will be difficult to address, even with major engineering efforts, for example, to divert water from the south to the dry northern areas.

The Ministry of Water Resources has a seven point framework for action that has significant implications for industrial development³¹: (1) long-term supply and demand planning and assessment; (2) water source, water quality and ecosystem protection; (3) groundwater conservation and sustainable use strategies; (4) assured domestic and industrial water supply; (5) pollution control and wastewater recycling; (6) coping with effects of climate change; and (7) management reforms.

The extent to which water issues are linked mainly to engineering solutions, or to mechanisms involving protection and enhancement of ecological services, such as increasing water storage in wetlands, is a debate just beginning to find its voice in China. Pricing has to be an important part of action for sustainable water management. Sustainable industrialization is highly dependent upon the outcome of action to conserve and better utilize water. Ideally, therefore, industry should be a leader in helping to shape outcomes.

Industrial Stewards of Land

The impact of industry on land issues is considerable in all parts of the world. Factors include regional and local land development, access, future uses, economic and ecological values, displacement of people and indirect impacts, for example, of land associated with transportation networks, solid waste disposal, reservoirs and other infrastructure. Liability associated with contaminated "brownfield" sites has become an expensive and contentious issue to deal with, especially in North America and in both eastern and western Europe.

In the U.S.A. the clean-up of toxic sites often becomes the responsibility of whoever has the deepest pockets and some association with the land. In Eastern Europe during much of the 1990s, concerns over liability for clean-up of badly contaminated sites held back investment in existing industrial operations by foreign investors. And many of the human health impacts associated with contaminated lands are not fully factored into costs of land mitigation. An important point which emerges from this experience is that land ownership, title transfer and investment possibilities become complex if uncertainty arises over who actually "owns" the liabilities associated with the land.

Sustainable industrialization should incorporate a comprehensive approach to land use-an approach

³¹ Baruch Boxer. China's Water Problems in the Context of U.S.-China Relations. (www.chinaenvironment.com)

that could be characterized as industrial land stewardship. Many companies already take such an approach, including some leaders within the mining and forest industries³². The Ford Motor Company has redeveloped its massive Rouge River industrial complex in Michigan, with environmental improvement and manufacturing innovation as complementary objectives. Long-neglected, often abandoned industrial sites in many cities are now seen as among the most valuable lands, sometimes with new, less polluting industries as tenants, along with residential and light commercial land uses. Denmark and other European countries provide very successful examples.

Clearly, local governments, both rural and particularly urban, have to play a proactive role in order for industrial land stewardship to be optimal. The location and conditions under which industrial parks are established, provision of common waste treatment facilities, and the development of local and regional transportation networks that do not take up excessive land are important examples that are best resolved at this level. Unfortunately, the outcomes—even where there has been an extensive investment in planning—often leave much to be desired. An example is the congestion on highways as a consequence of the “just-in-time” demands of manufacturing industries, and the desire to have the greater flexibility of delivery by trucks rather than by railroad transportation. Another is suburban land sprawl that arises from the desire of industries to build on “green fields” and the desire of residents to move from decaying centres of cities.

National and state/provincial governments have often taken on a “silent partner” role in relation to industrial environmental malpractice, for example, by not enforcing laws, or by encouraging bad land use decisions through perverse subsidies such as low land pricing. Governments can be highly proactive, but, ultimately contributing to unsustainable business situations, for example, by attracting industry to locations where land or water conditions may be unsuitable. Appropriate roles for national government include: creating a national inventory of contaminated sites, with strategies and plans for their restoration and future uses; development of a robust strategy for reducing and, where possible, eliminating hazardous wastes; and, through partnerships, creating examples that truly do work, often with remarkable financial return. An outstanding example in Canada is the redevelopment of False Creek, a highly contaminated brownfield area in Vancouver, now in high demand as a residential and commercial area. Japan is a source of many additional examples.

China has already demonstrated a remarkable capacity to develop and redevelop lands, especially in the cities. And with much of the country’s industrial development still ahead, the opportunity exists to avoid creation of new toxic areas, to plan for co-location of industries (in order to take advantage of byproduct synergies and to reduce transportation needs), and to plan cities and suburban areas that provide for both citizen and industrial needs.

32 See MMSD examples, Tembec, Swedish pulp and paper, etc.

There are existing problems that need to be overcome. One very important issue is hazardous waste management. There does not appear to be a full inventory of existing problem areas. Indeed, it is quite possible that nasty surprises may emerge in the years ahead. Hazardous wastes are covered under several pieces of Chinese legislation.³³ The siting of toxic waste treatment centres, and the conditions and management of municipal land fills need careful attention. The culture of industrial development will need to shift so that both state-owned and private enterprises see themselves as stewards, prepared to invest in proper land care, and to leave sites in better condition than when they arrived. Special restoration funds set aside by companies for land management once industrial activities are completed is a workable mechanism that deserves attention in China.

A peculiar problem, highlighted in the recent OECD review of China's domestic economy,³⁴ is the nature of land use rights granted to industrial operations rather than ownership, which is retained by the state. For many enterprises undergoing restructuring, these land rights may be their only valuable asset. But value varies according to location and therefore hinders restructuring for those located in low value sites. Thus old, poorly located industries continue past their desired lifespan since they do not have the funds to meet social costs and other expenses. It has been suggested by the World Bank that an administrative fund could be used to pool the revenues from sale of both high and lower value land use rights taken back from bankrupted enterprises in the region. The funds could then be used to meet social costs and rehabilitation fees of poorly-located industries wishing to declare bankruptcy.

Eco-Industrial Parks

The concept of industrial ecology is now well understood in various parts of the world, including China. There are several important points to this approach, as noted by J. Alan Brewster³⁵:

- ❖ *An industrial system should be viewed not in isolation from its surrounding systems, but in concert with them.*
- ❖ *No 'wastes' but only residual materials that can be used to produce other useful products.*
- ❖ *Looking at cumulative impacts of industrial sectors.*

Industrial ecology can be examined at various levels: enterprise (e.g. eco-efficiency); between enterprises (e.g. eco-industrial parks, product life cycle, responsible care); regional and global (e.g. budgets and cycles for dematerialization and decarbonization).

³³ China promulgated the "Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste" in October 1995. This legislation includes provisions covering hazardous wastes. Additional legislation regulates the import of hazardous waste.

³⁴ p.186 in Chapter 5, Industrial Reorganisation and Restructuring: Prospects, Problems, and Policy Priorities, in China in the World Economy. OECD, Paris. 813 pp.

³⁵ See J. Alan Brewster. 2001. Industrial Ecology and Its Relationship to Cleaner Production. International Conference on Cleaner Production. Beijing. 8 pp.

Of these topics, the one for discussion here is sometimes described as “industrial symbiosis”—the reason for bringing together various industries into close proximity. Standard industrial parks are giving way to a new model, or are being renovated to become this model, called an eco-industrial park (EIP).

There are many examples throughout the world. Chen et al.,³⁶ describe such parks as *an industrial system of planned materials and energy exchanges that seeks to minimize energy and raw materials use, minimize waste, and build sustainable economic, ecological and social relationships*.

Tsinghua University has been actively involved with such eco-industrial parks, working with several models (see footnote 37):

- ❖ Shandong Province—transforming a traditional industrial zone to an EIP, reducing water use by 40% and other major pollutants.
- ❖ Zhejiang Province—Juhua Group, one of China’s largest chemical enterprises, has developed material exchange among its chemical plants on a 600 ha site, where some 180 chemicals are produced.
- ❖ Guangdong Province—Nanhai greenfield development site involving four types of environmental businesses (environmental equipment manufacturing, environmental protection research and services, waste recycling, and environmentally-friendly products).

These facilities go hand-in-hand with urban development since they are a way of generating employment, providing tax revenues, and contributing directly to infrastructure development. And they are clean, generally adding to rather than detracting from urban environmental quality. It is also a means for attracting a mix of foreign and domestic investment that can have a beneficial capacity development and technology transfer component.

The EIP concept, and even grander scale efforts such as the eco-province and eco-cities concept now being promoted by the Chinese government will undoubtedly become much more commonplace. Undoubtedly they will contribute immensely to sustainable industrialization. Since much of the industrial capacity will be installed in the next decade or two, there are excellent opportunities to cluster appropriate combinations in order to promote synergies and industrial efficiency. It may, however, take considerable effort to add the dimensions that will help to promote *Xiaokang*.

³⁶ Dingjiang Chen, Yourun Li, Jingzhu Shen, and Shanying Hu. 2001. The Planning and Design of Eco-Industrial Parks in China. International Conference on Cleaner Production. Beijing. 7 pp.

ENVIRONMENTAL INDUSTRY SECTOR

For a number of years the development of environmental industries has been considered one of the fast-rising components of industrialization worldwide, with a potential on the scale of a trillion dollars. Much of the future growth is predicated upon continuing need for water supply and waste treatment, often based upon conventional technologies. But the approaches are changing as a result of shifts in both supply and demand. On the supply side, many new technologies and services are emerging, stimulated particularly by the demand side focus on sustainable development and the need to move towards “no waste” situations. As well, there is a broadening of definition to include “green” products and technologies based on “renewable” resources such as biomass and wind or solar energy.

In the future, environmental industries will move away from providing “end of pipe” pollution control solutions towards transformation of industrial processes and consideration of whole industrial landscapes in order to achieve byproduct synergies and more satisfactory co-existence with communities.

China is aggressively developing an environmental industry sector with the intent of not only meeting domestic needs but also finding international markets. This is an ambitious goal, but quite realistic given the projected needs associated with economic growth generally, urbanization and industrialization in China and other parts of East Asia. The growth and characteristics of China’s environmental protection industry is the subject of a CCICED Task Force Report to be discussed at this AGM.

It is clear that Chinese environmental industries are still mainly at the SME level. Many could be considered at the “incubator” stage. With the opening of China’s domestic market to foreign environmental protection companies, there may be stiff competition and a need to pursue strategies such as joint ventures. It has been suggested that their current level of technical knowledge lags 5 to 10 years behind international levels.

Demand for environmental protection services is a critical factor for growth of this sector. Government can assist in a number of ways, including consistent application of law enforcement, use of its purchasing power to stimulate production of “green products”, inclusion of environmental considerations in major developments and demonstration efforts, choice of new technologies such as wind power, investment in R&D, ecological construction and restoration, and in the application of various incentives via pricing, tax and subsidy systems. Many of these areas are now well recognized by the national government and it is likely that a reasonably coherent approach will emerge. One of the most difficult areas is devising changes in the fiscal system to remove perverse subsidies that promote unsustainable practices and old technologies,

but taking care not to introduce new distortions, and investments or incentives for new businesses that are doomed to failure.

The treatment of environment by local level governments deserves scrutiny. Markets need to be national in scale, and local protectionism or lack of concern for environment will work against development of a strong national environmental protection sector of industry. Also, as the sector matures, there will be a greater need for access to financial markets for necessary capital. There likely is a need to build greater understanding of the environmental protection sector so that financing does not become a bottleneck.

The development of the environmental protection sector should go hand-in-hand with the journey towards sustainable industrialization in China. It is a win-win proposition. By stimulating the development of this sector, a surprising number of jobs will be created, and the various objectives of environmental improvement should be met more quickly. And, as the sector matures, it should be possible to further refine the goals of sustainable industrialization, since new environment and sustainable development technologies and experience will be accessible within China.

ADVANCED TECHNOLOGIES AND SUSTAINABLE INDUSTRIALIZATION

Even as China builds its strategy for sustainable industrialization, many of the OECD countries are becoming post-industrial societies in which knowledge, entertainment and information technologies are currently playing a huge role. Yet, as these societies change, it is clear that it is not industry disappearing, it is industry being radically transformed. What should China learn from the international experience with these trends, especially those which link emerging technologies and sustainability ?

One clear trend is towards economies that are much more aligned with life processes. Biotechnology, while controversial in many aspects, is likely to become much more significant in its range of applications, including industrial processes (e.g. use of modified enzymes) and bio-based products. Industrial biotechnology is defined by OECD as that set of technologies that come from adapting and modifying the biological organisms, processes, products and systems found in nature for the purpose of producing goods and services.

Biotechnology promises to create products and industrial processes with performance characteristics that can be delivered by conventional industrial chemistry. Bioremediation to turn wastes into products offers great potential in food industries, energy, mining, etc. The major international trend is towards a new “Biological Economy” that will address biological diversity maintenance, sustainable industrialization, and sustainable natural resource use as interlocked subjects.

Another new theme, still in its earliest stages, but expected to develop rapidly, is the move towards understanding the properties of matter at the smallest scales, molecular to atoms, with the intent of using these properties to drastically dematerialize products and industrial processes. The emergence of nanotechnology as an important field has just begun. Yet some predict an amazing transformation of industry in the coming decade.³⁷ Examples include: pumps operating at 20 to 50% of existing energy needs; 100% recyclability of dangerous chemicals, “molecular machines (molecules acting as machines) that activate and deactivate catalysts for more efficient chemical manufacture, inexpensive solar power collectors using roads and building windows, and nano-scale computing technologies with much greater capacities than any current machines.

The remarkable array of alternative energy pathways already becoming available represents a third critical trend. The hydrogen-based fuel economy, bio-based fuels, solar and wind energy alternatives, and extreme measures for energy conservation are examples that have been discussed in CCICED meetings. During the current AGM the presentation of the Task Force on Transforming Coal for Sustainability will propose new options that have major implications for industry. With decarbonization of industrial processes being an additional important issue, new R&D directions are being set out in most OECD countries and in China. Decoupling energy demand from increases in human activities will continue to be perhaps the greatest social and technological challenge of our times.

These advanced examples, and others that might be mentioned, should provoke much thought and discussion on how best to address investment in the necessary R&D and commercialization of new technologies. Some may warrant attention at the earliest stages, perhaps involving products and approaches that are more advanced than those in OECD countries (for example on some aspects of alternative energy and of biotechnology.) In other cases, it may be wise to invest more cautiously, when it is clear which technologies are likely to be the most productive in meeting China’s sustainability needs. It should be clear, however, that it is a more diverse set of advanced technologies than those classified generally as information technologies, the major focus during the 10th Five Year Plan.

The role of new technologies that support the transition to sustainable industrialization does not stop with advanced production processes. Perhaps the greatest contribution will be if these new technologies actually do produce products of great utility for reaching *Xiaokang* objectives defined in the broadest sense of quality of life. If health is improved, if products are made much more durable, if people’s ability to communicate cheaply and over long distances is improved,

³⁷ See, for example, William Atkinson. 2003. *Nanocosm. The Big Change That’s Coming from the Very Small*. Viking Canada. pp. 306

and if knowledge can be made more accessible, for example through very inexpensive computing devices and networks, then the investment in new technologies will have proved to be extremely valuable.

INDUSTRY, TRADE AND SUSTAINABLE DEVELOPMENT

China already provides more than 4% of the world's exports and this figure is expected to rise to more than 7% by 2007. The remarkable feature of this growth is that it will come from a very diverse range of products, including processed foods, garments, chemicals, manufactured consumer goods such as electronics, and, heavy machinery. Thus China has a large stake in how WTO treats various aspects of environment and sustainable development, and also, of course, in how its trade competitors and those countries importing its products address these issues, including the use of various mechanisms such as non-tariff trade barriers.³⁸

CCICED's long-standing interest in trade and environment has produced much useful advice on this topic. Currently the Task Force is producing sectorally-based environmental assessments related to WTO accession, and the environment and sustainable development implications of the latest round of WTO negotiations now underway. These topics will be discussed during the 2004 CCICED AGM and therefore will not be covered here. But it is important to recognize the need to convey a clear and consistent picture of China's sustainable industrialization efforts in trade negotiations.

An opportunity that China might take is to brand its industrialization efforts as being environmentally and socially sound. This needs to be done in a fashion that is consistent and credible. Performance needs to be documented over a wide range of variables such as: actual enterprise performance; industrial support systems, including energy production and transportation networks; national sustainability policies; and China's overall performance on reducing environmental damage both within the country and internationally. This is a tall order, and can be realized only gradually. International perceptions about China's environmental performance probably vary greatly. It is doubtful, however, that many people or organizations would presume that China is indeed anywhere close to having a credible performance record on sustainable industrialization.

FINANCING AND INVESTMENT FOR SUSTAINABLE INDUSTRIALIZATION

Conversion of individual enterprises to a triple bottom line approach continues to gather momentum throughout most parts of the industrial world. The necessary investment is still far too limited. In theory the gains to be realized through greater eco-efficiency and cleaner

³⁸ See www.ictsd.org for in-depth coverage of international trends and action on the relationship between trade and sustainable development.

production should contribute towards a firm's profitability. But there is much caution and inertia, and real risks for both large and small operations. As well, conservative financial institutions, boards and shareholders focused on immediate return, stock markets and analysts indifferent to sustainable development, and the historical separation of environment from the financial return side of enterprises has made the task of funding needed sustainability changes more difficult than it should be.

For a country like China there are additional factors to be taken into account. One is the poor health of the banking system as it is currently constituted. Already saddled with a huge burden of non-performing loans, state-run banks are not well equipped to take on new challenges such as meeting the investment needs for sustainable industrialization. It has been suggested that within the four largest banks³⁹ half the loans are non-performing. Often rather than calling these loans, the banks find it better to let inefficient enterprises continue. These include many grossly polluting, resource-wasting enterprises.

China's banks do not have the experience of setting out strict environmental criteria associated with major industrial and commercial loans. These criteria have been developed in Western Europe, North America and elsewhere in response to exposure of commercial lenders to liability for environmental clean-up. Western insurance companies also have grown extremely wary of providing insurance for any industrial situation where companies are not providing sufficient attention to environmental compliance. UNEP has been instrumental in developing international voluntary guidelines for banking and the environment⁴⁰ and for other financial sectors, including the insurance industry.

Restructuring of financial institutions within China is called for by 2007 under WTO guidelines. By permitting private banks and other financial institutions to enter into competition with state banks, China will likely see rapid change in banking, insurance, and financial investment companies. This is an excellent opportunity to begin strengthening roles the private financial sector can play in supporting sustainable industrialization and also the well-off society (for example, insurance companies may be interested in industrial health issues).

The role of Foreign Direct Investment (FDI) in China's sustainable industrialization is presumed

³⁹ Bank of China, Industrial and Commercial Bank of China, China Construction Bank, and the Agricultural Bank of China.

⁴⁰ Many financial institutions have endorsed a 1997 statement prepared by UNEP that " We will work towards *integrating environmental considerations into our operations, asset management, and other business decisions, in all markets*". More recently, some commercial banks have signed a voluntary commitment to the *Equator Principles of the IFC and World Bank* under which " a bank undertakes to provide loans only to those projects whose sponsors can demonstrate to the satisfaction of the bank their ability and willingness to comply with comprehensive processes aimed at ensuring that projects are developed in a socially responsible manner and according to sound environmental management practices."

to be largely positive, since there are policies in place⁴¹ that, for example, should prevent investment in “*projects that pollute and damage environment, destroy natural resources or harm people’s health*”, or “*projects that use up large tracts of farmland*” or “*that are not beneficial to the protection and development of land resources*”. FDI that is encouraged includes “new or advanced technologies which can improve the quality of products, conserve energy and raw materials” or “raise technological and economic efficiency of enterprises.” Also, “investments related to comprehensive use of renewable resources and new technologies and equipment for environmental protection.”

Much of this investment will come from western multinational corporations used to applying high environmental standards in their operations worldwide. They can be an excellent source of technology transfer and environmental management system (EMS) expertise. But an increasing amount of China’s FDI comes from within the region, sometimes from companies with much less experience or even perhaps the will to be environmentally conscious, let alone be committed to strategies of sustainable industrialization.

In addition, some of China’s own corporations and investments operate in other countries, or have an impact outside China’s borders. Their investments and operations in other countries need to be brought under the umbrella of China’s sustainable industrialization strategy.

Export-Import banks located in countries trading with China are under increasing pressure to ensure that their loan guarantees or other support are made with due concern for environment and social well-being. This is an important avenue for scrutiny by international non-governmental organizations. If China is able to ensure coherence between its sound sustainability strategies and their application in projects and by industrial operations, credible positions can be maintained when this international scrutiny occurs.

In the same way, China is vulnerable in its industrial development financing to any manner of challenges arising in relation to issues that include environment, human rights, labour policies, etc. One example is a campaign over the past several years by several environmental organizations⁴² highlighting the underwriting of bonds by Morgan Stanley Dean Witter for industrial infrastructure development in China. Morgan Stanley is one of the largest securities companies in the USA. Global Response suggests a need for a clear environmental policy to address this underwriting activity, and suggests possible boycott action by clients (asset

⁴¹ OECD. 2002. China in the World Economy. p333, using information from the Foreign Investment Administration, MOFTEC.

⁴² See Global Response – Environmental Action & Education Network www.globalresponse.org. This campaign has involved networks and organizations such as the International Rivers Network and Friends of the Earth in Great Britain.

management and Discover insurance and credit card use). There is no evidence that this particular campaign has created huge hardship for either China or the Morgan Stanley group, but it is a sign of what the future may hold.

Monitoring of sustainability performance on the part of international financial analysts (e.g. Dow Jones Sustainability Index) is likely to start affecting share value of corporations active internationally. Even a 1% rise or fall in share value due to sustainability performance could translate into many millions of dollars in gain or loss. As Chinese firms and joint venture companies become more active on international stock exchanges, they will come under this type of scrutiny.

For both strategic and very practical implementation reasons, it makes a great deal of sense for China to pay considerably more attention to the financial mechanisms for China's sustainable industrialization. It would be wrong to assume that most of the funding should be the burden of government. In the spirit of cost internalization, the majority of the costs should be met by enterprises. And, with a gradual transformation of attitude towards the triple bottom line, greater benefits would accrue to the companies. Where government may need to play a key role is in setting out the enabling conditions and sanctions, and in developing mechanisms that will make the task more feasible for small and medium-sized enterprises. It is certainly not industry's role to fund directly the broad range of efforts required for achievement of a well-off society. Thus, in the future, government will have to provide for the social security benefits of a more mobile society.

TRENDS FROM CHINESE DATA

China's industrialization will have strong environmental and resource use impacts within and outside China. That much can be presumed. If China follows the western way of industrialization, could the world resource base support China at the consumption level of western society and what is the global environment likely to be? Presumably with much less environmental and resource damage, or hopefully, with actual net improvement in economic, social and environmental conditions, is an outcome based on sustainable industrialization. In this section scenarios developed by groups in China illustrate some of the projected differences between the conventional approach and sustainable industrialization approach. These scenarios start with data about existing and projected situations in the energy and automobile sectors. These are very important sectors for both industrialization and China's overall economic growth.

This section is intended to provide some basis for discussion of China's situation. There are many assumptions made in these scenarios and they should be considered as illustrative examples rather than definitive studies.

Energy Sector

The Energy Research Institute⁴³ of SDRC has simulated a number of possible energy development pathways. A set of scenario story lines for China was formulated using several key driving factors such as GDP growth, population, energy efficiency improvement, and environmental considerations. The future patterns were based on different trends of development in China.

Six story lines were developed (see Table 1). In order to reflect different voices for economic development in China, three economic development pattern are identified, including high GDP growth rate, medium growth rate and low GDP growth rate. The focus is on the medium growth rate, which follows the government planning assumption. There are two development paths for population, one is low population growth and another is high growth scenario, and the high population path is close to government planning.

Table 1. Description of Scenarios of Future Energy Demand in China

Scenario	Code	Description
Traditional development scenario	S1	Future energy and environment development follows the experience of industrialized country during their initial stage of industrialization. Large space for energy intensive industry because of relying on raw material production and low innovation of knowledge which makes slow technology progress and high energy demand.
Conventional scenario	S2	Economy development and energy industry follows the experience of China in last several decades. Industry will continue to keep dominant for next several decades. Energy supply mainly rely on domestic resource.
Energy policy intervention scenario	S3	Energy industry is promoted by government with planning, emphases on clean energy and improvement of energy efficiency. International energy market is regards as one of the important source for clean energy. Energy policies from government could be well implemented.
Environment driven scenario	S4	Base on the understanding on domestic environment problem, much more environment policies will be introduced beside existing energy and environment policies. Energy supply and use will satisfy the requirement of domestic environment. Clean energy and clean production is a mainstream of the society.
Tiger development scenario	S5	A higher economic growth is assumed. Conventional development pattern is same as that in scenario S2, when higher technology progress is assumed because of financial ability for technology R&D.
Gray development scenario	S6	A lower economic growth is assumed. Conventional development pattern is same as that in scenario S2, when lower technology progress is assumed because of financial ability for technology R&D.

According to the simulation, for the traditional scenario (S1), the primary energy demand in China would be huge. It would reach 6.5 thousand Mtce by 2050, which would be 5 times the energy consumption of year 2000. For the environmental driven scenario (S4), by 2050 the energy consumption would be only 3 times that of the year 2000.

⁴³ Jiang Kejun, Hu Xiulian(2003), Energy and GHG Emission Scenario for China, Proceeding of Climate Change Conference in Beijing, Metrological Press, Beijing.

Table 2. Primary Energy Demand in China with Traditional Scenario, Mtce

	1990	2000	2010	2020	2030	2040	2050
Coal	740	908	1 365	1 873	2 416	2 624	2 832
Oil	179	283	473	592	675	691	708
N.Gas	17	38	174	386	914	1 264	1 614
Nuclear	0	2	11	31	48	134	220
Renewable	26	41	65	111	245	706	1 166
Total	963	1 272	2 088	2 992	4 299	5 419	6 540

The detailed traditional simulation results for demand are shown in Table 2, with projected energy production shown in Table 3. For the conventional scenario, the primary energy demand in China would be followed by energy production. It would reach 4.8 thousand Mtce by 2050, which would be four times that of energy production of the year 2000. The deficit of energy, 1.7 thousand Mtce, would have to be met from the international market.

Table 3. Energy Production in China with Traditional Scenario, Mtce

	1990	2000	2010	2020	2030	2040	2050
Coal	801.8	904.2	1 368.2	1 869.7	2 241.6	2 500.9	2 760.2
Oil	191.1	242.2	273.0	266.1	245.7	215.0	184.2
N.Gas	17.1	40.9	78.5	177.4	464.0	827.4	1 190.8
Nuclear	0.0	3.4	10.2	30.7	44.4	126.2	208.1
Hydro	20.5	34.1	51.2	68.2	88.7	100.7	112.6
Biomass	0.0	0.0	0.0	6.8	81.9	225.2	368.5
Other renewable	0.0	0.0	0.1	0.4	1.3	8.4	15.4
Total	1 030.4	1 224.9	1 781.1	2 419.5	3 167.6	4 003.7	4 839.9

In 1993, China became a net petroleum importer. The volume exceeded 100 million tons in year 2002. This is well acknowledged in China's 10th five year plan for the automobile industry: motor vehicles consume 85% of the nation's total gasoline and 20% diesel. In the long run, shortage of oil will be a limiting factor for the automobile sector.

Sustainable industrialization could change the trends of China's energy demand and production. For example, suppose the growth of total amount of energy demand and supply consumption are at two different levels: slowly increasing as the result of energy policy intervention; increasing but not higher than GDP growth rate and being environmentally driven.

Table 4 shows the situation of energy demand in China with energy policy intervention. By 2050, total demand of primary energy would be 5.48 thousand Mtce, which would be four times the primary energy demand of 2000. Compared to the conventional way, there would be more than one thousand Mtce less by 2050, which is the contribution of sustainable industrialization.

Table 4. Primary energy demands in China with energy policy intervention, Mtce

	1990	2000	2010	2020	2030	2040	2050
Coal	740.4	907.6	1265.8	1685.5	2013.0	2395.2	2777.3
Oil	179.5	283.2	472.6	591.6	674.9	691.3	707.6
N.Gas	17.1	37.5	112.6	221.8	484.5	748.9	1013.3
Nuclear	0.0	2.4	10.9	36.3	61.7	139.7	217.8
Renewable	25.6	41.2	65.4	114.6	245.7	505.2	764.8
Total	962.5	1271.9	1927.3	2649.8	3479.8	4480.3	5480.9

With the energy policy intervention scenario, the energy production in China also would be less as well (Table 5). By 2050, the energy production would be 4.4 thousand Mtce, which is 0.4 thousand Mtce less than the conventional scenario. This is due to the contribution of sustainable industrialization.

Table 5. Energy Production in China with energy policy intervention, Mtce

	1990	2000	2010	2020	2030	2040	2050
Coal	801.8	907.6	1262.4	1682.1	1968.7	2323.5	2678.4
Oil	191.1	242.2	273.0	266.1	245.7	215.0	184.2
N.Gas	17.1	40.9	78.5	167.2	395.8	629.5	863.2
Nuclear	0.0	3.4	10.2	34.1	58.0	131.4	204.7
Hydro	20.5	34.1	51.2	68.2	88.7	100.7	112.6
Biomass	0.0	0.0	0.0	13.6	92.1	233.7	375.3
Other renewable	0.0	0.0	0.1	0.4	1.0	3.4	5.8
Total	1030.4	1228.3	1675.4	2231.8	2850.0	3637.1	4424.2

All simulation results for primary energy demand are shown in Figure 1. Obviously, some would show even greater reductions in potential demand than those discussed above.

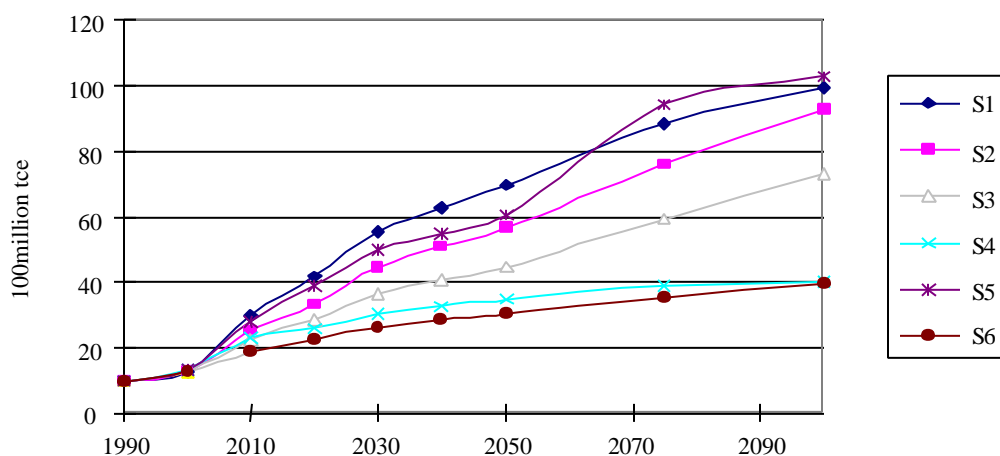


Figure 1. Scenarios of Primary Energy Demand in China

Information source:

Jiang Kejun, Hu Xiulian, Energy and GHG Emission Scenario for China, Proceeding of Climate Change Conference in Beijing, Metrological Press, Beijing, 2003

Automobile Sector Growth

China started its production of automobiles in the 1950s. For three decades up to the early 1980s, the automobile sector was under strict central planning in terms of investment, production and consumption. The market was highly isolated from the world. In 1971, total production of automobiles was only 100 000. It was in the 1980s, when open-up and reform policy was introduced, that the automobile sector gained its momentum for rapid expansion. In only a few years, the number of automobiles produced in China exceeded one million in 1992. This figure was doubled by the year 2000.

According to the analysis by Dr. Pan Jiahua of Chinese Academy of Social Sciences⁴⁴, since China's accession to the WTO in 2001, the automobile sector in China has been experiencing rapid market transformation. There are many factors contributing to the changes, including overall good performance of the economy, general increase in income, and improvement in infrastructure. In turn, the explosive expansion of the automobile industry has been an ever increasing key element that powers the growth of the economy, presumably benefiting the life of consumers able to afford cars, and generating various impacts on the environment. Rapid expansion of the automobile industry has made the sector an increasing stronger pillar of the Chinese economy (Table 6).

Table 6. Changing Position of the Automobile Sector in China's Industries

	1990	1995	2000	2001	2002	2003
% of sales revenue over total industry	2.2	3.3	3.9	4.4	5.2	6.2
Position in the industrial sectors	15	11	10	8	7	
% of profit over total industries			3.9	5.7	7.8	10.3

Note: first quarter of 2003.

Source: Various Yearbooks of China Automobile industry; Auto Digest 2003.

In 2002, production totaled 3.25 million, with sales revenue of 671.35 billion RMB, accounting for 5.5% of the nation's total industrial sales. Estimates for this year are over 4 million. China has exceeded France to be the 4th largest producer of automobiles in the world. There have been quite a few ups and downs of automobile production for the past three decades, but the overall trend since the middle of 1990s has been steady and accelerating (Figure 2).

⁴⁴ Pan Jiahua, Automobile: Environmental Impacts of China's Accession to WTO, 2003

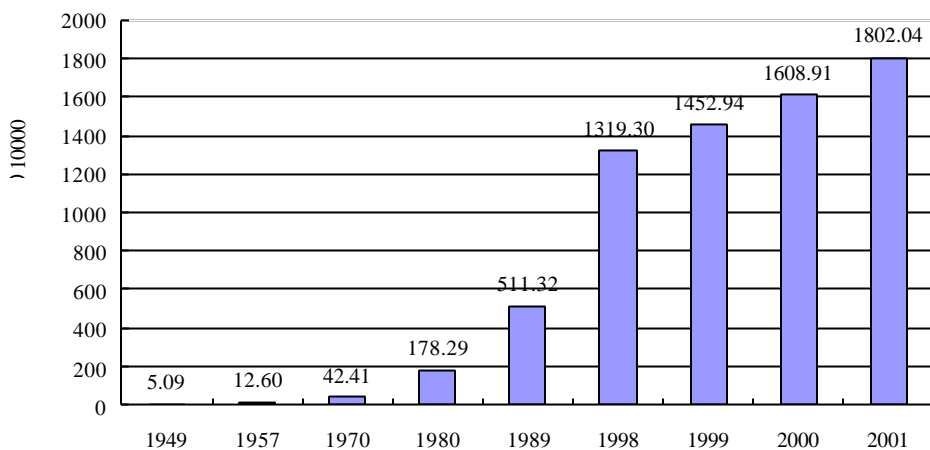


Figure 2. Increase in Number of Vehicles for Civil Use in China

At the same time, the demand for road is also growing very fast. Figure 3 shows the mileage of highway in last one and half decade. Right now China has almost 20 000 kilometers highway, ranking No.2 in the world after US.

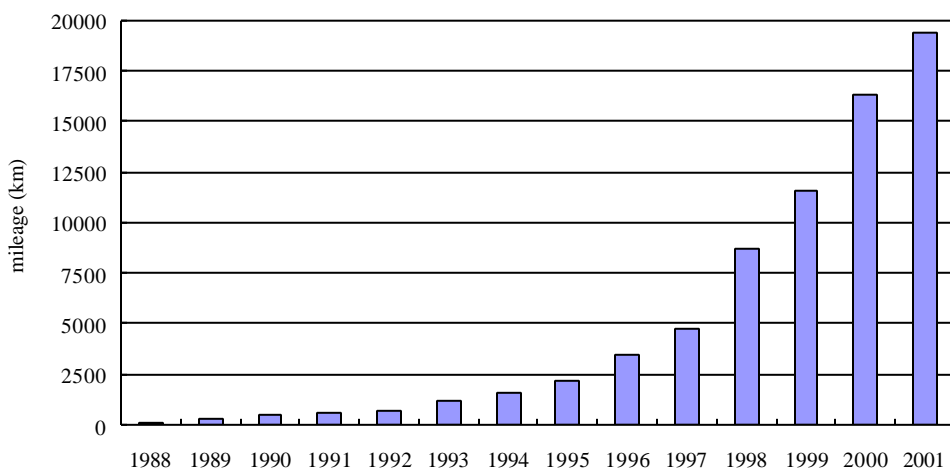


Figure 3. Kilometers of Highway in China, 1988—2001

The demand for vehicles, at the same time, is also growing very fast. Figure 4 shows the overall trend of production of automobiles in China with projection up to 2020.

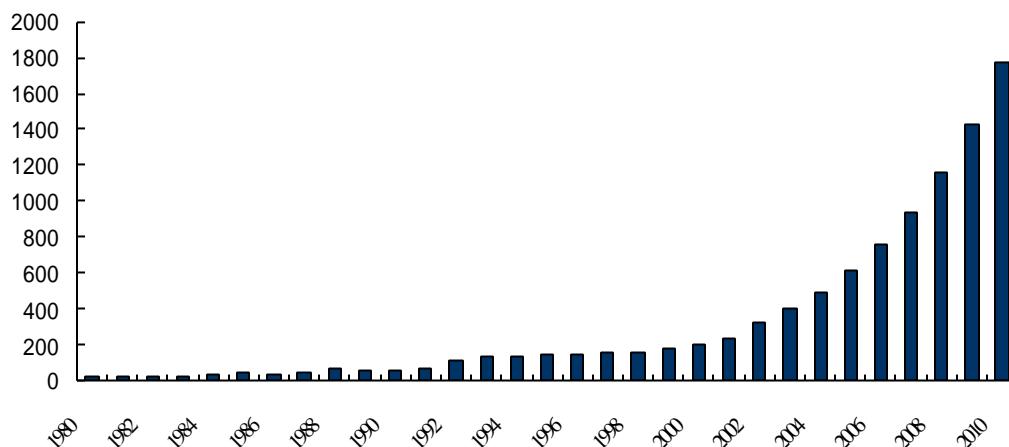


Figure 4. Automobile Production 1980—2010(10 000)

If China moved progressively towards a western level at 55 vehicles/100 persons and followed western levels of road development, by 2020 China would have 2.6 million km road and 70 thousand km of highway which would take up 5% of total farmland, and eventually China would have 17.6 million km road which takes up 32% of total farmland. Concerning future trends, car ownership in China is still very low. Table 7 compares the size of the vehicle fleet in China and a few major countries, indicating the challenges that China will have to face in relation to land use for vehicles.

Table 7. Current and Potential Land Area Needed for Roads in Selected OECD Countries, India and China

Country	Current Size of Vehicle Fleet	Vehicle Ownership	Road Distance	Current land Area used by cars	Vehicle Fleet Size for Industr.Vehicle Ownership	Total Paved Area Needed for Industr. Auto Ownership
Level	(million)		(million km)	(million ha)	(million)	(million ha)
Us	213.5	768	6.31	15.92	768	15.92
Japan	71.7	565	1.15	1.32	565	1.32
Canada	17.3	557	0.90	2.28	557	2.28
Germany	45.8	558	0.66	0.75	558	0.75
India	8.2	8	3.32	3.79	513	10.25
China	12.8	10	1.21	1.38	650	13.00

Note: cars plus commercial vehicles; vehicles per 1000 people; parking plus road; two people per vehicle; assuming the lower rate of 0.02ha/vehicle figure from Japan and western Europe as the reference figure for calculation.

Source: Lester Brown, 2001; Jiahua Pan, 2003.

Increasing the automobile population causes air pollution, especially in urban areas. Due to slow speed and low emissions standard, emissions by cars in Chinese cities are estimated to be some 10 times higher than those in developed countries. A World Bank (1997) report showed that the

size of car fleet in Beijing was only 1/10 that in Los Angeles, but emissions of pollutants were almost the same. In the middle of 1995, it was reported that the lead was found in children's blood in Shanghai (China's Env Yearbook, 1997).

The automobile industry currently employs over half a million people. Statistics show that one employee in the automobile sector would need 6 employees in the related sectors, such as sales, services, repairs, finance and insurance, oil stations. Therefore the total employment generated by the sector would be around 3 million. For each RMB yuan produced in the automobile sector, the amount of value added would be 0.65 and 2.63 in the upper stream and lower stream. It is easy to see, therefore, why car manufacturing is set up as one of the engines to drive China's economy. However, the side effects of using cars are obvious. A sustainable way to use cars, if it can be found, is very urgent.

Review of Progress

1 Energy efficiency improvement

China has placed emphasis on readjustment of its economic structure and its energy resource structure for raising efficiency of energy use and saving, so as to continually decrease the energy consumption intensity in economic growth. While China's economic growth stays at 9.7% annually, the first time energy consumption increased by only 5.2%. The energy resource intensity dropped from 0.95 kgce/1000 RMB (price at 1980) in 1987 to 0.62 kgce/1000 RMB (price at 1980) in 1997 (see Figure 5).

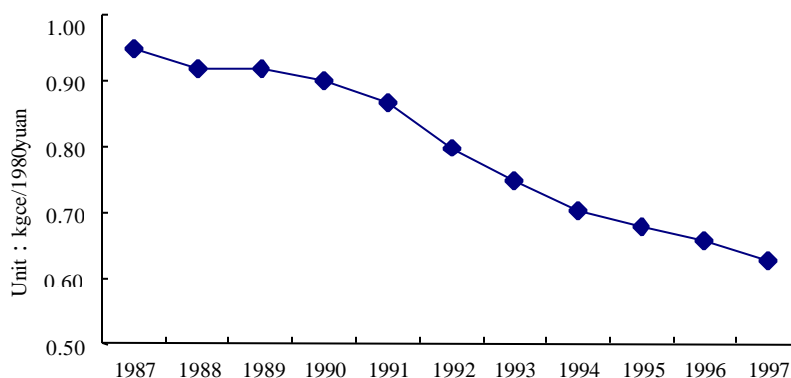


Figure 5. Trend of Energy Resource Intensity in China, 1987 - 1997

Source: China's Power Industry

The nation's per capita energy use amounts to only one-fifth European levels, though rapid economic growth continues to drive energy demand growth. In many rural areas, the Chinese people still lack access to commercial energy supplies—the oil, gas, and electricity elsewhere

taken for granted-and instead use firewood and crop waste for cooking and heating. Some 23 million Chinese have no access to electric power supply of any kind. Industry currently requires about two-thirds of all energy used in China, but this ratio is rapidly changing. As the country develops and narrows the income gap with the richer countries, more energy will be used in buildings and transportation.

A diverse set of energy supply measures and economic reforms has helped reduce the share of coal in total Chinese primary energy consumption from 76% in 1990 to 66% in 2000. One significant effort toward this end is the government effort in the late 1990s to close illegal and small, economically irrational coal mines. By the end of the year 2000, the government had shut down some 47 000 small coal mines, producing 350 million tons of coal. The extent to which this success is real and can be sustained has been debated, but there is no denying that it has deeply affected the coal industry and cut coal use.

The government at the same time has increased exploration and development efforts for natural gas and has made significant discoveries in central and western China. Not long ago conventional wisdom held that China lacked significant supplies of natural gas and had to rely almost exclusively on coal. Yet, some 28 new large and medium scale gas fields are now under development. The city of Beijing has required the use of gas in place of coal in new fuel applications, a measure made possible by the 1997 completion of the Shan-Jing gas pipeline from Shaanxi Province. A much larger step was taken in 2000 to help meet demand for high quality energy along the populous east coast by launching the “west-to-east” project, a 4200 kilometer high pressure gas transmission line from Xinjiang Province in far western China to Shanghai, which is expected to be completed by 2007. The gas pipeline will supply 12 billion cubic meters per year (almost one-half exajoule, or one half-quadrillion BTU per year), and will substitute for over 20 million tons of coal annually. A new natural gas development project also was started in the East China Sea in 2000, and is expected to produce 10 billion cubic meters per year by 2010. In addition, a project to import liquefied natural gas (LNG) has been started with an initial annual target of importing 3 million tons.

Renewables, including wind power, photovoltaics, and biomass contribute small amounts of energy compared with mainstream energy supply and demand. Roughly, modern renewables-wind, biogas, and solar thermal and photovoltaic sources, as opposed to firewood, crop waste, and dung-contribute several million tons of coal equivalent annually. There is no reliable calculation of the emissions reduction by these sources because of the difficulty of comparing their effect with respect to some status quo baseline. For example, the government recently initiated a national program for photovoltaic power development with a total investment of over \$US 200 million. Solar water heaters have expanded to a total of 26 million square meters of collection area, while accumulated photovoltaic modules exceed 15 megawatts and wind farms exceed 340

megawatts. Some 1,000 biogas tanks supply 600 million cubic meters of gas annually, and there are more than 1,300 geothermal developments, providing heat to more than 10 million square meters of living space along with 30 megawatts of power generation capacity.

Energy efficiency improvement and energy conservation are paid much attention in the energy development strategy in China. Since the 1980s, China has formulated energy policy “Giving equal priority to energy exploitation and energy conservation”, emphasizing the energy utilization in a sound and high efficiency manner and the improvement of energy efficiency. During the 1990s, energy conservation has been given the priority in energy policies.

High efficient and clean utilization of coal and other fossil energy is emphasized in the energy development strategy. The principle of developing clean coal technology is to improve coal utilization efficiency, reduce environmental pollution and promote economic development. High efficiency and clean technology plays very important role to reach low emission in China. Figure 6 shows an example in steel making industry for energy efficiency improvement and advanced technology diffusion.

With the different pollution intensity from the different sectors, sector restructuring will play a positive role to the improvement of environment. China has also attached great importance to the factors of environment in the process of sector restructuring. The restructuring of high-energy consumption sectors is quite representative. According to statistics on sector energy consumption, the six biggest coal consumption sectors are power, construction materials and non-metallurgical products, black metallurgical and pressing processing, coal mining and selection, chemical materials and products and oil processing and coke refinery. These sectors, named as “dirty sectors”, have taken 85% of the total coal consumption and the restructuring of these sectors will be of importance in terms of the reduction of SO₂ and soot emission.

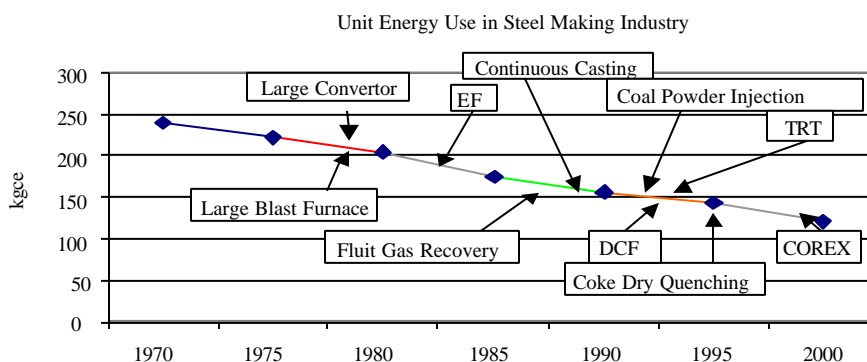


Figure 6. Technology Progress and Energy Efficiency Improvement in Steel Making Industry

Figure 7 shows the changing situation by percentage of these sectors in terms of their total production volume. The figure shows that the percentages of all these sectors are in a decreasing trend, which is good for the reduction of air pollutants. It plays an important role in national controlling of SO₂ emission.

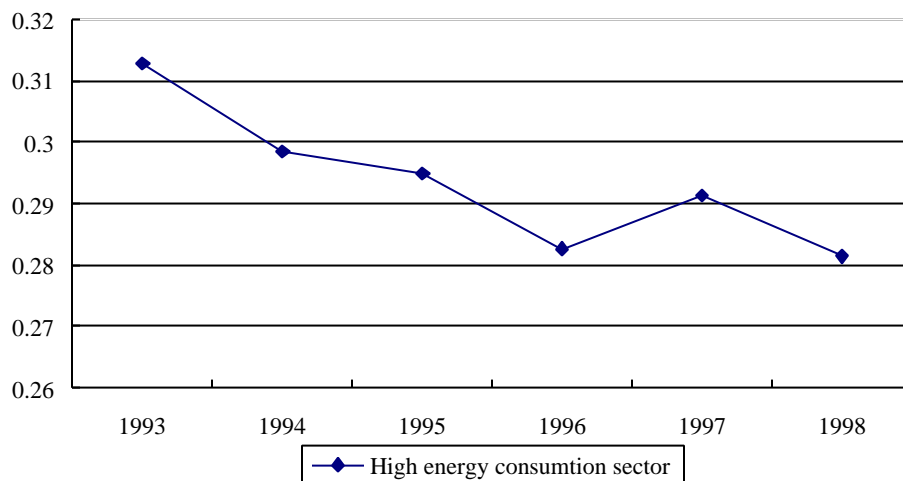


Figure 7. Percentages of Production Volume for Pollution Heavy Sectors

Table 8 shows the annual SO₂ pollution intensity of the heaviest pollution sectors. From Table 8 it can be seen that the power generation sector is the biggest one in terms of its pollution intensity of SO₂. With the big level of reduction for SO₂ intensity from 1132kg/10 000 yuan in 1991 to 392kg/10 000 yuan in 1997, the power generation sector makes great contribution to the reduction of SO₂.

Table 8. SO₂ Discharge Intensity by Sectors (kg/10 000 yuan)

Name of sector	1991	1992	1993	1994	1995	1996	1997	1998	1999
Power generation	1131.85	1108.86	1016.85	1003.51	905.40	294.95	391.71	229.36	240.04
Black metallurgical	49.81	52.77	47.44	43.14	45.60	28.53	28.47	27.73	23.20
Non-ferrous metallurgical industry	112.97	97.21	93.05	89.45	78.88	70.73	66.90	62.55	53.13
Chemical materials and products	70.76	61.06	59.55	53.49	50.01	34.34	30.52	28.52	21.96
Non-metallurgical processing industry	174.21	228.31	130.18	109.24	105.64	68.48	60.99	123.35	102.29
Machinery	11.42	9.96	7.42	5.83	5.07	3.89	3.64	2.84	2.20
Oil and coke refinery	12.53	12.46	11.40	11.40	19.31	6.95	7.65	12.11	12.36
Paper making industry	76.59	78.57	78.50	61.99	69.71	41.61	43.58	45.13	34.53
Textile industry	22.81	20.90	18.67	17.85	15.05	10.92	11.17	10.99	9.07
Food processing	33.71	27.21	23.97	21.20	19.87	11.66	9.88	8.79	8.03

In order to reach the target of energy efficiency, more and more policies and countermeasures have been announced to use standard and market based policies. These policies and countermeasures include:

- ❖ Energy efficiency planning. This planning is part of national Five-Year-Plan announced every five years. In the planning, energy use per industrial output value, unit energy use for major industry products and ability for energy conservation was set up; and some targets for rural energy production, requirement for energy conservation in sector and enterprise was given.
- ❖ Energy efficiency standards. Nearly 100 efficiency standard was announced by end of 1998, catalogue for machinery and electronic products including 1068 energy saving products and 610 products need to be disused was published.
- ❖ Price favourable for independent power plant investor. Price could be decided based on payback of loan and profit level.
- ❖ Tax derating for co-generation, energy saving building. Tax derating is given to wind turbine import, small hydro and biogas. No tax levy for wind farm in first two years in some province.
- ❖ Loan favourable for energy conservation project by different interest with average 30% lower.
- ❖ Price for energy saving by enterprise. Started from 1985, price is 8 to 10% of value by energy saving.
- ❖ Subsidy for energy saving stove in rural area, biogas promotion and city banquet production.
- ❖ Organize important energy conservation project by government including cement industry technology retrofit, fan and pump retrofit, World Bank/GEF project on energy conservation in China, green lighting, World Bank/GEF project on renewable energy commercialisation, forest energy project, pilot project of straw utilization, clean production plan, clean vehicle etc.
- ❖ Opening of energy price. Energy price could be decided by market and increased energy price could well contribute energy saving.

2 Emission Reduction

As we know, over the past two decades, compared with the rapid economic growth in China, emissions of pollutants have not grown as fast. The following group of figures⁴⁵ (Figures 8-13) show the situation. With GDP growth, effluent, industrial waste gases and solid wastes slowly increase; but industrial effluent, industrial smog and dust are going down gradually. These are very significant results of sustainable industrialization.

Figures 8-13 GDP and pollutants emission

⁴⁵ Hu Tao, Guo Dongmei, The relations between GDP growth and pollutants emission, 2002

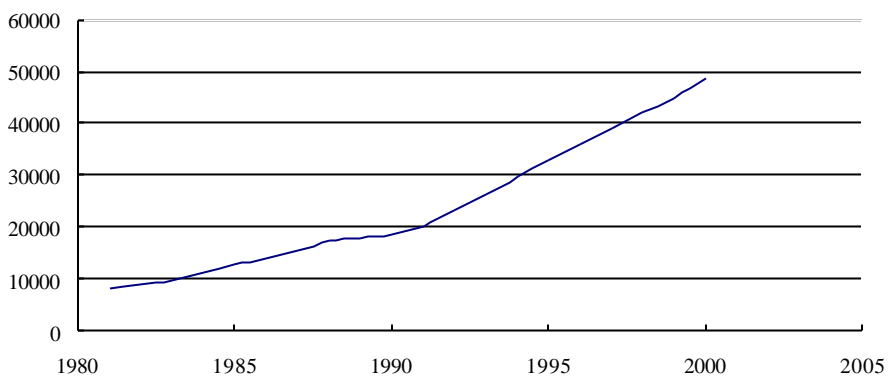
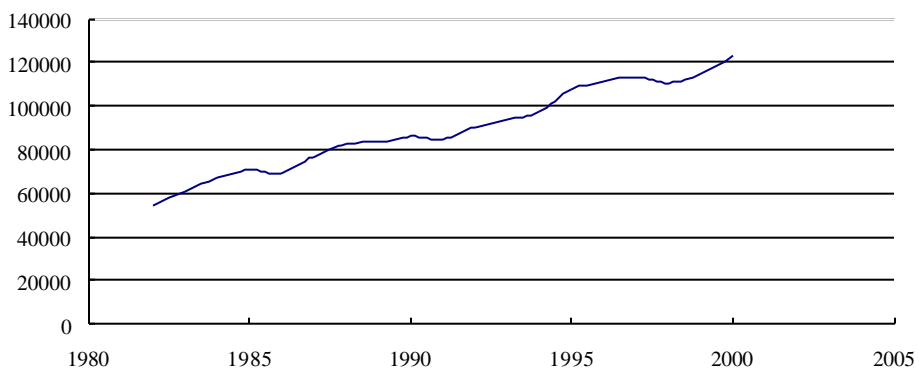
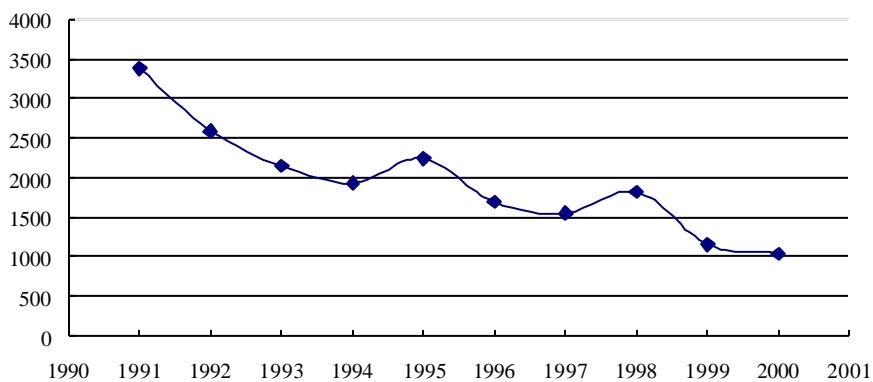


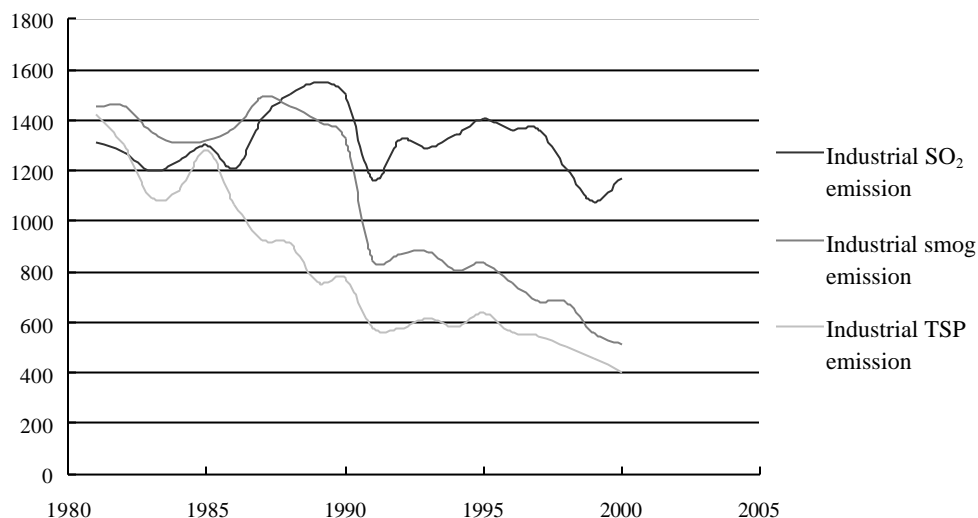
Figure 8. China's GDP(1990 Instant Price Unit: 10 billion RMB)



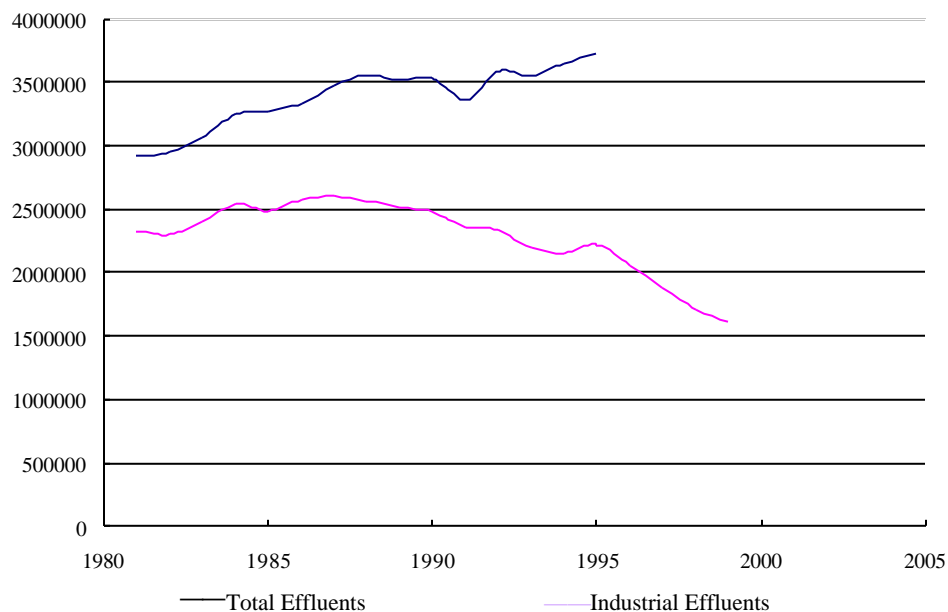
Figures 9. Total Emission of China's Industrial Gases Wastes(100 thousand cubic meters)



Figures 10. China's Industrial Solid Wastes Emission (10 thousand tons)



Figures 11. China's Industrial Emissions of SO₂, Smog and TSP(10 thousand tons)



Figures 12. Total Effluents and Industrial Effluents(10 thousand tons)

3. Comprehensive Comparison

In the last two decades, GDP has increased from 0.323 trillion USD in 1992 to 1.08 trillion USD in 2000. During this time, the intensity of energy and material consumption as well as major pollutants emission have decreased. Figure 13 shows the changes of GDP, exhaust gas, population growth, waste water and energy intensity.

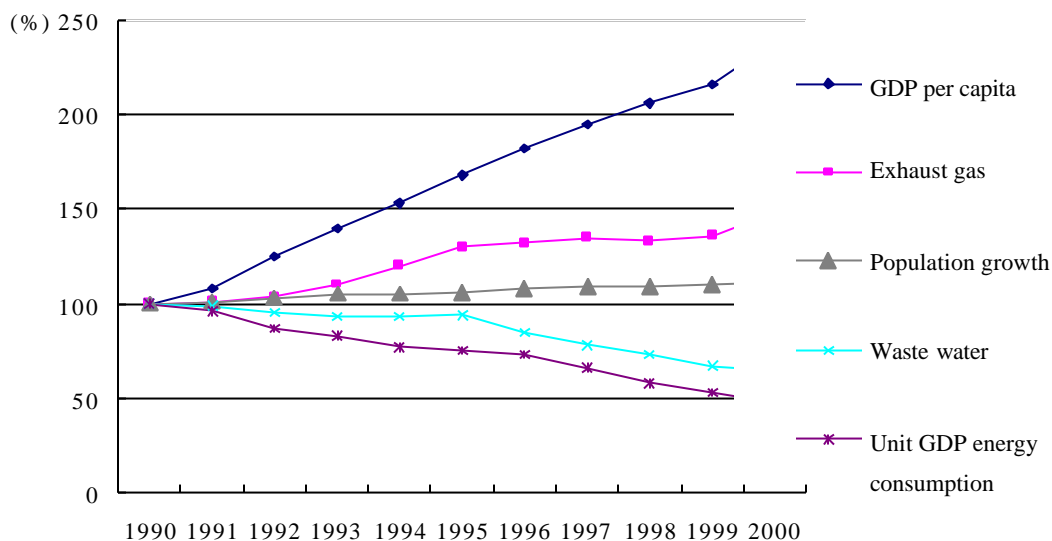


Figure 13.

Note: Jiang Kejun, Hu Xiulian. Energy and GHG Emission Scenario for China, Proceeding of Climate Change Conference in Beijing. Metrological Press, Beijing. (2003)

Pan Jiahua, Automobile: Environmental Impacts of China's Accession to WTO, 2003

Hu Tao, Guo Dongmei, The relations between GDP growth and pollutants emission, 2002

III ISSUES FOR DISCUSSION

CONTRIBUTION OF SUSTAINABLE INDUSTRIALIZATION

This review has highlighted the complexity of sustainable industrialization within China and internationally. Certainly remarkable Chinese progress has occurred over the past decade, including the strengthening of laws and regulations, improved monitoring and enforcement, restructuring of incentives, and opening of the market to greater competition and international standards, a focus on capacity building and on advanced R&D, awareness-raising within industry, communities and government through demonstration efforts, and very importantly, significant advances in financial investment and fiscal reform. The perspective has been dominated by concern for improved efficiency and for genuine improvements in the quality of both urban and rural environmental conditions during the rapid growth of both large and small industry.

These perspectives continue to be valid, but the increasing emphasis on the well-off society, with the explicit need to consider equity, presents additional challenges for sustainable industrialization as well as development strategies in general. It is perhaps China's good fortune

to have the opportunities largely ahead rather than in the past. There are genuinely better ways to meet these challenges than simply repeating the evolution of experience over the past 30 years in OECD countries.

China can, of course, learn much from past and current experience of other countries. Also, there is now an accumulated yet still evolving set of international norms and voluntary initiatives that can be applied quite directly within China. Examples include the ISO 14001 environmental management certification and the extensive experience associated with Cleaner Production and eco-efficiency.

The truly exciting opportunity for China is to move into an era of industrial development where there is a commitment to the sustainable technologies of the future, a commitment to ensuring that the benefits will be spread widely within Chinese society and in a fashion that respects both human and ecological development needs, and a commitment that will ensure that Chinese industrial development occurs in a fashion that benefits rather than destroys the global environment. The pathway to *Xiaokang* surely will require this broad and bold perspective.

The ten issues noted below should help to stimulate discussion among CCICED Council Members, and provide a framework for more specific discussions by each of the five Task Forces presenting reports and recommendations to the 2003 Annual General Meeting. These are by no means the only issues that deserve serious discussion and action. But it is difficult to ignore the importance of any one of them.

TEN ISSUES

1. The link between sustainable industrialization and a well-off (*Xiaokang*) society goes beyond issues of wealth creation and distribution, and these broader dimensions need considerable attention. Achieving the goal of a well-off society requires attention to many factors, including quality of life and environment, the ability to build new skills for a changing employment market, access to a safe workplace, social security, and a consistent, fair system of governance. The interplay between reform in government at all levels, and industrial reform needs to take these broader considerations into account. There are some obvious matters of concern, for example, the promotion of private automobile production as a major element of future economic growth and industrialization, even though it may well prove to have huge environmental and social costs. Reform of social security policy is lagging behind needs, with serious implications for sustainable industrialization. It is not a question of whether sustainable industrialization will contribute towards a well-off society, but a question of how much and over what time period?

ISSUE How much and how broadly should sustainable industrialization be expected to contribute to a well-off society in China? Can this be done in a way that actually improves

the profitability and right to operate of individual enterprises, while also reducing rather than contributing to China's overall environmental debt?

2. The success of sustainable industrialization will depend upon how well other components of sustainable development are implemented within China. Sustainable development is well embedded throughout the 10th Five Year Plan and within the long-term vision of China. Yet it would be a stretch to say that the approach is integrated across the various key sectors, such as energy, transportation, urban and rural development, agriculture, water resources and health. Generally, sustainable development in China is implemented in a sectoral fashion. The synergies that might be obtained through intersectoral cooperation are not being sufficiently realized. Sustainable industrialization cannot achieve its full potential without being linked more closely with many of these other sectors. Competition for water is an example. Industrial development may well be limited by water scarcity, even though industry generally will be paying more than other users. Another is the ability of industry to develop alternative power sources, including co-generation arrangements. Perhaps the biggest need is to link sustainable strategies for industrialization, energy, transportation and urbanization. Ideally, this effort should be carried out through integrated regional development planning and management.

ISSUE How can intersectoral communication and cooperation on sustainable development be enhanced so that the full potential of sustainable industrialization is realized, including its contribution to other processes such as sustainable urbanization?

3. Fiscal reform and financial sector reform are necessary to achieve sustainable industrialization. Action by industry is strongly influenced by the signals sent by government and by those who finance capital industrial needs. At the moment some of these signals are weak or contradictory, for example, limited enforcement of laws, incentives that work against sustainable development directions, and limited use of taxation measures. Issues of resource pricing and valuation of environmental goods and services are becoming more important with the increasing demands of various sectors, including industry. China's financial sector, including insurance companies, is not as advanced as counterpart bodies in other industrial economies in applying environmental and sustainable development criteria to their lending practices. And, importantly, by carrying many non-performing industrial loans, Chinese banks are slowing the transition to modernized, eco-efficient business enterprises. How fiscal reform and financial sector reforms are carried out has enormous implications for achieving a well-off society.

ISSUE Given a need for both fiscal reform and financial sector reform in order to achieve general development goals within China, which reforms are most likely to be useful in achieving sustainable industrialization, while at the same time contributing to a well-off society?

4. The appropriate scale for individual enterprise development and its relationship to both sustainable industrialization and urbanization require policy attention. Small and medium sized enterprises currently contribute the majority of China's exports and employment within the industrial sector. Many of the SMEs are among the most difficult to reach in terms of environmental management performance improvement. And much of China's large-scale industry is small by international standards, making it more difficult to achieve the economies of scale that would permit sufficient investment in safety, health and environment (SHE), advanced technologies and new highly efficient production processes. Urbanization policies have favoured development of many smaller cities. This policy may create additional costs and decrease the opportunity for large-scale investment of industry in advanced waste treatment facilities and environmentally-friendly transportation facilities. These arguments can be countered in various ways, for example, by the move to "cleaner" service and tertiary industries, where SMEs often thrive and may have a comparative advantage.

ISSUE Should China restructure its industrial base to encourage development of larger-scale industry that may be more capable of addressing sustainable industrialization? And, if so, are there strategic sectors to start this process, and sectors where it is still particularly important to foster SMEs ?

5. The legal framework for sustainable industrialization is still incomplete, but there are real tradeoffs between adding new laws and enforcing existing laws and regulations. The recently enacted Cleaner Production Promotion Law is an example of legislation that fills a gap for industry. But some would go further, for example, suggesting the need for separate legislation to promote the idea of a Circular Economy. And there may be specific needs such as stronger legislation to cover hazardous wastes. There is a balance at present between punitive and enabling legislation. There is not, however, a full incorporation of economic instruments within current environmental legislation, nor is there sufficient recognition of the role of voluntary initiatives. The biggest gap by far is the difficulty of consistently enforcing environmental laws nationwide, with sufficient impact that they go beyond "the cost of doing business." In the future, as compliance to law increases, there will be even more need to develop incentive-driven approaches that encourage innovation and development of new technologies consistent with a "triple bottom line" approach.

ISSUE Are there critical gaps in legislation and regulations to support sustainable industrialization, and if so, what should be the appropriate balance between adding new rules and improving enforcement of existing ones? How can enforcement be made more consistent at provincial and municipal levels? As well, more attention needs to be given to incentive-based approaches to industrial regulation. What are the most important areas to address using this approach?

6. China is not achieving an optimal transfer of environment and sustainability technology from abroad, and the rate of technology leapfrogging is less than would be desirable. There is a need to speed up the development of a Chinese environmental protection and sustainable development industrial sector. While supply is increasing from this industrial sector, the limited capitalization, small size of operations, and relatively small R&D investment levels are hampering development. The demand side is also inconsistent, or even favouring unsustainable pathways. There are numerous barriers to obtaining advanced technologies from abroad, leading to installation of technologies from the past generation rather than meeting a future generation of needs. The energy sector provides many examples where there is a need to move from conventional thinking to a broader range of alternatives, including ways of using coal to achieve multiple environmental, industrial and economic objectives.

ISSUE How can environmental protection and sustainable technology sector development be accelerated so that it can adequately support the needs of sustainable industrialization? And can the sector be developed in a fashion that stimulates innovation within industry, leading to useful, environmentally sound products that will contribute to a well-off society?

7. Measures of progress for sustainable industrialization in China are weak, and even less well developed for the linkage between this new style of industrialization and a well-off society. The business perspective that “if you can’t measure it, then it doesn’t count” is a bottom line approach which cannot be ignored. A national suite of sustainable development indicators is needed. And while some effort to develop these has taken place, their relationship to industrial development is poorly worked out. Internationally-developed metrics, such as those used by various organizations to monitor the sustainable development performance of individual enterprises, are not routinely used within China, although this will almost certainly change, and not necessarily in China’s favour. Much more work is needed on building an understanding of how to measure industry’s contribution to a well-off society. Basic measures such as growth in GDP provide limited insight.

ISSUE How can sustainable industrialization progress be monitored and measured in relation to its own performance and for its contribution to a well-off society? Which sustainability indicators are likely to be most useful, and can they utilize existing statistical information?

8. Capacity-building is highlighted by many sources as a high priority need within virtually all segments of the industrial sectors, in regulatory systems at national and local levels, within the management structure and board room of individual enterprises, and in financial institutions. Despite the recognized need for developing capacity and the vigorous efforts to keep pace with rapidly expanding demands, there is a serious gap. The gap leads to

systemic problems such as the inability to adequately enforce regulations, the lost opportunities for synergies across sectors, or in technology sharing, and the ability to move individual enterprises along their “sustainability journey.” There is no overarching body that adequately addresses capacity-building for sustainable development in general or sustainable industrialization in particular. Thus it is difficult to determine the appropriate supply and demand for human resources with specialized skills. This problem will grow as new technologies emerge and industrial demands change.

ISSUE The gap between skills required for sustainable industrialization and their supply is already large, and likely to increase over time unless there is concerted action and considerable foresight. What are the most critical actions that can be taken during the existing and coming Five-Year Plans, and within the private sector to address the gap?

9. China’s domestic market potential attracts attention from those who ask the question of whether the world’s ecosystems can support Chinese consumption at levels anywhere near those of western society; and others who see this emerging market as the most significant place in the world to stimulate consumption and, therefore, demand for their product, whether or not the product truly improves well-being or sustainability. Neither of these opposite poles is particularly helpful to Chinese efforts for sustainable industrialization. But they raise the very valid question of what measures should be put in place to identify and reinforce sustainable consumption patterns within China. In turn, this question raises important issues about innovation in technology, policy and management systems. Will they be able to deliver the levels of efficiency and types of sustainable products that will permit all citizens to enjoy the broad range of benefits that should be associated with a moderately well-off society?

ISSUE What actions are needed within China’s domestic marketplace to develop and reinforce sustainable consumption patterns, and how might such efforts improve both sustainable industrialization and the achievement of a well-off society?

10. Chinese efforts for achieving sustainable industrialization and a well-off society are taking place at a time of evolving international views towards globalization and development. Almost certainly there will be surprises (e.g. SARS) leading to international responses that may threaten progress. China’s dependence on international trade opens many options for enhancing industrial development but also creates vulnerabilities, depending upon international opinion. If China markets its products and image, for example as a “green” or sustainable development producer of goods, international credibility will have to be built and maintained. Key subjects such as trade and sustainable development, corporate social responsibility and climate change are examples where Chinese positions will need to be reviewed regularly in the context of changing international norms. As SARS demonstrated, it

can be difficult to predict specific issues before they happen, but it is the national response afterwards that is critical. And in the future, it may well be in a Chinese business response to an issue that becomes a matter of concern internationally.

ISSUE How can China reduce its vulnerability to potentially damaging events and perceptions that may affect its international markets, sustainable industrialization progress, and capacity to be fully engaged in a globalized world?

CONCLUSION

Sustainable industrialization is a process of development, a complex interplay between business, government, communities, science and technology, some international elements, and consumers. Thus, however many plans may be created, the outcome is by no means certain since there are a variety of factors that could derail the best efforts. The best hope is to build a shared understanding and genuine commitment nationwide, and across a range of sectors that the pathway of industrial development in China will take a unique direction, driven as much as possible by the enormous needs of the Chinese people. This would seem to offer the best hope for a major contribution of industrial development towards a *Xiaokang* society. It will require debate and understanding of why this unique direction may not follow the model of western industrial development, including measurement tools to demonstrate the value of Chinese alternatives.

Obviously, setting of visionary, yet realistic goals, and definition of various partnerships and joint venture approaches will be important for achieving sustainable industrialization. A danger is that progress will be more on paper than in practice. This is a concern today with the interpretation of environmental and other statistics.

Progress undoubtedly will depend upon on both financial and structural reforms that have been widely discussed within China and internationally. The impact of banking reform, pressure for changes to the fixed currency value, changes in the operation of state enterprises, and the on-going changes associated with WTO membership are examples. These factors may dominate in the high profile discussions about China's industrial future. And indeed they are very important, since sustainable industrialization depends upon fundamentals being handled well.

The international community should be in a position to assist China in achieving its industrial aspirations, and it is in the world's best long-term environmental and perhaps economic interest to do so. Some of the key ways for demonstrating support include sharing of technology and experience, capacity development, searching for common ground in the rounds of trade and also multilateral environmental agreements. But it is also true that many of the OECD countries are also competitors, for example in the supply of environmental industry services and goods.

China has surprised the world with its rapid and dedicated efforts for economic development. With this same degree of dedication directed towards sustainable industrialization and *Xiaokang*, we can hope for an interesting and globally significant business and sustainable development transition.

Special Guests Speeches

Speaking Notes at the 2nd Meeting of CCICED Phase III

Klaus Töpfer, Executive Director of UNEP

Oct. 30, 2003

I warmly congratulate the opening of the Second Annual Meeting of the China Council for International Cooperation on Environment and Development.

China has made significant achievements in economic development. It has successfully reduced its population in poverty from 100 million in 1986 to 28.2 million at present. We are especially happy to note China has also made important progress in meeting its environmental challenges. With 1.3 billion people and an official goal to quadruple economic growth by 2020, China's environmental performance will not only determine the well being of its own people, but will have consequences for the whole planet. Sustainable development is the only solution. To develop China into a well-off society and adopt a sustainable industrialization mode - this topic we are going to discuss at this meeting is most important and relevant.

At the United Nations Millennium Summit held in September 2000 in New York, the United Nations Millennium Declaration was adopted. At the Summit, all the participating UN Member States pledged to achieve by 2015 the eight goals which are called Millennium Development Goals (MDGs). Among others, Goal 7 is to ensure environmental sustainability. China's goal is in conformity with MDGs.

The World Summit on Sustainable Development held in Johannesburg in 2002 states that the fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development. All countries should promote sustainable consumption and production patterns. Governments, relevant international organizations, the private sectors and all the major groups should establish partnership and play an active role in changing unsustainable consumption and production patterns.

The United Nations has initiated a series of actions to promote sustainable consumption and production patterns. Among these is the Global Compact which is relevant to the theme of this

meeting. The Global Compact is an international initiative that brings companies together with UN agencies to support nine principles in the areas of human rights, labour and the environment. Through the power of collective action, the Global Compact seeks to advance responsible corporate citizenship so that business can be part of the challenges of globalization. Of the nine principles, 3 are related to the environment: Businesses should support a precautionary approach to environmental challenges, undertake initiatives to promote greater environmental responsibility and encourage the development and diffusion of environmentally friendly technologies. UNEP is one of the five UN' agencies which are at the core of the GC network.. Today, hundreds of companies from all regions of the world including many companies from China have joined the Global Compact. We appeal to all the enterprises, private or public in China to join this global initiative and implement its principles. It will help China in achieving its goal of a *Xiaokang* (Chinese meaning "well-off") society and embark on a road of sustainable mode of industrialization.

Promotion of sustainable consumption and production is a focal area of UNEP's programme. We have a Division of Industry; Technology and Economics in Paris and under it an International Environmental Technology Center in Japan. This Division together with other divisions has devoted a lot of efforts in the promotion of sustainable consumption and production patterns. Our Regional Office for Asia and the Pacific is doing a lot of work in this area in the region.

UNEP has been promoting Cleaner Production for many years. Cleaner Production is the continuous application of an integrated preventive environmental strategy to processes, products, and services to increase overall efficiency, and reduce risks to humans and the environment. Cleaner production can be applied to the processes used in any industry, to products themselves and to various services provided in society.

UNEP organized the launching of the International Declaration on Cleaner Production in October 1998. It is a voluntary but public statement of commitment to the strategy and practice of Cleaner Production. The Chinese Government is one of the signatories.

UNIDO and UNEP have joined forces to help introduce Cleaner Production in developing countries. These two organizations have helped China in establishing its National Cleaner Production Center under the State Environmental Protection Administration and we are continuously supporting the center.

We believe that cleaner production is the sustainable mode of industrialization. Great efforts should be made in promoting and applying cleaner production.

UNEP is also organizing activities and projects in China to promote sustainable consumption

and production patterns. I wish to give you some examples of our recent activities.

—The Greenhouse Gas Emission Reduction from Industry in Asia and the Pacific (GERIAP) project seeks to support Asian businesses to address climate change by becoming more energy efficient, and thereby reducing greenhouse gas emissions and costs. The project is funded by SIDA and implemented by UNEP in Bangkok. It is expected to be launched in China later this year.

—UNEP is sponsoring together with SEPA, The Government of Hunan Province and China Science and Technology Association an International Forum on Sustainable Production and Consumption Patterns and Exposition on Green Consumer Products and Services. It will be held in December this year.

—UNEP has assisted China in the development of the National Biosafety Framework with GEF funding. Now it is implementing a GEF project on the implementation of the National Biosafety Framework. A workshop on the project is going on now in Beijing.

We are experiencing a process known as globalization. Globalization has increased pressure of human activities on the environment. Since Stockholm Conference in 1972, the world has made great strides in placing the environment on the agenda, but sustainable development remains largely theoretical for the majority of the world's population of more than 6 000 million people. The world environment continues to deteriorate. China has been exploring a sustainable way for its economic development and has made noticeable achievements in environmental protection. China is yet to be on the track of reversing the trend of the loss of environmental resources and degradation of ecosystems. However, China has a historic opportunity to leapfrog traditional polluting technologies and to adopt sustainable production and consumption policies. We have confidence that China will meet its goal.

Sustainable consumption is also very important. The developed countries should take the lead in adopting sustainable consumption patterns. 20 percent of the population are consuming 50 percent of the world's energy. 1 billion people in the world still do not have enough food, clothes and houses. However the developing countries should also pay attention to this issue especially those countries which are becoming well-off like China. We have seen more and more private cars in the streets of Beijing and other big cities in China which are consuming more energy, creating more traffic jams and more pollution. More public transportation facilities should be developed.

I have the following recommendations for achieving a sustainable industrial development in China:

- To adopt cleaner production processes and technologies;
- To link the industrial development with poverty eradication.
- To apply more widely and effectively economic instruments and market mechanisms in

addition to the administration of the Government;

—To enforce more vigorously environmental laws and regulations;

—To improve coordination and cooperation among different sectors;

—To increase financial input in environmental protection and especially to develop and apply mechanisms which give incentives for the industries and businesses to increase their investment in the protection of the environment.

—To further raise the awareness of the people including decision makers on the importance of sustainable production and consumption.

UNEP is China's supporter in achieving its ambitious goal of establishing a well-off society and adopting a sustainable mode of industrialization. We are ready to assist China in achieving its plan.

I wish the meeting a great success.

Strengthening the Development of Public Health Emergency Mechanism and Promoting Sustainable Development

Zhu Qingsheng, Vice Minister of the Ministry of Public Health

Oct. 30, 2003

It is a great honor for me to attend today's conference on behalf of the Ministry of Health of China. On this occasion, I would like to share with you such topics as the establishment of mechanism for public health emergencies, public health security and sustainable development, especially the development of proper public health systems here in China. Now, I would like to address the following four issues.

1. The Important Inspirations and Experience Learned from the SARS Outbreak

SARS epidemic occurred in 24 provinces and cities in mainland China in the first half of this year, which affected 266 cities and counties, and caused 5 327 cumulative number of cases including 349 deaths. This unexpected catastrophe, once led us into a great trouble, threatened the health and lives of Chinese people and severely influenced normal social life, economic development as well as foreign affairs.

Faced with the severe SARS epidemic, the Central Government adopted decisive policies, directly launched a national-wide campaign against SARS, and won significant victories from one stage to another. Looking back to the soul-stirring campaign, we have obtained precious experiences and lessons. In the first place, the victory attributes to the strong determination and leadership of the central government. Secondly, the widespread involvement of the mass in the prevention and control of the epidemic works. Thirdly, the Chinese medical staff made a tenacious struggle and great sacrifice in the battle. Fourthly, we did our work with the help of legal system and science and technology. Fifthly, our openness and transparent policies play an important role. The sixth point attributes to our immediate expansion in international cooperation and exchange.

Meanwhile, we are fully aware that, with the rapid development of economic globalization and information technology, major public health events are not limited to general health problems, if not handled properly, they can affect beyond the national border and bring about significantly

adverse impacts on national economic development, social stability as well as international exchange activities. We must acknowledge the importance of well established public health system from the strategic point of view. SARS outbreak reveals that there exists serious defects and weakness in the public health system of China. It alerts us and makes the whole society reach the following common understanding. That is, we must increase the input for public health, establish a safe and sound health emergency mechanism, improve current diseases prevention and control system, and promote harmonious developments of our health system, economy and society.

2. The Establishment of Emergency Mechanism as an Important Component of Social Administration System

Currently, economic globalization brings prosperity for the whole world. However, many new problems and even conflicts go along with the process of globalization, which gradually lead to many potential crisis. With the rapid pace of urbanization and industrialization in China, there emerge many problems and potential conflicts between society and economy, between urban and rural areas, between human-being and the nature. Therefore, there are high possibilities of the occurrence of various social crises, natural disasters and unexpected catastrophes, which add more sophisticated and complex tasks and activities into the framework of social administration. As a result, they impose a greater challenge to the enhancement and reform of social administration systems in China. Thus, it is of great importance for the mass to improve their awareness of social responsibility, security, and active involvement in public activities. With regard to the government, the ability of social administration and the ability of the prevention from and the preparation for unexpected calamities and social crises shall be enhanced.

(1) Rapidly Establishing Various Kinds of Emergency Mechanisms

Emergency mechanism embraces a range of activities such as handling of major social crises, facing severe natural disasters, meeting the challenge of significant international events, as well as dealing with unexpected public health catastrophe. Emergency treatments and rescue work are involved in almost any kinds of sudden or unexpected events, which has a lot to do with public health system. Therefore, to make proper preparation, emphasis must not only put on the awareness and practical work, but also on the establishment and improvement of appropriate mechanism and system.

(2) Developing Safe and Sound Social Administration Mechanism

Social administration mechanism plays a fundamental role in the establishment and development of emergency mechanism. With well-established social administration system and its smooth daily operation, emergency mechanism will work better in case of need. Hence, government at all levels must, in accordance with the needs of market economy and new circumstances, actively change their roles and functions so as to further improve their administrating ability and public service performance. As social administration mechanism involves many aspects, it is

important to make unified planning with due consideration for all concerned, and strengthen one aspect after another. At the same time, attention must be paid to improve the linkages among various social management mechanisms so that a comprehensive administration system covering the management and services for the entire society can be formed.

(3) Developing a Well Established Mobilization Mechanism

The key of successfully tackling unexpected events lies in the prompt and effective mobilization of sufficient resources including human resources, financial resources and material resources. We must stick to the well established tradition and best practices in this respect. Meanwhile, we must give energetic support in developing new ways of mass mobilization. With the help of economic, political and legal measures, we will establish a safe and sound mechanism by which all the human and social resources can be effectively mobilized, organized and involved to meet the challenge of emergency events. In this way, we can make full advantage of and systemize the superiority of our socialist society, which refers to concentrating all national resources to achieve something great.

3. Accelerating the Establishment for Public Health Emergency Mechanism, Promoting Sustainable Development of the Economy and Society

The establishment of public health system is a huge and systematic social program that demands extensive participation and concerted efforts by both the people and the government. As the leading player, government must formulate relevant regulations and policies, promote the development of public health service; monitor and supervise the implementation of public laws and regulations; maintain social stability and good order in terms of public health; organize all social parties and forces as well as individuals to fight against unexpected health calamities and the spread of contagious diseases; educate the people to keep a good habit and live a healthy and civilized life; train high quality administrative and technical talents in the field of public health; and provide excellent service for public health.

With different historical and cultural background, each country has different economic levels and faces different tasks in the field of public health, therefore, the objective, focus and measures differ. For this reason, the identification of the focus and necessary activities for the establishment and development of the public health system in China must be in line with the fundamental situations of our country and with the consideration of major problems in public health. At present, the objectives of public health activities in China in the next three years are: to establish safe and sound public health emergency mechanism and develop diseases prevention and control system as well as monitoring and administration system for public health activities. In the next stage, we will improve basic health care system in urban area, primary health care system in rural area, national public health system and its financing channels so as to meet basic health needs of the Chinese people and continuously improve their health status.

It is the prime duty and top priority for health administration authorities to work well and build up their abilities in dealing with unexpected public health catastrophes. In the near future, health authorities will take the following tasks seriously.

(1) Making Protocol for public health emergency

With past experience and lessons in mind, health authorities at all levels must work out their protocol for public health emergency, including the establishment of an unified health event command, through which instructions are promptly delivered, responsibilities are clearly divided, all reactions are in time and efficiency guaranteed. To this end, we have formulated such programs as “National Protocol for Public Health Emergency” and “Protocol for the Prevention and Control of Potential Future SARS Cases”.

(2) Establishing an Unblocked Information Network for Epidemic Situation

With the help of modern information technology, health authorities at all levels must establish a unified, efficient, rapid and accurate reporting system for unexpected public health catastrophes or epidemic situation on a national scale. Disease prevention and control institutions at all levels must be able to get easy access to both national and local medical networks. The Ministry of Health will highlight the development of national health information platform and data base, and help local health authorities to improve their health information networking so that a national epidemic information network can be established by the end of the year. Meanwhile, the Ministry must also develop a information system to inform the public if necessary. In doing so, it strengthens the prevention awareness for the epidemic and urges local authorities to take active measures.

(3) Establishing and Developing Disease Prevention and Control System

In the light of Chinese situation, an appropriate national system for the prevention and control of diseases will be established through such measures as the identification and division of functions and responsibilities; deepening of the institutional reform; streamlining the workforce; building up sufficient and qualified professional team; and ensuring the necessary funds. The functions and responsibilities of disease prevention and control institution are explicated with optimization of personnel structure and implementation of public recruitment for positions and personnel allocation system to improve professional personnel team. Personnel funding and operation funding are truly guaranteed.

(4) Establishing Emergency Medical Treatment System

Emergency medical centers will be established in every municipalities directly under the administration of the central government, provincial capitals and prefecture cities. The emergency room of every hospital in these cities is embraced into city emergency medical treatment system. At the same time, every municipality and provincial capital will choose one

general hospital as a designated contagious disease hospital or reserve one for the same purpose as soon as some expansion and reconstruction work is done. An infectious disease hospital or a reserved one is also needed for all prefecture cities. As for county hospitals, an infectious disease division and a quarantined area must be provided.

(5) Establishing an Emergency Medical Treatment Team

Every provincial capital and prefecture city in China must set up a high-quality competent medical team composed of disease prevention and control professionals with the background of either Chinese traditional medicine or Western medicine, and rich in clinic and field experience. The Ministry of Public Health will collect the information on all emergency medical teams and establish a talents reservoir for handling of unexpected public health catastrophes. If necessary, the Ministry will pick up relevant specialists to form a national task force to provide inter-province support.

(6) Enhancing International Exchange and Cooperation

International exchange and cooperation plays an important role in the prevention and control of the SARS epidemic. Whereas in the process of the establishment and development of a good public health system and health emergency mechanism, it is also of great significance for us to learn from the well established foreign procedures and practices.

Distinguished guests, friends, the Chinese Government is a highly responsible government, and the Chinese people are intelligent and brave people. We have full confidence in the great course we are engaged in, and we firmly believe that we can successfully meet every challenge imposed by any kinds of diseases and public health emergency.

“Walk the Talk”: BASF in China

Dr. Diebmar Nissen
President , BASF East Asia Regional Headquarters of Germany

Oct. 30, 2003

BASF

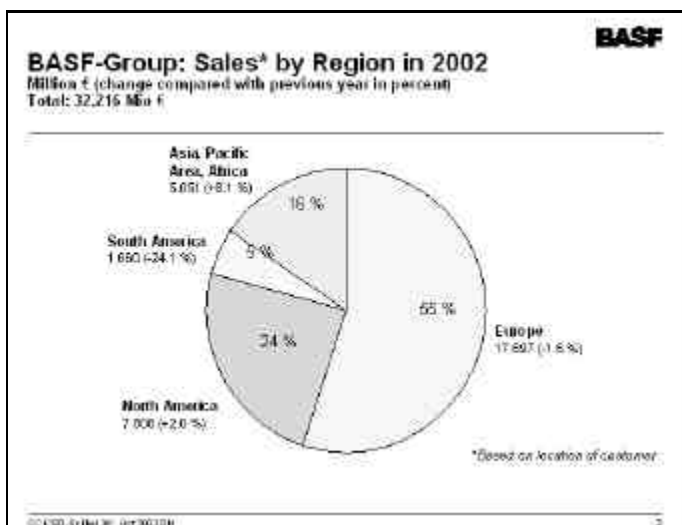
“Walk the Talk”: BASF in China



BPS Nanjing, July 2003

Dr. Dietmar Nissen
President, BASF East Asia Regional Headquarters

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BASF

BASF in Greater China

○ Production
● Sales offices
● Projects in progress

Sales Performance
2002: 1.4bn Euros
Employees: 2,800

10 wholly-owned & 7 joint ventures

Major Projects in
Nanjing 2.9bn USD
Caojing ca.1bn USD
(on stream 2005/2006)

BASF is the leading foreign chemical investor in China

CCC ED, Beijing 30th Oct 2003 DN 3

BASF

BASF's Commitment to Sustainable Development

- Member of the Global Compact

- Membership of the World Business Council for Sustainable Development (WBCSD)


- Committed to Responsible Care[®]

- Listed in Dow Jones Sustainability Index and FTSE4Good Index

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BASF

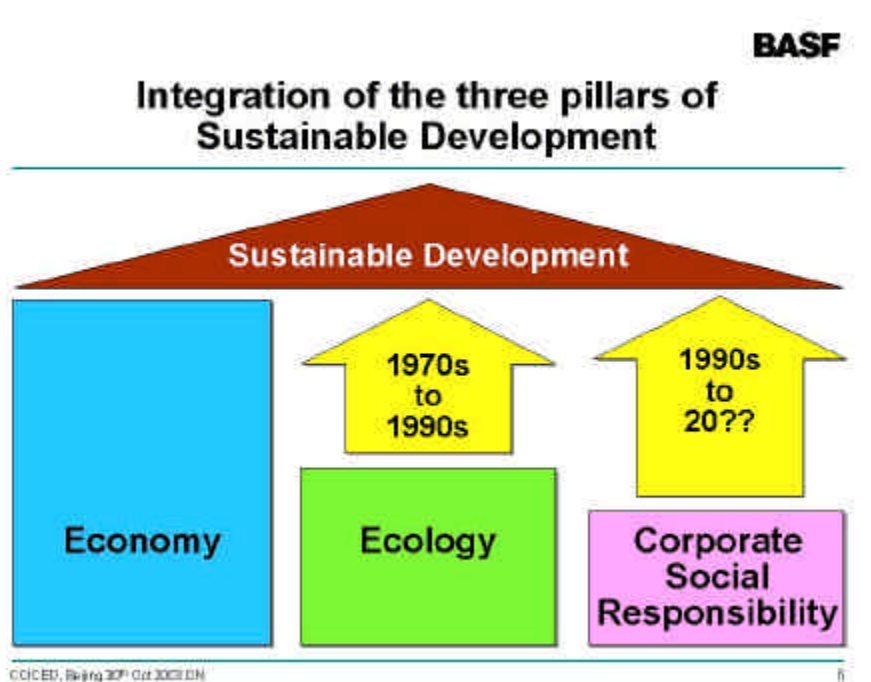
BASF has established SD as one of its 6 Values and Principles

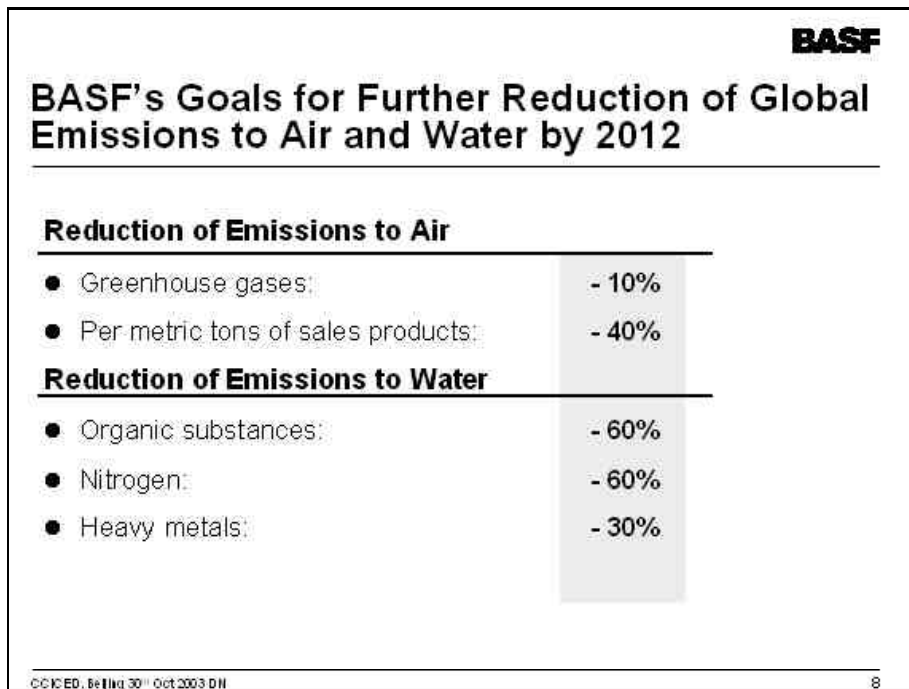
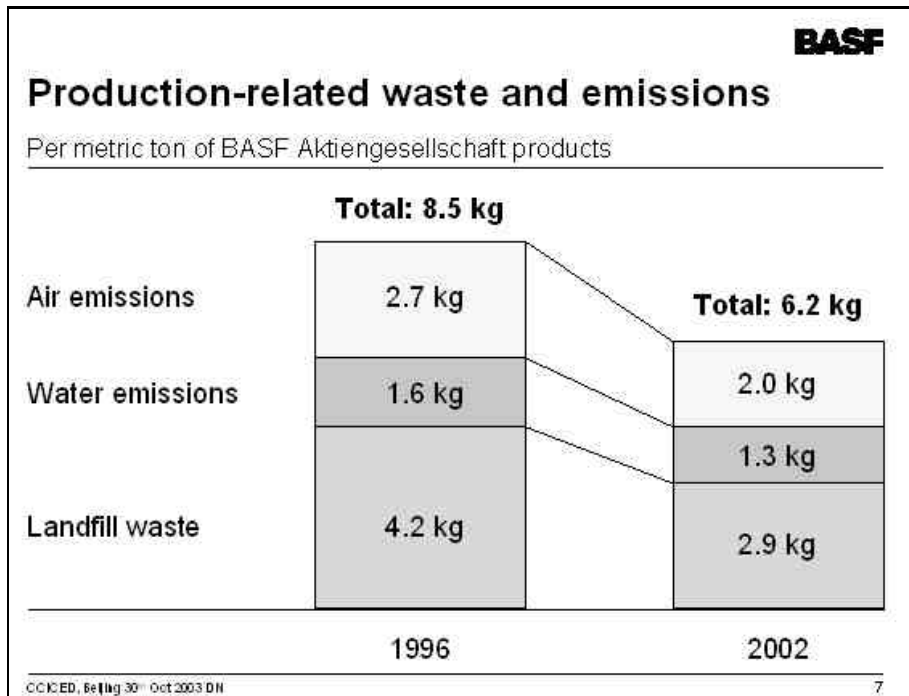


- **Sustainable Profitable Performance:**
 - Ongoing profitable performance in the sense of Sustainable Development is the basic requirement for all of our activities.
 - We are committed to the interests of our customers, shareholders and employees and assume a responsibility towards society.

CCICED, Beijing 30th Oct. 2003.DH

5





BASF

Eco-friendly process for Styropor® (expanded polystyrene foam for insulation)




- New agent used to stabilize Styropor beads
- Amount of wastewater reduced by 30 %
- Organic burden in wastewater reduced by 80 – 90 %
- First company outside of Ludwigshafen to implement the new process: Yangzi BASF Styrenics, Nanjing, 1999

CCICED, Beijing 30th Oct 2003 DH 9

BASF

Energy savings through thermal insulation with Styropor®



- BASF produces Styropor in Nanjing → cost efficient material for housing insulation
- In a single family home insulated with Styropor, 1,900 liters of heating oil can be saved per year
- To produce the Styropor needed, only 700 liters are used one time
- Joint project with Nanjing city for energy conservation by Styropor insulation

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BASF

Keropor® (“快乐跑”) fuel additives Seminar in Beijing



- In 2003 gasoline additives become legal requirement in China
- 50 participants from government authorities and organizations benefited from BASF's knowledge
- BASF is ready to support Sustainable Development in China

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11

BASF

Social responsibility of BASF in China: Employees, customers, suppliers



- 2,600 employees today
→ another 2,300 jobs until 2005
- Generation of “secondary” jobs in local environment
- Training, personal development
→ management competence in the region
- Customer education according to Responsible Care®
- Supplier audits
→ offer training, if standards unsatisfactory

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BASF

BASF in Pudong: “Most appreciated employer for the Staff” and “Model Corporate Citizen”



BASF is one of 15 foreign invested and private companies in Pudong that are most appreciated by the staff in 2003.

Reward for:

- Outstanding working conditions, social benefits and personal development opportunities
- Outstanding profitability, environmental and safety track records and contributions to local communities



CCICED, Beijing 30th Oct 2003 DN

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BASF

Social responsibility of BASF in China: Reaching out to the academic community



6 years BASF Sino
German Research &
Development Fund

It sponsors
Research projects and
Scholarships

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Social Responsibility

Kid's Lab of BASF in Beijing, Nanjing and Shanghai



- Concept proprietary to BASF
- First overseas implementation
- Hands-on experience with chemistry for 10,000 Chinese children (as of Oct. 30, 2003)
- Experiments illustrate environmental protection

Take the New Type Industrial Road and Construct Green Ecological Angang Group

Liu Jie
President of Anshan Iron And Steel Group

Oct. 30, 2003

In year of 2002, Anshan city became the Second “National Sanitation City” after the First one of Dalian City in Northeast of China. The expert in China Patriotic Health Campaign Expert Conclusion Committee pointed: “Anshan Iron and Steel Group (Angang Group) made a very good connection between the enterprise revamping and the overall control of the whole city environment. It increased efficiently the comprehensive prevention ability of the city pollution and the city function and make an outstanding contribution for the city to establish the work to be the national sanitation city and the increasing of the city’s comprehensive sanitation level.”

Since the “Ninth Five-Year Plan”, Angang Group made the large-size technical revamping work according to the requirement of walking on the way of new type of industrial road to look for the further potential of energy-saving and consumption-decreasing, strengthen the pollution prevention, utilize the “three wastes” reasonably, carry out cleaner production, and take a way of energy -saving, consumption-decreasing, utilization of wastes, self-improving and well-cycling. The development of the enterprise makes a historical new breakthrough and got a very high appraisal as “new face taking the place of old view”. All the products of steel in Angang Group got the certificate of ISO 14000 Environmental Management System. The enterprise has been awarded with Garden Plants of Liaoning Province.

1. Clean out the backward production processing and technical equipment by means of technical revamping.

Normally the old enterprise is always with high energy-consumption, terrible pollution and poor marketing competition ability. It is closely related to the backward technical equipment and the production processing. The appearance of Angang Group 9 years before was with the following features:

- **More furnaces and fewer converters.** The output of steel made with the furnaces was 62.1 5 of the total amount, the metal recovery ratio could only get to 80%, large energy consumption

and terrible pollution.

- **More modeling casting + Primary Rolling, less continuous casting.** Modeling casting + primary rolling was 70% of the entire process, poor quality, high-energy consumption and heavy pollution.
- **Backward equipment.** Among the equipment of the production, the equipment with-ness or clean-out occupied 80%, and the semi-continuous mill that produced nearly half of the total output of steel section was the equipment provided by the ex-Russia during the time of 50's in the Twentieth Century.
- **Lower Grade of the Product.** The product that could get to the international level was only 6%, and 69% of the product could get to the national standard level. The backward product was 25%.
- **Unreasonable structure of the product.** Less plate section or tube section. They were only 40% of the total; the bar section was 60%.
- **More primary level and less further processing product.** There were 2 million tons of slabs, and 4.8 tons of primary section, 900 000 tons of cold mill plate and 0 ton of color coated sheet.

In this case we can imagine that the enterprise problems with high energy-consumption and the heavy pollution could not be solved without increasing the strength of technical revamping. Otherwise the marketing competition could not be increased very easily.

Since “Ninth Five-Year Plan”, Angang Group has kept utilizing the high and advanced technology and the applicable technique to make the revamping work for the traditional production. The new road of “Higher Starting Point, Less Investment, Quicker Output and More Profit” is the technical revamping way for the old enterprises. This way not only increases the level of the product, improves the variety structure, enlarges the production size and makes Angang Group as the second “ten thousand tons of output” iron and steel enterprise, but also makes the energy-saving, environmental protection and achieves the “double increases” of both the economic profit and social benefit.

(1) The technical revamping projects during the “Ninth Five-year Plan” Period and the result of the energy-saving and the environmental protection

During the Ninth Five-Year Plan period, firstly we focused on the revamping work of the main final production processing flow part of well steel making and well rolling mill. During the Ninth Five-Year Plan, the investment of the environmental protection was 930 million Yuan and this investment was 7% of the total technical revamping investment for the Ninth Five-year Plan.

- **For the blast furnace, the new technique of coal blowing was used for energy-saving and consumption-decreasing.** We utilized technique of the basic-speed grinding and fine power coal collection with one machine. This technique increased the coal blower ratio of the blast furnace further more and decreased the amount of the coke into the furnace. The coke ratio into the furnace in 2002 decreased by 87 kg / t than that in 1995. In this case, it decreased the production

of the dust and the sulphur dioxide and it also saved the energy.

· **Clean out the process of furnace and the entire process of steel-making was with converter.** The feature of steel-making with furnace is high energy-consumption, low profit, and terribly heavy pollution. Especially the secondary dust and smoke going out of the workshop affected the quality of the air terribly. We cleaned out 5.30 million tons of furnace steel and built 6 sets of modernized converters. The steel-making with converter will decrease the cost by 95 Yuan per ton compared with steel-making with furnace. Since this project utilized some new technology like secondary dust collection, bulk material screening, new-type of oxygen gun positioning structure, and all the basic parameters such as the parameters of oxygen gun, weighing, boiler and dust and smoking cleaning etc. were controlled by the computer. 2.65 billion cubic meters of out-going air wastes were decreased per year. 18 thousand tons of dust drainage were decreased. Therefore, the pollution of steel-making was under the permanent control. For example: After the converter took the place of the furnace for No.2 steel-making works, the energy-consumption was decreased greatly and the environmental protection profit was very obvious. The steel output of this Works was increased from 2.75 million tons / year before the revamping to 3.26 million tons / year in 2002. However, the total energy-consumption was decreased by 52.9%, and the fuel-consumption was decreased by 52.6%. The dust and smoke (ash) in this Works is decreased 89.5% per year; the sulphur dioxide was decreased by 91.1%; and the solid wastes comprehensive utilization gets to 100%.

· **Clean out the modeling casting, and make the completely continuous casting in process.** The process of modeling casting is with high energy-consumption, poor profit, and serious pollution. The proportion of continuous casting in Angang Group in 1994 was only 24.88%. At the end of 2000, the entire line was with continuous casting process. Compared with the modeling casting, the cost of continuous casting can be decreased by 200 Yuan per ton. For the process of continuous casting project, we utilized the technology like roll gap automatic monitoring and measuring and the roll line with fine rollers, multi-point bending and multi-straightening, air-mist secondary cooling, hot charging and hot discharging for the continuous casting bloom etc. In this way, the polluted material drainage was decreased greatly. In No. 1 Steel-making Works, the dust and the smoke (ash) and the sulphur dioxide total drainage amount was respectively decreased by 1 058.88 tons and 1 620.09 tons per year by means of the measurements like increasing the continuous casting ratio, parts of continuous casting slabs with high temperature hot charging rolling, revamping the production process, decreasing the waste drainage and the steel-making energy-consumption in the sequence, cleaning out the backward production equipment etc. After the entire line was with complete continuous casting process in this Works, the ex-silicon sheet Works, the Primary Rolling Mill with high energy-consumption and wastes drainage, the ex-small size of No. 1 workshop etc were cleaned out. 86 700 tons of standard coal of consumption was decreased among the annual total energy-consumption.

· **Three short-circuit processing flow production lines with the international first-class were built. 1780 hot strip mill production line** was with the latest and most advanced hot strip

mill technology including energy saving and environmental protection technology. **1700 continuous casting and continuous rolling mill production line** is a short processing flow line composed of the sheet slab continuous caster, two stepped reheating furnaces, two sets of roughing mill stands and six finishing mill stands. Because a series of international advanced processing technology such as the advanced short processing flow compact layout, hot discharging and directly charging technology etc. are used in this line, the energy-consumption, material-consumption and all kinds of pollution drainages are decreased greatly. In 2002, the fuel consumption was decreased by 23 000 tons of standard coal / year compared with the consumption before the revamping work.; the drainage of the waste water was decreased by 2.16 million tons and as a matter of fact, the drainage of the waste water is zero. **The acid pickled-mill stand combined unit** utilized the hydrochloric acid process to take the place of sulphuric acid one and this process was combined with the five sets of mill stands to make an acid pickled-mill stands unit. In this way, it not only decreased the pollution material and the wastewater drainage amount during the processing, but also increased the product quality and the production ability. It saved the energy, decreased the consumption and decreased the pollution too. In 2002, the unit consumption of the acid pickled-mill stands combination unit was decreased by 76.8 kg standard coal / ton of steel compared to that before the revamping work.

(2) The technical revamping projects during the Tenth Five-year Plan Period and the result of the energy-saving and the environmental protection.

Under the condition with pay-back of the entire investment for the Ninth Five-Year Plan projects and the accumulated capitals, during the Tenth Five-year Plan Period, the revamping for the pre-iron - making and after rolling was done to improve the technical process before the iron-making and improve the further processing ability of the steel section.

- **In the mine, the revamping for increasing the content of iron and decreasing the silicon content was done.** The quality of the iron into the furnace in 2002 was increased by 3.5% compared to the one in 1995. Each percentage point increased for the iron grade into the furnace will decrease the slag amount by 30 ~ 40kg / t of iron and 50% of gas ash of the blast furnace. After the revamping project for increasing iron and decreasing-silicon, the iron consumption for the blast furnace was decreased by 99 kg / t of iron.

- **Clean out the hot sintering process, and make the cold sintering product ratio with 100%.** 8 sets of 90 m² sintering machines with hot sintering ability of 15.61 million tons altogether were cleaned out and two sets of 360 m² sintering machines were built to produce the sintering product. It not only optimized the charging material structure in the blast furnace, but also made the dust drainage amount decreased by 78.2% per year.

- **New No.1 Blast furnace project.** After the New No.1 blast furnace with 3200 m³ was put into production, it not only made the technical equipment for the iron-making system in Angang Group get to the advanced level in China, but also made a permanent control of the problem of iron-making causing the environmental pollution. This project utilized the latest advanced technology home and

abroad, firstly, in the production process, it is with high efficiency, good quality, energy-efficiency and decreasing pollution and this made the indexes for material-consumption, energy-consumption and water-consumption get to the advanced level home and abroad; we also took the reliable and perfect final end of control measurements to do the control for the entire processing pollution and make the output-increasing and pollution-decreasing. The major clean production technology we utilized include: entire computerized automatic control, trained cage eccentric discharging type of bell-less top of blast furnace, high-pressure operation technology, power-generating technology with the extrapressure on the top of the blast furnace, blast furnace rich oxygen coal blowing technology, extraheat utilization technology of the hot stoves, high air temperature operation technology, sintering product graded to charge into the blast furnace, the recovery of the small -piece of coke and the new technology of mix-charging of iron into the blast furnace, INBA slag granulation treatment technology, new technology of end control and water-saving technology etc.

· **Two sets of 55-bore 6-meter coke oven and equipped dry-extinguishing coke project.** No. 1 coke oven will be put into production in October of this year and No.2 coke oven is planned to put into production in December of this year. The dry-extinguishing coke project is scheduled to put into production in 2005. At the same time, we will equip dust collecting of coke oven charging and coke pushing to control the dust of the coke oven and the poisonous and harmful dust. The environmental protection equipment of the coke oven will decrease the dust by 896 tons per year, 170 tons of poisonous and harmful air such as sulphur dioxide etc; the environmental protection equipment of the dry-extinguishing coke project will decrease the dust by 912 tons per year and 350 tons of poisonous and harmful air such as sulphur dioxide etc.

· **Short processing flow of high-speed heavy rail production line.** This production line is the first short processing flow of high-speed heavy rail continuous casting and continuous rolling mill production line home and abroad. We imported the rail universal mill from SMS in Germany and the international advanced level of horizontal and vertical combined straightener and four-end straightener. The production line not only has the ability to produce high-speed and high strength heavy rail of 50 meters long and 300 kilometers / hour, but also can produce H section of steel product with middle and small size and this increased the competition ability of the section steel in the market for Angang Group. Since it was put into the production, the unit consumption of this production line had been decreased by 7 kg standard coal / t of steel and 7.5 tons per ton of steel for new water consumption compared to that before the revamping. The new water consumption is zero.

· **The revamping work of central power-station boiler in No. 1 Power Works.** The 220 tons / hour pure combustion of blast furnace gas boiler is scheduled to take the place of the present 11 sets of oil and coal fuel small boilers. This will decrease the dust by 10 000 tons / year and 4800 tons / year of sulphur dioxide. No. 1 boiler is planned to put into production at the end of March next year and the No. 2 boiler is scheduled to put into production in June next year. For this project, the recovery of blast furnace gas per hour will be 200 000 cubic meters. And 105,800 tons of standard coal will be saved every year.

Since the “Ninth Five-Year Plan”, all the energy-saving environmental projects that have been carried out have achieved very obvious results. The energy consumption of unit steel was decreased by 13.6% in 2002 compared to that in 1997, and the new water consumption of unit steel was decreased from 29.5 tons before to the present 16 tons. The industrial dust and smoke drainage in 2002 was decreased by 34% compared to in 1995.

2. The reasonable utilization of the industrial “Three Wastes”.

Since the “Ninth Five-Year Plan”, Angang Group has established more than 40 “three wastes (wastewater, waste smoke, waste slag) comprehensive utilization projects such as slag development, fully recycling of the gassy slurry and converter gas, recycling utilization of the extra heat and water resource, powder metallurgy and construction material. The industrial “three wastes” is treated with resource utilization.

(1) Increasing the water resource utilization ratio

- **The biggest wastewater treatment Works of China in western ditch was established.** The daily treatment amount is 220 000 tons and the water quality after the treatment gets to the standard of clean water circulation. The daily recycling of circulating water is 168 000 cubic meters.

- **Revamp and improve the wastewater treatment Works in northern ditch.** The daily treatment ability is increased by 40 800 tons.

- **In the Heavy Plate Mill Works and the Rod Section Works, the falling-down water after the rolling recycling project was carried out.** This made zero drainage of the “wastewater”. In the heavy plate mill works, the falling down water was decreased by 400 m³/ hour, and in the rod section works, it was decreased by 180 m³/ hour.

- **Revamp the biological wastewater treatment system of the General Chemical and industrial Works.** The measures for the nitrogen and ammonia treatment were taken. At present it is under the construction. After the project is put into production, it will make the content of nitrogen and ammonia in the water decrease by 245 milligram / liter, and the water after the treatment can be used for other multi-application such as dust collection etc.

In 2002, the output of steel got to 10.0665 million tons and it was increased by 17.03% compared to that in 1996. But the total water consumption was decreased by 12.96%; and the wastewater drainage amount was decreased by 51.1%. At present, the water circulating utilization ratio gets to 91% and the new water consumption of unit steel is decreased greatly.

(2) Utilize the secondary resource efficiently and decrease the air pollution

- **In No. 1 steel-making works, the steel-making was done with minus energy.** In January and February of this year, the energy consumption of NO. 1 steel-making works was 32.85 kg / t of steel (the steam recovery was 15.45 kg / t of steel, and gas recycling was 20.32 kg / t of steel), the recovery of secondary energy was more than the energy consumption of steel-making with converters and this is what we called minus energy steel-making. This index in China was in the

top level of the similar converters.

- **One set of converter gas recovery system with 80 000 cubic meters was established.** The converter gas recovery in No. 1 and No. 2 steel-making works was done and used for the reheating furnaces in 1780, 1700, medium sheet and middle size of rolling mill sequence and this ended the history of converter gas releasing of Angang Group. It not only saved the energy equivalent to 46,700 tons of standard coal / year, but also decrease the air pollution caused by the gas releasing combustion. The annual economic profit is more than 20 million Yuan.

- **The differential pressure of No. 11 blast furnace gas was utilized for generation.** One new set of TRT extra pressure generation system was built. And in 2002 the generation amount was 33.75 million KW and it is equivalent to saving 5734 tons of standard coal / year. The annual economic profit is more than 17 million Yuan.

- **The project of heavy oil fuel taken place by gas fuel was done.** The oil fuel was changed with gas for the reheating furnaces in heavy plate mill works, rod section works, seamless tube works and Lingshan Forging Works and two sets of limekilns in the refractory corporation. This decreased the heavy oil fuel consumption and efficiently decreased the environmental pollution. The annual comprehensive economic profit was more than 100 million Yuan.

(3) The circulation utilization of the solid wastes

A Large amount of solid wastes are produced with the production processing of iron and steel enterprises. These solid wastes pollute the environment and occupy the field. If they could be circulated to use, then the wastes can be changed to source and energy. This not only can decrease the environmental pollution, but also can increase the economic profit.

- **Treatment production for the steel slag.** 240 tons of steel slag treatment production line imported with German technique will make a treatment to the steel slag with iron-concentration. The steel slag with concentrated high grade of iron will be sent back to the raw material production system. This will save 150 000 tons of sintering material each year. This production line not only makes 100% of treatment for the new slag steel, but also makes the treatment for the piled slag for years.

- **The project of fine slag powder.** One production line of fine slag powder production line with annual output of 600 000 tons was established. The annual profit gets to 24 million Yuan. At the same time, one slag cement production line of 450 000 tons of annual output was established as well. The annual profit gets to 10 million Yuan.

- **Corporate with Jidong Cement Co. Ltd to establish cement clinker aggregate production line of joint venture.** In this line, we utilized 1.4 million tons of cement clinker aggregate with the generation dust ash, limestone screen underflow and slag etc. as the raw material.

With the measurements mentioned above, slag, blast furnace slurry, converter slurry, rolling mill slurry and the material with iron content etc. were circulated to utilize. The utilization ratio gets to 89.1%.

Since the “Ninth Five-Year Plan”, Angang Group has established 1109 sets of environmental protection facilities. Among them, there are 904 sets of smoke and dust treatment facilities, 87 sets of water treatment facilities, 87 sets of noise treatment facilities, and 31 sets of other facilities. Under the condition of steel output increasing, the amount of industrial smoke (dust) --releasing, oil pollution material in the drainage of wastewater and the suspending material drainage were decreased year after year. In 2002, the industrial smoke (dust)-releasing was decreased by 54 000 tons compared to in 1995, 10 000 tons of sulphur dioxide was decreased, and the oil pollution material and the suspending material drainage was respectively decreased by 34.5% and 52.2%.

3. Ecological environment recovery and rebuilding

(1) Mining Replanting

Angang Group owns 6 large-size of mines and has the production ability with 33 million tons of annual iron ore. Because of long time of mining, more than 2500 hectares of rock removal field and more than 1700 hectares of tailings dam were formed all-round the city. In order to prevent the soil erosion, decrease the effect on the environment and make the continuous development, Angang Group developed the mine and replanted it according to the spirit of “Mine Replanting, tree planting, mine beautifying and happiness creation for the young generation”.

- **The yellow mud after the stripping of the rock was used for covering on the top of the rock removal field.** The average thickness of the yellow mud is 3 meters.
- **Planting trees.** Till to the end of 2002, the replanting and greening area has been finished with 155 hectares and 600 000 trees have been planted.

By the way of replanting, the ecological environment has been protected and the enormous social profit was created and this also became the new economic increasing point of the mine. The fast-speed poplar trees that have been planted could make a direct economic profit of 23 million Yuan per year with the calculation format as 400 Yuan / m³.

(2) The greening and beautifying of the site of plant

- With the comprehensive control, from 1999 till now, the new increasing greening area is 2.112 million m² and there are 34 gardening greening land inside of the plant site with more than ten thousand square meters.
- Aiming to various pollution sources, we planted different kinds of arbor trees and bushes to improve the all-round environment. For example, we planted 1.37 million arbor trees such as pagoda trees and ginkgo (tree of heaven) that are anti-sulphur dioxide, dust prevention, and anti-chlorine etc. we planted 8.849 million bushes such as lilac, chrysanthemum etc. that could prevent sulphur dioxide, dust and smoke, hydrogen fluoride etc.
- Greening the Slag hills. On the slag hills, the new increasing greening area gets to 350 000

square meters and 100 000 arbor trees and 210 000 bushes have been planted. The small regional greening ecological environment has formed.

At present, the total area of greening land gets to 8.016 million square meters and the greening-covering rate reaches 33.4 %. This number is 12 percentage points more than that in 1998. In May of 2000, Angang Group was awarded with Gardening Plant in Liaoning Province.

With the development of greening, beautifying and replanting of the mine, the view of the plant site and the mine environment around of the city have been much more improved. Right now the present greening plants in the plant site could restrain the dust of 1 560 t/a, absorb 8064 tons of carbon dioxide each year and releasing oxygen of 8 240 t/a. This made the air quality of Anshan city improve a lot.

4. Develop the circular economy

The circular economy is basically a kind of ecological economy with continuous development. It requires restructuring the economy system according to the natural ecological system material cycling and the energy flow principle. The purpose for it is to make the economic system to be melted with the material cycling process of the nature ecological system in harmony.

With the revamping work and the development of the “Ninth Five-Year Plan”, Angang Group owns the basis of developing circular economy in principle. In 2002, the government of Liaoning Province approved Angang Group as the sample enterprise of developing the circular economy. Angang Group has made up and carried out the “General Schedule of Constructing the Cycling Economy Sample Enterprise” to establish a circular economic enterprise in 2010.

(1) “3R” Principle of circular economy

- Reduce: Reduce the resource employed/utilized and the target is to reduce the material amount that comes into the production and consumption.
- Reuse: processing control. The target is to increase the utilization efficiency of the product and the service.
- Recycle: turn the wastes into source to reduce the handling load at the end of pollution control.

(2) Major measurements and methods

- With the utilization of new process and the new technology to simplify, compact, expand and continue of the production process. Reduce the amount of material and resource of energy to come into the production process and make “Higher Starting Point, Less Investment, Quicker Output and More Profit”.
- Optimize the material structure of blast furnace to increase the level of concentrates. Reduce the source employed/utilized and clean the process and product.

- Strengthen the culurous use of the resource and the secondary resource of the wastes. The importance is to solve the problem of using the industrial wastes with high value and the secondary resource of fine coal ash and the tailings.
- Utilize the no-harm or low-harm new process and the new technology. Eliminate the releasing wastes in the production process. Those wastes are brought out from the steel production and cause the environmental pollution.
- Establish scientific management system and strengthen the management of energy, water, environmental protection and recycle the wastes.
- Make Angang Group as the center to establish the regional ecological industrial garden with the close connection for steel product with the relative circles like chemical petroleum, construction material, and resource etc. and the social life sharing resource, mutual control of the drainage wastes, mutual recycling utilization of secondary resource etc.

(3) Target of Development

In 2010, the steel output will be increased from the present 10 million tons to 16 million tons and Angang Group will become a modern plate section concentrate base with international marketing competition ability.

- Increase the iron resource utilization efficiency and reduce the environment loading. The self-production mine consumption will be decreased from 850 kg / t in 2002 to 578 kg / t.
- Reduce the energy consumption. The unit steel comparable consumption will be decreased from 871.8 kgce / t in 2002 to 678.2 kgce / t.
- Utilize the industrial water in an enclosed circuit and make the wastewater “zero drainage”. The recycling rate of water will be increased from 91.5 % in 2002 to 94.2%.
- Make the solid wastes as the secondary resource and make it as the new economic increasing point. The comprehensive utilization rate of the solid wastes (not including the tailings) will be increased from 89.1 % in 2002 to 95.9 %.
- Increase the greening-covering rate in the plant site. It will be increased from 32.42% in 2002 to 35%.

By means of developing the recycling economy, we will keep walking on the new-type of industrial way raised in the Sixteenth People’s Representative Conference — “high scientific and technical content, good economic profit, low resource of consumption, less environmental pollution and the advantage of talent resource is completely developed”. We will make the target of constructing the green ecological Angang Group to promote the harmonious development of our economy, society and environment and make new contribution share for establishing the “well-off” society.

Reports of Task Forces

Advancing Toward Sustainable Business Practices

Task Force on Enterprises' Development and Environment

Chinese Co-Chair: Zhang Yanning
International Co-Chair: Björn Stigson

Enterprise is the most important micro subject in national economy, while it is also the most major contributor to the environmental pollution load. Therefore, many of the environment protection issues will have to be studied and analyzed at the enterprise level, before the causes and contexts of the pollution problems be can be learned, so that the policies can be more specific and practical.

Task Force on Sustainable Industry Development and Environment was charged with identifying policy recommendations to energize and promote business progress toward more sustainable practices.

We reviewed four different industrial sectors during the work program: cement, oil refining, sugar, and pulp and paper. Separate studies were made comparing programs for small and medium enterprises (SMEs) in China with several other countries. The general approach taken was to collect current Chinese practice and best international practice in each sector. The pairs of sectors were then compared, and potential lessons drawn by analyzing the differences in performance between the two.

The large number of SMEs with out-dated technology in the industries that are easy to pollute the environment is one of the major sources in the current industrial pollution in China. It has been the difficulty in dealing with the environmental pollution problem of those SMEs because the treatment cost by the enterprises and monitoring cost by the environmental agency of government are comparatively high. Therefore, this TF has emphasized our study on the countermeasures to be taken against the environment pollution made by the SMEs this time. The concerns and recommendations related to strengthening sustainable business practices frequently cut across these related issues.

Overarching Themes

Despite the brief term of the Task Force, and the limited information made available, several overarching themes have emerged from these sector comparisons which appear common to all four sectors. We have identified these as five basic needs:

1. Business Scale

In the industries examined, we found that Chinese companies operate on a smaller scale than current international firms. The average cement plant in China produces less than 500 tonnes/day compared to a new world-class facility typically designed for 2 500-4 000 tonnes/day. The average Chinese refinery processes less than 50 000 BPD (with many processing less than 4000 BPD). Existing refineries outside of China have average capacities 2-3 times as great. More than 85% of China's paper mills have capacities of 10 000 tonnes/year, compared to a world average (excluding China) of nearly 80 000 tonnes/year.

Consequently most of the small size plants cannot compete economically because their costs per unit of output are spread over a smaller product output. In isolated regions, there may be little competition and this may not be so great a problem. In places where products are made for export (such as some cement) it would be difficult for Chinese plants to compete economically. Equally important, smaller plants cannot support significant environmental investments: They cannot support a staff size which might include experts in quality, control, and environmental matters. They are not able to support sufficient training, management development, and research. Their sales are not sufficient to support investments in efficiency.

This is not to say that "small is necessarily bad". Many small and medium-size enterprises (SMEs) function effectively in many businesses. However, for energy and capital-intensive industries manufacturing bulk commodity products (such as the four studied here) pressures for quality, low costs and well-managed environmental impacts encourage the use of large facilities or seek for more optimal mitigation of environmental impacts via, amongst others innovative collaborated action; e.g. combined treatment facilities for clusters of companies or more preventative via smart choices under an industrial ecology concept.

It is also not to say that "small associated facilities are not needed, even in these commodity industries", on the contrary because SME's are in many cases the motor of economic growth and innovation, also in China. In many industries (paper, cement, and petroleum are three) manufacturing is done in large, complex facilities, which offer the scale advantages noted previously. These facilities provide the energy intensive processing, and also contribute the major environmental impacts. But smaller facilities can be used for local blending, packaging, terminal and distribution services after bulk products are delivered from more centralized

manufacturing facilities. It appears this model could be expanded more fully in China, where currently weak infrastructure requires more local storage and handling for many products.

2. Strengthening Governance Frameworks

There appears to be a considerable gap between “theoretical” frameworks and their direct application to a business setting. Regulations, particularly those relating to Health, Safety and Environment exist, but their application and enforcement are far from adequate. Having laws without enforcement reduces their effectiveness and their value in providing a framework for acceptable behaviour. Added to this is the presence of corrupt practices in application of the rules such that some enterprises who are prepared to pay bribes to officials can avoid the much larger costs of abiding by the government’s requirements, thus distorting the competitive arena and damaging the environment. It is important that this practice and the perceptions of poor application of rules are eliminated. Doubtless this will take considerable time, and effort but it is a fundamental problem, and unless resolved, can indeed result in lack of foreign or local investment in sustainable development of industries and enterprises.

In the last thirty years, globally a complex mixture of systems and practices has evolved for governing the complex interactions between economic, environmental and social activities. These systems and practices define the “playing field” and “rules of the game” for enterprises in society. Most developed countries are now characterized by the kinds of systems and practices noted above. These are what China should learn, which will no doubt, help further define and level the “playing field” in China.

3. Key Performance Indicators (KPIs)

Enterprises have been simultaneously recording two opposing performances with their marching footsteps, which are “economic growth” and “environment destruction”. In this manner, it might be a wrong to define the “merits” and “faults”, from a single aspect, of “industrial civilization process” in the long history of human civilization. This demands us to search for a tool, on a new score, weighing in an objective and all-round way the ultimate contribution that an enterprise makes via production activities to the sustainable development of the society. Such a system must first be able to reach a full-scale understanding of the performance of enterprise activities. One area that appears particularly poorly connected to business performance in China is employee health and safety. Several standard measures are widely used internationally to track this, and would serve as useful benchmarks for their counterpart Chinese industries.

4. Need for Capacity Building

Despite much progress in China during the last 20 years, our Task Force found continuing, significant gaps in knowledge and implementation skills between Chinese and international business and government personnel at equivalent levels of responsibility in the areas of management, environment, and law. Both additional training and new delivery mechanisms are needed to speed up knowledge transfer and application.

The presence or absence of a functioning environmental industry (equipment suppliers and consulting/assessment services) is critical to increasing environmental protection in China. Without these native skills and services, environmental products may be too expensive and/or remote for common use.

Discussion and analysis of the SME-study

Our government and environment protection agencies have published many orders to severely punish the serious environmental pollution caused by some SMEs, either by fining or suspending or merger or even getting them closed down. All these measures, however, will be effective for a short period of time, and the pollution will come back again not long after. Therefore it seems that the administrative decrees can hardly cure the pollution although they can be effective for a period of time. We will have to make careful studies on the causes and difficulties of the pollution problem, before we can find a sustainable and effective measure to deal with it.

First of all, it must be clarified that the big cluster of the SMEs is an important supporting force for the development of our national economy, playing its irreplaceable role in employment, the support of economic growth, the promotion of specialized collaboration and division that will strengthen the competitiveness of our industries in the world and satisfying the diversified demands of our daily and economical activities. Hence, when we try to find the countermeasures in dealing with the environmental pollution caused by the SMEs, the compulsive closure orders can only be given to the minor enterprises that are proved to be serious pollution makers but have no way in their financial limitation to get the pollution controlled. While for the major SMEs, we have to try our best to find some way of economically feasible to deal with their pollution problem.

Secondly, as for the pollution control in the SMEs, the external monitoring (including that from the government, NGO, and public. In China, the role of the government is obviously more important.) is an important precondition. Without the external monitoring, there will be no driving force for them to pay the cost for the pollution control. In the past, the Centering Our Work Around The Economical Construction has been too much emphasized, which has led to a tendency of Judging a Success or Failure By GDP when we examine the performance of a local government. It is the factual inducement for the local government to neglect, or even ignoring the monitoring of the environment protection that has, in fact, indulged the enterprises' polluting activities, in order to maximize the local economical development at all costs.

Thirdly, in view of technical economy, there are actually some difficulties for the SMEs to handle the pollution treatment, including the low production capacity (less than half of their

pollution treatment facilities can meet the requirement of economical operation scale), and the short average survival period of 5-7 year, difficult to be funded for the investment on their pollution treatment facilities, unavailability of human resources and fund to keep the normal operation of the pollution treatment facilities.

Fourth, “local protectionism” has become one of the most common obstacles inhibiting the implementation of bans for pollution treatment. Taking account of requirements for environmental protection, it is very natural to close or halt the operation of a number of small enterprises that are sources of serious pollutions. But in the perspective of local governments, sudden closure of a good many small enterprises will not only seriously cut down local financial revenues and create practical troubles that are hard to get over temporarily, but will compel large amounts of labor force to run out of work, triggering off social problems in some areas and, in grave circumstances, jeopardizing social stability. To date, the Central Government keeps stressing that stability is an overwhelming task. Consequently, local governments must pay greater forethought on the relations of pollution treatment and social stability, compared with environment protection administrations with more candid objectives. This might be a deep-seated element for the existence of local protectionism. Accordingly, we must take earnest measures on policies to harmonize inconsistencies and realize win-win objective for the two. Otherwise, efforts in honor of needs and benefits of any of the two will hardly make the best of both worlds.

Policy Recommendations

1. By policy tools of market mechanism, encourage the enterprises of energy and capital intensive, which have big influence on the environment, to be restructured within the industries in order to obtain the benefit of scale of economy.

This should focus on energy- and capital-intensive industries producing bulk commodity products. These industries have major, lasting environmental impacts, which cannot be managed well in small-scale facilities. As for the producers of bulk commodities that are energy and funds intensive, support should be given to the relatively large enterprises to encourage the technical upgrading and transformation so as to improve their competitiveness, and encourage them to solve the existence problem of some of the small enterprises and the employment by merger and restructuring. On the policy level, economic measures and competition shall be more considered, letting the market mechanism of superior survival and inferior elimination to fundamentally handle the pollution problem caused by the small enterprises, not relying solely upon the administrative orders which are proved to be a failure in dealing with the problem.

Such restructurings must necessarily consider a wide variety of factors, including:

- ❖ Widespread use of quality and performance standards for major industry sectors,

including appropriate timeframes for industries to make improvements.

- ❖ Consolidation of energy-intensive manufacturing activities in fewer larger facilities, taking advantage of economies of scale and their ability to spread necessary environmental costs over a larger product base.¹
- ❖ With necessary re-education and training programs, preserving local employment when facilities are closed by using portions of smaller facilities to serve as local centers for operations downstream of manufacturing: grinding, packaging, blending, storage and distribution.
- ❖ Features which will enhance the attractiveness to private-sector foreign joint venture partners for participating in restructuring.

2. Develop strategy, tactics and institutional capacity for improving performance of SMEs.

Small and medium enterprises in both developed countries and in China must be managed in very different ways than large companies. Any system for dealing with SME's must include elements that are:

(1) Promoting centralized pollution treatment of the SMEs. Now that it is difficult to get the pollution treatment facilities by single SME to satisfy the economic operation scale requirement, measures shall be taken to move the SMEs into industrial parks so as to get the pollutants produced by the SMEs to be centrally treated. The practice in Zhejiang province demonstrates that in areas where the industrial cluster is formed, the mode of central treatment, by which one treatment enterprise can supply specialized pollution treatment services to many the SMEs, is an effective solution to the problem of not being able to reach scale of economy for a single small enterprise to deal the pollution problem by its own who is lack of necessary fund and technologies.

(2) The establishment of specialized companies with environmental protection facility operation certificate is a necessary system innovation. The establishment of specialized pollution treatment companies will lead to market-based operation of pollution treatment facilities. Here, market-based operation has three implications: First, pollution treatment enterprises and pollution discharging enterprises set up such a relationship as service providers and buyers. Second, pollution treatment enterprises and operating companies assume sole responsibilities for their profits or losses. Third, pollution treatment enterprises and operating companies must compete with each other as candidate service suppliers on the market. However,

¹ For example China has recently announced that it will raise the threshold size of permitted cement plants to 2000 tonnes per day, and continue to encourage consolidation among smaller plants. (Lexis-Nexis, 20 August, 2003). The government continues to encourage the formation of large industrial groups in sugar making, and electronics.

at the present time, pollution treatment enterprises are more or less in a monopoly situation. Since pollution discharge prices are approved and checked by the government, the implementation of the scheme demands for policy support and supervision from the government. The government must ensure that private investments are rewarded reasonably and, meanwhile, such efforts do not create additional burdens to pollution discharge enterprises. As the government is confined with limited fiscal capacity, such a scheme of inviting and profiting private capital in pollution treatment virtually resembles subsidizing loan discount interests to pollution treatment enterprises with national finance.

(3) As for SMEs of resources processing, comprehensive utilization of the “3 wastes” shall be strongly promoted in order to minimize the wastes discharge. This suggestion is made because that the resources processing enterprises produce large quantity of the “3 wastes”. The wastes will become pollutants if they are not recycled. They will become resources if they can be recycled. What is more, the comprehensive utilization of the “3 wastes” can usually bring us reasonably good economic benefit and win-win effect of economic benefit and environment benefits as long as proper technology is used. Guangxi Guitang Group has set us a successful example of the resources comprehensive utilization.

(4) Integrating the policies for the SMEs with the environment protection policies, so as to obtain a combined policy force. In China, policy system for the SMEs has formed its shape, and the socialized service system for SMEs, consisting of the SMEs service center, the SMEs credit guaranty center and productivity promotion center is now in construction. The policy goals for the SMEs, however, is quite simple, only focusing on how to support the establishment and development of the SMEs, with no interaction with the policies of environment protection. It is suggested, therefore, that the communication and cooperation shall be strengthened between the economic development department and environment protection agencies in the government, so as to effectively combine the policies for the SMEs and those for environment protection. For instance, projects related to the pollution treatment, cleaner production, waste comprehensive utilization and energy saving shall be clearly listed as key supported projects in the supporting policies for the SMEs, and supported in terms of financing guarantee, technical consultation and information supply and so on.

3. Strengthen Governance Frameworks

In the last thirty years, globally a complex mixture of systems and practices has evolved for governing the complex interactions between economic, environmental and social activities. These did not happen quickly and the details differ from place to place. There are, however, some common characteristics:

- ❖ A clear legal structure with adequate, consistent enforcement of laws and regulations at national and local levels provide specific Chinese examples for some of the following.

- ❖ Transparency and effectiveness in application of laws
- ❖ Public participation in rulemaking.
- ❖ Public reporting of health, safety, and environmental information by business and
- ❖ Active roles for trade and industry associations in assisting business understand and effectively manage environment, health and safety requirements
- ❖ Use environmental quality standards (ISO, EMAS, product specifications, etc.) and sectoral emission targets²
- ❖ Effective use of incentives and disincentives e.g. taxes, fines, “green” fees, and permit trading so that pollution reduction investments are less expensive than paying fines.³
- ❖ Integrate environmental success factors into economic evaluation of local government performance⁴

4. Develop Key Performance Indicators (KPIs) both for specific industries and for China’s key social, environmental and economic goals, so as to open up effective approaches for the government and whole society to understand and mutually supervise the process

Effective policy can only be built with an effective set of tools. It has been said many times that what is measured receives attention. This applies to sustainable development as well. Key Performance Indicators are one of those tools. It is strongly recommended that China develop and actively promote an appropriate set of performance indicators for critical industries that can then be used nationally and internationally for benchmarking, problem analysis and improvement. This demands that enterprises (at least “listed enterprises”) will not only submit Financial Statements to the government and society, but also Overall Reports of Enterprises for Sustainable Development. They include that these indicators may be used nationwide to evaluate management, analyze problems, and indicate improvement orientations. They mainly comprise such indicators as financial operation management status, production management efficiency, resources consumption, environment impacts, safety and health of staff workers and neighboring residents, and employment burdens.... In developed countries, increasingly more international-grade enterprises start to tap the measures of environment management accounting system (EMA), environment performance indicators and environment performance evaluation (EPI and EPE) to set up and promote the “performance indicator report system for sustainable development of enterprises”. It will facilitate us to measure more accurately costs of environment damages from

² In June, 2002, a new Cleaner Production Promotion Law was approved which went into effect on 1 January 2003.

³ At present local government has limited authority for enforcement. Pollution fines are limited to 10 000, 50 000 or 200 000 RMB (approx. \$1100 USD – 23 000 USD)-far below the investment cost for pollution control equipment. Should the Environmental Protection Bureau wish to close a polluting facility, this action must be approved by the local governor, Commerce Bureau, and Tax Bureau.

⁴ Since “economic development as center” has been emphasized without considering environmental protection equally, GDP has been the only criteria to judge performance of local government.

production activities and benefits from sustainable production. This has become one of the most essential ways for a country, a region or an enterprise to seek sustainable development.

Successful indicators would preferably be developed working jointly with industrial sectors to build meaningful, business relevant indicators that will be measured and tracked as a normal part of business operations. The sector studies provide some indicators that others have used for these particular industries.

In a business setting, successful indicators have common properties:

- ❖ They are simple to understand and explain
- ❖ They can be measured easily
- ❖ They are important to the ongoing health and operations of the business and its employees
- ❖ Their performance can be tracked over time

5. Give attention to both environment protection and local economic development

In order to avoid the passive results bringing by the compulsory indications, government'd better carrying out more flexible policies.

(1) The central government shall take policy measures to limit the impact of suspending and closing the polluting SMEs on the local finance revenue, such as fiscal subsidies, preferential taxation and so on.

(2) The enterprises that benefit from the technology upgrading and extension shall make some contribution to the local governments.

(3) SME's even require a tailored governance framework, and in order to keep the strength of this sector we have to allowing them *time to learn* to make a change-over to improved environmental standards while improving their economic conditions. The learning process is to be guided with a mix of instruments:

- ❖ set minimum standards that allow for the immediate closure of those facilities that have an unacceptable impact on the environment; unacceptable in terms of immediate danger to health and safety of people, and which cause irremediable damage; decisions to this effect should be transparent and openly publicized;
- ❖ set 'growing' standards (at increasingly higher levels) to be achieved over time, enforcement and compliance with these rules needs - in a learning-process - to become stricter over time (first check and advise; then penalties, then -if conditions remain unchanged- close down of facilities);
- ❖ break down the standards to clear sectoral targets for comparable industries in various

- sectors; determine priority sectors;
- ❖ create a level playing field: all rules are valid for all and enforcement is equal to all; enforcement decisions are clear, transparent and are published and made known to all; such ‘teaching-enforcement’ capabilities and capacity requires priority attention of the government
 - ❖ involve companies by providing fiscal/economic incentives for the installation of simple protective measures, expanding to incentives for the installment of cleaner technology; organize sectoral learning processes with the demonstration of improved practices and better technologies; provide cost-effective water treatment facilities; introduce waste collection structures and cost-effective waste treatment and recycling facilities;
 - ❖ involve companies by introducing an expanding scale of over time increasing pollution charges (to allow them to make their own marginal cost/benefit analysis);
 - ❖ involve companies by allowing them to relocate their business on favorable economic conditions under stricter new environmental rules (relocate to locations where they can cause less damage, or where the damage can be better controlled)
 - ❖ involve companies by organizing learning events for sectoral / regional better- to- best production practices; those successfully attending are eligible for economic incentives, and priority advisory services from enforcement staff

6. Speed up capacity building within a broad spectrum of business, management, legal systems, and social institutions.

Both additional training and new delivery mechanisms are needed to speed up knowledge transfer and application. In best-practice organizations, knowledge is shared between different operating units, making use of modern electronic delivery systems, and traditional management emphasis on problem solving. Some of the most successful organizations today are those that have mastered the difficult art of knowledge management. Training is used extensively to increase skills, introduce new ideas, solve old problems, implement new programs, identify new issues, and build teams. Areas where strengthening of existing Chinese systems would improve progress toward future sustainability include:

- ❖ Management training.
- ❖ Environmental knowledge and training
- ❖ Local environmental industry development
- ❖ Inspection and enforcement training
- ❖ Roles of business associations
- ❖ Community engagement training

Transforming Coal for Sustainability —A Strategy for China

Task Force on Energy Strategies and Technologies

Chinese Co-Chair: Ni Weidou
International Co-Chair: Thomas B. Johansson

Sep. 2003

The Three E's of Sustainable Development

In October 2002 the 16th Party Congress established the goal of expanding China's economy fourfold by 2020 and defined the Three E's strategy for Economic development, Energy security, and Environmental protection. In pursuing these goals, China's energy system cannot continue to expand using the current approach. The risks are that:

- ❖ China will become overly dependent on oil imports as a result of the rapidly growing demand for liquid fuels, especially in the transportation sector,
- ❖ Severe additional public health and environmental damages will occur in China with very large economic consequences (projected to grow from over 7% of GDP to 13% of GDP in 2020), and
- ❖ Climate change impacts will become significant, and China will not be able to make its contribution to mitigating greenhouse gas (GHG) emissions under the United Nations Framework Convention on Climate Change.¹

Can these risks be mitigated at reasonable cost? The answer is “yes”. This is based on specific technical analyses and modeling of China's integrated energy economy.² The Task Force on Energy Strategies and Technologies (TFEST) analyzed two alternative strategies, as shown in Figure 1 using Base case technologies and Advanced case technologies through 2050. The

¹ China, as a party to United Nations Framework Convention on Climate Change, “...should protect the climate system...on the basis of equity and in accordance with [its] common but differentiated responsibilities and respective capabilities.” (Article 3)

² See the list of background papers at the end of this report.

analysis indicates that there are advanced energy technology systems that can support growth objectives while dramatically reducing air pollution and without China’s becoming overly dependent on imports.

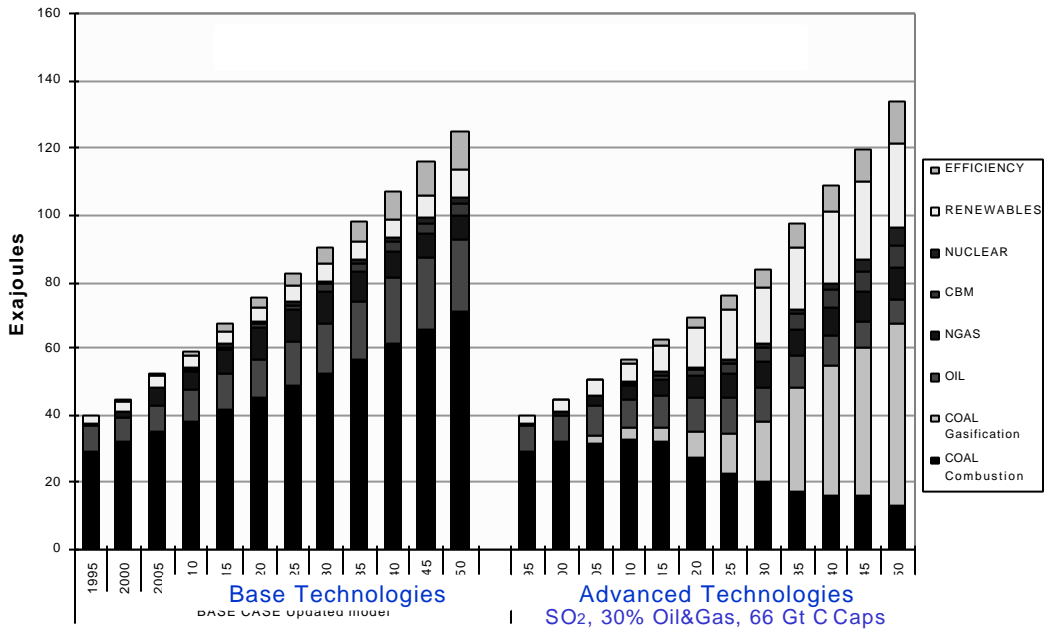


Figure 1. Total Primary Energy Supply for a Base Technologies (Business as Usual) Scenario and an Advanced Technologies Scenario with Constraints.

The Base technologies strategy, which continues to rely on coal combustion for power generation and on petroleum-derived fuels, cannot meet the same objectives, especially not the one for energy security. A recent Energy Research Institute (ERI) analysis,³ shown in Figure 2, indicates that oil imports might exceed 60% of total consumption by 2020 under a business-as-usual scenario.

However, the TFEST analysis shows that the Advanced technologies strategy, which provides the same energy services at about the same cost as the Base technologies strategy, might limit oil and gas imports to some 30% of total supply while also meeting constraints for SO₂ and long-term carbon emissions. This strategy builds on the combination of energy efficiency, natural gas, renewable energy, and “modernized” coal. By aggressively pursuing the Advanced technology strategy now, TFEST believes China could reduce projected oil imports by up to 50 Mtoe per year in 2020, and by rapidly increasing quantities thereafter.

³ Comprehensive Report on China’s Sustainable Energy Development and Carbon Emission Scenario Analysis, Energy Research Institute of the National Development and Reform Commission, May 2003.

Modernization of coal is a large and necessary component of energy systems that satisfy the Three Es for China’s sustainable development. Modernization of coal refers to the use of gasification technology to produce synthetic gas for power, clean fuels for transportation and cooking, and heat for both domestic and industrial heating applications, to replace coal combustion technology and oil imports. This strategy is based on technologies that are mostly known and proven, many of which are already in use in China, largely in the chemicals sector. What is needed for successful implementation is to promote the integration of, and investment in, those technologies rather than the development of many new ones. Investments in new capacity should be directed to gasification-based systems, with an emphasis on co-production of multiple energy carriers and often chemicals as well at the same site, i.e., polygeneration. A flexible and adaptive strategy needs to be implemented step-by-step. The TFEST outlines a vision and action plan in this report.

For the Advanced Technologies Scenario SO₂ emissions are reduced from 23.7 Mt in 1995 to 16.2 Mt in 2020 and 8.8 Mt in 2050. Imports of oil and natural gas are limited to 30% of consumption of oil and gas over the long-term. The 66 Gt C cap is a cumulative carbon emission allowance for China based on atmospheric CO₂ stabilization at 450 ppmv and a year-2000 population-based apportioning of globally allowed carbon emissions.

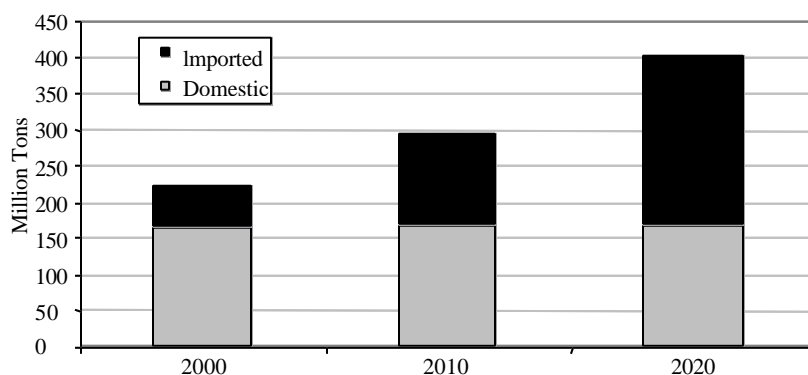


Figure 2. Projected Oil Consumption

This projection is from the Energy Research Institute’s Sustainable Energy Development and Carbon Emission Scenario 3 (High Efficiency, but without Coal Gasification).³

Based on estimates of the Electric Power Technology Market Association of China, two-thirds of the coal plant capacity that will be operating in 2020 is yet to be built.

Time is running out to implement this strategy because large investments are planned for electricity over the next decade that will lock in the mode of coal use for meeting China’s

electricity requirements through 2020 and for many decades thereafter. Figure 3 indicates that two-thirds of the coal plant capacity that will be operating in 2020 is yet to be built. The recommended strategy seeks to shift a significant portion of this new capacity onto a sustainable, modern path. Equally, decisions must be made now to allow for investments in new types of transportation fuels and infrastructure.

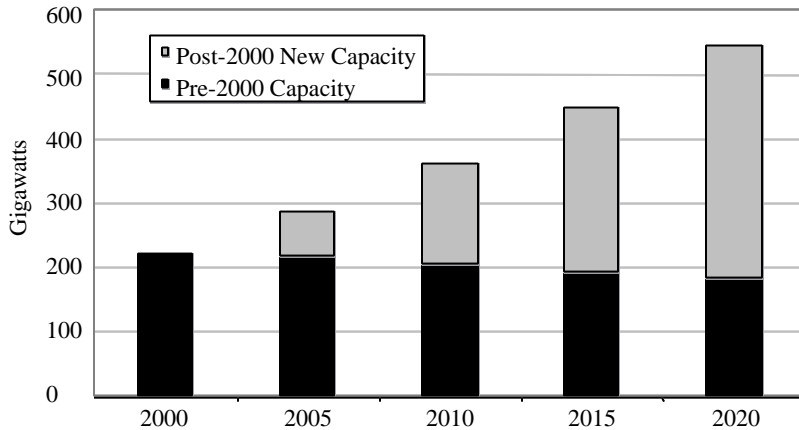


Figure 3. Projection for Coal Power Plant Capacity

Urgent Action by China’s Leadership is Required

The conclusions of the analysis carried out by the TFEST over the past two years are of vital importance to energy planning for China in both the near and longer term.

1. Strategy for Modernization of Coal

This report highlights the need for a fundamental and urgent change of direction towards investment in coal gasification and away from investment in coal combustion. There is strong evidence from the studies carried out by the TFEST that China’s energy system should evolve over time to the production of electricity, heat, clean fuels, and chemicals from various gas sources (synthesis gas from coal and biomass, natural gas, coal-bed methane). The polygeneration approach to providing these products is the most cost-effective and environmentally attractive supply option for reducing dependence on oil imports.

Polygeneration requires integrating and building flexibility into production facility siting and infrastructure planning so as to facilitate innovative approaches that optimize investments. One example would be mine-mouth siting of polygeneration facilities together with use of common rights of way for pipelines and electric transmission lines to get the products to market.

Investment decisions made over the near term for new capacity will be crucial to launching this coal modernization strategy. **Delaying the start of the transition to coal gasification-based polygeneration technology would significantly increase the costs to China of air pollution damages, of oil imports, and of reducing GHG emissions.**

In order for planning and implementation of a polygeneration strategy to move ahead fast enough to catch the investment cycle that is driven by rapid GDP growth, there is a need for creating new industries by merging traditionally separate industrial activities. There is a parallel need to integrate actions across the various government departments involved (such as chemicals; electricity generation, transmission, and distribution; petroleum refining and product distribution; natural gas; oil and gas pipelines; coal mining and transportation; renewable energy, transportation, etc.).

An important side-benefit is that if China follows the recommended approach it will inevitably drive costs down as it progresses along the learning curve and develop a uniquely valuable international competitive advantage and a capability that will eventually have export value.

The analysis has shown that a coal/synthesis gas polygeneration option must also be linked to an overall energy strategy that includes improved energy efficiency, the widespread use of renewable sources of energy and natural gas, such that developments in related energy fields are planned in a way that provides the maximum benefit to China.

2. Main Recommended Actions

The recommended merging of planning by government departments is not easily achievable. For this reason, and given the imperative of rapid decision-making by the government if the country is to enact the most efficient near- and long-term energy investment strategies, the TFEST recommends that the ideas proposed in its report be presented to top-level government officials as soon as possible.

This matter is of such strategic importance to China that:

- ❖ **a very focused “Deng’s trip to the South” type of government and industry initiative should be launched, and**
- ❖ **clear direction should be given such that the relevant integrated planning bodies, capacity building activities, and enabling policies will be put into place quickly.**

In the Chinese socialist market economy the government primarily creates the environment in which this initiative can be successful. It is necessary to state the objectives and targets clearly, to keep a consistent policy for a long time, to identify and remove barriers, and to create favourable conditions that will result in the intended actions by business.

This report explains the conclusions presented above in more detail.

Modernization of Coal

Coal is abundant and cheap but is an inherently dirty resource that historically has provided energy via its combustion. In this mode coal has a limited energy market opportunity (heat and power only) and causes enormous environmental problems. Gasification to make synthesis gas provides the basis for coal modernization that enables heat and power to be made in much improved ways and also opens up vast opportunities for new liquid and gaseous fuel markets so that coal can serve essentially all energy markets.

Coal modernization based on gasification can be realized with already commercial technological components that are brought together in new kinds of energy systems that are managed in innovative ways. Modernization brings immediate economic, oil-import reduction, and air-quality benefits, and puts into place the key enabling technologies that make it possible to address later, with only minor technical modifications and at modest cost, the challenge of climate change.⁴

Figure 4 shows that modernization of coal in China would build on the already extensive Chinese experience in the chemical process industry with coal gasification and a worldwide gasification experience base that is expanding rapidly.

In 2004

By activity:

24 GW_{th} chemicals

23 GW_{th} power

14 GW_{th} synfuels

By region:

9 GW_{th} China

10 GW_{th} N America

19 GW_{th} W Europe

23 GW_{th} Rest of world

By feedstock:

27 GW_{th} coal

27 GW_{th} petroleum residuals

6 GW_{th} natural gas

1 GW_{th} biomass



Figure 4. Cumulative Worldwide Gasification Capacity and Growth

Gasification is a booming activity worldwide, with a total installed synthesis gas capacity of 61 GW_{th} and new capacity being added at a rate of 3 GW_{th} per year.

⁴ The incremental costs are relatively modest because gasification makes it possible to recover CO₂ (for underground storage) at high concentrations prior to combustion.

1. Gasification for Power and CHP

Gasification makes it possible to exploit with coal the ever continuing advances in gas turbine technologies for both power only applications (combined cycles) and for combined heat and power (CHP) applications (gas turbines or combined cycles). Gas turbines and combined cycles offer substantial cost and thermodynamic advantages in CHP compared to the steam turbines that must be used with coal combustion. Electricity provided via gasification will have air pollutant emission levels as low as for natural gas combined cycle electricity.

Electricity via coal gasification can be provided in either an integrated gasification combined cycle (IGCC) power plant or in a polygeneration plant. At present, IGCC plants built in China cannot compete with coal steam-electric plants unless SO₂ and NO_x emissions controls are required for the latter-and even in that case IGCC plants would just barely be competitive on a lifecycle cost basis, which is not financially attractive enough to motivate power generating companies to adopt the technology for new plants. But as discussed below, electricity generated in polygeneration plants is a financially attractive option in China.

2. Gasification for Synthetic Fuels Production

Gasification also makes it possible to provide clean synthetic fuels in the near term, such as town gas for cooking and heating, dimethyl ether (DME) for cooking, and methanol, Fischer-Tropsch (F-T) liquids⁵ and DME for transportation. For the longer term, gasification makes it possible to provide fuel in the form of hydrogen with near zero emissions of greenhouse gases if the CO₂ co-product of hydrogen manufacture is stored underground.

Gasification makes it possible, starting with the two small molecules carbon monoxide and hydrogen that are the major constituents of synthesis gas, to design fuels that are vastly superior to hydrocarbon fuels (derived from crude oil or via direct coal liquefaction) with regards to both performance and emissions. For transportation fuels this is an important consideration because over time tightening air-quality regulations imply that meeting these regulations with conventional hydrocarbon fuels will require ever more sophisticated exhaust gas after-treatment technology and major improvements in fuel quality with concomitant large oil refinery investments.

The need for such costly continuing modifications of both production and end-use technologies can be minimized with gasification technologies. The basic approach is to first clean the synthesis gas of all the noxious materials such as sulphur, nitrogen, and mercury (as is already routinely done for most such materials in the chemicals industry in China) and then choose a chemical manufacturable from carbon monoxide and hydrogen that comes the closest to meeting

⁵ Primarily synthetic hydrocarbon fuels similar to Diesel fuel and gasoline.

the performance goals (e.g., high cetane number or high octane) and emissions goals (e.g., inherently low particulate and NO_x emissions in combustion).

3. Polygeneration

Synthetic fuels and electricity can be manufactured either in separate facilities or in polygeneration plants that provide both products simultaneously. There are substantial investment cost savings associated with the polygeneration option that makes it possible to produce clean synthetic liquid fuels from coal that will be competitive at crude oil costs of about \$20 per barrel or less. Because of the favorable economics of polygeneration, typical coal gasification-based systems in the future are likely to provide multiple energy products as well as chemicals. See Figure 5.

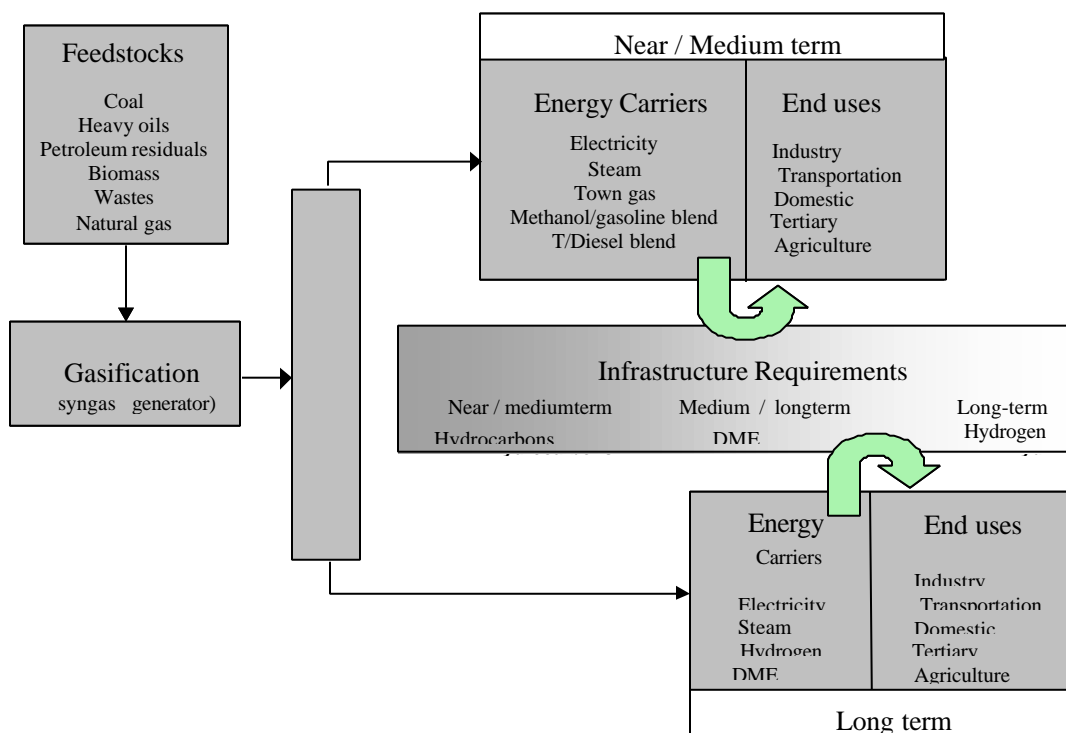


Figure 5. Vision for Modernized Coal

Gasification to modernize coal makes it possible to produce synthetic fluid fuels as well as heat and power. The least costly option is polygeneration, in which multiple energy products (as well as chemicals) are produced from coal-derived synthesis gas in the same facility. Modernized coal can provide energy carriers such as DME that are far superior to crude oil-derived hydrocarbon fuels. New infrastructures will be needed for DME in the medium-term and for hydrogen in the long term. Eventually synthesis gas might be made from a variety of carbonaceous feedstocks at the same facility (“carbon refinery”).

Unlike the situation for IGCC power plants, there is a strong financial incentive to produce electricity via polygeneration because by so doing the cost of synthetic fuel production can be significantly less than if only synthetic fuel is produced. However, essential to reaching attractive synthetic fuel costs is that the fuel producer must be able to sell the electricity co-product into the electric grid at a remunerative price. A TFEST analysis shows that such a price could correspond approximately to the cost of making electricity from a coal steam-electric plant equipped with SO₂ and NO_x controls.

4. Carbon Refineries in the Long Term

Modernization of coal via gasification puts coal on a path that is also being pursued for other carbonaceous feedstocks. At refineries around the world synthesis gas is being made by gasification of petroleum residuals for the polygeneration of hydrogen, electricity, and steam. (See Figure 4.) There is worldwide interest in F-T liquids derived from natural gas that is also based on first making synthesis gas from natural gas. A leading option for making synthetic fuels from biomass is via gasification; in Sweden, for example, activity is underway to make DME from biomass wastes in the pulp and paper industry.

In the future “carbon refineries” might provide a panoply of energy and chemical products from synthesis gas that is derived from a variety of *carbonaceous* feedstocks-various combinations of coal, heavy oils, petroleum residuals, natural gas,⁶ biomass, and even municipal solid waste, (See Figure 5). Rural carbon refineries based on agricultural residues might become important in China-e.g., producing via polygeneration DME (for cooking fuel) and electricity close to where the energy is needed.

Vision for Modernized Coal-by End Use

As shown in Figure 5, modernized coal would evolve from one set of technological options in the near/medium term (2006—2020) to a modified set of options in the long term (beyond 2020).

1. Near/Medium Term

In the medium term, town gas, methanol, F-T liquids, and DME would be produced in polygeneration facilities that make co-product electricity. The markets served would be:

- ❖ Domestic heating and cooking in urban areas: town gas as coal replacement
- ❖ Cooking fuel for rural areas and small towns: DME, which would augment LPG using the existing LPG infrastructure and would be derived from both coal (2006—2020)

⁶ Including small reserves of natural gas and coal-bed methane far from markets for which it is not cost-effective to develop pipelines.

- and biomass (beyond 2015)
- ❖ Industrial heating: town gas as coal replacement
 - ❖ Motor vehicle fuel substitutions that require no new infrastructures beyond refineries:
 - o Methanol in blends with gasoline (as gasohol)⁷
 - o F-T liquids in blends with Diesel fuel.
 - ❖ Motor vehicle fuel substitution that requires a new infrastructure: DME introduced during 2006—2015-starting with buses and trucks but later also in cars along with a shift to compression-ignition engines.
 - ❖ Urban electricity: coal polygeneration facilities co-producing methanol and DME
 - ❖ Rural electricity: biomass polygeneration facilities co-producing DME (beyond 2015)

Although in this period coal would not be decarbonized for climate reasons, partial decarbonization and underground CO₂ storage can be carried out as an acid gas management strategy in conjunction with synfuel production. Removal of the acid gases H₂S and CO₂ from synthesis gas is a necessary part of making these fuels. Removing them together and storing these acid gases underground can sometimes be a less costly option than the conventional approach of separating out the H₂S and reducing it to elemental sulfur (see Appendix A). This strategy can make liquid fuels produced from coal in the near term less GHG emissions intensive than petroleum-derived hydrocarbon fuels and provide near term experience with underground storage of H₂S and CO₂ to facilitate a transition later to higher levels of fuels decarbonization.

2. Long Term

In the longer term, when global climate change considerations will have a powerful influence on energy planning in all countries, it is likely that the major energy carriers will be hydrogen, electricity, and one or more carbon-based energy carrier provided in ways such that GHG emissions for the global energy system will be about 50% or less than at present. Such low emissions can be realized from coal via gasification at relatively low incremental costs if CO₂ is removed from synthesis gas and stored underground.

Producing hydrogen from coal with near zero GHG emissions will not be technologically challenging for China, and may turn out to be the least costly way to make hydrogen with near zero emissions (see Appendix B). The major challenges relating to hydrogen are: scientific uncertainties relating to underground CO₂ storage (many mega-scale demonstration projects are

⁷ Gasohol can be provided to gasoline engine vehicles without significant modification of the engine and fuel system with the methanol blending fraction up to 15% by volume (M15). One liter of methanol used in gasohol can displace 25%~30% more gasoline (by enhancing gasoline performance) than it can as M85 fuel. Therefore, oil import reduction can be maximized if the M15 limit is reached for gasoline before a shift is made to M85 vehicles to achieve further reductions of oil imports. Without M15, gasoline consumption in 2020 would be 170 billion liters/year. If M15 became the norm for gasoline by 2020, some 21 billion liters/year of gasoline could be displaced annually.

needed), and development of markets for hydrogen - there is intensive ongoing worldwide development of hydrogen fuel cells for vehicles.

Hydrogen would be used mainly in cities. For rural areas carbon-based fuels would be needed, because hydrogen infrastructure is very costly at low energy use densities. Although only partial decarbonization of coal can be realized with carbon-based fuels, total GHG emissions coming from rural areas would be so small that climate mitigation goals for the entire energy economy could still be realized.

Infrastructure Issues

Modernization of coal via gasification will pose new infrastructure challenges for China, but it will provide opportunities as well.

1. Easing the Rail Infrastructure Problem

Modernization of coal could provide opportunities for alleviating the formidable challenges of getting coal to market by rail, which presently accounts for about 70% of rail utilization capacity in China. Polygeneration plants located close to the coal mine could export electricity by wire and liquid fuels by pipeline as an alternative to getting coal to market by rail. Such “minemouth” siting would preclude the option of providing town gas as a polygeneration product, but town gas could be replaced by DME, a safer fuel because it contains no carbon monoxide.

2. Infrastructure for Electricity

Minemouth siting of polygeneration facilities might lead to greater electricity transmission requirements than would otherwise be the case. It will be important for China to keep abreast of and incorporate advances in transmission technology that are being continually made, especially for DC transmission technology, which offers cost advantages for long-distance transmission relative to AC technology.

3. Minimizing the Number of Carbon-Based Energy Carriers

The number of new carbon-based energy carriers should be minimized because infrastructure costs are huge. Thus it is desirable to try to find new carbon-based energy carriers to introduce in the near term that society will want to have even in the longer term. Ideally, there should be only one carbon-based energy carrier in the long term. DME is an outstanding “third” energy carrier candidate (the carbon-based complement to electricity and hydrogen) that can be introduced in the near-term. It can serve many alternative fuel markets, it is virtually non-toxic, and air-pollutant emissions from DME-fueled vehicles are low even without exhaust gas after-treatment.

4. Infrastructure for DME

Introducing DME as a new coal-derived energy carrier requires a new energy infrastructure, because this fuel must be mildly pressurized in canisters, as is the case for LPG. This infrastructure challenge is the main reason why most industrialized countries are not pursuing DME despite its outstanding performance and emissions characteristics. However, Japan is pursuing DME intensively - in part because it is the only industrialized country that widely uses LPG for domestic applications, and it recognizes that future LPG supplies may not be adequate to meet its domestic needs.

China, other developing countries, and Japan have extensive LPG infrastructures that can easily be adapted to DME. For these countries, bringing about a shift to DME will be far easier than for industrialized countries that lack extensive LPG infrastructures.

With respect to DME applications in transportation, China has an advantage relative to most other countries in that its hydrocarbon transport fuel infrastructure is at an early stage of development. However, this advantage would be largely lost if there is a long delay in introducing DME as a transport fuel. Thus there is an urgency to launch a DME economy for transportation during 2006 - 2015.

5. Infrastructure for Hydrogen

In the case of hydrogen, there is not an urgency for establishing an infrastructure for widely distributed applications, because hydrogen fuel cells and other end use devices are not yet close to being commercially viable. However, in the near term, limited hydrogen infrastructure development might be pursued for applications involving hydrogen refueling of dedicated vehicle fleets-such as for hydrogen-fueled hybrid electric/internal combustion engine buses and also for fuel cell vehicle demonstration projects. Such applications could typically use hydrogen available as a result of excess production capacity at ammonia plants and other chemical process plants.

Recommended Actions by Government

The National Development and Reform Commission (NDRC), especially the Energy Bureau, should clearly articulate the long-term energy strategy for sustainable development, including large-scale coal gasification and polygeneration.

- ❖ Develop a detailed cross-sectoral plan for gasification-based coal modernization.
- ❖ Identify and remove legislative and regulatory barriers to modernization of coal.
- ❖ Given the high rate of investment needed for any strategy to meet China's energy needs, remove barriers for rapid investment of Chinese funds, perhaps through a fast-track mechanism.

Establish the obligation by the power grid to buy gasification-based electricity.

- ❖ For an introductory (5~10 year) period offer remunerative prices for qualifying gasification-based projects.
- ❖ A date (e.g., in the period 2015 - 2020) should be set by which all new coal electric generation capacity should be gasification based.
- ❖ Establish a mechanism such as a portfolio standard to manage the transition from the introductory period in a manner that promotes competition in gasification power generation.

Establish the obligation by transportation fuel providers to use gasification-derived fuels (such as F-T liquids, methanol, and DME)⁸ designed with an emphasis on reducing oil imports.

- ❖ By 2020 most gasoline sold should be M15, with a step-by-step implementation from the present.
- ❖ By 2020 most Diesel fuel sold should be blended with F-T liquids, with a step-by-step implementation from the present.
- ❖ For an introductory (5~10 year) period offer remunerative prices for DME used in transportation, followed by incentives to progressively replace oil imports.

Provide market guarantees to introduce DME for expanding access to clean fuels in rural areas and small towns, primarily for cooking.

Facilitate financing for the modernization of coal.

- ❖ Support/promote private-sector investment in polygeneration, e.g., by reduced taxes, low-interest loans, making risk capital available.
- ❖ Develop appropriate policy for attracting foreign investment.

Promote multi-sector capacity building and education (e.g., NDRC, MOST, State Environmental Protection Administration, National Natural Science Foundation, electric power utilities, chemical industry association).

- ❖ Increase public awareness of the benefits of coal modernization.
- ❖ Organize seminars and courses of different levels (for government officials, leaders of enterprises, local government officials, engineering companies, and even students).
- ❖ Arrange site visits to already launched projects (and feasibility study projects) for above-mentioned organizations and personnel.
- ❖ Involve the concept and technology of modern coal utilization in appropriate courses for university students and technicians.
- ❖ Promote the formation of industry associations for targeted areas (e.g., polygeneration association, DME association).

⁸ In the transportation sector, this could build on the experiences of Shanxi Province and some cities where there exist strong local incentives and appropriate infrastructure for implementation of such a policy.

Fund and actively engage in more intensive RD&D and studies (NDRC, MOST, and others) in areas such as the following:

- ❖ Key technologies for polygeneration, such as gasification technology, large-scale gas turbines, liquid-phase reactors, and new catalyst systems.
- ❖ Application of DME as alternative fuel for compression-ignition engines.
- ❖ Application of methanol at high concentrations for high compression ratio spark-ignition engines.
- ❖ Infrastructure development needs and optimal investment plans required for coal modernization, e.g., understanding optimal siting⁹ of polygeneration facilities in the large-scale (post demonstration) phase.
- ❖ Role of polygeneration in sustainable urbanization.
- ❖ Support/promotion of gasification-based coal modernization projects that have already been approved (Yanzhou, Ningxia, Chongqin, Yantai, etc.).
- ❖ Support for additional polygeneration demonstration projects to come on line during 2006 - 2010, especially in regions with large resources of high-sulfur coal and/or with opportunities for CO₂ utilization or storage.
- ❖ International collaborations and demonstrations aimed at improving the understanding of the viability of underground storage of CO₂ (e.g., Carbon Sequestration Leadership Forum).

Support actions that will facilitate the proposed strategy but which are likely to be taken by government for reasons that are not specific to polygeneration:

- ❖ More emphasis on including health and environmental costs in the price of fuels.
- ❖ Introduction of more ambitious emission standards for electric generation and chemical process plants and for automobiles.
- ❖ Introduction of more ambitious standards for urban air quality.
- ❖ Liberalization of energy markets with regulations to protect public benefits.
- ❖ Freeing up of Chinese funds for investment.
- ❖ More emphasis on equal, transparent, and predictable conditions for domestic and foreign investment.
- ❖ Facilitation of joint ventures.
- ❖ Harmonization of international and Chinese design and construction standards.
- ❖ Improvement of the protection of intellectual property rights.
- ❖ Streamlining and speeding up of project approval process.
- ❖ Modernization of coal mining to reduce significant health, safety, and environmental problems.

⁹ For example, coal rail transport to city-gate conversion plants vs. remote siting with pipelines and electric transmission.

Appendix A: Acid Gas Management in Synfuel Manufacture

In the process for making synthetic fuel via gasification, the acid gases H_2S and CO_2 must be removed from the synthesis gas ahead of the synthesis reactor (see Figure A). The synthesis gas must be cleaned of H_2S to ppb levels to protect the catalysts in the synthesis reactor. Much of the CO_2 must be removed to maximize synthetic fuel production. The recovered CO_2 might be vented, but the H_2S cannot be vented because it is highly toxic. Typically, at plants around the world that make methanol via gasification of coal or petroleum residuals, the H_2S is recovered and reduced to elemental sulfur, which might be sold as byproduct. Once a large gasification-based fuels industry is established, the by-product value of sulfur will be negligible in many cases.

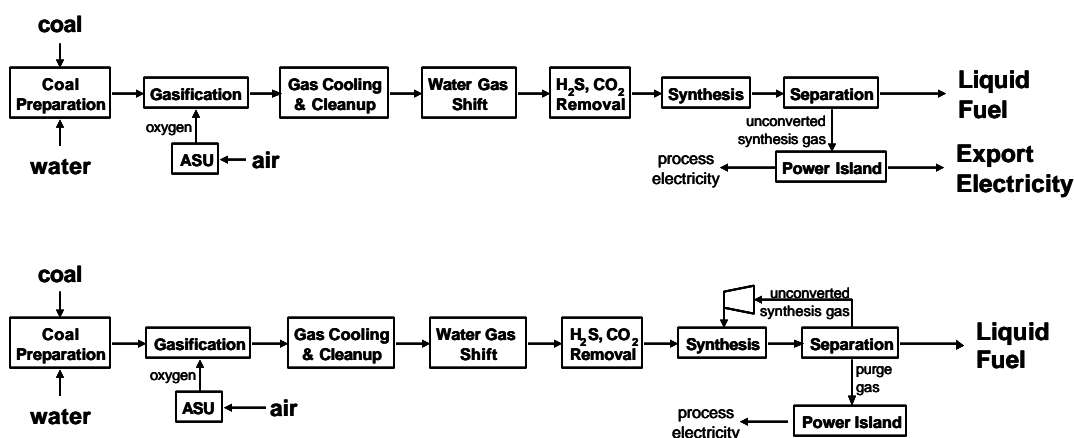


Figure A. General System Layout of Making Synthetic Fuels from Coal via Gasification

Two alternative system configurations for fluid fuels production from coal via gasification are shown. The configuration at the top represents “once-through” synthesis with exportable electricity co-product. The configuration at the bottom represents “recycle” synthesis with no net exportable electricity product.

An alternative acid gas management strategy that avoids the costs of separating the H_2S from CO_2 and reducing it to elemental sulfur is to capture the H_2S and CO_2 together using an appropriate solvent, to dry and compress the mixture to liquefy it, and to transport it via pipeline to an underground storage site-e.g., a deep saline aquifer or depleted oil or gas field.

There is already some experience with co-capture of H_2S and CO_2 and co-storage in underground media (aquifers and depleted oil and gas fields) in conjunction with natural gas production from “sour” gas fields, where the natural gas is contaminated with both of the acid

gases H_2S and CO_2 . There are 31 such projects in Alberta (Canada) and one in Texas (United States) (Longworth, et al., 1995; Wichert and Royan, 1997; Whatley, 2000). In these projects appropriate solvents are used to remove the acid gases before the natural gas is marketed. Environmental regulations require that the H_2S (or SO_2 if the H_2S is first burned) not be vented to the atmosphere. Originally, this activity involved reducing the H_2S to elemental sulphur, selling the sulphur, and venting the CO_2 to the atmosphere. However, sulphur prices are now so low that a less costly alternative is to not make sulphur but instead to dispose of the $\text{H}_2\text{S}/\text{CO}_2$ mixtures underground.

Analysis carried out for the TFEST (Williams and Larson, 2003) considered this $\text{H}_2\text{S}/\text{CO}_2$ co-capture, co-storage scheme (assuming 100 km pipeline transport of the $\text{H}_2\text{S}/\text{CO}_2$ mixture to a storage site in an aquifer 2 km underground), as well as the conventional scheme that recovers elemental sulfur for both methanol and DME manufacture. The fuel cycle GHG emissions of the $\text{H}_2\text{S}/\text{CO}_2$ co-capture, co-storage option were found to be no more than half as large as for the conventional scheme, at no increase in fuel cost-in essence, carbon mitigation at no increase in cost, as a byproduct of an innovative approach to acid gas management.

This finding is contingent upon the viability of large-scale underground co-storage of H_2S and CO_2 . Although experience with acid gas disposal in conjunction with sour natural gas projects in North America suggests that this strategy is effective, disposal rates for those projects are modest. Many “megascale” demonstration projects (e.g. involving geological CO_2 disposal at rates of the order of one million tonnes CO_2 per year) along with appropriate monitoring, modeling, and scientific experiments, in alternative geological contexts, are needed worldwide to give a high degree of confidence in the viability of this strategy. It is desirable to find out as soon as possible if underground co-storage of CO_2 and H_2S is a viable strategy for widespread applications-both as a climate mitigation strategy and as a sulphur management strategy in synfuels production.

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Wichert, E., and T. Royan, 1997: Acid gas injection eliminates sulfur recovery expense, *Oil and Gas Journal*, pp. 67-72, 28 April.

Williams, R., and E. Larson, 2003: A comparison of direct and indirect liquefaction technologies for making fluid fuels from coal. Background paper prepared for the Workshop on Coal Gasification for Clean and Secure Energy for China, Beijing, 25-26 August.

Appendix B: Making Hydrogen from Coal with Near-Zero GHG Emissions

Making hydrogen from coal with venting of the CO₂ co-product is fully established commercial technology that is familiar in China, which produces 5 out of the 40 million tonnes per year of hydrogen produced worldwide-mostly to make ammonia, with a significant and rapidly growing fraction made from coal using modern coal gasification technology.

The technology required to dry, compress, transport, and inject CO₂ underground in depleted oil and gas fields or deep saline aquifers is also fully established commercially-in connection with both enhanced oil recovery operations (mostly in the US), acid gas storage in connection with “sour” natural gas exploitation (mostly in Canada), and the Sleipner Project in the North Sea. And, in contrast to the high cost associated with recovering CO₂ from stack gases of fossil fuel combustion systems and storing it underground, the incremental cost of hydrogen associated with putting CO₂ underground is modest because the CO₂ is available in a relatively pure concentrated stream (whereas it makes up only about 15% of the stack gas of a coal combustion unit). Hydrogen from coal based on commercial technology with underground storage of CO₂ stands out as potentially the least costly means of making hydrogen with near-zero CO₂ emissions-less costly probably even than hydrogen from renewable or nuclear sources based on hoped-for future innovations (Williams, 2003).

Reference for Appendix B

Williams, R.H., 2003: Decarbonized fossil energy carriers and their energy technological competitors, pp. 119-135, in Proceedings of the Workshop on Carbon Capture and Storage of the Intergovernmental Panel on Climate Change, Regina, Saskatchewan, Canada, published by ECN (Energy Research Center of The Netherlands), 18-21 November, 178 pp.

Work Report

Task Force on the development of Chinese environmental industry

Chinese Co-Chair: Wang Yangzu
International Co-Chair: Rudi Kurz

Oct. 2003

1. Main activities

1.1 Preparatory meeting

The preparatory meeting for the task force on the development of Chinese environmental protection industry(EPI) successfully held from April 11 to 12, 2002 in Beijing with the participation of 6 Chinese experts and 4 foreign experts. Mr. Wang Yangzu and Mr. Rudi Kurz were appointed chairman of each expert team. Working schedule and main activities discussed and formulated.

1.2 Three workshops

Workshop on the development and policy discussion for environmental protection industry in China was held from June 25 to 26, 2002 in Beijing with the participation of 6 Chinese experts and related staff from the environmental associations in Guangdong, Jiangsu, Shanghai, etc. Such topics as the development situation and suggestion of Chinese EPI, wastewater and waste gas treatment, municipal waste treatment, environmental service, environmental labeling and organic food, how to develop the Chinese EPI were discussed. Eleven papers were submitted in the workshop.(submitted to the second meeting of the third phase of the CCICED)

Workshop on the legal framework and development of EPI in Europe was held from t.28 to 29, 2002 in Frankfurt, Germany, with the participation of foreign experts.

Workshop on the EPI developing was held from Mar. 18 to 19 in Beijing, with the participation of all the task force experts and experts form Japan and Korea, and related commissaries from the environmental associations in Zhejiang, Fujian, Shandong. 18 papers were submitted in the workshop.

1.3 Three workgroup meeting

The first task meeting was held on Mar. 20, 2003 in Beijing. Discussed the suggestion of the development of Chinese EPI (first draft).

The suggestion of the development of Chinese EPI (first draft) was sent to the environmental associations of all the provinces, municipalities and main municipalities to discuss.

Because of the SARS, the 2nd task meeting planned to be held at June in Germany was rearranged to be held each from Jun. 26 to 27 in Germany and July 26 to 27 in China. The meeting discussed and amended the suggestion (first draft).

1.4 Compilation

Two compilations: the development and policy of China EPI, the market analysis of China EPI.(English/Chinese) in Nov. 2002

Environmental protection industry (English/Chinese), in Oct. 2003

1.5 Submitted the development suggestion of Chinese EPI

2. Main achievements

With the development for 30 years, Chinese EPI has become a system that has diverse and complete products and can basically meet the country's demands, which are the technical and material base of pollution prevention, zoology protection and environmental quality improvement.

2.1 General situation of EPI

2.1.1 Industry scale

With the development for 30 years, EPI has become a comprehensive, diversified industry, including the production of environmental protection products, environmental protection services, comprehensive utilization of resources, ecological industry and production of cleaner products. The survey in 2000 indicates that there are 18,144 environmental protection industry enterprises, with 3.176 million workers and total profits of 168.91 billion yuan, taxes of 21.68 billion yuan, accounting for 1.9% of the GDP of the year.

2.1.2 Industry structure

Table 1-1 shows the developing situation of five fields in 1993,1997 and 2000.

Table 1-1 the structure of the national environmental industry

	Time	Units	Staff (Million)	Original value of fixed capital (billion yuan)	Total annual income (billion yuan)	Annual profit (billion yuan)	Exported contract capital (billion US dollars)
Total	1993	8651	1.882	50.13	31.15	4.09	—
	1997	9090	1.699	83.92	45.92	5.81	—
	2000	18144	3.176	848.47	168.99	16.67	1.41
Environmental products	1993	3158	0.517	10.10	10.40	1.34	—
	1997	4524	0.898	32.52	18.21	2.39	—
	2000	3786	0.272	20.19	23.69	3.20	0.10
Cleaner products	1993	—	—	—	—	—	—
	1997	110	0.027	1.18	216	0.24	—
	2000	1370	0.198	33.24	28.11	3.43	0.47
Environmental services	1993	3401	0.834	17.37	1.11	0.83	—
	1997	2364	0.247	12.37	5.78	0.83	—
	2000	9890	0.581	—	64.34	4.98	0.71
comprehensive utilization of resources	1993	2806	0.925	25.78	16.93	1.48	—
	1997	3491	0.633	36.94	18.14	1.94	—
	2000	2950	0.266	—	24.31	2.36	0.05
Nature ecology protection	1993	425	0.134	0.12	2.71	0.44	—
	1997	322	0.084	0.91	1.63	0.41	—
	2000	1482	1.656	—	28.54	2.70	0.08

Note: some units in the investigation are engaged in many fields. So the sum of the units and employees in different fields are not equal the total number.

Environmental product manufacturing industry and environmental service industry are the traditional environmental industry. The investigation in 1993, 1997 and 2000 reflected that the units and employees were obviously decreased in the environmental product manufacturing industry. But the total annual income increased notably. The units and staff and the total annual income were all obviously increased in environmental service industry. It shows that the environmental product manufacture is developing towards the intensive industry and the environmental service has a very great developing potential.

2.1.3 Regional distribution

According to the survey of the industry conducted in 2000, environmental industry concentrated such developed regions as coastal areas and regions along the river. It is calculated that total annual income in Zhejiang and Jiangsu provinces exceeds 20 billion RMB, 10 ~ 20 billion RMB were obtained in Shandong, Guangdong, Liaoning and Hunan province.

From the mid of 1990s, the environmental industry began to quicken up the tempo in the west area. But the scale of the environmental industry is still in small size. There are only about 2940

units and 220 000 employees engaged in the environmental industry, about 16% and 7% of the total number.

2.1.4 Benefit analysis

The environmental industry has gained a certain economic scale and achieved good economic benefit. Compared to 1997, the total income, the profit, per capita income and per capita profit of environmental industry has increased 268%, 187%, 73% and 53% respectively in 2000.

2.2 The technique situation of environmental industry

2.2.1 Environmental protection products

The environmental product manufacture industry has become a system that has diverse and complete products and can meet the demand of the pollution treatment in technology and product structure. But the manufacture still focus on wastewater treatment equipments and air pollution control equipments, whose income were 9.45 and 9.11 billion yuan respectively, about 38.5% and 37.2% of the total income of manufacture.

❖ Water pollution treatment equipment

Although the main enterprises were almost stand-alone and the integration was not high, the complete equipment supply has increased rapidly and the product variety and technology have been improved. The main problems are that the reproduction of the primary products was too large, the production serialization was discontented, the production level of complete equipment for sewage treatment computer control, membrane, biology and senior oxidization were scarce.

❖ Air pollution treatment equipment

The dust catchers include multicyclone, electrostatic dust precipitator and fabric filter. The dust extracting-simple desulfurization equipment can be divided into middle and small sized ones, which can meet the market demand in technology and production. Electrostatic dust precipitator has reached world standard. Besides this, the fabric filter is another kind of dust collector which has many kinds of product and has reached high standard. The simple wet dust extracting-desulfurizing equipment has been developed and used widely, but still needs improving in the performance. There is still not domestic desulfurization treatment equipment for the power station. The production capacity of dust extracting- desulfurizing equipments in mid and small scare exceeds the domestic demand.

The manufacture of exhausted gas control equipments has become specialization and in large scale. The related technologies of the toxic and harmful gas treatment equipments include filtration, condensation, adsorption, absorption, combustion, catalytic oxidation-reduction, electron beam radiation and biological treatment. For its the complex variety and RSD fund

shortage, The biological treatment of toxic gas is still in the lab research stage.

❖ **Solid waste treatment and disposal equipment**

The municipal refuse disposal and industrial wastes treatment are still under developed. The treatment device and integrated utilization equipment are still in primary stage. The production of vehicle for municipal garbage transportation has been achieved certain scale. But the penetration-proof material for landfill, the machine for landfill, separating machine, composting machine, large-size incineration equipment and some complete equipment are still in developing stage.

❖ **Noise and vibration control equipment**

The passive noise and vibration control equipment can meet the demand in China on the whole. And the function gap between the domestic and abroad products is narrow, some even at advance in micropore sound absorption and muffler. However, the quality, design and consistency of the equipment were unstable. There are no successful products on active noise and vibration control in domestic market. This falls far behind the advanced countries. Low noise equipments include low noise fan, low noise cooling tower, low noise motor etc, but the quality and producing technical gap between the abroad ones is far.

❖ **Environmental monitoring apparatus**

The sales of environmental monitoring apparatus in 2000 is 1.3 billion yuan. The apparatus for sampling and analyzing can meet the domestic demand on the whole. The online monitoring equipment made in our country began to be used through import, assimilation and nationalization. But the kinds, consistency and reliability can't meet the monitoring demand. The import trend hasn't been changed.

❖ **Medicament and material**

The medicaments and materials used for pollution control can meet the domestic demand on the whole now. Stability, quality, consistency and diversity of the products are a little behind the developed countries. Some products are almost good enough to match the overseas advanced products.

2.2.2 Environmental service

The environmental service includes technology service, environmental consultation, operation of the pollution control facilities, environmental trade and finance service.

The environmental technology and product R&D was accomplished mainly by traditional research institutes and universities. The enterprise development system hasn't been built up.

Our country can design and construct the treatment engineering on municipal wastewater, industrial wastewater, water recycle, dust removal and desulfurization, exhausted gas, noise and vibration. But the technology and design capacity on municipal refuse and dangerous wastes disposal are still in primary stage.

The units engaging in the environmental monitoring and analysis are mainly in environmental technology protection sectors, environmental research institutes and monitoring sectors. From recent years, some environmental firms and universities took part in the environmental monitoring and analysis.

Environmental consultation includes environmental impact assessment, environmental engineering consultation, environmental supervision, authentication of environmental management system and environmental symbolized products, authentication of organic food, environmental technology evaluation, life-cycle product evaluation, audit and training of cleaner production, environmental service and so on.

The units working for the environmental impact assessment are mainly from environmental protection sectors, environmental research institutes and universities. From recently years, some environmental consultation firms joined into this field. By the 20 years development, the policy, technical criterion and staff's ability of environmental impact assessment has become more and more perfect. The environmental impact assessment plays more and more important effect in the construction and developing management.

The whole level of environmental management system, environmental symbolized products, environmental information service, environmental engineering consultation, environmental audit, technology consultation on environmental engineering, environmental supervision needs improving.

Operation on the pollution treatment facilities is a new career, it will greatly develop in the pollution control field for its low cost and high efficiency with strengthening the environmental law and consummating the environmental economic policy.

The environmental finance industry is in primary stage. The exterior cost of environment and the existing system of investment and financing are restricting the development of the environmental finance industry.

In a word, the structure defect is obvious in the national environmental service, which restricts the development of the whole environmental industry.

2.2.3 Natural and ecological protection

The state paid more attention on natural resource and ecological protection, which now are the major point in the national development plan. However, the whole level of the industry is still low and staff working for the industry is discontent. The investment in this field is insufficient. The development is in imbalance state. In the aspects of agriculture ecological protection, water source place ecological protection, ecological function district protection, sand prevention and desert ecology resume, the multiformity of biology protection and so on need quickening the development.

2.2.4 Resource recycle and reuse

The scale of resource recycle has been expanded and the level has been improved gradually in our country. Some corresponding encouraging polices have been published. However, some favourable policies for resource recycle haven't been executed well. The investment is insufficient. The technology and apparatus fall behind the developed countries. The ecologic technology of industry is still in the primary stage. So the plan of the industry establishment on natural resource recycle and reuse should be strengthened according to the developing recycle economy theory.

2.2.5 Cleaner products

Cleaner products mean the environmental friendly products in the life cycle, named as harmless products or low harmful products. This field is in the primary developing stage and needs more improving.

2.3 Current problems of China's EPI

2.3.1 Chinese EPI has made rapidly development in recently years, but the contribution to the national income is little and there is still huge developing space.

2.3.2 Unreasonable industrial structure and regional distribution

At present, the scale of environmental industry is small and the number is huge, which results in the relative low situation of the industry supply capability and level. The industry is short of big units and not fit for the market demand. The environmental service industry needs more development.

2.3.3 Compared with technical policies and market mechanisms, national policies for environmental protection industry impact the development of this industry much more deeply.

2.3.4 Although the environmental industry has formed certain scale, the environmental capital market is still not come into being.

2.3.5 Low technical content in the environmental protection product, low level of standardization and serialization, insufficient of innovation ability

2.3.6 Disordered market, serious local protectionism .

2.3.7 Weak competitiveness in international market of environmental protection product

2.4 The demands for environmental protection in the national Tenth-Five Year Plan

2.4.1 The investment demand

To realize the environmental objectives in the tenth-five year plan, it requires about 700 billion yuan in environmental protection, about 1.3% of the GDP, 3.6% of the national fixed capital investment. it requires:

- about 270 billion yuan in wastewater treatment
- about 280 billion yuan in air pollution treatment
- about 90 billion yuan in solid waste treatment
- about 50 billion yuan in ecological protection
- about 10 billion yuan in environmental infrastructure

2.4.2 The investment source

❖ Form government

It requires 394 billion yuan, about 56% of the total investment demand. That is mainly from municipal construction maintenance fund, the finance budget investment, the charge of wastewater and rubbish treatment and others.

❖ From enterprise

It requires 306 billion yuan, about 44% of the total demand. Which is undertaken by the pollution enterprise according to the rule that who pollutes the environment should pay the charge.

170 billion yuan is invested in new and rebuilt industrial engineering projects. In order to control new pollution source, “three stages in the same time” system should be strictly executed and the environmental investment should be sufficient in the project plan.

It requires about 86 billion yuan in old industrial projects on pollution control. The investment is mainly undertaken by the enterprises or loaned from the bank.

It requires about 50 billion yuan in closing, moving and repairing factories due to their serious pollution. The investment is mainly raised according to the concerned national policy.

In order to fasten the rate of the enterprise pollution treatment, the state will supply certain assistance and interest of the loan for the important pollution treatment projects and the technology demonstration projects.

❖ From the society

Reform the pollution charge regulation and environmental protection investment & finance

system. Stimulate and collect the social funds by the market mechanism.

2.5 The important field of environment industry development in Tenth-Five Year

2.5.1 wastewater treatment

❖ **Municipal wastewater**

Focus on: technology and whole sets of equipment used for municipal wastewater treatment plant with capacity of more than 200 thousand tons per day and 100 thousand tons a day, and used for wastewater treatment and recycle in residential area.

❖ **Industrial wastewater**

Focus on: technology and equipment or whole sets of equipment for multifunction water treatment, high organic water treatment equipment and technology.(in the fields of ferment, medicine, paper making, chemical engineering, coal, breed, etc.)

❖ **Water saving and wastewater exchanging to water resource**

Focus on: technology and equipment for water saving in the industries of firepower plant, weave, petroleum chemical engineering, paper making, metallurgy, etc. Technology and equipment for industrial wastewater recycle and reuse in technics and circle water supply. Integrated utilization of municipal wastewater, water recycle and reuse in residential area, integrated utilization of sea water or salt water and desalt process.

❖ **Water body pollution treatment**

Prevent and treatment of nonpoint pollution and eutrophication: the technology and equipment for senior biological treatment, ecological treatment, bottom sludge dredge, high efficient utilization of agriculture fertilizer, wastes disposal from livestock plant.

Prevention of sea pollution and coastal pollution: technology and equipment for wastewater treatment for the ships, wastewater treatment from oil extraction, leakage oil treatment, wastewater treatment for the ports.

Repair of slight pollution water body: developing the technology and equipment used for repair and rehabilitation of every kinds of water body and slight pollution water body.

2.5.2 Air pollution treatment

❖ **The technology and whole sets equipment for desulfurization and dust control:** used mainly for power station and middle-sized boiler

To control the development of the normal electrical precipitator, and extend the electrical

precipitator to the treatment of high concentration, high ratio resistance soot, causticity gas and so on. To develop the monitoring apparatus and equipment, reduce the weight of main body, improve the standard and kind of material, consummate the technology of choosing type by computer. To develop the impulse power supply, microcomputer control, the equipment of adjustable pressure power, and the middle-small type electrical precipitator in propriety degree.

To develop the material and electrical fitting's performance of the bag-type collector, and the quality of the product. To develop the new products that are resistant to corrosion, high temperature and high moist, and develop the bag-type collector that can treat 105 m³ gas, bear above 250 with above 3 years use age.

❖ **The equipment and technology for exhausted gas control**

Focus on: high efficient and long life catalyst, design and manufacture the exhausted gas purification equipment in whole. Produce the high efficient and long life catalyst of exhausted gas, particulate control technology for diesel cars and catalytic technology for NO_x removal gradually. Promote the development and industrialization of motor technology of using nature gas, liquefied petroleum gas and blend fuel, and of the exhausted gas control technology.

❖ **The equipment for toxic and harmful gas control**

Focus on: the technology and equipment used in catalyze combustion for organic gas purification; organic gas recycle by carbon fiber; the biologic technology and equipment to control harmful industrial gas and malodor.

2.5.3 The treatment of solid waste

❖ **The technology and equipment for municipal solid waste**

Focus on: the equipment and technology for the collection, separation, pretreatment; the technology and whole sets equipment for large-middle scale solid waste incineration with steady run and high economical efficiency e.g. incineration, generate electricity, surplus heat utilization, landfill and compost. The key technology and equipment: the whole sets for the landfill gas callback and reuse, new protection against the seep and overcast materials, landfill equipment, the technology and whole sets equipment for the landfill filtration water treatment, the technology and whole sets equipment for large style and simple style composition, the technology and equipment for non-oxygen treatment, the technology and equipment for the solid waste used to be fertilizer, construct material.

❖ **The technology and equipment for dangerous solid waste disposal**

Focus on: the whole sets equipment and central treatment and disposal technology for the dangerous waste, the high temperature safe incineration technology and equipment, use as

resource, valuable mineral, waste and recycle and so on.

2.5.4 Resource recycle and reuse

Mainly on integrated utilization of associated mineral; the new art for integrated waste and recycle gold, silver, iron, rare earth, niobium, vanadium, titanium from associated mineral; improve the kaolin soil performance such as white chroma, particle size, and develop the integrated utilization technology for aluminosilicate, slag, sulfur iron mine, diatomite and so on; quicken the development and application of the technology for gangue producing architectural material and processing utilization.

Use industrial solid waste to produce new architectural material; establish demonstration engineering projects with high technology, good profit and certain scale; form the advanced, in point technics and whole sets equipments for resource recycle gradually.

Establish the waste and recycle center of past-use household electronic equipment and car, waste paper, waste glass, waste plastic, waste tyre, waste battery and so on.

2.5.5 The equipment for noise and vibration control

Focus on: multifunction muffler, sound absorption component, vibration isolation and decrease component, low noise draught fan, muffler used for vehicle, and some special muffler and vibration decrease equipment.

2.5.6 Environmental monitoring apparatus

Focus on: automatic sampler, pretreatment equipment, flux meter, continuous and automatic monitoring equipment and system for COD_{Cr}, BOD₅, TP, TN, ammonia nitrogen, cyanide, volatile phenol, oil, dust, sulfur dioxide and some other major pollutants, emergence monitoring equipment, alarm monitoring equipment, portable apparatus, electromagnetic monitoring instrument.

2.5.7 Environmental agents and materials

Focus on: desulfurization agent, sulfur fixation agent, agents for water treatment, membrane material, filler which is resistant to high temperature and corrosion and has long life, material for landfill, material for sound and vibration absorption, isolation and so on.

2.5.8 Environmental technology service

Built up the environmental innovation system based on combination of “produce, study and research” mainly by enterprises to speed the industrialization; set up the authentication system for environmental examining organization; improve the social service for environmental monitoring.

2.5.9 environmental consultation service

Promote the ISO14000 environmental management system, establish the third party authentication on environment symbolized products, environment technologies, environmental protection products and organic foods; develop the consultation service on environmental management and engineering, cleaner production audit, the consultation of environment technology, investment and finance, information and so on; improve the decision level and the supervision on environmental engineering.

2.5.10 Operation of pollution treatment facilities

Improve the market service on construction and operation of environmental infrastructure; improve the social service on industrial wastes treatment; accomplish the centralization of treatment, multi investment, socialization of service, operation market establishment, efficient enterprise management, and specialization of the staff; form the high efficient and low cost service system.

2.5.11 Environmental trade and finance service

Build up the extending and bargaining system for environmental technology; improve the import and export business on environmental technology, cleaner products, organic food and whole sets of equipment for pollution treatment; reform the pollution charge system and investment system on municipal wastewater, municipal solid wastes, sulfur dioxide, and industrial waste; improve the development of capital market and finance service for environmental industry.

2.5.12 Natural ecological protection

Improve the technology development and example establishment on treatment of water and soil lost and desertification; develop the water saving and irrigation technology used in arid area, sand area, and karst area; select the plant species resistant to drought , arid, and saline-alkali and use them in industry; rehabilitation of the polluted soil.

2.5.13 Cleaner products

Quicken the internationalization of the environmental symbolized products; develop the environmental symbolized products on biodegradation, recycle, low harmful, less pollutant discharge, water saving, energy saving and health protection.

2.6 The contradiction between supply and demand

The industrial supply and demand is the two basic factors to complete the existence and development of and industry. The efficient supply and demand is the two basic conditions of industrial development. The industrial development will be radically influenced if neither supply factor nor demand factor has some problems. At the same time, there is some particularity for

environmental industry. Compared with other industries, environmental industry mainly depends on the government policies to guide the social demand and adjust the balance of supply and demand.

The own development of environmental industry under the economic environment of our country necessarily lead to these problems, and sometimes they are related to government policies.

Environmental industry has its particularity compared to others, which needs the governmental policy to lead the social demand and adjust the balance of the supply and demand. If the environmental industry under the market economy system needs to be continuously and healthily developed, it must depend on the government's intervention and interference. Only effectively combining the government's intervention and market function, the environmental protection industry can healthily develop.

2.7 International environmental industry trends

In many OECD countries, the environmental industry has displayed very high growth over the last 20 years. In the United States, growth has been around 5% per year, with highest growth in the segment of environmental engineering and construction. In Germany, which has the largest environmental market in the European Union(EU), growth in the environmental industry is estimated at 5%-6% per year.

Forecasts point to higher growth rates in the future. Growth is being driven by a greater emphasis on environmental regulation in a broader range of OECD countries, leading to large investments in pollution -control equipment and purchase of waste management services and, more recently, services to improve firm-level environmental performance. there is also greater emphasis by firms on pollution prevention strategies and environmental planning, driving new technological developments and opening up mew markets. Firms are investing in environmental equipment and services to improve efficiency in their use of resources, and enhance their public image as well as to comply with government regulations (OECD, 2001a).

Continued growth in the environmental goods and services industry is highly dependent on technological innovation to efficiently adapt goods and services to new regulatory and customer requirement, on supply and upgrading of skilled labor, and on national and international adoption of environmental regulations and standards. Overall, demand for environmental products is gradually moving away from end-of -pipe solutions towards process and product modifications that are progressively cleaner and less environmentally harmful. It has been suggested that 50% of the environmental goods and services that will be used in 2010 have not yet been invented.

2.7.1 Environmental policies

Environmental regulations are directly responsible for the creation of the environment industry and remain an important driver of its development. Over the past two decades, environmental regulations have shifted from the command-and-control paradigm based on a specific technology towards increased use of incentives for improved environmental performance in industry. This has favored innovation in the environmental industry and prompted a shift in the corporate response towards increased use of cleaner technologies.

The effects of environmental policy instruments on innovation in the environment industry differ. Traditional forms of environmental regulation have not generally led to radical technological change, although they have contributed to significant pollution abatement over the years. Products standards tend to prompt incremental innovation or modifications at the margin. Products bans can stimulate radical innovation in the form of replacements but entail disruptions and costs.

As environmental policy has expanded from purely regulatory to include more flexible instruments, environmental industry output has correspondingly become more diverse. End-of-pipe pollution-control devices attached to the technologies of yesteryear are gradually being replaced by technologies that are cleaner by design.

2.7.2 Science and technology policies

Environmental policies define the demand structure for environmental goods and services and can set broad directions for environment industry output. But while environmental policies can influence the direction of technological change, they may have less effect on its rate. Governments must also use science and technology policies to support the development of the environment industry in the interest of sustainable development. They do this through support to basic research, technology partnerships with industry, fiscal incentives to R&D in enterprises, technology diffusion programmes, the protection of intellectual property rights, and other policies and programmes. In some OECD countries, S&T policies are taking more account of environmental goals, and technology development and diffusion schemes are acquiring an environmental dimension. This orientation provides both direct and indirect support to the development of the environment industry through stimulating supply and demand.

The great diversity of technologies considered useful for environmental protection implies an increasing importance of research and development. But government R&D budget appropriations for environmental research in the OECD area are about 2% of GDP. The share of funds devoted to environmental research has been growing in the last two decades in many countries. In countries which have large environmental industries-such as the United States, Japan and Germany-industry

participates more actively in environmental research. (OECD,2001b)

2.7.3 Industry policies

Industry-related policies also have a role to play in fostering demand for the products and services of the environment industry. Some governments are forging co-operation among firms and between firms and research institutions in the attempt to create more integrated environment industry sectors.

An important component of industry policies are schemes for small and medium-sized enterprises (SMEs). SMEs comprise a vast and diverse set of firms in both service and manufacturing sectors. Some small firms are environmental innovators, building on market niches in environment-related products and services.

The environment industry is increasingly important to both economic performance and sustainable development in OECD countries. However, the assessment of the industry and the formulation of appropriate policies is still at an early stage.

Environment policies should make greater use of economic instruments and other flexible approaches which encourage innovation in the environment industry.

Industry-related policies should reinforce corporate strategies that link environmental investments more closely to financial evaluation and overall corporate strategic planning.

2.8 The experiences and lessons of environmental industry in selected Asian countries

2.8.1 Development of environmental industry in selected Asian countries

A slow but a steady shift from heavy reliance on imported environmental technology, production processes, products and services.

A constant expansion and upgrading of environmental industry to meet higher and diverse standards requirements in response to changing environmental panorama and public pressures at home and abroad.

Strengthen interest and capability in environmental management at domestic enterprises, public sector and association institutes.

A rapid growth of environmental hardware, software and service production.

The state supports the environmental industry in the aspects of tax and financial incentives, administrative and legal support.

A series of international agreements, facilitating the expansion of: multinational corporate activities, local, national and international NGO activities, bilateral and multilateral cooperation on environmental government and technology.

2.8.2 Failures

- ❖ Lack of political will and commitment in many developing countries of Asia and the Pacific to environmental protection as illustrated by limited financing for environment, the mentality of “grow now and clean up later” and the lack of accountability for environmental mismanagement at the national, district, local and corporate levels, particularly in SEMs;
- ❖ Continued priority to sectoral approaches and the lack of an integrated approach to environmental policy-making at the national level;
- ❖ Market distortion;
- ❖ Weak authority given to the environmental ministry and agencies for environmental governance;
- ❖ Poor law enforcement and compliance
- ❖ Shortage of qualified and capable human capital to meet the changing and higher demand for environmental conservation, pollution prevention and abatement;
- ❖ Inadequate public support and participation in environmental monitoring

2.8.3 Changing role of Japan

2.8.3.1 Assisting Asian countries on the demand side

- ❖ Adjusting national development strategy in favour of sustainable development and greater EE interface.
- ❖ Enhancing environmental, quality-of-life and human rights awareness among people of all walks of life, particularly among children and youth in and off school.
- ❖ Strengthening environmental governance including administrative and legislative measures through pollution charges, facility licensing , green product certification and appropriate resource pricing.
- ❖ Provision of tax and other incentives for those households, schools, firms and other organizations interested in environmental improvement.
- ❖ Taking into the account the variation of regions or areas in terms of damage and abatement cost, setting the level of standards and introducing source-specific emission standards rather than across-the board ones.
- ❖ Adjusting the assistance to aboard in order to improve the environmental education and management.

2.8.3.2 Assisting Asian countries on the supply side at home and from overseas

- ❖ Upgrading tax and financial incentives and support to households, farmers and private

sector firms to install cleaner production technology and increase green investment, purchases and financing.

- ❖ Enhancing human and institutional capital and improving environmental management know-how.
- ❖ Strengthening administrative support for environmental protection through private-public sector collaboration, inter-sectoral policy integration and community-based resource management.
- ❖ Promoting partnership among all stakeholders at the corporate, local and national levels in improving environmental management through participatory planning, implementation, monitoring and evaluation process.
- ❖ Re-orienting and increasing foreign assistance at favourable terms in favour of capacity development, i.e. human capital and institutions.
- ❖ The CJK tripartite and regional cooperation for accelerating environment technology, financing and management know-how through private sector cooperation such as joint ventures and technology licensing and private-public partnerships.

2.9 The experiences and lessons of environmental industry in EU

2.9.1 Technology of water treatment

2.9.1.1 The experiences of Europe wastewater treatment

- ❖ Strengthen the basic design and technical plan of all scales wastewater treatment engineering.
- ❖ Strengthen the basic design of the industrial wastewater per-treatment and manufacture of the main parts.
- ❖ Strengthen the basic design of the industrial water recycle and reuse, and manufacture of the main parts.
- ❖ Improve the technological level of wastewater monitoring and process management.
- ❖ Improve the technology of analysis and control.
- ❖ Improve the manufacture technology and product's quality.
- ❖ Built up the training central for system maintaining, running and management.
- ❖ Built up the training central for system integration service.
- ❖ Enhance the training to the art person.

2.9.1.2 In Germany

There are about 6000 corporations have its own wastewater treatment facilities in Germany and about 1000 ones in Switzerland (data from ENVIRO-CHEMIE). The large-scale corporations have the advanced technology for wastewater treatment. If take count of the personal, industrial wastewater and the public treatment facilities, there are about 2000 units wastewater system in Switzerland, and about 10 000 units n Germany. (data from ENVIRO-CHEMIE) The maintenance and renovation of these facilities contribute the foundation to the domestic market.

Since the end of second world war, the Germany has taken much account of building the central sewage treatment system, which is based on the public demands and the commercial reasons. The target was to reduce the specific treatment costs and to improve the operational safety of the systems. But the following two problems arise increasingly:

- ❖ The central sewage treatment system requires a relatively long and widely diverse drainage network for the rest all gathered sewage contents are mixed together and diluted, which makes the removal of specific harmful substances very difficult.
- ❖ In order to protect the relatively small sewage treatment works and remove the harmful substances, small industries must also invest in sewage treatment systems.
- ❖ Up until 20 years ago there were only a few control methods available for the identification of suitable control parameters in sewage treatment. Today, all kinds of advanced control technology, apparatus and instrument have been applied to the sewage treatment systems.
- ❖ The legislation in Germany and in Switzerland is not unified, but they have both issued federal laws that regulate the sewage use since the 50's. By the laws about sewage and criminal law, which can punish those responsible like the managers or company executives or sewage groups. The German government declared more than 50management regulations with minimum demands sorted into sewage origin areas. The standard for communal sewage was constantly increased. The new detailed regulations for the different industrial fields brought a true innovation with industry solutions in the 80's and 90's. According to the European guideline(91/271/EWG) issued in 1991, more than 2000 inhabitants should build the sewage treatment system. This demand brought Switzerland and German manufacturers new markets in south Europe as well as in east Europe where these demands haven't yet been implemented.
- ❖ The different quality of sewage treatment in different countries-despite similar regulations-shows clearly that it is not all just about laws and regulations. More decisive is the enforcement and surveillance.

2.9.2 The technology of air pollution control

With the advent of the single European market, legislation at community level i.e. EU decisions, directives, ordinances and laws have become an increasingly important driving force in national law. This trend is particularly evident in the environmental protection sector where 70% to 80% of the environmental protection legislation is nowadays no longer enacted on national basis but in Brussels.

The EU Framework Directive(96/62/EC) on the Evaluation and Control of Air Quality^[5] and the associated sub-directives set new Europe-wide quality limit values, which are more exacting than the limit values currently applicable in Germany. Compliance with the limit values for fine particulates and nitrogen oxides in particular requires special emission control measures for facilities located in heavily polluted areas^[4].

EU Directive (96/61/EC) on Integrated Pollution Prevention and Control[6] sets the priorities on cleaner production measures against add-on exhaust gas cleaning measures, and a reduction of the emission mass flows(loads). The objective is to avoid the transfer of emissions to other media of the environment. The best available technique for environmental protection is not necessary to get the lowest clean gas pollutant levels. Air pollution control measures also have to think about energy and draw material consumption as well as wastewater, noise and odour problems.

To improve the air quality, the legal regulations and emission limits should be decided at first. After this, many factories will install new air pollution control systems or develop the existing system in its processes. Dust control and desulphurization in large industrial facilities have been playing a key role and have promoted the development of powerful pollution treatment technologies.

Besides, various cleaning technologies and systems have been developed to disposal the inorganic waste gas. These technologies can be combined and arranged in series to provide highly effective end-of-the-pipe solutions. At same time, emission measurement and analysis technology for the monitoring of both industrial processes and environmental air pollution have been getting more and more attention. Regarding the permitting of the new facilities, legislators have been increasingly pursuing cleaner production strategy. Ecological necessities and economic feasibility have been taken into account by adopting a phased approach.

To be brief, the strategy for improving the ambient air quality in a country can be formulated as follows:

- ❖ Adjust the emission standards according to the various industries and regions, provide the target and the corresponding implementation plan in detail.
- ❖ Definition of the requirements for industrial process equipment including the associated measurement and analyzer technology for process control and monitoring.
- ❖ Know-how transfer to the local plant engineering and construction industry(e.g. through joint ventures)
- ❖ Reconstruct existing pollution control facilities to meet the applicable statutory regulations(emission standards), close the unused or abnormal facilities and adopt the ecological and economic new ones.
- ❖ Besides adopting the emission control measures, consider the environmental friendly use of raw and auxiliary materials as well as improve the efficient use of energy source.

Factory ultimately determining a country's investment in air pollution prevention are environmental necessary, ecological principles and financial strength of the national economy.

The BimSchG is the basis for all air pollution legislation in the Federal Republic of Germany. Instead of making definitive statements, the BimSchG usually only provides general notes on the permitting requirements, or regulates the authorities for the promulgation of ordinances and administrative regulations, that is because the air pollution control law is too technical and to be formulated in legal norms. Moreover, the highly dynamic nature of the matter to be regulated makes frequent changes, and the law amendment procedure would take a long time. So the specific requirements are regulated in ordinances and regulations. The provisions of the BimSchG are detailed, specified and implemented through these so-called implementation regulations.

The key instrument for the implementation of the BimSchG is the recently amended General Administrative Order to the BimSchG.

The air pollution and emission situation in Germany

In Germany, the major advances in air pollution control have been achieved through add-on offgas cleaning technology. Emission reduction through cleaner production measures is an optimization process which takes into account all environment-relevant factors and reconciles economic with ecological aspects.

The drastic reduction in dust emissions in Germany is primarily attributable to the new German LÖnder where a large number of obsolete firing plants and industrial facilities have been closed down in the aftermath of the reunification. Moreover, the switch from solid fuels to more environment-friendly liquid and gaseous fuels has contributed to the positive development. These days, the main culprits of dust emissions are the industrial processes. Their share in the total dust emissions has risen to almost 40 %.

Regarding nitrogen oxides (NO_x) emissions, Germany has clearly outperformed the EU-imposed obligation of a 30 % reduction by 1998 measured against a 1987 baseline (3 177 kt) (-48%). Under the EU directives on national upper ceiling levels, Germany is obligated to cap NO_x emissions further to 1 051 kt/a by 2010. At about 64 %, the lions share of NO_x emissions stems from road and other traffic.

In the Helsinki Protocol, Germany committed itself to cut its annual sulphur dioxide (SO₂) emissions by a minimum of 30 % by 1993 measured against a 1980 baseline (7 514 kt). SO₂ emissions in 1993 were at 2 954 kt (61 %). Meanwhile, a further target of 990 kt set for 2005 has already been attained. Within the scope of the EU directives on national upper ceiling levels, Germany is now facing the challenge of cutting SO₂ emissions to 520 kt/a by 2010. Main sources of SO₂ emissions include power stations / district heating plants and industrial firing plants / industrial processes accounting for roughly 50 % and 35 % respectively.

The decline in carbon dioxide (CO₂) emissions between 1990 and 1999 reflects a 15 % reduction. Germany has set itself the national goal to cut CO₂ emissions by 25 % by 2005 as against a 1990 baseline. The emission reductions achieved so far are primarily attributable to the move away from brown coal to more environment-friendly fuels. Nevertheless, at about 40%, power stations and district heating plants continue to be the main contributors to CO₂ emissions, while industrial processes, small consumers (households) and traffic account for 20 % each.

Clean Air for Europe

The “Kyoto Protocol” on the World Climate Conference of 1997 requires the industrialised countries to cut greenhouse gas emissions (CO₂, CH₄, N₂O, H-FCC, HFC and SF₆) by a minimum of 5 % over the period of 1990/1995 to 2008/ 2012. In this Protocol, Europe has undertaken the commitment to curb greenhouse gas emissions by 8%. Taking into account national particularities, this minimum reduction obligation is being shared unequally between the individual member states. In Germany, which has to achieve a 21% reduction, it is in particular energy-induced CO₂ which contributes over 80 % of the greenhouse gas emissions, followed by methane from waste management operations, agriculture and natural gas supply as well as N₂O from agriculture and the chemical industry.

Lately the discussion of greenhouse gas emission trading has been gaining momentum. This is one of the so-called Kyoto mechanisms for the implementation of the ecological targets. The participating countries are assigned amount units which can then be allocated to companies. Independent certifying agencies determine a baseline for the company which serves as a reference for the development of CO₂ emissions in the absence of climate protection projects. Tradable emission credits are created when the actual emissions generated by a company remain below the baseline. Draft directives on this highly complex issue have meanwhile been issued by the European Commission. Experience is still outstanding.

The health impact discussion in Germany centres on aerodispersions and aerosols. At present, some regional emission levels of these components are still slightly above the annual mean values set by EU Directives for 2005.

Within the scope of the European CAFE - Clean Air for Europe action program, air pollution control strategies are being developed at 5-year intervals under the chairmanship of Austria. The priority air pollutants currently targeted by CAFE are fine particulates, ozone and nitrogen dioxide. As part of its programme, CAFE has set itself the objective of developing cost-effective measures for achieving target values.

Meanwhile an information exchange on Best Available Techniques (BAT) is also taking place at the European level. At the EIPPC Bureau in Seville, the European state of the art is currently

being established in BAT reference documents for the most diverse industries. Moreover, cross-industry BAT reference documents are being developed for emissions from the storage of hazardous substances and dust-generating materials or for emission measurement and monitoring^[9].

2.9.3 Waste Treatment

Until the sixties it used to be common practice in Germany to collect household waste and then dump it in “uncontrolled” pits. Health hazards caused by large waste volumes in densely populated and industrial areas, concerns over the degradation of the environment and, last but not least, the need for resource conservation have eventually led to a fundamental re-think. Today, avoidance, reduction, recycling, treatment and finally, environmentally compatible land disposal mark the order of the waste minimization hierarchy underlying the comprehensive German waste legislation.

Legal Framework

In the course of the past 30 years, Germany has seen an abundance of laws, ordinances, regulations and technical instructions regulating waste management as a whole or waste treatment in particular. In addition, a large number of EU directives aimed at harmonizing waste management practices in Europe have been implemented through national regulations.

All this has contributed to making the German waste legislation highly complicated. The high level of complexity is also inherent in the subject matter to be regulated. The waste problem not only concerns every citizen but also all areas of commerce, industry, the trading and services sectors - and ultimately every aspect of environmental protection.

Initially, the focus of the German legislation was on waste pretreatment for safe land disposal. This goal is reflected in all statutory regulations promulgated at that time. The resulting measures for the controlled collection and, even more important, the safe disposal of the various waste streams marked the most decisive step towards a rapid improvement of the environmental situation in the waste management sector. Only after this goal had been accomplished, did legislators turn to waste avoidance and recycling strategies to trigger the necessary optimization processes.

By that time, large corporations had installed their own disposal systems for the residues generated in their production plants, frequently for reasons of protecting proprietary production technology. For small and medium-sized firms lacking the necessary resources to meet the tightened regulatory requirements, supra-regional hazardous waste disposal companies had to be established with the participation of the German public sector. While these hazardous waste

disposal companies were responsible for serving the many small generators of industrial waste, the responsibility for the disposal of municipal waste rested and still rests with the municipalities.

With the recycling concept providing for maximum reuse of all types of waste, the German waste legislation embarked on the path leading to the current regulatory scenario. The German Federal Environmental Agency, which is the responsible technical authority of the Federal Ministry for Environmental Affairs, Nature Conservation and Reactor Safety

Conclusion

These days Europe can draw on the necessary technologies for the sustainable management of the production wastes and post-use consumer goods generated by our society. Sustainability in this context means environmentally compatible and economically affordable. However, the waste management policy must avoid the pitfall of promoting a mere economic optimization i.e. the cheapest solution. What is needed is a careful balance between ecological and economic considerations in order to preserve an intact environment for the future generations ^[12].

Disparities between the waste management standards of the various countries and provinces are likely to undermine the environmental legislation. This means that management of the waste streams will no longer be controlled by the environmental standards of the specific country but by the difference in price levels and ecological standards between the individual countries. Waste just dumped in uncontrolled landfills today is a time bomb and bound to become a major ecological and economic liability tomorrow.

Laws, directives and regulations are the prerequisite to launch a waste management system with the various alternatives presented in this paper. Within an economic region, uniform ecological principles are needed to ensure uniform waste management criteria and prevent ecological damage.

The build-up of a mere waste disposal infrastructure is no doubt the fastest route to achieving a clean environment. Waste avoidance and recycling are clearly the ecologically superior alternative. However, the implementation of this integrated approach is a lengthy process and requires a rethink on the part of the population. Accordingly, it is all the more important that it is launched in parallel with controlled waste disposal.

2.9.4 Environmental Protection Services

The market of environmental protection services, a part of the entire environmental protection sector of the national economy, presents itself as a very many-sided field with activities and/or professional groups that in many cases cannot be differentiated.

Although environmental protection services have only been of insignificant importance in the entire environmental protection sector up to the seventies, in accordance with the general development of the tertiary sector of the national economy, these services have become increasingly important and show more significant rates of growth as primary and secondary sectors since the nineties. In Germany in 1994 approx. 950 000, and in 1998 already more than 1,3 million work places making up 3.6 % of all employed persons depend on the field of environmental protection. Approximately 900 000 persons were employed in the environmental protection service sector in 1998 (totaling approx. 66% of the complete environmental protection sector). In 1994, from the approx. 530 000 people that worked in this sector (approx. 55% of the complete environmental protection sector), approx. 270 000 were employed in private economical service industry (a small share which belonging as well to consultation and expert opinion) and approx. 260 000 in public utilities (UBA 1997 and 2002). When rating the increase of the tertiary sector, the fluctuating rate of employment in the (environmental protection) industry in dependence of investment cycles must be taken into account. The people employed in the service sector make up approx. 2/3 of the private sector and approx. 1/3 of the public sector.

In the Netherlands in 1997, 1.3% of all employees worked in the general environmental protection sector, whereby scarcely 80% worked in the service sector, approx. 40% of these in public service (Dietz et al. 2000).

In Austria the number of the people that were employed in the service sector in 1998 was roughly between 55 and 60% (ÖSTAT).

In 1997 approx. 5 million persons in Europe had worked in environmental protection related jobs, but these jobs cannot clearly be attributed to the service area (Ecotec 1999).

Environmental protection services, being performed for a long time in independent organizations (private economy and administration), nowadays are carried out more and more in the industry itself as well as in the agriculture and forestry.

The consulting service which has developed greatly since the middle of the eighties is based on a number of influences. The driving forces hereby had been:

—Decree of concrete and course-setting general framework / regulations. Here, it happened that besides the general inducement of consulting demands by the steadily increasing flood of laws, new regulations made it possible to give clear growth impulses (e.g. packaging regulation, environmental impact assessment law, ordinance on specialized waste management companies, waste water ordinance, soil conservation law, etc.)

—Effective execution on the basis of qualified administration and consequent pursuit and sanctions in the case of non-observance of regulations. Besides Germany, this also applies in the majority of Middle-European countries in the EU.

—New environment protection subjects (e.g. environmental management, production-integrated environmental protection, integrated product politics, material-flow management) created new consultation requirements when the consulting demand of previous subjects slackened.

—Transfer of tasks (that first were carried out mandatorily and/or by public services) to the private economy (especially environmental monitoring, design engineering, system planning) with statement and control of defined quality standards (e.g. national authorizations and permanent quality controls at authorized analysis laboratories).

Growth of the service segment has been supported by the following influence quantities:

—Financial aid for the general and individual environmental consultation of enterprises and for the implementation and certification of implemented environmental management systems.

Experiences show that adjuvants alike were mainly requested when it was recognizable that concrete advantages could be achieved with a required consultation. In some European countries (e.g. Denmark) environmental consultants are also regarded as “export promoters”. In this case, the consulting work is financially subsidized by the state.

—Increasing environmental knowledge (education, training development) and environmental consciousness in all sectors (public, private sector and individuals).

It is a characteristics that environmental consulting services have developed along with increasing environmental protection requirements on enterprises due to special environment protection regulations and/or because of the increasing complexity of all laws and regulations.

The number of the environmental consultants (in private and public areas) was ascertained in Germany in 1994 with approx. 6000 persons. This corresponds to approx. 1 % of all people employed in the environment service sector. Approximately 78 000 employees (German Federal Environmental Agency 1997) of consulting engineers, environmental laboratories etc. must be added to these environment consultants. Thus, the share of people being employed in the environmental consulting segment ranges at roughly 16 % of all people that are employed in the complete environmental service sector. Within the entire environmental protection sector engineering services contribute with 5 to 10 % to its adding value (Bayer 2002).

In Austria about 7 700 people were employed in 1998 in environmental consulting services (ÖSTAT, UBA 2002). This corresponds to a share of approx. 9% of all the people that were employed in the environmental service sector.

In the Netherlands, roughly 7000 people can be assigned to nearer environmental consulting activities. This corresponds to a share of approx. 7.5% of all those employed in the entire environmental service sector.

As mentioned above, when evaluating the above figures it must be taken into consideration that particular activity groups (e.g. environmental laboratories, consulting engineers) were assigned to partially different groups when surveyed for statistical data. Regardless of the discussed data quality.

Summary and Outlook

After looking back on 30 years of development of environmental politics and environmental protection and nature conservation, it has turned out that environmental protection services have gained more and more importance within the complete environmental protection sector and in the entire national economy. This importance is not only limited to the protection of the environment itself, but it has also many positive influences on the complete development and the national economic competitiveness for example by the avoidance of consequent costs for use or damage of the environment or the creation of jobs.

In different Middle and North European countries as in Germany, a worldwide accepted high level of general environmental knowledge / environmental education has been achieved. An extensive and differentiated offer of general and special consultation, expert opinion and education services with regard to environmental subjects still meets, although again declining since begin of the 21st century because of business cycle effects and due to the fact that environmental protection no longer ranks at the top of social matters list, an average satisfaction requirement. Furthermore, the market for environmental experts is expanding.

Here, the use of a broad spectrum of different instruments has especially been approved in Germany in order to realize environmental political objectives. Besides policy law demands, and self-obligations of enterprises and economic instruments, especially information and qualification as well as research and development can be added to these instruments.

The very satisfactory success of the environmental protection performance of the organizations and the high level of the three segments of the environmental protection service market especially here in Germany cannot only be attributed to particular actions and/or instruments, but can be found in the great variety of co-operating and mutually positively influencing instruments.

Inseparably combined with the success of this cause-and-effect relation are different social groups, especially corporate organizations. Representations of interests of individual

corporations (e.g. Association of German Engineers - VDI) and branch associations proved in many cases to be a competent connecting link in the national pluralism. Corporate representations like the Association of German Engineers (VDI) stand for the promotion of the professional capacity of engineers, and are thus an important impulse transmitter for the operational environmental protection and therefor for the markets mentioned above, too.

The development of the three represented segments of the environmental protection service sector has partially proceeded in other European countries in the same way. In some cases, the development of the service sector has not yet advanced in the same way as in particular Middle- and North European countries, and also in Germany. The reason therefore - among others - is the deficient fulfillment of EU-wide harmonized environmental protection regulations.

For many decades not only in Germany but also in the European Union the crucial point concentrated on the decree and fulfillment of regulations, economic leading instruments have been placed more and more in the foreground within the past few years. It is prognosticated that, to some extent, the service sector can also be promoted by ecological taxes. The fact that prevailing attempts (e.g. the economic tax) did not become effective can be traced back to the great number of exceptions that are admitted by the law.

Recommendations

Transferable to the development of the environmental protection service sector especially in Germany and to a large scale also in Europe (especially Middle- and North European countries) the following cause-and-effect relations are considered just as important, that - in their chronological sequence and effect with regard to individual measures and measure packages are carefully tuned one in accordance with another - can be helpful to the further development of environmental protection and the environmental service market in the people's republic of China:

—Consultation, expert opinion and education were promoted (partially directly) by decree of regulations and an evident enforcement (this refers to all environmental aspects) being supported by qualified environmental enforcement and professional competence authorities. This includes institutionalization of company internal environmental representatives.

—Therefore, consultation, expert opinion services and education on the basis of successively increasing environmental protection demands on enterprises (because of special environmental protection regulations and due to increasing complexity of the great number of regulations) could make further developments.

—The increase of consultation, expert opinion and education was additionally stimulated by voluntary self-obligation (certification, branch agreement).

—Consultation was supported by financial support if an advantage was clearly to be recognized

(ecological advantage, juridical advantage, image-oriented advantage).

—Furthermore, consultation and education could be stimulated to a certain extent by insurance conditions.

—Incentives for environmentally friendly procedures / products could also further advance consultation and education.

—After particular consultation and expert activities had first been initiated as official authorities they could, controlled and under defined quality conditions, be transferred to the private economy, bring about further strengthening of the segment concerned.

—After consultation, expert opinion service and education markets first have been induced and supported by demands on the environmental protection performance of organizations, these services themselves have led to a further development of environmental protection technology and environmental protection regulations, too, so that a mutually forcing process resulted.

—Consultation, expert opinion service and education could be enlarged and promoted by discussion of environmental protection subjects in multiplicatively acting associations (that stress those subjects due to its increasing importance for their members represented) and also by the improved availability of environmental protection knowledge and concentration of communication.

—By the integration of environmental protection knowledge and consciousness in education, training and advanced education on all sectors (public and private sector and individuals) a basis for the successful advanced development of the service area could also be created.

According to what experiences made in Germany and also in Europe have taught us, it seems to be advantageous for the politics to use instruments / measures in such a way so that required and/or desired changes of structural kind will be promoted.

In order to judge feasibility and the effectiveness of recommendations, an estimation of the interference intensity of measures in the scope of actors may be useful (e.g. expert evaluations, model analysis).

2.9.5 UK Experience

The UK experience makes a strong case for the use of market based instrument and voluntary tools, such as EMS, Benchmarking, target setting etc.

In addition the whole importance of training of employees and the development of human resources for the purpose of delivering the change that is needed to drive environmental performance will be a critical aspect for the future of Chinese industry.

However this needs to be combined with a strong command and control approach that takes cost benefits calculations into considerations.

Cleaner Production should always be considered as the preferred option, but not all environmental and pollution problems can be solved with this approach and therefore end of the pipe control will be required to solve certain environmental health and pollution problems.

It is recommended that a holistic overall “media cross cutting” approach be being considered which makes use of command and control and market based instruments.

The IPPC regulation provides a relevant EU approach to an integrated approach, however learning from best practice and avoiding mistakes that have been made in Europe would help to fast track developments in China.

In terms of the development of an environmental protection industry this requires a balanced approach. Support for both a technically focused “hardware sector” that supplies pollution control as well as support and capacity building for the supply of “soft services” is needed.

Appendix 1 Environmental legislation overview - UK www source

1. Public Health Act. – 1875

Rationalised and codified law of sanitation and health to improve living conditions and increase mortality rates.

2. Public Health Act – 1936

This act permits local authorities to take action against statutory nuisances such as odour, pollution of water prejudicial to health, and contaminated land.

3. Public Health (Drainage of Trade Premises) Act – 1937

This act enables sewerage undertakers to accept trade effluent.

4. Clean Air Act: – 1956

Prohibited emission of dark smoke from chimneys, with some exceptions.

5. Public Health Act. – 1961

This act prevents the discharge to sewer of a substance, which could damage the sewer or the treatment process and enables the imposition of trade effluent discharge conditions.

6. Clean Air Act. – 1968

Extended the smoke control provisions of the 1956 Act and added further prohibitions on dark smoke emission.

7. Health and Safety at Work, etc Act. – 1974

The health and safety of employees in the workplace are regulated by this act. A duty of care is also imposed to prevent harm to other people. The act is enforced by the Health and Safety Executive (HSE) which sets emission and occupational exposure limits for hazardous and dangerous substances. Certain offensive or noxious substances must be rendered harmless or the best practicable means employed to prevent their release to the atmosphere.

8. International Convention on Long Range Transboundary Pollution – 1979

Introduced to control the transboundary effects of acid rain and to limit emission of acidifying

pollutants.

9. Food and Environment Protection Act. – 1985

This act included regulation of the sea dumping of waste and hazardous waste, and incineration at sea. A licence from the Ministry of Agriculture, Fisheries and Food (MAFF) was required, and these activities were phased out by the end of 1998. The act remains in force with respect to control of dredgings, fish waste and the use of oil dispersants.

10. Control of Pollution (Amendment) Act – 1989

This act covers the registration of waste carriers and controls fly-tipping. Waste carriers are obliged to register with the Environment Agency. The Agency has the power to apply to a court for a warrant to seize a vehicle which has been used for fly-tipping.

11. Water Act – 1989

This act gives the Environment Agency power to regulate water company discharges, and to control pollution in controlled waters.

12. Environmental Protection Act – 1990

This act defines pollution, harm and the environment. It also differentiates between individual and corporate liability, and allows prosecutions for either. A personal conviction can lead to an unlimited fine and imprisonment for up to two years.

The act introduced the concept of Integrated Pollution Control (IPC) which means that, for the first time, all the emissions from the most polluting (Part A) industrial processes are considered as a whole and not dealt with in isolation. As a result, the process is considered in its entirety. The act also covers Local Air Pollution Control (LAPC) for certain less polluting (Part B) processes.

The act also regulates waste management and disposal. Producers and handlers of waste are now bound by a duty of care to ensure waste is disposed of directly to a waste disposal authority (WDA) or to a registered carrier, accompanied by a transfer note, or a consignment note in the case of special waste. A waste management licence for a waste disposal site is required from the Agency, and the site may only be run by a fit and proper person. The Agency is required to inspect closed landfill sites.

Waste collection remains the responsibility of the local authorities and there may be charges for certain types of waste. The act also deals with statutory nuisance, and allows local authorities and individuals to obtain an abatement notice or nuisance order.

13. Planning (Hazardous Substances) Act – 1990

This act requires consent from local authorities for the storage or presence of certain hazardous substances above threshold quantities.

14. Town and Country Planning Act – 1990

This act requires a local authority to assess the environmental effects of certain development projects, and to consult the Environment Agency before granting planning permission.

15. Water Industry Act – 1991

This act obliges sewerage undertakers to provide and maintain a drainage and sewerage system, and to authorise and charge for the discharge of trade effluent to sewer.

16. Water Resources Act – 1991

This act regulates the activities of the Environment Agency. The Agency is obliged to prevent pollution of a watercourse or groundwater. The Agency establishes water quality objectives for controlled waters, and issues consents to make discharges to watercourses. To pollute a watercourse is a criminal offence, and offending individuals and companies can be prosecuted. The act enables the Agency to set up water protection zones and the Ministry of Agriculture, Fisheries and Food (MAFF) to designate nitrate sensitive areas.

17 Clean Air Act – 1993

This act deals with the emission of dark smoke from agriculture, industrial burning, industrial furnaces, railway engines and ships. The best practicable means must be used to reduce emissions and furnaces are required to be fitted with plant for arresting grit and dust. Chimney heights are also specified. The act is enforced by local authorities, who can prosecute directors, managers and employees. The act also specifies maximum concentrations of lead and sulphur in motor fuel.

18. Waste Management Licensing Regulations – 1994

These regulations (SI 1994/1056, as amended), made under the 1990 Environmental Protection

Act, make it an offence to treat, keep or dispose of controlled waste except under and in accordance with a waste management licence. Certain activities are exempt from the requirement for licensing, but these exemptions require to be registered with the waste regulation authority, the Environment Agency.

19. The Control of Substances Hazardous to Health Regulations (COSH) – 1994

Regulations, provide a legal framework to protect people against health risks from hazardous substances used at work. Guidance on the main requirements of COSHH is found in a free booklet entitled COSHH The new brief guide for employers. All employers have to consider how COSHH applies to their work. Complying with COSHH involves assessing the risks, deciding what precautions are needed, preventing or controlling exposure, ensuring that control measures are used and maintained, monitoring exposure, and ensuring that employees are properly informed, trained and supervised.

20. Environment Act – 1995

This act established the Environment Agency, and empowered it with inter alia the functions of water pollution control, waste regulation and IPC regulation. The act makes provision for the remediation of contaminated land, and the control of pollution from abandoned mines. The act also established national air quality and waste strategies.

21. Special Waste Regulations – 1996

The regulations (SI 1996/972, as amended), made under the 1990 Environmental Protection Act, cover special waste in England and Wales.

22. Packaging Waste Regulations – 1997

A company involved in the production and sale of packaging or packaging materials has an obligation as a ‘producer’ under the Producer Responsibility Obligations (Packaging Waste) Regulations 1997 (SI 1997/648, as amended) where the company owns and handles more than 50 tonnes of packaging material in a year and the annual turnover of the company or the group exceeds £ 2 million. The obligations can be discharged individually or by joining a registered scheme.

23. Groundwater Regulations – 1998

The regulations (SI 1998/2746) implement the Groundwater Directive, 80/68/EEC.

24. Packaging (Essential Requirements) Regulations – 1998

These regulations (SI 1998/1165, as amended) are enforced by trading standards officers of local authorities, and apply to all packaging placed on the market in the UK. The regulations place a responsibility on any company that introduces packaging onto the marketplace to ensure that it is minimal, safe, and is either reusable, or recoverable, or recyclable.

2.5 Pollution Prevention and Control Act – 1999

The Pollution Prevention and Control Act 1999 and the Pollution Prevention and Control (England and Wales) Regulations (SI 2000/1973) provide for a new pollution control system known as Integrated Pollution Prevention and Control (IPPC), to be introduced to industry between 2000 and 2007. Part A1 installations will be regulated by the Environment Agency, and Part A2 installations that fall within the terms of the directive will be regulated by local authorities. Part B processes will continue to be regulated by local authorities under LAPC. IPPC regulation will extend integrated control to some smaller companies and to new industries, such as the food industry and intensive agriculture.

26. Air Quality Regulations – 2000

Under the 1995 Environment Protection Act a system of local Air Quality Management (LAQM) was established. The Air Quality (England) Regulations 2000 (SI 2000/928) and the Air Quality (Wales) Regulations 2000 (SI 2000/1940) made under that act set out objectives for seven pollutants in accordance with the 1997 Air Quality Strategy.

27. Ozone depleting substances (ODS) Regulation – 2000

This regulation applies to the production, importation, exportation, sale, recovery, recycling, reclamation and destruction of ODS. It aims to phase out the non essential supply and use of ODS and to prevent the release of existing ODS and ensure it's recovery.

28. Waste Electrical and Electronic Equipment (WEEE) Directive – 2003

Producer responsibility directive for the reclamation of end-of-life WEEE goods such as fridge and computers.

The Conclusive Report by Task Force on Financial Mechanisms for Environmental Protection in China

Chinese Co-Chair: Zhang Kun
International Co-Chair: Hidefumi Imura

CONTENT

1. Introduction

1.1 Background

Insufficient environmental investment has long been a bottleneck hindering environmental protection in China. Although significant efforts have been made and have led to a number of achievements, the country's environmental situation continues to deteriorate. In order to achieve the environmental objectives set down in the Tenth Five-Year Plan, a significant amount of investment is required in the field of environmental protection and pollution control. In many ways, China is on the road to establish a well-off society, but without introducing effective environmental measures, this may also bring about further negative impacts on the environment. In order to achieve a balance between economic growth and social development, on-going efforts must be made for environmental protection. Also, ensuring a stable and safe living environment for the country's population has been recognized as a growing need in Chinese society. Therefore, China has set high goals and is expected to initiate further actions for environmental protection. To this end, the Government of China has identified insufficient environmental investment as a serious issue and has prioritized it in its planning agenda. In addition, positive actions to explore financial channels may provide a breakthrough for environmental protection in the country.

The conditions necessary for researching and innovating financial mechanisms for environmental protection have begun to take shape. Over the past two decades of reforms, China's economy has experienced rapidly, continuous growth and the state of citizens' incomes, and governmental finances have improved remarkably. With regard to the transformation from the planned economy to a market economy, China has achieved marked success in setting up a socialist market economy primarily. In terms of environmental protection, environmental

management has undergone reform and innovation, with a focus on the market economy, and in the process has accumulated valuable experience and methods in researching financial mechanisms. Accession to the World Trade Organization (WTO) has also provided China with new opportunities to utilize international capital for environmental protection.

In this context, the China Council for International Cooperation on Environment and Development (CCICED) approved the establishment of the Task Force of Financial Mechanisms for Environmental Protection in China in the first year (2002) of its third-phase activities, and the Task Force has received financial support from the government of Japan.

1.2 Objectives and subjects of study

The objectives of the Task Force are to identify key problems faced in the field of environmental investment and financing in China, in order to create innovative approaches to solve these problems, address environmental protection priorities, and make holistic and strategic policy recommendations to the Government of China.

The results of the analysis on the current status of environmental investment and financing illustrate that insufficient investment and low investment efficiency are the two key problems faced in this area, as discussed in detail in Chapter two. These problems are obvious in the field of urban environmental infrastructure (UEI) and pollution control in small- and medium-sized enterprises (SMEs)¹. Although the problem of low investment efficiency is not directly associated with the mechanisms of investment and financing, it directly affects the effectiveness of investment.

Therefore, the Task Force chose urban environmental infrastructure (UEI)² and pollution control for SMEs as its areas of research. It has hoped that the study will contribute to finding the solution to these problems, especially in the context of insufficient investment and low investment efficiency.

In the field of UEI, research was undertaken on how to establish a mechanism to utilize non-governmental investment entities and commercial financing approaches. It is apparent that foreign funds should also be fully mobilized for environmental protection. Regarding the pollution control in SMEs, the study focuses on establishing specialized financing mechanisms and institutional arrangements under governmental support. In addressing the improvement of

¹ SMEs used in this Task Force are defined according to the standard and criteria stipulated under the newly promulgated *SMEs Promotion Law of the People's Republic of China* (for further details, research studies have been conducted by Zhou Guomei and Xia Guang, 2003 "Study on the Financial Mechanisms for Pollution Control for SMEs in China" unpublished).

² The term *urban environmental infrastructure* in this study refers mainly to urban domestic wastewater treatment and solid waste disposal facilities

funding efficiency, the study focuses on the two areas, in view of achieving market-based approaches to the construction and operation of pollution treatment facilities. It is also expected that introducing market-based approaches will increase the efficiency of the investment itself.

2. Current situation and key issues in environmental investment and financing in China

Insufficient investment and low investment efficiency are the main obstacles blocking effective environmental protection investment and financing in China. In particular, these problems are prominent in the two fields of UEI and SMEs' pollution control. Although many other factors contribute to the problem of insufficient investment, from the perspective of investment and financing mechanisms, the absence and insufficient functioning of social investment entities other than government and polluters³ and the lack of commercial financing methods could be other important contributing factors. These are closely related to the China's under-developed financial market and credit system as well as the absence of a mechanism to absorb and mobilize the capital that has accumulated in society in the process of rapid economic growth. Meanwhile, the lack of competition in the construction and operation of pollution control facilities is another important reason for the low efficiency of environmental investment in China. The above-mentioned characteristics and present situation constitute the key issues in environmental investment and financing in China.

2.1 The issue of insufficient investment

2.1.1 Investment in environmental protection⁴ in China has been increasing rapidly, but total investment is still insufficient to meet needs.

Since the 1990s, the Government of China has placed greater importance on environmental protection, and, as a result, investment in environmental protection has increased rapidly. The sum of investment in environmental protection was 360 billion RMB during the period of the Ninth Five-Year Plan (1996 - 2000), which is 2.6 times that of the Eighth Five-Year Plan period (1990 - 1995), and in 2002, it reached 1.12% of the country's gross domestic product (GDP). Investment in environmental protection increased substantially after the government adopted a proactive financial policy. Environmental investment (including funds for ecological construction) between 1998 and 2002 was 580 billion RMB - 1.7 times as large as between 1990 and 1997 - and accounted for 1.3% of GDP. The current environmental investment in China is equivalent to that of

³ The term *polluters* refers to enterprises and private businesses that discharge pollutants to the ambient environment.

⁴ In accordance with statistics from the environmental protection authority in China, this research defines *environmental investments* as those in pollution prevention and control, including three types, namely, investment in pollution prevention and control for newly-built industrial projects, investments by existing industrial enterprises, and investment in urban environmental infrastructure construction projects.

middle developed OECD countries in the early 1990s. Urban environmental infrastructure is one area in which investment is growing rapidly; its share of overall environmental investment rose from 33% in 1991 to 55% in 2002.

The current investment in environmental protection, however, is far from adequate to meet actual demand. In the Ninth Five-Year Plan period, despite the adoption of a positive financial policy, actual environmental investment did not quite reach 450 billion RMB, and in fact there was a shortfall of 90 billion RMB compared to the amount initially planned. In the Tenth Five-Year Plan period, the investment required for environmental protection is 700 billion RMB. According to a preliminary estimate, the investment demand for environmental protection in the Eleventh Five-Year Plan (2006 - 2010) period is expected to be about 900 billion RMB, or 1.1% to 1.3% of GDP in the same period. If the current investment and financing mechanisms are not reformed, investment shortfalls will worsen, which may hinder the implementation of China's environmental protection plan.

2.1.2 Insufficient investment is especially prominent in the fields of urban environmental infrastructure and SME pollution prevention and control.

Insufficient investment is a problem common to many aspects of environmental protection in China, and it is especially prominent in the fields of UEI and SMEs' pollution prevention and control-the two weakest areas of environmental pollution control in China. From the mid-1990s, the focus of environmental protection was on the treatment of industrial pollution, while urban domestic pollution, such as household wastewater and solid waste, was considered a minor issue. Due to rapid urbanization, the growing problem of urban domestic pollution has become increasingly prominent, while construction of related treatment facilities has lagged far behind. This has resulted in a huge demand for funds for the construction, operation, and maintenance of treatment facilities. In industrial pollution prevention and control, attention has always been placed on the large- or medium-sized polluting enterprises (including some SMEs). No special policies exist to support SMEs in investment and financing, which has left them to face certain difficulties alone in investing and financing pollution prevention and control.

2.1.2.1 Urban environmental infrastructure is underdeveloped and faces serious funding deficiencies.

Since the introduction of its reform policies, China has undergone rapid urbanization, with the urbanization rate of the population currently at 37%. By 2010 and 2020, this rate is expected to increase to 46% and 55%, respectively. Growth in the number of cities and an expansion of existing cities will result in a corresponding increase in the volume of urban domestic wastewater and solid waste. Over the past decade, discharges of urban domestic wastewater have increased by 5% annually. In 1999, the amount of urban domestic wastewater discharge

exceeded that produced by industry for the first time. In 2002, the amount of urban domestic wastewater discharge reached to 23.22 billion tons, accounting for 52.9% of China's total emissions of wastewater, and urban domestic solid waste increased by between 5% and 8%. In 2002, the amount of urban domestic solid waste generate reached 1 360 million tons. It is predicted that by the year 2020, the production of urban domestic wastewater and solid waste will increase by between 1.3 and 2 times the volumes discharged in 2000.

Existing facilities for treating urban domestic wastewater and solid waste, however, are seriously deficient, and new construction is lagging behind. By the end of 2001, the rate of primary treatment of urban domestic wastewater was merely 36.4% of the total amount produced, of which only 18% received secondary treatment. The municipal solid waste disposal rate was 58.2%, of which only 10% received sanitary treatment and disposal.

According to China's environmental protection plan for the Tenth Five-Year Plan period (2001-2005), the treatment rate of centralized urban domestic wastewater is targeted at 45% by 2005, and the rate in cities with populations larger than 500,000 is targeted at 60%. Under the plan, the increased capacity of sanitary treatment and disposal of urban solid waste is supposed to be 150,000 tons per day. In order to realize the above objectives, China will need hundreds of billions of RMB to construct treatment facilities for urban domestic wastewater, and 45 billion RMB to invest in the construction of domestic solid waste treatment facilities. The Task Force predicts that during the Eleventh Five-Year period, the investment required in these two fields will be around 170 billion RMB. Under the current investment mechanisms and capabilities, it will be very difficult to satisfy these demands. For some local areas, the problem of insufficient funding for construction of urban environmental infrastructure will be very serious.

2.1.2.2 Specific difficulties faced by SMEs

SMEs play a significant role in China's national economic development plan, evident in the fact that 99% of all enterprises in China are small- and medium-sized organizations. They contribute 50.5% of the nation's GDP and 76.6% of total value-added by industry and 43.2% of revenue, as well as 57.1% of commodity sales value. Most job opportunities are found in SMEs, which is over 75% the corporate employment rate. Among the annual export value of 200 billion dollars in recent years, SMEs accounted for about 60%. Owing to their flexibility and innovative characteristics, SMEs are the core driving force in the nation's industrial development and economic restructuring, and they play a crucial role in the optimization of resource allocation.

At the same time, SMEs are the major source of industrial pollution in China. According to preliminary estimates by the Task Force, SMEs contribute about 50% of total industrial pollution discharges, and this proportion is increasing. In contrast to large point sources of pollution, the

fact that SMEs are large in number and spread out over large areas has also caused difficulties in pollution management.

SMEs are predominant in sectors such as paper-making, the leather industry, electroplating, printing and dyeing, cement manufacturing, brick making, and mining for coal, ferrous and non-ferrous metals, and non-metal minerals, etc., all of which employ unsophisticated technologies but present difficulties in pollution treatment.

Industry has generally been regarded as a target area for improving environmental management, but SMEs have not been specifically identified for improvements in management and service and for implementation of the polluter-pays principle. Taking advantage of the recent industrial restructuring, a large number of SMEs identified as serious polluters have been given administrative orders to close down. In general, either actively or passively, most SMEs are taking positive steps towards pollution control; however, they face the critical problem of insufficient funds for taking such actions. First, their poor economic capacity limits their ability to fund pollution control by themselves. Second, it is difficult for them to obtain financial resources for pollution treatment due to its high cost and the risky nature of financing and credit. Third, SMEs are at a disadvantage because they cannot apply for government funds for environmental protection, nor can they benefit from subsidies provided by local governments.

2.1.2.3 Lack of sound investment and financing mechanisms is an important cause of insufficient investment in environmental protection in China.

Insufficient investment in environmental protection in China is mainly caused by the excess demand for investment and the undeveloped state of current investment and financing mechanisms. Since these mechanisms are controllable and changeable over the time, they were chosen as the focal point of Task Force.

The large demand for funding is determined by the severity of China's environmental situation and quality as well as the government's environmental protection objectives. Now experiencing rapid economic development, China must face not only the problems emerging from industrialization (e.g., industrial pollution, urban domestic pollution, destruction of ecological systems), but at the same time it also faces newly-emergent problems, including global environmental issues. In this context, China faces environmental challenges that are more severe than those experienced in any developed country. In order to solve such complex environmental problems, a large amount of investment is needed. On the other hand, economic growth continues where rapid urbanization is shaping the creation of an affluent society. In addition, in order to satisfy the needs of social development in China, environmental objectives must be set high.

The shortcomings of existing investment and financing mechanisms are the most significant causes of insufficient investment in environmental protection today. As the country develops a clearer picture of its needs for environmental protection, and as China makes progress with reforms of its economic system (including overall national investment and financing systems), the future structure for environmental investment and financing is taking shape in China, with the involvement of multiple investment entities, financing channels and instruments. The multiple entities include governments, environmentally-liable social entities (e.g., polluting enterprises), and non-environmentally-liable social entities (e.g., enterprises and other profit-oriented and non-profit organizations). The multiple channels and instruments include public budgets, environmental levies (from enterprises and non-profit organizations for pollution discharge and from urban residents for wastewater treatment and waste disposal), treasury bonds, government loans, funds from enterprises, enterprise loans, and private funds, etc.

In terms of the roles played and contributions made by the entities and various instruments, however, the current mechanisms reflect the following characteristics: (1) they mainly rely on measures and channels under governmental plans, e.g., public budgets, environmental levies, and treasury bonds, etc.; (2) measures related to non-environmentally-liable social entities and public fund-raising approaches are either insufficient or non-existent; and (3) levy systems for urban domestic wastewater treatment and waste disposal are still at an initial stage and they have not been fully utilized. According to initial estimates, about 60% of urban solid waste is subject to a levy to pay for treatment, with the price ranging between 0.2 to 1.2 RMB per ton, while only about 16% of waste is subject to a levy for solid waste treatment and disposal.

The above-mentioned problems in investment and financial mechanisms are the main causes for the insufficient investment in environmental protection, particularly in urban environmental infrastructure. According to a study, governmental and public funds account for more than 70% of the expenditures for environmental protection in China. Conversely, in countries under a market-based economy, such as the United States and the United Kingdom, the private sector accounts for 60% of pollution abatement expenditures. Although financing has been increasing significantly in recent years, mainly through governmental channels, the huge need for investment in urban infrastructure construction in China has barely been satisfied. Investment in urban environmental infrastructure mainly relies on tax revenues, local financing, and treasury bonds. Over the past decade, investment in urban environmental infrastructure increased rapidly. In terms of SME pollution control, the shortage of funding is mainly caused by the unfavorable position of SMEs, under the current financing and investment system and mechanisms for industrial pollution control. Low environmental awareness and weak enforcement of environmental laws also contribute to the lack of incentives for corporate investment in pollution control.

2.2 The problem of low investment efficiency

Due to the growing demand for financing, and despite inefficiencies nationwide, China has started to introduce market-based approaches for pollution prevention and control. The low efficiency of environmental investment in China is mainly reflected by inefficiencies and problems in the construction, operation, and management of urban wastewater treatment and solid waste disposal facilities as well as in industrial pollution treatment facilities.

For years, in the field of urban environmental infrastructure, the government has been the main source of funding for construction of these facilities, with non-profit organizations⁵ responsible for their operation and management. This type of government monopoly excludes institutional competition, which in turn contributes to the problem of low investment efficiency. In this regard, similar situations have occurred in the past in developed countries and in some cases still exist. But the problems formed under the planned economy are especially complicated and severe. In industrial pollution control, China implemented a single basic policy that states that the polluter is the one responsible for treatment, and, subsequently, all polluting enterprises built and operated their own treatment facilities. Little consideration was given to leaving pollution treatment to specialized enterprises through a levy mechanism, which could bring about efficiencies in the division of labor and economies-of-scale into full play. Because of this, implementation of the “polluter treats pollution” policy caused investment inefficiencies for SMEs. The emergence of this situation in China was clearly associated with the development process of the environment-related service sector.

With the advancing reforms of the market economy system and the ongoing development of the environmental service industry, a pattern of so-called “marketization”⁶ emerged in China for pollution treatment at the end of the 1990s, based on international trends favoring practices such as PPP and PFI⁷. In the field of urban environmental infrastructure, marketization is contributing to a break-up of the government’s monopoly structure. This was carried out at three levels:

⁵ In brief, government affiliated non-profit organizations refers to a category of public services operated according to governmental mechanisms, whose finance is provided by the government, and whose human resources are managed by the government.

⁶ The term “marketization” derives from the process of a planned economy to a market-based economy in specific circumstances in China. This includes the “utilization of economic instruments based on market mechanisms,” the “corporatization/privatization of public and/or government-run sectors”, “introduction of profit-oriented capitalistic management” and so forth. It bears a broader meaning than PPP arrangements (partnership between public and private sector) or PFI (private financing initiatives). In addition, the term *marketization* has been officially adopted by the government of China in many of its policies and documents, and widely accepted by all walks of society in China. Therefore, this study continues using the term. The terms PPP and PFI are also used where appropriate.

⁷ PPP (public-private partnership) or PFI (private financing initiatives) refers to establishing partnerships between government departments and private sectors in the field of infrastructure improvement. PFI refers to private investment initiative or private capital participation, both of which break-up the government monopoly structure, per se, and encourage private participation in the construction and operation of facilities.

levying urban residents for household wastewater treatment and waste disposal and opening up the development of urban environmental infrastructure through public bidding; demolishing the system of government-dominated construction and operation by introducing competitive mechanisms (i.e., enterprises⁸ take over commercialized management of existing facilities); encouraging the participation of other economic entities⁹, apart from government agencies, in the construction and operation of the facilities, attracting capital that has accumulated in the society; and establishing a management system, under which various entities participate in facility construction. The corporate operation of those facilities is also based on market mechanisms.

In the field of industrial pollution treatment, the essence of marketization is that either specialized enterprises can be chosen to treat pollution through a levy system, with division of labor and economies of scale, or enterprises can handle their own pollution treatment if it is cost-effective. The market-based approach may not only improve investment efficiency but also contribute to increasing the chances of securing financing.

Since market-based patterns could increase investment efficiency and secure financing, active reforms have been undertaken in recent years in China. Ground-breaking progress has been made in both shifting policy and practices for the marketization of pollution treatment, although these are still at their initial stages in the context of China's overall situation.

3. Guiding principles and overall strategies for designing financial mechanisms for environmental protection

3.1 Environmental financing as a tool for environmental management

Environmental financing is a tool used to implement environmental policy, but without a proper mix of funding and technology, it cannot be effectively enforced. The scale and range of financing should be properly designed and determined according to the environmental policy goals of the state or region.

The primary objective of environmental financing is to raise the funds necessary for special environmental protection purposes, but the choice of financial instrument may have far-reaching implications, including various economic and social impacts. Therefore, financial mechanisms

⁸ The enterprises referred to here include those established on the basis of reformed government-affiliated non-profit organizations (e.g., state-owned or state-held enterprises) and other types of enterprises.

⁹ In China, economic entities other than the public sector include state-owned enterprises, collective enterprises, private enterprises, foreign-funded enterprises, and joint ventures, etc., whose content exceeds the private sector, as frequently mentioned in the global forum.

should be properly designed so that they can meet multiple economic and social objectives, such as the improvement of investment efficiency, correction of market and government failures, and the achievement of equity goals (i.e., income redistribution, re-adjustment of regional gaps). Among others, improving the efficiency of environmental projects is a key issue to consider in designing functional environmental financing mechanisms in China. Moreover, in the reform of its economic system, the development of environmental financing mechanisms focused on marketization is especially vital in order for China to achieve both its economic and environmental objectives. In this regard, the following strategies should be considered in order to address the problems of insufficient investment and low efficiency:

(1) Environmental protection requirements should be met by designing financial mechanisms that incorporate the polluter-pays principle and the user-pays principle. Efficient financing and social equity (equity between well-off and impoverished population/regional distribution) and financial risk mitigation, should also be taken into account.

(2) The roles of the various actors in investment should be clearly defined. Among them, the Government should play a lead role by (i) implementing and enforcing environmental laws and regulations, (ii) increasing the amount of investment in its fiscal budget, and (iii) promoting financial procurement from the market.

(3) Investors other than the Government and polluters should be encouraged in environmental investment. To this end, the establishment and improvement of market-based financial mechanisms should be given high priority.

(4) UEI construction and SME pollution control should be designated as priorities in the efforts to establish effective environmental financing mechanisms.

Among the multiple channels available for financing and investing in environmental protection, the main ones are governmental and commercial. After two decades of stable and rapid economic development, China has witnessed a dramatic increase in the level of government financing, and the government, at all levels, has strengthened inputs in environmental protection. It is recommended that it should further strengthen the facilitation of the less-developed western region in environmental protection. Capacity building for environmental management and urban environmental infrastructure construction should be prioritized.

The development of commercial financing instruments should be included in development planning, and existing financial resources in the country should be mobilized for environmental protection, in particular, for the construction of urban environmental infrastructure.

In addition, in light of international experience and practices, the design of China's investment and financing mechanisms should include utilizing governmental budgets, specialized funds, or other economic measures such as policy-oriented investments, project financing, long-term financing, and foreign direct investment (see Table 1).

Table 1. Main options for environmental investment in China.

National budget or specialized fund for environmental protection	
Environment-related economic measures	Pollution discharge levies and fees on sewage treatment and solid wastes disposal
	Environmental taxes (#), taxes on products (#) with pollution, and emission trading (#), etc.
Policy-guided investment	Environmental policy-oriented investment: "three simultaneous" ¹⁰ ; fund for technical innovation ¹¹ ; revenue from integrated utilization ¹² , etc.
	Deduction of loan interest (*).
	Preferential taxation (*) and subsidies.
Project financing (#)	BOT (build-operate-transfer), BOO (build-own-operate), and TOT (transfer-operate-transfer)
Long-term capital financing (#)	Commercial bank credit, treasury bond, municipal bond, corporate bond, trust fund, multi-lateral authorized bank loans, and environmental lottery, etc.
Foreign direct investment (FDI)	
Bilateral assistance, e.g. aid provided to China by Japan	
Preferential loans from multilateral channels and international financial institutions, e.g. loan from Japan, the Asian Development Bank and the World Bank.	
Financial mechanisms under multilateral environmental agreements, e.g. the financial mechanisms under the <u>Montreal Protocol and United Nations Framework Convention on Climate Change (GEF)</u>	

Note: The approaches marked by “#” have not been adopted in China, or are financial approaches still under research; those marked by “*” indicate that further strengthening is needed.

3.2 Principles of environmental financing

In order to operationalize the above-mentioned strategies, it is critical that the most effective and efficient financial instruments are chosen and applied, in order to meet the need for environmental protection in China. Implementation rules, including those for target groups and projects, must be clearly defined, and they should conform to the environmental regulatory framework such as the polluter-pays principle and the user-pays principle. To this end, the following points should be taken into consideration:

(1) Environmental goals/targets - The enhancement of sanitation and public health, through both

¹⁰ Three simultaneous refers to the system which the government requires the simultaneous undertaking of principal projects pollution control facilities in the design, construction and operation of any new project.

¹¹ Enterprises in China are required to allocate 7% of their investment for pollution control during upgrading and innovation of technologies and production processes.

¹² Revenues gained from reusing and recycling wastewater and sludge could be given a preferential tax policy for enterprises investing in pollution control.

UEI and SME pollution control, is a primary goal that should be identified as a priority item on the national and local policy agendas.

(2) Effectiveness - The selected instruments should be effective enough to achieve the environmental goals set by environmental policy.

(3) Efficiency - The selected instruments should be most efficient, or more efficient, than existing ones, in order to achieve environmental goals.

(4) Equity/fairness - Distributional effects such as the impact on the poor and the widening of regional gaps should be carefully assessed. Government is supported to special economic sectors such as the poor and SMEs could be justified, as it is an important role of public policy to correct market failures.

(5) Repayment and cost recovery - Any fund procured by debt financing (borrowing, bonds, etc.) or by PFI must be repaid within a certain period. Environmental financing mechanisms should incorporate proper revenue-raising and cost-recovery programs. In the case of UEI, costs should be covered by user fees or transfers from the general government budget (tax revenue). User fees should be set at a level that can cover all costs for construction, operation, and maintenance, or a part of operation and maintenance. The actual level of fees should be decided considering the WTP (willingness-to-pay) and affordability for the local people. In the case of SMEs, the polluter-pays principle should be adopted.

(6) Social acceptance - Support by the public and interested parties is a prerequisite, especially if the system causes a new burden on special sectors or groups of people.

(7) Dynamic economic efficiency - Various economic impacts and their dynamic consequences should be considered in terms of macro-economic impacts, fiscal impacts (burden on the government's budget) and impacts on occupations, the environmental industry and technology.

(8) Administrative cost - The costs of implementation should be as low as possible.

(9) Risks - Any financial mechanism are accompanied by certain financial risks. Environmental financial mechanisms should incorporate proper measures to lower such risks, protect lenders and investors, provide credit guarantees, etc.

(10) Transparency - Especially when government is involved or public funds are used, data and information should be transparent and openly disclosed.

3.3 Roles of the actors

As mentioned above, in the field of environmental financing there are various actors with different natures and functions, including the government, enterprises, consumers, and other entities. The roles to be played by these different actors should be clearly defined, paying special attention to the polluter-pays principle and the user-pays principle. Also, responsibility and subsequent obligations to be imposed upon the respective actors by such definitions should be fair (see Table 2, which shows the environmental services provided by these actors using various financial mechanisms).

Table 2. Composition of entities responsible for environmental protection and investment orientation and practices in China.

Investment sectors		Investors	Cost borne by	Financing channels
industrial pollution prevention and control		polluting enterprises	polluters	self finance by polluters, pollution discharge levies, commercial financing channels, and government assistance (particularly to SMES)
urban pollution	household wastewater and solid waste	government and enterprises	beneficiaries, with governmental subsidies	Urban pollution
	vehicle pollution	vehicle owner and local government	polluters (vehicle owner and manufacturer), with subsidies from local government	Government Supervision, and Controlled by Vehicle Producers and Owners
ecological construction and conservation	natural reservation	government	government	Ecological construction and conservation
	ecological recovery measures	government and enterprises	government and beneficiaries	Government Supervision, Investment and Construction with Multiple Entities' Participation
agricultural pollution and rural environmental protection		government	fertilizer users, with governmental subsidies	levy by fertilizer users, public finance, and commercial financing
regional/river basin environmental protection		government and enterprises	government and responsible entities for pollution	governmental levies on pollution discharge, levies from beneficiaries, commercial financing, private/foreign direct investment, and international assistance and loans
implementation of multilateral environmental agreements		government, related responsible parties, and international organizations	government and related responsible entities	public finance and international financial mechanisms
environmental management capacity building		government	government	governmental budget

Amongst many actors, the Government should play a lead role. Here, it is important to note that

the roles to be played by the central government and local governments are different, although they are both lead roles. The central government must provide the legislative framework (including implementation and enforcement) necessary to achieve national environmental goals, which is the first step in defining the roles of respective actors. Also, since one of the most important aspects of environmental protection is the public interest, it should provide improved environmental services to the people, correct market failures, adjust regional gaps, etc. In environmental financing, it must guide and supervise the financial market for environmental protection, and take measures to avoid risks. Provision of urban environmental services falls under the responsibility of local government. Decentralization is a desirable trend for delegating power along local governments to conduct projects that fit local needs, but it should be accompanied with the transfer of financial power.

The marketization and corporatization of public utility services, which are currently operated by local government, should be accelerated. As enterprises are responsible for bearing the cost of pollution (according to the polluter-pays principle), if the government clearly stipulates the responsibilities and obligations of enterprises in its fundamental environmental role and regulations concerning protection, they will be more smoothly facilitated to play their role in environmental protection in a concrete sense. In turn, the government would be able to rely on a legal basis for regulating and supporting enterprises in conducting environmental protection. With regard to the role of citizens, who are also a group of beneficiaries of environmental protection, their level of WTP (willingness-to-pay) and the affordability of environmental services is rising, boosted by rising average incomes. This may result in making it easier to raise user charges for water supply, wastewater treatment, municipal solid waste collection and treatment, etc.

4. Conclusions and specific policy recommendations on mechanisms for financing UEI in China

This chapter presents the results of researches on how to solve the problems of insufficient investment and low efficiency in the field of UEI. Generally speaking, the most effective ways to solve both problems are to establish and improve commercial financing mechanisms and to promote the marketization of UEI construction and operation. The research results consist of two parts: major policy-oriented conclusions and specific policy recommendations. The former refers to the conclusions made on the basis of case studies and analysis of a large amount of data. These can be used as a valuable reference for governmental decision-making as well as the basis for specific policy recommendations. The specific policy recommendations are proposed based on policy-oriented conclusions and in such a way as to be practical and feasible. Some of them focus on national institutional arrangements and, therefore, require decisions by the central government.

4.1 Establishment and improvement of multiple channels for UEI financing mechanisms

4.1.1 Major policy-oriented conclusions

4.1.1.1 According to the reform of China's financial institutions and the development of commercial financing mechanisms, the tools for financing UEI projects include commercial bank loans, bonds, trust investment funds and multi-lateral authorized bank loans. These provide a multiple channel system for financing UEI.

(1) At present, if system reforms are made to improve the ability of UEI projects in terms of both borrowing loans from banks and repaying them, commercial bank loans can be an important tool for financing UEI projects, but the following system reforms are necessary:

- ❖ State-owned corporations involved in urban infrastructure development could be the borrowers eligible for bank loans, but not the juridical person of the UEI project. For a UEI project, the borrower should be different from the owner of the project. In order to increase borrowers' repayment capability, local governments should offer the borrowers preferential policies including granting them rights for developing other more profitable urban infrastructure projects, offering preference for land use, paying loan interest with government funds, providing security, and offering preferential treatment for issuing corporate bonds and assisting with financing through stock markets.
- ❖ The principal shareholder should provide security for the loan borrower. Given this condition, the borrower is also the owner of the UEI project, but the stakeholder who owns the most shares should provide security for the borrower. Also, state-owned corporations involved in urban infrastructure development (which can be supported by local government) could be eligible warrantors or loan guarantors.
- ❖ Local governments can grant the borrowers rights to develop other profitable projects and require them to use the profits gained from these projects to repay loans.
- ❖ The government should open up the packaging of loans to UEI projects combined with other urban development projects. For instance, an urban wastewater treatment project can be combined with an urban water supply project to apply for packaged loans from commercial banks. Repayment can be ensured by profits gained from both projects.
- ❖ In order to increase the repayment capacity of UEI projects, several mechanisms including subsidizing interest payments, issuing corporate bonds, transforming bonds into shares, and inviting banks to act as financial advisors to the borrowers are available.

(2) According to the trend of financial policy reform, corporate bonds will play a more important role. The government should actively make use of corporate bonds as a tool for financing UEI projects.

(3) The Government of China has had clear policies on using trust investments to finance environmental projects. It is necessary to study the feasibility of establishing a “Public Environmental Trust Fund”. The method of raising money through the Social Security Fund can be used as a good reference. In order to establish the environmental trust fund, the government, enterprises and urban citizens could invest jointly. The foundation of such a fund should get approval from the State Environmental Protection Administration (SEPA), and it should act as a supervisor of the fund. The Public Environmental Trust Fund should be established by means of trust investments, and should be managed and operated by qualified trust investment agencies.

(4) There are several successful cases in which multi-lateral authorized bank loans are used for financing UEI projects. It is necessary to conduct further study on the development of relevant financial policies and successful experiences.

In the context of China’s financial institutions and policies, the financial tools mentioned above will certainly play more important roles in project financing. However, their application to UEI projects has the following limitations:

(1) Corporate bonds, by their nature, conflict with UEI which is a public goods. Since the Budget Law prohibits the issuance of municipal bonds, corporate bonds are used to finance UEI projects instead. Although enterprises issuing corporate bonds nominally assume the responsibilities for repayment and bear the risks; in practice, however, local governments offer them various types of support and subsidies. This kind of bond is essentially not a corporate bond but a kind of municipal bond, which is commonly used in other countries for financing public works. Presently in China, the examination and approval process for issuing corporate bonds is very strict. The issuance cost is often high, and the total volume of corporate bonds is still limited, and thus they cannot satisfy the large financing demands of UEI projects.

(2) Trust investment funds are widely used in China, however, this is not the financing channel specialized for UEI projects. In addition, trust investment agencies do not play a major role in China’s financial sector. Neither their scope nor their capacities can make them a major financing channel for UEI projects.

(3) For multi-lateral authorized loans, although the depositary banks do not bear responsibility for repayment, public loans are still heavily dependent on the credit standing of banks. Therefore, potential social risks exist.

(4) Bank loans play a major role in China's financial sector and are eligible to become a major channel for financing UEI projects. From a macro-perspective, however, there are still some problems. On one hand, financial risks are too concentrated in banks. On the other hand, in view of promoting direct financing, the proportion of financing through bank loans should therefore be reduced gradually, and then private investment will increase by providing more channels for direct financing. Therefore, from the perspective of future development of China's financial sector, i.e., reducing banks' risks and increasing direct investment, bank loans cannot be depended on excessively for financing UEI projects.

4.1.1.2 Issuing municipal bonds is an ordinary method for financing UEI in developed countries. There is a growing feasibility of issuing municipal bonds in China.

For municipal bonds, the debtor is the local government or state-owned enterprises (such as a wastewater treatment plant, water supply company, or urban infrastructure construction and management company) that issue bonds open to the capital markets. Funds raised by municipal bonds are usually used for the construction of urban infrastructure or public utilities, including roads, bridges, water supply, wastewater treatment, solid waste disposal and other public facilities. UEI is one of the components of overall urban infrastructure. With the support of local governments, the repayment of municipal bonds can be guaranteed by several sources. Also, profits gained from other development projects can be used to compensate for UEI projects. These characteristics make municipal bonds a promising tool for financing UEI projects.

4.1.1.2.1 Issuing municipal bonds is a common approach in developed countries for financing UEI projects.

Issuing municipal bonds as a way to raise funds for urban public facilities has a history of more than a few decades in developed countries. In the United States, the annual investment for water utility construction (including water supply, drainage networks, treatment facilities, and basin-related works, such as dredging river courses) is US \$230 billion, of which 85% is raised by issuing municipal bonds and the remaining 15% comes from government budgets. Municipal bonds in the United States not only provide a direct channel to raise private funds for UEI projects, but they also play a role in channeling private investment into more profitable urban infrastructure projects, or into UEI projects that are less profitable but provide stable returns. Financing through municipal bonds can therefore preserve government funds, which can then be used for other, less profitable urban public facilities.

In Japan, municipal bonds are called "local bonds". The share of investment through local bonds represents 20% to 40% of total investment in the construction of urban wastewater treatment facilities.

In Europe, the construction of municipal utilities has a long history, and various financing mechanisms are available. Most European countries have adopted an open policy towards issuing municipal bonds, and moreover, a number of market-based approaches are used to help in financing public facilities.

4.1.1.2.2 There is a growing feasibility in China to issue municipal bonds.

Based on the current trend, there is a growing notion that local governments will be given permission to issue municipal bonds.

(1) The essence of municipal bonds is government debt. Issuing municipal bonds will help to not only establish a stable channel for financing UEI projects but also to adjust the structure of government debt, which helps to share the central government's debts with local governments. This is conducive to reducing the amount of treasury bonds and their risks, since the financial burden can be partly shared by local governments. The central government can provide the necessary support to local governments, including transferring money from the central government to relevant local governments and offering other preferential policies.

(2) Municipal bonds are consistent with the nature of UEI as a public good. Municipal bonds are different from other commercial bonds. Since the objective of municipal bonds is to provide financing for public facilities, their issuance and trading are often tax-free. The application of municipal bonds is often limited to pure public goods or quasi-public goods that have difficulty or are incapable of recovering their costs over a short term. UEI is typically one of these projects.

(3) Issuing municipal bonds is useful for enabling local governments to fulfill their responsibilities, one of the major ones being to provide UEI service. Compared to other financing mechanisms, municipal bonds can better help realize governmental objectives, relate governmental responsibilities with their credibility, and strike a balance between their responsibilities and resources availability (in terms of government budget plus their financing capacity).

(4) Municipal bonds are conducive to directly addressing the financing requirements for construction of UEI, thus reducing financing costs. Compared with other financing mechanisms, there are two reasons for its lower financing costs. On one hand, the issuer of municipal bonds is usually a municipal government or juridical person of a project who is guaranteed by the municipal government. The credibility of the issuer or the warrantor determines lower risks in issuing municipal bonds. In addition, tax preference also helps to lower the costs for interest payment. On the other hand, since the municipal bonds are issued to serve the general objectives

of urban construction and development, their scale of financing is usually much larger than single project financing. Under the same conditions, the larger the scale, the lower the cost for financing.

(5) The funding conditions and financial environment necessary for issuing municipal bonds now exist. By the end of 2002, China's national savings reached about 1 trillion RMB, equivalent to 1.02 times the country's GDP. From 1998 to 2002, the national savings showed an increase of 21% annually. The swift increase of national savings represents the rapid growth in the national economy on one hand, but has limited the channels available for private investment on the other hand. Under this circumstance, sufficient funds available for private investment provide a solid basis for direct financing through municipal bonds. In addition, China has established complete financial institutions under the market economy with a financial market system and a corresponding supervision and management system, which provide the necessary conditions for issuing municipal bonds.

(6) The risks associated with issuing municipal bonds can be effectively controlled, but this depends on a number of aspects, first of which is the good credibility of the issuer. Municipal bonds are issued or guaranteed by a municipal government that has stable revenues from taxes and assumes the responsibility of providing public facilities. This relationship plays an important role in managing risk. Second, the use of municipal bonds usually has low risks. Municipal bonds, different from other ordinary commercial bonds that usually have no restrictions on their usage, can only be used for investment in urban infrastructure. Generally speaking, if UEI facilities can be operated and managed properly, their operating risks are far lower than other commercial projects. Third, the issuer of municipal bonds also assumes the responsibility for their management. Sustaining financial stability and reducing financial risks are important responsibilities of municipal government. In this context, a municipal government, as both the issuer and municipal governor, should bear the financial risks not only in issuing the bonds but also in their governance. Therefore, the risk control of municipal bonds pertains to not just bond risk control but social financial risk control as well, and acts as a "ruler" to indicate social financial risks. The municipal government will by all means pay great attention to controlling and balancing the risks of issuing municipal bonds.

4.1.1.3 Treasury bond investment has played a significant role in accelerating the construction of UEI and boosting economic growth in China. The Government should further strengthen treasury bond investments in environmental projects and limit their application. The use of this type of bond should be concentrated more on priority projects. It is necessary to increase the variety of treasury bonds and to promote market-based mechanisms for their issuance and management.

From 1998 to 2002, the central government issued a total of 660 billion RMB in long-term

treasury bonds, of which 65 billion RMB was invested in the construction of 967 UEI projects, covering 95% of cities and some counties in western China. Treasury bonds not only accelerated the construction of UEI in some cities in China but also played a positive role in boosting economic growth. During 1998 to 2002, the accumulated total of long-term treasury bonds directly produced about 2500 billion RMB in investment from local governments, relevant departments, enterprises, and bank loans. One study showed that projects funded by treasury bonds led to a 2% increase of GDP in 1999.¹³

There are also problems with the use of treasury bonds. For instance, the required counterpart funding to be provided by local governments was not put in place. In addition, the application of treasury bonds is too broad and the supervision of projects funded by treasury bonds is not effective enough. In addition to risk management concerns also found in other developed countries, treasury bond issuance has another two problems seen particularly in China. The first is that local governments ask for a “lease” from the central government, or they attempt to get approval of projects from the central government and make them into the object of treasury bond investment. The second problem is that the issuance of treasury bonds relies too much on administrative tools that do not take advantage of market mechanisms for effective resource allocation. Therefore, the reform of issuing treasury bonds is urgently needed.

The use of treasury bonds should be focused on priority projects in major regions, and treasury bond investments in environmental projects should be further strengthened. In planning, priority should be given to major environmental protection projects in specific regions proposed in the Tenth-Five Year Plan for Environmental Protection. Particularly, the Government should increase the proportion of treasury bond investment in some poor regions, where the financing capacity is usually low and counterpart funding cannot be ensured by local governments.

Market mechanisms should be employed for issuing treasury bonds. Two reforms could be considered. Firstly, to diversify the treasury bonds. Special treasury bonds for the construction of UEI could be an option. In issuing the special treasury bonds, the central government should clearly define the issuer and the borrower, as well as the responsibilities and rights of the central government and the local governments. The issuing of special treasury bonds should make use of market mechanisms. Referring to practices in other countries, part of the treasury bonds can be replaced gradually by municipal bonds (see Conclusion 4.1.1.2). Secondly, to make full use of market mechanisms for the issuance and management of treasury bonds. A trusteeship experiment for treasury bond management should be conducted. In this experiment, it is necessary to select eligible agencies as investors on behalf of the Government. Detailed

¹³ Wang Yaoxian, FangZhi, Ji Min, Huang Jinlao and Tan Li, A Study on the Multi-Channel Investment in China Urban Environmental Infrastructure Construction, in *Report of the Task Force on Financial Mechanisms for Environmental Protection*, CCICED, 2003

management procedures should be specified. Based on the experiences of industrial investment the market mechanisms could be applied to the issuance and use of treasury bonds in order to increase their efficiency and promote their sound development.

4.1.2 Specific policy recommendations

4.1.2.1 Make full use of multiple channels of commercial financing tools, such as bank loans, bonds, trust investment funds, and multi-lateral authorized bank loans, to raise funds from the market by improving relevant policies.

Among the existing tools for multiple channel commercial financing, bank credits and corporate bonds are the two most important, and should be fully employed through the reform of relevant policies.

Bank loans play a key role in China's financial system, accounting for 90% of the total financing volume. The Government should pave the road to using bank credits for financing the construction of UEI. In addition, governmental policies of supporting environmental protection should be integrated with the requirements of risk management for bank credits. This would include:

- (1) implementing a pilot system which allows levy authority for environmental projects to be used as a mortgage for loans;
- (2) to integrate environmental projects, such as wastewater treatment and municipal solid waste disposal facilities, into the master plan for the construction of urban infrastructure (taking advantage of combined bank credits), select qualified borrowers, and adopt the system of integrated loans for urban development;
- (3) to implement the system of initial fund requirement for environmental projects and to attract funds from commercial banks in line with the national reform of the financial system and on the basis of promoting the system of project ownership, attracting private investment and promoting concession transfer;
- (4) to properly extend the purview of bank branches in issuing credits;
- (5) to include more environmental projects into comprehensive urban development programs financed by the National Development Bank; and
- (6) to make full use of governmental investment as a facilitator in the financing of commercial banks. For example, combining governmental fiscal funds with commercial bank credits in ways

such as paying interest for bank loans and subsidizing the initial funds required for environmental projects can increase the financing capability of environmental projects.

The issuance of corporate bonds complies with the general direction of China's financial reforms. In the process of revising the Ordinance for Corporate Bonds, the government should design the necessary policies to facilitate corporate bonds to be used for financing the construction of urban infrastructure, including UEI. These policies include:

- (1) incorporating environmental projects into the bond issuance plan for comprehensive urban development;
- (2) selecting urban construction enterprises with high credit and strong repayment capability as borrowers according to the requirements of urban construction;
- (3) granting the borrower with the right to develop other urban infrastructure projects (non-environmental projects), allowing them to use profits gained from non-environmental projects as a repayment source for loans borrowed for environmental projects, and providing favorable land-use policies for UEI projects;
- (4) by using local governmental revenues beyond the fiscal budget, subsidizing the bond interest when the corporate bond interest rate is higher than that of the treasury bonds; and
- (5) facilitating the circulation of corporate bonds used for the construction of urban infrastructure.

4.1.2.2 While making full use of various commercial financing channels to raise funds from the market, the Government of China should seriously consider the introduction of municipal bonds, which would serve as a new and important channel for financing UEI.

Issuing municipal bonds is important for both the reform of China's financial system and the institutional reform of investment and financing. It will not only influence the re-allocation of financial power and responsibilities between the central government and local governments but also require revision of relevant laws and adjustment of policies. In addition, it is necessary to establish a system for evaluating the credit of local governments, as well as a supervision system and monitoring mechanisms. The Task Force therefore recommends that the State Council should require the relevant departments to study and design an implementation scheme for issuing municipal bonds. The following points should be taken into account:

- (1) Pilot projects on issuing municipal bonds should be conducted in some selected major cities in China's developed regions. In issuing municipal bonds, the volume of issuance should be

strictly controlled, and the types of projects which use municipal bonds should be limited. For example, the construction of facilities for the 2008 Olympic Games in Beijing and for the Horticulture Expo in Shanghai could be good candidates for experimenting with the issuance of municipal bonds.

(2) Supplementary policies for issuing municipal bonds should be developed, starting with creating tax incentives, including tax reduction and exemption policies, to attract investment from financial organizations and private investors. Second, the market of municipal bonds should be opened up to commercial banks, and policy support should be provided for commercial banks to invest in municipal bonds. Third, municipal bonds should be made tradable in and beyond nationwide bond market, so that they should be circulated more broadly and their risks reduced. Fourth, effective issuance and assurance mechanisms should be established for municipal bonds. It is important to promote the issue of municipal bonds through the market and properly select issuers and sellers as well as the method of issuance. In addition, it is necessary to construct a rational guarantee structure and implement guarantors' responsibilities and investors' liabilities for bearing the risks.

(3) Mechanisms to ensure preferential use of municipal bonds should be developed to UEI construction projects. In order to prevent large amounts of funds raised by municipal bonds from flowing into more profitable sectors such as transportation and water supply, and therefore forcing less profitable environmental projects to continue facing the bottleneck of financing problems, it is necessary to integrate government intervention with market mechanisms to guarantee the funds needed for UEI construction. For example, the government could create a special environmental budget for buying bonds and offer preferential policies of guarantee.

(4) A draft amendment bill to the Budget Law concerning the provision that "local governments shall not issue local government bonds" needs to be proposed to the National People's Congress after it is first approved by the State Council.

4.2 Promoting marketization for UEI construction and operation

4.2.1 Major policy-oriented conclusions

4.2.1.1 Marketization of the construction and operation of UEI is an effective mechanism for increasing investment efficiency, and it plays an important role in project financing.

The way in which government constructs and operates UEI facilities usually results in institutional problems and low efficiency. Marketization, however, can attract private investment in UEI projects and introduce competition mechanisms, which will help increase the efficiency of UEI construction and operation.

4.2.1.2 Government should play a lead role in UEI construction, but marketization can be

fully employed in its operation and maintenance as well as in the collection and transportation of municipal solid waste. In the process of marketization, the government should retain the responsibility of creating, regulating, and supporting the market.

Among the existing practices of marketization in China, there are two tendencies in the relationship between the government and the market. The first is that the government plays a dominant role, while the market can only play a minor one. The second is just the opposite, in which the market is regarded as omnipotent. There are also differences between regions in addressing this issue. In eastern regions, the role of the market is given more weight, while in the western part of China, construction and operation of UEI is still largely dependent on the government. Based on an examination of international experiences, as well as analysis on the feasibility of marketization of UEI conducted by some international organizations, it is clear that the Government must play a lead investment role in the construction of UEI, while the market approach can be fully adopted for operation and maintenance of urban wastewater facilities, and for the collection and transportation of municipal solid waste.

In order to create the market, the role of the government is to help transform potential demands for pollution abatement into actual demands through strengthened enforcement. Based on market principles, such as the polluter-pays principle and the right of investors to gain profits, the government should establish a user-charge system, making arrangement of user-charge rates to ensure full cost recovery. In addition, property rights should be well-defined when changing UEI from pure public goods to price-exclusive quasi-public goods. Moreover, the government should accelerate the corporatization of the existing non-profit agencies and establish legal entity corporations for wastewater treatment plants and municipal solid waste disposal facilities.

To regulate the market, the government should design a comprehensive plan for UEI so as to avoid unorganized construction when adopting the marketization approach. It is necessary to establish rules on market access and fair competition for private enterprises' involvement in order to avoid disorder and unfair competition. In addition, the Government should remove administrative and territorial barriers by establishing a public bidding system, thus providing an open and fair competitive environment. Also, while regulating user-charges, the poor should also be ensured access to services.

To support the market, the Government can offer a number of preferential policies on taxes, land use and electricity pricing, and provide information and consulting services to facilitate marketization. In addition, it should establish a special catalogue or information sources for the public welfare sector and offer various preferential tax policies to different types of corporations.

4.2.1.3 In China's eastern region, fundamental conditions are available for wide and intensive development of marketization in the urban wastewater treatment and solid waste

disposal sectors. In western China, local governments should adopt a step-by-step approach to promote marketization.

In the urban wastewater treatment and solid waste disposal sectors, the fundamental conditions exist for wide and intensive development of marketization. The following marketization models are recommended :

(1) Governmental non-profit organizations in charge of the operation of wastewater facilities or solid waste collection and transportation should develop a corporatization approach. After the reform, enterprises can be either state-owned corporations or joint-venture stock companies with cooperation between the public and private sectors. The corporatization of governmental non-profit organizations should be implemented, otherwise the government's financial burden cannot be reduced and the quality of service cannot be improved.

(2) Operation of existing facilities constructed by the Government and the construction of new facilities could be contracted out to corporations for cost-recovery by using the transfer-operate-transfer (TOT) model.

(3) In areas where conditions are appropriate, new facilities could be constructed using the build-operate-transfer (BOT) or quasi-BOT models. Successful cases can be seen in the eastern regions.

In contrast, the conditions for employing the market-based approach in western China are not as advanced as in the eastern regions; however, the corporatization of government-affiliated businesses can be prioritized. In case user-charges are not sufficient enough to attract private funds, the Government can provide financial subsidies. In regard to concrete market-based models, the Government could consider, first, the use of the quasi-BOT model, and then gradually apply the TOT and BOT models. For application of specific marketization models, experiences in the eastern regions can be studied.

4.2.1.4 The Government should make great efforts to settle the laid-off people due to corporatization and solve tax issues.

Corporatization of governmental non-profit organizations is the major way of marketization of urban wastewater treatment and solid waste collection, treatment and disposal. There are two common challenges that are now faced or will be faced by local governments. The first challenge is countermeasures against the reduction in employment due to corporatization. How to settle the laid-off people becomes a priority issue in the institutional restructuring process. The second challenge is the increase of tax payments. According to China's Corporation Law and Tax Law, after existing governmental non-profit organizations are restructured into legal corporate entities, they must pay income tax. Therefore, the restructured corporations will have

to bear a larger portion of operational costs. These two challenges discourage local governments from promoting corporatization.

In Beijing's experience, the municipal government has made great efforts to solve these two problems in order to facilitate corporatization. The people laid-off in the corporatization process can enjoy not only the supportive policies for ordinary people laid-off during China's economic and institutional reform but also benefit from special preferential policies concerning their retirement pension and health insurance. In addition, the municipal government provides related training services to help them obtain employment in the urban construction sector or in the environmental industry sector.

4.2.2 Specific policy recommendations

In order to make use of marketization to tackle the problems related to low efficiency and insufficient investment, it is necessary to solve policy issues that occur in the process of marketization. The Task Force proposes three policy recommendations in promoting marketization of UEI construction and operation.

4.2.2.1 Unify existing policies and publish the “Ordinance on Promotion of Marketization of Urban Environmental Infrastructure Services.”

In recent years, China published seven sets of guidelines on the marketization of providing services for urban wastewater treatment and municipal solid waste collection and disposal. From the effectiveness of their enforcement, however, the number of these guidelines may detract from their effectiveness since they may cause confusion and reduction in their authority. Without driving incentives for enforcement by local government, some key policies necessary for promoting marketization cannot be implemented effectively, particularly with the Users Pay Policy for wastewater treatment and municipal solid waste disposal, which resulted in limited collection of user fees and low tariffs, etc. In addressing such issues as corporatization, opening up of the market, access to the private sector, user-charge policy and tax preferences, it is suggested that the current leading views held by corresponding individual departments should be brought together under one integrated ordinance issued by the State Council, called the “Ordinance on the Promotion of Marketization of Urban Environmental Infrastructure Services.” This ordinance should be designed to improve the authority and feasibility of enforcement, and ensure the sound development of marketization. According to the reform process of China's public utility sector, the Government should create a plan to establish a special law on the marketization of public utilities, including UEI.

4.2.2.2 Provide training on relevant knowledge and technology to improve the capacity of local government to implement marketization of UEI construction and operation.

The capacity of local governments to implement marketization is seriously lacking. Sometimes,

a sufficient amount of time for project preparation is required, or a contract may not be signed after years of negotiation. In other cases, the contract was signed hastily without proper negotiation over some key elements, including prices, investment returns, and supervision.

In order to avoid these problems and to enhance local capacity, the Task Force suggests that the corresponding department should formulate and facilitate a training programme on capacity building for implementing the marketization of UEI services. The training programme should be designed for both local governmental officials and corporate managers. The contents of the programme can include relevant governmental policies on the marketization of urban wastewater treatment and solid waste disposal; financing for UEI; models of marketization and related advantages and risks; samples of contracts for different models (such as BOT, quasi-BOT, and TOT); key technologies for urban wastewater treatment and solid waste disposal; and supervision and management of marketization.

4.2.2.3 Define governmental responsibilities for implementing supervision and providing corresponding services for the marketization of UEI construction and operation.

The marketization of construction and operation of UEI requires stricter supervision and better services by local governments. If governmental supervision is not effective, serious secondary pollution may be generated by wastewater treatment and solid waste disposal, particularly from incineration facilities. In order to prevent non-compliance and secondary pollution, the UEI facilities should be regarded as polluting sources and be included in the monitoring scheme of local environmental protection bureaus. The State Environmental Protection Administration should establish standards for technical evaluation, certification, and information disclosure, and provide authoritative technological information for local governments and enterprises.

5. Conclusions and policy recommendations on financing mechanisms for SME pollution control

Presently, the major steps that need to be taken to address the problems of insufficient investment and low efficiency facing SMEs in their pollution control are to establish supportive government financing mechanisms, such as special funds, and promote market-based approaches for the construction and operation of abatement facilities. In the medium and long term, it is necessary to establish special commercial financing mechanisms for the development and pollution control of SMEs.

5.1 Major policy-oriented conclusions

5.1.1 Government should support the financing of SMEs in pollution control.

International experience shows that SMEs are generally faced with special challenges in

financing their pollution control; however, some positive experiences and successful cases do exist. Drawing on Japanese experiences and good practices in China, it can be concluded that government should support financing SMEs in pollution control, which complies with the existing policy direction of encouraging and supporting the development of SMEs. Although the Government will spend money for the pollution control of SMEs, it can be compensated by higher tax revenues resulting from establishing a better environment attracting investment.

5.1.2 Government should support the pollution control of SMEs that comply with national industrial policies and that have growth potential.

In general, SMEs do not employ advanced technologies and usually generate serious pollution. A number of them are in sectors that are either restricted or prohibited by industrial policy. Not all SMEs are eligible for obtaining governmental support to finance their pollution control. The supportive policy should be aimed only to those complying with national industrial policies and that have technological potentials. In addition, the selected SMEs should have sufficient profits and play a critical role in local industrial chains. The selection work should be conducted by relevant service agencies based on specific procedures and criteria.

5.1.3 Three mechanisms can be applied for financing SMEs in pollution control: direct government financing through special supportive mechanisms; raising funds from the market through commercial mechanisms that can integrate pollution control into the overall development of SMEs; and preferential policies.

To make use of supportive governmental financing mechanisms, the Task Force suggests that both proposed Development Fund for SMEs and Special Supportive Fund for the Development of SMEs can be used as financing channels for SME pollution control. In addition, the existing Special Fund for Environmental Protection can be applied to offer subsidies for SME pollution control, including subsidies for bank loans and subsidies for interest payments.

For commercial financing mechanisms, several financing tools are available to SMEs, including bank loans, security, issuing corporate stocks and bonds, as well as private investment. In addition, it is important to establish special financial agencies to provide tailored service for SMEs, e.g., an investment company for SMEs.

Preferential policies to support SME pollution control include a preferential tax policy for environmental companies that provide pollution control services to SMEs, and preferential policies on bank loans and land-use.

5.1.4 In the end, SMEs should bear the pollution control costs themselves.

Although the Government should provide supportive mechanisms to finance SMEs in their pollution control, the polluter-pays principle should also be adhered to. In this context, SMEs

should ultimately bear all or most of the pollution costs by themselves. This can be an effective incentive for SMEs to improve their production and management processes. The role of the government is only to help SMEs with financing, rather than paying the pollution control cost on their behalf. Therefore, it should be clearly defined in governmental policies that SMEs should pay the final control costs themselves.

5.1.5 Service agencies should play a role in providing services for SME financing and investment.

Government need not work directly on the detailed financing procedures and can authorize service agencies to provide relevant services.

5.1.6 In order to increase investment efficiency, the Government should encourage the establishment of industrial parks for SMEs where collective pollution treatment is employed. For SMEs that practice individual or non-collective pollution control measures, the Government should encourage the introduction of models in which the operation of pollution control facilities are consigned to specialized companies.

Most of the SME pollution control facilities in China have been funded, built, and operated by the enterprises themselves (non-collective approach). This kind of approach has disadvantages in terms of low efficiency in investment and pollution control due to the lack of access to appropriate expertise in pollution treatment technology and management. Currently water management in China has been emerging in areas such as pollution control conducted by sub-contracted specialized companies and collective control facilities. These have demonstrated their strength in improving environmental investment efficiency and pollution control effectiveness because they take advantage of the merits of division of labor and economy scales. At the same time, such methods have improved and stabilized the compliance rate with industrial discharge standards, enhanced the competitiveness of these companies, and helped to improve achievements in reaching total emission control targets.

5.2 Specific recommendations on supportive mechanisms for financing SMEs in pollution control

Based on the above conclusion that the Government should support SMEs in financing their pollution control, the Task Force proposes three recommendations on supportive mechanisms.

5.2.1 Establish special appropriations for pollution control of SMEs under both the SME Development Fund and the Special Supportive Fund for the SME Development

In line with supportive government policies on the development of SMEs and the provisions referred to in the Promotion Law for SMEs (SME Development Fund and Special Supportive Fund) for the SME Development, the Task Force proposes the following recommendations:

5.2.1.1 Establish a special appropriation for SMEs' pollution control under the SME Development Fund. Applications of the special appropriation include the following:

Provide subsidies for relocating SMEs in industrial parks, which should be less than 10% of the total relocation costs.

Provide funds for preliminary construction of collective pollution control facilities. If these are planned and implemented by local governments, construction can be fully financed by the special appropriation. Local governments should entrust a specialized organization for the construction work. After SMEs move into the industrial park, the initial investment can be gradually repaid by collecting user fees, with the period of repayment set for around five to ten years.

Provide preferential loans for financing SMEs in cleaner production and pollution control technologies. If SMEs do not join in the collective pollution treatment, and when they need financing for their own pollution control, the special appropriation can provide them with preferential loans. The interest rate will be 1% to 3% less than other commercial bank loans, while the difference in rates will be covered by utilizing funds under the special appropriation.

Provide security for financing the environmental projects of SMEs through commercial bank loans. According to the Promotion Law for SMEs, providing security for financing SMEs is one of the applications of the Development Fund for SMEs. Therefore, when complying with provisions for application of the Fund, the special appropriation under the Fund allows security to be provided for commercial loans, and provision of security from other sources becomes unnecessary.

5.2.1.2 Establish appropriation for SME pollution control under the Special Fund for Environmental Protection.

The appropriation for SME pollution control should be used for the following purposes:

- ❖ construction of a service system for SME pollution control (i.e., establish environmental organizations which provide services for SME pollution control);
- ❖ research on laws and regulations relating to SME environmental management;
- ❖ providing technical guidance to SMEs;
- ❖ providing other services for SME pollution abatement.

5.2.1.2 Establish appropriations for SME pollution control under the Special Fund for Environmental Protection.

Based on the revised Ordinance on Collection, Utilization and Management of Pollution Fee, the Task Force suggests that priority for using the Special Fund for Environmental Protection, established by governments at all levels in China, should be given to SMEs for pollution control. In addition, the Task Force recommends that appropriations for SME pollution control should be established under the existing Special Fund for Environmental Protection, and should be used to provide grants to SMEs or to pay the interest for commercial bank credits.

Applying the Special Fund to support SMEs with the provisions on the application and scope of the Special Fund, which focuses on the abatement of major polluting sources and pollution control projects planned by the State Council. SMEs are regarded as a major source of pollution according to their share of total emissions, while, at the same time, the government has recognized and attached great importance to the sound development of SMEs because of their important role in the national economy.

In addition, other sources for supporting the Special Fund can be considered, including governmental budgetary appropriation (the government can appropriate a sum of money either periodically or one time to the Special Fund) and other sources. Referring to experiences in Japan, the Government can re-allocate its budget and apply those funds usually used as deposits or for providing security (such as funds provided for the elderly and for social security) to the Special Fund. These funds can then be transferred to the appropriation for SME pollution control under the Special Fund. SMEs that are funded by the appropriation should repay both the principal and the interest. The principal in the Special Fund will not decrease but will increase. In this sense, the Government budget plays an important role in providing security.¹⁴

5.2.1.3 Establish an organization to be in charge of both pollution treatment and financing.

The Promotion Law for SMEs prescribes that “local governments higher than the county level and affiliated agencies in charge of industrial promotion and other corresponding agencies should provide guidance and service for small and medium enterprises within their jurisdictions.” According to this provision, SME pollution control, as an integral component of SME development, should also be an important part of governmental responsibilities for supporting SMEs.

Local governments, however, usually focus their resources on construction, innovation, and market development of SMEs and overlook pollution control. Environmental agencies, on the other hand, usually regard all enterprises as being in one category without taking note that SMEs require tailored supervision and services different than large-scale enterprises. Consequently, no specialized institutions have been created to prevent and control pollution from SMEs. In order

¹⁴ The feasibility of this approach needs further study and discussion

to implement the Promotion Law for SMEs, it is necessary to clearly define the responsibilities of both governmental agencies in charge of industrial sectors and environmental sectors, so that these agencies can provide guidance and support for financing SMEs in their pollution control. In addition, an “Environmental Management Office for SMEs” should be established within the State Environmental Protection Administration to implement relevant provisions in the Promotion Law for SMEs, including providing financing for pollution control. Moreover, a non-profit environmental organization should be established to implement supportive measures provided by the Government for SMEs.

5.2.1.4 Apply innovative approaches to utilize commercial bank credit

The use of commercial bank credit for control of pollution from individual SMEs may be uneconomical and risky due to the nature of these enterprises. The Task Force therefore recommends some innovative approaches. Establish special investment companies for pollution control involving SMEs. These special investment companies would then apply for commercial bank loans and provide the funds to SMEs for pollution control; An authority that collects pollution levies should provide guarantees for commercial bank loans to SMEs, in order to facilitate loan approval in the event SMEs apply directly for loans; Utilize leases as one option for financing SMEs. Environmental companies in charge of controlling pollution from SMEs could apply for lease financing from the special investment companies, to allow them to pay for pollution control facilities. This would help resolve the limitation that commercial banks prefer to offer only short-term financing to SMEs; A consortium of SMEs can apply for issuing bonds or apply for bank loans for the construction of an industrial park which is installed with collective pollution control facilities.

Working Report

Task Force on Strategy and Mechanism Study for Promotion of Circular Economy and Cleaner Production in China

Chinese Co-Chair: Qian Yi
International Co-Chair: Tsugio Ide

Sep. 2003

At the turn of the 21st century, under the guidance of CPC, Chinese people are devoting all their efforts to building a well-off society in an all-round way. One of the most significant tasks is to quadruple GDP by the year 2020. At the same time of rapid economic growth, we should not ignore some drawbacks.

First, China's cost for per GDP has been among the highest in the world, including energy consumptions and material consumptions for per GDP. If this situation continues, it will greatly discount our actual economic benefits. It will lead to a disadvantageous position in international market competition and will make the development unsustainable.

Second, it is not optimistic for our nation's natural resources. The import of crude oil is growing rapidly while the water resource is in shortage. Many mines are being over exploited, and there are dozens of cities around the country facing natural resource depletion.

Third, the problem of unemployment is severe. With the process of reforms of enterprise ownership and political regime, many workers have been laid-off while many others facing potential unemployment. Population growth and urbanization demand for more work positions. The situation of weak group has raised concerns of the whole society.

Fourth, the environment is being overloaded. Though great efforts have been made, environmental pollution and eco-degeneration are only partially ameliorated while deteriorated as a whole. In recent years, Water pollution, cutoff of Huang River, sandstorms, floods and SARS have highlighted the severe situation of the environment, and have shocked the leaders and public as well. In addition to all these, the disadvantageous effects of global environmental problems have slowly appeared. We are facing an inevitable environmental challenge now.

The key points for maintaining the rapid economic growth while sustaining social stability is to change the traditional pattern of economic growth, and to truly implement the sustainable development strategy. Since 1980s, China has played an active role in the implementation of “cleaner production plan” established by UNEP, and gradually carried out cleaner production through out the country, which have a sound effect. In late 90th, China introduced the new idea of circular economy from abroad, and was thought highly of by the top leader. On the Global Environment Facility Meeting 2002, President Jiang Zemin gave the important speech of “Sustainable development can only be achieved through the way of circular economy based on utilizing the resource with maximum efficiency and environmental protection”. The speech was warmly received and thus circular economy became a popular trend throughout the country.

Our Task Force was founded on the basis of former Cleaner Production Working Group to conform to the trend of times aiming at illustrating the concept of circular economy, gathering and sorting the experiences on circular economy of foreign countries, and providing related policy recommendations to promote the healthy progress of China’s circular economy.

1. The Concept and principles of Circular Economy

1.1 The Concept of Circular Economy

1.1.1 Circular economy is a revolution on linear economy

Circular Economy is the abbreviation of closing materials cycle economy. From the angle of material flow patterns, traditional industrial economy is a one-way linear economy consisted of “resource-production - consumption – disposal”. In this kind of open-loop linear economy, people extensively drain all kinds of materials and energy from the planet, then release them as pollutions and wastes to air, water and soil, treating the earth as “sewer” or “garbage can”. Circular Economy, which is different, promotes an economy development pattern harmonious with the earth. The main purpose of it is to organize the economic activities to a close-loop process of “resource-production-consumption-secondary resource”. All materials and energy can be used rationally and continuously in sustained economy cycles, hence the harmful effect to natural environment can be reduced to a possibly minimized level.

Circular economy is an eco-economy in essence. It requires that all human activities be guided by ecology rule instead of mechanical rule. Circular economy is an imitation of the eco-system, so it is essentially an eco-economy. The basic difference between circular and linear economy is that the latter is merely a superposition of separate linear material flows, so the trans-system material flows are much greater than those within the system. Economic activities are characterized by “High exploitation, low utilization, and severe pollution”. However, the former

one require that materials and energy be exchanged in an intergraded way, recycle materials in every possible process, utilize the materials and energy at maximum to achieve the goal of “Low exploitation, high utilization, and low pollution”. An ideal circular economy usually consists of these four major roles: miners, processors(manufacturers), consumers and waste disposer. Because of the retroactive and network interactions within the system, material flows between different roles can be much greater than trans-system flows. Circular economy is the product of economy and ecology. Under the guidance of ecology, it can offer an overall thought to optimize the interactions between different parts of human economic activities. It can give a strategic theory for the transition from the traditional economy since industrialization period to a sustainable development economy; hence it will eventually harmonize the long conflict between environment and development.

1.1.2 “3R” is the working principles of circular economy

The principles of circular economy are “Reduce, Reuse and Recycle” (also called “3R” principles). Every principle is vital for the successful implementation of circular economy.

(1) Reduction is method concerning input, aiming at reducing the input material flows and energy flows into the production and consumption process, so it can also be called material reduction. In another word, we should learn more about how to produce the essential products with as little resource as possible. We should learn to prevent the waste from generation instead of dispose of them after production.

(2) Reuse is a method concerning processing. We should try to use natural resources and products in every possible ways. By reusing them, we can prevent them from becoming wastes, thus prolong the life span of products and services.

(3) Recycle is a method concerning output. By turning wastes to secondary resources, it reduces the wastes for final disposal in volume and decreases the consumption of natural resources. Producers should try to use secondary resources to displace natural resources. Consumers should buy the products containing the maximum raw materials made by secondary resources. These will help to close the economy loop.

The priorities of these 3R principles are not equal. Some may simply regard circular economy as the recycle of wastes. Actually, the fundamental goal of circular economy is to systematically prevent and reduce the wastes in economy process. The recycle of wastes is only one of the ways to reduce the wastes for final disposal. E.g. the “Circular Economy and Wastes Management Law” of Germany enacted in 1996, listed the priority concerning wastes problem as: Reduce-Recycle-Disposal. The principle of the law is to first reduce the generation and release of wastes from its beginning, then, wastes which cannot be reduced or the package and second-hand goods

used by consumers (These are called recyclable wastes) should be recycled. Only when both reduction and recycle can not be achieved, final wastes (These are called disposable wastes) are allowed to be environmental soundly disposed of. Take solid wastes as an example, this prevention-centered method of circular economy has a goal with different levels:

- (A) Wasted should be reduced by prevention;
- (B) All products should be used for maximum times;
- (C) Try to recycle wastes. Some organic wastes can be composted;
- (D) For those which can not be reduced, reused, recycled or composted, incineration is the choice;
- (E) After all the four criteria are satisfied; remains should be sent to advanced landfills for disposal.

1.1.3 Circular economy is the economic pattern for sustainable development

When judging the rationality of economic development in 21th century, we should consider all the three dimensions of sustainable development, i.e. the integration of economic, social and environmental dimensions. According to the need of sustainable development pattern, first, we should try to make more values in economy aspects. It is the matter of effective distribution of resource, which can be regulated by price. Second, we should try to reduce bad influences in environment aspects. It concerns the maintenance of a healthy eco-system, of which the prevention of ecologic degeneration can be the major policy goal. Third, we should try to solve the problem of employment in social aspects. It is regarded as the problem of a fair distribution of social wealth, of which tax can be the major policy tools.

Traditionally, economic growth and environment protection are the two sides of a coin in the traditional industrialization pattern. They are separated instead of integrated in solving economic, social and environmental problems. Traditional economy solely pursues GDP growth. On one hand, it makes growth at the cost of natural capital consumption, thus lead to the antagonism between economy and environment; on the other hand, it reduces employment positions by increasing the level of automation, thus lead to the conflict between economy and society. Traditional environmental protection strategy lays great emphasis on terminal recovery, thus triggers violent contradiction between pollution recovery, economic growth, and social employment. For example, the “close, stop, merge, shift” policy towards pollution companies to solve environmental problems has brought with the problem of unemployment, and effected people’s livelihood and social stability.

Instead, circular economy is a “triple-win” economy; it combines economic growth, environmental protection and social employment all together, leading the three-dimensional separated development to an integrated one. In every aspect of development, circular economy means a revolutionary change. In the aspect of promoting economic growth, it brought the

revolution from material growth in volume to service growth in quality. In the aspect of solving environmental problems, it brought the revolution from open-loop terminal recovery to close-loop process control. In the aspect of promoting social employment, it brought the revolution from employment-downwards society to employment-upwards society.

We have long follow the linear growth pattern of the three-dimensional separated traditional linear economic growth. As the result, economic growth accelerated at the cost of ecological deterioration. So we must find a new economic pattern for China's future development, i.e. the organic integration of economic growth, environment and resource protection, and social employment achieved by circular economy.

1.2 The significance of circular economy to China development

1.2.1 China should become a sustainable development economic power in 21st century

The modernization of China is not only to build an economic power of 18th-20th century, but a power facing 21st century. Following the thoughts of traditional industrialization can only leads to traditional linear economy and pursuing GDP growth from pure economic and technical views, etc. China's environment and resources can not afford such kind of economic power, and such kind of development can not be sustained.

To change our way of thinking and research on the establishment of a new economic pattern-oriented economic power is our urgent task now. At present, there are two new economic patterns of revolutionary significance in the world. One is knowledge economy, the other is circular economy. The former emphasizes the replacement of intellectual resources of material resources and to achieve the intellectualization of economic activities. (So called "soften" trend); the latter aims at environmental sound utilization of natural resources and environment capacity and to achieve the ecological reform of economic activities. (So called "green" trend) Both eventually lead to dematerialization. Since the establishment of sustainable development strategy in 1990th, countries including Germany, Japan, and USA have all regarded the development of circular economy and the establishment of a circular society as an important way and the effectuation of sustainable development strategy. It is explicit that the development of knowledge economy and circular economy are two major trends in recent years. In China we have reached a consensus on the importance of knowledge economy, yet we should learn more of the significance of circular economy.

1.2.2 Circular economy and building a well-off society in an all-round way

We should have a comprehensive understanding of the goal of building a well-off society in an all-round way, instead of laying all emphasis on the increase of GDP. The goal of building a well-off society in an all-round way includes four aspects: the strengthen of economic development and national power, the perfection of democracy and legal system, the development

of science, education, culture and health sectors, and the improvement of eco-system and resources efficiency. Thus, the increase of GDP can not represent the establishment of a well-off society in an all-round way. We need some more comprehensive and scientific indicators.

Obviously, if we only pay attention to the quadruple of GPA in next 20 years and maintain the present economic pattern, the consumption of natural resources and environment pollution will quadruple as a result. It will run counter to our goal of a well-off society. The living standard may not be improved; on the contrary, it may deteriorate. Economic development will be constrained and can not be sustained.

The goal of building a well-off society in an all-round way requires that we develop economy in harmony between human and nature. The improvement of living standard means that we should improve our resource utilizing efficiency and reduce pollution. Because of China's huge population and limited resources per people, circular economy is the only choice. We should limit the resources consumption increase to a very low level, thus we should improve our resource utilizing efficiency by 4-5 times. At the same time, we should control pollution to zero-increase or to decrease, leading China to the road of productivity development, wealthy life and healthy environment.

1.2.3 The implementation of circular economy needs the cooperation between government sectors.

The promotion of circular economy is a task with great comprehensiveness. The cooperation and coordination between different government sectors and industries is necessary. With out the participation of economic sectors, circular economy will be mired in the situation of "circular but not economy". So we believe that the popularity of circular economy should spread from environmental sectors to economic and social sectors. The research on the integration of the three dimensions: economy, society and environment should be promoted. Peoples from different fields should be attracted to participate into following research and practices.

(1) In economic aspects, function-oriented economic revolution should be promoted in China. China economic growth has been greatly damaged by cheap disposable products. China in the future should dedicate to the development of durable and valuable products and services. "Made in China" should be brand production, instead of the workshop of mass production.

(2) In social aspects, we should take the way of circular economy to solve the unemployment problem. The huge population of China is a major obstacle in the way of modernization. Future China should convert from country with huge population to country with huge employment. Industrial chain will be extended and all kinds of services will be developed through circular economy. More employment will be offered by service sectors.

(3) In environmental aspect, we should perfect the resources utilization and pollution control based on prevention and process control. The safeguard of China's modernization is the improvement of natural productivity. Future China should make more efforts on the entire proceeding of economic development from macroscopic view, and the life-cycle analysis of a product from microscopic view to ensure that China's natural resources will fully serve the development of social economic development.

1.3 The three patterns of circular economy

Research has shown that an industrial system of circular economy should comprise at least following five characters:

- (1) Production should not only focus on products development and quality, but also focus on the reduction of raw materials consumption and choice of recyclable materials and structures.
- (2) We should resist the over-packaging of products for sales. When simplifying the package and containers, try to use recyclable materials and containers.
- (3) When reducing the emission of industrial waste, try to recycle and reuse them. Hazardous wastes should be environmental soundly disposed of without delay.
- (4) Foster the recycle industry of used products and reduce landfill and incineration of municipal wastes to minimum.
- (5) Replace traditional energy resources by green energies like: solar energy, tidal energy and geothermal energy.

The industrial system of circular economy can be built in three different levels.

1.3.1 Minor cycles: Pattern of Dupont Chemical Co-Circular economy in an individual company

The material cycle within a company is the basic expression of circular economy in micro-levels. World Business Committee of Sustainable Development (WBCSD) members, who take eco-economy benefits as their principle, all attach importance to the inner-company material cycle. Dupont Chemical Co. is a typical example. In late 1980th, the researchers of Dupont creatively adapted the "3R" principle to "3R" manufacture code according to the reality of chemical engineering industry to reach the environmental protection goal of less emission or even zero emission. By abstain from using some hazardous chemical, reducing the usage of some chemicals and inventing new technologies to recycle company's products, by 1994, the plastic wastes was reduced by 25% while air pollution was reduced by 70%. Meanwhile, they recycled chemicals from plastic wastes like discarded milk boxes and disposable plastic container, and developed some new durable productions using recycled polythene. The vice manager of Dupont Mr. Terb said: "The goal's establishment (Zero emission) encourages our creativity. The more we consider this goal, the more we understand that wastes reduction is actually the development

of whole new technologies to use things usually discarded by us.”

Generally speaking, the cycle within a company comprise following situations: (A) Retrieve the lost materials to former process as raw materials, for example: the recovery of paper pulp from wastewater in paper industry. (B) Through certain treatment, retrieve the waste of production to former process as raw materials or raw material alternatives, for example, copper can be extracted from waste electrolyte in electrolytic copper production through some treatment, and then reused as raw materials. (C) Through certain treatment, wastes of production can be reused as raw materials for other manufacture processes within the company.

1.3.2 Meta cycle: Pattern of Carlonberg ecological industrial park - circular economy facing symbiosis companies.

There is a limitation of cleaner production and circular economy within a company, for there will certainly be some wastes and by-products that can not be recycled within the company. Material cycle outside the company is necessary. The ecological industrial park is a manifestation of the circular economy principle in a wider range. It is an industry symbiosis of different companies linked to share resources and exchange by-products. The waste air, heat, water, materials of one company is another's raw materials and energy. Carlonberg of Denmark is the most typical example of industrial ecological system in the world. The major companies of this industrial ecological park are a power plant, a refinery, a pharmaceutical factory and a plaster tablet factory. The exchange of wastes and by-products based on these four companies through trade relations not only reduces wastes in volume and costs for disposal, but also creates sound economic benefits, thus forms a benign cycle between economic development and environmental protection.

Circular economy in the form of ecological industrial park has raised two challenges to traditional business management. On one hand, Traditional business management lays all emphasis on the sales department, and throws the problems of wastes management and environment to secondary sectors. However, equal attention should be paid to wastes appreciation. The optimization of company's material and energy exchange should be equally valued as the sales of products. On the other hand, with the background of fierce competition between companies, traditional business management has established the tenet of competitiveness. However, industrial ecological system requires the establishment of a management form beyond the limits of individual companies instead of pure opponent relationship to facilitate the optimized reciprocal utilization of resources.

1.3.3 Macro cycle: Pattern of Duals System Deutschland AG - Circular economy between production and consumption

Form the angle of general cycle in the whole society; it is a demand to develop second-hand regulation and resources recovery industries. (Called “vein industry” in Japan) Only by this can a circular economic loop of “resources--production--consumption--secondary resources” be

created in the whole society. Duals System Deutschland AG has played an exemplary role in this field. The Duals System Deutschland AG, a non-profit company, is in charge of organizing this system and recycling sales packaging. Commissioned by companies, it organizes collectors to collect and classify package wastes, and then sends them to relevant recovery factories to recycle. Package wastes which can be reused are directly sent back to producers. The establishment of DSD greatly improves the recycle of package wastes in Germany. For example, the recycle rate set by government for package like glass, plastic and paper box, etc. was 72%. It has reached 86% by the year 1997. In 1994, wastes recycled were 520 000 tons. It reached 3 590 000 tons in 1997. Package wastes falls from 13 million tons to 5 million tons per year.

1.4 Cleaner production is the cornerstone for circular economy.

With the enactment of “Law for Promotion of Cleaner Production”, under the plan and guidance of the department concerned, there will be a campaign for the promotion of cleaner production in all professions and trades around the country. Meanwhile, some provinces carried out drastic reforms on circular economy. What exactly is the relationship between circular economy and cleaner production? Without a clear idea of this question, it will lead to confusions in concept and misplacement in practice. It will interrupt the implementation of cleaner production, and be harmful to the healthy development of circular economy.

We believe that cleaner production is the cornerstone of circular economy, and circular economy is the extension of cleaner production. In concept, they share the same background and origin from the same theory; in practice, they have interlinked implementation ways, and should be integrated.

1.4.1 The raise of the two concept are both based on the demand of the day

We all know that industrial society exploited nature resources mercilessly with exponential growth, and has caused global environment deterioration, natural resources depletion and an overloaded earth. Traditional development pattern can not be sustained. Under the guidance of sustainable development theory, UNEP drafted “Cleaner Production Plan” in 1989, and promote cleaner production all around the world. In year 1996, German Closed Substance Cycle and Waste Management Act (CSCWMA) came into force. This waste management decree promotes economic development based on resources recycling, and thus a significant step towards building a circular economy. Both laws emerged in response to the conflict between economic development and natural resources.

China’s ecological fragility is well below the world’s average. With the population ascending to its peak, many experts predicted that the first 20 ~ 30 years of the 21st century will be a “narrow way” for China’s development. During that period, pressures caused by some unsustainable factors including the decrease of arable lands, water shortage, food insufficiency, energy shortage, aggravation of air pollution, and mineral insufficiency will be further increased. Some of these

factors will reach its limit. Facing the real danger to livelihood, cleaner production and circular economy will be the only choice to surmount the “bottleneck” in China’s sustainable development.

1.4.2 Both based on the theory of industrial ecology

Industrial ecology can also be translated into Chinese as trade ecology. As a branch of applied ecology, it uses the theory of ecology to study the interrelation between industrial activities and ecologic environment, to investigate the through process of substance cycle from the environment and to the environment, to probe the way of ecological industry. It regards the economic system containing human production & consumption activities as a special system in the whole biosphere. So economic system is not only subject to social rules, but is also subject to natural ecologic rules. To seek the harmony between society and environment and the compatibility between technosphere and biosphere, the only solution is to fit the economic system into ecological system, to imitate nature macroscopically, and thus make economic activities resemble the ecosystem structure principles and operational rules to a certain level, achieving the ecological transformation of economy, also called “ecological economy”. Industrial ecology has offered thoughts and tools for the integration of economy and ecology. Circular economy and cleaner production are both important components under the industrial ecology’s framework.

1.4.3 Share the same targets and routes

Though designed mainly to prevent pollution, cleaner production has targets other than material recycling on different levels. Those include the reduction of hazardous raw material usage, wastes and pollution reduction in generation and emission, economizing on energy, and decarbonization of energy resources etc. Circular economy mainly aims at the recycling of natural resources, especially indispensable resources. Their targets are exactly the same. In recent years, some developed countries have set the goal of “zero emission, zero growth in material and energy consumption, and zero wastes landfill”. (3 Zero) Obviously, the “3 Zero” also represent the targets of cleaner production and circular economy.

There are also many similarities between circular economy and cleaner production in implementation. The practice of “cleaner production” can be divided into two categories, i.e. source reduction and recycling, including: reduction the consumption of resources and energy, reuse of the raw materials, intermediate products and products, recycle of substance and products, utilization of secondary resources and environmentally sound alternatives. The 3R principle of circular economy also derives from these.

1.4.4 The differences and relations between cleaner production and circular economy

The major difference between the two concepts is in the implementation level. Cleaner production on company level is the minor cycle of circular economy. Cleaner production can be implemented on a single product, single equipment or a single production line, using the

concepts of circular economy. However in ecological industrial park, cleaner production in individual companies is only the first step, cycles involving different companies are needed. In general circular economy, a great range and area is a necessity. For example, in Japan, it is called “the construction of a recycling-oriented society”. The implementation of circular economy covers a wide range, involves different sectors and factors, and will not show obvious effects in a short time. Not a simple department can undertake such a task of planning and organization.

In practice, when implementing circular economy, various technical problems should be solved. Cleaner production has provided an essential technical support. Especially, the premise of the implementation of circular economy is the ecological design of products. Without it, circular economy will remain as a slogan, and will never come true.

China has promoted cleaner production for over ten years, and has accumulated some precious experience in solving problems of state system, mechanism and legislation, and in the construction of methodology. The experience can be used as reference for the implementation of circular economy.

Present major task is to grasp the rare opportunity of the enactment of “Law for Promotion of Cleaner Production”, devote major efforts to implementing cleaner production, and lay the bases for circular economy. While practicing circular economy, it should be combined with cleaner production. The department concerned should include both circular economy and cleaner production, develop advanced industry guidelines, set unified plans, clarify the strategic task for dematerialization, and pursue for the reciprocal of environment, society and economy.

2. Case study on circular economy in home and abroad

2.1 Various approaches of circular economy practices with examples from Japan, Germany and the United States of America

It is necessary for China to learn from other countries, which have already had some experience with elements and practices characteristic of a circular economy. Hence, relevant policy developments as well as case studies from Japan, Germany and the U.S. have been selected and studied. In these countries some far-reaching and exemplary efforts have been realized to increase eco efficiency and implement elements of a circular economy. There are both similarities and differences in the approaches of these countries and China should evaluate them thoroughly. However, the lessons learned in the different countries during the implementation are highly valuable for China’s discussion on circular economy.

2.1.1 Efforts towards the construction of a recycling-oriented society in Japan^{1,2}

2.1.1.1 Brief history towards a recycling-oriented society

Since the late 1950s when Japan's high economic growth started, industrial pollution began to draw attention. During the 1960s and 1970s, the government of Japan established environmental policies to address this kind of industrial pollution. During the so-called bubble economy of the late 1980's, the volume of waste increased dramatically leading to an ever growing need for waste disposal sites and a strengthening of waste management policies. The Waste Management Law was revised and the Law for Promotion of Utilization of Recyclable Resources was passed in 1991. The Containers and Packaging Recycling Law and the Home Appliances Recycling Law were enacted in 1995 and in 1998, respectively.

By the end of 1990s, following the trend of these policies, rising awareness evolved of a need to shift away from the current socio-economic system, and to develop a new socio-economic system of the coming 21st Century that would enable Japan to overcome its environmental and resource restrictions.

The Industrial Structure Council of MITI³ prepared a report called "Vision of a Recycling-oriented Economy" in July 1999. This report concluded that, in order to achieve both environmental protection and sustainable economic growth, it would be necessary to create "a recycling-oriented economic system" by incorporating environmental protection measures and resource saving actions into every facet of economic activities.

The concept of a recycling-oriented economic system comprises four factors:

- ❖ To realize the maximization of resource and energy use efficiencies through input and output minimization in a way to harmonize environment and economy through making use of the market mechanism;
- ❖ To build a new economic system that is characterized by a cooperative partnership consisting of businesses, consumers, and national and local governments;
- ❖ To establish a new system for industrial technology development. To be specific, it is necessary to develop technologies to reduce environmental burdens throughout an economic system as a whole ranging from upstream to downstream of resource exploitation, raw material production, parts and components manufacturing, processing and assembly, distribution, consumption, and waste disposal and recycling;

¹ Tsugio Ide, Professor, Director of 3E Institute, Keio University, Japan; Kotaro Kimura, Executive Director, Global Industrial and Social Progress Institute (GISPRI), Japan; Tohru Sasaki, Senior Researcher, Global Industrial and Social Progress Institute (GISPRI), Japan

² NOTE: Writers of this thesis owe a great deal to Mr. Yasuo Tanabe, former Director of Recycling Promotion Division of METI to write this.

³ Ministry of International Trade and Industry, which became METI, Ministry of Economy, Trade and Industry in 2001.

- ❖ To foster environment-related industries by the “environmentalization” of industries as well as the industrialization of the environment. As a party to facilitate a recycling-oriented economy, the industry sector has an extremely important role, and the environment-related industry is likely to create a market of about 37 trillion yen (about US300 billion dollars) and the employment of about 1.4 million people in 2010.

The MITI’s initiatives and the following intensive debate within the government also stimulated active discussions in the general public. The year 2000 was named the “First Year of a Recycling-oriented Society”, and the Diet passed six recycling-related bills marked with an asterisk in the below figure (The Waste Management Law was revised and the Automobiles Recycling Law was enacted in 2002.).

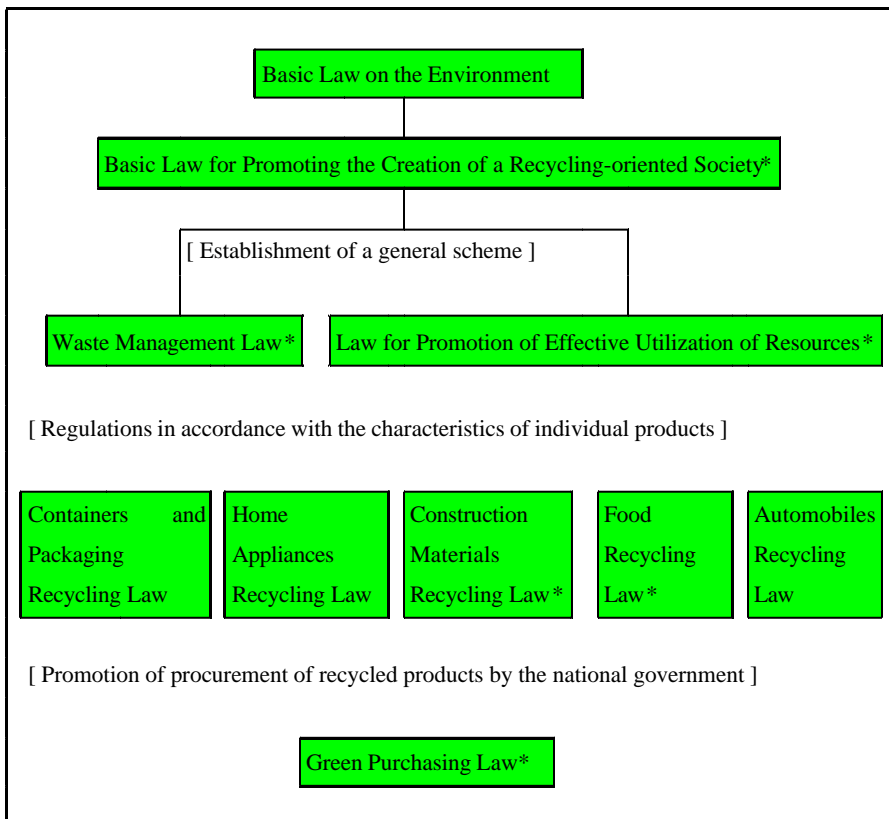


Figure Legislative Framework for Promoting the Creation of a Recycling-oriented Society

2.1.1.2 Promoting the creation of a recycling-oriented society

The *Basic Law for Promoting the Creation of a Recycling-oriented Society* provides a basic legislative framework for such a society and rules over other recycling-related laws and regulations. This law defines the recycling-oriented society, determines the distribution of roles and responsibilities among the related parties, sets out basic principles for necessary measures, and requests the formulation of a national basic plan. The recycling-oriented society is a society

where the consumption of natural resources is well managed, and the environmental burden is reduced as much as possible. In addition to advocating the creation of such a society, it also strives for a “sound economic growth with less environmental burden.”

The emphasis is on the distribution of roles and obligations among the related parties, especially the “*Extended Producer Responsibility*” for businesses, and the “*Emitter Responsibility*” for consumers. The basic principle on priorities of necessary measures is as follows:

- ❖ “Reduction”, i.e. to require further reduction of waste;
- ❖ “Reuse,” i.e. to promote the reuse of “recyclable resources,” recovered from waste as products or parts;
- ❖ “Recycle”, i.e. to require further use of “recyclable resources” as raw materials;
- ❖ Recover heat from “recyclable resources”;
- ❖ Appropriate disposal of waste if unusable as “recyclable resources”.

The application of this basic principle to particular industries and products is to be stipulated by respective laws and regulations.

In accordance with this law, the Government of Japan decided the first basic plan for promoting the creation of a recycling-oriented society in March 2003.

2.1.1.3 Promotion of effective utilization of resources

The *Law for Promotion of Effective Utilization of Resources* requires the industry sector to implement waste reduction, reuse and recycling activities from upstream to downstream processes. It is an epoch-making and unprecedented legislation in the world, mainly aiming at creating an economic system with higher resource and environmental efficiencies. The law sets seven categories in which 3R (Reduce, Reuse, Recycle) efforts shall be made. A cabinet order was issued to designate 69 product categories in 10 industries effective from April 2001.

In addition, regulations in accordance with the characteristics of individual products are implemented through other five recycling laws and the *Green Purchasing Law* promotes the procurement of recycled products by the public sector.

2.1.1.4 Promotion of businesses and technological development

Since the mandatory regulation may not lead to actual practice of recycling, METI has introduced a supportive system for businesses.

The most effective one may be the *Eco-Town* businesses, which promote zero-emission towns in a region by offering subsidies to private entities that want to build sophisticated high-tech recycling facilities and to develop the recycling industry. Since its introduction in fiscal 1997,

METI co- approved 14 *Eco-Town* plans with the Ministry of Environment and granted subsidies to 24 facilities. Because technological innovation is a key for the creation of a recycling-oriented society, METI has a system to support such technological development in order to increase the potential for commercially feasible recycling businesses.

2.1.1.5 Lessons to be considered

Three lessons can be drawn from the past experiences of Japan. The first is the importance of public awareness. A recycling-oriented society deeply and inevitably involves the people living in that society. Therefore, to enhance the public awareness on the importance of realizing a recycling-oriented society is very vital. Information exchange and education play a critical role in this area.

The second is a need to take precautionary measures. Throughout its economic development, Japan tried to take the best measures available at each time. Unfortunately, taking precautionary measures would have reduced recovery costs in some cases. In the extreme case, pollution damage compensation and repairing cost is estimated to be 100 times more than that of taking the precautionary measures. It is important to realize that to ignore potential problems will increase the necessary future costs.

The third lesson is to utilize the market function as far as possible. This can be described as the internalization of the environment into the market economy. It is necessary to provide waste management and recycling services through proper cost sharing, whether they are managed by the public sector or the private sector. In Japan, the introduction of *Extended Producer Responsibility* is advancing the shift from public sector waste management to private sector economic activity.

As each country in the world has its own characteristics, it is impossible and also undesirable to transplant the experiences of one country to another country. The past experience of Japan may be a useful guide for China to build up its own recycling-oriented society.

2.1.2 Approaches to a circular economy in Germany⁴

2.1.2.1 Brief review of legislative development

A major legal development in the area of waste management in Germany was the enactment of the *Waste Disposal Act* in 1972. Before, the only existing administrative measures were obligations of the communities to collect and eliminate the waste within their districts. Standards for treatment and disposal did not exist and, as a result, an immense number of contaminated

⁴ Compiled by Rolf Dietmar, Director of the GTZ-Programme Environment-oriented Enterprise Consultancy Zhejiang, Hangzhou, China (The compilation is partly based on a study conducted in April 2003 by Ellen Gerdes).

areas generated. In 1986, the *Waste Avoidance and Waste Management Act* came into effect taking into consideration the basic elements of a progressive waste management system, consisting of waste avoidance in terms of volume and hazardousness, as well as material recycling, energy recovery and proper final disposal.

The *Packaging Ordinance* of 1991 applies to the packaging of all goods except hazardous substances aiming at the following goals:

- ❖ Significant reduction in the packaging materials by avoidance, reuse and recycling;
- ❖ Placing responsibility for product disposal on those who manufacture and market products;
- ❖ Relief of the local communities from the burden of disposal tasks;
- ❖ Clear promotion of material recycling.

Accordingly, end-of-use packaging has to be collected and recycled by commerce and manufacturers, who can be released from individual take-back obligations by joining a nationwide collection system. Industry has set up its own take-back and recycling system, financed by more than 19 000 licensees using the Green Dot as a label on their packaging and, in this way, financing the separate collection, sorting and recycling of plastic sales packaging. The Duales System Deutschland AG, a non-profit company, is in charge of organizing this system and recycling sales packaging.

The latest milestone in the development of German waste management legislation emerges with the Closed Substance Cycle and Waste Management Act (CSCWMA) that came into force in 1996. This waste management decree represents a real beginning of closed-loop recycling and thus a significant step towards building a circular economy. It represents a new dimension in German waste management policy with its central goals of avoidance and recycling.

There is an obligation to avoid waste in production processes with the CSCWMA requiring that whoever produces, markets and consumes goods is also responsible for avoidance, recycling, reuse and environmentally sound disposal of the waste. Thus, the CSCWMA clearly introduces the polluter-pays-principle.

Hence, waste minimisation is a key element of the German strategy to introduce a closed substance loop with the following hierarchy:

- ❖ Waste prevention/avoidance is first priority;
- ❖ Re-use has the same priority as recycling;
- ❖ Recycling on-site is prior to recycling off-site;
- ❖ Reduction of toxicity is as important as the reduction of waste quantity;
- ❖ Material recycling is as important as energy recovery;
- ❖ Priority of recycling over landfilling.

As a logical consequence, product responsibility is one of the centrepieces of the CSCWMA that aims at promoting the development of products, which on the one hand are of multiple use, have a long life, are repair-friendly, and, on the other hand, can be recycled and disposed of in the safest possible way.

In 2001, the *Ordinance on Environmentally Sound Disposal of Municipal Waste* was adopted specifying a regulation enacted in 1993 stipulating that by the year 2005 at the latest, the disposal of non-pretreated domestic waste would be prohibited⁵. As a consequence, disposal of mixed waste with organic and soluble components will not be possible without prior thermal and/or mechanical-biological pre-treatment.

2.1.2.2 Effectiveness of closed cycle approaches

The effectiveness of the closed cycle approach may be measured by the avoided waste streams as well as the collection and recycling rates and the economic benefits through efficient use of resources and energy (eco efficiency).

The result of the efforts with regard to *Municipal Solid Waste* are shown in the below Table representing “average” rates extracted from different publications. They differ considerably, as collection systems and recycling facilities are not the same throughout the country.

Table : Collection and recycling rates of municipal solid waste components

Type of waste/component	Collection rate	Recycling rate (of collected total)
Organic fraction	50%	96%
Paper and cardboard	87%	100%
Glass	78%	100%
Tin and aluminium in cans and other metals	65%	approximately 100%
Plastic and paper packaging	75%	97%
Batteries	35%	100%
Automotive batteries	95%	100%
Waste tyres	94%	98%
Waste of Electrical and Electronic Equipment	no data available	estimated at 10%
Textiles	estimated at 70%~80%	estimated at 70%~80%

Source: Compiled by Ellen Gerdes, 2003

The *Packaging Ordinance* as a major regulation has demonstrated very good performance within a rather short period of time. As a result, waste generation from packaging decreased significantly, and packaging design changed towards lightweight, low-waste, single-compound packaging. The ordinance has proved successful in several fields:

- ❖ Manufacturers have changed their packaging habits. Environmentally friendly disposal

⁵ Dr. Helmut Schnurer, Section Head at the Federal Environment Ministry, “ German Waste Legislation and Sustainable Development”, p. 26, 2002

of packaging is taken into account during the production process and is increasingly used as an advertising argument;

- ❖ In the field of transport packaging a trend towards reusable packaging is obvious, for example packaging for furniture, food, and pharmaceutical products;
- ❖ Industry has set up a nation-wide collection system for throw-away packaging and has increased its recycling capacities;
- ❖ The large quantities of collected packaging have brought considerable relief to landfill sites.

Despite the increase in overall consumption, the total sale of primary packaging was reduced from 7,6 to 6,7 million tons per year between 1991 and 1997 and industry collected more than 74 million tons of packaging waste (40.6 million tons thereof were sales packaging) and conveyed them to recovery with 25 million tons being returned to the production loop.

2.1.2.3 Introducing elements of a circular economy - lessons learned

From Germany's experiences representing several decades of policy evolution and huge efforts by all involved stakeholders, the following major conclusions can be drawn:

- ❖ Tapping the potential of the general public can be highly effective. The majority of Germans have proven to be both very responsive and cooperative in any measures that are being taken to reduce or recycle waste. Both individual citizens as well as non-governmental organizations have become major supporting factors leading to the success of policies.
- ❖ Involving relevant stakeholders and appealing to their responsibility is crucial. Achieving active participation such as voluntary self-commitments has shown to be vital for waste policies. Proactive communication addressing pressure groups from industries and related associations is likely to generate substantial support. For instance, the German paper industry released a voluntary self-commitment in 1997 of increasing the waste paper recycling quota. After years of high investments, the utilization rate of recycled waste paper in paper production reached 65% in 2001.
- ❖ Making use of market mechanisms and market-based instruments increases efficiency. Relying on the polluter-pays-principle is instrumental in leading to reduction at the source of any waste cycle. For example, a deposit fee system, introduced in early 2003 for one-way drinking containers, has proven to be very effective in reducing littering and shifted consumption on a large scale to returnable containers.
- ❖ Adjusting counterproductive regulations at an early stage reduces hazards and long-term costs. The *CSCWMA*, for example, gives a preference to recovery before disposal, which has led to the use of hazardous waste to fill abandoned coalmines, a legally possible way of recovery. Reacting to this development, the German government issued the *Ordinance on Underground Waste Stowage* in 2002, regulating in detail types of waste, rock formations and documentation with regard to underground stowage of waste.

- ❖ Applying principles of circular economy pays off economically in the long-term. Focusing on efficiency reveals potential for cost reduction both in companies and in the whole economy. Additionally, the search for eco-efficient solutions in production unleashes innovative forces and creates business opportunities resulting in enhanced competitiveness not only domestically but also internationally.

Looking at some of Germany's experiences summarized above might be helpful for China in identifying its own most suitable policies. Above all, the outlined approaches must be carefully evaluated in view of an entirely different historical, societal and economic background.

2.1.3 Two case studies from the United States⁶

2.1.3.1 U.S. Toxic Release Inventory - information disclosure policy for environmental improvement⁷

In 1986, as part of the *Emergency Planning and Community Right-to-Know Act*, the U.S. Congress created the *Toxic Release Inventory (TRI)*. Enacted in the wake of two major environmental accidents involving the release of toxic chemicals in Bhopal, India (1984) and Institute, West Virginia (1985), *TRI* was a response to growing public demands for information about toxic chemicals and the potential for deadly exposures in local communities.

Unlike many environmental regulations, *TRI* did not require corporations to treat or reduce pollution emissions but simply to estimate and report to the U.S. Environmental Protection Agency (EPA) "the quantity of chemicals emitted directly into the air, land, and water or sent to locations that treat, store, or dispose toxic waste."⁸ EPA compiles all the reported data, issues annual public reports, and provides public access to information.

Prior to the implementation of *TRI*, estimates of the extent of toxic emissions were widely disputed, with industry representatives challenging the "exaggerated" figures suggested by environmentalists and members of Congress.⁹ When the first annual report was released containing data for 1988, it revealed that total emissions were far higher than either industry or the EPA had anticipated.

Although not initially designed to reduce toxic emissions, public disclosure and the widespread

⁶ Compiled by Mr. J. Alan Brewster, Associate Dean, School of Forestry & Environmental Studies, Yale University

⁷ This Case Study draws extensively from two papers by F&ES doctoral student Monica Araya: "From Washington to Brussels: The Influence of the Toxic Release Inventory in the European Union" (DRAFT), February 2003 and "Information as Environmental Regulation: A New Disclosure Rationale for International Business Activity" (Dissertation Prospectus), New Haven, CT, May 6, 2003

⁸ Monica Araya, "From Washington to Brussels: The Influence of the Toxic Release Inventory in the European Union (Draft)," February 2003, p. 7.

⁹ *Ibid.*, p. 2.

public concern created by the release of this information caused private companies to take strong measures. As a result, over the course of the next twelve years direct emissions of the initial list of toxic chemicals to the air were reduced by almost 1.4 billion pounds (63.3%) and discharges to surface waters dropped by 65.1 percent (see Table above). In subsequent years, additional toxic substances were added to the list and a wider group of industrial facilities were required to report.

Table: TRI Total Releases (1988, 1995, and 2000)

	1988	1995	2000	Change 1988-2000	
On-Site Releases	Pounds (in Millions)			Pounds (in Millions)	Percent
Total Air Emissions	2 180.54	1 205.16	800.76	(1 379.79)	-63.3%
Surface Water Discharges	41.91	17.09	14.62	(27.29)	-65.1%
Underground Injection	161.91	154.74	111.33	(50.58)	-31.2%
On-site Land Releases	405.81	269.87	285.58	(120.23)	-29.6%
Total On-site Releases	2 790.17	1 646.86	1 212.29	(1 577.88)	-56.6%
Total Off-site Releases (Transfers Off-site to Disposal)	421.41	294.48	449.04	27.63	6.6%
Total On- and Off-site Releases	3 211.58	1 941.34	1,661.33	(1 550.26)	-48.3%

Source: U.S. EPA

How and why has TRI worked?

The following analysis is a discussion of crucial factors that underline why information disclosure policies work:¹⁰

- ❖ Self-Monitoring: Pollution inventories offer information that is valuable to corporate managers in its own right. Managers are not required to improve their performance, but the information might expose inefficiencies in their processes or unnoticed opportunities for improvement.
- ❖ Peer Monitoring: In the case of *TRI*, peer-pressure is possible because the information comes in a comparative format, which allows benchmarking of companies.¹¹ As a result of the benchmark exercises, companies that are underperforming vis-à-vis comparable peers (or competitors) face an incentive to improve their relative positions in the rankings.¹²

¹⁰ Taken directly from the dissertation prospectus of F&ES doctoral candidate Monica Araya.

¹¹ Karkkainen, “Information as Environmental Regulation: T.R.I. and Performance Benchmarking, Precursor of a New Paradigm?”

¹² Organization for Economic Cooperation and Development, “Pollutant Release and Transfer Registers

- ❖ Communities as Monitors: When faced with information about environmental harms, communities can engage in self-help action, putting pressure on the polluter.¹³ *TRI* has created a system whereby maximum attention is placed upon minimum performers.¹⁴
- ❖ NGOs as Monitors: There is evidence that non-governmental organizations (NGOs) can help multiply the effects of information disclosure by communicating key aspects of the *TRI* reports to the general public.
- ❖ Media as Monitors: Neither command-and-control regulation nor market-based mechanisms have made headlines in the way that *TRI* has.¹⁵ The media (especially local) covers the annual releases of the *TRI* and exposes the names of the worst performers.
- ❖ Regulators as Monitors: The government has an incentive to monitor the data from the *TRI* as a way to assess whether the environmental regulation in place is effective and to identify new priorities.
- ❖ Markets as Monitors: There is evidence that some banks, insurers, and real estate brokers in North America use the release and transfer data as a method to assess a company's operations.¹⁶ Hence, poor performance may affect the availability and price of insurance and non-equity capital.

Potential for effective implementation in China

The experience in the U.S. indicated that prior to *TRI* many industrial enterprises did not know the extent of their own toxic emissions, and that the process of measuring and reporting on these emissions was an important step in understanding how to deal with them. Achieving widespread compliance with such a policy may not be easy. As in the U.S., it may be best to start with a limited number of industrial sectors and mandated reporting on a limited number of toxic substances.

Enterprises may need technical assistance to enable them to measure these releases and to adopt cleaner production methods leading to their reduction. Public education may be necessary to enable communities and the general public to understand the implications of the information on toxic emissions. Local and provincial authorities may also need to be given training and resources to enable them to monitor and assist enterprises in compliance with the information disclosure requirements.

(P.R.T.R.s): A Tool for Environmental Management and Sustainable Development.”

¹³ Register results can also be used to plan for possible emergencies by providing insight into the kinds of releases that could occur under emergency circumstances. *Ibid.*

¹⁴ Fung, “Reinventing Environmental Regulation from the Grassroots Up: Explaining and Expanding the Success of the Toxics Release Inventory,” 120.

¹⁵ For an early example see “Air Pollution, It’s All Legal,” *Newsweek*, July 24, 1989.

¹⁶ Commission for Environmental Cooperation, “Putting the Pieces Together: The Status of Pollutant Release and Transfer Registers in North America,” (Montreal: CEC, 1996).

With ongoing efforts to ensure compliance and to enhance the capacity of enterprises, communities, and local officials, an information disclosure policy such as TRI could become an effective tool to promote cleaner production and a circular economy in China.

2.1.3.2 Life-Cycle Analysis to Improve Environmental and Economic Performance¹⁷

The paper industry is an important component of the U.S. economy, with annual output of \$55-60 billion, (0.6 percent of GDP) but contributes significantly to environmental pollution.¹⁸ In the early 1990s a major study was carried out to recommend steps to be taken by large corporations with respect to their purchasing and use of paper products.¹⁹ The study included an extensive analysis of the environmental effects and compared the overall environmental impacts of production using virgin fibers versus recycled paper.²⁰

“For the recycled fiber-based system, the Task Force examined used paper collection, transport of the recovered paper to a material recovery facility (MRF), processing of the material at the MRF, transport of processed recovered material to the manufacturing site, manufacture of pulp and paper using recovered fiber, and disposal of residuals from MRF operations and paper manufacturing. For the virgin fiber-based system, the Task Force included harvesting of trees and transport of logs (or chips) to the mill, debarking and chipping, manufacture of pulp and paper using virgin fiber, collection of the paper after its use as part of Municipal Solid Waste (MSW), transport of the waste to MSW landfills and waste-to-energy incinerators, and disposal or processing of the waste at such facilities.”²¹

The analysis compared both production systems for five types of paper and found “clear and substantial environmental advantages from recycling all of the grades of paper examined. For each of these grades, and for the majority of the parameters examined, a system based on recycled production plus recycling results in comparable or smaller energy use and environmental releases than does a system based on virgin paper production plus waste management.”²² For example, in the production of newsprint, recycling would reduce total energy use by 43 percent and solid wastes by 62 percent. While some water pollutants would increase, others would decrease, and all forms of air pollution would be reduced significantly.

¹⁷ This case study is based largely on an article in the *Journal of Industrial Ecology*, Volume 1, Number 3: “A Life-Cycle Approach to Purchasing and Using Environmentally Preferable Paper: A Summary of the Paper Task Force Report” by Lauren Blum, Richard A. Denison, and John F. Ruston.

¹⁸ U. S. Department of Commerce, Bureau of Economic Analysis (www.bea.gov).

¹⁹ Paper Task Force. 1995. *Recommendations for purchasing and using environmentally preferable paper*. New York: Environmental Defense Fund.

²⁰ Blum, Lauren, Richard A. Denison, and John F. Ruston. *A Life-Cycle Approach to Purchasing and Using Environmentally Preferable Paper: A Summary of the Paper Task Force Report*, cited in *Journal of Industrial Ecology*, Vol. 1, Number 3, p. 15 (Special Issue on The Industrial Ecology of Paper and Wood; MIT Press).

²¹ *Ibid*, p. 25

²² *Ibid*, p. 28

Potential for Effective Implementation in China

The life-cycle analysis described above is not directly applicable to China. The Chinese paper industry is very different from the U.S. industry, for instance in terms of scale of operations and cost structures.

However, the use of life-cycle analysis techniques to assess the environmental impacts of industrial systems and alternative inputs and technologies, has great potential for China as its industries expand and evolve. Industry associations or government departments could take the lead in sponsoring or conducting appropriate life-cycle analyses. These studies could help steer investments and technological choices in the direction of more efficient production systems and improved environmental performance.

2.2 Domestic case study

China initiated activities of cleaner production as early as the late 1970s. During more than ten years from the 1990s to the present, China witnessed rapid growth of its implementation of cleaner production and circular economy, with its scope being gradually expanded from inside the enterprises to the eco-industry parks and further to the cities and provinces. Hereinafter we'll give introduction and analysis on different levels as to some cases of the successful implementation of circular economy in China on the basis of our research and investigation.

2.2.1 Enterprise level

The enterprise is a basic unit composing the economical system. Accordingly, material cycling in enterprise level is the basic performance of circular economy in the microcosmic scale. On the one hand, the enterprise can, relative freely, organize the inner material cycling based on its own objective and desire, and consciously program constructing its own ecological industrial chain; on the other hand, as one section of the circular economy loop, the enterprise can consciously exert providing chain management to restrict other enterprises but can also be restricted in reverse. Some enterprises such as 3M and DuPont, which are well-known international corporations, have achieved excellent accomplishments and gained precious experience. For instance, DuPont Chemical Corporation initiatively developed the "3R Principles" into "3R manufacturing methods", which are well combined with the actual chemical industry through totally abandoning using some environmental harmful chemical substances, reducing the using amount of some chemical substances and inventing new technologies to recycle its own products. As a result, until 1994, the amount of plastic waste produced in the manufacturing process had reduced by 25 percent, and that of air pollutants by 70 percent. Recently, some enterprises or enterprise groups, which aim at programming and constructing characteristic ecological industrial chain, also start to come into being in China.

2.2.1.1 Ecological industry in Guigang's sugar-making

Guitang (group) Company Limited is in Guangxi province that mainly produces sugar. The company is located in the national sugarcane planting base——Guigang city of Guangxi Chuang Municipality. Sufficient sugarcane resources are featured resources of Guigang city, and such an economic structure, in which sugarcane planting is the base, sugar making is the leader, and paper making development keeps abreast of wine making development, has formed in recent decades. The total amount of direct, indirect and radiation-driving production value of sugar making industry accounts for 33.8 percent of the total GDP in Guigang city, thus the sugar making industry becomes the support industry of Guigang's economic development and the main power of resolving the unemployment problem and reinforcing the social stability and solidification. As the leading enterprise in Guigang, with the support of National Environment Protection Bureau, in 2001, Guitang(group) planned to construct the first ecological industrial chain of sugar making industry in China in 10 or 15 years. In this chain, sugar making is the main support industry, and ecological industrial theory is applied to instruct it. And based on this construction, a national demonstrational ecological industrial zone of sugar making industry, whose leading enterprise is Guitang(group), will be constructed. This ecological industrial zone will be the first national one in China.

The main contents programmed to construct in Guitang sugar making ecological industrial chain are as follows. Guitang (group) Company Limited will be the core company, and combined with the sugarcane planting, the utility of by-produced gooey and the recycle of waste alcohol, through many processes such as reacting, optimizing, advancing, expanding, there will establish sugarcane system, sugar making system, alcohol system, paper making system, combined heat and electricity producing system, environmental comprehensive treating system. And after that a multiple-industry integrated chain with a structure of “Sugarcane—sugar-making—alcohol—paper-making—heat and electricity—cement—compound manure” will be formed. To achieve this object, 12 key construction programs have been planned during “the tenth five-year” period: a) modern sugarcane zone construction project that can provide the zone with high-yield, high-sugar, safe and stable sugarcane to ensure sufficient materials; b) technological innovation engineering of alcohol as energy resources; c) the expansion project of paper used in daily life; d) biological engineering of low-polymerization fructose; e) biological engineering of yeast; f) CMC engineering that can fully utilize the by-produced bagasse, waste gooey and waste alcohol and thus achieve the efficient circular utility of resources; g) technological innovation engineering of organic sugar; h) technological innovation engineering of green paper pulp; i) new technology improvement of sugar-making that can greatly increase the technological contents of the products , improve the producing structure and enhance the competition ability of the enterprise; j) technological innovation engineering of the sugar-pith production using the combination of heat and electricity; k) water-saving engineering that can notably reduce the consumption of public resources such as a coal powder and fresh water; l) construction

engineering of ecological industrial ability that provide insurances from many aspects such as policy and training. Such programs mainly embody the characteristics of transverse coupling, lengthwise closing, and districts conforming:

(1) There are three ecological chains that form a transverse coupling relationship with each other and come into being a reticulation structure :

- ❖ sugarcane sugar-making alcohol production from waste goeey compound manure production from waste alcohol ;
- ❖ sugarcane sugar-making paper and pulp making from bagasse;
- ❖ sugar-making low-polymerization fructose production.

(2) The efficient operation of the sugar zone, which is both the origin and converge, and the above three ecological chains embodies the zone's lengthwise closing that is from origin to converge.

(3) The reduction of waste released toward outside and the ability of collectively treating bagasses and waste goeey from Nanning and even the whole districts of Guangxi achieved districts conformity.

2.2.1.2 Ecological industry in Tuopai's wine- making

Tuopai Company established a combined corporation ecological mode involved in vintage industry, ecological agriculture, stock raising, medicine industry etc. Its main characteristics are as follows:

(1) Form good recycle with natural ecosystem and achieve ecological balance: In Tuopai zone districts, animal egesta and other plant organic manure is used for ecological agriculture, wastewater is retreated to be virescence irrigation water when reaching standards. Ecological agriculture can produce unpolluted vintage raw material, this provides substance insurance for Tuopai's ecological vintage; varieties of virescence trees make climate warm and wet which does good for plenty of microbe enrich and propagate, stable microbe system again makes plenty of crooked medicine and vault mud inoculate naturally. This creates conditions for ecological alcohol vintage and good living environment for stuff in the company.

(2) Industrial ecological chains are integrit and substances utilize sufficiently: Tuopai Company designs a full chain which use lees in breed aquatics- use animal egesta to produce methane- use methane to warm vintage- use creature production in pharmacy- use fertilization in ecological agriculture- provide unpolluted vintage raw material. Lees are used to produce mash and biological active organic manure; mash is used in breed aquatics of cattle, pigs and ducks; animal egesta and other plant material are used to be organic manure or produce methane; methane is used in vintage;

cattle, pigs, ducks productions and valuable Chinese traditional medicine material planted in the zone are used as biological pharmacy raw material; mash is used in ecological agriculture; plants provide unpolluted vintage raw material; Bricks which are made from char bits are used in zone construction; 90 percent of waste water is reused in secondary production.

(3) Tuopai Company collectivizes in management and has extruded characteristics Tuopai Group Company has 24 filiales which deal with items upward. These form a multilayer, multiple cell and high benefits intensively management striding districts and trades enterprise combination which majors in vintage also deals with domains such as medicine industry, packaging, feedstuff, construction, commodity and technology exploitation and melt with science industry and trade business.

2.2.1.3 Ecological industry in Lubei

Lubei ecological industrial mode is another form in ecological industrial practice in China. Its main characteristic is two ecological industry chains which majors in exploitation of material of industrial waste such as phosphor gesso and salt gesso and seawater through developing patch chain techniques, which contain high technology.

(1) Ecological industrial chain which use gesso to produce acid: Lubei Huagong builds the first phosphor ammonium, vitriol and cement combination production equipment in China from techniques before. The equipment uses waste residue phosphor gesso, which is left from phosphor ammonium production to produce vitriol and cement at the same time, vitriol can be returned to produce phosphor ammonium. It makes upstream production to be raw material for downstream processes. Resources are high efficiently recycled used in the whole production process owing to no waste letting off.

(2) Ecological industrial chain which use water in excessive ways : Lubei Huagong builds modern big salt field and an ecological industry chain which use salt water in excessive ways which realize theoretical qualify and good resources recycle and utilization of “salt water breeds aquatics, secondary water brings up bromine, saturation bittern water make salt, salt alkali electricity produces together, high level bittern water brings up kalium and magnesium, saltern waste residue salt gesso produce vitriol and cement at the same time” through reasonable distribution modulation in the process of salt evaporation and purification. This produces integrated efficiency.

Production costs reduce in evidence owing to low raw material expenses of Lubei’s two production industry chains. For example, the same phosphor ammonium, vitriol and bromine element cost 30~50 percent lower than single manufacture factory, a ton of bromine element reduce 1 200~1 400 yuan. This greatly increase enterprise competition power, bring along

construction of items such as manure, chemical industry, construction material, salt industry etc. It promotes integrated economy increasing.

2.2.2 Industrial Zone level

Ecological industrial zone is a practice mode with circular economy principles between several corporations beyond enterprise level. It obtains scale benefits and ecological benefits in corporation management, attains high energy and resources utilization efficiency, improves social, economic and environmental reveals in whole zone districts by resources share, rundle utilization and waste exchange. Following ecological industrial zone mode in Denmark Carlonburgh, some countries such as U.S., Canada and France began ecological industrial zone programming and construction practices quite early and gained rich experience. China also develops fast with advocating and support of related country departments. Based on incomplete understanding, there have been dozens of ecological industrial zone of different types under programming and construction and many economy development districts in process of preparation for economic industrial districts practice.

2.2.2.1 National ecological industrial demonstrational zone in Nanhai

National ecological industrial demonstrational zone in Nanhai is entirely new programming and dummy districts. Nanhai city locates at Zhujiang delta. Nanhai's economy develops fast, its environmental markets have large requirements, and possesses manpower, technology and industry needed in environmental industry development. Combined with district development programming, its leading industry is defined to be highly new technology "Large Environmental Industry", including four leading industry groups-environmental science enquiry services, environmental material and equipments making, manufacture of green products and resources recycling.

Twelve core enterprises and seven dummy enterprises in existence are designed to be members of industrial ecosystem in Nanhai zone districts. Based on forward and backward position relations, technology and economic feasibility and environment innocuity requirements, five symbiotic industrial ecological communities are programmed in Nanhai zone districts. These form nine industrial ecological chains (three are close recycling chains), set up ecological administrative system of three levels such as products, corporations and zone. Its target in the near future is to build national environmental industrial basements with many functions adopted to 21st century such as environmental technology research, production, incubation, communion and innovation.

Characteristics in Nanhai zone districts programming:

(1) There are five industrial ecosystems such as green board materials, disposal plastic, environmental equipments, aluminum materials, green-frozen systems which each are

comparatively independent, together form symbiotic chain-net structure. This highly increases flexibility in industrial ecosystem.

(2) Environmental science and technology enquiry services play an important part in Nanhai zone. This makes great sense for ecological industrial construction, zone industry level improvement and promotion of traditional industry upgrade revolution.

(3) The industrial ecosystem of board material process systemically describe and explain five substance recycling levels such as origin recycling, material recycling, chemical recycling, waste recycling and heat energy reuse recycling.

(4) Nanhai eco-industrial zone programming improve resource utilization efficiency through highly new technology and also quite emphasize on resource recover and reuse.

2.2.2.2 Quzhou shenjia eco-industry Park

The Quzhou shenjia eco-industry Park in Zhejiang Province neighbors on the inorganic chemical raw materials base and the fluorine chemical base, with sufficient supply of chemical materials, which facilitates the development of fine chemical industry. Scores of chemical corporations have settled down into the Park, except that they are all small scale corporations, so the leading orientation of the Park becomes fine chemical industry, the one that is compositive and reconstructive.

The construction and programming of the Park features the following characteristics:

(1) Products programming of matter integration: Based on the system of the products in existence and the backward position, combined with the trend of development, a concourse of super products is developed, together considering the centralization, marketing risk, and the feasibility of technology and other factors, discriminate the concourse of preponderant products that boosts the development of Shenjia Park. Analyze the compatibility of the matter to the programming of the products, consider the matching characteristics of different products in the park enough, so that the system of the products can be established on the basis of compositive system of technologies.

Bring forward project of integration of matters in different levels as follows: substitution of matters, reduction of the fountainhead, improvement of the process, waste use, waste exchange and waste recycling and so on for the industrial ecosystem program, it has overcome the shortcoming that these eco-industry park are barely resting on the program of product chain now, it goes deep into the inside of the technologies and the core of the process, applies the technique of the process integration to realize the aim of the eco-industry.

(2) The construction of the eco-industry management information system: The characteristic of the system is that it provides expert supportive tools for administration: the analysis tools for

river polluted fountainhead and accident fountainhead, the evaluate tools for the coming corporation. The former could clustering analysis through the three points---time, spot, pollutant, then make certain the most possible polluted fountainhead, so that the park could take some steps in time; the latter could evaluate the program of the coming corporation in several aspects—technique, economy, environment, so that they can make certain whether the corporation is suitable to develop in the park, it is propitious to improve condition that the investment program depends on the experience and the main opinion of the manager.

2.2.2.3 Baotou eco-industry park (Inner Mongolia)

Baotou eco-industry park(Inner Mongolia) is located in the eastern part of DongHe District in Baotou, covering an area of 19.8 square kilometers from HeBei Village in the west to MaoQiLai Village in the east and from the yellow river dam in the south to State Route No.110 in the north. The park is centered on the joint ventures of aluminum industry and electricity industry, with the former as its leading industry and the latter as its basis. A chain/network of eco-industry will be formed through the material exchange between intermediate products, end products and wastes in various systems involved, thus make it possible for optimum allocation of resources, effective utilization of wastes, minimization of environment pollutions and promotion of economic benefit, all of which can finally boost local economy.

The eco-industry park is constructed under the following aim: within about eight years, to set up an ecological aluminum industry park with aluminum electricity joint ventures as its core industry and the electrolysis and intensive processing of aluminum as its main route. The construction of the park is guided by the theory of circular economy and ecological industry and is supported by Baotou Aluminium (Group) Co., Ltd.. Upon completion, the park will have such features as high energy transmission, state-of-the-art technology and low pollution in addition to its optimized structure, reasonable overall arrangement and complete necessary facilities. Furthermore, it will become the biggest aluminum alloy production base in Asia, which will lend solid support to the implementation of the strategy of DongHe District to convert part of its secondary industry into the tertiary industry, help Baotou to form its spanning economic development as the new spotlight and present a new pattern of development of aluminum industry and other industries of high energy and high pollution in China.

The eco-industry park is comprised of three functional zone. The core zone is based on the joint ventures of aluminum industry and electricity industry and focuses on the development of such related industry as electricity, aluminum electrolysis and intensive processing , aluminum alloy casting and new lanthanide series construction materials .The expanded zone is the expansion of the core zone, into which part of the foundry industry and other industries of high energy are introduced as what are removed from the original location due to the reconstruction of DongHe District as well as the implementation of the strategy of converting the secondary industry into

the tertiary industry. The emitting zone will bring its eco-industry function and emission effect into full play, taking advantage of the development of the park to promote the development of other industries and other districts so as to accelerate the adjustment and the evolution of the industry structure in Baotou and Inner Mongolia.

2.2.2.4 Shihezi eco-industry park (XinJiang)

Shihezi eco-industry park(XinJiang) is about 3 kilometers in width with an area of 1 million mu around the Shihezi reclamation zone(Xin Jiang), which is mainly used for achnatherum planting and municipal sewage treatment. It will make great efforts to develop the paper making industry under the support of such local leading enterprises as XinJiang Tianhong Paper Making Co.Ltd. and will gradually emit into the whole Shihezi reclamation zone so as to meet the ever increasing need for extension of the industry chain brought about by its development.

The eco-industry park is based on the eco-environment construction and can further accelerate the improvement of eco-environment and the adjustment of the industry structure. The town of Shihezi faces a marked problem of ecological environment and resources, in which increasing deterioration of the eco-environment, desertification and salination of ploughs are quite common. Industry sewage and municipal sewage lacks necessary treatment and the main water body is severely polluted. Therefore, the construction of the park takes advantage of local resources and is based on achnatherum planting and the beneficial utilization of municipal sewage and industry sewage. Three main eco-industry chains are developed as follows: farming system paper making system sewage treatment system farming system; farming system stockbreeding system livestock product processing system sewage treatment system farming system; farming system ecotourism system. The park will focus on the adjustment of the industry structure, the development of state-of-the-art technology, and finally the construction of an green industry system which may act as an economy aircraft carrier.

The park is constructed under the following aim: During the 10th five years plan period, to treat the most part of the saline-alkaline land and part of the desert within Shihezi District so as to significantly improve the eco-environment of Shihezi; to reorganize and to improve the traditional industry structure and distribution, to optimize resources allocation and to form a series of first-stage industry groups and product groups that are widely recognized domestic and abroad; to establish one or two famous brand names that are characteristic of great economic benefit, high technology, marked emission effect and a long industry chain. Within another 10 to 20 years, to form a new eco-pattern of Shihezi with an optimized structure, to expedite the strategic shift of the stockbreeding in XinJiang and to restore and improve the beauty of the eco-environment of the vast Tianshan. To fulfill its construction aim of high-tech, premium quality, great economic benefit, low pollution, having complete necessary facilities and being ecological friendly, to stand as an eco-industry park of world fame, to create a ecological scene showing the

harmony of industry and nature and to realize the sustainable development of Shihezi in its social, ecological and economic aspect.

The park is divided into three main functional zone (core functional zone, expanded functional zone and supporting functional zone) and is comprised of six main systems(farming system, paper-making system, breeding system, livestock product processing system, eco-tourism system and sewage treatment system). The core functional zone consists of the farming system, the paper making system and the breeding system, which make up the most basic and indispensable units of the park. The expanded functional zone consists of the livestock product processing system and the eco-tourism system, which aims at promoting sustainable development of the park as well as increasing the value of its products. The supporting functional zone refers to the sewage treatment system, which, as the decomposer of the contaminants produced in the eco-industry chain , is an indispensable part of the eco-industry chain.

2.2.2.5 Practices of other eco-industry parks

In 2001, UNEP designated four demonstration industry zone in China on environment management, namely Dalian economic development zone, Tianjing economic development zone, Yantai economic development and Suzhou new zone, which are joint programs of UNEP DTIE and the SEPA. Each industry zone has its particular emphasis in the course of construction, that is, Dalian economic development zone emphasizes on the implementation of APELL program, Tianjing economic development zone on the development of cleaner production, Yantai economic development zone on the development of regional cleaner production and Suzhou new zone on the establishment of environment management system. Furthermore, on the basis of what's mentioned above, Yantai economic development zone has its clear goal of the development of regional circular economy and as well as the construction of eco-industry parks with ISO14001 environment management standard system as its safeguard mechanism and the implementation of cleaner production as its technological instrument. Plans of the construction of eco-industry parks are also under way in Tianjing economic development zone and Dalian economic development zone.

2.2.3 City level

Based on the above analysis, much more aiming at the natural and economic differences in China and imbalance in the development of cities, they are classified from the view points of the structure and layout of economic industries, energy resources and environmental conditions, the infrastructure system, security system for ecological circulation, actuality of ecological environment, etc.. And the main problems about the influence of the economy and administration in Chinese cities on their sustainable ability are explained, furthermore, specific problems influenced various classes of cities are analyzed.

2.2.3.1 Shanghai

Shanghai is a megalopolis in East China, and the LEADER of the Changjiang River Delta, one of the most active areas of Chinese economy. For several years, Shanghai has explored the way of sustainable development in developing countries, combining with the advantages of being a world megalopolis. Since 1995, Shanghai has early concerned on the various approaches of circular economy practice from Japan and German, and the circular economy practice in Shanghai has come through for three states. Firstly, the circular economy study was included by the Shanghai program of 21st Agenda of China in 1995. Secondly, from 1999 to 2001, Shanghai directed the circular economy into the “Tenth-Five Year Plan” of economic and social development. Finally, from 2002 to 2005, Shanghai will establish the special plans directed by circular economy, and implant the plans in different levels as inside the corporation, between the corporations, between the industries and integration, especially for the key projects of garbage, water town, city forest and exploit of Chongming Island.

One of the important specialties in the circular economy practice of Shanghai is the innovations in the city development, systems and techniques, which harmonized the circular economy and the development as possible. With the lead of Shanghai Plan Committee, several department were joint to bring the principles of circular economy into the economy structure modulate, reconstruction of the city zone, optimization of industry layout and ecology construction. As long as the rapid rise of the Third Industry, from 27% in 1990 to 51% in 2003, the environmental protection and ecology construction were enhanced, and the circular economy was combined with city development organically. For instance, railway traffic was developed and the structure of roadway was optimized to decrease the air pollution, the housebreaking for storied building was changed to housebreaking for road, and even to housebreaking for lawn. The natural resource protection and source control were emphasized, especially the protection of plantation, wet-land and natural protection areas. As the same time, Shanghai combined the construction of law and codes organically with the circular economy, which included environmental economy policies such as price of water, charges for disposing sulfur dioxide, and the state environmental laws were implement strictly.

The economy development and environmental protection are greatly improved and approbated all over the world. In 2002, Shanghai was awarded the “Sustainable Development Award” by the Summit Reference of Sustainable Development, which proved that the developing countries can coordinate the economical development and environmental protection, choosing the style of circular economy.

The practice of circular economy development in Shanghai has succeeded undoubtedly. However, Shanghai has more work to do with the non-economy macroscopic objectives and leading the development of the whole district. Some experts pointed that, viewing the

macroscopic objectives, the non-economic achievements in Shanghai had lag behind for 5 years compared with the economic ones, and Shanghai was lack of integration ideas and macroscopic design replying the challenge of resources in the future. For example, although Shanghai has recycled the garbage with classification, the source reduction still needs more great efforts. Furthermore, the government should do more jobs to guide styles of production and consumption, and implement the “leading by market, promoting by government” reliably.

2.2.3.2 Guiyang City

Guiyang is the first experimental city of circular economy established by the State Environmental Protection Agency. As one of the open cities inland, Guiyang grasped the opportunity of circular economy and decided to build a ecological city following the circular economy style. At the middle of April, 2002, Guiyang and Tsinghua University came to a full collaborate to achieve success in environmental projects, city construction in circular economy style as the core. Then, Chinese Environmental Academy was invited by Guiyang to study and workout the experimental blue print of ecological city construction with circular economy, and draft the *Regulation of Construction Ecological City in Circular Economy Style in Guiyang*. At May, Guiyang was confirmed by the State Environmental Protection Agency to be the first experimental ecological city in circular economy style in domestic.

Compared with German and Japan, which are advanced in circular economy construction, Guiyang has great contrast in economy and society. Although undeveloped economy, many inherited social problems, and great lack of basic installations for future development, were deposited as the initial obstacles, they brought advantages and opportunities of latter development, and made Guiyang modulate and concentrate novel industries and styles more easily. Since the Reformation, Guiyang had developed very quickly. From 1978 to 2002, the GDP(gross domestic product) of Guiyang increased 9.6 times, annual increasing with 10.4 percent (as the price of 1990). At the same time, however, the consumption of resources increased 3.3 times (included biomass, fossil fuel, metal mine, nonmetal mine, construction material), annual increasing with 6.3 percent, which is much higher than the average all over the country. The careless development style depending on the resources had resulted in large-scale and irreversible disaster on local environments and ecological conditions. It’s an important practical problem for Guiyang to deal with, and even a long-term strategy of future development, that how to find a new developing style to prevent the synchronizing increases of economy, resource consumption and pollutant discharge, to increase the economic benefit and improve the potential of the city development, and finally to implement (Ö the Better Welfare Society) in the undeveloped inland cities of West China with weak ecological environment.

So, Guiyang has planed to Implement One Objective, Transform Two Styles, Construct Three Core Systems, and Promote the Formation of Seven Circular Systems. To Implement One

Objective is to build a good welfare society, and keep on improving the standard of people living, maintaining the beautiful ecological environments with the continuously rapid increase of economy. *To Transform Two Styles* is to change the styles of product and the consumption. Firstly, the traditional careless style of city development depending on resources consumption will be transformed to novel sustainable developing style based on resources benefits. While the gross of economy reach the certain amount, the economy increase will be disjoined from the resource consumption in the future ten year or even longer. At the same time, reasonable policies and regulations on Green Consume need to be issued to build the atmosphere of Green Consume, cultivate the service systems for circular economic industries and the environmental friendly commodities. *To Construct Three Core Systems* is to construct circular economic systems involved the three industries, to construct the basic installation especially the recycling system of water, energy and solid waste, to construct the system of ecological protection, including green architecture, dwelling environment and ecological protect. The first of the *Seven Circular Systems* is recycling industrial system of phosphor. And the second is the system of aluminum. The third is of Chinese herbal medicine. The fourth is of coke. The fifth is of agriculture. The sixth is architecture and basic installation. And the final is tourism and service for circular economy. The industries included in the seven circular systems will occupy 75% of GDP in 2005, and 78% in 2010, and 83% in 2020.

2.2.4 Province level

2.2.4.1 Liaoning province

Liaoning province is the first demonstration province of circular economy established by the State Environmental Protection Agency. Lead by the State Environmental Protection Agency and Liaoning province government, experts evaluated the Experimental Program of Developing Circular Economy in Liaoning Province in March, 2002. At June 5th, the CCP Committee and government of Liaoning province hold a meeting to mobilize and deploy the experimental program of circular economy, which initialized the experiments in whole province.

Liaoning province is an important base of raw material and accoutrement production in China. For decades of years, Liaoning province had contributed greatly for the industrialization and modernization of China. Especially during the Open and Reformation, the civil economy kept on increasing and became robust, and progresses were kept on making in the standards of people's living. GDP of Liaoning province in 2002 is 466.83 billion yuan, and that of the first industry is 51 billion yuan, that of the second industry is 230.73 billion yuan, that of the third industry is 185.1 billion yuan, respectively occupying 10.9%, 49.4% and 39.7% of the total. As the industrialization and modernization were rapidly accelerated, Liaoning province intensified the environment protection and the ecological construction. The aggravating tendency of environmental pollution was held, and the ecological damage was alleviated, even the environmental qualities of some districts were greatly improved. However, because of the

industrial structure following the traditional development style with heavy industry as the core, the exasperate tendency of ecological environment all over the province haven't been controlled yet, with high consume of resource and energy, heavy environmental pollutions, and obvious environmental problems of the cities. The economic development in Liaoning is confined by the lack of resources, the environmental pollutants, and ecologic damage. It's inevitable to follow the way of novel industries and develop circular economy.

The objective of the experimental development of circular economy in Liaoning is to merge the ideas of circular economy into the reform of the economic structure and transition of the industries in Liaoning province, in order to coordinate the economy, society and environment according to the actuality of Liaoning. In near future, perhaps in five years, Liaoning will establish a set of circular economic enterprises and ecological industrial parks, and several cities with resource transitions. Industrial bases of territorial resource recycling will be constructed to cultivate new points of augments, and the mechanism and system for circular economic development will come into rudiments. In ten years or so, new developing style will be formed and the systems and frameworks of circular economic development will be perfect to lead Liaoning into the sustainable way of economic and living development with fine ecological conditions. The main job of the experiment is to build several enterprises with circular economy, some ecological industrial parks and recycling-oriented societies. The government adopted following steps. construct full regulation and law system for circular economic development. research advanced suitable techniques to build the technical support system for circular economy. complete the social agencies to set up the platform to exchange information. strengthen the propaganda and education, and promote the Green Consume. cooperate and communicate with international organizations, foreign governments, financial and scientific institutions to study successful experiences of the circular economy in the developed countries, and to introduce finance and advanced technology. 6. reinforce the lead and confirm the division of work in departments to promote the development of circular economy.

After one year, Liaoning Province constructed the security system of the organization and issued the implement programs to promote the experiment all over the province, and harvested abundant fruits including:

(1) Promotion of clean production is effective. Since 2001, there have been 230 key enterprises that completed the evaluation of clean production, and 3 933 clean production projects have been implemented, with total investigation of 1.086 billion yuan and financial benefits of 902 million yuan, and the annual abatement of 110 million tons industrial wastewater, 12 thousand tons Chemical Oxygen Demand and 12.2 thousand tons sulfur dioxide, respectively occupying 10%, 6% and 2% of total discharge. Wastewater of ten coal washery, steel rolling wastewater of Anshan steel corporation, Benxi steel corporation and Dalian steel plant, ore dressing wastewater

of Anshan steel corporation and Benxi steel corporation, and ash-sluicing wastewater of six coal-fired power plants have realized Zero Discharge, and saved 53.63 million m³ water. The recycling chain among the enterprises appeared. Jinxi Natural Gas Chemical Plant in Huludao utilized highly pure carbon dioxide discharged by hydrogen process in Jinxi Petrochemical sub-Company to produce urea, and increased 18 thousand tons urea annual with benefit of 11.4 million yuan. Gaoyang Company in this city used desulfurizing wastewater of twenty molybdenum smelting plant to produce sodium sulfite crystal, with benefit of 893 thousand yuan and abatement of four thousand tons sulfur dioxide.

(2) Ecological industrial parks were initialized. Fushun Mining Industrial Group began to construct the ecological industrial park emphasized on the project of “One Mine, Four Plants and One Gas” and concentrated the coal cutting, oil refinery, power generation, building materials and coal bed gas utilization. The project of sintering brick from coal gangue was put into production and produced 60 million pieces annual. The first term of the project supplying 1.25 million m³ per month to Shenyang city was accomplished. Anshan Corporation Group began to build the system for material recycling, energy converting and waste reusing, and constructed a reusing project of 180 thousand tons water to help the industrial water recycling rate to reach 91%. At 2002, there were 109 thousand tons boiler slag and 5.789 million tons metallurgic slag recycled, and project of recycling the blast furnace gas, reel oven gas and coke-oven gas was implemented, as well as the project of ecological remedy in mine area. The program of the ecological industrial park in Dalian Economical Development District , which was recently worked out, reused 7.5 thousand water per day, and realized Zero Discharge in electroplating industrial park. The integrated reuse of hazard disposal and waste household electrical appliances, recycling of industrial mediator, and reuse of fly ash was going on practice.

(3) The demonstration of recycling-oriented society was initialized. Combined with the construction of municipal wastewater treatment plants, the project reusing 1.2 million tons mid-water per day has been started, which occupied 62.3% of the total wastewater treatment capacity in the whole province. Dalian, Anshan, Shenyang, etc. have realized recycling 452 thousand tons mid water per day. In the aspect of solid waste recycling, Dalian established experimental districts of separate garbage collection in ten communities, schools and departments, and Jinzhou cultivate the capacity of utilizing garbage to produce soil ameliorant and organic fertilizer. Fushun was building solid water treatment plant with capacity of 800 tons separated collection garbage. Shenyang had produced a device with capacity of 30 thousand tons annual to extract protein feed from table waste. The integrated reuse of coal gangue and fly ash of Chaoyang Hualong Corporation Group and Tieling Xinxin Group was put into production, and utilized 330 thousand tons coal gangue and 700 thousand tons fly ash annual.

2.2.4.2 Jiangsu province

Jiangsu province is one of the areas where the industrial economy is developed. The industrial augments and amount of main industrial production in Jiangsu kept rapid increasing, and occupied much in those of Changjiang delta district and even those of whole country. Along with the improvement of industrial structure and technical level, the industries in Jiangsu developed into mid-final term of industrialization instead of mid term. But the continuous increase of industrial economy in Jiangsu cost high and durative inputs of natural resources such as water, energy, land, metal, nonmetal, lumber and etc.. From 1990 to 2001, the increase of wastewater, air pollution and solid disposal came to 2.53 times, 2.54 times and 1.62 times. Especially, the hazard metal pollutants as the total cadmium and total plumbean, which are easily accumulated in environment, have not decreased since 1990, and the discharge of total cadmium increased 5.6 times, much more than the increase of industrial output value at the same term. In 2001, the pollution load per territorial area in Jiangsu province was highly serious all over the country, which was worthy of concerning.

Jiangsu province made rapid progress in the industrialization process, but the material metabolic process supporting the run and development of industrial system was characterized with high consume and serous pollution, because of the traditional and one-way developing style of Resource - Production(Consume) - Waste. Take into account the lack of natural resources and energy in Jiangsu and the weak bearing capacity of ecological environment, if the careless development style was hold, the ecological environment would be seriously destroyed inevitably and the sustainable development of the economy and society in Jiangsu province would be confined. There are great challenges in the development of Jiangsu province. It's very important for Jiangsu province to transformation the traditional development style, and construct the circular economic development style base on effective utilization of resources, continuous decrease of pollutant discharge, recycling and reuse of the waste, to achieve the Twice Double in economy, and construct the affluent society in Jiangsu with spanning over in the new industrial development.

In the tide of the circular economic development in domestic, at December 2002, the Environmental Protection Agency of the province government organized related departments, colleges and research institutions to study the program of the circular economic development in Jiangsu province. The plan contains for sub programs as circular agriculture, circular industry, circular three industries and circular society. The plan is demanded to promote the circular economy as the most optimized bonding point of environment and development, aiming at the general objective of constructing the affluent society in precedence, realizing the modernization in precedence and constructing the ecological province. Later, the province government selected eighty towns, enterprises, departments, schools and communities carefully to experiment with various circular economic styles. Now, the work of the plan comes to the end.

3. Main Conclusions and Policy Suggestions

Task Force on Circular Economy and Cleaner Production was established in responding to the call of the Chinese government to take the circular economy approach for new industrialization and sustainable development. Built on the policy studies and experiences from home and abroad, the Task Force defined the concept of circular economy, collected and reviewed experiences from home and abroad, and presented policy recommendations to the Chinese Government.

3.1 Main Conclusions

(1) The rapid progress towards establishing a comprehensive well-being society should take a sustainable approach

During the past 20 years, GDP growth rate reached 9.7% in China each year. In 2000, China's GDP reached 8,900 billions RMB, per capita GDP exceeded 800 US dollars for the first time. With the fast economic growth, the economic operation quality improved. However, some worrying signs emerge. The material and energy consumption per unit of GDP in China is far higher than that of the developed countries. This not only trades off greatly the growth rate but also puts China in competitive disadvantage. On the resource front, our outlook does not allow us to be optimistic. The oil import is at a steep increase during the past 10 years. Water resource is becoming much scarcer and many mineral resources are over exploited. On the environmental front, despite the tremendous efforts, improvements are only seen in local places and the overall situation is still worsening. Both top decisions making of the country and the people are increasingly disturbed by the water body pollution, drying up of Yellow River, sand storms, floods and SARS epidemic. Global environmental problems are also increasingly threatening China's ecosystem and people. It is reported that Mr. Klaus Topfer, the executive director of UNEP, once said that the target of China's comprehensive well-being society can not be realized if the trends of resources depletion and environmental pollution continue. In all, to achieve the goal of developing well-off society and to solve these problems, China needs change the economic development approach.

(2) Circular economy is an important pathway towards economic growth transformation, newly industrialization and comprehensive well-being society

Comparing with the traditional one-way and linear material flow growth mode, circular economy is coined to present a new economic growth mode which operates in the way of "resource extraction — production — consumption — regenerated resources". By organizing economic activities in a closed-loop of materials, circular economy promotes the harmony between economic system and the ecosystem. In an ideal circular economy system, all the

materials and energy are effectively utilized in the circulation and therefore reduces the impacts of development on the ecosystem to the minimum. Thus, the visions under circular economy correspond to the targets of new industrialization and comprehensive well-being society. However, it is proximally estimated that the environment deterioration in China will stop only when the resources utilization ratio increase 8~10 folds. Obviously, only circular economy can realize this ambitious target.

(3) Implementing Cleaner Production Promoting Law, deepening the promotion of cleaner production is a significant measure to develop circular economy

Currently, China has issued the *Cleaner Production Promoting Law*, and till now has more than 10 years' experience of promoting cleaner production in a systematic way. However, comparing with the industrialized countries such as German and Japan, there is a deep gap in the aspects of utilization efficiency and benefit of energy and resources. For example, the produced GDP per kg energy (equivalent oil) for China is 0.7 US dollars, while USA is 3.4 US dollars, German 7 US dollars and Japan 10.5 US dollars. Another example, the energy consumption of main industrial products in China is also higher than that of industrialized countries. These facts show that China should pay more attention to cleaner production while facilitating wastes reuse and recycling, and put the reduction of resource use and wastes creation on the top of priority. Thus, China should reinforce the cleaner production promoting law at levels of industrial activities.

(4) The coordination and cooperation is crucial to promoting circular economy

Currently, some components of circular economy, such as waste minimization, cleaner production, wastes comprehensive use, industrial symbiosis and green consumption, have been implemented to some extents in China. Meanwhile, being a comprehensive and integrated framework, circular economy is also piloted at provincial, municipal, industrial parks and other levels. In this demonstration tide, Shanghai, Liaoning, Guiyang and Jiangsu took the lead and have gained some successful experience. However, the promotion of circular economy involves activities on all aspects of an economic system and requires coordination and cooperation of all agencies of government and participation of all stakeholders. The environmental agencies play a very important role in promoting circular economy, especially at initial stage. However, without active engagement and support of economic and development agencies, there will only be circulation and no economy. It is very important that economic development agencies and all the sectors in the society to take part in the development of circular economy.

3.2 Policy Suggestions

Based on the above conclusions and the overview of the relevant practices at home and abroad, the Task Force presents the following five recommendations:

(1) To formulate the master plan of promoting and implementing circular economy by the governments under the guidance of the State Committee of Development and Reform

The development of circular economy is crucial to the realization of the strategic target of comprehensive well-being society. Thus, the development goals and master plan should be formulated to promote and implement circular economy by the governments under the guidance of the State Committee of Development and Reform. According to the principles under circular economy, increasing the utilization efficiency of energy and resources, decreasing the resources depletion and pollutants creation should be incorporated into the controlling targets. In the master plan, from the national perspective, the overall development framework should be outlined, the implementation schemes and pathways should be formulated, the driving mechanism should be created, and finally, the national capacity of implementing circular economy should be built. Under the vision of the master plan, with the economy double increasing, the resources depletion will be well controlled at a reasonable lower level and even reaches zero-increase, the discharge rate of wastes and pollutants will be well controlled. Based on the master plan, some provinces, cities and industrial parks will be selected as demonstrations to carry out some pilot projects. With information and lessons sharing, the experience of implementing circular economy can be disseminated to the rest of the country.

(2) To promote the development of circular economy by enforcement of policy and legislation

According to the agency reforming of the State Council, the Task Force suggests that some modifications should be made on the Cleaner Production Promoting Law and the law enforcement agency should be decided as soon as possible. Based on the experience from home and abroad, the implementation rules of cleaner production should be formulated, and policy and legislation instruments, including forcing, economic and voluntary instruments, should be coined or modified to guide the capacity building, research and development, finance, taxation reform, government procurement, and others towards the development of circular economy and new industrialization. Meanwhile, some laws for special areas can be formulated immediately, such as for packaging, household electric appliance management and pollution emission inventory. Based on these lower laws or regulations, the basic law for circular economy promotion can be developed in future.

(3) To establish an integrated evaluation indicators' system to monitor the progress of circular economy and sustainable development, and the corresponding databases and information systems on material and energy flows.

Due to the drawbacks of GDP (Gross Domestic Production) to evaluate the economic development and governance, an integrated evaluation indicators' system should be established

to include the four pillars of the comprehensive well-being society: economic increase, resources depletion, environmental quality and peoples' well-being. To support this system, the state statistics agencies should build a systematic, comprehensive, and integrated database that contains data not only on economic performance but also on resources and its use-efficiency, environment quality, especially the utilisation efficiency of stressed and scarce resources. The agencies should also establish an information system in which information can be collected and map out the material and energy flows at different levels. The development of the information system should ensure the quality, completeness and up-to-date aspects of data. The information sharing should be integrated into the system development at early stage.

(4) To promote green consumption by implementing green procurement at governmental levels

Promoting green consumption should be enlisted in government agenda and work plans, specially the environmental protection plans. Encouraging green consumption not only reduces environmental impacts of consumption activities but also fosters market for cleaner production and eco-design practices. Green procurement is an effective means to create green market and promote green consumption. There exist already some practices in green procurement in different places of China. These efforts should be promoted, expanded, better organised and regularised through government policy.

(5) To promote the technological renovation and innovation by enforcing the support to R&D and policy studies

As an innovative new economic model, circular economy needs renovations and innovations on the aspects of theories, policies and technologies. The Task Force recommends that all studies concerning circular economy should be incorporated into the state long-term plan on the development of sciences and technology. Considering the current states and future needs of economy, society and environment, the main resources and environmental problems deferring or will defer the social and economic development should be identified, the key R&D regimes or areas should be decided, especially the key techniques to support the transformation of production mode and/or consumption mode should be put forward. More studies should be carried out on: key techniques to significantly increase the utilization efficiency of energy and resources; advanced, environmentally benign manufacturing technology; new industrial technology or system with wastes as raw materials or feedstock; economic and/or taxation policies to facilitate the material closing under the banner of market economy instruments; tracing mechanism and evaluation indicators to monitoring the development of circular economy.

In the perspective of the Task Force, circular economy is an effective approach to sustainable

development. It encompasses a wide range of issues, needs multi-stakeholder involvement, long-term efforts, and co-ordination and cooperation among difference agencies. With a clear vision, strategy, action plan and innovative practices, the People’s Republic of China will be able to reach its development goal through the development of circular economy.

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| 1. Svend Auken | First Vice Chairman of the Danish Parliament and Chairman for the Environment |
| 2. Michael Bohnet | Deputy State Secretary, Director General for Bilateral Co-operation, Federal Ministry for Economic Co-operation and Development (BMZ), Germany |
| 3. Yvo De Boer | Deputy Director General for Environmental Protection, Ministry of Housing, Spatial Planning and the Environment, Netherlands |
| 4. Kå re Isaachsen Willoch | Former Prime Minister, Norway |
| 5. R. Martin Lees | Rector, United Nations University for Peace |
| 6. Klaus Töpfer | Executive Director, United Nations Environment Program |
| 7. Crispin Tickell | Chancellor of the University of Kent, Director of the Green College Centre for Environmental Policy and Understanding, Former Chairman of the British Government Panel on Sustainable Development, and Former British Ambassador to the United Nations in New York |
| 8. Claude Martin | Director General, World Wide Fund for Nature, Switzerland |
| 9. Björn Stigson | President, World Business Council for Sustainable Development, Switzerland |
| 10. Achim Steiner | Director General, The World Conservation Union, IUCN |
| 11. Ian Johnson | Vice President, World Bank & Head, Environmentally and Socially Sustainable Development Network |
| 12. Joseph Eichenberger | Vice-President, East Asian Development Bank |
| 13. Michael B. McElroy | Director, Harvard University Center on the Environment, USA |
| 14. Arthur Hanson | Former Director, International Institute for Sustainable Development, Canada |
| 15. Laurence Tubiana(female) | Environment Advisor, Office of Former Prime Minister of France Director, Institute of Sustainable Development and International Relation |
| 16. Eileen Claussen (female) | President, Pew Center on Global Climate Change |
| 17. R K Pachauri | Director General, TATA Energy Research Institute, India |
| 18. Masami Ishizaka | Executive Vice President, Japan National Oil Corporation |
| 19. Malcolm Brinded | Managing Director, Shell Companies |

20. Catherine Day(female) Director General DG Environment - European Commission
21. Zephirin Diabre Associate Administrator, United Nations Development Program

Name List of Co-Chairs of Task Force of CCICED Phase III

1. Task Force on Integrated River Basin Management

Chen Yiyu, Academician, Chinese Academy of Sciences, China

A.J.M. Smiths, Professor, Department of Environmental Studies/Nature Restoration of Stream Corridors, University of Nijmegen

2. Task Force on Environmental and Natural Resource Pricing and Taxation

Ma Zhong, Executive Dean and Professor, School of Environment and Natural Resources, Renmin University of China

Jeremy Warford, Professor, Center for Social and Economic Research on the Global Environment, University College London, USA

3. Task Force on WTO and Environment

Ye Ruqiu, Former Deputy Administrator of National Environmental Protection Agency, China

David Runnalls, President, International Institute for Sustainable Development, Canada

4. Task Force on Non-Point Agriculture Pollution Prevention

Zhu Zhaoliang, Academician, Chinese Academy of Sciences, China

David Norse, Professor, Agricultural Policy, University College London, UK.

5. Task Force on Energy Strategies and Technologies

Ni Weidou, Academician, Chinese Academy of Engineering; Vice-Chairman, Committee of Administrative Affairs, Tsinghua University, China

Thomas Johansson, Professor, University of Lund, Sweden

6. Task Force on Strategy and Mechanism study for Promoting of Circular Economy and Cleaner Production in China

Qian Yi, Academician, Chinese Academy of Engineering, Tsinghua University, China

Tsugio Ide, Former Vice-Director for International Economic Affairs, Economic Planning Agency; Professor, Keio University, Japan

7. Task Force on Financial Mechanism for Environmental Protection

Zhang Kun, Director General, Sino-Japan friendship Environment Protection Center
Hidefumi Imura, Professor, Graduate School of Environmental Studies, Nagoya University;
Director, Kitakyushu Office of Institute for Global Environmental Strategies, Japan

8. Task Force on Development of Environmental Protection Industry

Wang Yangzu, Former Deputy Administrator of National Environmental Protection Agency,
China
Rudi Kurz, Professor, Fachhochschule Pforzheim, Germany

9. Task Force on Enterprises' Development and Environment

Zhang Yanning, Managing Vice President of China Enterprises Confederation(CEC), China
Björn Stigson, Executive Director, World Business Council for Sustainable Development

10. Task Force on Policy Options for Agricultural and Rural Development in China

Huang Jikun, Director of the Center for Chinese Agricultural Policy, Chinese Academy of
Sciences
Bernard H.Sonntag, Former Director General, Prairie Farm Rehabilitation Administration,
Agriculture and Agri-Food Canada

11. Task Force on Protected Areas

Wang Song, Vice-Chairman, National Science Committee of Endangered Species, China
Peter Johan Schei, International Negotiations Director, Norwegian Directorate for Nature
Management, Norway

12. Task Force on Sustainable Transportation

Zhou Wei, The President of China Academy of Transportation Sciences, Ministry of
Communications, China
Joseph. S. Szyliowicz, Professor, University of Denver Graduate School of International Studies,
USA

CVs of New Vice Executive Chairman Secretary-General, Deputy Secretary-General, Council Members

Paul Thibault, Vice Executive Chairman

Date of Birth: April 1945

Education: Bachelor's degree in Social Sciences, University of Ottawa; M.A. studies, Carleton University; Diploma in Public Administration, Ecole nationale d'administration-Paris

Professional Experience :

From May 2003	President, Canadian International Development Agency
Apr. 2001 – Apr. 2003	Associate Deputy Minister of Foreign Affairs
Jul. 2000 – Apr. 2001	Associate Deputy Minister of Industry
Oct. 1998 – Jul. 2000	Federal Coordinator, Y2K National Contingency Planning, Department of National Defence
May 1997 – Oct. 1998	Executive Director, Immigration and Refugee Board
Aug. 1996 – May 1997	Assistant Secretary, Government Operations Sector and Executive Director, Canada Infrastructure Works Program, Treasury Board Secretariat
Mar. 1996 – Aug. 1996	Acting Deputy Secretary, Program Branch, Treasury Board Secretariat
Oct. 1992 – Mar. 1996	Assistant Secretary, Program Branch (Government Operations, Foreign & Defence), Treasury Board Secretariat
Jan. 1988 – Oct. 1992	Assistant Secretary to the Cabinet (Security & Intelligence), Privy Council Office
Aug. 1985 – Dec. 1987	Director of Operations, Priorities and Planning Secretariat, Privy Council Office
Jun. 1968 – Aug. 1985	Various assignments in Ottawa and abroad with the Department of External Affairs, including Geneva, Tehran and Paris

Zhu Guangyao (Secretary-General and Member)

Mr. Zhu Guangyao, Vice Minister, State Environmental Protection Administration of China. Male, born in October 1944 in Yiyang, Hunan Province. Graduated from Department of Forestry

Science, Central South China Institute of Forestry in 1968. From 1968 to 1976, he worked as technician on Jilongshan Forest Farm, Boluo County, Guangdong Province as well as in the Bureau of Agriculture, Forestry and Water Resources of the county. From 1976 to 1981, he worked as Director of the Party Office, Qingshigang Forest Farm, Ling County, Hunan Province, Program Officer of Administrative Office of Ling County Party Committee, Deputy Secretary and Secretary of Ceyuan Communist Party Committee. From February 1981 to July 1986, he was Vice Magistrate and Magistrate of Ling County. From July 1986 to July 1993, he was Deputy Director-General and Director-General of Department of Afforestation, the Ministry of Forestry. From July 1993 to March 1998, he was Vice Minister of Ministry of Forestry. Concurrently he was Deputy Director of the Administrative Office of the National Committee on Afforestation and the Secretary-General of China Implementation Committee for the United Nations Convention to Combat Desertification. Mr. Zhu was appointed as Vice Minister of SEPA in April 1998.

Shao Ning (Member)

Mr. Shao Ning, born in Hangzhou, Zhejiang Province, July 1952. He holds a master degree in mechanical engineering.

Jan. 1969 – Nov. 1974	In Yan'an, Shann'xi for reeducation
Nov. 1974 – Aug. 1978	Worker, Beijing Chaoyang Auto-Parts Factory
Aug. 1978 – Nov. 1984	Studying in Department of Mechanical Engineering of Tsinghua University
Nov. 1984 – Jun. 1988	Deputy Director of Bureau of General Economic Affairs, State Economic Commission
Jun. 1988 – Aug. 1996	Director, Deputy Director-General of Economic Research Center and Macro-economic Research Institute, the State Planning Commission
Aug. 1996 – May 2003	DG of the Bureau of Enterprise (later the Bureau of Enterprise Reform), Deputy Secretary-General, the State Economic and Trade Commission
May 2003 –	Vice Chairman of the State-owned assets supervision and administration Commission of the State Council (SASAC)

Shen Guofang (Member)

Mr. Shen Guofang, born in Jiangsu Province November 1952, graduated from Beijing Foreign Studies University.

1978 – 1981	Staff member, Information Department
1981 – 1983	Attaché, Chinese Embassy in Nepal

1983 – 1984	Attaché, Information Department
1984 – 1993	Secretary, the General Office
1993 – 1996	Deputy Director General, Information Department
1996 – 1998	Director General of the Information Department, Spokesman of the Ministry of Foreign Affairs
1998 – 2002	Deputy Permanent Representative and Ambassador, Permanent Mission to the United Nations
2002 – 2003	Ambassador, Ministry of Foreign Affairs
Mar. 2003 -	Assistant Ministry of Foreign Affairs

Yi Xiaozhun (Member)

Mr. Yi Xiaozhun, Assistant Minister, Ministry of Commerce, born in Beijing December 1951. He holds a Master degree.

1973 – 1977	Studying in Department of Economics, Peking University
Aug.-Dec. 1985	Trade Policy Training Program organized by the GATT
June 1996-July 1998	Postgraduate, College of Economics, Nankai University
Sep.-Nov. 1997	Advanced Training Program for Business Administration organized by the Business School, Harvard University
1977 – 1984	Beijing Economics Research Institute, China
1984 – 1987	GATT Affairs Division, Department of International Relations, MOFERT
1987 – 1992	Third Secretary and later Second Secretary, Commercial Section, Embassy of P.R. China to the US
1992 – 1996	Deputy Division Director and later Division Director, Department of International Trade & Economic Affairs (DITEA), MOFTEC
1997 – 1999	Deputy Director General, DITEA, MOFTEC
2000 – 2003	Director General, DITEA, MOFTEC
2003 –	Assistant Minister, MOC

Shen Guofang (Member)

Professor of silviculture in Beijing Forestry University, Member and Vice-president of Chinese Academy of Engineering. He graduated from Leningrad Forest-Technical Academy of Former Soviet Union in 1956. After graduation, he came to join Beijing Forestry University for teaching and research activities and became President of Beijing Forestry University during the period of 1986-1993 and Chairman of Chinese Society of Forestry in 1993-1997. He is an expert on silviculture, forest ecology and sustainable development of forestry.

Wang Luolin (Member)

Professor Wang Luolin, Vice President of Chinese Academy of Social Sciences (CASS), male, was born in Hubei Province in June, 1938. He graduated from the Department of Economics, Peking University in 1960. From 1961 to 1983, he worked as lecturer, associate professor and professor at the Department of Economics and the Department of International Trade successively in Xiamen University. He served as Vice President of Xiamen University from 1984-1993. Since 1993 he has been Vice President of CASS. He was an alternate member of the 13rd and 14th Central Committee of Chinese Communist Party (CCP) and is a member of the 15th Central Committee of CCP. He is concurrently Vice Chairman, Academic Degree Committee of the State Council, P.R. China; Vice Chairman, National Commission for UNESCO, P.R. China; President of the board, China Association of Japanese Economics; Vice President of the Board, China Society for Monetary and Economic Studies; and Dean of Economic School, Zhejiang University.

Professor Wang Luolin's Research fields include: Macroeconomics, Finance, International Trade and Investment.

Catherine Day (female, Member)

Catherine Day, Director General DG Environment, European Commission.

Previous responsibilities

2000 – 2002 Deputy Director General, Directorate General for External Relations: Responsible for relations with the Western Balkans, NIS, Mediterranean including Middle East.

Responsibilities included:

- ❖ Political and economic relations, developing and implementing Commission/EU policy towards each region and country
- ❖ Negotiation of international agreements
- ❖ Designing and overseeing the development of financial assistance programmes with an annual assistance budget of around €2 billion (CARDS/Tacis/MEDA)
- ❖ Co-ordination and liaison with the EU's international partners and representation of the Commission at international meetings and conferences, including co-chairing of international donor conferences etc.
- ❖ 2000 – 1997 Director, DG IA, subsequently DG Enlargement, responsible for relations with candidate countries of central and eastern Europe

Responsibilities included:

- ❖ Developing the accession framework, designing and negotiating Accession Partnerships with the Council and implementing them with the candidate countries, preparing annual Regular Reports on each country

- ❖ Chairing all the Association Committees under the Europe Agreements
- ❖ Implementing the reform of the Phare programme (annual budget of €1.5 billion) and deconcentration/decentralization of aid implementation to partner countries

1997 – 1996 Director, DG IA responsible for relations with Balkans, Turkey, Cyprus and Malta, EEA/EFTA countries

Responsibilities included bilateral relations with each country, development of assistance programmes and liaison with international partners and organizations, in particular various peace conferences on the Balkans. Relations with EEA/EFTA included participation in Association Committees and Councils, harmonization of the acquis and co-operation with the EEA/EFTA Surveillance Authority.

1997 – 1995 Deputy Chef de Cabinet to Sir Leon Brittan Responsible for relations with United States, including development of New Transatlantic Agenda. Also responsible for relations with Canada, Japan, Australia and New Zealand.

1995 – 1989 Member of the Cabinet of Sir Leon Brittan
Responsible for relations with central and eastern Europe, including development of the pre-accession process. Also responsible for relations with the NIS, including conclusion of Partnership and Co-operation Agreement with Russia. From 1989 to 1993 responsible for state aids when Sir Leon was Competition Commissioner.

1989 – 1985 Member of the Cabinet of Mr. Peter Sutherland and Responsible for state aids and infringements.

1984 – 1982 Member of the Cabinet of Mr. Richard Burke

1982 – 1979 Administrator, DG III

1979 – 1975 EC Information Office, Confederation of Irish Industry

1975 – 1974 Loan officer, Investment Bank of Ireland

Zephirin Diabre (Member)

Mr Zephirin Diabre is currently the Associate Administrator of the United Nations Development Program, the number two position of that organization.

In this position which he has assumed since January 1999, Mr. Diabre acts as the Chief Operations Officer, with direct responsibility and supervision role over the operations the UNDP around the world, in nearly 150 country offices, organized in five regional bureaus (Africa, Arab States, Latin America and Caribbean, Asia and Pacific, Europe and CIS countries).

Mr. Diabre came to the UN, after a distinguished career in academia, business, and the government of Burkina Faso (West Africa).

Just before joining the UN, Mr. Diabre was a Visiting Scholar at the Harvard Institute for International Development (HIID) and a Fellow of the Weatherhead Center for International Affairs (WCFIA), at Harvard University, from August 1997 to October 1998.

At HIID, Mr. Diabre worked and conducted research on the Political Economy of Reform, and advised many African governments in the implementation of their reform programs. His contribution was particularly valued in the production of the first Africa Competitiveness Report, now a regular input to the meeting of the World Economic Forum in Davos.

As a fellow of the WIFA, Mr. Diabre familiarized himself with the new dynamics of international relations and world diplomacy in a post cold war era.

Mr. Diabre's arrival at Harvard was preceded by a noticed career in the government of Burkina Faso (West Africa) where in various positions; he was instrumental in forging the success of the structural adjustment program of that country:

- From September 1996 to August 1997, Mr. Diabre was Chairman of the Council for Economic and Social Affairs, a consultative body in which representatives from the government, the private sector, the trade unions, and the civil society discuss economic and social matters, and make recommendations to the government.
- From March 1994 to September 1996, Mr. Diabre served as Minister of Economy, Finance and Planning. In that position, which he took a few weeks only after the historic devaluation of the CFA currency, Mr. Diabre conducted the country's post devaluation reform program. Under his stewardship of the economy and the public finance at that period, Burkina was ranked among the best performing countries of the CFA zone, in the aftermath of that devaluation.
- From June 1992 to March 1994, Mr. Diabre served as Minister of Trade, Industry and Mining, a position in which he was appointed when the adjustment program of Burkina was about to start. In that capacity, he was in charge of the initial reforms of the regulatory framework, that helped create a more liberal environment in the country: the privatization of state owned enterprises, the liberalization of the trade system, the reform of the price policy, and the reform of the investment codes.

Before entering government, Mr. Diabre was an active member of the private sector in Burkina.

From 1989 to 1992, he was deputing managing director of the Burkina Breweries, (Brasseries du Burkina), a beer and soft drinks producer, and local branch of the French multinational Beer Company Brasseries et Glacieres Internationales.

While in the private sector, Mr. Diabre founded and initially chaired two important organizations of the private sector of Burkina, which are still active today:

- The Burkina Management Association (1989), which aims at promoting modern management

techniques in the enterprises of Burkina

- The Burkina and France Business Association (1991), which aims at promoting joint ventures between companies from Burkina and France.

Mr. Diabre joined the private sector from academia. From 1987 to 1989, he was assistant professor of business administration and head of the department of Management Studies at the Faculty of Economics and Management, University of Ouagadougou, Burkina Faso.

Mr. Diabre completed his university education in France, where he received a Master's degree of Business Administration from the Ecole Supérieure de Commerce de Bordeaux in June 1982, and a Ph.D. in Business Finance from the University of Bordeaux in February 1987. His doctoral dissertation was a study of the link between growth strategy and debt policy in medium sized industrial corporations.

Born, raised and educated in his native Burkina Faso, a francophone country, and in France, Mr. Diabre is now completely bilingual, and speaks very fluent English.

He also speaks many dialects of Burkina, and has some notions of German.

Mr. Diabre has received high-level distinctions from his country and foreign governments, including the French Legion d'Honneur.

A citizen of Burkina Faso (West Africa), Mr. Zephirin Diabre is married, and is the father of three children. He was born on August 26, 1959.

Xu Qinghua (Deputy Secretary-General)

Mr. Xu Qinghua, born in Beijing September 1952.

Degrees: Bachelor for Environmental Monitoring (1981)

Master for Environmental Management Engineering (1984)

Certificates: Certificate for Applied Remote Sensing Technology (1988)

Certificate for International Negotiations (1991)

Working Experience:

1984 – 1985 Lecturer for the System Engineering of Environment, Beijing Polytechnic University, Beijing, China

1985 – 1986 Deputy Director, Planning Division of National Environmental Protection Agency (NEPA), Beijing, China

1986 – 1987 Visiting Scholar, U. S. EPA, Washington D. C., US

- 1988 – 1990 Director, Standards Division of NEPA, Beijing, China
- 1991 – 1993 Vice President, Chinese Research Academy of Environmental Sciences, Beijing, China
- 1993 – 1996 Counsellor and Deputy Representative of China to United Nations Environment Programme (UNEP), Nairobi, Kenya
- 1996 – 2003 Secretary-General for China Environmental Protection Foundation (CEPF) Beijing, China
- 2003 – Director General, Department of International Cooperation, State Environmental Protection Administration
Deputy Secretary-General, China Council for International Cooperation on Environment and Development (CCICED)

Peng Jinxin (Deputy Secretary-General)

- 1998 – Director-General of Department of Policies, Laws and Regulations, SEPA;
Member of Commission of China International Economy and Trade Arbitration
- 1994 – 2003 Deputy Secretary-General of China Council for International Cooperation on Environment and Development Phase I & II
- 1992 – 1997 Deputy Director-General and Director-General of Department of Policies, Laws and Regulations, SEPA
- 1991 – 1992 Director of Division of Policies, Laws and Regulations Department of Policies, Laws and Regulations, SEPA
- 1978 – 1990 Director of Administrative Office, Hubei Environmental Protection Bureau,
Director of Environmental Sciences Research Institute, Hubei Province
- 1969 – 1978 Technician of China No. 2 Automobile Manufacturer
- 1962 – 1968 Beijing University

In the past 10 years, he has been responsible for organizing the formulation of environmental policies, laws and regulations in China. He is also Guest Professor to many universities. About 10 books and over 20 papers have been published.

CVs of New Task Force Co-Chairs

A.J.M. Smiths, International Co-Chair of Task Force on Integrated River Basin Management

Mr. A.J.M. Smiths, Department of Environmental Studies/Nature Restoration of Stream Corridors, The Netherlands, University of Nijmegen, born in 1955

- 2000 – Head of the Department of Integrated Water System Policy, Ministry of Transport, Public Works and Water Management, Division East Netherlands
- 1995 – 2000 Head of the Department of Strategy and Environmental Planning, Ministry of Transport, Public Works and Water Management, Division East Netherlands
- 1992 – 1995 Policy adviser Integrated Water Management, Ministry of Transport, Public Works and Water Management, Division East Netherlands; Program Manager and Coordinator ecological rehabilitation of the Rhine tributaries.
- 1990 – 1992 Researcher (Aquatic Ecology), Ministry of Transport, Public Works and Water Management.

DAVID NORSE, International Co-Chair of Task Force on Non-Point Agriculture Pollution Prevention

Born in 1939, Visiting Professor of Environmental Management, University College London.

- 1991 – 1994 Senior Research Fellow, Overseas Development Institute, London and Environmental Change Unit, Oxford
- 1992 – 1994 Visiting Fellow, Green College, Oxford
- 1983 – 1992 Senior Policy and Planning Coordinator, Office of the Assistant Director-General, Agriculture Department (AG), United Nations Food and Agriculture Organization (FAO)

Zhu Zhaoliang, Chinese Co-Chair of Task Force on Non-Point Agriculture Pollution Prevention

Academic qualifications:

Chairman of Soil Science Society of China, 1999

Academician of Chinese Academy of Sciences, 1993

B.Sc.(Special Honours Chemistry) 1953, Shandong University.

Major research field:

Major research focus on the soil fertility and plant nutrition, especially on the nitrogen cycling in agro-ecosystems.

Recent or Current Activities:

Most activities related on the nitrogen cycling in agro-ecosystems, including the transformation, immobilization, loss and balance of nitrogen in different land use forms. The main ones are:

The reasonable use of nitrogen fertilizer in paddy field;

Estimating the input, output and balance of nitrogen in wheat-rice cropping system.

Ma Zhong, Chinese Co-Chair of Task Force on Environmental and Natural Resource Pricing and Taxation

Mr. Ma Zhong, Executive Dean and Professor, School of Environment and Natural Resources, Renmin University of China, born in 1954.

Education:

1974 – 1977 Luoyang Polytechnic Institute, Henan, China

1986 – 1988 Renmin University of China, Beijing, China M.A. degree awarded (1990)

1996 – 1999 Renmin University of China, Beijing, China Ph.D. degree awarded (1999)

Employment:

2001 Executive Dean and Professor, School of Environment and Natural Resources, Renmin University of China

1992 – 2001 Deputy Dean, Director of Institute of Environmental Economics
Deputy Dean, Department of Agricultural Economics, Renmin University of China, Associate Professor, Professor

April 1995 Research Associate, London School of Economics and Political Science, London, U.K.

1991 – 1995 Visiting Fellow, Resources for the Future, Washington, DC, U.S.A.

1978 – 1992 Teaching Assistant, Assistant Professor, Department of Agricultural Economics, Renmin University of China.

Huang Jikun, Chinese Co-Chair of Task Force on Policy Options for Agricultural and Rural Development in China

Dr. Jikun Huang is the Founder and Director of the Center for Chinese Agricultural Policy, Chinese Academy of Sciences (CAS) and Chief Scientist at the Institute of Geographic Sciences and Natural Resources Research, CAS. His research covers a wide range of issues on China's economy, including agricultural and rural development, R&D policy, resource and environmental economics, trade and agricultural decision support system. Currently, he is also member of International Policy Council, panel member on Food for Africa, International Academy Council, Executive Regional Director in the Center on Rural Economies of the

Americas and Pacific Rim, University of California (Davis), International Fellow of Asia-Pacific Policy Center in the University of the Philippines (Diliman), associated editor of Agricultural Economics (IAAE), Executive member of Science, Technology and Education Committee of MOA, member of Science and Technology Committee of Chinese Academy of Agricultural Sciences, Vice-President of Chinese Association of Agro-Technology Economics, honor or adjunct professor in Zhejiang University, Nanjing Agricultural University, China Foreign Economics and Trade University, and Beijing University, and editorial advisory board member for 12 academic journals.

He received his BS from Nanjing Agricultural University in 1984 and his Ph. D degree in agricultural economics from University of the Philippine in 1990. He once was Research Fellow of International Food Policy Research Institute and International Rice Research Institute, and Professor of Chinese Academy of Agricultural Sciences. For years, he has been international policy consultant for World Bank, Asia Development Bank and the United Nations.

BERNARD H. SONNTAG, International Co-Chair of Task Force on Policy Options for Agricultural and Rural Development in China

Professional Experience:

- 2001 – President, Sonntag Agricultural Services
- 1996 – 2001 Director General, Prairie Farm Rehabilitation Administration, Agriculture and Agri-Food Canada (AAFC), Regina, Saskatchewan
- 1989 – 1995 Director, Lethbridge Research Centre, AAFC, Lethbridge, Alta.
- 1986 – 1989 Director, Swift Current Research Station, AAFC, Swift Current, Sask.
- 1980 – 1986 Director - Brandon Research Station, AAFC, Brandon, Manitoba
- 1979 – 1980 Regional economist, Research Branch, AAFC, Western Region Headquarters, Saskatoon, Sask.
- 1968 – 1979 Economist, Lethbridge Research Station, AAFC, Lethbridge, Alta.
- 1966 – 1968 Economist, D. Wm. Carr and Associates, Ottawa, Ontario
- 1962 – 1966 Economist, Economics Branch, AAFC, Saskatoon, Sask

Education:

- 1971 – Ph.D., (Agricultural Economics), Purdue University, Indiana, U.S.A
- 1965 – M.Sc., U. of Saskatchewan (Ag. Economics)
- 1962 – B.S.A., University of Saskatchewan

Zhou Wei, Chinese Co-Chair of Task Force on Sustainable Transportation

Mr. Zhou Wei, President of China Academy of Transportation Sciences, Ministry of Communications

Education:

- 2000 Ph.D. Highway Engineering, Changan University
- 1989 M.S., Traffic Engineering, Xi'an Highway University
- 1982 B.S., Engineering mechanics, Xi'an Highway University

Experiences:

- 2000 – Vice President, Professor, CATS
- 1998 – 1999 Visiting Scholar, Southwest Louisiana State University, USA
- 1997 – 1999 Vice President, Professor, Xi'an Highway University
- 1995 – 1997 Assistant President, Associate Professor, Xi'an Highway University

His research interest is sustainable transportation, his contribution covers highway network planning, traffic safety, and economic analysis and transportation environment protection in recent years.

Joseph S. Szyliowicz, International Co-Chair of Task Force on Sustainable Transportation

Mr. Joseph S. Szyliowicz is faculty director of the Intermodal Transportation Institute and is a professor in the Graduate School of International Studies (GSIS). An international expert on transportation policy, technology, and development, he is author or co-author of a half-dozen books on transportation, energy, technology, and the Middle East. He has written more than two dozen articles and op-ed pieces that have appeared in *Transportation Research*, *Transportation Quarterly*, *Transportation Law Journal*, *Policy Sciences*, the *Chicago Tribune*, and *Engineering-News Record*. He received his PhD from Columbia University and joined the faculty of GSIS in 1965, where he teaches classes in transportation policy, comparative politics and technology, and international affairs.

Participants List of the 2nd Meeting of CCICED Phase III

Bureau Members

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|------------------|---|
| 1. Zeng Peiyan | Vice Premier of the State Council, China (Chairman) |
| 2. Paul Thibault | President, Canadian International Development Agency, Canada (Vice Executive Chairman) |
| 3. Xie Zhenhua | Minister, State Environmental Protection Administration, China (Vice Executive Chairman) |
| 4. Liu Jiang | Vice Chairman, National Development and Reform Commission, China (Vice Chairman) |
| 5. Qu Geping | Former Chairman, Committee of Environmental and Resources Protection, National People's Congress, China (Vice Chairman) |
| 6. Måns Lönnroth | Former State Secretary, Ministry of the Environment, Sweden (Vice Chairman) |
| 7. Zhu Guangyao | Vice Minister, State Environmental Protection Administration, China (Secretary-General) |
| 8. Earl Drake | Director of Secretariat Canadian Office |

Chinese Members

- | | |
|-------------------|--|
| 1. Shen Guofang | Assistant Minister, Ministry of Foreign Affairs |
| 2. Zhang Xinsheng | Vice Minister, Ministry of Education |
| 3. Li Xueyong | Vice Minister, Ministry of Science and Technology |
| 4. Zhu Zhigang | Vice Minister, Ministry of Finance |
| 5. Shou Jiahua | Vice Minister, Ministry of Territory and Resources (Huang Zongli attended the meeting on her behalf) |
| 6. Qiu Baoxing | Vice Minister, Ministry of Construction |
| 7. Hong Shanxiang | Vice Minister, Ministry of Communications (Xu Guoyi attended the meeting on his behalf) |
| 8. Suo Lisheng | Vice Minister, Ministry of Water Resources |
| 9. Zhang Baowen | Vice Minister, Ministry of Agriculture |
| 10. Yi Xiaozhun | Assistant Minister, Ministry of Commence |

11. Zhu Guangyao Vice Minister, State Environmental Protection Administration
12. Shao Ning Vice Chairman, State-owned Assets Supervision and Administration Commission of the State Council
13. Li Yucai Deputy Administrator, State Forestry Agency
14. Ma Shengrong Deputy Director and Standing Vice Chief Editor, Xinhua News Agency
15. Chen Yiyu Vice President, Academician, Chinese Academy of Sciences
16. Wang Luolin Vice President, Chinese Academy of Social Sciences (Wang Tongshan attended the meeting on his behalf)
17. Shen Guofang Vice President, Academician, Chinese Academy of Engineering
18. Sun Honglie Academician, Chinese Academy of Sciences (Lead Expert)
19. Chen Shupeng Academician, Chinese Academy of Sciences
20. Li Yining Chairman, Guanghua School of Economics, Peking University (absent)
21. Tang Xiaoyan Academician, Peking University
22. Ni Weidou Academician, Tsinghua University
23. Lu Zhongwu Academician, Northeast University (absent)
24. Ding Yihui Special Consultant on Climate Change, Research Fellow, China Meteorological Administration
25. Zhang Jinqiu Academician and Great Architect, China Northwest Institute of Design and Architecture (absent)

International Members

1. Svend Auken First Vice Chairman of the Danish Parliament and Chairman for the Environment
2. Michael Bohnet Deputy State Secretary, Director General for Bilateral Co-operation, Federal Ministry for Economic Co-operation and Development (BMZ), Germany
3. Yvo De Boer Deputy Director General for Environmental Protection, Ministry of Housing, Spatial Planning and the Environment
4. Kå re Isaachsen Willoch Former Prime Minister, Norway (absent)
5. R. Martin Lees Rector, United Nations University for Peace
6. Klaus Töpfer Executive Director, United Nations Environment Program
7. Crispin Tickell Chancellor of the University of Kent, Director of the Green College Centre for Environmental Policy and Understanding, Former Chairman of the British Government Panel on Sustainable Development, and Former British Ambassador to the United Nations in New York
8. Claude Martin Director General, World Wide Fund for Nature, Switzerland
9. Björn Stigson President, World Business Council for Sustainable Development, Switzerland

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10. Achim Steiner Director General, The World Conservation Union, IUCN
 11. Ian Johnson Vice President, World Bank & Head, Environmentally and Socially Sustainable Development Network (absent)
 12. Joseph Eichenberger Vice-President-East, Asian Development Bank
 13. Michael B. McElroy Director, Harvard University Center on the Environment, USA
 14. Arthur Hanson Former Director, International Institute for Sustainable Development, Canada (Lead Expert)
 15. Laurence Tubiana(female) Environment Advisor, Office of Former Prime Minister of France
Director, Institute of Sustainable Development and International Relation
 16. Eileen Claussen (female) President, Pew Center on Global Climate Change (absent)
 17. R K Pachauri Director General, TATA Energy Research Institute, India (absent)
 18. Masami Ishizaka Executive Vice President, Japan National Oil Corporation
 19. Malcolm Brinded Managing Director, Shell Companies
 20. Catherine Day(female) Director General DG Environment - European Commission
 21. Zephirin Diabre Associate Administrator, United Nations Development Program (absent)

Task Forces' Co-Chairs

1 Task Force on Integrated River Basin Management

Chen Yiyu, Academician, Chinese Academy of Sciences, China

A.J.M. Smiths, Professor, Department of Environmental Studies/Nature Restoration of Stream Corridors, University of Nijmegen (absent)

2 Task Force on Environmental and Natural Resource Pricing and Taxation

Ma Zhong, Executive Dean and Professor, School of Environment and Natural Resources, Renmin University of China

Jeremy Warford, Professor, Center for Social and Economic Research on the Global Environment, University College London, USA

3 Task Force on WTO and Environment

Ye Ruqiu, Former Deputy Administrator of National Environmental Protection Agency, China

David Runnalls, President, International Institute for Sustainable Development, Canada

4 Task Force on Non-Point Agriculture Pollution Prevention

Zhu Zhaoliang, Academician, Chinese Academy of Sciences, China

David Norse, Professor, Agricultural Policy, University College London, UK.

5 Task Force on Energy Strategies and Technologies

Ni Weidou, Academician, Chinese Academy of Engineering; Vice-Chairman, Committee of Administrative Affairs, Tsinghua University, China

Thomas Johansson, Professor, University of Lund, Sweden

6 Task Force on Strategy and Mechanism study for Promoting of Circular Economy and Cleaner Production in China

Qian Yi, Academician, Chinese Academy of Engineering, Tsinghua University, China

Tsugio Ide, Former Vice-Director for International Economic Affairs, Economic Planning Agency; Professor, Keio University, Japan

7 Task Force on Financial Mechanism for Environmental Protection

Zhang Kun, Director General, Sino-Japan friendship Environment Protection Center

Hidefumi Imura, Professor, Graduate School of Environmental Studies, Nagoya University; Director, Kitakyushu Office of Institute for Global Environmental Strategies, Japan

8 Task Force on Development of Environmental Protection Industry

Wang Yangzu, Former Deputy Administrator of National Environmental Protection Agency, China

Rudi Kurz, Professor, Fachhochschule Pforzheim

9 Task Force on Enterprises' Development and Environment

Zhang Yanning, Managing Vice President of China Enterprises Confederation(CEC), China (Pan Chenglie attended the meeting on his behalf)

Björn Stigson, Executive Director, World Business Council for Sustainable Development

10 Task Force on Policy Options for Agricultural and Rural Development in China

Huang Jikun, Director of the Center for Chinese Agricultural Policy, Chinese Academy of Sciences

Bernard H.Sonntag, Former Director General, Prairie Farm Rehabilitation Administration, Agriculture and Agri-Food Canada

11 Task Force on Protected Areas

Wang Song, Vice-Chairman, National Science Committee of Endangered Species, China

Peter Johan Schei, International Negotiations Director, Norwegian Directorate for Nature Management, Norway (absent)

12 Task Force on Sustainable Transportation

Zhou Wei, The President of China Academy of Transportation Sciences, Mministry of Communications, China

Joseph. S. Szyliowicz, Professor, University of Denver Graduate School of International Studies, USA

Keynote Speakers

- 1 . Borge Brende, Minister of Environment, Norway
Chair of the United Nations Commission on Sustainable Development (CSD)
2. Xi Jinping, Secretary of Zhejiang Committee of Communist Party of China (CPC)
(represented by Vice Governor Bayin Chaolu)

Special Speakers

1. Klaus Töpfer, Executive Director of UNEP
2. Zhu Qingsheng, Vice Minister of the Ministry of Public Health
3. Dietmar Nissen, President of East Asia Regional Headquarters, BASF Ltd.
4. Tang Fuping, Vice President of Anshan Iron and Steel Group

Special Guest

Hau-sing Tse, Vice President, Canadian International Development Agency, Canada

