Sino-Italian Cooperation Program
Environmental Training Community

中-意合作计划
环境培训园地

newsletter
工作通讯

07

Italian Ministry
for the Environment, Land and Sea

VIU

Venice
International
University

Italian Ministry for the Environment, Land and Sea
意大利环境领土与海洋部
Via Cristoforo Colombo, 44
00147 Rome Italy

Venice International University
TEN Center, Thematic Environmental Networks
威尼斯国际大学
Isola di San Servolo
30100 Venice Italy
Tel. 电话 +39 041 2719525-524
Fax 传真 +39 041 2719510
ten@univiu.org

Sino-Italian Cooperation Program for Environmental Protection
中国 – 意大利环境保护合作项目管理办公室
Program Management Office, Beijing
北京项目管理办公室
Oriental Kenzo-Office Building Room 25 a-d
48 Dongzhimen Waidajie,
100027 Beijing, P.R.China
中国北京市东直门外大街48
号东方银座写字楼25 a-d
房间 邮编: 100027
Tel. 电话 0086-10-51600666, 84476610
Fax 传真 0086-10-84476455
newsletter@sicppmo.org
info@sicppmo.org
Program Management Office, Shanghai
上海项目管理办公室
Room 1901-1906,
The Center, 989, Changle Rd.
Shanghai, 200031 P.R. China
上海市长乐路989号世纪商贸广场1901-1906室
中意环保项目上海办公室
Tel. 电话 021 61104860
Fax 传真 021 61104861
info@sicppmo.org

AGRINNOVA

Editorial board
Corrado Clini,
Italian Ministry for the Environment, Land and Sea
Ignazio Musu,
TEN Center, Venice International University
Maria Lodovica Gullino,
Agroinnova, University of Turin

Edited by
TEN Center
Thematic Environmental Networks,
Venice International University
Italian Ministry for the Environment, Land and Sea

Project coordination
Alessandra Fornetti
Gianluca Ghiara
Ilda Mannino

Grapich design
peppe clemente, studio cheste, venezia

Cover & on focus photos by
Andrea Penisto

English proofreading
Lisa Negrello, Venezia

Chinese translation
Mike Peng, Beijing

Contributions by
Selina Angelini, Federica Belloro, Lisa Botter,
Marian Chertow, Eleonora Chinellato, Jorgen Christensen,
Zhu Dajian, Giovanni Ferro, Alessandra Fornetti,
Gianluca Ghiara, Ilda Mannino, Ignazio Musu,
Denise Tonolo, Francesca Zennaro

The Sustainability of Supply Chains

Stefano Micelli, VIU Dean

Environment and industry are growing closer together. Signs of a renewed industrial culture are increasing and suggest the possibility of a new phase of economic development. For too long we have considered industry and third sector development as being in contrast with environmental sustainability and the protection of natural resources: for this reason we entrusted the public sector with the burden of setting up regulatory tools capable of stemming the impact of production and consumption on natural resources. In recent years a lot has changed. The comparison between industrial development and environmental sustainability, although still problematic, has taken on a different tone.

In the current issue of the newsletter, Marian Chertow illustrates the topics of Industrial Ecology and writes about an industrial sector that has become increasingly "Green" thanks to investments made in technological innovation. According to Chertow, Industrial Ecology today has consolidated methodologies such as life cycle assessment and environmental design that represent efficient tools of company management and production supply chains. The same concepts are recalled by Dajian Zhu, who underlines as Circular Economy has become one of China's important strategies to realize scientific development and build ecological civilization at present.

On a local territorial level there are good examples of this new industrial approach. The current issue of the newsletter proposes a series of eco-industrial park case studies that are international examples useful for imagining new methods of production and for understanding how to manage the relationship with the environment. Alongside the Kalundborg Danish case study, presented by Jorgen Christensen, the newsletter also illustrates the Italian case study of Porto Marghera, analyzed by Ignazio Musu, Ilda Mannino and Marian Chertow. Although these case studies are not a real best practice, Porto Marghera is nevertheless a national laboratory for developing new ways of considering industry and the management of poisoned sites. This complex problem is also the topic of an article by Giovanni Ferro and Federica Belloro.

How can this process of convergence between Environment and Industry be accelerated? How is it possible to identify capacitating factors of this new stage of development of advanced and consolidated sectors?

Venice International University has decided to launch a research project on the Sustainability of Supply Chains in order to focus on the complexity of any changes needed for a truly "green revolution" of the entire production cycle, with a special emphasis on traditional Italian industry sectors.

For the first time we are witnessing a transformation of the consumer, who is increasingly sensitive to an environmentally friendly culture and to a sensible use of environmental resources.

Also for the first time, market regulation no longer takes place in spite of the expectations of public demand, which in the past was little inclined to take upon itself any sustainability costs, but instead follows the profound cultural transformations witnessed in large portions of public opinion.

We believe that, by analyzing and understanding these Italian supply chains, new ways of interpreting sustainable development can be deduced, not only in Italy but worldwide.

Renewables: Parliament Wants Binding Sectoral Targets

The European Parliament has voted by a large majority in favor of setting binding sectoral renewables targets at EU level. The Commission is due to present a proposal for further legislation on renewable energies soon.
The issue of sectoral targets is central to the debate on the promotion of renewable energies, which currently account for just fewer than 7% of the EU's energy mix.
The report backs the target of 20% renewables use by 2020 and "urges the Commission to propose a sectoral approach within the legislative framework, setting clear and realistic binding targets for electricity, transport and heating and cooling sectors".
The report insists that while differing national potentials can be taken into account, as some member states argue that setting binding targets for the use of other kinds of renewable energies in electricity, transport and heating/cooling, differing climatic and geographical conditions across the EU means that some states will be at a disadvantage in terms of meeting the targets.
Parliament moreover wants the Commission to adopt a strict approval and monitoring process for the member states National Action Plans (NAPs) on renewables, which would be required as part of the implementation of the upcoming legislation.
Renewable energy groups hailed Parliament's vote as a step in the right

direction; according to EWEA, the European Wind Energy Association, the Parliament "has sent a very clear and strong signal to the European Commission and member states". Moreover, the European Renewable Energy Council (EREC) urged the Commission to "give itself the means to monitor the implementation of (National) Action Plans and not leave to member states the margin of maneuver to implement them or not".

Liberalisation of EU Electricity and Gas Sector

The programme of a single European market without internal frontiers did not include the EU's energy sector; finally, the Commission and member states agreed to tackle this problem. Following the entry into force of 2007 EU directives, both industrial consumers and private households are now in theory able to freely choose their energy supplier but many obstacles remain with a single European energy market still far from reality. To make up for the shortcomings, the Commission is planning to make further legislative proposals that could include controversial plans to break up the production and distribution arms of large integrated energy firms.
The objective of the directives is to open up the electricity and gas markets through the gradual introduction of competition, thereby increasing the efficiency of the energy sector and the competitiveness of the European economy as a whole.
The most important elements of 2007 EU directives are:
Unbundling: Energy transmission networks have to be run independently from the production and supply side. This measure

is designed to avoid preferential access to transmission systems and gas networks for energy companies.
Tariffs: Transmission tariffs must also be applicable to all system users on a non-discriminatory basis and third-party access to gas storage facilities must be guaranteed.
Services of public interest: The directives also set common minimum standards regarding public service requirements, which take into account the objectives of common protection, security of supply, environmental protection and equivalent levels of competition in all member states.
The European Commission has made clear that it favours splitting up energy firms' production and distribution activities as the best way to ensure fair competition and lower prices for consumers; consequently EU member states are requested to appoint an independent national regulator to monitor market developments and prevent discrimination between operators on the market.

Global Leaders Rejoice Over New Ozone Pact

The EU joined 190 countries in signing a unanimous agreement to accelerate by ten years the phase-out of ozone-depleting chemicals used in refrigeration and cooling systems.
Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (the Parties) began meeting in 1987 to discuss reductions in the use of fluorinated gases (f-gases) such as chlorofluorocarbons (CFCs) and other harmful ozone-depleting substances used in refrigerators, air-conditioning systems and other cooling devices. According to the Commission, f-gases are more than 20,000 times more damaging than CO_2 in terms of their global-warming potential, with CFCs among the most potent.
In the 1990s, hydro chlorofluorocarbons (HCFCs) were introduced to replace CFCs as a less harmful substitute. But HCFCs are still considered to be detrimental to the ozone layer, and the emergence of alternative cooling substances and technologies has increased calls for an HCFC ban.
The Parties began their 20th anniversary meeting in Montreal to hammer out an agreement to accelerate the reduction and ban of HCFCs.
In what is being hailed as an historic step forward in the fight against global warming, the Parties reached a unanimous deal to accelerate the phase-out of HCFCs, starting in 2009.
Developed nations agreed to a timetable of 90% reduction by 2015 and total phase-out of HCFCs by 2020. For developing nations, the dates were set back ten years: 67.5% reduction by 2025 and total ban by 2030.

Environment and Health Strategy

Concerned about the increasing effects of environmental pollution on people's health, the Commission adopted a new European strategy for Environment and Health.
According to recent data, it appears to be an increasing incidence of illnesses related to the environment. Air pollution, noise, chemicals and electromagnetic fields have all been linked with health problems such as allergies, asthma, respiratory illnesses, development disorders and cancer. As one of the most vulnerable groups in society, children are increasingly exposed to the damaging effects of environmental activities. Chemicals that are harmless to adults may bring permanent damage to the developing bodies of children.
The "new" strategy (known as "SCALE" for Science, Children, Awareness, Legislation and Evaluation) has four key features:
_ it is based on science and look at the complex interactions between different pollutants and the body;
_ it focuses on children: the Commission will launch pilot actions on pollutants with specific relevance to children, such as dioxins, heavy metals and endocrine disruptors;
_ it aims to raise awareness from stakeholders and the general public;
_ EU legislation will complement national laws and be reviewed to reflect children's special situation and needs.

As a follow-up to the strategy, the Commission presented an action plan aiming at improving the co-ordination between the health, environment, and research sectors. The actions are divided into the three following areas:
Monitoring: Developing indicators to measure the link between environment and health and understand the routes pollutants take from their source to the human body.

Research: Focusing research on four priority diseases (asthma/allergy, neuro developmental disorders, cancers and endocrine disrupting effects) to fill the knowledge gap.
Communication: Developing citizen's awareness to help them make informed health choices.
Moreover European Public Health assured that this new strategy will involve pilot monitoring activities to track pollutants from the environment into the food chain and human beings

Chemicals Policy Review

The chemicals industry is the third largest manufacturing industry in the EU, generating 1.7 million jobs and indirect employment for more than 3 million people. There is a general lack of knowledge regarding the chemicals that were placed on the market before 1981. This is because prior to that date, no stringent health and safety tests were needed to market chemicals. There are 3,000 so-called new substances which had to go through a more stringent safety screening after 1981.
After years of heated debate, EU lawmakers agreed on a far-reaching proposal to review the way chemicals are approved in Europe, placing the burden on businesses to prove their products are safe before they can be placed on the market. The system aims to make chemicals safer for human health and the environment and to stimulate innovation in the sector.
Under the system, both "existing" and "new" chemicals will be screened for health and safety over an 11-year period.
A new chemicals agency in Helsinki will be tasked with authorizing or rejecting the applications; and central to the system is a requirement for producers and importers of chemicals to prove that their substances are safe before they can be placed on the market.

Commission Unveils Urban-Mobility Strategy

As an increasing number of European cities suffer from congestion, noise, accidents and pollution, largely caused by excessive use of private cars, the Commission believes that it is time for a European strategy focusing specifically on urban transport.
Indeed, urban traffic accounts for more than 10% of all emissions of carbon dioxide in the EU.
It is also the main source of other pollutants, including carbon monoxide and fine particulates.
Presenting a new Green Paper on Urban Transport, EU Commission outlined a large range of potential solutions and areas where actions could be taken in order to tackle the growing congestion, pollution and safety problems in Europe's cities.
The aim of the Green Paper is to create free-flowing and greener towns and cities, smarter urban mobility and an urban transport which is accessible, safe and secure for all European citizens. The main suggestions are:
_ Promoting less car-dependent lifestyles by making alternatives to car use safer and more attractive, as well as by encouraging car-sharing or car-pooling solutions;
_ encouraging towns and cities to implement urban charging schemes;
_ establishing harmonized rules for setting up urban green zones;
_ making use of Intelligent Transport Systems to improve urban traffic management;
_ supporting the introduction of clean and energy-efficient vehicles through green public procurement;
_ setting up a European Observatory on Urban Mobility to collect and exploit data and identify best practices.
The Commission points out that the financing needs are huge. They include investments in infrastructure and intermodal terminals, as well as operating costs and the maintenance and renewal of rolling stock.

Industrial Ecology and the Greening of Industry

Marian Chertow, Yale University School of Forestry and Environmental Studies

Can Industry Help to Reduce Environmental Impact?

Population growth, rising standards of living, and industrial expansion have all combined to put increasing pressure on earth systems. Back in the 1970s, ecologist Paul Ehrlich created the IPAT equation which conceptualized environmental impact as a function of three terms:

Environmental Impact (I)=
Population x Affluence x Technology

According to UN projections, population will increase for at least the next several decades. Increasing affluence increases environmental impact, but also has the potential to improve quality of life for billions of people around the world. Technology, too, surely can increase the amount and the reach of pollution. By the 1990s, however, a new group of industrial ecologists – who study industrial systems in the context of the natural systems that surround them - reassessed the IPAT equation with a more optimistic view of the technology variable.
In the first textbook on Industrial Ecology, Graedel and Allenby (1995, 2003) created the "Master Equation" of Industrial Ecology as a variation of the IPAT equation. In the master equation, affluence is specified as "GDP per person" and the technology term is portrayed as the amount of environmental impact per unit of GDP. Even with rising population and affluence, if we, as a society, can continue to produce GDP but with declining pollution, then the technology term, rather than increase environmental impact, will be the term that can bring the equation into balance.

Environmental impact =
Population x GDP x Environmental impact
Person unit of GDP

Appreciation by industrial ecologists of the role that technology can play in solving environmental problems carries through to an acknowledgement of the importance of private industry both in allocating resources and in implementing technological innovation. In this regard, Industrial Ecology positions firms as key players in environmental protection and heralds the greening of industry as a way to offset other forms of environmental impact in the progression toward sustainable development.

What is Industrial Ecology?

The new field of Industrial Ecology is both "industrial" as well as "ecological" (Lifset and Graedel, 2002). It is industrial in that it focuses on the production and manufacturing of goods and services from extraction to final disposal or reuse. It is ecological because it borrows from nature the notion of cycling – that the industrial system should emulate the natural one by conserving and reusing resources as completely as possible in production and consumption.
Central to Industrial Ecology is the notion of preserving "Embedded Energy and Materials", which is the total quantity of resources used to make or deliver a product, process, facility, or service. The most basic questions an industrial ecologist asks are: where does material come from and where does it go? How does it move from place to place? What happens when the original purpose of a product or facility is spent? Which materials stay behind and which dissipate into the environment?
How much of the embedded energy and materials can be recirculated or recovered? Within the Industrial Ecology System, there is no concept of traditional "waste"; rather, discards are viewed as valued raw material which embeds energy to be used again.
Industrial Ecology is highly multi-disciplinary, connecting environmental science, engineering,

business, and policy. The hallmark of Industrial Ecology is its principal concern with the flow of materials and energy through systems at different spatial scales, from products to factories up to national and global levels. As shown in Figure 1, Industrial Ecology allows focus at the facility level, across firms and other organizations, or, more broadly, at the regional and global level with the goal of Industrial Ecology as sustainability.

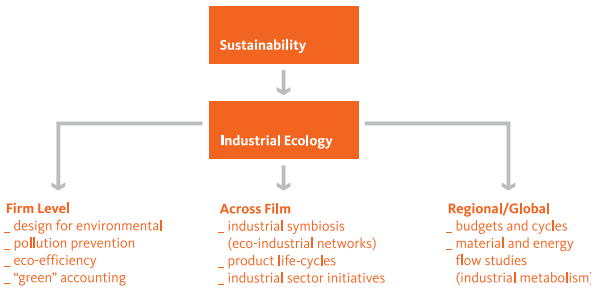


Figure 1. Industrial Ecology operates at three levels

What Are Some of the Key Tools of Industrial Ecology?

Material Flow Analysis (MFA)

Material flow analysis methods are used to map and quantify the flow of materials through a network of actors, be they in a single facility or group of facilities, a defined region or country, or along a product supply chain. Locally, actors of interest can be approached individually to identify and quantify all of their energy, water and material inflows and outflows. At broad scales, generic data, compiled from a wide range of sources, can be used to create expected material flow data templates for different industries. At other scales, a single material or substance can be tracked nationally or globally or many materials can be tracked more locally. Tools and software have been developed for material flow analysis and Substance Flow Analysis (SFA) that formalize tracking practices (Brunner and Rechberger, 2003).

Life Cycle Assessment (LCA)

The breadth of focus from a life cycle perspective is not limited to what happens within one facility or factory, but considers the entire set of environmental impacts that occurs at each stage of industrial development and use across entities. Such thinking creates new awareness about precisely which lifecycle stages most effect the environment for different products or services. Many consumer electronics, for example, are manufactured efficiently but are difficult to dispose at the end of their useful lives. Motor vehicles generate some 90 percent of their environmental impacts not in the factory but in the use stage – e.g. when cars are being driven or airplanes flown well after the vehicle has left the manufacturing site. Based on procedures of the Society of Environmental Toxicology and Chemistry (SETAC), the formal structure of Life Cycle Assessment (LCA) contains three stages as well as on-going interpretation. These stages are: 1) *goal and scope definition* to define the boundaries of what is being studied; 2) *inventory analysis* to total up the types and quantities of energy and materials used in an industrial system as well as resulting environmental releases; and 3) *impact analysis* to group and quantify the resources used and emissions generated into environmental and toxicological impact categories which are then weighted for importance. Formal LCA can offer a quantitative comparison between alternative product or process designs. Because such analysis can be complex and expensive, industrial ecologists have also worked on streamlined lifecycle methodologies or considered life cycle management more broadly but less formally to provide general guideposts in thinking beyond a product or process.

Design for Environment (DfE)

Design for Environment is a design strategy in which the environmental characteristics of a product, process, or facility are internalized and optimized from the earliest stages. Building in environmental considerations before capital equipment is purchased and distribution channels are developed is arguably the least expensive time to make proactive decisions which can, in turn, influence the entire life cycle chain.
In industrial product design there are multiple goals in addition to environmental ones. These are sometimes called "Design for X," where X represents many useful design attributes including ease of assembly and consideration of how design affects reliability, safety, or serviceability. A central tenet of DfE is that DfE actions should not compromise other design attributes of a product such as performance, reliability, aesthetics, maintainability, cost, or time to market (Graedel and Allenby, 1995, 2003). DfE is associated with a life cycle perspective in the Industrial Ecology literature because it builds in longer term considerations beyond production to use, reuse, and disposal recognizing that every engineering decision is also an environmental one.

Two Examples: Industrial Ecology in Denmark and China

One of the applications of the Industrial Ecology is "Industrial Symbiosis (IS)." The concept of Industrial Symbiosis (IS) is broadly based on the idea of exchange, where one facility's waste (energy, water, or materials) becomes another facility's feedstock. Thus, inherent to Industrial Symbiosis is a cooperative approach to competitive advantage among traditionally unrelated firms. Industrial Symbiosis engages traditionally separate entities in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and byproducts (Chertow, 2000).
The term Industrial Symbiosis was first used in relation to an industrial district in the small town of Kalundborg, Denmark. The primary partners in Kalundborg, including an oil refinery, power station, gypsum board facility, and a pharmaceutical company, share ground water, surface water, and wastewater, steam, and fuel, and also exchange a variety of by-products that become feedstocks in other processes [Figure 2]. High levels of environmental and economic efficiency have been achieved which has led to many other less tangible benefits involving personnel, equipment, and information sharing. [Figure 2]
China has great potential to realize Industrial Ecology considering its global importance in manufacturing and industrial activities. As a means of addressing the vast environmental costs that go along with this leadership, China has included the concept of the "Circular Economy" in its 11th Five Year Plan which has much in common with the principles of Industrial Ecology. As envisioned thus far, the Circular Economy concept calls for high efficiency in resource flows as a way of sustaining improvement in quality of life within natural and economic constraints. So far, projects have been planned at the individual plant level, across firms as in Eco-industrial Parks, and more broadly, at the level of the eco-city or eco-province (Yuan et al., 2006).

Greening of Industry

Industrial Ecology does not focus on remediation of past environmental ills, or on end-of-pipe controls, both of which generate costs while contributing little to productivity of business. Its purpose is to avoid environmental damage in the first instance through systems analysis, through product, process, and facility design, and through technological innovation. Several policy ideas influencing businesses around the world

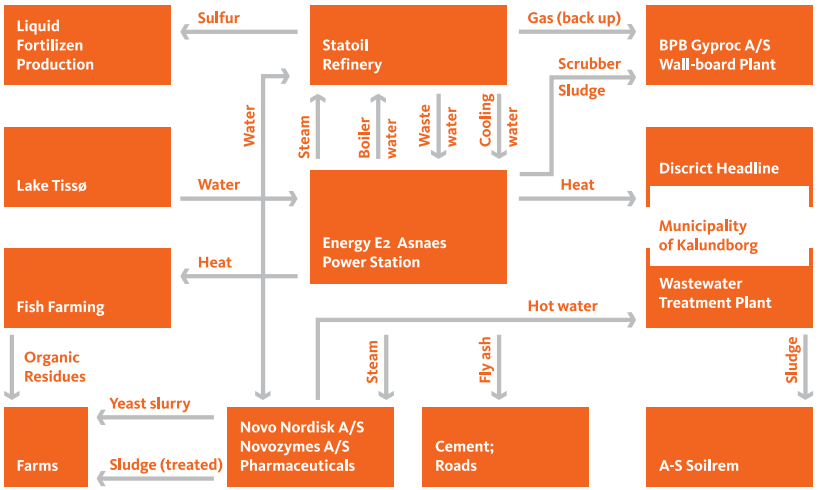


Figure 2. The industrial ecosystem of Kalundborg, Denmark

are rooted in Industrial Ecology such as:
Greening the supply chain – recognizing that companies are not really making green products or delivering green services unless their suppliers also become green.
Extended producer responsibility – putting more life cycle accountability on companies for what happens at the end of useful product life.
Environmental certification – a process of singling out particular products or classes of products as being environmentally superior according to agreed upon criteria such as for forest products, coffee, or textiles.
In conclusion, Industrial Ecology provides principles and tools for industry to be able to optimize entire manufacturing process as cost-effective and environmentally benign ones along the path to environmental sustainability.

References

Brunner, P., and Rechberger, H. (2003) *Practical Handbook of Material Flow Analysis*. Baton Rouge, Louisiana: CRC Lewis Publisher.
Chertow, M.R. (2000) Industrial Symbiosis: Literature and Taxonomy, *Annual Review of Energy and Environment*, Vol. 25, p. 515-557.
Chertow, M.R. (2006) *Industrial Ecology in a Developing Context, Chapter for Sustainable Development and Environment Management*. Advanced Training Program, Venice International University, Springer, Forthcoming.
Graedel, T.E. and Allenby, B.R. (1995, 2003) *Industrial Ecology*. Englewood Cliffs, NJ: Prentice Hall.
Lifset, R. and Graedel, T. (2002) *Industrial Ecology: Goals and Definitions, Handbook of Industrial Ecology*. Ayres, R. and Ayres, L., Cheltenham, UK, Edward Elgar Publications: p. 3-15.
Yuan, Z., Bi, J., and Moriguchi, Y. (2006) The Circular Economy: A New Development Strategy in China, *Journal of Industrial Ecology*, Vol. 10, No 1-2, p. 4-8.

The Industrial Symbiosis at Kalundborg, Denmark – a Short Description

Jørgen Christensen, JC consult., Symbiosis Institute

An early example of industrial ecological practice is the Industrial Symbiosis at Kalundborg (IS). It is an environmental and resource network developed throughout more than three decades. Not as a carefully planned network, but as a series of individual projects that developed spontaneously through bilateral agreements, and which were initially quite independent of each other. It was a "non-project" created by a "non-organisation". The main principle is: "someone's waste is another one's raw material".
The initial incentive to these projects was to save expenses, but gradually environmental objectives were emphasized. All project agreements were commercially negotiated between two parties. All projects required investments and resulted in profits or savings for both parties.

The Partners

The present partners of the IS are:
_ Gyproc, a plaster board factory (200 employees).
_ The Asnæs Power Station, owned by DONG Energy A/S, the biggest power station in Denmark (250 employees).
_ The StatoilHydro Refinery, also Denmark's largest (350 employees).
_ The Kalundborg Municipal Department for water and energy supply. Kalundborg is a small city of about 50.000 inhabitants (with 20.000 in urban Kalundborg), located 100 kilometres West of Copenhagen.
_ Novo Nordisk and Novozymes (until year 2000, one company: Novo Nordisk) whose plants in Kalundborg produce insulin and industrial enzymes and employ more than 3.300 people.
_ RGS 90 A/S (earlier name SOILREM), a soil remediation company (50 employees).

Further, in 2001 Kara/Noveren, a waste handling company, joined the network, supporting the Symbiosis Institute.

The Projects

There are three types of projects: recycling of water, transfer of energy and recycling of waste products. Until now, the IS has created 24 projects, 12 of which involve water, 6 exchange of energy and 8 the reuse of solid waste products. (Two steam projects count as both water and energy projects). All projects can be seen in figure 1.

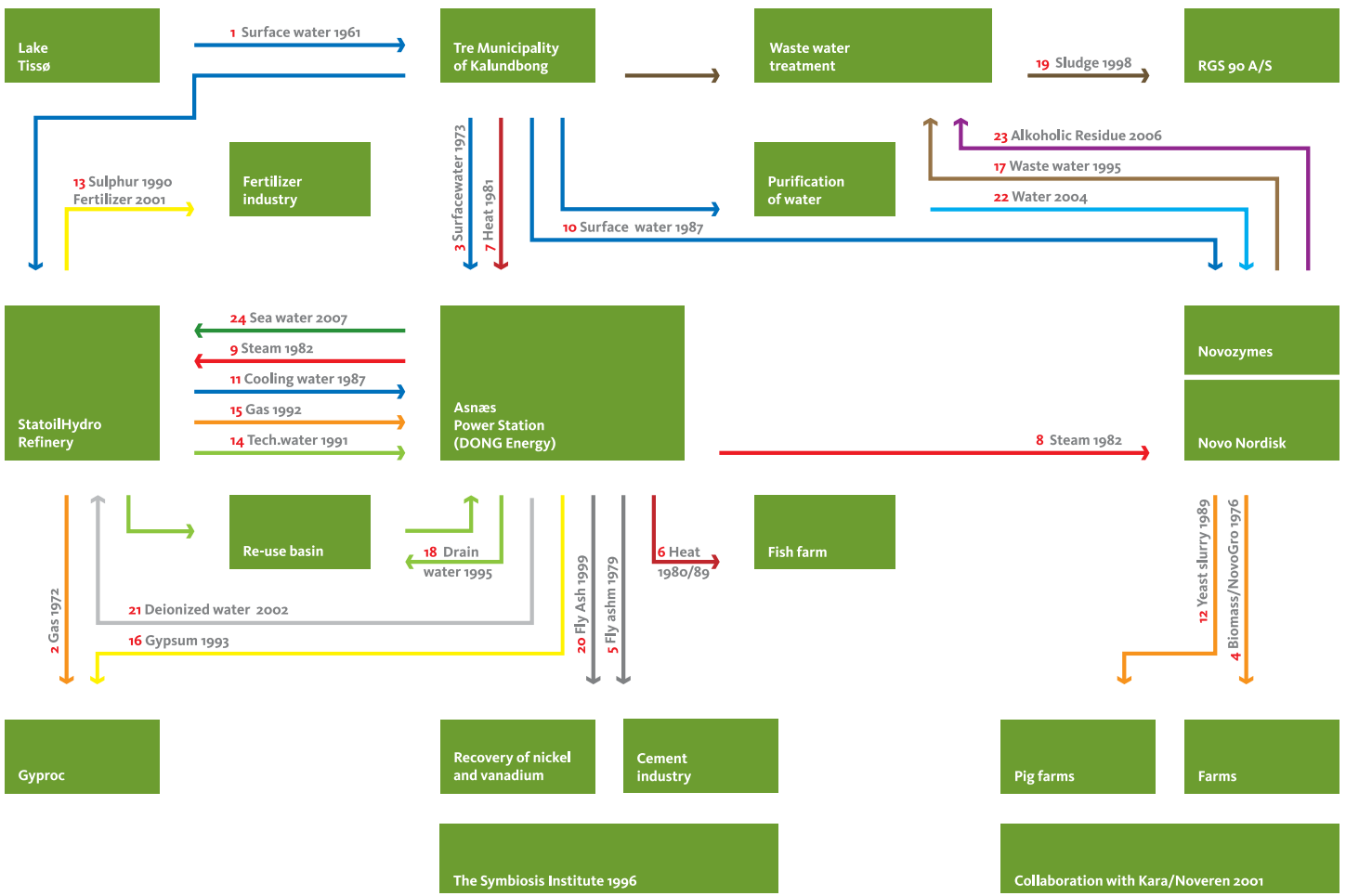
Water

In 1961, the new refinery needed large quantities of cooling water, and the municipal water supply was not sufficient. However, untreated water from Lake Tissø could serve the purpose and was much less expensive. The city of Kalundborg then built a pipeline and the refinery financed it. This water supply, although not a waste product, led to a number of other projects, which have tied a number of industries together in a network, for which many years later, in 1989, the name of "Industrial Symbiosis" was coined.
Later, water from Lake Tissø was supplied to the power station to be used in boilers, and later, also to Novo Nordisk for their cooling towers. In a subsequent project, the used cooling water from Statoil – uncontaminated, only a few degrees warmer – was utilised at the power station.
The refinery built a waste water treatment plant. The treated water was used at the power station for certain technical purposes (cleaning of boilers, flushing of ashes, etc.). Later, a large buffer basin was built at the power station for this "technical water" together with drain water from the power station's own land.
In 1995, Novo Nordisk developed a two-stage treatment of their wastewater. The second treatment was carried

out in the municipal wastewater plant. This postponed an enlargement of Novo Nordisk's own wastewater plant.
In Denmark, ground water is the normal source of water supply. However, Kalundborg and Novozymes received a special permission to build a water work to supply surface water in drinking water quality from the Lake Tissø, to be used in the production of technical enzymes. This way a large amount of ground water was substituted by surface water.
A few years ago, the power station also started supplying ultra-pure, de-ionized water (of boiler water quality) to the refinery. And very recently, the refinery agreed with the power station that sea water from the cooling water intake of the power station could be used as cooling water in a new part of the refinery.

Energy

The first energy project was the supply of excess gas from the refinery to Gyproc. Gas which otherwise would have been burned in the "eternal flame" of the refinery was now utilised as fuel for drying the plaster boards. (Later, the excess gas was substituted by other gas types).
During the seventies, district heating was established in some parts of Kalundborg. After the oil crisis, the district heating was expanded and integrated in one system, heated by the power station. A double pipeline for hot circulation water was built in 1981.
In 1982 two very important projects were completed: the supply of steam from the power station to Novo Nordisk and to the refinery. They trained four parties to co-operate: Asnæs Power Station, Novo Nordisk, Statoil and finally Kalundborg Municipality, that built



the foundations that carried both the district heating pipelines and the steam pipeline. In 2002, this pipeline was duplicated.
Fish grow faster at elevated temperatures. Sea water that has been used as a coolant for the power station is reused in a fish farm, resulting in an annual production of more than one hundred tonnes of trout.

(Solid) Waste

The discharged bio-mass was a waste product from the enzyme production at Novo Nordisk, consisting of dead micro-organisms. This bio-mass was initially mixed into waste water, but from 1976, it was used as a fertiliser on local fields where it replaced inorganic fertilisers. Part of the bio-mass produced by Novo Nordisk consisted of yeast. This yeast by-product is now sold to farmers as a pig fodder.
After the first oil crisis, all Danish power stations converted from oil to coal. Coal leaves large amounts of fly ash, which was initially a problem. However, an application for fly ash was found in cement production elsewhere in Denmark. In a period, the fly ash from a particular fuel (Orimulsion) contained large amounts of vanadium and nickel and was used in Britain for the recovery of such products.
The gas from the refinery was desulphurized by a catalytic process, which yielded a hot, yellow, liquid sulphur, used for the production of sulphuric acid. Later, this process was changed into a process in which the fertilizer ammonium thiosulphate is formed. The desulphurization of the refinery gas allowed the power station to use the gas as a supplementary fuel.
The power station desulphurized the smoke. A method was chosen by which gypsum (calcium sulphate) is formed, which could be used as raw material for the production of plaster boards at Gyproc, thus replacing natural gypsum imported from Spain.
The soil remediation company, now called RGS 90 A/S, cleans oil contaminated earth by microbiological processes. Sludge from the municipal wastewater treatment plant is used to accelerate the microbiological processes.

The Symbiosis Institute

The purpose of the Symbiosis Institute is to gather information on the IS and other examples of Industrial Ecology and to be an information centre for the IS. Furthermore, the Institute can also act as a consultant. The Institute was founded in 1996 and is financed by the symbiosis partners and revenues from services rendered to clients.

The Results of the Industrial Symbiosis.

During the development of the Symbiosis, environmental awareness grew. Although profitability was the initial incentive for the Symbiosis projects, the companies gradually tried to lower their resource consumption and reduce the emissions into air, water and soil. At the same time, the companies come forward with enhanced environmental consciousness. Such objectives are now prevailing.
The resource savings are quite substantial. On an annual basis, 1.9 million cubic metres of ground water; 1 million cubic metres of lake water; 20,000 tonnes of oil and 200,000 tonnes of natural gypsum are saved. The emissions into air, water and soil have also been reduced.
Economically, the IS is a success. Each project is carefully evaluated by the individual partners and found profitable under the circumstances at the time. Although it is difficult to get a precise picture, an estimate in 1998 showed that the total investments of all projects amounted to a total of USD 75 million, the annual savings exceeded USD 15 million and the total accumulated savings (until 1998) were likely to total USD 160 million. Today, the figures would be much higher.
The IS has had a number of spin-off effects in local society. Examples are the establishing of an Industrial Development Board, the co-operation between five municipalities, the establishing of joint training programmes for safety between the industries etc.

Important Factors for IS

The industries must fit together, but be different. The geographical distance should not be too large, as the length of pipelines will set an economic limit. More important, however, is the “mental distance” between partners. Communication, confidence and a mutual understanding of what goes on in the neighbour industries are important for the realisation of an inter-company network.
An IS is never static but subject to developments, dynamics and dependence. Many of the projects have been changed due to technological development or market prices. Three of the projects have stopped during the years, but new projects have come up, other projects have grown and may have undergone technological changes.

Industrial Symbioses Elsewhere

There has been an increasing interest in applying the IS principles elsewhere in the world. From about 1994, there have been many attempts to copy the system, either in existing industrial areas or in new industrial areas (often called “Eco-industrial Parks”). Many of these attempts failed initially, but after a long period it now seems that successful projects are going on in many countries. The Rotterdam port is such an example. In China and in South Korea a big number of Eco-industrial Parks have been approved, and in Britain a big “National Industrial Symbiosis Programme” was launched in 2003 and is making good progress in establishing symbiotic relationships in existing industrial areas.

Conclusion

The principle of co-operating “across the fence” offers considerable advantages, both for economy and for environment. There is a large potential, both in existing industrial areas and in new Eco-industrial Parks. The barriers for the introduction of IS are neither technological, nor environmental, but have to do with human communication, personal relations and co-operation. From this point of view, Industrial Symbiosis is a management discipline.

Background, Pattern and Policy of China for Developing Circular Economy

Zhu Dajian, Director of Sustainable Development and Management Research Institute under Tongji University

Circular Economy has become one of China's important strategies to realize scientific development and build ecological civilization at present. As in China Circular Economy was put forward as a new economic pattern, the international community generally holds that this is an innovative move for China's economy to realize leap-forward development and hopes to learn more about the theory, policy and practice relating to China's Circular Economy. This article introduces and comments on the necessity to develop Circular Economy in China, implications and characteristics of China's Circular Economy, and China's main practices and policies to promote it at present.

Why Does China Need to Develop Circular Economy Vigorously?

The period from 2000 to 2020 is a development stage in which China will strive to build an overall well-off society and realize modernization first in the developed eastern region. China's economic growth goal by 2020 is to quadruple per-capita GDP over 2000 that is, achieving US $3,000, more than four times that in 2000. According to China's 9-10% economic growth rate over many years, such a goal is attainable. The problem now is that China's economic growth over the past 30 years was achieved at the cost of consuming large quantities of resources and discharging large amounts of pollutants. For example, data shows that China's total GDP accounted for about 5.5% of the world's total in 2006, but standard coal, steel and cement China consumed for this accounted for 15%, 30% and 54% of the world's totals, respectively. If such trend continues in China's future economic growth, the prospect would be "worsening" instead of getting better.

Hence the solution to this problem is to decouple the economic growth from resource consumption and environmental pollution. Circular Economy was proposed against this situation and regarded as an important approach for China to change its development pattern and realize "decoupling" development in the future. I think China's environment and development by 2020 can be roughly divided into the following three patterns, with Pattern C being what China needs to strive to realize by developing Circular Economy and suitable for China's current development level.

Pattern A The strong materialized pattern of high resource consumption and high environmental pollution. The so-called Pattern A adopts the view of American scholar Lester R. Brown in his book *Plan B: Rescuing a Planet under Stress and a Civilization in Trouble* (published by Oriental Publishing House, 2003). The strong materialized pattern is expressed as simultaneous development of economy and environmental pressure. While GDP grows, environmental pressure also grows, which is the traditional economic growth pattern. China's economic development basically followed Pattern A in the past. For example, it's said when China's per capita GDP was US $ 400-1,000 (i.e. in the light industry stage), its pollutant discharge level was already equal to that reached by developed countries when their per capita GDP was US $ 3,000-10,000 (in the high processing industry stage). It is to break away from such a resource-consuming and environment-destroying development road that we pay attention to Circular Economy today. When participating in researches for the state's medium and long-term sci-tech strategic plans, I estimated with relevant experts: if our country continues the current resource-utilizing method and pollutant-producing level, the influence of the economic and social development on environment

will probably be 4-5 times that at present in the future when population continues to grow and economy quadruples by 2020. Apparently, this pattern not only means serious social instability and serious resource and environment problems, but economic development itself will also not be sustainable.

Pattern B The dematerialized pattern which requires absolute decoupling of economy from environment. Pattern B is opposite to Pattern A and Lester R. Brown advocates it in his book as the future development pattern. Its target is that environmental pressure doesn't grow or even grow negatively when economy continues to grow positively, i.e. realizing absolute decoupling of the two. In the long run, such a target is a must for both developed countries and developing countries and it's the highest connotation of ecological modernization or sustainable development. However, can this development target be used right away in China's development in the next 15 years? My answer is negative. I also estimated roughly that resource productivity must be increased by four or five times if environmental pressure is not to be increased apparently when China's economy grows by four times by 2020 and resource productivity must be increased by 8-10 times if environmental pressure is to be alleviated apparently (by half). This target is certainly encouraging, but, judging from China's current technical ability and management level, it's very difficult to realize this high dematerialized pattern. If we have to do it, it means China's economic target must be adjusted. Obviously this will affect Chinese people's living standard and quality from the other aspect.

Pattern C The pattern for increasing resource productivity which is fit for China's current stage. China cannot continue to follow traditional Pattern A because of the shortage of natural resources and restriction of environmental pressure and, restricted by its current development stage, it cannot adopt Pattern B for the high development stage immediately either. Hence I propose a development pattern fit for China's development stage in the next 15 years, which is shortened to Pattern C (China). In Pattern C, China's economy will keep growing according to the established targets and growth of resource consumption and pollutant production will be stabilized after being decelerated. Such development should be acceptable for both China and the world. For one thing, it accords with the requirements of sustainability; for another, it accords with the requirements of ecological equity because it creates safer living environment for the world while providing reasonable room for 1.3-1.5 billion Chinese people to improve life. China will probably implement a more than four times greener development strategy after 2020, i.e. the total economic quantity will continue to double but resource consumption and pollutant production will be halved to realize the above-mentioned decoupling of China's economic development from environmental pressure. However, as Shanghai, Beijing, Guangdong and other developed coastal areas in the southeast lead other areas in development levels in China, a much dematerialized strategy should be implemented for them first so that modernization with a win-win meaning in both economy and environment can be basically realized by 2020.

Connotations and Main Characteristics of China's Circular Economy

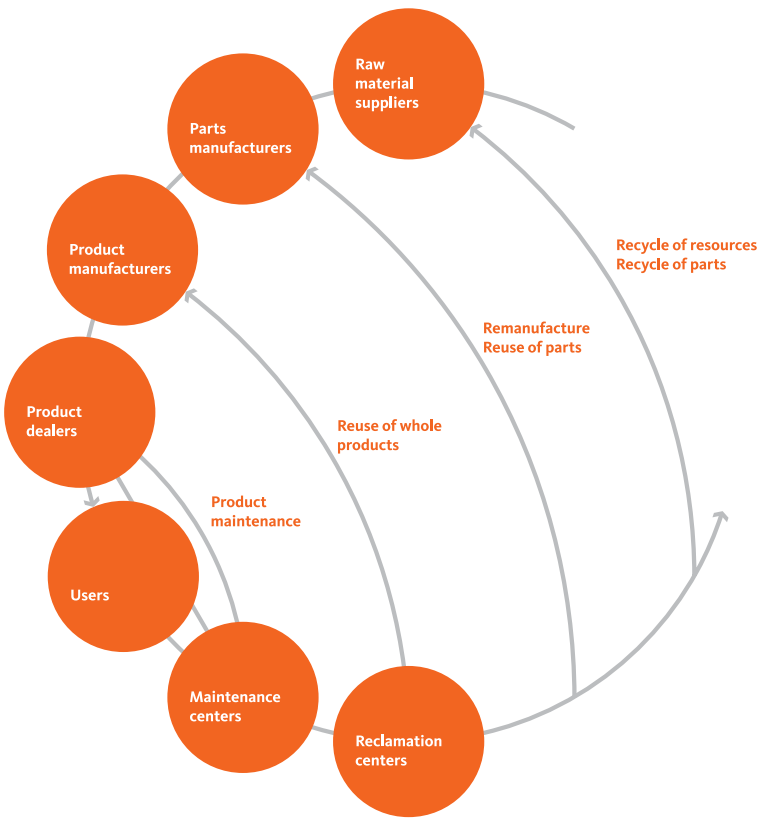
Although the proposal of the idea of Circular Economy in China (in 1998) was inspired in time by the Recycling Economic Law on Waste promulgated by Germany in 1996 (Japan proposed the idea of the recycling society in 2000 after China proposed the idea of Circular Economy), the contents of China's idea of Circular Economy include many theoretical study achievements made in the world in the fields of ecological economics, Industrial Ecology, etc. since the 1990s. Therefore China's idea of Circular Economy has its own characteristics. I believe at least the following characteristics are worth emphasizing. First, China's Circular Economy is an idea about the economic pattern in respect of nature rather than an idea about environmental management in some other countries, because China hopes to reduce resource consumption and pollutant production at sources and in the whole process by changing the economic pattern. It also hopes to achieve win-win in both economy and environment by Circular Economy instead of "economy without recycle" or "recycle without economy"; therefore the department proposed for planning Circular Economy as a whole in China is the State Development and Reform Commission which has a comprehensive nature instead of environmental management departments in some other countries. Second, China's Circular Economy not only aims at garbage economy or 3R economy for treating solid waste in respect of objects

but at all scarce resources involved in China's economic development, including water, land, energy, materials and corresponding waste; to a certain extent, it is of more urgent significance for China to develop Circular Economy which deals with consumption of water, land, energy and other resources and control of related pollutants. Third, China's Circular Economy comprises different space levels in respect of scale and includes Circular Economy of individual enterprises, industrial parks, regions, etc. Fourth, China's Circular Economy stresses progressively increased practice forms on the following three levels in respect of pattern and emphasizes the need to develop from low-level recycle of waste based on ecological efficiency (to reduce consumption and pollution) to high-level recycle of products and services based on ecological effects (to prevent consumption and pollution).

Recycle of Waste It mainly refers to reclamation of waste from production and consumption by technical and management means and is the concrete embodiment of the principle of recycle of resources in the 3R principle in Circular Economy and also an important content of Circular Economy in Germany and Japan. This practice reduces effectively the final quantity of waste to be treated and is a remarkable progress in comparison to the traditional treatment at terminals. Recycle of waste is applicable to three scales, i.e. enterprises, parks and regions. Specifically, a closed-loop production process should be built in individual enterprises to reduce production and discharge of waste in individual enterprises as much as possible. Next, different factories should be linked to form industrial symbiotic combinations to share resources and exchange by-products by building Eco-industrial Parks so that the principle of Circular Economy can be implemented in a larger scope. Finally, the centralized resource-recycling industry should be established in the treatment link in cities and regions as by turning traditional landfill sites into composite waste -recycling parks with the vein industry as the main content.

Recycle of Products It mainly refers to using products for as many times and in as many ways as possible instead of using them once in the past so as to extend their useful life. As shown in the following map, products are put into maintenance centers or reclamation centers after use, but products don't need to be put into the reclamation centers if they can be reused after simple maintenance. Only if products are damaged seriously and cannot be restored and reused after simple maintenance they will be put into the reclamation centers and then returned to product manufacturers, parts manufacturers or raw material suppliers for corresponding resource recycle according to their damages. The ultimate aim of recycle of products is to realize minimum discharge of waste or even zero discharge of waste (so-called zero waste) filled in land in the end.

Recycle of Services It mainly refers to enterprises dealing in and managing products manufactured by them as assets, promoting the concept of developing from "selling products to providing services" and realizing recycle of assets by establishing a product-service system (shortened to PPS). Its basic premise is "the value of products lies in the benefit and utility they bring for consumers", i.e. the real value of products



should be their “utilization value” instead of their “exchange value”. This is in fact the difference between the emphases of linear economy and Circular Economy. Exchange value is the central concept in linear economy while use value is the central concept in Circular Economy. There may be three kinds of economic types from products to service: pure products, product services and pure services. Reasonable combination of products and services constitutes the so-called product-service system and profits of enterprises, satisfaction of consumers’ needs and lower social influence on environment can be realized by it. For example, consumers are no longer inclined to have their own washing machines or cars through recycle of assets but are inclined to use washhouses on streets and means of public transport.

China’s Systems and Policies to Develop Circular Economy

The development of China’s Circular Economy has mainly undergone three stages since 1998. The period from 1998 to 2000 is the stage in which relatively academic concept was introduced and theoretical studies were conducted. Researchers and scholars in institutions of higher learning and scientific research institutions played the role of ideological enlighteners in this stage. The period from 2001 to 2005 is the stage in which clean production in enterprises and Eco-industrial Parks were emphasized in experimenting on Circular Economy. The national environmental protection department played an important role in this stage. Circular Economy was advocated as a national strategy in 2006 and China entered the stage of promoting the development of Circular Economy systematically at all levels. Apart from theoretical studies and practical promotion, the Chinese government mainly took systematic actions in the following four aspects in this stage:

Draft an Economic Law on China’s Circular Economy

Under the support of the NPC of China and the State Development and Reform Commission, China is busy designing an economic law on Circular Economy and the relevant draft may be passed officially at the NPC meeting in February 2008. The draft of the economic law on China’s Circular Economy emphasizes: first, China should stick to the principle of giving priority to quantity reduction in developing Circular Economy. Particular attention should be paid to quantity reduction because China is in the high-speed development stage of industrialization, energy and material is consumed too much, waste of resources is serious and the potential for quantity reduction at front ends are great; second, key points should be highlighted and special efforts should be made to put an end to high energy consumption, heavy pollution and problems that affect the development of China’s Circular Economy and hard restrictions should be available to control high consumption and high discharge; third, the roles of the government, enterprises, public and industrial associations should be highlighted in major economic processes, i.e. all links in production and consumption, so as to constitute synergy for pushing forward the development of Circular Economy; fourth, basic systems favorable for development of Circular Economy should be established, including the system for planning Circular Economy at the national, provincial, municipal and county levels, the systems for controlling the total quantities of resource consumption and pollutant discharge, the system for extending mainly manufacturers’ product responsibilities and the appraising and examination system based on indexes of resource input, recycle and pollutant discharge. Although the drafting of the law on Circular Economy should solve the outstanding problems in development of China’s Circular Economy at present, I think the nature of the law on Circular Economy as a general guideline and its strategic significance should be made clear in explaining the connotations and characteristics of China’s Circular Economy. It should also be stressed in particular that this law is an economic law instead of an environmental law and, its objects are mainly scarce resources and pollutants, it covers all stages from exploitation, production, consumption to treatment of waste and its forms include recycle of waste, recycle of products and recycle of services.

Set Goals for Development of Circular Economy

China’s Eleventh Five-Year National Economic and Social Development Plan passed in 2006 set national goals with binding significance for development of China’s Circular Economy in the next five years in light of China’s main problems in resource consumption and pollutant discharge at that time. It requires energy consumption per unit GDP to be lowered by 20%, the total discharge quantity of such main pollutants as chemical oxygen content and sulfur dioxide to be lowered by 10% and the total area of farmland not to

be less than 1.8 billion mu. The so-called restrictive indexes are what the government must realize and fulfill and they have legal force and should be put into the system of all regions and departments for appraising economic and social development comprehensively and examining performance. This shows the government has regarded realization of Circular Economy as a public affair which it must do. However, looking from a more systematic angle, I think it's not enough to just list a few control indexes in the comprehensive economic and social development plan to develop Circular Economy. China needs to make a more detailed and more scientific plan for Circular Economy and dematerialization in line with economic growth. Its contents should include indexes for controlling the total consumption of water, land, energy and materials, as well as the total discharge of main pollutants so as to adjust the economic growth speed and scale in the future and realize transition from the development pattern of economic growth advancing the scale of resource consumption to the development pattern of the scale of resource consumption controlling economic growth.

Make Experiments on Circular Economy

China adopts the method of experimenting in experimental units and expanding gradually in development of Circular Economy and expects to form Circular Economy of a certain scale by 2010. Hence the State Development and Reform Commission started to experiment on Circular Economy in the first group of experimental units in 2006 and these units are divided into four categories. The first is represented by enterprises in high-consumption and high-discharge key industries; the second by Eco-industrial Parks; the third by waste-recycling enterprises or the vein industry; the fourth by cities and regions with comprehensive nature, which include some resource-dependent cities in the central and western regions and super-large cities with scarce resources. In my opinion, the focus of these experiments is still mainly low-level recycle of waste with recycle of resources in waste as the main contents and it is necessary to further study and develop high-level recycle of products and services with more quantity reduction nature because this is the fundamental reason for China to develop Circular Economy. To our pleasure, the Comprehensive Work Plan for Energy Saving and Reduction of Discharge worked out by the State Development and Reform Commission together with other relevant departments has mentioned that China will experiment on Circular Economy in the second group of experimental units and recycle of waste and old household electric appliances and remanufacture of auto parts and machinery will be included so as to further develop the practice of Circular Economy.

Make Appraising Indexes for Circular Economy

The State Development and Reform Commission, State Environmental Protection Administration and National Bureau of Statistics have compiled and published an index system for appraising Circular Economy in four aspects, i.e. output of resources, consumption of resources, comprehensive utilization of resources and discharge of waste. Therein the resource output index mainly refers to GDP produced by consumption of unrenewable resources (including coal, oil, iron ore, non-ferrous metal ore, rare earth ore, phosphorus ore, sulphur ore, limestone, gravel, etc.); the resource consumption index mainly describes resources consumed by creating per unit products or per unit GDP and it reflects reduction of resource consumption, i.e. "quantity reduction", at sources; the comprehensive utilization of resources index mainly reflects reclamation and utilization of solid waste, wastewater, urban household garbage and traditional waste and old materials and embodies the effect of recycling waste; the waste discharge (disposal) index mainly describes the final discharge (disposal) quantity of solid waste, wastewater, SO_2 and COD and reflects the finally reduced discharge (disposal) quantity of waste through development of Circular Economy. I think study and implementation of statistic indexes should be linked more closely with the targets of Circular Economy as the fundamental aim of developing Circular Economy is to realize dematerialized economic development, i.e. reduced resource consumption and pollutant discharge, and raise the ecological efficiency of economic growth.

Venice Industrial Area and Industrial Ecology Challenge: Could it be an Eco-Industrial Park?

Ilda Mannino, TEN Center, Venice International University
Ignazio Musu, TEN Center, Venice International University; Ca' Foscari University of Venice
Marian Chertow, School of Forestry and Environmental Studies, Yale University

Recent overviews and assessment studies on Industrial Symbiosis have highlighted that self-organizing symbioses have usually led to more sustainable industrial development than the attempts to plan Eco-industrial Parks (Chertow 2007).
While industrial planning is more institutionalized in Asian countries, such as China, Korea, and Singapore, research has shown it is very important to identify and foster already existing symbioses.
Italy could represent an interesting case study. This country has many industrial parks, several of which are now at least partially disused and contaminated. The reason is the re-localisation of the industry towards developing countries that has started in the 70s.
The manufacturing sector is still very important in Italy, and the identification of existing symbioses and their promotion in accordance with the principles of Industrial Ecology could contribute to help both the revitalization of economic development and the solution to environmental challenges in these industrial areas. In the following pages, we briefly describe the case of Venice's industrial area, Porto Marghera.

The History of Porto Marghera

The area of Porto Marghera is located 5 km NW of the historical centre of Venice, between the urban inland and the coastal lagoon; it spans on an area of 2000 hectares, representing, as for its extension and importance, one of the main Italian industrial sites.
Porto Marghera was founded at the beginning of the last century as a commercial port and industrial area by financiers who saw the opportunities linked to its favourable geographical position: it was located near the core of the Italian manufacturing industry, on the Adriatic route and, at that time, it could draw on an almost inexhaustible low cost labour force. The idea was to create an integrated pole, where firms could benefit from their reciprocal proximity and interaction.
Porto Marghera was developed in different periods of time. The first industrial zone was developed between 1917 and 1940, whereas the second industrial zone, dominated by the chemical sector, followed in 1955.
A third industrial zone was planned in 1965, but the terrible flood experienced by Venice in 1966 and the huge damages that followed, in addition to the first signs of a growing environmental awareness on the one hand, and of the global re-organization of the international specialization of industrial production involving an increasing role of developing countries on the other hand, lead to stop the project.
Locally, people tended to blame the construction of the first two industrial zones and other transformations that occurred in the lagoon over the last century for the devastating environmental effects. From this debate, a special law for the safeguarding of Venice was approved. It entered in force in 1973, and was in fact the first step towards the stopping of the construction of the third zone. The law had as main objective the preservation of employment in the existing industrial areas; however, the real crisis of Porto Marghera started in the late 70s, linked to the general restructuring of the industrial sector that occurred in western countries, with the closing of many plants with the consequences of unemployment.
Despite the crisis, today Porto Marghera still represents one of the main industrial parks as for the number and type of activities, both in Italy and Europe. Even if this industrial area is experiencing a general turn-over towards logistics and the commercial sector, the traditional activities of Porto Marghera are still there, representing about 100 industrial firms out of the 302 in the area, to testify that this industrial sub-sector is still alive. However, Porto Marghera is currently

experiencing a period of readjustment in the metallurgy sector, while the future of chemistry is still uncertain. The future of the area depends heavily on the political choices that will be made.
Another important element to consider is that Porto Marghera has been recognised by law 426/98 as one of the first among 14 industrial areas at highest environmental risk because of the contamination left by past activities. Porto Marghera has also to comply with the restrictive requirements introduced by the EU legislation in the field of control of major accident hazards, involving dangerous substances and pollution prevention and control. The main stakeholders involved in Porto Marghera reacted to these measures by signing the "Accordo di Programma per la Chimica a Porto Marghera" (Program Agreement for the Chemistry in Porto Marghera), in 1998. The main objective of this document was to create and maintain over time the ideal conditions for the coexistence of environmental protection, development, and productive transformation of the chemical sector of Porto Marghera, by identifying as fundamental goals the reduction and management of environmental risk and the redevelopment of Porto Marghera.
Among the engagements of the agreement, the signatories are committed to develop *environmental management systems* within the firms, to present an annual *environmental report*, to improve some *processes* and to develop research for the amelioration of the sector, to reduce and rationalize the movements, to substitute specific processes and substances with less polluting and hazardous ones and to promote research in this field.

Porto Marghera as Eco-industrial Park

Does Porto Marghera represent a case of Industrial Symbiosis? According to the minimum criterion "3-2 heuristic", given that an Industrial Symbiosis is made up of at least three different entities involved in the exchange of at least two different resources (Chertow 2005), Porto Marghera represents a basic industrial ecosystem, even if still immature. In fact, within the petrochemical area, four chemical firms are involved in the exchange of steam, cooling water, residual gas and some by products (Figure 1).
On the basis of literature (Ehrenfeld and Chertow 2002, Côté et al. 1995, Lowe and Warren 1996, President's Council on Sustainable Development 1997, Peck and Associates and Dalhousie University 1997, Research

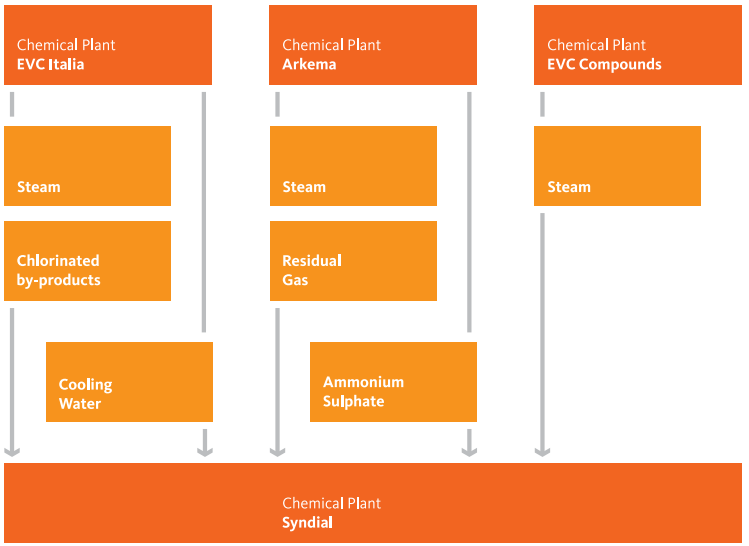


Figure 1. Industrial Symbioses in Porto Marghera.

Triangle Institute 1995, Cohen-Rosenthal 1999, Chertow 1999, Côté and Cohen-Rosenthal 1998, DSA Environment 1997, Côté and Hall 1995, Mirata 2004, Chertow 2004) a set of elements favourable to the development of symbioses can be identified in Porto Marghera.
The first important aspect is represented by pre-existent synergies: in relation to its nature of integrated pole, there are already numerous exchanges going on in Porto Marghera that can represent a good basis for further trades, both in terms of existing infrastructures and cooperative approach. Concerning the latter point, the signatories of the Agreement represent, at least in principle, an organizational partnership, born from the need to comply with legislation and to prevent and manage the risk, and to allow the redevelopment of the industrial zone.
The green accounting that the signatories are voluntarily committed to present yearly, could be a useful tool to track the flows of material and energy for each firm involved and the exchanges between them and, maybe in the future, to identify further opportunities for exchanging and recycling.
These data are collected and elaborated by ARPAV, the Regional Agency for the Environment Protection. The monitoring of the air quality is instead carried out by the industrial association of Porto Marghera (Ente zona industriale di Porto Marghera), as important

basis for the prevention of industrial accidents and pollution control. This association involves 43 firms of Porto Marghera. Another important association in Porto Marghera is the Province's industrial association, Unindustria.
These different associations could play an important role as facilitators and coordination unit to foster a further development of symbiosis.

Conclusions

The dynamics of the area show that Porto Marghera is still alive, but its future development depends heavily on the choices that will be done in the future, regarding the industrial sector and, in particular, the chemical sector. The general policies concerning Porto Marghera and its future remain still uncertain. On the one side, the will to maintain this area active, characterised by important economic and employment issues for Venice, is still strong. On the other side, the need to preserve the unique lagoon ecosystem and the possibilities to choose less impacting activities are taken in consideration.
A preliminary analysis of Porto Marghera has highlighted an existing symbiosis, even if at an early stage, involving some of the firms in the area. Also, other elements that could favour a further development of this symbiosis, such as existing synergies, infrastructures, energy and material accounting and facilitators, are present in Porto Marghera. However, this symbiosis has not been really uncovered yet and the main stakeholders and public are not aware of the opportunities coming from this new approach. This may be one of the reasons of the difficulties periodically encountered in the implementation of the signed agreements.
Further studies, dissemination and involvement of stakeholders in the development of a new vision for Porto Marghera could represent an important opportunity for the future of the area. The Porto Marghera project could represent a reference point for other industrial parks in Italy, presenting already existing industrial symbioses and where the fostering of these symbioses and the rethinking of the area as Eco-industrial Parks could offer opportunities for a more sustainable development.

References

Andrews C., Rejeski D., Socolow R., Thomas V., 1998. *Linking Industrial Ecology to Public Policy: Report of a Workshop*, Working Paper 4, Report No. 310, Edward J. Bloustein School Center for Energy and of Planning & Public Policy Environmental Studies.
Chertow M.R., 1999.The eco-industrial Model Reconsidered, *Journal of Industrial Ecology*, Vol. 2, n. 3.
Chertow M.R., 2004. "Industrial Symbiosis", Encyclopedia of Energy, 3, pp. 407-415.
Chertow M.R., 2005. "Dynamics of Geographically Based Industrial Ecosystems", Yale School of Forestry and Environmental Studies, Submitted.
Chertow M.R., 2007. "Uncovering Industrial Symbiosis", Journal of Industrial Ecology, Vol. II, No. 1, pp. 11-30.
Cohen-Rosenthal E., 1999. *Handbook on Codes, Covenants, Conditions, and Restrictions for Eco-industrial Parks*.
Côté R., Cohen-Rosenthal E., 1998. "Designing Eco-industrial Parks: a synthesis of some experiences", *Journal of Cleaner Production*, 6, pp. 181-188.
Côté R., Hall J., 1995. "Industrial parks as ecosystems", *Cleaner Production*, Vol. 3, No. 1-2, pp. 41-46.
Côté R., Ellison R., Grant J., Hall J., Klynstra P., Martin M., Wade P., 1995. *Designing and operating industrial parks as ecosystems*, Halifax (Nova Scotia), School for Resource and Environmental Studies, Dalhousie University.
DSA Environment, 1997. *Avant-propos: Charte PALME du parc d'activitiés de Landacres*, Paris.
Ehrenfield J.R., Chertow M.R., 2002. «Industrial Symbiosis: The Legacy of Kalundborg», in *A Handbook of Industrial Ecology*, R.U. and Ayres L.W., Eds. Edward Elgar, Cheltenham, UK.
Erkman S., 1998. "Industrial Ecology and Competitiveness, Strategic Implications for the Firm", Journal of Industrial Ecology, 2 (1), pp.35-43.
Lowe, Warren J., 1996. *The source of value: an executive briefing and sourcebook on Industrial Ecology*, PNNL-10943, Richland (Washington), Pacific Northwest National Laboratory.
Mirata M., 2004. "Experiences from Early Stages of a National Industrial Symbiosis Programme in the UK: Determinants and Coordination Challenges", *Journal of Cleaner Production*, 12, pp. 967-983.
Peck and Associates and Dalhousie University, 1997. *Promoting Eco-industrial Park development: exploring challenges, drivers and opportunities for progress in Canada*, A report for Environment Canada and Industry Canada, Ottawa.
President's Council on Sustainable Development, 1997. *Eco-efficiency task force report*, Washington (DC).
Research Triangle Institute, 1995. *Developing an Eco-industrial Park: Supporting Research, Volume 1, Final Rep*ort, Research Triangle Institute Project Number 6050, Research Triangle Park, NC. Final report for the U.S. http://www.rti.org/units/ssid/cer/parks.cfm

kxxi 3/3

Cleanup of Dismissed Industrial Sites: a New Chinese Issue

Giovanni Ferro and Federica Belloro, I.S.A.F. S.r.l., Savona, Italy

International Framework

In almost all industrial countries, the issue of preventing and cleaning-up soil contamination arose with reference to the use of dismissed industrial sites for urban development, as a later phase of the growing up of environmental awareness.
In the United States, the soil clean-up issue was firstly addressed, following the Love Canal famous case. There (a new small town near Niagara Falls), in the 70s, the population experienced an unusually high number of miscarriages, newborn deformities, blood diseases, cancers, epilepsy and other diseases due to pollution in the subsoil, caused by dumped wastes from a chemical industry, buried underground in the 40s and 50s, before the urban development of the area. After this and other similar events, the US Congress enacted in 1980 the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which created a tax on chemical and petroleum industries, financing a trust fund (Superfund) for cleaning-up abandoned or uncontrolled hazardous waste sites. This was the first regulation worldwide on soil protection; subsequently, further federal and local regulations were issued in the United States to prevent subsoil contamination and enforcing the clean-up of contaminated sites.
In the 80s and 90s almost all major industrial countries issued regulations for preventing and cleaning-up subsoil contamination; the most recognized criteria were set by Australia, Canada, Netherlands and United Kingdom, but also countries like Germany, Spain, Italy and many others now have specific nationwide legislation on the matter. Few countries, like France, do not have a comprehensive soil protection legislative system, although public environmental policies (leading to establish pollution prevention and monitoring criteria as well as public register for potentially polluted industrial sites) and a general environmental liability regime compensate, at least in France.
Worldwide regulations on soil protection are aimed to assure land conservation for future generations, as land is vital for human and ecosystem life, and they are based on three key principles:
_ industrial activities must not pollute subsoil (soil and groundwater) and, if it occurs, immediate clean-up must be undertaken;
_ subsoil at dismissed industrial sites must be checked and, if the case, cleaned-up before any new development at the sites;
_ the polluter must pay the cost of clean-up.

Although regulations are quite different from country to country in terms of criteria, standards, enforcing systems, duties, procedures and other details, these three principles are stated almost everywhere and can be considered generally recognized bases for soil protection regulations.

Chinese State of the Art and Upcoming Issues

Land conservation is one of the pillars of the Chinese environmental policy, as outlined in the 11th Five-Year Plan, which indicates a target of developing a cyclic economy and building a resource-conserving and environment-friendly society (Chapter 6).
Although the development of Chinese environmental policies and regulations started many years ago, only recently more specific attention has been devoted to soil pollution problems and its clean-up, especially with reference to new development of dismissed industrial sites. Although the 1995 Chinese law on prevention and control of pollution from solid wastes and the 1996 law on prevention and control of water pollution, as well as many other Chinese environmental regulations, contained clauses aimed at protecting soil

and groundwater from pollution, the first specific ruling related to control and clean-up contaminated sites appeared in 2004 (Document of Chief Office of SEPA N. 47 “Notice to Ensure Prevention of Environmental Pollution during Enterprises Moving Process”).
This document addresses the urban development of areas made available in the center of the cities due to the moving out of industries, in a process of adjustment of industrial structure and urban relocation, and states that:
_ when operation are dismissed and land use is changed at sites where dangerous wastes were produced or handled, soil investigations must be performed and a clean-up scheme must be prepared;
_ in any case, in dismissed industrial areas where urban development is ongoing, soil pollution investigations are mandatory, to define appropriate clean-up plans;
_ the organization originally operating the industrial activity is responsible for soil remediation.
Not surprisingly, this first regulation on soil protection and clean-up deals with dismissed sites, as it occurred in most industrial countries, and it has come out in recent years, when, for the first time, urban development in China is targeting dismissed industrial areas (brownfields) and not only land not previously developed (greenfields). In particular, in Beijing which now is leading its regulation development, big industrial areas are closing production and being dismissed (such as the former Beijing Coke Plant - BCCW and the Giant Steel Plant - Shougang), in order to move all polluting plants far from the cities.

This 2004 SEPA document has to be seen as a first step towards a comprehensive soil protection regulation system, which has to cover many complex issues and likely to be developing in several phases, as it occurred in the other industrial countries. On the basis of the experiences in other countries, a first main phase of development of soil protection regulations, still focused on dismissed sites, is expected to cover:
_ criteria and standards for site assessment and clean-up, aimed at defining a standardized process to decide whether clean-up operation have to be undertaken or not at a given site and to set clean-up goals;
_ technical procedures and standards for subsoil investigation and clean-up operations, mostly adapting to the Chinese technical practice well established international standards;
_ enforcing rules, able to make the principle “polluter pays” effective;
_ administrative procedures, in order to assure the effective control by public authorities of the entire investigation and clean-up process.
Presently, a great deal of research and technical activities in these fields are ongoing in China in universities, research institutes and other organizations, building up the scientific and technical background for a comprehensive regulation on soil protection.
Likely, a second phase of development of soil protection regulations in China will address existing industrial activities, with reference to both steady conditions and emergency response to soil contamination. In this phase, a critical issue, which has been the subject of extensive discussions in many countries, is related to the effectiveness of newly stated soil quality standards with respect to past subsoil contamination, which would imply clean-up obligations for events already occurred (retroactive liability). This is quite a sensitive issue for operating industries, where historical subsoil contamination most often exists and which is going to raise, in this case, sudden liabilities and costs.
Quite different positions on retroactive liability are presently existing worldwide: in the United States CERCLA retroactive liability has generally been upheld by court decisions, although no specific statement was introduced by the law (recent debates in the Congress are focusing on a possible limitation of retroactive liability in some specific cases); the European Union issued in 2004 a directive on environmental liability (2004/35/EC), which excludes retroactive liability at European level, leaving this issue open to national legislations; the only two European countries where the directive has been implemented took opposite choices: Germany, in the Environmental Damage Act (2007), stated that retroactive liability only exists for events occurred after April 30, 2007, while Italy, with the 152/2006 Law, maintained retroactive liability, as coming out from court decisions on the previous soil protection legislation.

Effects of Legislation on Soil Protection

The experience in Europe and in the United States of a comprehensive legislation on soil protection application can be useful in evaluating its major effects on industry and economy.
A study released in 2000 to estimate potential economic impact of the European directive on environmental liability (J. S. McGuigan, “The Potential Economic Impact of Environmental Liability: the

American and European Context"), indicated that, in the United States, from 1980 to 1999, responsible parties have spent over $15 billions on clean-up, not including administrative costs, while the federal government directly spent $16 billions on the Superfund. Not surprisingly, the chemical and allied product industry took the largest share of clean-up costs, close to 25 percent; however, in aggregate, clean-up and transaction cost represented less than one percent of the industry's added value in 1990. These figures must be evaluated keeping in mind that CERCLA implies retroactive liability, which accounts for a significant amount of clean-up total costs.
In general, experiences on soil protection legislations indicate that, when implemented, it results affordable by the industry in aggregate, even if some effects can be seen on industry profits, especially in the first years, and some specific industrial sectors can face more serious problems.
As another important consequence, soil protection legislation, especially if retroactive liability is introduced, generates the problem of the transfer of related liabilities, when a business or a real estate is sold. This has become one of the major issues when drafting contracts, as well as a matter for legal actions and court decisions.
Finally, in all countries, a comprehensive legislation on soil protection has led to the development of a new industrial sector, devoted to clean-up activities, which includes services, technology development and production, as well as field work. Revenues from remediation activities in United States are estimated over $7 billion in 2006, with a growth of 6 percent over 2005; excavation and off-site disposal cover more than one third of this market, followed by groundwater treatment.

Conclusions

Following the same trend as in all industrialized countries, the issue of preventing and cleaning-up subsoil contamination has recently come explicitly out in Chinese environmental regulations. This can be expected at the beginning of a process, lasting some years, to build up a comprehensive legislation on soil protection and clean-up enforcement. Several critical issues have to be faced in developing this legislation, which can have significant influence on its effectiveness and impacts on the Chinese industry and economy.
In any case, this kind of legislation allows, on the one hand, to assure land conservation, as a vital resource for future generations (at affordable costs for the industrial system) and promotes, on the other hand, the growth of a new industrial sector, providing services, technological products and operations for clean-up.

kxxi 3/3

VIU training program echo from participants

This section is written by the Chinese participants in the training program.
We hope hereby to provide the Newsletter readers with an authentic flavour
of the training experience.

Environmentally Friendly City,
SEPB March 2007

Under the sponsorship of the Italian Ministry for the Environment Land and Sea (IMELS), an "Environmentally Friendly City Training Course" was held from March 15 to 17 2007 in Shanghai. Approximately 40 trainees from different city government departments, as well as district/county level environmental protection bureaus participated in this three-day training course. The experts from Italy gave lectures to introduce their experiences and practices in environmentally friendly city initiatives in Italy. Environmental professionals from Shanghai also introduced the on going environmentally friendly city related practices in Shanghai.

The Chinese participants all regarded it was a well-organized course. A number of very experienced professionals from Italian universities and companies were chosen and their presentations were well-prepared and focused on the topic. Environmentally friendly city is a newly arisen topic in China and it has been become an important issue nation wide. The creation of PPP (Public Private Partnership) is one of the most important components of environmentally friendly city development processes. The Chinese participants were very much interested in learning from the lectures titled "How to attract private sectors to participate in the construction of urban infrastructure" in which incentives for encouraging private sectors to participate in sewerage construction were described in details by calculating investment/operation costs and cost recovery strategy, etc. This quantitative analysis is crucial for attracting business sectors in urban infrastructures in China. Therefore, the Italian approach and case studies should be shared with Chinese counterparts in their future activities of building up public and private partnerships. Meanwhile, Chinese participants really hope to learn more about the role of local governments in the promotion of environmentally friendly city initiatives in Italy. It is believed that China has comparatively strong governments which can play very important roles in launching, organizing environmentally friendly city initiatives and guiding public participation. The Italian experiences should be very helpful to us.

Water Pollution Prevention and Control,
CASS May 2007

It was a great honor for me to participate in the Italian Phase of the Eco-management Training Program from May 12 to 26, 2007. We experienced Italian polices and practices in environmental management and visited historic locations such as Rome, Venice, Milan and other cities. The efforts paid by the Italian government in environmental management and the achievements obtained in the city construction, wastewater disposal, water resources management and ecology conservation were presented to us through various activities such as lectures, site visits, investigations and studies, etc. We were deeply attracted by beautiful human and natural landscapes. The considerate and thoughtful arrangements by the Italian organizers made an unforgettable impression on us.

Specialized in environmental project management and environmental policy research, I was interested in Italian environmental policies and related legislation. What pleased me most was that my field of interest was involved in the part of training and many questions were answered during the lectures. Especially in the part of the training based at Venice International University, we learnt about the history of the development of a water city like Venice and its successful practices in urban environmental protection.

We were deeply impressed by Italy's creativity in the field of water resource conservation. For example, a large-sized man-made wetland was built up in Venice to realize ecological and environment friendly sewage treatment. It was not less than a useful experience for China's cities with vulnerable eco-environment and a lack of funds and resources. Moreover, the base management planning implemented by the Regional government was quite valuable for China's management practices.

In the future trainings it could be interesting to visit man-made wetland project and know more about concrete practices in the domain of biodiversity protection, eco-compensation, response to climate change and others.

We were touched by the Italian organizers' high concern regarding the program during the training. The Sino-Italian organizers demonstrated a careful attention for the trainees. They have a great experience as far as training contents, training agenda, staff arrangement and living details are concerned. The study tour enhanced our knowledge on Italy's historical culture and development process. Not only did it widen our horizons, but it also deepened the understanding about the training. The Sino-Italian Training Program builds up a bridge of communication between the Chinese and Italian personnel working on environmental management. It can promote a long-term and deep cooperation between Italy and China on environmental protection and management.

Dr. Zheng Yan

Sustainable Urban Development in Coastal Areas, TSTC

March 2007; June 2007

The training program on "Sino-Italian Sustainable Development Capacity Building" was held in Tianjin, China from March 12th to 15th and in Italy from June 16th to July 2nd 2007, respectively. This training was conducted according to the bilateral cooperative agreement signed between the Italian Ministry for the Environment, Land and Sea and Tianjin Municipal Science and Technology Commission. The first training ended under the auspices of the Organization Department of the CPC Tianjin Committee, Tianjin Foreign Affairs' Office and the relevant commissions, offices and bureaus of Tianjin.
Professors, researchers, engineering technicians and administrators from Italy who have made considerable achievements in environmental management and sustainable development research presided over this training, which was supplemented by on-the-spot visits to ancient Roman architectural remains, the lagoon ecological area in Venice, etc. Participants mainly studied EU and Italy's theoretical knowledge and practical experience in planning and management of historic cities, management of ports, disposal of sediments, restoration of ecology, environmental engineering, etc. and conducted the Sino-Italian exchange in the light of Tianjin's practical problems. Therefore good results were achieved from the training.

Gains from the study

_ Sustainable development cannot be realized by a single individual, a single city or a single nation and environmental problems arising from development have to be tackled from a regional or even a world's perspective. The EU drafted a series of statutes and measures for environmental protection, which propose recommended standards and guidelines for various environmental protection issues from the perspective of regional environmental protection so that all EU Members can regulate domestic environmental protection and economic development according to relatively unified standards or minimum requirements. Italy made provincial and municipal master development plans and ecological recovery plans from the national perspective for urban development and ecological environmental protection in corresponding administrative areas according to the relevant requirements of the EU. The master development plans and ecological recovery plans were well implemented in these administrative areas because they were founded on careful preliminary investigations and studies and contained good and detailed arrangements for the implementation of such plans (including timing, people and funds for plan implementation).
_ Italy protects its historic remains. Take Rome, Florence, or Venice, for example: Italy has a sound legislation on the protection of national historic remains. When urban development and protection of ancient sites conflict with each other, cultural heritage is always given priority. In order to maintain the historic atmosphere of the whole city, Rome stipulated that any new building and rebuilt building may not be higher than ancient landmark buildings. This is an important reference in the development of the Italian-style street and for the protection of the financial street in Tianjin.
_ Italy has passed the stage of "pollution first and treatment later" or "pollution and treatment at the same time" in environmental protection and advocates comprehensive and systematic environment management concept and methods. On the one hand, Industrial Ecology pledges for the integration of full service life and environment-oriented design of products by means of clean production to gradually build an environmental management pattern characterized by treatment at source and management in the whole process, which originates from the same source as the Circular Economy that is emerging

vigorously in China; on the other hand, we can see that the relationship between human beings and the environment has been lifted to a new height in this process. The value of human life and human health has been considered in the theoretical calculation of reduction of losses by environmental protection. This is a concrete explanation of the human capital theory in developed countries and one of the best ways to explain the people-oriented philosophy. It shows that human health and sustained development are the foundation of sustainable development.

Study and experience

_ The ranks of selected trainees are high and they are also highly specialized. The training class is composed of leaders in charge of environmental protection, urban construction and technology in cities, districts and counties and members of scientific research institutes. Participants have a wide knowledge and high proficiency in professional work, important for the best fulfillment of the training.

_ Training contents are rich and systematic, and concern environmental legislation in relation to the treatment of environmental pollution; urban planning and development, utilization and protection of ancient architectures; development of industrial parks near ports and restoration of eco-environment; integrated management of policy, technology and implementation can all be investigated meticulously under the subject of sustainable development.

_ Diversified teaching forms: teachers are university professors, engineering experts, executives of companies or government officials. All courses were illustrated by many figures and graphics in PPT. Theory and on-the-spot visits to waste treatment companies, environmental engineering companies and developers of scientific parks were integrated organically to enhance the training and practical results.

_ The Italian party was good in the organization and efficient in work by making adequate and careful preparations for this training. The training and itinerary were arranged scrupulously and activities were planned for specific periods of each day, from transit between cities to the daily meals. The starting and ending time and responsible units were all indicated clearly on the schedule. Next, the Italian party's professional division of work was both fine and closely connected, reflecting pragmatic and highly efficient work style.

Main suggestions

Strengthen legislation on sustainable development

There are unified practices, recommended standards and guiding documents within the EU and all Members have made their own standards under these conditions. For instance, the EU has a framework directive on water Italy has unified the decrees on water protection, harmful compound quality standard and water management. Venice has the lagoon water quality target, discharge ban, optimized technology and regulation on the maximum load of lagoons and the maximum discharge capacity of rivers. In view of this, the following is suggested:

_ Define the main legislative body and law enforcement responsibilities for environmental protection and water protection and implemented laws and statutes in connection to the treatment of environmental pollution. Strengthen communication between the main legislative body, law-enforcement body and illegal body; enhance environmental protection awareness and consciousness and strengthen enforceability and deterrent effects of environmental protection statutes.

_ Push forward the legislation for Circular Economy and strengthen the evaluation of environmental impact in the Binhai New Area first. The state is discussing and ready to

introduce the Law on Circular Economy. Evaluation of environmental impact should be conducted and the “three simultaneous” systems and clean production should be carried out for newly introduced domestic and foreign projects in the Binhai New Area first, which is an experimental area in a new round of development and opening and one of the pilot areas for the state policies.

Strengthen international technical exchange and cooperation

We visited companies such as Vesta, Vega and Thetis and industrial parks and found that their technology and management have a good guiding and promoting role as for development, environmental protection, recycling of waste and restoration of ecology. Moreover, other cities have conducted project cooperation with Thetis under the assistance project of the Italian government, as in developing Beijing’s intelligent transport system and Shanghai’s Chongming Island. In view of this, the following is suggested:

_ Restore ecology in the Bohai-rim region. Cooperate with the Italian government and companies to treat environmental pollution and water pollution and restore ecology on land and in water and sea in the Bohai-rim region.

_ Develop intelligent transport system. Cooperate with the Italian government and companies to build an intelligent transport system for Tianjin and eliminate traffic congestion in urban areas by planning the city as a whole. Make experiments on carrying out integrated city and township design and planning newly developed suburbs and surrounding districts and counties, build sustainable development projects that will benefit future generations.

_ Waste treatment and recycling projects. Strengthen cooperation and exchange with Italy, intensify separation and separate treatment of garbage and pay attention to reclamation and recycling of waste and old materials; strengthen recycling of wastewater, sewage and rainwater, build a drainage management system for tap water, recycled water and sewage, strengthen development and utilization of water resources and alleviate the water crisis in our city.

_ Share information resources. Learn EU and Italy’s information management platforms, build a management platform to link scientific knowledge, practice and policies organically at a public network platform, strengthen information sharing and transmission and promote democratization and transparency of government; work to involve the whole society in the construction of municipal works and environmental protection.

_ Establish an office for managing cooperative projects. Drawn on Beijing and Shanghai’s experience to drive cooperation in international projects in training and strengthening the implementation and management of technical projects; set up an office for managing cooperative projects. On July 13, Mr. Coaster, Director of the Genoa Aquarium, Italy (who received us when we were in Italy for training) came to Tianjin to investigate the possibility of building a large aquarium in the Binhai New Area. Comrade Guo Ming, Li Shuyi, Deputy Head of Jinnan District (leader of the training class) and Liu Yongqiang, Party Secretary of the Tianjin Environmental Protection Bureau, received Mr. Coaster and his entourage and briefed them on Tianjin’s preferential policies. The Italian party was very interested and expressed their thanks.

State Environmental Protection Administration of China

Water Pollution Prevention and Control
Italy, September 1-15, 2007
25 participants

VIU and SEPA have successfully organized four courses on *Water Pollution Prevention and Control* in 2007, the last one of which took place from September 1st to the 15th.
In accordance with the trainees' suggestions and the results from the previous courses, this training largely focused on health issues and economic and ecological aspects of water management that were topics discussed mainly at VIU.
In Rome, at the Italian Ministry for the Environment, Land and Sea, the delegation was introduced to the different roles and competences of the Ministry at national and local levels, especially in promoting the water pollution control policy in Italy.
At the University of Siena, the basics of EU organisation and EU Environmental Policy were discussed, in addition to the presentation of different agencies of the EU which are involved in managing water management from different perspectives.
In Venice, Prof. Borghesi, an health and environment expert of the University of Siena, held a lecture on the connection between water quality, health and national economy. He suggested solutions and economic means to realise the common goal of the three interlinked important factors.
The economic aspect of water management was presented by Prof. Massarutto, an environmental economist of the University of Udine. He illustrated the meaning of water sustainability and presented newly developed policies in Europe and some case studies on urban water quality management.
Moreover, experts from Italian research institutes and governmental bodies gave an exhaustive overview on drainage basin management and problems related to high tides in Venice, suggesting technologically innovative solutions to face them. Some site visits to waste treatments plant were organised, where recent experiences and planned actions for future projects on waste water treatment in Venice Municipality were presented.
In Turin, lessons on water conservation and a further visit to a water treatment plant were organized. Prof. Meineri (ecoBioqual) presented a chemical and biological monitoring example that is also applied in Shanghai, focusing on the importance of ecotoxicity tests as tools to evaluate water quality.

Beijing Municipal Environmental Protection Bureau

Environmental Management and Sustainable Development
Italy, September 15-29, 2007
21 participants

The last course scheduled for the year 2007 in cooperation with the Environmental Protection Bureau of the Beijing Municipality was dedicated to capacity building on "Environmental Management and Sustainable Development".
The training aimed at covering a broad range of key issues concerning environment management and solutions to foster sustainable development with a specific focus on urban settings through case studies on local environmental interventions, according to municipalities' possible needs.
In Rome, the lectures gave a general overview on the Environmental Policy in Italy, focusing on the role of the Italian Ministry for the Environment, Land and Sea at national and local levels.
In order to embrace the Italian policy in the European context, the delegation had the chance to meet in Siena lecturers from the Environmental Legal Team, a group of experts in the legal field within the University of Siena. The Legal Team not only gave them the basics on EU organisation and EU Environmental Policy, but also provided them with the fundamentals on the European Legal Approach to Sustainable Development. Moreover, the delegation was introduced to the European Legislative Framework for Industrial Installations, considering the strict connections between urban and industrial development.
In Venice, the Chairman of the Environmental Commission of the Municipality of Padua, Mr. Francesco Bicciato, met the delegation to present the energy plan adopted by his city, as a possible way to apply practical measures for energy efficiency. He also illustrated the economic and environmental benefits that can be obtained with those measures.
The central issue of air pollution was also addressed through the presentation of some measures adopted by local governments, in particular through the monitoring action played by the Regional Agency for the Environmental Protection (including urban and industrial areas) and Thetis' project case study "Beijing Intelligent Transport System" which was discussed as a major tool to reduce polluting emissions that most affect modern cities. Similarly, a representative of the Italian Local Agenda 21 Network presented other projects that could be adopted at municipal level for a more sustainable way of living.
Other local experiences on urban waste management and waste water treatment were presented, including the management of hazardous waste which was presented in Turin.
In addition, the case study of VEGA, the scientific and technological park of Venice, was an example of how a dismissed industrial area can be reclaimed and, instead of being a heavy burden for the urban territory, can integrate with the surrounding cities and become an opportunity of growth for new enterprises and research centres.

Chinese Ministry of Science and Technology

Capacity Building on Sustainable Development and Legal Aspects
Italy, October 20 - November 3, 2007
24 participants

Following the opening session held in Beijing, the course organized in Italy focused on the broad topic of sustainable development with the aim of underlining the most important legal provisions and their enforcement.
In Rome, the role of the Italian Ministry for the Environment, Land and Sea in promoting policies and actions for the protection of the environment, both at national and local levels, was introduced to the delegation.
During the visit at the University of Siena and thanks to the contribution of the University's Environmental Legal Team, the basics of EU organisation and EU Environmental Policy were discussed to allow the Chinese participants to better understand the general framework of the European Union. While explaining the EU framework, the lectures also emphasized the role of different EU agencies such as the well known European Environmental Agency (EEA) and the Agencies for water management (Eurowaternet), for the promotion of environmental information (Eionet) and for the implementation and enforcement of the law (IMPEL).
Lectures in Venice were structured as to cover different areas concerning sustainable development. The European Water Framework directive and its implementation by Member States at local level, air pollution control and industrial risk prevention, economic and legal aspects of waste management, energy efficiency programmes, and environmental auditing were all covered through both classroom lessons and site visits.
The specific topic of sustainable agriculture and its legal aspects were discussed on the last day in Turin.

Chinese Academy of Social Sciences

Energy and Industry
Italy, November 3-17, 2007
38 participants

Following the plenary session held in October in Beijing, which inaugurated another year of cooperation between VIU and CASS, the first delegation of 38 participants selected by CASS came to Italy at the beginning of November to attend a session dedicated to “Energy and Industry”.
Since the beginning of the training courses in 2003, a specific course on energy has been regularly organised each year. This time, however, the course was designed as to fulfil the requirements of the delegates of the industrial district of the Municipal Government of Tangshan, an industrial city located at 180 km east of Beijing: therefore, special attention was paid in investigating the relationship between the industrial world and the energy sector.
In Rome, the delegation made two site visits related to the field of Energy Efficiency and Renewable Energy. First, they had the chance to visit an Italian company, Enipower, leader in advanced applications of solar energy, specifically on hi-fi solar cells and PV modules.
In second place, the delegation visited the Children’s Museum of Rome to see a practical application of a PV System in public buildings that improves the quality of natural lighting and decreases the building’s heat load.
Naturally, “classic” energy subjects have also been taken into consideration. The policies for the promotion of energy efficiency at European and national levels have been widely discussed to underline the fact that energy saving is one of the most important measures for improvement of energy efficiency.
The delegation followed lectures on energy efficiency in the building sector and environmental and economic suitability of the eco-building choice. A visit to the TiFS building was organized to show that, if correctly designed, an eco-building structure is no more costly than a conventional building and that all investments are recovered in few years thanks to energy savings.
Besides the European policies for the promotion of renewables, practical advances in the exploitation of alternative energy sources like solar energy, wind, biomass and geothermal energy have been presented.
The experience of the Venice Port Authority in managing an industrial and tourist port while protecting the special environment of the Lagoon has been presented as a case study for those who need to establish a new port and prevent an increase of pollution without hindering economic development.
The delegation visited also VEGA, the scientific and technological park of Venice, a former industrial site that had undergone a deep remediation, in order to understand which can be the possibilities for the requalification of brownfield areas.
A meeting with the local industrialists’ association was also organized to discuss the role of this kind of structure in helping small and medium size enterprises in complying with the current environmental legislation and with needs of a more efficient energy use.

Sustainable Urban Development and Eco-building

Italy, November 17-December 1, 2007
41 participants

The third session of CASS Training for the academic year 2007-2008 took place in Italy during the second half of November. Sustainable Urban Development and Eco-building are still key issues proposed for the third year in a row. This choice reflects the importance of a well planned city development in a country such China, characterized by some of the most important and large urban conglomerations in the world.
The training aimed at covering the policies related to both sustainable urban development and eco-building, as well as advanced technologies that can be used in new and old buildings.
As always, the lectures in Rome introduced Italian and European policies in the field of sustainable development and environmental issues. In this case not only principles, trends and initiatives of eco-building in Italy were presented, but also the recent directives and regulations of EU to reduce air pollution from vehicles.
Strategic Environmental Assessment was introduced on the first day in Venice as a very important tool for national and local authorities to include environmental aspects in any of their policy and planning progress. The delegation had then the chance to visit the wood in Mestre, a project which is an example of how to plan and redevelop green areas in cities, with many social and environmental benefits.
Italian and Chinese case studies in the field of Intelligent Transport System and sustainable mobility were presented. These are in fact very important issues in cities' development, as more traffic leads to a series of negative aspects like air pollution and therefore health problems for citizens, as well as economic losses caused by time spent to travel, just to name a few.
Advanced technologies for eco-building and energy efficiency found their place in the schedule agenda through case studies and a site visits.
A very interesting issue for the development of sustainable cities, such as the management of hazardous waste in hospitals, was also presented in Turin.

Shanghai Municipal Environmental Protection Bureau

Environmental Management
Italy, December 1-15, 2007
20 participants

Last December, VIU organised the third Advanced Training Course in accordance with the requests of the Shanghai Environmental Protection Bureau. The course, devoted to Environmental Management, aimed at facing the main topics of sustainable development and translating into practice its principles, considering, in particular, the local level and its management. The delegation spent two weeks in Italy, and precisely in Rome, Siena, Venice and Turin, having the chance to meet different Italian realities.
In Rome, the lectures gave a general overview on the Environmental Policy in Italy, focusing on the role of the Italian Ministry for the Environment, Land and Sea at national and local levels.
The Environmental Legal Team of the University of Siena briefly introduced the EU framework on Environmental Policy and the approach used by the EU to foster Sustainable Development in terms of legal principles. In particular, the presentation focused on the application of the "subsidiary principle" and the Environmental Impact Assessment procedure.
During all lectures, the theoretical principles were presented through their specific application in several case studies, with the goal of sharing the real experience as a tool of promotion of sustainability. Starting from the general principles, the themes were translated into practice with a deep comparison between the European and Chinese realities. The most useful instruments currently available to improve and to foster the environmental management were analysed as well.
In order to create an active network of discussion on energy efficiency, waste and hazardous waste management, water treatment and air pollution, several experts and representatives of companies and industries joined the course both in Venice and in Turin. Special attention was given to the introduction and application of green technologies, a topic that is becoming more and more important for industrial cities in China.

Tianjin Science and Technology Committee

Sustainable Development in Urban and Industrial Areas
Italy, December 8-22, 2007
25 participants

Tianjin city can boast a high level of industrialisation and a bustling financial and commercial life. Nevertheless, the rapid economic growth combined with a strong population increase has worsened the relative lack of resources and the pollution level. Nowadays, Tianjin is one of the most polluted cities in China.
On the other hand, Tianjin is famous for its folk art and has many historical sites characterized by a unique architectural style that attracts tourism. Therefore, it is important to preserve these remarkable places from pollution.
In this context, TSTC and VIU have jointly organized a training course on *Sustainable Development in Urban and Industrial Areas,* held in Italy from December 8th to the 22nd.
In Rome, the delegation visited the Institute for Atmospheric Pollution, which is part of the Centre for National Research (CNR), in order to get a general overview on air pollution in coastal areas, its practical measurements through the use of technologically advanced instruments and its effects on cultural heritage.
In Venice, the trainees explored in details themes such as policies for energy efficiency and renewable energy on urban scale. They visited institutions involved in air quality control and sustainable mobility, air quality monitoring and land remediation. A visit to the integrated waste treatment plant of VESTA gave them an overview on how to manage the disposal of different waste.
Moreover, a significant part of the training was devoted to industrial aspects. PhD Ilda Mannino, Head of the research unit of VIU's TEN Center explained the concept of "Industrial Ecology" and introduced the participants to green industrial production technologies.
The training course ended in Novara and Turin with other visits to industries in the forefront of the technologies used. In Novara, participants visited Novamont, an innovative company producing a bio-plastic from vegetable raw materials named Mater-Bi™. In Turin, the delegation was taken to Iveco Company, where some opportunities for environmental care and vehicle emission reduction were presented.

Soil Clean Up

In order to realize the commitment of the "Green Olympics", improve urban environmental quality and speed up the steps of energy and industrial structure adjustment, Beijing Municipal Government has deployed and implemented a series of important measures to replace urban coke oven gas with natural gas and relocate polluting enterprises from the urban area. With many industries being shut down or decommissioned in Beijing, their dismissed sites are almost always characterized by the presence of pollutants in the subsoil. The Chinese government is aware of this problem and in the last decade, the State Environmental Protection Administration issued several general guiding documents, e.g. on a) environmental quality standards of soils (1995); b) health and safety standards for the protection of soils and waterbeds (1999); and c) technical specifications on soil environmental monitoring (2004).
Beijing's EPB and the Italian Ministry for the Environment, Land and Sea have agreed on a comprehensive project aimed at putting in place a regulatory system for the Beijing Municipality on contaminated sites and at building strong capacity for Beijing's EPB to manage these problems. This project is situated in Fatou region outside the Fourth East Ring Road in the Chaoyang District; objectives of the project are the following:
_ prepare and propose an applicable system of standards and guidelines for

cleanup of contaminated soils, appropriate to protect human health and ecosystem and to economically allow the recover of contaminated sites;
_ test and calibrate standards and guidelines, by means of a number of practical cases, where investigation, design and demonstrative work are performed;
_ build strong capacity for Beijing's EPB to manage problems of contaminated sites, with reference to both technical and administrative issues.
To reach the above objectives, the project aims at producing the following specific deliverables: a list of Contaminants of Concern (COC) appropriate for the Beijing area, on the basis of the types of industrial plants historically located there; a set of Threshold Level Concentrations (TLC) and a Maximum Level Concentrations (MLC) for each contaminant, depending on the type of site use; guidelines to perform risk analysis; guidelines for planning site investigations; guidelines for performing site investigations; criteria for cleanup control and certification.
According to these general considerations, control and certification criteria, rather than guidelines, will be developed, thus enabling to set, for each cleanup project, uniform and consistent control and certification procedures.

Sustainable Master Plan of the "New Intelligent City" Project

On April 12, 2007, the Italian Ministry for the Environment, Land and Sea (IMELS) and Haihe Economy Development Office (HEDO) have signed an agreement stating that IMELS will assist "the development of the future Tianjin in the areas of environmental protection and urban

development supporting the introduction of Italian technology and planning", creating the "Italian Support to the Environment of Tianjin".
The "Sustainable Master plan of the new Intelligent City" Project (SMIC) defines the activities and deliverables for the development of the new Intelligent City masterplan.
The future Intelligent City is situated in the first segment of Haihe river, north of its bank, delimited at east by the external ring, at south from the river Haihe, at west by the highway and at north by Tanggu road; for a total area of 8 km^2.
The project will take advantages of the use of different ecological resources, and intelligent and advanced technology with the intention of creating a new centre for the new satellite city based on an ecological structure and high technological production.
The project has been divided into 2 steps; the first has started in August 2007 and will end in January 2008, the second will start in February 2008 and will end in July 2008.
The Step 1 proposal for SMIC Project is intended to: collect necessary input data; analysing the collected information and providing a site characterization report; provide a development model, giving indications on functions and land-use mix; create conceptual master plan options that illustrates development opportunities, which will lead to testing its financial & marketing feasibility at a later stage, and will guide subsequent detailed design and investment analysis.
The Step 2 proposal for SMIC Project is intended to: establish a vision for the development, building a Final master plan which takes into consideration the notes and remarks of the previous concept and details all the aspects, including natural environment and infrastructural aspects; develop planning-level construction cost estimates and a development program of land use and infrastructure facilities; develop in more detail the former-steel factory area master plan, providing architectural concept design with video renderings and maquette; provide recommendations for implementation and future phases and provide guidelines for sustainable masterplanning.

Sustainable Urban Design: the Case Study of Huai Rou New Town

The Huai Rou new town master plan, commissioned by the Municipality of Beijing, was the occasion for a deep analysis of urban sustainability, one of the most important topics in today's China.
The present Huai Rou town is situated in the Beijing district, 50 km from the capital; the project extends on an area of approximately 870 hectares situated east of the existing Huai Rou. The Huai Rou new town master plan was designed on the basis of the local culture, context and tradition and on a set of design concepts founded on the European experience, taken as keystones so to build, together with the Chinese partners, a common idea of an eco-friendly town.
The methodological principles, drawn from the reflections about sustainability, can be highlighted by the following key concepts: complexity, accessibility and adaptability, supporting the idea of a livable and legible town and pursuing sustainable development.
The master plan must integrate in an omni-comprehensive and flexible design the various systems that regulate the urban structure: improvement for efficient private and public transport systems (based on the existing roads linking the old town to the eastern villages, following the Chinese traditional street grid, reducing traffic congestion by diffusing public transport system and connecting the railway station to the key transport interchange); decrease of pollution and waste generation, improvement of human scale activities, use of eco-friendly technologies and buildings, and significant presence of green spaces as urban textures. On June 19, 2007, the Huai Row master Plan was officially presented in Beijing at the

“Sino-Italian Beijing Strategic Environmental Assessment”
Workshop at the presence of high official representatives of the Beijing Environmental Protection Bureau and of the Italian Ministry for the Environment, Land and Sea.

The Spline

The Spline is part of the Sino–Italian Cooperation Programme between the Italian Ministry for the Environment, Land and Sea (IMELS) and Beijing Municipal Environmental Protection Bureau (BMEPB). Started in 2005, it identifies scientific and technical activities for the implementation of sustainable projects.
The project area, which extends for approximately one kilometer by one hundred meters, is located on the central axis and in south of Beijing, between the third and fourth ring, and brushes with the Liangshui River on the north side.
The Spline demonstrates how, through a deep study of the area, it is possible to create a relation with the adjacent buildings, recapturing their modular order and at the same time with the recognizable features of, the new buildings.
Moreover another purpose of the project is to demonstrate that the study of the complex surrounding area is essential to understand how the project should be developed.
In particular, the project involves the following points:
_ the definition of the facades and of materials;
_ the definition of the functional and distribution layout of the building;
_ the optimization of plant engineering system;
A multiplicity of theories have been examined also for the internal arrangement of the spaces in order to make them adaptable to different needs: the plant module was conceived to be assembled and disassembled to obtain versatile spaces. In conclusion, the design process gave us the opportunity to conceive a building complex, improved by suitable technological systems and capable of maintaining a more human perceptive scale.

what's next

VIU's Advanced Training Program opened in January 2008 with two training sessions focusing on air pollution addressing the Beijing Municipality (Italy, Jan. 12-26) and SEPA (Jan. 19-Feb.2), respectively. This confirms that air quality management especially in urban areas is of major concern for China, also in view of the forthcoming Olympic Games.
In fact, the main attention of the SEPA training will be on the monitoring and control of *Air Quality*, whereas Beijing Environmental Protection Bureau will concentrate on a specific aspect of modern urban environment as *Electromagnetic Pollution*. Similarly, both the Beijing Municipality and SEPA will be back to Italy in early spring to further explore air quality management in two other trainings respectively devoted to *Vehicle Emission Control* (March 29-April 12) and *Air Quality Control* (April 12-26).
In addition, the Chinese Academy of Social Science will also concentrate on sustainable urban development, even though the attention will be focused on *Waste Management* (Feb 23-March 8).
MOST Training sessions to be held in March and April will be more technical and will be devoted to *Energy*, in particular to the promotion of renewables, on the one side, and to *Capacity Building for CDM*, on the other.
We would also like to announce a special training activity launched by the TEN Center of Venice International University, the *Energy Technologies and Management* Short Training Course. The Course, which will be held at VIU on February 4-8, is organized under the scientific coordination of prof. Giuseppe Zollino of the University of Padua, in cooperation with the TEN Center. The initiative confirms the TEN Center and VIU as the ideal management structure and location for arranging high-level, international training activity in the field of environment.