

**Work Report**  
**Task Force on the development of Chinese**  
**environmental industry**

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International Co-Chair: Rudi Kurz

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## 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 2<sup>nd</sup> 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	2.16	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 scale 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 stuff 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 m<sup>3</sup> 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<sub>x</sub> 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 callback and recycle and so on.

#### **2.5.4 Resource recycle and reuse**

Mainly on integrated utilization of associated mineral; the new art for integrated callback and recycle gold, argentine, iron, rare soil, niobium, vanadium, titanium from associated mineral; improve the kaolin soil performance such as white chroma, particle size, and develop the integrated utilization technology for allophane, saggar, 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 callback 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 vibrancy 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<sub>Cr</sub>, BOD<sub>5</sub>, 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 new 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

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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 abroad 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 pre-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 in 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 50 management 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/EEG) 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<sup>[5]</sup> 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<sup>[4]</sup>.



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<sub>x</sub>) 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<sub>x</sub> emissions further to 1 051 kt/a by 2010. At about 64 %, the lions share of NO<sub>x</sub> emissions stems from road and other traffic.

In the Helsinki Protocol, Germany committed itself to cut its annual sulphur dioxide (SO<sub>2</sub>) emissions by a minimum of 30 % by 1993 measured against a 1980 baseline (7 514 kt). SO<sub>2</sub> 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 SO<sub>2</sub> emissions to 520 kt/a by 2010. Main sources of SO<sub>2</sub> 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 (CO<sub>2</sub>) emissions between 1990 and 1999 reflects a 15 % reduction. Germany has set itself the national goal to cut CO<sub>2</sub> 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 CO<sub>2</sub> 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 (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, H-FCC, HFC and SF<sub>6</sub>) 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 CO<sub>2</sub> which contributes over 80 % of the greenhouse gas emissions, followed by methane from waste management operations, agriculture and natural gas supply as well as N<sub>2</sub>O 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 CO<sub>2</sub> 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<sup>19)</sup>.

### **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 <sup>[12]</sup>.

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 21<sup>st</sup> 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 (COSHH) – 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.