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Environmental Training Community

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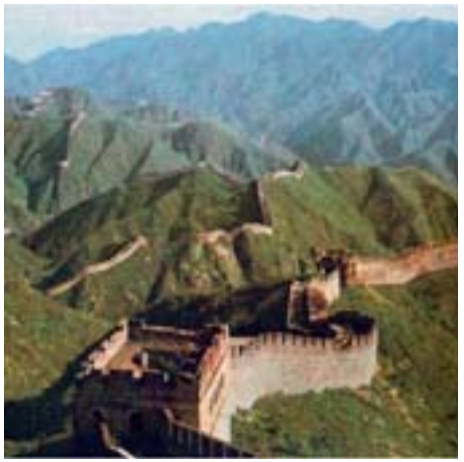
2006, the Year of Italy in China

The Year of Italy in China has been officially launched on January 19th 2006; it aims at strengthening the Italian presence in this growing country, and presenting to the Chinese public an overview of the Italian past and present. During this year, Italy will be represented in a variety of aspects, from the traditional to the contemporary: arts, cutting-edge technologies, scientific achievements, cuisine, and fashion.
On the first week of July, the Italian Ministry for the Environment and Territory, in partnership with the State Environmental Protection Administration and the valuable collaboration of the Chinese Academy of Social Sciences, is organizing a special week of events to celebrate the five years of the Sino-Italian Cooperation Program for the Environmental Protection and its activities.



During this week high level representatives of all the Chinese Institutions involved in the Program and all the members of the VIU Training Community will be invited to take part to the events.
Multiple thematic forums such as Energy, Management of water resources, Sustainable development of Urban Areas, Sustainable Architecture, Sustainable Agriculture, and Beijing Green Olympics will be held. Those activities will see the involvement and support of the Chinese Institutions which had been cooperating with the Sino-Italian Cooperation Program in the last years such as the Ministry of Science and Technology, the Ministry of Water Resources, the Beijing Municipality. Moreover both Chinese and Italian experts and representatives from the most important Chinese and Italian enterprises will be invited.

Activities and events related to the week will include several exhibitions on different fields such as the Sino-Italian Environmental Cooperation, Italian Contemporary Architecture, Industrial design, Recycled-material Products.

Some of the most important events that are going to be presented are here reported:

1. Toward the Environmental Friendly Society; Sino-Italian Cooperation in Environmental Protection Forum

The event will be a high level forum to discuss the achievements reached during the first five years of the Sino-Italian Cooperation Program in environmental protection and to look into the Program's future developments.
Premier and vice Premier from the Chinese State Council, Ministers and high rank officials from the parties involved in the Program will be invited.

2. Meeting of VIU Training Alumni Community

In 2003, the Italian Ministry of the Environment and Territory started an advanced training program on environmental management and sustainable development in collaboration with Venice International University; during these years, almost 1,500 Chinese people have participated in the program. Participants in the advanced training courses will be invited to Beijing to attend

the week events for an update on the progress of the Sino-Italian cooperation in the fields of environment.

3. Inauguration of the "Italian Pavilion" at Tsinghua University

The Tsinghua Ecological Energy Efficient Building, also known as the "Italian Pavilion", is an eco-friendly, technologically advanced intelligent building that respects environment and uses energy efficiently. The building includes offices, laboratories, and an exhibition center on Italian technology. The inauguration of the Italian Pavilion will be an opportunity for a high level event on eco-friendly constructions and energy conservation.

The establishment of the Italian Tongji Technology Transfer Center in the Tongji University of Shanghai

Following the agreements signed with the Municipality of Shanghai and the University of Shanghai, the Italian Ministry for the Environment and Territory has established the Italian Tonji Technology Transfer Center in the Tonji University of Shanghai; the goal is to study and test eco-friendly technologies to be designed by enterprises and Chinese and Italian experts. In this Center, the first Chinese plant for electricity, heat and refrigerating system tri-generation, using the new Sino-Italian technology of high level efficiency micro turbines will be tested.

EU's Strategy on the Sustainable Use of Resources

The European Commission has unveiled two thematic strategies aiming at revolutionizing EU's use of resources and waste management. The first, on the sustainable use of natural resources, will kick-start a long programme to reduce the environmental impact of resources. The second, on waste prevention and recycling, attacks the waste phase of resource management.
The strategy on the sustainable use of natural resources will set out an "analytical framework" allowing the environmental impact of resource use to be "routinely factored into public policymaking". The Commission proposed an action plan with a time horizon of 25 years; the first action will be a wider application of life-cycle thinking in policymaking, with specific "sectoral initiatives" applying life-cycle thinking under the EU's economic growth strategy. The second one will create a "data centre" of natural resources to help fill information gaps. It will collect information from existing EU statistics, research, energy and environment agencies.

New waste strategy: Making Europe a recycling society

The European Commission proposed a new strategy on the prevention and recycling of waste. This long-term strategy aims at helping Europe to become a recycling society that seeks zero waste discharge by reduction, reusing and recycling the wastes. This revision includes a legislative proposal to modernize the 1975 Waste Framework Directive, with the aim of approving the proper regulatory environment for recycling activities.
The waste and resources strategies are two of the seven "thematic" strategies required under the 6th Environment Action Program (2002-2012); the main elements of the

proposed revision are:
_ to focus waste policies on the improvement of the use of resources;
_ to improve the recycling market by setting environmental standards that specify the conditions under which certain recycled wastes should no longer be considered waste;
_ to simplify waste legislation by clarifying the definitions and the streamlining provisions and by integrating the directives on hazardous waste (91/689/EEC) and waste oils (75/439/EEC).

Commission fosters CO2-free energy

The European Commission, who will invest about 70 million Euros in this field, launched the Technology Platform for "O Emission Fossil Fuel Power Plants"; it will orient, amongst different actors such as energy companies, equipment suppliers, consumers, public authorities, researchers and civil society, research activities towards environment-friendly power plants with the ultimate goal to boost research on sustainable energy sources and processes. Focus of the Platform will be on CO2 Capture and Geological Storage, which consists of developing technologies that capture and store carbon dioxide emissions underground, in order to avoid their interaction with the atmosphere and the greenhouse gas effect.

New generation vehicle emission standards

The European Commission issued some formal proposals for setting new EU vehicle emission standards. The plan for "Euro 5" norms is backed by a draft legislation requiring one-quarter of public spending on vehicles such as buses, to be directed to "clean vehicles". The "Euro 5" emission limits have ended up in line with a draft version issued by the Commission in July (ED 18/07/05). The EU executive stressed that the new limits would reduce key pollutants in fine particle emissions from vans by up to 90%.
For diesel cars, the limit for ten micron particles (PM10) will be 5 mg/km, for petrol cars, hydrocarbon emissions will be restricted to 75 mg/km; and NOx will be limited to 60 mg/km. The new standards are expected to come into force in 2008.

Regulations gurantee safer food for consumers

The year 2006 marks a significant milestone for food safety in the EU with the application of a large updated body of legislation on food and feed; these new laws will bring a new level of protection for EU citizens and offer benefits to food businesses by clarifying and simplifying the rules they must comply with..
The Food "Hygiene Package", the Regulation on microbiological criteria for foodstuffs, the Regulation on official feed and food controls, and the Feed Hygiene Regulation, constitute a complementary set of rules to tighten and harmonize EU food safety measures. These laws will apply at every point in the food chain, in line with EU's "farm to fork" approach. A key aspect of the new legislation is that all food and feed operators, from farmers and processors to retailers and caterers, will have primary responsibility for ensuring that food put on the EU market meets the required safety standards.
Responding to the conclusions of the Council of October 2004 on the European Action Plan for organic food and farming (EAP), the European Commission adopted a proposal for a new regulation on organic production, which aims to improve clarity for both consumers and farmers. Thanks to these new rules it will become much easier now for consumers to recognize organic products and understand their environmental and animal welfare benefits; moreover, they will define the objectives and principles for organic production, clarify labelling rules and regulate imports. Products containing GMOs will not be able to be labelled as organic, except for those containing up to 0.9 percent of GMO content through accidental contamination.

Farms still main cause of nitrate pollution

Nitrogen pollution of water bodies is still produced by agriculture, which contributes up to 80% in some catchments despite of the fact that, on the whole, levels of nitrogen and phosphorus pollution are continuing to fall. For this reason, on the one hand, the Council of Ministers aims at identifying policy gaps preventing further pollution cuts. On the other hand, the Council is about to approve a "codification" of all amendments to the 1976 dangerous substances directive, which sets the limits on discharges into water. The law is being superseded by the 2000 water framework directive.

Promoting renewable energy and energy efficiency in liberalised markets

Arturo Lorenzoni, University of Padua

Since the creation of the European Union a great effort has been done to create single markets for goods and services. This task was relatively easy in some sectors, while it implies a long process of convergence in others, namely energy, for its important implications at the strategic level.
The European energy policy is inspired by three main targets: environment, efficiency, security of supply. Their priority changes with time, but they always remain the top priority of public intervention.
The European Union has chosen to introduce competition in the energy sector to enhance its overall efficiency since the mid-Nineties. This decision creates some difficulties for the growth of renewable energy, which is supported for its environmental benefits, but can hardly participate in a competitive market. Thus, one of the challenges for the European energy policy is the conciliation of competition and the promotion of new technologies.
In addition, a great effort has to be made to give coherence to the national regulatory approach of the EU Member States, which are very different for historical and political reasons. In this perspective, the EU energy policy has to be seen as a process towards common long-term goals rather than a short-term uniform policy.
The creation of a common market in the sector of renewable energy could also put in danger the fulfilment of the so-called "multiple dividends" of investments that is at the base of their development's desirability. The multiple dividends are referred to the following benefits:
_ environmental benefits;
_ high labour intensity compared to fossil fuels;
_ involvement of local knowledge, capital, labour;
_ security of supply;
_ certainty of future cost of energy.

A series of Directives have been issued in the last years addressing the EU policy for renewables and energy efficiency, aimed at driving the national policies towards common targets:
_ directive 2001/77/EC, on the promotion of renewables;
_ directive 2002/91/EC on certification of energy performance of buildings;
_ directive 2003/30/EC on promotion of biofuels;
_ directive 2004/8/EC on the growth of cogeneration.
All these documents set a favourable framework for new investments in the sector of renewable energy and in energy efficiency, even if the EU policy remains constrained by many different targets.
The energy market in Europe is heavily subsidised, but only about 5 on a total of 30 billion Euros per year of direct and indirect subsidies go to renewable energy sources (data from the www.eea.org). The energy market appears to be heavily distorted and the search for the maximisation of social benefits necessarily involves a new taxation of energy products, as stated by the 2003/96/EC Directive.
The present tax systems are quite diverse and this can harm the competition among companies at the EU level. The Directive requires from the EU Member States a minimum level of taxation related to the environmental impact of different fuels, in order to reduce the effect of environmental externalities.
With reference to renewable energy, at the moment, different support schemes coexist, based on price (feed-in tariffs) or quota (green certificates, green tenders), with very different results in terms of production growth. (EC, DG TREN: How to support renewable electricity in Europe? Memo, Dec. 2005)

Feed-in tariffs exist in most of the Member States. These systems are characterised by a specific price, normally set for a period of several years that must be

paid by electricity companies, usually distributors, to domestic producers of green electricity. The additional costs of these schemes are paid by suppliers in proportion to their sales volume and are passed through to the power consumers. A variant of the feed-in tariff scheme is the fixed-premium mechanism currently implemented in Denmark and partially in Spain. Under this system, the government sets a fixed premium or an environmental bonus, paid above the normal or spot electricity price to renewable electricity generators.
Under the **green certificate** system, currently existing in five Member States, renewable electricity is sold at conventional power-market prices. In order to finance the additional cost of producing green electricity, and to ensure that the desired green electricity is generated, consumers (or in some countries, producers) are obliged to purchase a certain number of green certificates from renewable electricity producers according to a fixed percentage, or quota, of their total electricity consumption/production. Since producers/consumers wish to buy these certificates as cheaply as possible, a secondary market of certificates develops where renewable electricity producers compete with one another to sell green certificates.
Pure **tendering** procedures existed in two Member States (Ireland and France). However, France has recently changed its system to a feed-in tariff combined with tendering system in some cases and Ireland has just announced a similar move. Under a tendering procedure, the state places a series of tenders for the supply of renewable electricity, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of renewable electricity are passed on to the end-consumer of electricity through a specific levy.
Systems based only on **tax incentives** are applied in Malta and Finland. In most cases (e.g. Cyprus, UK and the Czech Republic), however, this instrument is used as an additional policy tool.

While Germany and Spain have experienced impressive investments in the renewable energy sector, other countries like France and the UK are still waiting to see the results of their policies. Moreover, the integration of New Accession Countries adds new challenges to the design of a joint support policy.
It has not to be forgotten that the instruments adopted for the promotion of renewable technologies are strictly related to the goals of policies at national level,

which can range from the development of a national industry, the maximisation of RES production, the gain of environmental benefits and the maturation of young technologies. Giving priority to one or another of these aspects leads to the choice of different policy instruments. Requiring all EU countries to agree on these policy goals is impossible, as the EC DG for Energy and Transport recognised in a report issued in December 2005, and pushes a smooth harmonisation process. The European Strategy for the development of RES has recently been focused on the following targets (EC DG TREN, 2005):
Increasing legislative stability and reducing investment risk. One of the main concerns with national support schemes is any system's stop-and-go nature. Any instability in the system creates high investment risks, normally taking the form of higher costs for consumers. Thus, the system needs to be regarded as stable and reliable by the market participants in the long run in order to reduce the perceived risks. Reducing investment risk and increasing liquidity is an important issue, notably in the green certificate market. The design of a support mechanism

must minimise unnecessary market risks. Increased liquidity could improve the option of long-term contracts and will give a clearer market price.
Reducing administrative barriers, including the streamlining of administrative procedures. The administrative requirements for access support schemes should be reduced in order to minimise the burden on consumers. Clear guidelines, one-stop authorisation agencies, the establishment of pre-planning mechanisms and lighter procedures are concrete proposals to Member States in addition to the full implementation of the Renewables Directive.
Addressing grid issues and the transparency of connection conditions. Transmission reinforcement needs to be planned and developed in advance with appropriate financing. The Commission recommends, firstly, that the principles of cost bearing and sharing should be fully transparent and non-discriminatory. Secondly, the necessary grid infrastructure development should be undertaken to accommodate the further development of renewable electricity generation. Thirdly, the costs associated with grid infrastructure development should normally be covered by grid operators. Fourthly, the pricing for electricity throughout the electricity network should be fair and transparent, taking into account the benefits of embedded generation.
Encouraging technology diversity. Some support schemes tend to support only the strongest of the renewable technologies in terms of cost competitiveness. For instance, offshore wind energy would usually not be developed if it came under the same financial framework as onshore wind power. Such schemes could therefore be complemented with other support instruments, in order to diversify the technological development. A good overall support policy for renewable electricity should preferably cover different renewable technologies.
Member States should better use the possibilities of **tax exemptions and reductions** offered to renewable energy sources under the Directive on the taxation on energy products (2003/96/EC).
Ensuring compatibility with the internal electricity market. EU Member States are in the process of liberalising their power markets. This criterion assesses the ease with which a support scheme can be integrated into a liberalised power market, and its effectiveness in functioning together with existing and new policy instruments.
Encouraging employment and local and regional benefits. A substantial part of the public benefits pursued by policies supporting renewables relate to employment and social policies, and rural development, while other national policy goals should be respected and duly taken into account.
Twinning actions on energy efficiency and demand management. The progress of renewable electricity generation is being offset by excessive growth in electricity consumption and must be avoided. Only a combination of RES-E support measures and electricity end-use efficiency measures will bring Europe further in its energy policy goals.

In conclusion, the European Member States are experiencing very different growth rates with renewable energy by adopting different support schemes. This makes the convergence of national markets quite difficult and poses some doubts on the feasibility of long-term targets. Nevertheless, the commitment on increasing the share of renewables and on creating a solid domestic industry doesn't seems to be under discussion.

The Sino-Italian Cooperation for the Improvement of the Energy Saving and Energy Efficiency in the Industrial Sector: the Energy Planning Project

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Danilo Bosia, D'Appolonia S.p.A. - Genova

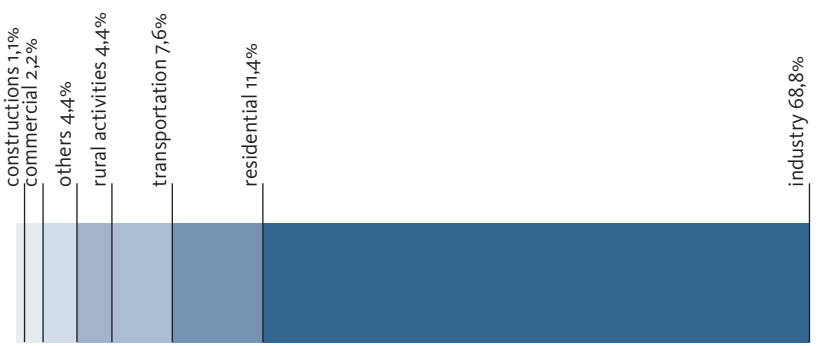
Introduction

Currently, China is by far the fastest developing Country in the world. This extraordinary growth, together with the beneficial effects for the population, demands an increase of energy to be consumed. In spite of the strenuous efforts by the Chinese government to reduce it, the energy consumption has almost doubled in the last twenty years and is not yet expected to level off.
China is the second greatest energy consumer (behind the United States), accounting for about 10% of the world's total annual energy consumption. Production and consumption of coal, its dominant fuel, is the highest in the world. Rising oil demand and imports have made China a significant actor in world oil markets: it has been the world's second largest consumer of petroleum products in 2004. China is currently the second greatest electricity generating country (after the United States) and accounts for more than 11% of the world's total annual electricity generation (International Energy Agency, 2005).
In terms of CO_2 emissions, China is ranking at the second place in the world behind the United States (US-DOE, 2005).
In general, concerns regarding the environmental impact caused by this uncontrolled energy sources exploitation are rising worldwide.
The energy consumption statistics (National Bureau of Statistics of China) reveal that industry is by far the most energy intensive sector in the Chinese economy. As shown in Figure 1, industry accounts for about 68% of the total primary energy consumption in China and its weight in the national context is still growing. Energy saving potentials are relevant in all the major industrial sectors and energy efficiency levels can be easily increased in the majority of Chinese industrial sites.
Because of the reasons indicated above it is widely recognized that China could be one of the major suppliers in the international carbon credits market, which can help meeting Italy's commitments under the Kyoto Protocol in an economically efficient way. Italy has in fact an ambitious emission reduction objective (60 million tons CO_2/year in the period 2008-2012) that could not be achieved solely through domestic initiatives.

Energy Planning for a Sustainable Development

The Sino-Italian Cooperation Program for Environmental Protection (SICP), launched in 2000 by the Italian Ministry for the Environment and Territory (IMET) and the State Environmental Protection Administration of China (SEPA), implements pilot projects and technical assistance in the environmental energy and sustainable development field.
Within this framework, IMET and SEPA launched the project "Energy Planning for a Sustainable Development" (ENP)
The general objective of the ENP project, jointly developed by the Foreign Economic Cooperation Office of SEPA (FECO/SEPA) and the Italian experts has been the identification and evaluation of optimal solutions to reduce Green House Gases (GHGs) emissions and

china energy consumption breakdown by secto



to improve the integrated environmental quality in the long term.
Three pilot municipalities (Jinan, Suzhou and Taiyuan) have been specifically selected as representative of the Chinese context. In each one, energy efficiency assessment of different sectors has been carried out, evaluating the potential for an increase in energy efficiency in the most significant energy consumption sectors, taking into account the energy end-use and related environmental pollution issues. The formulation of a practical approach to achieve higher levels of energy efficiency was developed to provide basic support and guidance to the local authorities in the energy and environmental sectors, with particular emphasis on the industrial sector.
The project activities focused on energy efficiency improvement options applicable to a wide spectrum of industrial subjects. This extrapolation of results was feasible since audited sites were selected not only on the basis of their potential for energy efficiency improvement, but also for their representativeness within the Chinese economic context.
On the basis of the performed work the Sino-Italian team of experts was able to provide guidelines to local authorities on energy efficiency improvement, energy management and GHGs emission reduction.

Pilot Municipalities

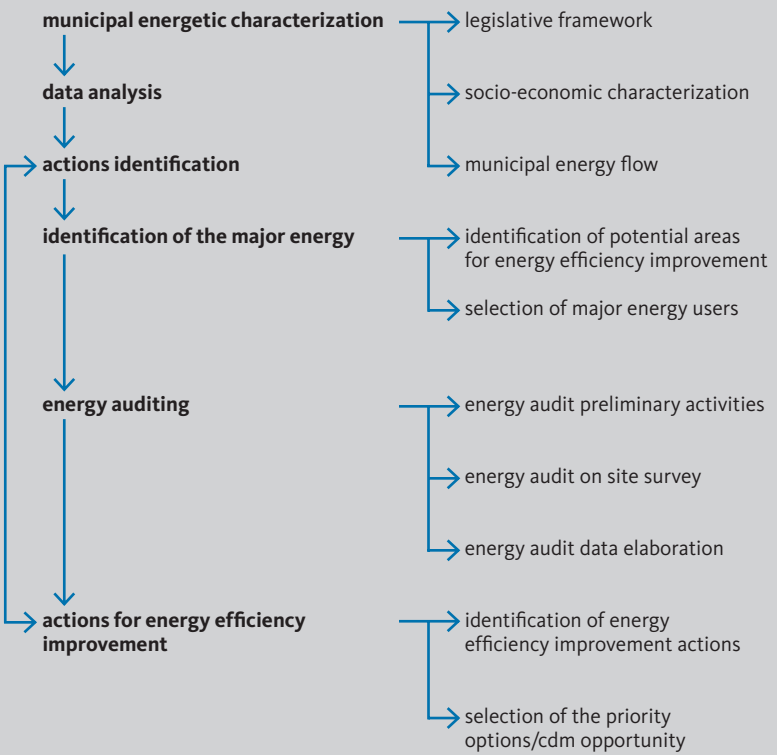
The three pilot municipalities (Figure 2) were identified as representative of widely diffused situations within the Chinese territory.
These municipalities were considered suitable for a comprehensive characterization of the Chinese energy context, as they show:
_ presence of a large (as energy consumer) industrial district;
_ presence of energy-intensive industries (e.g. steel and iron plants, cement plants, power plants, etc.);
_ energy structure dominated by coal, with potential for other energy sources;
_ municipal size representative of a wide spectrum of Chinese municipalities (the three pilot municipalities range between 3 and 5 million inhabitants).

Project Approach

The ENP project followed in its development an innovative approach which was adopted since the early work-planning phase.
The energy planning approach, usually relying only

Figure 2
如图2

Figure 3



on the analysis of aggregated data and macro level information, was in this case oriented towards the identification of effective municipal strategies complemented by interventions for energy efficiency improvement in major energy consumers. The main characteristics of this approach can be summarized in the following:
_ Focus on energy efficiency concept as the most convenient way to pursue the final objectives of sustainable development and GHGs emission reduction;
_ Adoption of a bottom-up approach, consisting of an analysis based on direct observations of the present energetic situation in selected major energy users and trying then to draw general principles in the energy efficiency sector.
The project activities focused on identifying solutions for energy efficiency improvement applicable to a wide spectrum of subjects. Figure 3 graphically describes the methodological approach that was developed and tested during the project.
The most critical activity of the methodology was data and information collection, also due to the difficulties of the working context. Specific questionnaires, forms and tools were developed and applied with the aim of simplify the essential activity of energy consumption data collection.

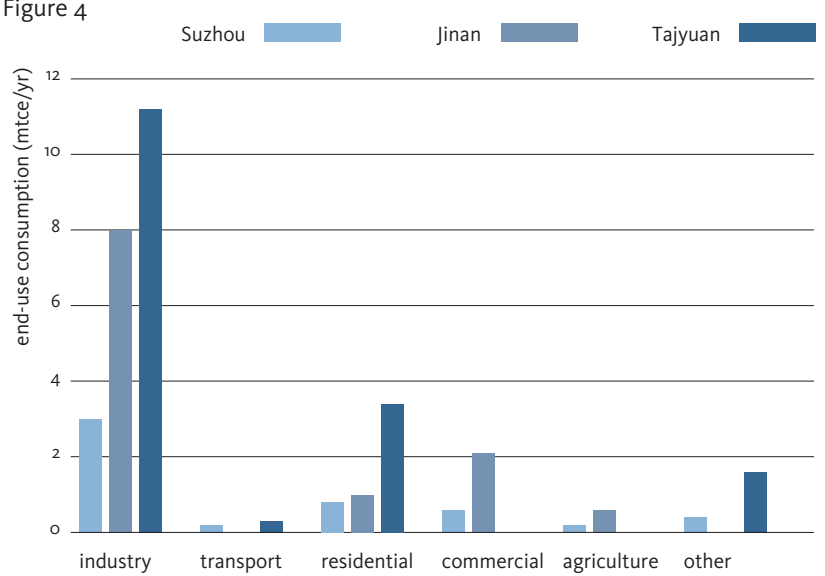
Project Objective

The project aimed at promoting GHGs emissions reduction by increasing energy efficiency and energy savings, pursuing the following objectives:
_ Perform energy investigations on the three pilot municipalities, in order to support the decisions and strategies of the local authorities and planners in optimizing energy usage and management;
_ Investigate and assess the energy efficiency in the major energy users of the three pilot municipalities, in order to identify possible actions to save energy and reduce CO_2 emissions;
_ Provide general working guidelines as a technical support tool in the route to energy efficiency improvement and GHG emission reductions in China;
_ Provide the Chinese experts and local EPBs with the necessary know how in order to replicate and disseminate the approach developed within the current project in similar contexts.

Project Development

To achieve the scopes of the project, the following main tasks were accomplished:
_ Identification of the general energy framework in the three pilot municipalities: this task was essential in order to identify sectors showing relevant potential for energy efficiency improvement;
_ Development of municipal strategies as support for local authorities to set up energy plans;
_ Selection, within the sectors identified in the previous task, of the sites where to perform specific energy audits;
_ Implementation of energy surveys in the selected energy users: each major energy user was preliminarily assessed through site-specific questionnaires, and then investigated through on-site energy surveys;
_ Identification of specific energy efficiency improvement actions within the surveyed sites based on the data and information previously collected;
_ Generalization of the approach into operational guidelines to energy efficiency improvement, as tailored on the sites surveyed during the project;
_ Training addressed to selected SEPA experts and to the representatives of local EPB and of the industrial relevant sectors, on the most significant topics, such as energy characterization and energy audits, energy efficiency improvement possibilities, CDM opportunities in energy efficiency, etc.;
_ Dissemination of project results consisting of a widespread disclosure of the project approach and

Figure 4



outcomes through the general distribution of the results.

Municipal Analysis Outcomes

The consumption by sector of the three cities is similar, being dominated by the industrial sector (Figure 4). The major source of energy is in all cases coal, and this scenario is expected to change in the medium term only in Suzhou, due to the construction of the West to East natural gas pipeline. The main difference between these cities is energy availability: Suzhou is a pure importer of energy, while Taiyuan has enormous reserves of coal; Jinan stands in the middle. Availability of energy at low costs affects the efficiency of energy exploitation. Strategies and interventions for energy efficiency improvement and GHGs emission control are reported below. As already indicated, it should be noted that suggestions for municipal strategies take into account the experiences developed during the onsite energy surveys. Notably, extrapolation of the results from the site surveys was of great value in the identification of the real areas for improvement.

Energy Efficiency Improvement In the Industrial Sector

The Sino-Italian team performed energy audits in nine industries (Table 1) and found out more than 30 possible actions for energy efficiency improvement and/or energy consumption reduction.
Whenever possible, each intervention has been characterized in terms of expected energy savings, payback period and rate of investment. The interventions have been divided in "Best Practice" interventions and "Process Modernization" interventions. "Best Practices" interventions include actions that can be implemented in the short term, usually with limited costs. "Process Modernization" interventions include actions that imply more extended modification in the energy process in the plant, and whose costs are subsequently higher. In general, the following common observations can be made:
_ The study and results from the on-site direct energy surveys showed a high potential for energy efficiency improvement, in all the industrial sectors investigated.
_ Energy efficiency can be achieved in phases: some interventions require a very limited investment (e.g. establishing a tracking index), allowing to save money for further investments.
_ Most of the industrial sites that were visited use coal as main energy source: energy consumption reduction will have immediate benefits also in terms of GHG's reduction.
_ Most of the interventions are related to improvement of specific equipment operations (in particular, boilers), minimization of energy wastes (heat and steam pressure) and modernization of equipment.

Municipality	Site
Suzhou	Suzhou Steel & Iron Factory Suzhou Thermal Power Plant Suzhou Zixing Paper Company Suzhou Chemical Industry
Taiyuan	Taiyuan Second Thermal Power Plant Taiyuan Iron and Steel Taiyuan Highway Members Works (Cement Plant)
Jinan	Shandong Huang Tai Thermal Power Plant Shandong Cement Plant

Conclusions

The outcomes of ENP project have a general value and can be applied to a wide variety of municipalities in China, pursuing the final objectives of energy efficiency improvement and GHGs emission reduction.
Now more than ever, following the last steps of the International Community towards Kyoto Protocol implementation, the ENP results reinforce the Sino-Italian cooperation in the field of the energy efficiency improvement and sustainable development, and make it now possible to launch and implement specific interventions towards effective CO_2 emission reduction.
Possible future developments due to the experience and results of the ENP project include interventions oriented towards energy efficiency improvement and sustainable development, such as technical upgrade of industrial equipments, fuel switching, industrial processes optimization, energy management systems improvement.

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Sino-Italian Challenging Projects for Landfill Biogas Capture and Exploitation in China

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Introduction

Refuse disposal is the most common way currently used in China for solid waste management. China produces more than 150 Mtons of garbage annually, of which 90 percent is dumped and untreated into dedicated landfills.
By the end of 2000, over 1000 landfills were active in large and middle-sized cities in China. These dump sites produce and release in the atmosphere a great amount of landfill gas (LFG), mainly consisting of methane (CH_4) and carbon dioxide (CO_2) as well as some micro constituents.
In order to control GHGs emissions, LFG recovery and utilization need to be considered when establishing the municipal solid waste disposal system. However, a number of sanitary landfills have been recently set in place in large Chinese cities, e.g. Beijing, Shenzhen and Hangzhou not considering the reuse of the generated LFG: in most landfill facilities the LFG produced by urban waste decomposition is collected and flared or is not even collected. Only in a few cases, pilot LFG recovery and utilization systems were set in place and the recovered gas was used for power generation.
The ongoing Sino-Italian projects are aimed at demonstrating the technical and economical feasibility of the energy production from LFG recovery in China, thus promoting the associated greenhouse gas emissions reduction. In addition, through pilot systems installations the use of biogas can be promoted and expanded by improving gas collection activities in smaller landfills and by employing practices that increase gas production and the efficiency of the conversion into energy.

Landfill Gas Production

Biogas is typically produced at wastewater treatment plants, landfills, food process plants and other industrial strucutures. In addition, there is largely untapped potential in agriculture, where animal waste (manure and processing waste) is often land applied or otherwise disposed off without conversion into energy. Technological, economic, and political changes are converging to encourage the collection (thus avoiding its release in the atmosphere) and the use of this renewable resource for energy production.
Landfills offer the greatest potential for energy production, compared to other sources listed above, thus representing a valuable source of renewable energy. By year 2000, the annual solid waste production was of the order of 120 Mtons (1.16 kg per day per capita on the average) and in the last five years has rapidly increased. As organic waste deposited in a landfill decomposes underground, LFG is generated by bacteria degrading biological material in the absence of oxygen, in a process known as anaerobic digestion. Each ton of organic waste generates 60 to 120 cubic meters of LFG over its lifetime (25-30 years).
LFG consists generally of about two-thirds methane (CH_4) and one third carbon dioxide (CO_2). Note that 1 ton of methane released in atmosphere pollutes as 21 tons of CO_2 (from the values of Global Warming Potentials). Composition and yield of LFG at a given site are affected by various social (waste composition and generation rate, recycle/reuse), environmental (internal and external to the landfill), and management (waste processing, leachate recycle, waste landfilling) factors.

CDM Perspective of Landfill Gas Projects

Following the recent ratification of the Kyoto Protocol, LFG-to-energy projects are becoming more attractive for investors.
Italy has a severe commitment for the period 2008-2012 to a large reduction of CO_2 emissions (more than $40x10^6$ tons CO_2/year). The Clean Development

Mechanism (CDM) provides a means for countries or companies to financially contribute to GHG reduction measures in developing countries. In return, the investing companies receive "Certified Emissions Reduction" (CER). In this framework, China will benefit from CDM LFG projects and investments resulting in certified emission reductions (CERs), while Italy may use CERs obtained from such projects to contribute to the compliance with Kyoto Protocol commitments.
The Italian Ministry for the Environment and Territory (IMET) is thus promoting the implementation of CDM projects in China (especially biogas recovery projects), where possible contributing to the feasibility assessment and/or for the emission credit certification costs.

Sino-Italian LFG Projects Development

Since year 2004, a number of LFG plant opportunities in China are under assessment by Italian experts and investors for their development as CDM projects. Several activities are under way for project implementation and credit generation, as detailed in the following:
_ selection of the landfill site, based on its dimensions and on quality/quantity of the solid waste potentially dumped;
_ preliminary assessment of the Technical and Economic Feasibility for plant construction/operation/maintenance (e.g. installation and operation costs, energy selling price, maintenance fees, payback period);
_ set up of a Memorandum of Understanding (MoU) with the site owner in view of a long-term agreement for LFG reuse after completing the design process;
_ development of the relevant CDM documentation, i.e. a) the Project Idea Note (PIN) as a concept paper summarizing all general information on both project and proponents for preliminary evaluation of the project; and b) the Project Design Document (PDD) as the standard design document to be submitted to the CDM review committee;
_ development of a project financial plan (installation and operation costs, energy selling price, maintenance fees, funding timetable, plant payback period, etc.);
_ signature of a Joint Venture agreement with Chinese partners for LFG recovery system installation and for construction/operation of the energy plant;
_ development of the final design and technical specifications (e.g., civil works, material and equipment for LFG recovery and power generation systems, O&M procedures);
_ application in order to obtain all needed authorizations and permits for plant construction/installing at the selected site;
_ definition of a Power Purchase Agreement with local energy traders/users;
_ plant installation and commissioning;
_ plant operation (LFG recovery, electric power generation and transfer to the local power grid) and emission credits certification.
The Italian ICLE Consortium is widely active on these initiatives. The Consortium is formed by:
_ Asja Ambiente Italia S.p.A., a firm internationally qualified in the sector of energy production from renewable sources; Asja develops and operates plants in the energy valorization of landfill biogas and in the wind energy field;
_ D'Appolonia S.p.A., an engineering company operating worldwide in the energy, environment and infrastructures, transportation and industry sectors; D'Appolonia provides design, construction supervision capabilities as well as technical, administrative and financial advise for CDM project implementation;
_ Consorzio GAIA S.p.A., a waste management operator active since 1997 in Central Italy, with highly qualified know-how in waste management, landfill reclamation, biogas collection systems set up and construction/management of Waste-to-Energy Plants.
Specifically, ICLE is working with the owners of several sites with the following objectives:
_ installation of a LFG recovery system and optimization of landfill management in order to maximize methane production;
_ construction and operation of a LFG reuse station, based on Italian technologies and techniques;

_ implementation of the project as a Sino-Italian Clean Development Mechanism (CDM) initiative.
All activities are developed with the valuable support of the State Environmental Protection Administration (SEPA) team of experts, who are providing suggestions for suitable site identification and support in approaching the site owner and the local administration.

Landfill Gas Plants

The simplest way to handle LFG is flaring, a combustion process taking place in dedicated equipment (flares). Flares have an elevated stack with an open burner tip, usually protected by a windshield, at the top. Combustion, typically characterized by very high efficiency, still produces emissions of NOx, CO, and other products of incomplete combustion. Flares are the easiest and least costly LFG control system to install and operate; however, these systems, while minimizing methane emissions, do not allow LFG reuse for energy production.
Landfill gas-to-energy applications (usually suitable for sites capable of power production of at least one MW), typically perform generation of electricity by internal combustion engines: three to five engines are employed per project (1 MW generating capacity per unit being the most common). Electrical power is sold to the local electric utility, or used on-site to offset operational energy requirements.
LFG-to-energy plants design should account for several operation difficulties. For instance, LFG engines are subject to corrosion due to the presence of naturally occurring halogenated compounds in the gaseous fuel. Combustion of these compounds creates acids that are carried through the lubricating system, corroding the metal surfaces of engine parts. These phenomena call for specific corrosion control measures (enhanced lubrication, etc.) as well as engine adjustments (proper spark advancement, etc.).

Financial Feasibility of Landfill Gas Reuse

LFG plants costs are essentially connected to the LFG extraction, cleanup, and energy recovery operations. The analysis of the commercial utilization of LFG in an energy recovery project focuses on the following factors:
_ gas quantity/quality;
_ site age and projected gas production life;
_ availability of the end user for energy; and
_ economics of utilization.
Economic evaluation of LFG utilization projects requires the assessment of the following components:
_ administrative costs, incurred during project development and design (e.g., legal fees, permit applications, and contract negotiations);
_ capital costs, i.e. the "up front" costs of site improvements, gas extraction and cleanup, energy equipment and pollution abatement equipment;

_ operating and maintenance costs (e.g., labor, equipment maintenance, spare parts, materials);
_ revenues from energy sales, typically based on competing fuel or energy prices in the area (LFG projects, as other renewable energy production projects in China are going to be based on a predefined energy pricing, higher than the energy produced by fossil fuels);
_ royalties payment, i.e. the continuing fees proportional to energy output or revenue, (ranging from 5 to 10 percent of gross sales and paid, after negotiation, to the landfill owner or to the owner of the gas extraction or delivery rights);
_ emission credits revenues, i.e. the continuing benefits proportional to the CO_2 removed.

The analysis of the economics of a specific project, or the comparison of alternative projects, is often quite difficult; site-to-site variation is wide, even when comparing projects with similar configuration and scale. Capital costs can vary by an order of magnitude for utility provisions (landfill management improvement, landfill embankment reconditioning) and utility interconnects (connection to the power grid).

The assessment of project economics is typically performed before the contract negotiations or the agreement on financing with the local partners; in addition, costs and revenues are carefully monitored during development and construction to assess or verify the benefit of design modifications (e.g., modular installation of the LFG engines), and during the life of the project.

CER's generation may enhance the attractiveness and profitability of LFG utilization initiatives: the projects recently assessed by the project group were often financially viable only through the sale of CERs.

To ensure profitability, our preliminary project results suggest that LFG-to-energy projects should exceed 1 MW in size and the selling price of electricity should fall in the range 0,05 to 0,06 Euro/kWh. Any royalty payments should not exceed 5 percent of gross energy sales at this level of pricing. Emission credits earnings royalties should not exceed 10 percent of the CERs sale revenues.

Conclusions

Landfill gas is a relatively clean, environmentally friendly, renewable resource. The construction of the LFG plants, by capturing and exploiting the methane contained in the biogas extracted, avoiding its release in the atmosphere, contributes to the reduction of China's dependence on non-renewable fossil fuels, pollution and GHG generation problems.

Several LFG plant environmental benefits can be easily identified, such as odor reduction and explosion or fire risk reduction at landfill sites as well as reduction of greenhouse effect from landfill gas emissions and from the production of energy from non-fossil fuels. However, in spite of the fact that LFG collection and reuse systems allow to offset costs associated with LFG extraction or landfill operations, or make a profit through the sale of energy, the expected environmental and economic benefits are not valued enough to drive landfill owners toward LFG plant installation. Limited and variable quality and quantities of gas production and recovery, poor construction and inefficient management of landfill sites, costs of cleanup and energy conversion and/or distribution, and unfavorable markets and regulatory environments have inhibited for a long time the development of LFG utilization projects in China.

With the formal effectiveness of the Kyoto Protocol, LFG energy utilization, as an important greenhouse gas emission reduction measure, is taking off also in China. The new incentives mechanisms, such as the Clean Development Mechanism (CDM), allowed LFG projects to become attractive and to compare fairly and favorably with other energy initiatives, especially in terms of the total cost per unit of energy produced.

Based on the recent Sino-Italian experience, LFG projects development in China must overcome several obstructions. First, the recovery and utilization of landfill gases must involve effective landfill gas collection and treatment. In order to ensure the landfill gas production's quantity and quality, higher requirement are needed for the landfill site construction and operation – in some cases not easily affordable if not considered at the time of the landfill design.

In addition, since China started landfill gas reuse relatively late and lacks LFG-to-energy technology, the core equipment for landfill gas utilization such as engines and generators need to be imported from abroad, thus increasing capital costs.

Finally, LFG utilization can be developed only through close business cooperation between investors and site owners. The central government should facilitate investment promotion stimulating public-private partnerships through joint activities in landfill construction, cultivation and management and identifying financial mechanisms for enabling foreign investors to play a prominent role in the waste disposal business and landfill gas recovery.

The Hydrogen Cooperation Program in Shanghai

Emiliano Cecchini, Sino-Italian Cooperation Program Energy Expert
Prof. Yonghao Luo, Shanghai Jiaotong University

On November 2005 world wide top officials and experts mainly from China and Europe met at the Chinese Academy for Social Science in Beijing for a 'Dialogue on Energy'. The purpose of the Dialogue was to assess the Chinese state of the art of the energy availability, safety and sustainability.
One of the key issues that came out from the talking is that the use of Chinese coal to match the overwhelming need of energy of China, and of the world in general, cannot be eluded. Environmental concerns are not able to stop this trend so a clean way to go through the coal production of energy is a compulsory issue to any decision maker on global scale. Hydrogen technologies can help in the clean use of coal because high temperature coal gasification processes, like the IGCC, produce a synthesis gas ("syngas") rich in hydrogen.
In addition, hydrogen and fuel cells technologies, with their fast evolving research, were considered, by the auditorio of the Academy, technologies to follow with interest.
This framework perfectly matches with the projects set up by the Sino-Italian Cooperation Program on hydrogen in Shanghai.
The program, established in 2004 with an agreement between the Italian Ministry for the Environment and Territory (IMET), the Chinese Ministry of Science and Technology (MOST), the Science and Technology Commission of the Shanghai Municipality and the Italian Lombardy Region, is composed by five feasibility studies. These range from the massive coal gasification production of energy and hydrogen with on-site reuse of waste CO_2 in the chemical production, to a big molten carbonates fuel cell (MCFC) and down to small size use of fuel cells in the housing sector and automotive application in particular refilling infrastructures. These projects mean to match the best Italian experiences with the incredibly fast raising Chinese awareness and technical skills in these fields. Hydrogen is just a carrier of energy, like electricity and not a source of energy so it has to be produced and stored. Today China offers perhaps the world's best chance to test mass production, storage, pipeline transfer and use of hydrogen. And the Shanghai area, with its outstanding mix of industries, universities, political and financial institutions, is the place where to start.

Hydrogen production from coal gasification by IGCC and Re-use of the Carbon Dioxide produced.

The Huayi Group, through its Shanghai Coking & Chemical Corporation (SCCC) is running a large scale chemical production plant based on coal gasification for methanol and other chemicals in Wujing (Shanghai). The National Development & Reform Commission specifically encouraged this industry to develop clean coal technologies in Shanghai. In the Huayi perception the technology is ready and its Italian counterpart, ENEL, has developed interesting skills in the field especially due to its experience in the EU project for the IGCC plant in Puertollano (Spain) but Huayi wants to clearly assess the economic feasibility before starting the design of a new IGCC in Wujing.
Thus a feasibility study will be outlined based on computer simulations by ENEL, performed while training on-the-job some Chinese experts and will be carried out mainly to investigate costs, engineering and quality related problems due to the particular chemical composition of the Chinese coal.
This project has involved also the Shanghai Jiaotong University with its students, PhD, experts and professors.
"The focus of our project – reports Li Meining a technical expert of the SCCC recently send to ENEL in Italy for a study tour - is to develop an IGCC for power generation but combined with our chemical productions

using Hydrogen as a source in large scale, reducing CO_2 emissions".
The planned size for the IGCC to be simulated is about 200MW but, since the maintenance and operative costs could be unreasonably high, a preliminary simulation is basic for any hypothesis of implementation project . The simulation also allows to study in detail the system design, the engineering, the process and the output while training the personnel at any level on the virtual operating management of the plant.
Beside these simulation results, the feasibility study will also compare different gasification processes and a complete examination for combining power generation and chemical production in order to support local and national policy makers in the final decision.
As CO_2 emissions are concerned, due to IGCC and ordinary chemical production processes in Wujing a lot of CO_2 will be produced. The idea is to reduce CO_2 into a chemical raw material. Huayi experts, Jiaotong University and ENEL Ricerca will also draw up a feasibility study for this technology.

MCFC for the EXPO 2010 in Shanghai

During the Shanghai WORLD EXPO 2010, according to the primary plan for the EXPO Energy Center and the ideas of the Municipal Government, a Fuel Cell power generation system will be established in the Expo Park for hydrogen energy demonstrations.
A Feasibility study for installation of a Molten Carbonate Fuel Cell (MCFC) system in this Energy Center is being executed by Shanghai Electric Power Co. (SEP) and Ansaldo Fuel Cells SpA (AFCO).
Fuel Cells are devices able to generate electricity and heat from the chemical energy of a fuel (like hydrogen). For MCFC this can be any gaseous, liquid fuel or mixtures, even in addition to coal gas or biomass derived fuels (wastewater treatment gas or landfill gas). Since the fuel cell relies merely on electrochemistry and not on combustion, emissions from this type of a system are almost completely pollution-free.
"The installation foreseen for the Shanghai Expo, the first of its kind in China, will incorporate state-of-the-art technology and will represent for both parties a very interesting test for perspective future cooperation in developing larger application for the Chinese market", says Bartolomeo Marcenaro AFCO marketing director.

The study will be based on the specific site requirements, the capability of the MCFC technology and the perspective "state of the art" expected for the next years. It will address the following issues:
_ Overview of Chinese energy scenario
_ Overview of MCFC technology
_ Site requirements definition
_ Fuel Cell System optimal size selection to match site requirements (heat and power) and technology availability
_ Evaluation of expected costs
_ Preliminary system lay-out
_ Preliminary P&I Diagram
_ Time Schedule for the "realization project"
_ Estimation of the environmental impact

The project is aligned with the present market trend, which is oriented to the distributed generation as a new way to address energy industry deregulation. The plant will be powered by two or more modules based on the TWINSTACK® configuration and will be also used as a "building block" for larger size power system. In this last case the Balance of Plant will be optimised in terms of suitable integration of some components in order to reduce space requirement and costs as well as to increase performance. The main characteristics of the project are:
_ the integration of the modules on a skid with the arrangement of the stacks, modular integrated reformers and catalytic burners inside a pressurised vessel;
_ the compact arrangement of all other auxiliary subsystems including the control system and the power conditioning with relevant electrical boards inside a suitable container.

The plant, which will be fed by natural gas, is designed to reach, in particular, the following technical targeted data (reference is made to a 0,5 MW plant):

_ Current:	1200 A
_ Voltages	416 V/
_ Electrical power	500 kW
_ Emissions (kg/MWh)	NOx < 0.003
	SOx < 0.0005
	CO < 0.001

Ms Li Xin of the Shanghai Electric Power Co., Ltd assesses that Ansaldo Fuel Cell has many advantages in terms of high overall efficiency (45-60%), low cost maintenance and very low emissions. The cost for Fuel Cell is continuously reduced depending on the fuel

cell technology research and the production of the accessory equipments.
The strategy sought by a possible joint venture to make it a competitive power generation technology is to produce the accessories in China and keep the stack and core technologies in Italy.

Hydrogen in eco-housing

The team for architecture energy conservation of the Politecnico di Milano, led by Prof. Federico Butera promotes and execute the renewable energy utilization and eco-building design. The team has systemic design theory and rich experience also in China since it designed The Tsinghua Eco-building in Beijing. The idea of this project is to evaluate the potential of renewable energy sources and low energy technologies in the Shanghai's fast growing building stock, and to develop sustainable building design guidelines for deriving new building regulations.
SRIBS has a long experience and skills in designing eco-building or high energy efficiency solutions and can provide all the necessary information for developing guidelines well suited to the actual Shanghai's construction market.
SRIBS will provide information related with Shanghai climate and energy supply conditions whereas Politecnico di Milano will provide the renewable energy utilization technologies and methods in building sector, as well as the experience in similar approaches in Italian cities, with the strong feedback of the SRIBS experts in order to choose the most suitable kind of renewable energy technologies for the building sector in Shanghai.

Hydrogen automotive infrastructures

Reasonably in a next future most of the cars will not be based on an unique technical solution: NG/GPL vehicles, hybrid, electric, H2 -natural gas and finally 100% H2 powered vehicles will presumably penetrate the market at some extent and will probably coexist for many years with the traditional solutions, i.e. the phase out of leaded gasoline has been delayed for many years after the introduction of unleaded gasoline, because of existing huge fleet of cars based on the former fuel.
"To support this gradual evolution – states Mr Sergio De Sanctis, Director of the Innovation Department of SAPIO - multiple fuels and additional services will be needed at the same place, with an increasing complexity of the refuelling stations. The refuelling station will actually become a "multienergy station" in order to satisfy this more sophisticated demand".
The concept of multienergy station includes both conventional, high quality fuels such as low aromatics gasoline and ultra-low sulphur diesel fuel, and even more environmentally acceptable alternative fuels such as LPG and compressed natural gas.
In particular, the lack of specific rules and standards for H2 represents an important obstacle for obtaining all the needed permits from the Public Bodies.
The main scope of the project in Shanghai, carried out by Italian SAPIO and Shanghai Tongji University is to afford and solve all these aspects, through the design and construction of at least one innovative multienergy distribution plant, open to private customers as well as to a pilot fleet of low emission cars and based on alternative fuels. This approach is also aimed to address the public awareness and sensibility to environmental issues and to increase the acceptance and confidence towards alternative, environmentally benign fuels such as Hydrogen.
So far three Hypothesis are under examination: a pure hydrogen filling station by the EXPO Park to serve fuel cells shuttles during the Shanghai Expo 2010, the revamping of an existing LPG and gasoline station or a dedicated retrofit for LPG station. A feasibility study will present the layout and flow chart for each kind of station, including the equipment list, cost budget and corresponding equipment supplier in order to allow the most efficient technology choice.
As this project is concerned, Prof. Zhou of the Tongji University that recently joined the program study tour in Italy, believes that SAPIO and his University "can finish the feasibility study on time since both sides expressed the intent to cooperate for the station design to be built in Shanghai when the conditions are ready".
The interest on both sides is high and so is the probability to actually build the plants sketched in the feasibility studies but over all the extraordinary effort in cooperation put by so many different bodies, companies and institutions is already a great achievement of the program itself .

Echo from participants

Eco-Management Strategies & Policies Advanced Training Program: To create a more dynamic platform for information and communication

Addressing the current situations of China's growing energy demand, relatively shortage of energy resources, coal-dominated energy structure, limited energy technology, energy issues have attracted broad attention in China, which is driving China to a new age of energy efficiency.

One of the important parts of China's energy strategy is to promote energy-efficient building and to cut huge energy consumption, for the energy consumption in buildings accounts for 27.8% of China's total energy consumption.

Considering this background, Venice International University (VIU) organized two sessions of training in Italy for the Chinese participants from the Eco-Management Strategies and Policies Advanced Training Program(III)(CASS) from November 26 to December 9 2005 (Energy Efficiency) and the latter December 9 to 23 2005 (Eco- Building), with the support from the Italian Ministry for the Environment and Territory (IMET).

The participants agreed that the success of training program is attributed by the closely-linked subject, integration of environmental protection policy with technological communication, linking of theory with site-visits and interactive communication between participants and training lecturers.

During the training on "Energy Efficiency and Renewable Energy", the lecturers introduced the energy efficiency and renewable energy in Italy, advanced application of solar energy, energy efficiency in Eco-building, geothermal and wind energy and energy from Biomass. General information on the energy policies in EU and Italy, and concrete introduction to electricity production technology are presented, too.

While in the training thematic session on "Sustainable Architecture and Urban Sustainable Development", the lectures focus on Theoretical Elements of Urban Sustainability, Ecological and Energy Efficient Building, Sustainable Planning, Sustainable Transportation and Hospital Waste management. In particular, the participants are guided to visit some sites such as Eni Tecnologie, Fusina (VESTA), Eco-Building in Padua, Thetis, to apply these learned theories and approaches to their practical work.

The participants benefits from the following shining point of the Eco-Management Strategies and Policies Advanced Training Program(Đ), namely, the training program combined the most innovative and latest environmental protection ideas and experiences with the serious environmental issues and new environmental policies in China.

1. Training theme closely related with the 11th Five-Year (2006-2010) Plan. Based on the idea of building an energy efficient and environment-friendly society in China, the plan stressed the importance of developing circular economy and strengthens Chinese environmental and ecological protection. Therefore, China will take the renewable energy, energy industries, energy efficiency technology, ecological building as important moves to realize the goal. The two training courses on "Energy Efficiency and Renewable Energy

1/3

news and events

on focus

VIU training program
Echo from participants

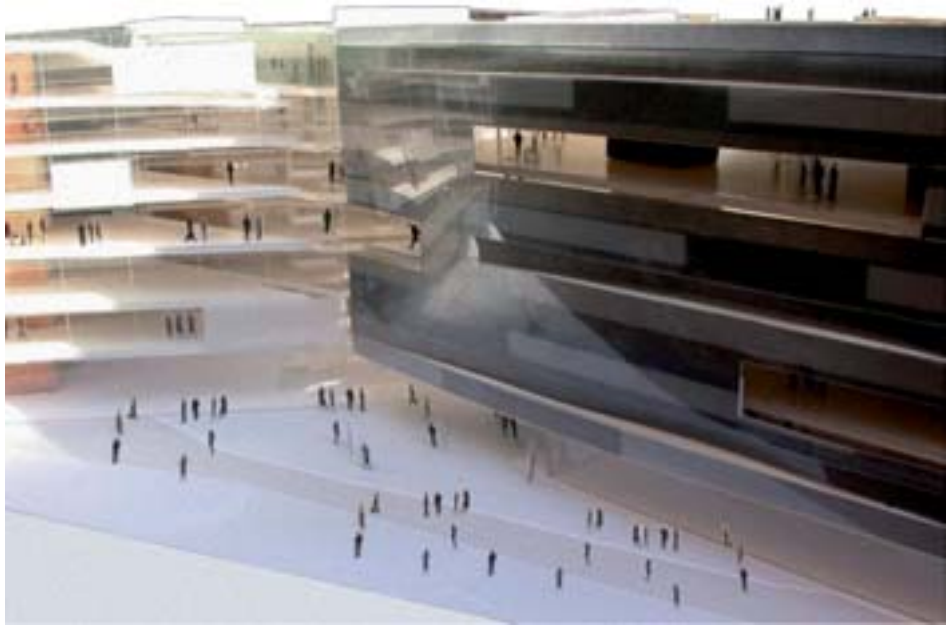
Energy Efficiency and Renewable Energies, CASS

Chinese Academy of Social Sciences Urban Sustainable Development and Eco-building

Beijing Municipal Environmental Protection Bureau Environmental Education Advanced Training Program

around us

what's next



and “Sustainable Architecture and Urban Sustainable Development” strengthened the comprehensive capability of the participants, and are bridging a channel for China to introduce the advanced energy-efficient technologies and eco-building design.

2.As to the policy implementation of developing western region of China, it is of great significance for China western region to strengthen the infrastructure and ecological environment construction and to develop some prevalent industries such as energy, mining industry and tourism in line with the resources advantage and industries comparative advantage. A certain amount of participants from environmental sectors of western China in Inner Mongolia Autonomous Region, Ningxia Autonomous Region, Qinghai Province, Shannxi Province, Sichuan Province, Yunnan Province and Chongqing Municipality etc, attended the training course in Italy, which cultivated human resources on introducing Solar and wind technology, efficient usage of renewable energy, developing energy industries and solving local energy issues.

3.Traffic is one of the troublesome problems for the sustainable development in China’s urban areas. During the training on “Sustainable Architecture and Urban Sustainable Development”, a case study of Milan on sustainable transportation showed relevant institutions and technologies on how to tackle the traffic jam and how to reduce the greenhouse gases and other pollutants generated by motor vehicles, through the establishment of an Intelligent Traffic Control System in China. The Italian innovative technologies and management measures are applied in the project “ Intelligent Transport System-Traffic Air Pollution” under the Sino-Italian Cooperation Program for Environmental Protection, which was launched in 2005.

4. According to the statistics, among the current total area of 43 billion square meters architectures in China, only 5% can meet the energy-efficient building standard, even 90% of the newly constructed buildings are still low energy-efficient. The serious energy consumption makes the energy efficiency in buildings a pressing issue. The training courses take the Sino-Italy Environment and Energy Efficient Building (SIEEB) in Tsinghua

University as a case study, introduced the construction concepts of the SIEEB, exterior design of the building, advanced curtain wall system design, environmental protection and energy efficient energy supplying systems and advanced intellectual management system. The building will serve as a research platform for the long-term concerted development in the environment and energy field in China and a technology demonstration platform for the construction of the next generation energy efficient buildings in China. Through the training, the participants get more information on the idea and design of the building, which promote further Sino-Italian cooperation on ecological building.

The great achievements of the training program today are attributed to the unremitting efforts from the organizers. Meanwhile, with the increasing challenges of global environment change and new environmental issues, participants proposed some suggestions for the contents and form of the training as well as the interactive communication after training.

First, the participants suggested establishing an interactive virtual community for the communications between the participants, the lecturers and the organizers. By optimizing the Italian innovative experiences in environmental and ecological protection, the Program aims to train Chinese middle-aged and young scholars, government officials, technical experts and managers of enterprises in the field of environmental protection, to enhance their comprehensive capability in theory, policy, law-enforcement and technology. Hence, it's very important to increase mutual understanding and information exchange between the participants, lecturers and organizers, paving the way for a strengthened, long-term and continuous interactive mechanism and virtual community through Internet and alumni event.

Second, they consider it as a very important part to expand the training courses to the field of investment in environmental protection and evaluation standard for energy-efficiency.

The shortage of relevant fund is a bottleneck to the development of China's environmental protection industries. China has great potential in energy-efficiency field and need more investment to develop energy-efficient technology and produce energy-efficient equipments, thus the very important channel to meet the financial need in environment are how to increase the fund-raising scale from domestic business financial institutions and promote the international organization's investment to China. Some environmental protection enterprises can't survive for lack of financial support due to the complex procedures in financial investment. The participants especially those coming from environmental enterprises expressed that they are quite satisfied with the rich and vivid contents, but they hope to learn more about the procedures and approaches for environmental fund-raising and investment encouragement.

Efficient use of renewable and harmless building materials is important in energy-efficient building since China is still in the process of exploring and building a complete system on energy-efficient evaluation. To establish a more practical evaluation system on energy-efficiency system in China and increase the energy utilization of China's building enterprises, more information on the Italian standard of energy-efficiency evaluation are suggested to introduce to the participants.

Furthermore, they are expecting a comprehensive question database to be established by the program organizers for the participants. For the time limits or the language misunderstanding, the participants sometimes can't fully understand the answers given by the lecturer in the short time. A comprehensive question database can gather and classify all the questions put forward by the all the participants, which will guide the lectures to adjust the training courses accordingly.

Energy Efficiency and Renewable Energies, CASS

Italy, November 26th - December 10th 2005

42 participants

Energy Efficiency and Renewable Energies is a topic of outstanding importance, especially for countries experiencing a high rate of economic, urban and industrial growth like China. Lectures focused on the sustainable use of energy, energy economics and policies, evaluation of alternative sources, eco-building and the use of renewables.

The "energy problem" is recognized at world level. Analyses on energy consumption show that the demand of energy is steadily increasing. Coal and oil are still the main sources of energy, although an increment in the use of renewables is actually been recognized. In order to expand the use of alternative energies, in 2001 the European Union approved a specific directive which sets the increment of renewables' shares, with specific targets for each country. On the other hand, however, many EU governments point out the difficulties in fulfilling the goals set by the directive and by the Kyoto Protocol as well.

During their visit in Venice, the participants were introduced to the experience of the Venice Energy Agency in the attempt of reaching such ambitious goals, starting from the promotion of a sound energetic policy at local level. The Agency presented the different axes of intervention undertaken to implement energy efficiency strategies and CO_2 reduction policies for the city of Venice. The most interesting projects concern the efforts in decentralizing the production of energy through co-generation and tri-generation plants, suitable for major energy users especially, and the utilization of district heating near the main power plants.

The opportunities offered by solar energy were discussed during a site visit at EniTecnologie, near Rome. The delegation visited the solar cells production lines, and the international cooperation project "Solar Home System", carried out by EniTecnologie in Inner Mongolia, was presented.

During the site visit at VESTA S.p.A. integrated waste treatment plant, located in Venice's mainland, the delegation was introduced to the use of wastes for energy recovery. In this plant, the residual fraction of wastes that remains after the separate collection of organic waste, glass, paper and tins, is treated and converted into fuel, producing high calorific power.

Besides the RDF plant, the delegation also visited the Enel S.p.A. a power plant where this type of fuel is actually being used and was just successfully tested.

Finally, the delegation discussed the possible uses of geothermal energy. The potential of geothermal power is still underexploited: some analyses suggest that 8.3% of the world's total electricity could be produced with this type of power. The Olympic Village in Beijing case study was presented as an example of sound use of this renewable resource. The Olympic Green, where the most important facilities for the 2008 Summer Olympic Games are located, will be provided with space heating and domestic hot water produced by geothermal waters that reach temperatures of 40 to 88°C in the area of Beijing and that are already being used for various direct purposes.

Chinese Academy of Social Sciences
Urban Sustainable Development and Eco-building
Italy, December 9th -23rd 2005
42 participants

This training was the last of eight courses held in 2004-2005 in cooperation with CASS, and the second one devoted to Urban Sustainable Development and Eco-Building. The need of different Chinese institutions of addressing this issue was enthusiastically welcomed by VIU, as it is commonly understood to be one of the most significant issues for the promotion of a sustainable growth. The course embraced important fields of urban development such as energy efficiency, renewable energy, new constructing methods and cities' development planning, with the aim of providing the participants with basic principles on sustainable development of towns, according also to eco-building practices. The lecturers, from the academic world and from the public and private sectors, presented the main issues of urban sustainability.

The starting point for discussion was the description of Italy's approach towards a sustainable architecture, underlining the existing policies at local, provincial and regional levels. The specific environmental problems of a unique city like Venice were presented to describe an example of urban development which also takes care of the surrounding environment; particular attention was given to urban planning, fleet management systems for public transportation, and traffic and mobility management both in Venice and Milan, in order to confront the practical experience of two completely different Italian cities. Another special example was given by the just concluded work in Turin for the Winter Olympic Games and the impacts of new buildings and infrastructures on the environment and population.

Agenda 21 applied at local level is one of the main points to discuss the possible development of a city that also takes in consideration social and environmental issues. The example of Ferrara, a mid-sized Italian city, which is trying to meet important objectives such as health protection for its citizens, local welfare improvement, good municipal services, a strategic vision for the urban structure and the creation of new business and employment opportunities, was presented as case study of urban sustainable development.

Starting from an overview on the world's urban areas situation and pointing out the key role of the cities in sustainable development (although they also must be considered responsible for many local and global threats), the most important issues of urban sustainability were discussed. Great attention was given to transportation, energy consumption, green areas, built environment, water consumption, waste disposal, landscape alteration, contamination, abandoned areas, and community cohesion in order to point out the need for an integrated approach such as Urban Metabolism. Moreover, the principles of eco-building were explained with the help of Huai Rou New Town case study.

An important part of the training was the visit to an eco-building near the city of Padua

1/2

news and events

on focus

VIU training program
Echo from participants

Energy Efficiency and Renewable Energies, CASS

Chinese Academy of Social Sciences Urban Sustainable Development and Eco-building

Beijing Municipal Environmental Protection Bureau Environmental Education Advanced Training Program

around us

what's next

to underline the importance and opportunities of energy efficiency in buildings. The structure was built by the engineering company Tifs Ingegneria, which operates in the sector of plant engineering. The delegation had the opportunity to investigate the details of its construction and functioning, the used materials and the principles of eco-building applied to this construction.
Energy is one of the important issues that eco-building must handle, since the gases affecting the atmosphere and the consequences on climate change directly depend on the use of different sources for electricity and heat supply. Furthermore, specific energy efficiency tools are needed, considering that 40% of EU's energy consumption is channelled into buildings. This is the reason why specific measures are fundamental to achieve a conscious and rational use of energy resources and to reduce the environmental impact of energy for buildings. Therefore, the application in EU's Member States of the minimum requirements concerning energy performance in new buildings and in large existing buildings subject to major renovations, is a fundamental instrument that responds to this urgent need.

Beijing Municipal Environmental Protection Bureau Environmental Education Advanced Training Program

Italy, January 7-21, 2006

21 participants

Venice International University was very pleased of granting Beijing Municipality's requests to arrange a training program devoted to Environmental Education. The task was challenging and exciting at the same time, as it required engaging diverse and cross-cutting subjects (going beyond environmental sciences per se) as well as a wider range of actors and audiences. Following Beijing Municipality's suggestions, the training agenda was constructed in such a way as to focus on awareness programs, public participation in environmental protection, and environmental information. As a matter of fact, Environmental Education has to be understood not only as the spreading of knowledge about environmental issues but as the way to provide individuals and communities with appropriate tools to face sustainable development; at large, it is a way to improve the quality of life as well as to facilitate and ensure the effectiveness of environmental policies by an active and aware public participation.

As a first step, participants were introduced to the main European and Italian policies that promote environmental education and awareness programs. The international framework of Environmental Education (EE) and Education for Sustainable Development (ESD) were discussed at the Italian Ministry for the Environment and Territory in Rome, as these frameworks are believed to strongly contribute to the achievement of sustainable development. Experiences and initiatives in practice for environmental education and information of the Italian Ministry for the Environment were presented. Particular emphasis was devoted to the activities directed to teachers and children as "The Junior Report on the State of Environment", a hand-book studied to help teachers explaining the holistic approach to sustainable development to young students.

The topic of Education for Sustainable Development was further explored in Venice, thanks to the contribution of Prof. Pellizzoni, Professor of Environmental Sociology at the University of Trieste, who promoted a reflection on the social aspects of environmental education. The basic message proposed in his lecture was that environmental education has to be understood in its broadest sense, to include not simply one-sided flows of information from political, educational, scientific or economic institutions, but also bottom-up flows coming from citizens and consumers as individuals, groups and communities.

Local Agenda 21 in Europe properly fits with this issue as it aims at an interactive process that includes education as well as consultation/involvement of communities and public, in particular the participation and cooperation of local authorities and the role of local communities in environmental management and the so-called participatory approach. The latter was explained in depth through the presentation of a case study developed in Venice, the "Pandora Project": the Participatory Networks and Databases fOr Sustainability Research and Assessment is conceived as a support tool for public

1/2

news and events

on focus

VIU training program
Echo from participants

Energy Efficiency and Renewable Energies, CASS

Chinese Academy of Social Sciences Urban Sustainable Development and Eco-building

Beijing Municipal Environmental Protection Bureau Environmental Education Advanced Training Program

around us

what's next

authorities and citizens who want to exchange information, communicate and participate in joint problem-solving for local sustainability.
Other case studies discussed during the training included UNESCO's role in environmental education, with the explanation of the United Nations Decade of Education for Sustainable Development and the strategies adopted to implement such a project; school and extra-school activities' importance and, more widely, the actions undertaken by Venice Municipality, which has a specific office dedicated to Environmental Education. A site visit was arranged to two institutions created by Venice Municipality in order to help citizens in playing an active role in the safeguarding of the Lagoon of Venice.
When in Turin, the BJEPB delegation had the chance of meeting and confronting itself with the main governmental and non-governmental organizations thanks to a debate organized with some local representatives of the environmental sector. Another interesting meeting was organized with Mr. Igor Staglianò, a well known Italian journalist working for "Ambiente Italia", a popular national TV program, who debated with the delegation about the central issue of environmental education and communication on TV.

For further details on the training schedule as well as contact information on lecturers, please contact VIU offices in the Contact Us section.

Energy safety in China and pollutant emissions reduction represent the two major priorities of the strategy on diversification of energetic sources. This strategy is supported by important initiatives funded by the World Bank, the Global Environmental Facility and the Asia Development Bank.
The projects started by the Italian Ministry for the Environment and Territory are set in this framework.

"Solar Village", energy from the sun in Inner Mongolia and Western China

In the framework of the cooperation between the Italian Ministry for the Environment and Territory (IMET) and the Ministry of Science and Technology of the People's Republic of China (MOST), the project "Solar Village" in Inner Mongolia foresees the realization of the pilot project "Solar Village" for the electrification of rural areas in Inner Mongolia and Western Chinese Provinces, using renewable energy sources instead of coal. It is a "headlight" of the Sino-Italian Environmental Cooperation, and it is co-financed by the Italian Ministry for the Environment and Territory and Chinese public funds.
To implement the project, the priority has been given to the use of equipments manufactured by "Zhejiang Sino-Italian Photovoltaic", the first Chinese factory producing multi-crystalline wafers, constituted in 2001 and co-financed by the Italian Ministry for the Environment and Territory.
Demonstrating the Italian and Chinese Photovoltaic technology and verifying PV modules and systems from an industrial cooperation between Italy and China, the major objective of the project is to give electricity to rural Chinese communities.
During the years 2004 and 2005, following several technical inspections, the Chinese and Italian experts presented a joint report, and on the basis of its proposals, all the equipments were installed, tested and completed.
The main expected results of the project have been achieved: i.e. to provide a village and several homes with PV technologies, to improve the quality of life and to change the economic behaviour of the inhabitants. By 2005, a total amount of 100 kWp photovoltaic power has been already installed, supplying a total number of 160 families approximately. Moreover, the project is going to be particularly helpful since the use of techniques and technologies utilized in other development plans will be possible.

Landfill gas recovery for energy production

Ningxia Pilot project

In the framework of SICP a specific agreement was signed between the Ministry of Science and Technology of the People's Republic of China (MOST) and the Italian Ministry for the Environment and Territory (IMET) for the recovery and use of biogas coming from landfills for energy production. This project will be used to design the methodology for the

recognition of credits in the framework of the Clean Development Mechanism (CDM).
This wide project, of which the pilot phase is realized in Ningxia Province in collaboration with a public company, consists in biogas capture from landfills and its utilization for energy production, with specific reference to the pilot site of Yinchuan; the utilization of methane in cattle farm, with specific reference to the pilot site of Pingjipu; the development of a CDM methodology on the utilization of biogas digester for rural households and methane gas generated by animal waste to be used for electricity production.
The first phase of the project was completed in June 2005 with the production of technical reports by the joint working team, and with the signature of two agreements for the constitution of a joint venture with the owner of the

Yinchuan landfill site and a joint venture with the cattle farm owner.
The second phase foresees the preparation of the CDM documentation as well as the necessary documents for the constitution and registration of the joint ventures. During this phase, the CDM methodology on biogas digesters for households will be finalized and, as soon as the CDM application will be approved by the Executive Board (EB) of the CDM, the joint ventures will start the construction phase.

CDM project identification

In the framework of the Cooperation Agreement with SEPA for the Sino-Italian Cooperation in the CDM sector, signed on July 25th 2003, the identification of urban waste landfill sites in China has been carried out. Refuse disposal is currently one of the most common ways used for solid waste management in China. In most landfill facilities, gas produced by urban waste decomposition is not collected, thus representing an important green house gas (GHG) emission. It is internationally recognized that landfill gas (LFG) represents a valuable source of renewable energy when recovered and used in gas fired electrical plants, and also that technology for LFG reuse is tested and available on the market. Moreover, environmental benefits are significant, in relation to GHG emissions reduction associated with the collection and use of gas for electricity generation.
The twofold purpose of the activity is to recover landfill gas for energy production and to facilitate the cooperation between Italian enterprises and Chinese landfill owners for the development of CDM projects. Therefore, by establishing a practical approach methodology, this activity will allow Italian investors to start CDM cooperation projects in China. In June 2005, a consortium of Italian enterprises signed the first preliminary agreements with Chinese landfill owners, aiming at developing technical and methodological studies in order to sign, in the next six months, a concrete cooperation agreement. Specifically registered for this activity, the Italian consortium together with SEPA officers, created a Working Team that carried out a scouting activity of several landfill sites. This process of contacting and dealing with landfill sites operators allowed the Working Team to elaborate an effective approach strategy in line with Chinese regulations on CDM projects.
In April 2005, SEPA completed the phase of scouting and investigation of landfill sites to identify those who were interested in technical cooperation to develop CDM projects with Italian enterprises, as well as to identify the sites that already have investors but are willing to sell Carbon Emissions Reduction Credits (CERs) to Italy. Among the 13 landfill sites selected during this phase, two sites signed a preliminary cooperation agreement with the Italian consortium and three other sites did so in July 2005. The signature of such agreements opened a phase that consisted in the verification of the data collected, the implementation of the CDM procedure and application, and at the same time the preparation for concrete technical cooperation. As soon as the CDM application will be approved, the construction phase will start.

Energy from Biomasses

Within the Cooperation Agreement signed on May 16th 2003, the Italian Ministry for the Environment and Territory (IMET) and the Ministry of Science and Technology of the People's Republic of China (MOST) jointly decided to cooperate in the development of a feasibility study on energy production from biomass.
The use of biomass for energy production has been recognized as an effective measure to control, reduce and prevent anthropogenic emissions of greenhouse gases, thus contributing substantially to the mitigation of climate change.
The implementation of the project has

been done in such way as to consider it as a Sino-Italian Clean Development Mechanism project case under the Kyoto Protocol in order to demonstrate the GHG emission reduction potentiality.
The Parties introduced two different proposals in the feasibility study, each of them relevant for different approaches:
_ Biomass Cogeneration Plant based on the complete combustion of rice husks; the project consists of a 6.5 MW power plant entirely fed by rice husks produced by local mills.
_ Pilot Demonstration Project for Power Generation based on Biomass gasification Technology.
The project's objectives are: to provide electricity in an area that is short of electrical supply; to serve as a pilot project for clean energy production with no appreciable carbon emissions; to assist in the management and disposal of rice husks which imply logistic and storage problems as well as methane emissions.
Both feasibility studies have been completed; the design of the industrial project is actually been carried out, while the Parties are bringing forward the procedure to file it as a CDM project to the CDM Executive Board.

Sustainable Development of Energy and Environment in Tibet

Within the framework of the cooperation

between the Italian Ministry for the Environment and Territory (IMET) and the Ministry of Science and Technology of the People's Republic of China (MOST), and in consideration of the available energy resources and their rational utilization in Tibet, on August 31st 2004 in Lhasa, MOST and IMET signed an Agreement for the "Promotion and Dissemination of Renewable Energies in Tibet".
The joint activities in Tibet have been designed and implemented to build an integrated package of measures for the use of different renewable and conventional energy sources in order to meet, in a sustainable way, the energy demand in Tibet.
The working group is made up of Chinese and Italian experts; in particular, the Italian group is constituted by experts of hydropower, geothermal and solar energy, and energy planning, whereas the Chinese side consists in five governmental entities and research institutes. The Group has produced a joint report to present the work that has already been done and the expected next steps on solar and geothermal energy. In particular, the report defines an energy plan proposal for the Tibetan Region, which has to consider the potentiality of energy production from both renewable energy sources and from fossil fuels, as well as the demographic distribution in Tibetan Region and the development trends. Moreover, the report includes an evaluation on the technological and financial measures for the promotion, development and dissemination of renewable energies in Tibet.
The reports and proposals will include suggestions and possible pilot projects that should start within 2006. A special attention will be given to identify financial mechanisms to integrate public and private resources, including the World Bank and the Global Environmental Facility.

Development of photovoltaic – Hydrogen hybrid energetic systems

In consideration of future energy development and the progress of technologies, renewable energy is the best option to increase energy security and to deal with the protection of regional and global environment. Therefore, within the framework of the cooperation between the Italian Ministry for the Environment and Territory (IMET) and the Ministry of Science and Technology of the People's Republic of China (MOST), both Parties agreed to implement a feasibility study for the application of Hybrid PV/FC technologies in China.
In the project experts of China and Italy have been working jointly to study the development trends of Solar PV/FC technologies, in order to obtain practical applications of such technologies.
At present, the team is working on the "Feasibility Study Report on 100 KW Class PV/FC Demonstration Hybrid Power Station", which includes: the analysis of resources and market demands in China for the development of PV/FC Hybrid Power Systems; the development, application status and forecast of PV/FC technologies in Italy, Europe, China and all the world; the R&D, product status and forecast of PV/FC generator facilities and devices; the general design scheme of PV/FC demonstration projects; the selection of locations of the demonstration project; the design of the demonstration project and the performance index in the main facilities; the fund raising and investigation of the demonstration power station; the economic analysis and the evaluation.

Study of CDM Projects in China Key Sectors

Sponsored by the World Bank, the Italian Ministry for the Environment and Territory (IMET) and the Chinese Ministry for Science and Technology (MOST), a study to promote Clean Development Mechanism projects in the energy sector in China has been carried out.
The project allowed setting up a methodology in two key sectors of the Chinese economy, i.e. steel and iron and

building sectors. In both cases, specific projects for carbon credits generation in the framework of the Clean Development Mechanism have been selected.
The study aims to develop real CDM cases in China, including the work related to methodologies and economic-financial analysis. The project is based on four lines of activities/tasks: (1) Methodology, (2) Cases (3) Economic Analysis of Certified Emission Reduction Credits (CERs) and (4) From Cases to Methodology. Italy has been devoting its operational contribution to the fourth task.

Sino-Italian Pavilion

With the cooperation among IMET, MOST and Tsinghua University, the Sino-Italian Pavilion (SIEEB) is being under construction on the campus of Tsinghua Univiersity.
The Pavilion is an "eco-intelligent" building referred as a model for the use and diffusion in the Chinese building industry of high energy and environmental efficiency materials and technologies. It is entirely realized with Italian technologies and is a showroom of Italian enterprises and Italian innovation in eco-building.
The project aims at introducing Italian technologies in the Chinese housing sector - which has a rushing development -, and to contribute to the improvement of efficiency standards and regulations to reduce energy and water consumption

VIU Training Activities March-June 2006

It will be a hot spring for the Sino-Italian Training Program!
9 Training sessions will be arranged between Italy and China and **more than 200 participants** will be involved in the training activities.
Between March and June, almost all Chinese institutions cooperating in the Sino-Italian Cooperation Program will send their delegations to Italy, so that outstanding Chinese representatives will have the chance of enjoying the spring beauties of Italy.
However, the news of the season is an intense 3-days training in Shanghai devoted to *Capacity Building on Clean and Development Mechanism* organized thanks to the support of the **Shanghai Environmental Protection Bureau** (March 23 to 25). The training session will involve Italian and Chinese lecturers from the Fondazione ENI Enrico Mattei, the Shanghai Development and Reform Commission, MOST, SEPA and the PMOs of Shanghai and Beijing. The SEPB will also participate in an Italian training session devoted to *Urban Sustainable Development and Eco-Building* (May 28-June 10).
The **Chinese Ministry of Science and Technology** has just opened the season in Italy with a Training on *Energy Efficiency and Renewable Energy*, organized in cooperation with the China Energy Research Society (February 25-March 11). As in the past two years, a training session on *Capacity Building on Sustainable Development* will be organized in cooperation with The Administrative Centre for China's Agenda 21. The peculiarity of this training, which will introduce 30 participants (mostly Deputy Directors from Science and Technology Bureaus of different Chinese provinces) to a general overview of sustainable development, is that it will consist in two parts: a first introductory session will take place in Beijing and a second, with a more in-depth approach, will follow in Italy. (Beijing, March 27-31 and Italy April 1-15). MOST will be back in Italy at the end of June, a perfect timing for a training devoted to *Marine Protection*.
During this spring, the **Chinese Academy of Social Sciences** will be in Italy twice, the first time in March with a training session devoted to *Waste Management* (March 4-18), and the second time in May with a training on *Water Pollution* (May 13-27). Given the quite technical profile of the issues, both trainings will be characterized by a high number of site visits.
Also the **State Environmental Protection Administration of China** will be present in Italy with a delegation of 25 Deputy Directors involved in a training session on Sustainable Development and Environmental Management.