Energy management in practice: communities acting to protect the climate

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Abstract

The International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection Campaign works with local governments to reduce greenhouse gas emissions, using a comprehensive and strategic energy management approach. A sampling of the 386 local governments, in 43 countries, participating in the Cities for Climate Protection Campaign demonstrates that concrete actions have improved local energy management and reduced GHG emissions.

Résumé

La campagne "Cities for Climate Protection" du Conseil international pour les initiatives locales en environnement (ICLEI) a été lancée en collaboration avec des collectivités locales dans le but de réduire les émissions de gaz à effet de serre grâce à une approche complexe et stratégique de la gestion de l'énergie. Un échantillon de 386 collectivités locales dans 43 pays participent à la campagne, apportant la preuve que des actions concrettes permettent d'améliorer la gestion de l'énergie à l'échelon local et de réduire les émissions de gaz à effet de serre.

Resumen

El Consejo Internacional para Iniciativas Ambientales Locales (ICLEI) colabora con los gobiernos locales a través de la Campaña de Ciudades para la Protección del Clima, con el fin de reducir la emisión de gases de invernadero, sirviéndose de un enfoque integral y estratégico de la gestión de energía. Una muestra de 386 autoridades locales de 43 países, que participan en la Campaña de Ciudades para la Protección del Clima, testifica que las acciones concretas resultan en la mejora de la gestión local de energía y la reducción de la emisión de gases de invernadero.

The current report of the Intergovernmental Panel on Climate Change (IPCC) ratifies the conclusion arrived at in 1995: that human activity is the most significant cause of the increasing greenhouse gas emissions responsible for an accelerating increase in the Earth’s surface temperature. The 1990s proved to be the hottest decade on record, with each month from May 1997 to September 1998 breaking the previous monthly world average temperature record.

What are the human activities the scientific community is referring to? The most substantial is the burning of fossil fuels, which releases CO₂, the major heat-trapping gas being added to the atmosphere. Deforestation, land clearance, and waste products from intensive agriculture and urban waste management practices also contribute. However, it is the 20th century’s dependence on fossil fuels to fulfill energy needs—burning coal, oil or natural gas to generate electricity, power vehicles, heat and cool buildings, or manufacture products—that is the nucleus of the problem. Managing energy needs and changing energy sources are thus at the heart of the solution.

Political attention to this issue is largely focused on negotiations among national governments to reach agreement on the UN Framework Convention on Climate Change and to hammer out mechanisms to meet the emissions reduction targets in the Kyoto Protocol to the UNFCCC. Local governments are generally in the background of the international debate, but they have significant influence on GHG emissions throughout the world.

ICLEI’s effort to understand the relationship between urbanization and climate change began in 1991 through the Urban CO₂ Reduction Project, which brought together a group of 14 US, Canadian and European cities to analyze communities’ contribution to the total of greenhouse gas emissions and to develop a municipal planning framework for GHG reductions. The hands-on research conducted by ICLEI staff and consultants and the participating cities revealed a striking correlation between the level of emissions in the community and factors such as population density, type of infrastructure, land use patterns, presence of transit options and transit system design, local building design, use of combined heat and power systems, and type of waste management practices. These factors, often wholly or partly controlled by local governments, have profound and long-lasting effects on the level of energy and fuel used, and waste generated, thus affecting the level of air pollution and greenhouse gas emissions emanating from a particular locality.

The lessons learned from the Urban CO₂ Reduction Project led ICLEI to initiate the Cities for Climate Protection (CCP) Campaign, which helps cities, counties, towns, and other local authorities address global warming through a comprehensive and strategic energy management approach. Today, 386 participating local governments in 43 countries are taking concrete steps to improve energy management and reduce greenhouse gas emissions.

Cities influence energy use and global emissions

The human population increasingly lives in cities. As countries develop technologically and industrially, those that were largely rural are rapidly becoming urbanized, increasing the rate and quantity of energy use.

From the point of view of energy management, urbanization can be a curse or a blessing. Cities’ physical form and organization have a profound effect on the level of energy use and the quantity of greenhouse gases emitted. In studying the differences between European and North American cities, the Urban CO₂ Reduction Project found that higher urban population densities facilitated urban settlement and development patterns, transit and transportation systems, and housing and building characteristics that resulted in lower per capita energy use. Yet population density was not itself the determinant of energy use levels.

Details in the planning, design and building of the European cities, such as transit and auto infrastructure, a mix of uses that put housing, jobs and services in proximity rather than separated by long distances, and incorporation of district heating and cooling systems, provided efficiencies in energy use that were absent in cities in North America (Figures 1-3).

The findings of the Urban CO₂ Reduction Project showed that local governments are in a unique position to affect energy use and reduce greenhouse gas emissions. While they cannot legislate carbon taxes or mandate nation-wide changes in the fuel mix for electricity or other energy supply, the facilities they operate and the decisions they make significantly influence present and future levels of energy consumed, fuel used and waste generated in the communities they serve.

Local governments have a critical role to play in the energy management and global climate change picture because:

- Decentralization of powers and authority from national governments to lower levels of government is expanding rapidly worldwide;
Local governments own and operate buildings, vehicles, and facilities such as recreational facilities, street lighting and water supply and treatment that directly consume large quantities of fuel and electricity.

- Local governments manage and operate landfills and waste treatment plants, which are major sources of methane.
- Local government expenditures are a significant portion of GNP in most countries, giving local governments significant market influence with regard to vehicles, equipment and technologies.
- Local governments control local land use policies, determining where buildings and development are located and the mix of uses allowed. Zoning, permits and municipal by-laws influence energy use by affecting residential and commercial density, residential access and proximity to services, transit accessibility and other factors.
- Local governments make or influence infrastructure decisions and investments, such as for roads and the type of transportation or transit systems.
- Local governments control the type of transportation or transit systems they use – from fuel and electricity use to waste management and transport. The local government begins by collecting data on electricity and heating fuel used in the residential, commercial and industrial sectors. Distance travelled and fuel consumed by vehicles, and quantities of waste-generated and waste treatment methods. This information provides the local government a picture of the energy system and the emissions resulting from these various activities.
- The next step is moving from understanding to action. The local government now knows what activities are the main source of emissions. Because most local governments are concerned about the cost of the energy system or the negative impact it may be having on air quality, rather than the issue of global climate change, the tools ICLEI provides convert the local government’s energy data not only into GHG emissions but also into costs of energy and fuel use and the emissions of standard air pollutants. The emphasis is on motivating action; the tools and assistance ICLEI provides help the local government evaluate the beneficial impact of the variety of measures it has initiated and map the local government’s impact on air quality.

- Recognizing these energy forms and uses, the CCP is structured to encourage local governments to analyze all aspects of their communities’ energy use – from fuel and electricity use to waste management and transport. The local government begins by collecting data on electricity and heating fuel used in the residential, commercial and industrial sectors. Distance travelled and fuel consumed by vehicles, and quantities of waste generated and waste treatment methods. This information provides the local government a picture of the energy system and the emissions resulting from these various activities.

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The initial focus of ICLEI’s work was on cities in Annex 1 countries, where the majority of greenhouse gas emissions are produced. In 1998, ICLEI initiated the Climate Action Project, involving five local governments in Mexico and six in the Philippines, to test the CCP Campaign in developing countries.

Although their greenhouse gas emissions per capita are still quite low, the CCP strategic approach is appropriate for cities in rapidly growing, industrializing economies, both to address the immediate problems of serious air pollution and inefficient energy systems and to reverse “business as usual” scenarios projected to produce substantial emissions growth.

The rapid growth rate in infrastructure and other development that characterizes cities in developing countries presents a precious opportunity to plan for and build in energy efficiency and environmental sustainability that would be
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*Performance Milestones*


2. Adopt an emissions reduction goal. ICLEI encourages participants in Annex 1 countries to adopt the "Toronto target" to reduce GHG emissions by 20% from 1990 levels by the year 2005 or 2010. Cities in non-Annex 1 countries are encouraged to choose a goal appropriate to local conditions, such as stabilizing per capita emissions.

3. Develop a Local Action Plan. The Local Action Plan contains the policies and measures that, implemented, will achieve the emissions reduction goal.

4. Implement policies and measures. This can be a first step, since the local government may choose to start implementing emissions reduction measures before completing the Local Action Plan.

5. Monitor and verify results. The final step is to monitor and verify progress on the implementation of actions and to quantify emissions reductions.

much more costly to put in place later. Decisions that local governments make about land use, transportation, building construction, infrastructure investment, and industrial and urban development will either mitigate or exacerbate global warming, air pollution and other urban problems. Applied comprehensively, ICLEI's model can improve urban energy management in a manner that reduces energy demand, energy costs and the negative impacts associated with energy use, while expanding the use of clean energy sources.

The analysis and planning undertaken by cities as they move through the CCP's milestone process will help get the "energy system" right. Research indicates that when cities plan and develop with energy efficiency in mind, per capita energy consumption for residential and transportation needs can be cut by several tens of per cent from typical levels. Initial build-in or inclusion of technologies for clean energy, energy efficiency and low GHG emissions comes at a much lower cost than that required to retrofit such systems and technologies later. The rate of development and the enormity of infrastructure investments in developing country cities provide an even stronger rationale for employing the type of methodology embodied in the CCP's Five Milestone Framework.

Urban climate protection in action

ICLEI has developed a standardized methodology for completing the Five Milestone and for monitoring, measuring and reporting municipalities' emissions reduction performance. This protocol is embedded in the CCP Greenhouse Gas Emissions Software developed by Torrie Smith Associates, currently used by 150 local governments in Australia, Canada, Mexico, the Philippines and the United States.

The CCP software facilitates the emissions analysis process: estimates the potential benefits of proposed emissions reduction measures; and tracks reductions of GHG emissions, air pollutants, cost savings and other co-benefits of specific actions. The software converts energy and waste data into both GHG and standard air pollutant emissions, as well as estimating potential reductions that could result from implementing specific energy efficiency, fuel-switching, waste reduction or other measures (Figure 4).

The examples that follow illustrate the CCP methodology in practice. With the exception of the European example, the emissions inventories and quantification of emissions reductions from measures were calculated using the CCP software.

United States

The Cities for Climate Protection Campaign has been active in the United States since 1995. Seventy-two cities and counties, representing 10% of total US greenhouse gas emissions, now participate.

Portland, Oregon's local government participated in the CCP's predecessor, the Urban CO₂ Reduction Project. Portland was the first US city to adopt a local strategy to cut global warming emissions. It identified transportation and building energy use as the primary sources of emissions and set a community-wide reduction target of 20% below 1990 levels by 2010.

Measures being implemented as part of Portland's Local Action Plan include:

- City Energy Challenge Programme: energy efficiency retrofits for municipal buildings and the efficient design of new municipal buildings and facilities.
- 9.5 million kWh of electricity reduced
- $1.3 million saved by the city in reduced energy expenditures
- CO₂ emissions reduction = 4269 tonnes
- Renewable Energy Power Purchase: Portland developed a contract with an electric utility to guarantee 5% of electricity would be produced by new wind power sources
- 4 million kWh switched to wind power
- CO₂ emissions reduction = 1863 tonnes

Adopt an emissions reduction goal. ICLEI encourages participants in Annex 1 countries to participate.

- Develop a Local Action Plan. The Local Action Plan contains the policies and measures that, implemented, will achieve the emissions reduction goal.
- Implement policies and measures. This can be a first step, since the local government may choose to start implementing emissions reduction measures before completing the Local Action Plan.
- Monitor and verify results. The final step is to monitor and verify progress on the implementation of actions and to quantify emissions reductions.
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- Residential Home and Multi-unit Weatherization Programme provides energy efficiency services to homes and apartment dwellers.
- 19,030 households have received energy efficiency improvements
- $2.5 million saved in reduced energy expenses over the past 10 years
- CO₂ emissions reduction = 10,970 tonnes
- Partners for Energy Efficiency: provides technical assistance, incentives and tax credits for energy conservation measures in commercial buildings.
- 436,193 million BTU reduced
- CO₂ emissions reduction = 38,355 tonnes
- Fuel Cell for Electricity Generation: Methane from a waste water treatment plant powers a hydrogen fuel cell to generate electricity. The 200 kW fuel cell uses 20% of the treatment plant’s methane and produces enough power to eliminate the need for the facility’s back-up generator.
- 1,960,000 kwh saved
- $78,460 saved in reduced electricity expenses
- CO₂ emissions reduction = 882 tonnes
- Change in Land Use Policies: 2500 new housing units per year in the downtown area have reduced the length and number of vehicle trips. 2.5 million vehicle miles traveled (VMT) eliminated.
- 137,958 gallons of gasoline saved
- $179,346 saved in reduced fuel expenses
- CO₂ emissions reduction = 1380 tonnes
- Recycling: The Portland metropolitan area now recycles 3% of all solid waste, up from 26% in 1988. Its recycling goal is 60% by 2005.
- As of 1995, Portland’s actions had reduced per capita emissions 3% below 1990 levels, and had decreased emissions from the city/local government operations to more than 15% below 1990 levels (Figure 5).

Australia
Since the Cities for Climate Protection Campaign began in Australia in late 1998, 88 local governments (representing over 40% of Australia’s population) have taken up the challenge. The campaign’s target is to recruit 200 local governments (representing half the country’s population) by 2003.
The city of Brisbane in Queensland is the largest local government in Australia. Brisbane’s baseline emissions inventory showed that 70% of the 1.02 million metric tonnes of GHG emissions produced by city government operations came from methane emanating from the Brisbane’s landfill sites and waste water treatment plants, 23% from electricity consumption and the remainder from vehicle use. The draft action plan, underpinned by a community survey indicating that two-thirds of Brisbane’s population was concerned about climate change, led the Brisbane City Council to adopt the goal of reducing greenhouse gas emissions from their municipal operations 20% below 1990 levels by 2003. A priority area is to capture and use landfill and sewage gas for energy production. This builds on the success of Brisbane’s Luggage Point sewage treatment plant, where methane is being converted into electricity – offsetting approximately 5% of municipal consumption. Brisbane has a landfill gas project which is using recovered gas to heat a municipal swimming pool. In 1999, these initiatives saved the city more than US $1 million in electricity costs and cut CO₂ emissions by approximately 12,000 tonnes.
Electricity use in Brisbane’s municipal facilities amounts to almost 225 GWh, costing $A 16 million per year and producing 250,000 tonnes of CO₂ emissions. An energy performance contract covering three major buildings, including the City Hall, has cut electricity consumption by 2 GWh. The city’s primary strategy for reducing motor vehicle emissions is to convert its fleet of more than 600 buses to compressed natural gas (CNG).

Europe
Overall, 102 local governments throughout Europe participate in the Cities for Climate Protection Campaign. Over 30 of them have reached milestone 5 and are in the process of monitoring and verifying the outcomes of their local action plans. Many of the European CCFP municipalities are meeting their emission reduction targets through switching to cleaner or renewable fuel sources of electricity, installing energy efficiency measures in buildings, and implementing district heating systems.
Copenhagen, which was an original participant in ICLEI’s Urban CO₂ Project, set a GHG reduction target of 30% by 2005 with 1990 as the base year. Coal was then the primary fuel used in generating electricity and heat, making that end-use responsible for 63% of the city’s GHG emissions. Copenhagen owns and operates its own energy supply, giving it the power to modify the energy supply infrastructure in order to improve energy efficiency and cut emissions. Two of the six main areas of action in Copenhagen’s Local Action Plan reduce reliance on coal as a fuel source, for a projected reduction of 830,000 tonnes of CO₂ and the corollary reduction in standard air pollutants (Figure 6). Measures in Copenhagen’s action plan include:

- Combined heat and power
  Expansion of the district heating system to cover 95% of the city’s heating needs. The city used its regulatory authority to mandate compulsory connection to the system and prohibited installation of electric heating in new buildings. This measure accounts for about one-third of its CO₂ reduction target (570,000 tonnes).

- Substitution of natural gas for coal
  Copenhagen determined that most of its coal-fired boilers could be modified to burn natural gas, and that new natural gas generating stations would be less expensive than coal-burning counterparts. The policy aims to triple the use of natural gas for power generation, resulting in a 5% reduction in CO₂ emissions (260,000 tonnes) and cleaner air.

- Waste management
  By 1995, Copenhagen had met its goals of recycling or composting 56% of household, commercial and industrial waste. As a result, 400,000 tonnes of CO₂ emissions were cut, an 8% reduction compared with 1990.

- Commercial and residential energy services
  The City Lighting Department offers proactive educational and technical services that include energy audits and information about energy-saving appliances and practices for all consumers. These services are expected to reduce CO₂ emissions by 290,000 tonnes by 2005.

The Philippines
Six local governments in the Philippines partici-
ILEI is an association of local governments dedicated to preventing and solving local, regional and global environmental problems through local action. Its mission is to build and support a worldwide movement of local governments to achieve tangible improvements in global environmental and sustainable development conditions through cumulative local action. More than 350 cities, towns and counties and their associations worldwide comprise ICLEI’s membership. They and hundreds of other local governments are engaged in ICLEI’s regional projects and international campaigns. ICLEI serves these municipalities as an information clearing house on sustainable development. It provides policy guidance, training and technical assistance, and consulting services to increase local capacity.

Through its three international campaigns, ICLEI generates the policy commitment of participating municipal councils to address regional and global environmental challenges while building local capacity to address these challenges.

The Cities for Climate Protection™ Campaign (CCP) is a global campaign to reduce emissions that cause global warming and air pollution. Since 1993, it has engaged in this effort more than 385 local governments, which account for approximately 7% of global greenhouse gas emissions.

The Local Agenda 21 (LA21) Campaign, initiated by ICLEI in 1992, seeks to generate tangible results and increase standards of local performance through instituting broad-based participatory planning processes aimed at achieving sustainable development. It is estimated that over 3000 communities worldwide have undertaken an LA21 planning process.

The Water Campaign, launched in June 2000, at Global Cities21®, ICLEI World Congress of Local Governments, provides local governments with a supportive framework to address their unique local water management concerns while helping the current global water crisis. Regional projects focus on diverse priorities and needs. They include environmental budgeting, eprocurement and environmental management systems.

Through its Members, ICLEI represents a substantial local government voice in regional and international deliberations on sustainable development. Since its establishment, ICLEI has worked continuously to bring the voice of local government before national and international agencies. As a result of its efforts, delegations of local government have presented their concerns and successes to annual meetings of the U.N. Commission on Sustainable Development and to key meetings of the Conference of the Parties to the U.N. Framework Convention on Climate Change.

ICLEI also has helped represent local government at the U.N. Centre for Human Settlements (UNCHS) Habitat II, City Summit. In 1999, ICLEI, UNCHS and UNEP jointly authored a memorandum of understanding by which ICLEI will serve as a bridge linking local government actions to the global programmes of these international bodies.

ICLEI Offices Worldwide are located in Toronto, Canada; Freiburg, Germany; Tokyo, Japan; Berkeley, California, USA; Harare, Zimbabwe; Melbourne, Australia; and Santiago, Chile.

For more information about ongoing activities, visit the ICLEI website: http://www.iclei.org or contact the ICLEI World Secretariat, City Hall, 16th Floor, West Tower, Toronto, Ontario, M5H 2N2, Canada. Tel: +1 (416) 392-1462, Fax: +1 (416) 392-1478, E-mail: icel@iclei.org.
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From the operation of water and sewerage infrastructure, to the construction and maintenance of roads and transit systems, to the planning processes that determine development and settlement patterns, local governments already play a large, yet unappreciated, role in determining energy use and global greenhouse gas emissions. Working with local governments to respond to immediate needs for clean energy, efficient infrastructure, effective transportation and cleaner air, Cities for Climate Protection is helping to put in place the long-term decision-making processes and practices ultimately needed to meet the threat to our global climate.

The International Council for Local Environmental Initiatives (ICLEI), founded in 1990, is an international association of local governments dedicated to the prevention and solution of local, regional and global environmental problems through local action. The Cities for Climate Protection Campaign (CCP) and its Five Milestone Framework are registered trademarks of ICLEI.

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Notes
1. Since CO₂ and methane are the principal GHG emissions globally and in urban areas, the Climate Protection Campaign’s methodology targets and measures these two emissions. In this article, references to GHG emissions in the context of the CCP therefore refer to CO₂ and methane.
2. Tonnes in this example are US or “short” tonnes. Quantification citations for all other examples are metric tonnes.
3. For quantification purposes, methane emissions are converted to “equivalent CO₂” or eCO₂.

References
Jessup, P. and R. Torrie (1995) Saving the Climate, Saving the Cities. ICLEI.
Building networks of energy-efficient cities: some practical experiences in Europe and Brazil

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Energy policy today has to combine initiatives directed at both energy supply and energy demand. A new energy policy, based on management of energy consumption and increasing use of local (renewable) energy resources, has become necessary due to the growing pressure of environmental constraints and energy-saving behaviour since the oil price crises. The local and regional levels are partners in this approach. The development of energy efficiency projects, and the exchange and spread of information on best practices among municipalities, are being organized worldwide by networks of energy-saving institutions. Several examples of the development of such networks are presented below.

An established network for building local government capacity for sustainable development is the International Council for Local Environmental Initiatives (ICLEI). The European Commission is drawing on three networks of local authorities: Energie-Cités for municipalities, Islenet for islands, and the European Federation of Regional Energy Agencies (for regions) and Islenet for islands. These networks' roles include:
- distribute information;
- assist in forming partnerships to draw up proposals;
- distribute results;
- encourage exchange of experience and know-how among local authorities in Europe;
- make proposals and express opinions on European Commission proposals.

About 170 local, regional and island energy agencies have been supported by the EC. Sixty-four were local agencies sponsored by municipalities. There are Local Energy Management Agencies belonging to the Energie-Cités network in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain, the Netherlands and the United Kingdom.

The EC, as part of SAVE II, provides financial assistance with setting up local or regional teams in municipalities and regions. To encourage exchange of experience and transfer of know-how, local authorities are required to network with other authorities. The programme is open to EU Member and associated States.

In Eastern Europe, institutional energy-saving capacity building at the local level started as part of system transition. An important example is the Center for Energy Efficiency EnEff, established at Sofia in 1992 to improve energy efficiency and support the efforts of central and local authorities in Bulgaria to attain sustainable development. EnEff was founded with initial financial support from Battelle/Pacific Northwest Laboratory in the U.S. in collaboration with the US Environmental Protection Agency, U.S. Department of Energy and USAgency for International Development.

EnEff belongs to national and international networks. On the national level it is the executive agency of the Municipal Energy Efficiency Network, which in 1999 consisted of 26 Bulgarian municipalities working in close collaboration with Energy-Cités to reduce energy costs. The international network of energy efficiency centres in Eastern Europe consists of the Polish Energy Efficiency Foundation (FEWE), with branch offices in Klaipėda, Krakow and Warsaw; the Czech Centre for Energy Efficiency (CEN Ef) in Prague; the Russian Centre for Energy Efficiency (CEN Ef) in Moscow; and the Centre for Energy Efficiency of Ukraine (ArenEco) in Kiev. Also participating in this network is the Chinese Centre for Energy Efficiency and Renewable Energy Sources (BeCon) in Beijing. This new network aims to foster cooperation in energy efficiency among both local authorities in China and local authorities in the European Union.

Local Sustainability was launched at the 2nd European Conference on Sustainable Cities and Towns in Lisbon on 6 October 1999. Three key services cover good practice guidance, examples, and policy documents on sustainability and the urban environment. For Local Sustainability, the European Good Practice Information Service is developed and operated by EURONET Environment Planning and Development and ICLEI, with financial support from the EU.

The searchable Best Practices database contains over 650 proven solutions to common social, economic, and environmental problems in an urbanizing world. This database, a joint product of UNCHS (Habitat), the Dubai Municipality and the Together Foundation, has been made possible with support from the Best Practices Partners and the governments of Spain, Switzerland and the UK.

The Climate Alliance of European Cities with Indigenous Rainforest Peoples is a network of European local authorities and indigenous rainforest peoples, whose goal is protecting the Earth's atmosphere. In January 2000, nearly 900 European member cities worked jointly on drawing up and implementing climate protection action plans and cooperated with the partners to preserve tropical rainforests. Climate Alliance members are located in Austria (209), Belgium (7), Denmark (5), Germany (403), Italy (58), Luxembourg (13), the Netherlands (107), Spain (2), Sweden (3) and Switzerland (12). There are 38 associated members. An example of this network's approach concerns the Swedish town of Våxjö (70,100 inhabitants), which has decided to stop use of fossil fuels by the municipality and to reduce CO₂ emissions by 50% by 2010. The decision to stop using fossil fuels resulted from Local Agenda 21 work. Several local companies have praised this decision. Våxjö has managed a decrease of almost 20% of CO₂ emissions per inhabitant since 1993, mainly related to the heating sector.

The networking of municipalities to save energy costs also has a foothold in Latin America. In October 1998, the Network of Energy Efficient Cities was launched in Brazil as an ELETRON BRAS initiative. Its purpose is to persuade municipalities to implement "Municipal Energy Management (Gestão Energética Municipal, or GEM) in order to reduce energy waste in areas such as public illumination, sanitation and buildings. At the end of 1999, approximately 265 municipalities in Brazil had joined the network, with the aim of facilitating the exchange and spread of information on the development of electric power efficiency projects among both Brazilian and non-Brazilian municipalities. Successful local experiences, stored in a database, will be disseminated in the form of bulletins and at network meetings.

One of the network's major activities is organizing courses on subjects related to energy management. They include talks to raise technical staff's awareness of the problem. One of the benefits for towns integrated in the network is the possibility of reducing electric power bills through implementing procedures that inhibit energy waste. The network wants to foster technical co-operation, as well as national and international agreements, with a view to improving energy-efficient management and activities.

The establishment of well functioning and innovative networks of energy efficiency institutions on the central and regional/local levels has been going on for over a decade. The initiatives of cities concerned with energy-saving and renewable energy sources play a crucial role in this process. However, these networks require stabilization and extension, for example in regard to education and awareness raising.

References

Climate Alliance, CLIMAIL europe99/2. Energie Saveo Grow, published by FURNAS CENTRVAL/ELETRIC RASSA, Rio de Janeiro (E-mail: energyplus@furnas.gov.br).

Energie-Cités, list of local energy agencies (http://www.energie-cites.org/Textesweb/englishversion/planlops.html).

Urban environmental management

Intelligent building = green building

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Abstract
Over the past decade, the term “intelligent building” has been used extensively to describe new high-tech buildings. This term has been quite popular in Asia, where many of the largest new building construction projects have taken place. The intelligent building concept naturally links to environmentally friendly “green buildings”. This article includes a description of the Brengel Technology Center, one of the first 12 buildings certified under the US Green Building Council LEED (Leadership in Energy and Environmental Design) Green Building Rating System.

Résumé
Depuis une dizaine d’années, on parle souvent de “bâtiments intelligents” pour décrire les nouvelles constructions high-tech, notamment en Asie où ont été réalisés la plupart des plus gros projets récents de construction. Le concept de bâtiment intelligent est lié tout naturellement à la notion de “bâtiments verts”, respectueux de l’environnement. L’article présente le Brengel Technology Center, l’un des 12 premiers bâtiments à avoir reçu le label LEED (Leadership in Energy and Environmental Design) décerné par le US Green Building Council selon son système de notation baptisé “Green Building Rating System”.

Resumen
Durante la última década, el término “edificio inteligente” se ha aplicado en particular a aquellos edificios con la más alta tecnología. El vocablo se ha hecho muy popular en Asia, donde se han erigido muchos de los mayores proyectos de edificación actuales. El concepto de edificio inteligente está naturalmente vinculado al de “edificio verde”, respetuoso del medio ambiente. El presente artículo ofrece una descripción del Brengel Technology Center, una de las 12 primeras construcciones premiadas con el galardón LEED (Lider en energía y diseño ecológico) del Consejo Estadounidense de Construcción, según el Sistema de clasificación de edificios verdes (Green Building Rating System).

Definition of an “intelligent building”
The definition of an “intelligent building” has been controversial since the term was coined 15 years ago. It was first used in the United States to describe buildings offering shared tenant services, such as long distance access, through a common PABX.

NTT, the Japanese telephone giant, used a three circle model to describe an intelligent building (IB) (Figure 1). This model implies that integration of the telecommunications, office automation and Building Automation Systems make the building intelligent.

The European Intelligent Building Group (EIBG) produced a triangular model of an Intelligent Building with a “Computer Integrated Building” at the apex, supported by Building Automation and an Integrated Communications System (text, voice, data, image, etc.).

In the U.S., the Intelligent Building Institute (IBI) created another intelligent building model (Figure 2).

In Malaysia, the Kuala Lumpur city hall issued “Intelligent Building Guidelines” which assigned a star rating (similar to hotels). These guidelines did not mention office automation or telecommunications, but addressed many architectural issues (height of lobby, etc.).

A survey conducted by Singapore’s Construction Industry Development Board (CIDB) showed that some industry professionals would go to mechanical and electrical consultants for more advice on building intelligence, while others would go to office automation specialists. In other words, there is disagreement on what constitutes an intelligent building, even within the same marketplace.

The latest development is to figure in energy efficiency when intelligent buildings are being defined. Increasingly, energy efficiency has taken on a broader meaning – it means green. In today’s urban areas, with their density of population and structures, and often depleted or degraded environments, making buildings green has taken on a new urgency. Today, it is highvoltage power, urbanization, organic compounds (VOCs), rather than heavy industry factories belching smoke, that have the greatest global impact, simply because of their relative numbers.

I would like to introduce my own definition of intelligent buildings, which I believe encompasses all of the other definitions. My definition is...

Owner needs
Low first costs
Imagine that you buy a new 10 horsepower motor, the type commonly used in air conditioning systems. Imagine that you then run this motor 24 hours each day. How long before the electricity cost to run the motor is equal to the capital cost of buying a new one? When asked this question, most “building experts” would estimate a period of one to two years. In fact, in almost all countries the correct answer is two to three months. This message is that even “building experts” are overly focused on first cost, rather than considering life cycle costs. The lifecycle cost of a US office building over 40 years has the following components:

- 25% construction/financing costs;
- 25% energy costs;
- 25% operations and maintenance costs;
- 25% retrofit costs.

Low operating and maintenance costs
Increasingly, professional building managers are trying to standardize procedures and are turning to computers as a tool. For example, an integrated Building Automation System provides a computerized platform to accommodate...
Low energy consumption

Lowering energy consumption impacts more than just energy costs. In the US, the State of Wisconsin recently embarked on a Wisconsin Energy Initiative (WEI). WEI brought the state significant financial and energy savings and reduced pollution. Wisconsin saved more than US$10 million through better prices, reduced energy use, and utility rebates. State energy demand has been reduced by 20 MWh and energy consumption is down by 61 GWh annually. WEI has eliminated 55,000 tonnes of CO₂, 669 tonnes of SO₂ and 235 tonnes of NOₓ emissions. More than 600,000 used fluorescent light bulbs and 1 million pounds of PCB ballasts have been recycled.

According to the on-line Cleaner and Greenpower “Pollution from Electricity Use” Calculator from the Leonardo Academy (http://www.cleanerandgreener.org/pollution-from-electricity.html), a commercial building in New York that spends US$10,000 per month for electricity generates the following annual pollution:

- 1,068,960 pounds of greenhouse gases (CO₂);
- 15 pounds of volatile organic compounds (VOCs);
- 1,445 pounds of nitrogen oxides (NOₓ);
- 103 pounds of carbon monoxide (CO);
- 3818 pounds of sulphur dioxide (SO₂);
- 33 pounds of particulates (PM₁₀);
- 11,710 mg of mercury;
- 2374 mg of cadmium;
- 28,316 mg of lead.

To save energy in a building, it is important to focus on the major energy-consuming devices and systems. In most buildings, the Heating, Ventilating and Air Conditioning (HVAC) system uses more than half the building’s energy. Together, the HVAC and lighting systems consume more than three quarters of the energy in a typical office building (Figure 4).

Today’s commercial buildings are typically equipped with a Building Automation System which controls the HVAC and lighting to reduce energy. Lifts/elevators come equipped with their own energy-efficient controls.

Occupant needs

A quality building environment

Building occupants want a quality building environment to enhance productivity (Figure 5). A 1995 White House report suggests that, in the US, better constructed facilities could increase employee productivity and comfort up to 30% nation-wide. The Office of Science and Technology Policy released the report.

In a paper presented at the Indoor Air ’96 Conference in Japan, Dr. David Wyon of Johnson Controls showed how individual adjustment of the thermal climate to take account of different personal requirements can improve group average performance of office tasks. The expected improvements were in the range of 2-10%, depending on the task.

“Total labour-related costs per square foot of office space are typically over 100 times greater than the costs of regulating temperature and maintaining the building,” says Dr. Wyon. “If these operational costs were doubled to achieve a quality building environment, they would pay for themselves with only a 1% improvement in occupant productivity. A quality building environment does not have to be costly, but it does have to be better thought out and better maintained.”

Comfort involves more than temperature. Other factors, such as lighting and acoustics, also affect how comfortable an employee is in the workplace. Studies have shown that effective ventilation, adequate lighting, good acoustics and superior indoor air quality can increase productivity by 6-15%.

Flexibility

The facility infrastructure must deliver five services to the desktop: air conditioning, lighting, power, data and telephones. The intelligent building must also be able to deliver these services when they are required (time flexibility) and how they are required (space flexibility).

In the future, the occupancy pattern of buildings will be changed due to:
- increasing use of “flex-hours” to reduce traffic congestion;
- shifting demographics in the workplace, from clerical to knowledge workers;
- globalization, requiring extended support and video conferencing.

As shown in Figure 6, the amount of time a building will operate at partial occupancy will increase dramatically.

This situation raises some interesting issues that have received little attention in previous building design:
- providing effective security in a partially occupied building;
- providing an effective fire detection and prevention system and effectively managing an evacuation of a partially occupied building;
- ensuring that air conditioning and lighting are only applied when required, to minimize energy use.

To meet these challenges, the intelligent building must be designed with many zones and the Building Automation System must be able to control the systems for each zone. The occupancy status of a zone (occupied/unoccupied) can be determined according to time schedules, occupancy sensors, card readers, door lock indicators, or triggered using the telephone or PC. When the Building Automation System of an intelligent building is aware that a zone is occupied, it can automatically:

- set the sensitivity of smoke detectors to low, in order to avoid unwanted alarms;
- inhibit alarm reporting for selected security devices in the zone;
- change temperature setpoints to the occupied level;
- set ventilation requirements to the occupied level;
- turn on the lights in the zone.

An intelligent building must be able to accommodate a changing usage pattern for the space. It must also be able to accommodate dramatic shifts in how the space is used.

According to a 1995 survey conducted by the International Facility Management Association (IFMA) Foundation and Haworth, 83% of companies are participating in alternative-office strategies such as modular workspaces, telecomm-
Urban environmental management

muting, flexible work schedules and hoteling – which one firm describes as “just-in-time offices.” When IBM announced that it had saved more than US $1 billion in real estate expenses through shared office space, corporate America began to take notice.

From today’s vantage point, it is a safe bet that corporations will be in a state of continuous reorganization. They will demand building products that are compatible with reconfigurable architecture systems, are expandable when necessary, and can be modified by the end-user.

Office equipment manufacturers are meeting the flexibility challenge with innovative “plug-and-play” workspace designs. It is now possible for individuals to wheel their personal workspaces – and all the technology they use, such as computers and telephones – into common areas for team meetings. They can drop in or out of meetings easily just by wheeling back to where they came from. In this way, corporations avoid the costly and time-consuming re-arrangement of office space to meet the changing needs of the company.

In an April 1996 cover story, Business Week quoted a Vice President at Procter & Gamble who predicted that innovations like these should help increase productivity by 20-30% at a new P&G facility devoted to product development. The executive said the facility was designed and built “as if we were developing a new product.”

Supporting the corporate mission

“A facility is not just a place to go to work – it’s a place that determines how productive employees will be and how they perceive their company,” says Shari Epstein, a research specialist at the International Facility Management Association (IFMA).

There is increasing awareness that a company’s facilities must reflect and support their corporate mission. Increasingly, corporate missions are reflecting concern about the environment. Many organizations want their buildings to act as a showcase of this concern. As described in the box, the US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System allows recognition of such facilities.

Case study: Brengel Technology Center

The US $5 million Brengel Technology Center, with 130,000 square feet, was built by Johnson Controls in Milwaukee, Wisconsin. The seven-storey facility is a showcase for Johnson Controls’ advanced building controls technology and expertise in creating quality building environments. Johnson Controls, a building systems and energy efficiency expert, is helping customers save US $18 billion in energy costs during the next decade while reducing air pollution by 352 million tonnes.

The new building complements the original building right next door, which was built in the early 1900s and was the first home of what was then Johnson Service Company. It is named for Fred L. Brengel, the fifth executive to head Wisconsin’s largest publicly held company, which now has sales exceeding US $16 billion annually. Dedicated on 21 March 2000, the building will be fully occupied by the summer.

Unique sustainable features

- An open courtyard offers green area in the middle of a major city’s downtown;
- Personal Environments systems give employees desktop control of temperature, lighting, airflow and background noise masking;
- This new building in the city centre mirrors the architecture of the original adjacent headquarters, which is still in use. Employees who bus or bicycle to work are accommodated, with showers available;
- Each employee has the ability to communicate the building’s environmental conditions from his or her desktop computer;
- The Building Automation System optimizes the efficiency and performance of the building’s mechanical and electrical systems, with remote access to any activity from turning off lights to starting their conditioning;
- A roof-mounted weather station helps improve the accuracy of energy applications by forecasting system load;
- Utility services use energy sub-metering, load profiling and cost report generation to better identify savings opportunities;
- Advanced lighting technology complements the abundant natural light.

Other features

- The interior design easily accommodates reconfiguration of employee workstation areas to foster new ways of working;
- Open ceilings with painted ductwork throughout the building allow visitors to see Johnson Controls products in use;
- A single cabling network integrates voice, data, video and controls systems;
- Access and security systems ensure safety.

The Brengel Technology Center was one of the first 12 buildings certified under the US Green Building Council LEED Green Building Rating System.

Rob Moul has been involved with intelligent buildings for 15 years.

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LEED builds performance inside and outside

Breakthroughs in building science, technology and operations are available to designers, builders and owners who want to build green: maximizing both economic and environmental performance.

The US Green Building Council offers a leading edge system for designing, constructing and certifying the best buildings on the planet – buildings that save energy and water, reduce pollution and waste, and enhance occupant health and productivity. The USGBC is a non-profit, consensus-based coalition of diverse leaders from all sectors of the building industry.

Leadership in Energy and Environmental Design, or LEED™, is a comprehensive system of building rating and certification that offers:
- well-founded scientific standards;
- up-to-date green building training;
- a professional accreditation programme;
- knowledgeable technical support;
- prime educational and internet resources.

LEED guides

The LEED Green Building Rating System (the complete framework of standards for setting building goals), used in concert with the LEED Reference Guide (a comprehensive reference tool of design and construction strategies), shows builders how to:
- maximize efficiencies in resource investment and energy use;
- achieve optimal economic and environmental performance;
- use building site, assets and materials creatively and wisely;
- be inspired by the natural environment in landscaping, material use, recycling efforts and more.

LEED encourages state-of-the-art green and sustainable strategies, focused on standard building topics such as:
- building materials;
- construction waste management;
- energy efficiency;
- indoor air quality;
- landscaping/exteriors design;
- occupant comfort and health;
- renewable energy;
- ozone depletion/CFCs;
- transportation;
- water use efficiency.

Overview of the LEED process

1. Register building project;
2. Take advantage of LEED education and technical support;
3. Apply for LEED certification.

LEED certifies

At the beginning stages of a building project, the design/construction team registers with the USGBC for LEED certification. Once minimum prerequisites are satisfied, LEED awards credits for achievements in innovative, cost-effective environmental design and construction in the following areas:
- Site – site selection, native landscaping, erosion and storm water control, heat island and light pollution reduction, and location efficiency;
- Water – water efficiency and reuse, rainwater capture and use;
- Energy – efficient design, energy system commissioning, renewable energy, performance measurement and verification, elimination of harmful refrigerants, and green power;
- Materials – resource reuse, recycled content, construction waste management, use of local materials, and occupant waste recycling;
- Indoor environmental quality – thermal comfort, low VOC materials, air monitoring, contaminant control.

LEED also features innovation creditsto provide flexibility in addressing regional issues, unique projects, or innovative approaches to sustainable design. When the building project is finished, project leaders submit a documented application for certification by the USGBC. LEED™ certification from the USGBC is awarded on one of four tiers:
- LEED Green Building – High level of accomplishment in sustainable design;
- LEED Green Building Silver – Excellence in sustainable design;
- LEED Green Building Gold – Outstanding sustainable design;
- LEED Green Building Platinum – Highest achievement in sustainable design.

LEED supports

LEED technical expertise is available to registered projects every step of the way, to ensure success in applying LEED green building standards towards LEED certification. Building project leaders have ready access to LEED technical support to answer tough questions, provide credit interpretations, and guide designers, builders and owners through the certification process.

LEED educates

The USGBC, together with other associations, present green building issues and knowledge learned through LEED. Seminars help maintain a high quality application of LEED standards. They also provide a forum for showcasing the best practices of LEED certified buildings and green buildings. Workshops and seminars are an ideal way for those starting a building project to learn more about LEED.

For more information about LEED, contact the US Green Building Council, 110 Sutter Street, Suite 410, San Francisco, California 94104. Tel: +1 (415) 445 9500; Fax: +1 (415) 445 9911; www.usgbc.org
Urban energy management initiatives in Malaysia

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Abstract
No matter what development models are followed, urban growth exerts tremendous pressures on resource use and management. Urban development based on the concept of sustainability needs to address the validity of these models, including consideration of the impacts they have already had. It can be argued that solutions to urban energy problems (e.g., energy efficiency and reduced use of fossil fuels) need to be based on economic and business principles that accommodate sustainable development.

Résumé
Quel que soient les modèles de développement adoptés, l'urbanisation exerce des pressions considérables sur l'utilisation et la gestion des ressources. Tout développement urbain basé sur le principe du développement durable doit, par conséquent, vérifier la validité de ces modèles en tenant compte notamment des impacts qu'ils ont déjà eus. On pourrait proposer que les solutions aux problèmes énergétiques en milieu urbain (comme le rendement énergétique et un usage réduit des combustibles fossiles) soient basées sur des principes économiques et commerciaux compatibles avec un développement durable.

Resumen
Sean cuales sean los métodos de desarrollo que se apliquen, el crecimiento urbano supone un reto importante en cuanto al uso y la gestión de recursos. Si lo que se pretende es un desarrollo urbano basado en el concepto de sostenibilidad, se debe plantear la validez de estos métodos, teniendo en consideración sus repercusiones precedentes. Del mismo modo, se puede aducir que las soluciones a los problemas de recursos energéticos urbanos (como el uso eficiente de energía y la restricción de carburantes fósiles) han de basarse en fundamentos económicos y empresariales que coadyuven a un desarrollo sostenible.

A vast literature exists on the subject of urban growth and development, as well as urban environmental management. Although a few distinct urban growth patterns can be discerned, all urban areas exhibit certain common characteristics. One is the relentless growth of urban areas, corresponding to increases in the number of residential and commercial areas as well to habits of over-consumption. Producing energy from renewable sources has become a much heralded objective, but the amount forth coming is still very short of the energy consumed by the urban metropolis. The engine of urban growth is capitalism and commercialism. The cynic of the situation is that there is a possibility that individual and cluster cell growth may be occurring at the expense of the main organ. Since it might be impossible to counter this pervasive and entrenched ideology, solutions to the urban energy problem may need to be based on economic and business principles that accommodate sustainable development. Businesses plan for a number of possible alternative futures as a way to hedge risk and allow for contingencies. Urban administrations and residents should adopt similar methods to address urban energy management. Approaches such as energy efficiency, improved fuel economy and reduced use of fossil fuels can provide relatively quick results in terms of emission reductions.

The Malaysian experience
Malaysia's rapid modernization and development have greatly depended on energy, especially energy based on fossil fuels. Recently, in line with international initiatives and to fulfill its global obligations, Malaysia has embarked on reconfiguring its energy structure. Instead of a "four-fuel strategy" - coal, oil, gas and hydro - renewable energy is now included in a "five-fuel strategy". The National Energy Policy will focus on developing a more sustainable energy system. In opening the World Renewable Energy Congress in Kuala Lumpur in June 1999, the Prime Minister said that "the next five-year national development plan, the Eighth Malaysia Plan (2001-2005), will identify appropriate implementation strategies for the development and utilization of renewable energy sources as an important component of our total energy mix." He went on to say that recurring savings from energy efficiency programmes would also qualify as renewable energy.

Energy use in Malaysia
In 1996, total commercial energy consumption in Malaysia was about 24.2 Mtoe (million tonnes of oil equivalent) by the following sectors:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>39%</td>
</tr>
<tr>
<td>Transport</td>
<td>37%</td>
</tr>
<tr>
<td>Residential and commercial</td>
<td>15%</td>
</tr>
<tr>
<td>Non-energy use</td>
<td>7%</td>
</tr>
<tr>
<td>Agricultural</td>
<td>2%</td>
</tr>
</tbody>
</table>

The energy sources were:

- Petroleum products: 71.1%
- Electricity: 15.7%
- Gas: 10.2%
- Coal and coke: 3.0%
- Distillate: 0.5%
- Biomass: 0.5%
- Other: 0.9%

The following statistics from the Malaysia Energy Centre, established in mid 1998, apply to Malaysia for the year 1999. About 85% of Malaysia's electricity was generated from non-renewable sources. With rapid annual economic growth of around 8% over 10 years, irrespective of the temporary slack during the last two years, the annual increase in peak electricity demand was 12-15%. Peak demand growth and forecast are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Maximum demand (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>3,000</td>
</tr>
<tr>
<td>1997</td>
<td>9,200</td>
</tr>
<tr>
<td>2000</td>
<td>11,000</td>
</tr>
<tr>
<td>2005</td>
<td>17,000</td>
</tr>
<tr>
<td>2020</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Malaysia's electric power plant mix, with an installed generation capacity of 14,709 MW, is:

- Gas: 58.5%
- Hydro: 13.4%
- Oil: 13.0%
- Diesel/fuel oil: 7.7%
- Coal: 4.8%
- Distillate: 1.2%
- Biomass: 0.5%
- Other: 0.9%

Electric energy of 61,785 GWh is produced from the following resources:

- Gas: 65.6%
- Oil: 16.0%
- Hydro: 7.2%
- Coal: 6.7%
- Diesel: 3.3%
- Biomass: 1.0%
- Distillate: 0.2%
Total electric energy consumption of 52,430 GWh is by the following sectors:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>51.9%</td>
</tr>
<tr>
<td>Commercial</td>
<td>28.4%</td>
</tr>
<tr>
<td>Domestic</td>
<td>18.6%</td>
</tr>
<tr>
<td>Public lighting</td>
<td>0.8%</td>
</tr>
<tr>
<td>Mining</td>
<td>0.2%</td>
</tr>
<tr>
<td>Export</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

There are 5.22 million electricity consumers. They break down into the following categories:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>63.7%</td>
</tr>
<tr>
<td>Commercial</td>
<td>15.3%</td>
</tr>
<tr>
<td>Public lighting</td>
<td>0.5%</td>
</tr>
<tr>
<td>Industry</td>
<td>4.0%</td>
</tr>
<tr>
<td>Mining</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Industrial and commercial users account for over 80% of total consumption, while domestic consumers make up less than 20%. Efforts to reduce energy consumption should therefore be aimed primarily at the former to achieve the maximum effect. As they are organized business entities, a business approach would be the most attractive to them. Furthermore, the number of entities is very much smaller, enabling effective outreach programmes.

Malaysia is on course to become an industrialized country by 2020. One of the clearest signs of this is rapid urbanization. The number of new urban centres has increased, as has the sprawl of urban centres (the Kuala Lumpur-Petaling Jaya-Kajang-Serdang-Bangi conurbation, the Shah Alam-Sungai Klang-Selangor, the Johor Baru-Pasir Gudang spread). Other indicators are the increasing proportion of urban dwellers compared to rural ones and the urbanites' growing per capita incomes, the higher urban contribution to GDP, the increasing number of motor vehicles, and new road systems as well as transport modes.

Urban energy management

A corollary of this urbanization is the heavy demand on energy resources. Realizing the limited potential and drawbacks of existing energy sources, the Malaysian government is spearheading urban initiatives as outlined below to refigure the energy situation through focusing on renewable energy.

The Malaysian Industrial Energy Efficiency Improvement Project

The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) has been developed in the programming context of removing barriers to energy conservation and energy efficiency in industrial sectors such as cement, ceramics, glass, pulp and paper, iron and steel, wood, food, and rubber.

The rationale of this project is to reduce barriers that are economic, financial, informational, regulatory, and technical in nature. Barriers to implementing energy efficiency and energy conservation (EE & EC) projects in industries include limited knowledge and awareness, together with lack of information concerning EE & EC techniques, technologies and benchmarks and life-cycle economic benefits. Producers remain extremely sensitive to the relatively high first cost of energy efficient equipment.

Implementation of the ongoing energy efficiency programme is primarily guided by the utilization objective of the National Energy Policy. In consonance with the utilization objective, a national energy efficiency strategy is currently being considered for implementation. The objective is not to constrain energy consumption, but to promote efficient use of energy resources.

Urban-centred energy facilities

Some Malaysian initiatives aimed at efficient energy use and management in an urban environment are described below.

Gas district cooling

Gas district cooling systems are gaining prominence in Malaysia. An increasing number of commercial districts are opting for this system to meet their air conditioning requirements. Since 1993, an estimated 95,000 refrigerant tonnes (RT) of district cooling system capacity has been developed.

A gas district cooling system is a centralized energy plant generating chilled water to meet the air conditioning requirements of several buildings in a district. The district cooling system uses energy more efficiently than conventional air conditioning systems, as a single system supplies to a wide area and to various buildings, loads off the energy load and saves fuel. The cooling plant also has the dual function of cogenerating electrical energy and thermal energy, thus reducing dependence on the national electricity grid. This optimizes energy use, as urbanization is characterized by high density of buildings and people that need to be cooled within a given area (e.g. apartments, offices, commercial centres, entertainment centres, hotels, indoor stadiums, galleries and museums, restaurants, transport terminals). District systems can cool these establishments simultaneously at minimal set-up, operational and maintenance costs.

At the plant, natural gas piped in from the source is fired to drive gas turbines, generating electricity. The heat is cogenerated to produce steam, which is used to drive chillers that cool the water. A combination of steam absorption chillers and electrical centrifugal chillers is used. Chilled water at 7°C is then piped to buildings for air conditioning. Once thermally spent, the water returns to the plant to be re-chilled. To ensure uninterrupted operation, the system is designed to run on alternative fuels such as diesel.

Apart from normal electrical wiring, the only installations required in each client building are two networks of pipes – one to supply chilled water, and the other to return the thermally spent water to the plant. The popularity of the district cooling system is enhanced by its pollutant-free and environment-friendly features. The cooling plant uses natural gas as the main fuel, while its chillers use non-CFC based Refrigerant 134A. By concentrating a district's air-cooling and electricity-generating facilities in one building, the system minimizes air and noise pollution. Without the multiplicity of cooling towers within an area, it reduces the "cooling drift" of chemically treated water escaping from conventional cooling towers and reduces the "composite noise" and heat that is caused by many cooling towers. Quality of life in the urban areas is therefore enhanced.

The benefits of the gas district cooling system are summed up as follows:

Economies of scale

Various types of buildings such as offices, apartments, hotels, restaurants and airports can be cooled simultaneously at minimal set-up, operational and maintenance costs.

Low start-up costs

The initial capital cost of individual structures for a building's air conditioning needs is eliminated. Instead, all air conditioning costs can be written off as operational expenses.

Reliability

The gas district cooling system provides a reliable, uninterrupted 24-hour supply of air conditioning and electricity, which is essential for buildings such as hotels, factories, and hospitals.

Total self-sufficiency

The gas district cooling plant supplies both chilled water and electricity, making client buildings totally self-sufficient.

Manpower cost savings

Individual building owners need not employ technicians and operators as they do now to handle a conventional air conditioning system. Maintenance servicing comes as part of the district cooling package.

Space saving and aesthetic appeal

Since chillers and cooling towers are not needed in each building within a commercial district, the extra space can be used for "green lungs" or recreational purposes. This will improve the overall appearance of commercial district.

The Kuala Lumpur City Centre

The Kuala Lumpur City Centre (KLCC) is the first project in Malaysia to utilize gas district cooling for its air conditioning system. The cooling plant, with a capacity of 30,000 RT, has the following system configuration:

- three units of electrical centrifugal chillers, each with a capacity of 5000 RT;
- three units of steam turbine centrifugal chillers, each with a capacity of 5000 RT;
- two units of gas boilers, each with a capacity of 47 tonnes per hour;
- two units of gas turbine generating units, each with a 4 MW capacity;
- two units of gas turbine generators, each with a 50 MW capacity.
Urban environmental management

Chilled water from the district cooling plant is supplied to an estimated 6.5 million square feet (603,870 m²) of floor space in various buildings in the KLCC’s North West Development area, namely:
- the 88-storey PETRONAS Twin Towers, currently the world’s tallest building;
- the 50-storey M enara M ep; and
- the 32-storey Suria KLCC Retail Centre;
- the 32-storey M andari O riental H otel;
- the 30-storey M enara Eso;
- the Dewan Philharmonik PETRO N A S;
- thePETRO SA I N S (Science Exhibition Gallery);
- the G aleri PETRO N AS; and
- the P ernamaKLCC.

Kuala Lumpur International Airport (KLIA)
In addition to cooling purposes, the airport’s dis- trict cooling plant has been designed with an added emphasis on generating electricity to variousKLIA facilities. About 10-15 MW of elec- tricity will be consumed internally to produce chilled water, while the remaining 25-30 MW is supplied to various premises at the airport.

Phase 1 of the district cooling plant, with a capacity of 22,500 RT, is currently operational and has the following system configuration:
- nine steam absorption chiller units, each with a capacity of 22,500 RT;
- two standby auxiliary gas boilers units, each with a capacity of 25,000 RT;
- three cogeneration system units, each with a capacity of 20 MW.

The district cooling plant supplies chilled water to 14 buildings within the KLIA, such as the Main Terminal Building, Administrative Building, Contact Pier, Air Traffic Control Tower, Satellite Building A, Engineering Complex and Custom Complex.

Another 7500 RT cooling capacity is installed to cater for additional demand from privatized airport facilities.

Expansion of the district cooling plant under Phase 2 is envisaged in 2012, to complement the expansion of the airport. The additional capacity to be installed is 12,500 RT. Another 20 MW cogeneration will also be installed to increase the amount of excess electricity available to airport facilities. By the year 2012, about 45 MW of electricity will be supplied to them.

To minimize the redundant steam recovered from the gas turbine exhaust, the gas turbine will be operated in accordance with the actual chilled water load demand. The electricity generated by the cogeneration system is first consumed in the plant. Only the excess electricity will be supplied to KLIA facilities. The remaining power requirement will come from the National Electricity Grid.

Putrajaya
Putrajaya, the Malaysian Federal Government’s new administrative centre, is a RM 20 billion mixed development project on a 4390 ha site, about 60 km south of Kuala Lumpur. Besides cooling and electricity generation facilities, the cooling plant here is equipped with thermal energy storage of 18,000 RTH. This is a storage facility for chilling and storage of water at night, to take advantage of the cheaper electricity tariff between 10 p.m. and 7 a.m. Chilled water will be delivered during the day, since the demand is from offices operating in the district.

The plant’s cooling capacity is 25,000 RT. The total system configuration is as follows:
- nine steam absorption chiller units, each with a capacity of 25,000 RT;
- two centrifugal chillers, each with a capacity of 1250 RT;
- one thermal energy storage unit, with a capacity of 18,000 RTH;
- four auxiliary gas boiler units, each with a capacity of 22.5 tonnes per hour of steam;
- three cogeneration units, each with a capacity of 4.4 MW.

The projects for implementing more gas dis- trict cooling systems are good, as more property owners, developers and managers realize the benefits of using an environmentally friendly and energy-efficient system for air conditioning. With abundant availability of natural gas, the cogeneration system is also a viable back-up to conventional electrical systems.

The above facilities are undertaken by a company, Gas District Cooling Sdn. Bhd.

Waste to energy
Pahir Gudang is the primary shipping terminal in the south of Peninsular Malaysia, located on the southern tip of the state of Johor on the Straits of Johor. Recently a second facility, the Port of T anjong Pelepas, was established in the southwestern part of Johor. Also at Pahir Gudang is the well-developed satellite town of Johor Baru, with its mix of light, medium and heavy industries. Among them are marine and industrial complexes. These entities serve domestic and international maritime and oil and gas industries, focusing on the core activities of ship repair, shipbuilding, and oil and gas offshore engineering.

The 1992 amendments to Annex I of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), which is concerned with oil pollution, brought in “double hull” requirements for tankers and also considerably reduced the amount of oil ships could discharge to the sea (for example, following cleaning of cargo tanks or from engine room bilges). Oil tankers had been permitted to discharge oil or oily mixtures at the rate of 60 litres per nautical mile, the amendments reduced this to 30 litres. For non-tankers of 400 grt and above, the permitted oil content of the effluent that may be discharged to the sea was reduced from 100 to 15 parts per million.

A “Waste to Energy” plant has been set up in Pahir Gudang to treat sludges and sludge from ships. It can store and process oil-based wastes, particularly from ship repair operations, in order to recover oil and produce electricity. In addition, the facility can provide a total solution not only to its parent company but to other M alaysian industries for complete treatment of associated hydrocarbon wastes.

This is the first such facility in Southeast Asia. Its initial design capacity is to process 12,000 tonnes of oil sludges per year and 5000 tonnes of sludge at any one time. The electric power it generates is utilized by a parent shipyard engineering company at its complex premises. Oil is recovered for sale and a waste water treatment plant treats contaminated water or water drained from sludge per hour to produce 1.5 MW per hour of electricity. It meets national pollution and noise control standards.

The plant utilizes a bubble-fluidized bed combustion technology with similar applications in North America and Europe. This technology has proven very effective in burning sludge with a high moisture content, an area where other incin- eration methods have been found wanting. Another major advantage of the system concerns reduction of noxious gas emissions, with control of vaporization of heavy metals such as lead meet- ing the more stringent EC air emission standards.

Unlike the more conventional means of burn- ing solid fuels in a fixed or travelling grate sys- tem, fluidized bed combustion technology relies on the extreme turbulence established by an upward flowing air stream in a “bed” of inert sand particles. Within a fluidized bed combustor, the turbulence in the vessel, the density of the sand mass and the scouring effect of the sand par- ticles allow complete, controlled, uniform combus- tion – a key to maximizing thermal efficiency, minimizing ash and controlling emissions. Typi- cal units can achieve carbon burn-out within the combuster well in excess of 95%.

Gaseous elements are fully burned in the incinera- tor’s top section before the gas leaves the incinerator on its way to a boiler. The hot gas is then cooled in the boiler. The heat extracted in this process creates steam which turns a turbine, generating electricity. At the next stage the cooled incinerator gas is filtered in a bag house before passing up a stack. Ash is collected from the incinerator bed, the boiler and the fabric gas-cleaning bags.

Emissions from this combustion method are lower, since low combustion temperature and air staging within the bed reduce the formation of certain emissions such as NOx. High combustion efficiency also results in the formation of smaller amounts of CO2. Emissions such as SO2 or N0x may also be abated by injecting lime and or ammonia into the bed. High combustion effi- ciency results in reduced amounts of inorganic mate- rial in the form of fine ash; with low toxicity levels, this is sold as input for other materials like cement.

This facility is operated by T echno I ndah Sdn. Bhd.

Biofuels
M alaysia is the world’s leading producer of palm oil. In 1999, it produced 10,553,918 tonnes of crude palm oil. In 2000, it is projected to pro- duce 10,799,150 tonnes.

Development and innovations in this important industry have been overseen by the Palm Oil Research Institute of Malaysia (PORIM). Even as
this article was being written, however, a new statutory body, the Malaysian Palm Oil Board, officially came into being. It is operational as of 1 May 2000. With the establishment of the MPOB, both the Palm Oil Registration and Licensing Authority (PORLA), which has seen the orderly growth of the Malaysian palm oil industry through enforcement of regulations, licensing and quality control, and PORIM will cease to exist. These two bodies are now merged into the MPOB.

Diesel has been successfully derived from palm oil. Tests on motor vehicles have demonstrated its compatibility with internal combustion engines. While this renewable energy source has been shown to be a viable fuel, market acceptance has not materialized for commercialization. Private enterprise has now introduced a palm oil based additive for combustible fuel, to be used in both petrol and diesel fuelled vehicles, and a palm oil based engine oil. Phenolic additive is also said to reduce CO2 emissions by 30% and CO emissions by some 27%. It helps enhance fuel combustion, with up to 98% of the fuel being burnt off instead of the normal 70-75%. This additive's most unique advantage is that it lengthens oil change intervals. It also reduces fuel consumption, increases engine power and extends engine life.

Malaysia has the reserve capacity to convert palm oil to motor fuel, as well as the supply to match the increase in demand. Widespread adoption of this biofuel could reduce demand for fossil fuel, as well as reducing greenhouse gas emissions to a certain extent. This product is produced by M arvel Zone Sdn. Bhd.

Renewable energy technologies

Some promising and commercially viable renewable energy technologies that have been considered in Malaysia and elsewhere are presented below.

Biomass

At the moment, using biomass as a source of renewable energy is considered the most likely starting point on the road towards a sustainable energy management. This is mainly due to its abundance in Malaysia. Huge amounts of waste (fibre, shells and empty fruit bunches, or EFB) are generated in palm oil mills, for example. The potential energy that could be harnessed from EFB alone is estimated at over 2.0 million Mtoe, or about 6% of the total national energy supply. Additional energy from biogas, generated as a by-product of anaerobic treatment of palm oil mill effluent, is also a potential supplementary energy resource.

A feasibility study on grid-connected power generation using biomass cogeneration technology was carried out by SIRIM, the Malaysian standards and research organization. The study was commissioned by the Ministry of Energy, Communication and Multimedia, with funding from the Malaysian Electricity Supply Industry Trust Account. In the study, SIRIM recommends that boilers in the cogeneration system use multi-fuel burners that are able to burn any type of solid biomass fuel, such as wood chips or sawdust. It also recommends supplementary fuel oil, to ensure continuous power supply to the grid. Cogeneration facilities are particularly viable in integrated palm oil complexes that require both steam and power.

The following assumptions were made in order to produce a standard comparison of the demonstration plants:

- power generating capacity of 5 M We
- plant load factor of 90% and part load factor of 10%.
- fuel characteristic: EFB moisture content of 40%; fuel moisture content of the EFB is 80%.
- 85% boiler efficiency.
- 50% of project cost financed at a fixed rate of 10% over five years.
- total of 8300 plant operating hours per year.
- number of personnel required to operate the power plant: nine per shift.
- electricity produced sold to the grid at 16 sen
- ash sold at RM 120 per tonne.
- each site given pioneer status tax exemption for the first five years.

The economic feasibility study was done using the Standard Techno-Economic Model (STEM), which has four main sections: general data on the energy plant; mill data on energy plant data; and cash flow table. The study also looked at the greenhouse gas emission reduction that might be expected after biomass cogeneration plants were set up at each potential site. Potential GHG emission reduction was 23,352-26,839 tonnes of CO2 equivalent per year. These numbers take into account the fact that almost all the potential sites currently use diesel to run their boilers and generators.

Potential emission reduction is 12.85% for NOx, and 89.97% for SO2. These figures essentially reflect the lower sulphur and nitrogen content of biomass fuel compared with diesel, as well as the average emission from electricity generation in Malaysia.

In addition to that of SIRIM, another study on the feasibility of new power plants fuelled by palm oil waste was carried out by a subsidiary of the TNB Group, headed by a North American company. It looked at a centralized power plant with biomass fed from 10 nearby mills, thus allowing for economies of scale and improvements over smaller plants. This study shows a large potential for power generation beyond the mill's own requirements. These studies demonstrate that there are no unresolved technical issues concerning conversion of biomass into usable energy. Apart from the EFB readily available from palm oil mills, biomass can be obtained from tree cropping, pruning and undergrowth clearing. More also becomes available when large areas are replanted in oil palm and rubber plantations. In the process, old trees are either felled and burnt in the open (with the approval, and very close and stringent monitoring of the Department of Environment) or left to rot in the field.

In Malaysia's urban areas, town beautification and horticultural activities are gaining in popularity. Biomass from these sources can also be better used as an energy source (anaerobic gas production or biomass fuel) than by open burning or sending to landfill. However, technical, logistical, economic and financial issues must be addressed if these methods are to be implemented. Major attitudinal and perceptual changes are also needed, among the population, government decision-makers and businesses, in line with sustainable development concepts.

Solar energy

Malaysia has abundant sunshine throughout the year. Though it would seem natural to assume that solar energy would be well utilized, the reverse has been the case. Until now, the only semblance of solar energy use has been passive water heating in some residential units and generation of electricity by photovoltaic systems in remote areas and for experimental purposes. The relatively low cost of grid-supplied electricity, the high initial cost of PV panels and of their installation, plus the marketing strategies for mains-supplied electric appliances, have severely curtailed the emergence of this energy source as a major component in the national energy mix.

It should be noted that experiments in the United Kingdom and Japan have demonstrated the viability of this energy source. In Japan, some houses have solar panels on the roof. Electricity generated during the daylight hours is channelled to the grid to help meet high energy demand, at a time when household demand is at its lowest; the dwelling uses electricity from the grid between dusk and dawn, when grid demand is low and household demand is high. From an economic point of view, this works out to be a wonderful equation. Houses act as nano-generators during the peak demand period, selling their output to the grid at a higher price. Then they buy from the grid at a lower price. What has been hindering adoption of this technique is people's attitude to power generation factors, as well as the lack of policy and strategy innovation at the government and power suppliers' organizational levels.

Of late, there has been increased activity to consider the viability of solar energy in Malaysia. A subsidiary of the National Power Company (TNB) is conducting a study to assess the performance of a grid-connected rooftop 3 kW, three-phase photovoltaic system. This study will observe the technical capability and commercial viability of the system and its behaviour during peak load demands. A survey to gauge acceptance of this system among potential power system operators and the public is also to be conducted.

In late 1999, the Malaysian Energy Centre initiated a programme using solar photovoltaics. The objective of this programme is to evaluate the applicability of PV systems in Malaysia's climate by monitoring and collecting data on system performance at different locations. At the same time, this technology will be introduced to people in remote locations. The programme uses thin film amorphous silicon technology capable of 12 Wp. Another project will assess the performance and commercial appeal of solar street lighting along highways.

If findings from these studies are encouraging and show that solar power is a viable energy alternative, public relations and awareness campaigns...
may be needed to achieve mass acceptance in urban areas. Toward that goal, regulations can be fashioned to stimulate a demand for solar power. This might include changes to building codes and rethinking of architectural principles. Urban local authorities could impose conditions.

Translucent PV panels could be substituted for roofing tiles, offsetting the cost of roofing to some extent and allowing light into the building. The extra cost of the PV panels could be offset in the long run by energy savings due to the ambient light allowed in. Artificial daytime indoor lighting is a common feature of high density urban building design.

Strategies promoting renewable energy use
I repeat below some strategies that Stephan Schmidheiny of the World Business Council for Sustainable Development (WBCSD) lists in his book Changing Course: A Global Business Perspective on Development and the Environment. Though some of the suggestions might be debatable, and could even be detrimental to development policies, they are presented here as strategies that could find acceptance in their suggested form, or an altered or amended form.

These strategies require actions by governments, local authorities, industry, international agencies (governmental and non-governmental), trade groups and associations at the international, regional and national levels, consumers and researchers.

Actions with immediate effects
- Reforming energy pricing policies to reflect the full environmental cost of energy by removing energy subsidies for use of polluting sources, such as through abolishing coal subsidies. Putting a value-added tax on electricity and gas;
- Developing and setting standards for products and appliances to make producers and consumers more aware of energy input, using, for example, life cycle energy accounting; energy efficiency standards for buildings; energy use and life cycle energy labelling of cars and refrigerators (refrigerator systems);
- Attacking waste through, for example, improving power plant efficiency in developing countries; encouraging cogeneration; promoting increased recycling of paper, glass, metals and used oil; capturing methane emissions from landfills, and reducing gas leaks and gas flaring.

Actions with medium-term effects
- Making investments in energy-efficient technologies more attractive, such as by priming emerging markets for new energy-efficient products through government purchasing schemes for new products such as refrigerators, housing and equipment in public projects, and providing financial and infrastructure support for introducing energy-efficient products in developing countries;
- Shifting the energy mix towards more sustainable sources, for example through integrating alternative energy sources into present infrastructure; increasing the share of small-scale hydropower projects in developing countries; promoting more efficient use of biomass, especially in developing countries;
- Accelerating research in promoting technologies such as biomass gasification, clean coal technology, next-generation nuclear power plants and hydrogen through joint industry-government research programmes, and focusing on national research programmes;
- Improving access to the latest energy technology and management expertise in developing countries through building up training programmes and infrastructure for the introduction of new technology.

Actions with long-term and permanent effects
- Increasing knowledge of climate change and its impact by supporting research projects on climate change science and the impact of climate change, as well as economic policy implications and systems analysis;
- Developing more efficient energy technologies through research cooperation on fuel cells, intrinsically safe nuclear energy, photovoltaics and other solar energies, coal gasification, high-efficiency transport equipment and biomass-based fuels;
- Developing cost-efficient CO₂ sinks to compensate for emissions, such as domestic and international afforestation programmes; research on CO₂ absorption; improved forest management and biomass handling;
- Developing new urban and regional infrastructures that limit CO₂ emissions through, for example, investment in new transport systems and new guidelines for urban and regional planning; evaluating the introduction of an “insurance premium” on emissions of pollution even when we do not know the full environmental cost, such as through a carbon content levy;
- Promoting changes in life style by encouraging public transport and more environmentally sustainable consumption patterns through better information on energy intensity of products, and education and public awareness programmes.

Specific initiatives by industry
- Assessing energy efficiency investments at the lowest discount rate applicable to any investment; for utilities, setting up “best practice” systems to aid developing country utilities in setting up joint international efforts to tackle major projects, such as gas pipeline leaks in the former Soviet Union; taking the lead in energy use labelling of products and processes;
- Making staff available to help eastern European and developing country companies with energy efficiency and audit efforts initiating, with governments, long-term energy strategies that are consistent at the national, regional and global level, such as the Japanese Action Programme to Arrest Global Warming (“New Earth ’21”).

Conclusion
The use of commercial parameters needs to be encouraged when dealing with energy sources in urban areas. Businesses, which are the backbone of urban areas, should be built on sustainability concepts. Accounting principles should follow the triple bottom line approach, with priority given to environmental, ethical and social costs and gains before pecuniary costs and gains. Decisions should incorporate life cycle analysis concepts. I would also say that lifecycle accountability should be reintroduced, to instill a sense of responsibility for commercial actions taken which could have dormant catastrophic potential for both the urban population and the environment.

Renewable energy management in the context of urban environmental management faces great challenges. The ubiquitous motor vehicles are approaching something of a Mephistophelian nature in urban areas. Urban populations have learned to live with the mephitic atmospheric pollution, but the question being addressed is whether the Earth can go on as a living planet. Once it dies, everything else also ends. Policies and strategies to address resource depletion and green-house gas emissions have to emanate from the invisible hand of the private enterprise market economic system before cities become hollows without souls.

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Note

References
Eco-Indicator 99 - A Damasi goal oriented method for Life Cycle Impact Assessment.

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Abstract
Utilities have major impacts on environmental quality, especially in urban areas. At first glance, liberalization or privatization of utilities would not appear to offer any environmental benefits. If such a change occurred within an adequate administrative-legal framework, however, the result could in fact be increased attention to sustainability. In this context, a case study of opportunities for improving sustainability in regard to road transport is presented.

Résumé
Les entreprises de distribution d’énergie ont des impacts majeurs sur la qualité de l’environnement, notamment en zone urbaine. À priori, il n’y a aucune raison pour que la libéralisation ou la privatisation de ces entreprises ait un quelconque effet positif sur l’environnement. Pourtant, si ces changements s’opéraient dans un cadre juridico-administratif approprié, ils pourraient, davantage encore, attirer l’attention sur les questions de développement durable. Une étude de cas sur les possibilités de faire progresser le développement durable dans le secteur des transports routiers dans ce contexte est ici présentée.

Resumen
Los servicios públicos tienen una gran influencia en la calidad medioambiental, sobre todo en los núcleos urbanos. A primera vista, la liberalización o privatización de estos servicios no parecía ofrecer ninguna ventaja. Sin embargo, si el cambio se produjese en un entorno legal y administrativo adecuado, podría coadyuvar a que se prestase más atención a la sostenibilidad. En este contexto, aquí se presenta un caso sobre las oportunidades de mejorar la sostenibilidad en lo relativo al transporte terrestre.

In the past, governments have always believed that in view of the typical economic characteristics of utilities there was only one way to ensure that they were kept up to par. In general, this approach has encompassed strict government control on one hand and the protection of utilities against competition on the other. Utilities were long regarded as natural monopolies exempt from the normal rules of the market, particularly in view of their inextricable relationship with infrastructure. After all, water, transportation and electricity could only be provided if suitable infrastructure was in place. And infrastructure, unfortunately, was and is difficult to duplicate.

The enormous investment required to build new infrastructure, and the slow pace at which these costs could be recovered, effectively prevented the realization of alternatives. Governments developed two scenarios for monitoring natural monopolies: public ownership and public supervision. The usual justification for public ownership was the fact that utilities were a potential source of public income. In the case of public supervision, commercial exploitation was considered to be in the best public interest. Risks associated with what was in effect a private monopoly could be mitigated by ensuring adequate public supervision.

In recent years, however, utilities have lost their status as an undisputed public good. New developments, including technological progress and far-reaching legislative changes (e.g., ongoing Europeanization), are occurring rapidly and transforming the utilities sector. New ideas are shaking the once infallible belief that market forces do not apply to natural monopolies. Old paradigms are being replaced by new ones, and governments are having to develop new scenarios.

The liberal wind blowing in the Netherlands and other western European countries is breaking open protected markets. Proponents of this process expound on the benefits of liberalization and privatization for society at large. The utilities are also affected by these developments. There is much concern about their “marketing”. One fear is that universal service and affordability might no longer be guaranteed. We will focus here on new opportunities for sustainability that may arise from public utilities’ privatization and liberalization.

This article is written from the perspective of urban environmental management. The relationship between utilities and sustainability is of particular concern in regard to the urban environment because of the major impact the utilities tend to have. By extension, the opportunities that privatization and liberalization provide with regard to sustainability are particularly interesting for the urban environment.

The tone of this article is tentative. The developments described are still in progress and are by no means completed. Consequently, there is an almost complete lack of empirical evidence. The article should therefore not be regarded as a systematic and empirical evaluation of the effects of these developments on key sustainability variables.

Assumptions
This article is based on two assumptions which will remain undisputed here. We assume first that utilities in general have a considerable impact on the quality of the environment, and second that individual utilities may offer major opportunities for enhancing environmental quality. The examples below, which pertain to different utilities, serve to support these assumptions.

The energy sources – renewable or non-renewable – used in a society are largely determined by the power sector. This sector also bears primary responsibility for power generation processes and the resulting emissions. It has considerable influence on a society's total energy consumption.

The public transportation sector co-determines a society's "modal split". Its actions are an important determinant of the number of motorists who make the switch to public transportation such as the bus and train. In this way, the sector may reduce total car mileage and ultimately reduce total environmental damage (fuel use, exhaust emissions, noise pollution, etc.).

Activities carried out by the waste sector impact directly on the environment. Waste collectors and processors ensure that waste is collected, recycled
Urban environmental management

and processed (burned or dumped). They are the cleaners of our environment in the broadest sense and have an important role in waste prevention.

At the level of the individual organization, a utility can choose to use selected environmentally friendly products and process innovations. Innovation has a major marketing advantage, in that the utility can continue to provide the same service at a lower cost to the environment. Environmental benefits can be realized in several ways. A company may develop alternatives for scarce (non-renewable) resources or reduce hazardous emissions. A power company switching from fossil fuels to sustainable sources of energy (e.g. solar or wind) would be achieving both objectives.

A new paradigm
Perhaps the most important reason utilities are now being subjected to market forces is the adoption of a new paradigm in the field of economics. What was once dismissed as impossible is now considered both feasible and desirable. Like the old paradigm, the new one accepts the difficulty of duplicating infrastructures. However, this conviction does not necessarily lead to the conclusion that the entire production column must be organized as an amonopoly. In the new paradigm, the utilities production column is regarded as a chain of distinct links and the necessity of an amonopoly or the feasibility of competition must be assessed for each individual link (production, transportation, supply). By distinguishing infrastructure management from the provision of services, for example, components of the utility production column can be opened to competition and market forces. New insights show that competition at the level of services may be feasible.

Liberalization and privatization: paradoxes and opportunities for sustainability
Varying degrees of liberalization can be implemented in the utilities sector. The most dramatic form is competition between infrastructures, which requires the existence of at least two. In this situation, users can choose which supplier they want to do business with. When competition between infrastructures is not possible, various companies provide similar services using the same infrastructure. The third type of liberalization is competition for access to the infrastructure. Concessions to exploit and/or manage the infrastructure are periodically put out to tender by the government that owns the infrastructure. In its mildest form, there is no direct competition but benchmarking does take place that is, comparisons of performance are made by a third party. Benchmarking that could have consequences for a company (such as concession loss) is called “yardstick competition”.

Privatization also comes in varying degrees. The most far-reaching form is, of course, full private ownership. In other words, the utility is a private company whose shares are owned by private shareholders and which falls under private law. In a less drastic form, the utility may be publicly owned but placed at such a distance from the government that it no longer falls under its political responsibility. In this case, too, the utility’s legal status is that of a private company, but its shares are owned by the public administration. The mildest form of privatization is that in which the utility is in the hands of government and falls under the government’s political responsibility, but otherwise operates “commercially”. In this case, the utility must be given sufficient freedom to decide its own managerial and financial course.

Liberalization is a potential threat to sustainability. After all, competitive businesses tend to slim down operations and seek to maximize efficiency and effectiveness. Proposed investments that enhance sustainability may be dismissed as “unnecessary” or a “luxury”. By contrast, a business with a long-term monopoly can afford to take measures that enhance sustainability but do not have a quick return.

Paradoxically, however, breaking open the market may also boost sustainability. An open market implies that more companies are active, either on the same market or on different markets, that they periodically attempt to take over other markets. When a market is populated by multiple competing companies, direct comparisons of performance can be made. Such comparisons need not be limited to the quality and price of the delivered products, but may also extend to environmental performance (emissions reduction and efficient resource use). Consumers choosing between two service providers may consider a company’s “green” image in their decision. Another benefit of liberalization is that it stimulates innovation. Product and process improvements are opportunities for a company to set itself apart from its competitors. Companies with a monopoly position lack this incentive to improve.

Privatization, too, poses a potential threat to sustainability. A private utility is more likely to pursue a singular goal, that of continuity. The company must obtain a maximum return on invested capital. For that reason, it will disregard other values, such as sustainability, from the point where its continuity might be at stake. A public utility, on the other hand, pursues several objectives, of which financial profit is only one. Other objectives include providing a universally guaranteed service and realizing sustainability.

Paradoxically, however, privatization can enhance sustainability. Publicly-owned utilities are sometimes handled with kid gloves by the government. It may, for example, apply more relaxed environmental licensing standards or take a lenient attitude when standards are not met (the so-called “tolerance policy”). This cautious attitude is often the result of conflicting interests. The government has a financial interest in having a willing utility, but it is also a public authority responsible for assessing licence applications and monitoring compliance with legal standards. Personal and political factors might also be involved. A privatized company operating at a distance from the government is less susceptible to such conflicts of interest, so that the authorities will be less inclined to take a lenient attitude.

Strictly speaking, privatization does not necessarily enhance innovation. A private monopoly can afford to be just as lazy as a public monopoly. In private monopolies, only those innovations which increase profits can count on an enthusiastic response and external pressure groups may find it difficult to push the company to adopt other types of innovations. Innovation, after all, is not something that can be enforced.

At first glance, neither liberalization nor privatization would appear to hold any benefits for sustainability. A closer look, however, leads to a different view. Liberalization, in which multiple companies are active on a market, enables a comparison of the companies’ performance, for example in environmental matters. The results may be used to set the best-performing company as the standard for the other companies. Privatization increases the distance between the government and the utility, making it easier for public authorities to treat the company objectively and professionally. In time, this may result in a stricter monitoring of the company’s environmental performance.

Both liberalization and privatization provide opportunities for sustainability. These opportunities are particularly interesting for the urban environment, on account of both the major impact utilities tend to have on the urban environment and the considerable environmental benefits they may produce. Both liberalization and privatization may result in improved environmental performance, provided the government succeeds in channelling these developments in the desired course. Optimal utilization of opportunities depends on the government’s ability to develop an adequate administrative-legal structure.

Potential scenarios
Legislation that recognizes the spirit of the market
In the utilities sectors, preference should be given to administrative-legal structures that recognize a greater or lesser extent the economic rationale of the market. Legislation and economy have different rationales, and the ability of legislation to influence the market depends on how well it dovetails with the economic rationale. Thus, government measures that have financial consequences are generally more successful in steering corporate activities than those that appeal exclusively to moral conscience. Instruments that recognize the realities of the market (e.g. production or user levies) can play a role here.

Optimal influence or direction is achieved using incentives as well as penalties. Certainly a company should be fined for not meeting environmental standards. However, the best way to stimulate companies to realize environmental goals is to offer a reward to those that make the extra effort. A public authority, for example, could consider past environmental performance when assessing concession applications and give the concession to the company with the best environmental score. In this case, legislation need only lay down minimum performance criteria.

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Two ideal administrative-legal structures

Below we roughly sketch two ideal administrative-legal structures that incorporate the realities of the market: an adapted version of a traditional structure, and a modern inspection and/or certification structure. The adapted version of the traditional “command and control” structure is based on the traditional licensing system. However, granting of a license is conditional on general targets being met rather than on compliance with specific measures. A company is free to decide by which means to achieve these targets, which may be based on best practices. The inspection and/or certification structure does not involve a licensing system. Instead, the government demands that a company wanting to provide a service be accredited. A company is accredited if it meets the criteria of a certification system carried out and monitored by a third party. These criteria may also be based on best practices.

Case study: road transport

Current situation

Currently, road management is an almost exclusive domain of government. The government has a monopoly on the roads: it is the sole builder and owner of roads and highways, and the only party engaged in road maintenance. Private road management is practically non-existent. Would liberalization and privatization provide new opportunities for sustainability here? To answer this question, we have sketched a future scenario in which utilities have been privatized and face increased competition.

The road transport sector plays an important role in regard to the sustainability issue. Road construction and use cause considerable environmental damage. This applies strongly to urban environments. Landscapes are severely broad stretches of asphalt. Motorized traffic not only uses a lot of fuel, but also emits toxic emissions and causes noise pollution.

Environmental impacts are particularly dramatic in urban areas. Measures to reduce the environmental impacts of road transport can be implemented at two levels: that of the road user, and that of the road itself. Measures aimed at road users include technical requirements to increase traffic safety, taxes on fuel to reduce total mileage, and higher road taxes for heavier cars. Road measures include maximum speeds and special provisions in areas flanking the road. Maximum speeds are established primarily for traffic safety reasons, but have positive environmental effects (less noise pollution, lower fuel consumption and reduced emissions) as well.

Special provisions include noise barriers along roads that exceed traffic density standards and run through built-up sensitive areas. These provisions are required under a generic scheme to restrict noise pollution.

Possible future scenario

Liberalization and privatization of the road transport sector is feasible in the form of electronic road pricing systems that will enable road exploitation to be contracted out to third parties. These systems are expected to be operational and profitable in the near future. Private companies could then apply for a license to exploit a certain road during a set period, for which the government would pay a certain remuneration. The exact financial arrangement would of course depend on who pays the costs of road construction, including those of purchasing land on which to build the road and those of measures to mitigate environmental damage. Liberalization could be realized by, for example, putting a concession out to tender every 10 years. In this case, private companies would be competing for the market. The company obtaining the road management licence would for the time being have the road market or, more broadly, the mobility market to itself. Its services, for which motorists would have to pay a fee, might consist of facilitating a smooth journey without delays from A to B, with a money-back guarantee should congestion nonetheless be encountered.

New road management would bring with it new sustainability opportunities. The road manager would be subject to environmental permit laws, requiring compliance with several environmental standards. The advantage of this arrangement is that the road manager can be held accountable for the environmental results achieved. The road manager would be responsible for meeting environmental standards or risk losing his permit, which would force him to stop all business activities. This threat should be enough to ensure that a road manager makes every effort to comply with environmental regulations. Delegating responsibility can thus stimulate creativity and result in optimal performance.

Environmental performance can also be stimulated by introducing new administrative-legal structures such as those concerned with “pollution rights”, which could be made available in the form of an emission quota, an inammutual quota of activities causing environmental damage. The benefits of this structure would be twofold. The quota clearly defines a road manager’s task, while at the same time stimulating optimal use. For example, damage to certain individual environmental aspects could be weighed against improved performance on other aspects or, within certain margins, discounted over time. Ultimately, both public environmental interests and private business interests could be satisfied.

Opportunities for sustainability

In a privatized sector, the road manager would be encouraged to innovate. As a provider of mobility, the road manager’s first action would likely be to offer road space to motorists. Before long, however, he would be exploring other opportunities to provide mobility on “his” route and adjoining ones. In the long run, the road manager could also help develop and invent measures to increase road capacity. Such measures might include the development of vehicle guiding systems or more effective noise barriers.

Liberalization would enable more companies to be active in this market. These companies would compete to be the best and fastest to utilize the new opportunities for sustainability, since a head start in sustainability know-how would also give a head start in the race for concessions.

Closings remarks

The liberalization and privatization paradoxes are rather optimistic assumptions that will only hold true if governments succeed in utilizing the resulting opportunities for sustainability. We have made some practical suggestions in this case study above. In any event, both government and industry must respond alertly. It is also possible to ignore opportunities, at the risk of poorer environmental performance by utilities. Governments that are not on the ball may miss out on opportunities that will not soon present themselves again. Once it happens, environmental damage is irreversible.

We are somewhat sceptical about governments’ willingness to understand just how crucial this point is. Our scepticism would appear to be justified, in view of the Dutch government’s poor record on making the most of new opportunities. The potential benefits of liberalization and privatization, with respect to the quality and price of utilities, are (still) not being realized.

Notes

5. In this article do not discuss the private law approach: e.g. a structure in which open standards laid down in general legislation are sanctioned by liability law, which pretty much comes down to “judge’s law”. The advantage of a private law structure is that the costs of regulation are paid by the private sector, i.e. the parties who benefit from the service (producers, consumers), rather than by taxpayers.

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Transforming post-industrial areas as an urban environmental policy tool (Katowice, Poland)

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Abstract
Political changes have created the possibility to restructure industrial areas in Poland and other Central and Eastern European countries. Initiatives related to improving brownfield areas in the Katowice agglomeration reflect the region’s industrial development. From the local authorities’ perspective, transformation of post-industrial and other degraded areas of the Katowice agglomeration is an essential part of urban renewal and sustainable development activities.

Résumé
Les changements politiques intervenus en Pologne et dans d’autres pays d’Europe centrale et orientale ont rendu possible la restructuration des zones industrielles. Les initiatives prises pour dépolluer les terrains en friche de l’agglomération de Katowice sont typiques de la politique de développement industriel de la région. Pour les collectivités locales, la transformation des zones post-industrielles et autres zones dégradées de l’agglomération de Katowice est un aspect essentiel de la rénovation urbaine et de la mise en place d’activités favorisant un développement durable.

Resumen
Los cambios políticos que se han operado en Polonia y en otros países de Europa central y del este, han hecho posible la reestructuración de sus polígonos industriales. Las iniciativas relativas a la optimización de brownfields (polígonos industriales baldíos) en la aglomeración de Katowice son reflejo del desarrollo industrial de la región. Desde el punto de vista de las autoridades locales, la transformación de las áreas postindustriales y de otras áreas impropias de dicha aglomeración constituye una faceta esencial de las actividades de rehabilitación urbana y desarrollo sostenible.

The Katowice agglomeration, on the Silesian upland in south-central Poland, is considered one of Europe’s most highly industrialized, densely populated and environmentally devastated areas. It is the largest Polish agglomeration, with over 1000 km² and 2 million people. Heavy industry has determined this area’s environmental quality. Since the 19th century, it has been an industrial region with an extremely high concentration of industry based on coal, lead and zinc. In the past, coal mines and factories gave rise to the development of towns. Worker settlements usually developed around industry. Old plants are often found among residential buildings. The spatial structure of the Katowice agglomeration consists of a mixture of different types of land use. Its towns suffer from the lack of separation of industry from residential areas. The landscape is dominated by heavy industrial plants, coal mines, shafts, derelict areas and solid waste heaps. The changes in Poland’s political system since the early 1990s have been accompanied by a difficult process of national restructuring whose aim has been to reintroduce a market-oriented economy. Socio-economic changes have been especially painful in highly industrialized areas, of which the Katowice agglomeration is an important example. This region was once a workhouse of the national economy. Political changes have created the possibility to restructure the entire area. Closing down, privatizing and transforming numerous industrial plants has caused a shift in the activities of numerous local communities, often making it possible for them to undertake other than purely industrial tasks. While this makes new economic developments possible, necessary steps need to be taken towards making degraded areas, construction and industrial sites more environmentally secure. The process of transforming post-industrial areas is very complex and spread over time. In order for it to proceed smoothly, both the internal structure of the areas involved and the goals and conditions of their transformation need to be determined.

Aims of restructuring post-industrial areas
The strategic aim of restructuring post-industrial areas is to bring about equilibrium between such areas and their surroundings. The existence of such an equilibrium is achieved when, for instance, mutual relations are beneficial for the parties involved. Taking into account the sustainable development principle of post-industrial areas restructuring process, it is worth stressing the opportunities such transformation phenomena create for local government agencies in relation to the planning and management of an urbanized environment. This process can be illustrated by describing the implementation of a few pilot projects, a common initiative of the UN and local governments of the Katowice agglomeration.
The UN project “Urban Environmental Management and Sustainable Development”, developed according to sustainable development rules, assists municipalities both by supporting local teams dealing with city planning and management, and by providing tools that the municipalities can use in the process.

A working group dealing with issues concerning post-industrial areas’ transformation in the Katowice agglomeration was formed in September 1997. Its internal structure has emerged during workshop sessions. The working group includes two task teams. The first is focused on highly degraded areas requiring complex reclamation treatment, as well as on actions to protect inhabitants and the environment from these areas’ harmful impacts. The second team has been creating databases on post-industrial areas and target objects that could potentially be adapted to novel functions activating the particular area and increasing its economic value.

Actions taken up by the two task teams have resulted in the implementation of four pilot projects. Each project presents a specific type of post-industrial target object or area and necessarily remains at a different phase of implementation. Regardless of the stage of their advancement, all the projects are interesting since they represent certain segments of a broad spectrum of issues related to transformation of industrial sites. One is focused on a large area that has been devastated and degraded by the coke chemical industry. The second concerns land use changes following reclamation of a municipal waste landfill. Solving yet another range of issues is being attempted through a third project concerned with the adaptation for new uses of some valuable historic and industrial objects protected by law. Still another group of problems is being tackled by the fourth project, which concerns a land use proposal for areas regained after tearing down industrial plants.

The goal of both the working group and the project is to elaborate the “bank of potential solutions” available to municipalities through the project. It is expected that these solutions will be a component of municipal strategies as well as an overall strategy for the Katowice agglomeration.

Particular solutions provided by pilot projects may be applied in other places, respecting some local specifics. Hence the replication possibility is a primary advantage of each pilot project.

The pilot projects presented below address different aspects of post-industrial and barren areas. By the same token, this is a typical and representative example of significant number of such spaces and premises in the Katowice agglomeration.

The process of the pilot projects’ preparation is associated with their typology assessment and clarification in respect of the adaptation capacity. Pilot project documentation, along with the set of solutions, is expected to create an informative database to serve the municipalities and their partners involved in the Katowice agglomeration’s transformation process. It will also be a basis for elaborating the internal strategy for municipalities in the field of post-industrial areas.

Initial results are illustrated by the ongoing pilot projects described below in the cities of Ruda Śl., Siemianowice Śl., Chorzów and Częstochowa.

Ruda Śl. City

“Pre-investment Study Preparation for a Local Plan of a Post-industrial Area Located within the Shut Down ‘Wawel’ Coal Mine and ‘Walenty’ Coke Plant”

This project comprises the following elaborations and documents:
- report on environmental risk assessment of the pilot project area (based on data analyses from the “Silesia Programme” – conducted by Polish and American partners);
- analyses of existing documents and elaborations in respect of legal requirements and financing possibilities;
- elaboration of functional and spatial concept (in two versions).

Siemianowice Śl. City

“Model Recultivation of the Landfill Area for Communal Wastes, in Order to Incorporate it into the Protective System of Siemianowice Śl. Green Areas”

In the pilot project documentation, a programme and technical concept have been elaborated for Sector I of the selected area and for the surrounding area (phase I), as well as a programme and technical concept for the remaining landfill area (phase II). Part of the project is a proposal to use gas recovered from solid waste storage to heat houses near the landfill. The next necessary step will be elaboration of environmental risk assessment. All parties involved in implementing the pilot project (the Siemianowice Śl. municipality, the private firm “Landeco” and the above-mentioned UN project) expressed the desire for further cooperation in order to implement the proposed solution.

Chorzów City

“M³od Area and Transformation of the Shut Down ‘Kościuszko’ Steelworks in the Chorzów Municipality”

The goal of the pilot project documentation is to prepare a solution compromising the expectations of the main interest groups, as well as the preferences of the Chorzów municipality.

There are two concepts of land use and objects’ adaptation respecting the existing conditions, as well as the interests of the main economic partners involved in the investment.

The pilot project is assumed to begin the nature of a study, focused on a model and implementing issues concerned with the transformation of post-industrial areas. The proposed solution for land use in this area is based on strategic planning methodology, involving the use of a workshop method.

The local land use plan defines the area as industrial in nature. However, its future use will be associated with the development of service and communication functions locally and regionally.

The following strategic objectives have been defined:
- integration of industrial and urban areas;
- creating an attractive environment for inhabitants;
- strengthening of the town’s image in the region and the country.

Two alternatives concerning function-spatial solutions have been formulated in order to realize the strategic objectives.

Alternative I: “Active Recreation Park”

Creation of a park area with a rich user programme, including: sport-related objects, active recreation equipment, entertainment, commercial and gastronomic objects. A complementary area, exhibition halls and office buildings will be constructed. In this alternative, accomplishment by stages would begin in the area of the so-called “Upper Steel” processing plant, with adaptation of the existing industrial objects. Relatively small-scale individual investments would be made by a number of developers.

Alternative II: “Service Centre”

Creation of a service centre of a large city character, with a special function enriching the service offered by the urban Chorzów downtown area. Oneto three commercial objects of high architectural value in the area of the shut down steel processing plant would radically change radically the town’s image. According to this alternative, it would be necessary to demolish the existing post-industrial objects in the area of the Upper Steel processing plant. It would also require engaging a limited number of strategic developers able to undertake large investments.

Both alternatives assume that redeveloping this area should be seen as a long process carried out together with the management of other, surrounding areas, beginning in the area of the railway station. This is associated with organizational activity lying beyond the range of the area’s redevelopment. In order to assess and choose the optimum alternative, the following criteria have been selected:
1. investment efficiency;
2. communication function, in which the aspect of motor vehicle access to the area has been shown to be critical.

In the case of Alternative I, the first criterion was related to acceptance of a solution providing quick, immediately visible effects enabling later realization of the investment by stages, with the possibility of obtaining implementation effects step-by-step. This solution is based on a number of small investments, involving limited expenditure, carried out by local developers. Other advantages have also been taken into account, such as improvement of urban environmental quality and modernization of the urban communications system.

In Alternative II, significant financial benefits have been assumed from the large investment required. This is related to the necessity of finding
Urban environmental management

Serious strategic investors with financial abilities, other non-financial criteria were treated as complementary.

The number of parking places calculated in the analysis of the areas communications service can be obtained using either alternative. However, estimating the traffic efficiency of the existing communications system has shown that at present only Alternative I has a chance of being realized in a limited programme range. The effects of the redevelopment process, in the case of either alternative, depend on possibilities for redeveloping the areas surroundings, including above all access roads, parking places and multi-level garages in the area of the railway station.

For each alternative, two versions have been proposed. They differ in land management character, in how they address the communications service system, and in the number of investment lots.

Regarding the limits of transportation access using the first alternative, the following principles have been proposed:

- Development of land-use functions not determined by the more than 200 parking places located in the project area;
- Development of active functions first of all beyond rush hours.

The principles of the area's spatial development are assumed to be as follows:

- Realization of spatial solutions following the general strategic line of the areas development;
- Possibility of using the existing post-industrial objects and adapting them according to the strategic land use objectives;
- Creation of space for the public available to inhabitants, covered with trees and greenery and integrated with the urban centre;
- Shaping of landscapes of high architectural value with consideration of the areas exposed location.

The proposed programme would include

- "Active Recreation Park" with multi-cinema or garden-commercial centre as a basic function, and additional sports and recreation functions with mainly open-air equipment and gastronomic and commercial objects;
- "Centre of the Town Future", with an exhibition function and others associated with the town's promotion.

Based on the pilot project's elaboration, the Chorzow City Hall prepared an investment offer that was awarded second prize at the National Investment Fair in Poland.

Czeladz City

"Architectural and urban study of factory hall adaptation within the area of the Saturn Coal Mine in Czeladz for the purpose of the University and three other projects dealing with restructuring of coal mine shafts in Katowice, Ruda Sl. and the city of Jaworzno."

These projects propose new activities and economic functions for existing premises with respect to their historical value.

The large number of post-industrial areas and old obsolete industrial objects in the Katowice agglomeration is expected to increase significantly in the coming years. This process is directly related to regional transformation. Therefore, local authorities as formal hosts should not be passive towards ongoing changes, regardless of who is the legal owner of the municipal space. That is why they are authorized to control land use according to municipal policy and development strategy, through designation of new functions in such documents as Study of Conditions and Development Direction of the Municipality Spatial Land Use, as well as regulations included in local land use plans.

Pilot projects signal possibilities for transformation processes and demonstrate that a selected modus operandi has been adopted. Although these projects are limited in scope (as they are local initiatives), they not only allow testing of solutions applicable to such local settings but, through sharing experience and implementing municipal cooperation, contribute to a richer choice of urban environmental planning and management tools.

On the local and regional levels, such tools can help to:

- Improve overall environmental conditions;
- Develop local economies;
- Preserve cultural heritage landmarks.

Respect for the principle of sustainable development in the process of transforming post-industrial areas allows:

- Minimizing the negative impact of implemented changes on natural environment;
- Making use of local renewable resources and space in the process of adaptation to novel functions;
- Respecting the interests of local communities with regard to such areas, as well as preserving their cultural identity.

The Katowice agglomeration is a special place on the map of Poland and of Europe. This old industrial region, experiencing the long-term results of excessive industrialization, now requires rapid and radical transformation.

The scope of the problem, primarily the size of the areas involved as well as the extent of their transformation, presents a huge challenge for the Katowice agglomeration's governmental agencies. Skilful management of transformation processes may secure a chance to successfully achieve the renewal and subsequent development of the Katowice agglomeration and of the entire region.

The activities described may be a valuable starting point for implementing sustainable development policy in the Katowice agglomeration.
“What a waste”: solid waste management in Asia

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Abstract
Nowhere is the global challenge of solid waste management greater than in Asia, which is rapidly urbanizing and increasingly becoming a “consumer society”. Based on existing data and current trends, waste quantities and composition can be projected for 2025. At a minimum, waste quantities will double over the next 25 years, with the highest growth occurring in low income countries. Regional approaches are suggested, with an emphasis on broader business involvement.

Résumé
Nulle part le défi mondial de la gestion des déchets solides n’est plus problématique qu’en Asie, en raison d’une urbanisation galopante et des progrès fulgurants de la société de consommation dans cette région. A partir des données existantes et des tendances actuelles, il est possible de faire des projections de volumes et de composition des déchets jusqu’en 2025. Elles montrent que, dans le meilleur des cas, le volume des déchets doublera dans les 25 ans à venir, les maxima devant être atteints dans les pays à plus faibles revenus. Des approches régionales sont ici suggérées, en insistant sur l’importance d’une participation plus grande des entreprises.

Resumen
La gestión de desechos sólidos nunca ha representado un reto mayor que en Asia, que se está urbanizando rápidamente y se está convirtiendo progresivamente en una «sociedad de consumo». Basándonos en las cifras disponibles y las tendencias actuales, podemos calcular tanto la cantidad como la composición de los desechos para el 2025. Como mínimo, la cantidad se duplicará durante los próximos 25 años y el mayor aumento se observará en los países con menores ingresos. Se proponen enfoques regionales, haciendo hincapié en una mayor participación empresarial.

Introduction
As urbanization and economic development increase in Asia, nowhere is the impact more obvious than in society’s “detritus”, or solid waste. Today the urban areas of Asia produce about 760,000 tonnes of municipal solid waste (MSW) per day, or approximately 2.7 million m³. In 2025, this will increase to 1.8 million tonnes, or 5.2 million m³, per day. These estimates are conservative; the real values are probably more than double this amount. Figures 1-3 show some projections of waste quantities and composition in 2025.

Local governments in Asia currently spend about US$ 25 billion per year on urban solid waste management. This amount is used to collect more than 90% of the waste in high income countries, 50 to 80% in middle income countries, and only 30 to 60% in low income countries. In 2025, Asian governments should anticipate spending at least double this amount (in 1998 US dollars) on solid waste management activities.

To carry out integrated solid waste management, local governments need partners. National governments must reduce the externalities of waste by considering measures such as full cost accounting, package deposits, manufacturer responsibility and extended product care. The general community, probably the most important stakeholder in waste management activities, must also actively participate in the solutions by modifying its behaviour patterns. For example, it needs to exert discipline in separating waste, using containers in a beneficial way, and exercising environmentally friendly purchasing habits.

Poor solid waste collection causes flooding and an increase in pests such as mosquitoes and rats, as well as their accompanying diseases. It is a large source of particulate air pollution (as waste is burned) and water contamination (as waste is dumped in rivers and canals). Solid waste is also a significant source of greenhouse gases. People know that poor waste management affects their health; 94% and 93% of those surveyed in India and China, respectively, agreed that “their health was affected by environmental problems” (Washington Post). Solid waste management is probably the single most important service a city provides, in that it is often their largest budget item, requires management capacity to do well (regardless of availability of funds), and is an absolute necessity for any city that wants to be considered of international repute. Solid waste management is usually a precursor for all other municipal services. No city will be able to earn the respect of its citizens, keep health care costs and threats of epidemics low, manage more complex services, attract sustained foreign investment or maintain a thriving tourist industry if it is unable to manage its waste.

Waste characterization
Severe under-recording of waste quantities is typical. Total waste generation is usually much higher than that reported by government agencies. Apart from localized anomalies, such as use of coal for cooking and heating, urban generation rates are generally consistent vis-à-vis local economic activity and residential wealth. Because waste characterization studies are relatively expensive to conduct, general “rules of thumb” should provide sufficient direction for the purposes of waste management planning.

MSW includes wastes generated from residential, commercial, industrial, institutional, construction, demolition, process and municipal services. However, this definition varies greatly among waste studies. Some sources are commonly excluded, such as industrial, construction and demolition, and municipal services. Often only residential waste is referred to as MSW, and in high income countries only 25 to 35% of the overall waste stream is from residential sources. It is important to define the composition of the municipal waste stream in a clear and consistent fashion. For example, if it includes construction and demolition waste, the quantity is usually doubled. Far too often waste management decisions are based disproportionately on residential waste, which accounts for an increasing small fraction of the waste stream as an area industrializes.

Waste generation rates
Waste generation rates are affected by socio-economic development, degree of industrialization, and climate. Generally, the greater the economic prosperity and the higher the percentage of urban population, the more solid waste produced.

Low income countries have the lowest percentage of urban populations and the lowest waste generation rates, ranging between 0.4 and 0.9 kg per capita per day. All countries that have a GNP per capita below US$ 400 generate less than 0.7 kg per capita per day. As GNP increases towards the middle income range, per capita waste generation rates also increase, ranging from 0.5 to 1.1 kg per
Urban environmental management

The high income countries show the highest generation rates, varying from 1.1 to 5.07 kg per capita per day.

Hong Kong generates enormous quantities of construction and demolition waste, which explains its exceptionally high per capita MSW generation rate in comparison to other countries. Its waste generation rate better reflects the true quantities of waste produced by all activities within the municipality than that of some other countries. Although Singapore and Japan report significantly lower generation rates than other high and middle income countries, the figures presented do not represent all municipal solid waste. The Singapore generation rate considers only residential wastes, whereas the Japanese data include only wastes produced from households and general wastes from business activities. In the case of both countries, total waste quantities would be much higher if industrial, commercial, institutional, construction and demolition, and municipal services wastes were included.

Urbanization and rising incomes, which lead to greater use of resources and therefore more waste, are the two most important trends that factor into rising waste generation rates. For example, per capita use of resources by individuals living in India’s urban areas is nearly twice that of those living in a rural setting. Because they consume and generate more solid waste, the Indian urban population is expected to produce far more waste per capita than its rural population. This difference between rural and urban waste generation rates also exists in other Asian countries, such as Bangladesh, where the rural population generates only 0.15 kg per capita per day while their urban counterparts generate 0.4 to 0.5 kg per capita.

Waste composition

Waste composition is also influenced by external factors such as geographical location, the population's standard of living, energy source and weather. Generally, all low and middle income countries have a high percentage of compostable organic matter in the urban waste stream, ranging from 40 to 85% of the total. China and India diverge from this trend because they traditionally use coal as a household fuel source. The ash is very dense and tends to dominate the waste stream in terms of weight. Ash, which is included in the “others” category, makes up 45 and 54% of waste composition in India and China, respectively. The compostable fraction in high income countries, ranging between 25 and 45%, is significantly lower than in low and middle income countries. The percentage of consumer packaging wastes increases relative to the population’s degree of wealth and urbanization. The presence of paper, plastic, glass and metal becomes more prevalent in the waste stream of middle and high income countries.

Waste trends

Waste quantities are inextricably linked to economic activity and resource consumption. Over the next 25 years, poverty in Asia is expected to continue declining (despite the recent economic
cises. Besides economic growth, Asian countries are also experiencing urban growth rates of approximately 4% per year, a trend that is expected to continue for several decades. By 2025 the Asian population is projected to be about 52% urban.

China, for example, is experiencing rapid population and economic growth. Consequently, municipal solid waste is increasing in excess of 10% per year. Wuhan City, the capital of Hubei province, with a population of more than 6.8 million, has an extensive industrial base comprising metallurgical industries, manufacturing, textiles, transport manufacturing, oil processing, pharmaceuticals, electrical equipment, construction materials and food industries. According to Wuhan City’s Environmental Protection Department, MSW quantities increased from 1.19 million tonnes in 1985 to 1.50 million in 1993. Not only are increases in waste quantities commensurate with the growing economy and expanding population, but the composition is also shifting towards plastic and paper packaging, a reflection of improved living standards (Figure 4).

The per capita waste generation rate for most low income countries will increase by approximately 0.2 kg per day, as these countries have relatively high annual GNP growth rates and urban population growth rates. As China, India and Mongolia become more prosperous and move away from coal, the traditional fuel, ash composition will greatly decrease and the percentage of compostable organic matter will increase slightly. Packaging waste, such as paper, plastic and glass, will become more predominant in the waste stream as the economies increase and the population becomes more urbanized.

By contrast, middle income countries should anticipate a per capita increase of about 0.3 kg per day since their economies are expected to grow at the highest rates and will experience significant population growth in the urban sector. Indonesia and the Philippines will produce significant quantities of waste, which will require management with a still relatively small per capita GNP. Although Thailand and Malaysia will have the highest per capita waste production rates, they should also have stronger economies and more resources with which to begin implementing integrated solid waste management plans. Overall, waste composition is predicted to become even more variable as the percentage of compostable matter declines and packaging wastes, especially paper and plastic, increase.

As a whole, urban populations from low and middle income countries will triple their current rate of municipal solid waste generation over the next 25 years. Nepal, Bangladesh, Myanmar, Vietnam, and the Lao PDR, and India can each expect to see their urban waste quantities to increase by about four to six times the current amount. By 2025, the low income countries will generate more than twice as much municipal waste as all the middle and high income countries combined – approximately 480 million tonnes of waste per year. Such a dramatic increase will place enormous stress on limited financial resources and inadequate waste management systems.

The per capita municipal solid waste generation rate in high income countries is expected to remain stable or even decrease slightly due to the strengthening of waste minimization programmes. The total amount of waste generated in 2025 will increase by a relatively small amount – about 1 million tonnes per day compared to current waste quantities. Construction activity in Hong Kong is expected to continue. No immediate proposals are under way regarding how to reduce construction and demolition wastes. Thus, wastes from this sector will remain high and will keep contributing significantly to the municipal waste generation rate. Singapore and Japan have the lowest waste generation rates among high income and even some middle income countries, although these rates may reflect definition inconsistencies rather than waste minimization practices. These two countries have implemented integrated solid waste management plans, but it is unlikely that they will significantly reduce their waste quantities below current levels. The overall MSW composition for high income countries is predicted to be relatively stable. Only a slight decrease is expected in metal and glass wastes; increases should occur in plastic, paper and compostable wastes.

A different trend emerges when comparing waste amounts in terms of volume. On average, decreasing, while low and middle income countries are expected to remain stable or even decrease slightly due to the strengthening of waste minimization programmes. The total amount of waste generated in 2025 will increase by a relatively small amount – about 1 million tonnes per day compared to current waste quantities. Construction activity in Hong Kong is expected to continue. No immediate proposals are under way regarding how to reduce construction and demolition wastes. Thus, wastes from this sector will remain high and will keep contributing significantly to the municipal waste generation rate. Singapore and Japan have the lowest waste generation rates among high income and even some middle income countries, although these rates may reflect definition inconsistencies rather than waste minimization practices. These two countries have implemented integrated solid waste management plans, but it is unlikely that they will significantly reduce their waste quantities below current levels. The overall MSW composition for high income countries is predicted to be relatively stable. Only a slight decrease is expected in metal and glass wastes; increases should occur in plastic, paper and compostable wastes.

A different trend emerges when comparing waste amounts in terms of volume. On average,
Waste quantities and compositions vary not only among countries, but also among individual cities and communities within a city. The figure below illustrates the differences between the waste composition of two residential areas in Beijing. Wealthier households produce significantly higher percentages of paper, plastic, metal and glass waste, most likely from packaging materials. Compostable matter, such as food, horticultural and ash waste, are predominant in single-storey residential waste streams. The high ash and dirt content is from coal since use of gas is not yet widespread (Beijing Environmental Sanitation Administration, 1996).

In 2025, high income countries are expected to experience about a three-fold increase in overall waste quantities and volumes, while those in low and middle income countries will be the largest generators of waste on a mass basis. They will also surpass the total volume of waste produced by the high income countries. The increasing percentage of plastic and paper materials in the waste stream will contribute to the growing waste volume. In the next 25 years, both low and middle income countries will experience about a three-fold increase in overall waste quantities and volumes, while those in South Korea, Hong Kong, Singapore and Japan will stay relatively constant.

**Consumer societies**

Industrialized countries, with only 16% of the world’s population, currently consume approximately 75% of global paper production. India, Indonesia and China are three of the four most populous countries and among the lowest consumers of paper per capita. However, as their GNP and urban populations grow, paper consumption and related packaging wastes will also increase. If they follow industrialized countries, their paper requirements will be enormous.

As countries become richer and more urbanized, their waste composition changes. The substantial increase in the use of paper and paper packaging is probably the most obvious change. The next most significant change is a much higher proportion of plastics, multi-material items and “consumer products” and their related packaging materials.

More newspapers and magazines (along with corresponding increases in advertising), fast-service restaurants, single-serving beverages, disposable diapers, packaged foods and mass-produced products are all by-products of widespread increases in local “disposable incomes.” A negative side of greater affluence is that it brings with it more waste, in greater volumes (making it more expensive to collect). Increased use of plastic waste and food packaging often results in an increase in the amount of litter.

The rate of change in MSW quantities and composition in Asia is unprecedented. As lifestyles rapidly change, the related conveniences and products—mobile phones, electronics, items made of polyvinyl chloride (PVC) plastic, disposable diapers—pose special waste disposal challenges. Even more problematic is the fact that in most low and middle income countries, development of waste management systems woefully lags behind the realities of a quickly changing waste stream.

In addition, newly mobilized consumers and their market-savvy suppliers rarely consider the potential waste management problems that go hand in hand with changing lifestyles. The Coca-Cola Company is one telling example of how a multinational company may endeavour to increase its market share. In its 1996 Annual Report, Coca-Cola reported to shareholders that two of its four key objectives were to increase volume and expand its share of beverage sales worldwide by “investing aggressively to ensure our products are pervasive, preferred…” In another part of the report the president of the company was quoted as saying, “When I think of Indonesia— a coun-
try on the Equator with 180 million people, a median aged 16 and a Muslim ban on alcohol - I feel I know what Heaven looks like." If the per capita consumption of single-serving beverages increased by just one serving a month in China, India and Indonesia, 26 billion containers would be added to the waste stream (Figure 6).

Business involvement in waste management

In pursuit of expansion, multinational corpora-
tions with global marketing programmes undoubt-
edly change and increase the overall waste stream. On the positive side, many of the larger ones - such as McDonald's, Coca-Cola and Unilever - often have progressive programmes that address their specific, as well as the overall, waste stream. By contrast, local firms (e.g. bottled water vendors in Indonesia) are often even more prolific waste generators than their international counterparts. However, the larger multinational compa-

ties, with their global expertise, can also become powerful allies to local governments in the fight against waste. Governments are increasingly realizing that they cannot handle waste management alone. To respond to the call, many progressive companies are working as equal partners with governments in developing comprehensive waste management programmes. A few examples of this enhanced business in-

Figure 6 1996 per capita Coca-Cola consumption and market populations

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6 oz servings of Company beverages per person per year (excludes products distributed by the Minute Maid company) (Coca-Cola Company, 1997)

Figure 7 Global paper consumption rates (1995)

<table>
<thead>
<tr>
<th>Country</th>
<th>Per capita consumption¹ (kg/year)</th>
<th>Per capita GNP² (1995 US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>313</td>
<td>26,980</td>
</tr>
<tr>
<td>Japan</td>
<td>225</td>
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<td>Germany</td>
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<td>18,700</td>
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<tr>
<td>Australia</td>
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<td>18,720</td>
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<tr>
<td>South Korea</td>
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<td>620</td>
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<tr>
<td>Egypt</td>
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<td>790</td>
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<td>Viet Nam</td>
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</table>

¹ Djuweng, 1997
² World Bank, 1997

3. Local governments should focus primarily on residential waste collection, especially waste from poor and densely populated areas, and empower the private sector to pick up waste from non-residential sources. Commercial, institutional and industrial waste collection can usually be self-financing. Local governments should license private haulers, generate revenues and to ensure proper collection and disposal.

4. Municipalities should charge for waste disposal, and possibly collection, based on generation rates. Direct user charges and waste fee collection should begin with the business community.

5. An integrated approach to solid waste management needs to be followed. Municipal waste managers should opt for the least technically complex and most cost-effective solution (e.g. limited mechanization and incineration). Waste diversion should be maximized, and a keen awareness of waste trends is needed. For example, as mentioned above, industrialized countries now contain 16% of the world's population but use about 75% of its paper supply (Figure 7). This has a huge impact on the rapidly developing countries of Asia in terms of both overall global commodity prices and local waste disposal costs.

6. All levels of government, multinational agencies, and domestic and transnational corporations must play a role in long-term programme development, e.g. extended product responsibility, life-cycle analysis, waste exchanges and natural resources tax regimes.

7. Local governments must honestly and respect fully gauge the public’s willingness and ability to participate in the design and implementation of waste management programmes. Through good partnerships, progressive programmes can be developed in a complementary manner. These programmes include community-based operations, micro-enterprise development, waste segregation for increased recycling and composting, and reduced collection frequency. Local governments usually underestimate the public’s willingness and ability to participate in progressive waste management programmes.

8. All levels of government should promote the hierarchy of waste management (i.e. reduce, reuse, recycle, recover) and encourage waste separation to maximize flexibility to deal with future changes. Wherever appropriate, government should view solid waste as a resource rather than just a "local problem.

9. Although waste collection, treatment and disposal costs often place a large burden on local government finances, improper disposal is far more expensive in the long run, with costs accruing over many years and to many stakeholders. The urban areas of Asia now spend about US$ 25 billion on solid waste management per year; this figure will increase to at least US$ 50 billion in 2025. Today’s daily waste generation rate in the four Asian countries covered in this report is about 760,000 tonnes. By 2025, this will increase to about 1.8 million tonnes. Governments need to start budgeting for these trends.

10. Local governments are usually in the best position to assume key responsibility for municipal
solid waste collection and disposal. However, sustainable financing and sustainable service provision still need to be defined by a broader set of stakeholders. Local governments need the assistance of all levels of government to provide waste management services efficiently. Regional approaches to waste disposal (e.g., shared landfills) are especially important.

11. Generally, solid waste planners place too much emphasis on residential waste. This waste represents only about 30% of the overall municipal waste stream, but often receives the lion's share of attention. Costs also change as a country develops. For example, the amount Japan spends on waste disposal is about 10 times greater than collection costs (mostly incineration costs). Total waste management costs in low-income countries are usually over 80% of collection costs. Most countries' overall costs can be minimized by:

(a) relying on landfilling, which is usually a more practical waste disposal option than incineration;
(b) focusing on organics and paper (two of the largest components in the waste stream - paper is the fastest growing in many countries). Waste managers should also concentrate on cities, since urban residents generate two to three times more solid waste than their fellow rural citizens;
(c) pursuing regional (e.g., Asia-wide, or ASEAN) approaches to many solid waste management problems, e.g., packaging regulations, product stewardship, and import/export rules.

Note
1. In this article Asia is limited to China, Japan, Hong Kong, the Republic of Korea, Mongolia, Indonesia, the Lao Peoples Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, Bangladesh, India, Nepal, and Sri Lanka.

This article is based on What A Waste: Solid Waste Management in Asia by Daniel Hornweg with Laura Thomas, Urban Waste Management, East Asia and Pacific Region, Working Paper Series 1, WTE World Bank 1999.

References


Washington Post, 22 November 1997 (article by Anderson and Smith quoting a 1997 Environics International Ltd. 24-country survey).

1991 Urban Population (in millions)

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<tr>
<th>Components</th>
<th>Nepal</th>
<th>Bangladesh</th>
<th>Myanmar</th>
<th>Laos PDR</th>
<th>India</th>
<th>Sri Lanka</th>
<th>China</th>
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Type of Waste

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Singapore based on the entire country. Japan based on Metropolitan Tokyo. Hong Kong based on the entire country.