Case Study 21

Office occupants reduce energy use by 20% in local government building

Cape Town, South Africa

The Tygerberg Administration building in Parow, Cape Town was chosen as a lead building energy-efficiency project after an energy audit was performed and huge saving opportunities were identified. The project, initiated in 2003, aimed to reduce energy use, expenditure and GHG emissions through introducing technological interventions and the promotion of behavioural change amongst building users (city staff).

Based on an initial energy audit, a 20% savings target was established for the project. Regular project meetings were held with relevant staff members to plan for the interventions, provide feedback on successes and problem areas of the project and decide on what follow-up actions were required. Substantial support from a consultant was provided during the project implementation.

The technological interventions included the replacement of 500 incandescent light bulbs with compact fluorescent light bulbs (CFLs), installation of a solar water heater, installation of geyser timers on hot water cylinders, the replacement of some of the tea urns with insulated urns (hydroboils), installation of more efficient fluorescent tubes/ballasts and adjusting air conditioning thermostat settings and use times.

The behavioural change component of the programme involved regular information of staff members via email, a display board set up at the entrance of the building displaying savings from the project, information pamphlets and newsletters keeping staff constantly updated on project achievements and requesting staff to take action to reduce their electricity bill.

The project achieved a saving of 12,000 kWh per month amounting to annual saving of 144,000 kWh of electricity – a 22% saving. This translates to saving of R39,000 (US$5,159) and 158.4 tonnes of carbon emissions per year. Approximately 14% saving was achieved in the technical phase (when the technological interventions were implemented) while 8% was achieved in the 'staff participation' behaviour change phase.

The project reflected huge savings potential from the interventions used, shown by the project targets being easily met and a short payback period estimated at 2 years. This implied that the application of such interventions in other City of Cape Town buildings would likely be technically and financially feasible, save substantial amounts of money and reduce GHG emissions. It was difficult to determine a clear distinction between change attributed to technical interventions and staff awareness (behavioural change) due to change in staff behaviour already occurring on hearing about the project being performed, well before the behavioural changes were requested.

Source: How to implement renewable energy and energy-efficiency options – support for local government. Sustainable Energy Africa and REEEP. 2007.

Case Study 22

Guidelines for building better

San José, USA

The city of San José, the third largest city in California and home to a million people, experiences temperatures ranging form 10°C to 21°C. San José found that by properly orienting streets, sites and buildings, developers could reduce the energy used for space heating by roughly 11% and for cooling by up to 40%.

The San José Environmental Services Department has therefore developed voluntary guidelines, called solar access guidelines, to encourage solar orientation in new constructions. These solar access guidelines specify that the long axis of new dwellings should face within 30° west and 45° east of true south. Because houses in a subdivision usually face the street, planners in San José found that the easiest way to achieve solar orientation was to orient the streets with 30° of the true east-west axis. Homes in such a subdivision would have good solar orientation by default.

In 1998 The San José City Council also approved a recommendation to create a green building task-force that would recommend a green building policy for the City of José. Creation of this task-force was based on a community-initiated recommendation that the City begin to explore green building opportunities. Green building policies and programmes are designed to promote building practices that maximise the health of the occupants and minimise the negative environmental impacts associated with the design, construction and operation of buildings.

Based on discussions with area builders, developers and architects and an understanding of other green building programmes across the country, the Environmental Services Department formed three major work groups:

- **Green Building Steering Committee** – made up of representatives from key city departments
- **San José Green Building Workgroup** – a self-selected group of individuals from the community
- **Green Building Taskforce** – comprised of key building, housing and community sector members appointed by the Mayor

In June 2001, City Council adopted green building policies as developed by the members of the community with the input of city departments.

www.sanjoseca.gov/esd

www.sanjoseca.gov/esd/natural-energy-resources/gb-background.htm

Table 1: Total savings

	Saving/mth	Saving/yr
kWh/month	12,000	144,000
Tonnes CO_2	13.2	158.4
Rands	3,240	38,880

Case Study 23

Learning from termites to cool and heat naturally
Harare, Zimbabwe

The Eastgate Centre is a shopping centre and office block in downtown Harare that has been designed to be ventilated and cooled entirely by natural means. The building stores heat in the day and in the evening, the warm internal air is vented through chimneys, assisted by fans but also rising naturally because it is less dense and drawing in denser cool air at the bottom of the building. At night, the process continues, with cold air flowing through cavities in the floor slabs until the building's fabric has reached the ideal temperature to start the next day. This makes a mechanical or passive cooling system a viable alternative to artificial air-conditioning. The complex also consists of two buildings side by side that are separated by an open space that is covered by glass and open to the local breezes.

This ventilation system was achieved by the incorporation of biomimicry principles[4] into the architectural plans, using design methods inspired by indigenous Zimbabwean masonry and the self-cooling mounds of African termites. Termites build gigantic mounds inside which they farm a fungus that is their primary food source. The fungus must be kept at exactly 35°C, while the temperatures outside range from 1.5°C at night to 40°C during the day. The termites achieve this remarkable feat by constantly opening and closing a series of heating and cooling vents throughout the mound over the course of the day. With a system of carefully adjusted convection currents, air is sucked in at the lower part of the mound down into enclosures with muddy walls and up through a channel to the peak of the termite mound.

The Eastgate Centre uses less than 10% of the energy of a conventional building its size. Eastgate's owners have saved $3.5 million alone because of an air-conditioning system that did not have to be implemented. Outside of being eco-efficient and better for the environment, these savings also trickle down to the tenants whose rents are 20% lower than those of occupants in the surrounding buildings.

http://en.wikipedia.org/wiki/Eastgate_Centre,_Harare;

www.inhabitat.com/2007/12/10/building-modelled-on-termites-eastgate-centre-in-zimbabwe/

Case Study 24

Mali by Sean Mcgrath/flickr.com

Retrofitting hotels
Bamako, Mali

In May 2006, an International Finance Corporation (IFC) conducted an audit of the Chaîne Azalai Hotels in Bamako and determined that with proper technology the hotels could save up to 23% in energy and water use. Investments in cleaner technology that were identified included room keys that switch air conditioning and lights off when guests leave the rooms, efficient light bulbs and a solar water heating system.

These improvements would result in a 50% increase in net profit and could be paid off in a year and a half from cost savings.

This is the first cleaner production initiative of its type for both Mali and Burkina Faso. Given the Chaîne Azalai's leading position in Mali's tourism market, if it chooses to implement the recommended cleaner production investments, it could lead to rapid adoption of similar improvements by other players in the region's tourism sector.

www.ifc.org/ifcext/media.nsf/Content/African_Hotels_Energy_Water_Savings

3.3 Water services, wastewater and sanitation

The energy costs to run drinking water and wastewater systems – to pump, treat, deliver, collect and clean water – can represent as much as one-third of a municipality's energy bill. There are ways to improve efficiencies, save money and reduce water consumption while delivering these important services.

Using water efficiently will conserve water and energy, prevent water pollution at source and reduce costs associated with the expansion of municipal water distribution and wastewater treatment systems.

Methane, a greenhouse gas, can be an off-gas from sewerage works. Flaring this gas could increase your carbon footprint. This gas could be used productively and turned into electricity or bio-methane for transport, potentially bringing in income while reducing one's carbon footprint.

[4] This is the study of natures best ideas and how to imitate these great designs or processes to solve human challenges

Case Study 25

Saving water, saving energy, saving money, reaching more people
Fortaleza, Brazil

The Companhia de Água e Esgoto do Ceara (CAGECE) in the Northeast of Brazil in partnership with Alliance to Save Energy aimed to improve the distribution of water and the access to sanitation services, while reducing operational costs and environmental impacts.

Over four years, CAGECE saved 88 GWh of energy, improving efficiency each year. Before CAGECE instituted their energy-efficiency programme, they provided access to 442,400 households. Four years later, the utility provided 88,000 new connections over the original baseline, while decreasing total energy consumption and costs and maintaining water consumption levels. Four years of official data show savings of over US$2.5 million with an initial investment by CAGECE of only US$1.1 million. As a result of this 127% return on investment after 4 years, CAGECE was initially approved for financing by the energy-efficiency fund of PROCEL (Government Brazil Fight Against Electricity Waste Programme) to work with the World Bank to implement further efficiency measures. The Alliance helped develop five projects, including replacing motors with high performance motors, maximising pumping efficiency, suspending pumping during peak hours and increasing capacity of the current pumping stations and specifications relating to energy efficiency. If implemented these projects would add a saving of 7 million kWh per year, with a total investment of US$2 million by the PROCEL and the World Bank. The cost/benefit analysis predicts a payback period of 3.5 years. However, the financing opportunity was lost because funds were obligated to pass through the state energy utility in Ceará (COELCE) and the legal departments of COELCE and CAGECE could not come to an agreement.

Further intervention included automation of operations, rewinding and replacement of motors, maximising existing pump systems efficiency and increasing storage capacity to allow the shutdown of pumps during peak hours. An operations procedure manual was created to serve as a reference for daily performance to operations crews and CAGECE management. CAGECE established an operational control centre for the water supply system of Metropolitan Fortaleza. The objectives of the automation of the water supply system of Fortaleza were to optimise operations to reduce energy costs, improve system management by centralising control, speed up recognition of and response times to maintenance needs using sensors and by acting through controlling devices and generate system diagnostics using historical records of operational data.

www.watergy.org/resources/casestudies/fortaleza_brazil.pdf

UNEP Sustainable Building and Construction Initiative (SBCI)

The UNEP Sustainable Building and Construction Initiative (SBCI) provides stakeholders with a common platform to promote the adoption of sustainable construction principles. Industrials, construction companies, real estate developers, financers, architects and local authorities are working with UNEP and its partners to propose energy efficiency and CO_2 emissions from buildings and to develop benchmarks for sustainable building.

This initiative provides reviews of policy instruments for reducing greenhouse gas emissions from buildings, has a key report on how buildings can play a key role in combating climate change and provides targeted policy briefings for countries and regions.

To achieve its final objective of promoting a worldwide adoption of sustainable buildings and construction practices, SBCI is implementing a 4 step process.

STEP 1 – Provide a common platform for the stakeholders
SBCI provides a common platform to all buildings and construction stakeholders for addressing sustainability issues of global significance, especially climate change.

STEP 2 – Establish baselines
SBCI establishes globally-acknowledged baselines based on the life cycle approach, with a first focus on energy efficiency and CO_2 emissions.

STEP 3 – Develop tools and strategies
SBCI will develop tools and strategies for achieving a wide acceptance and adoption of sustainable building practices throughout the world.

STEP 4 – Implementation through pilot projects
SBCI promotes the adoption of the above tools and strategies which will be evaluated through pilot projects to key stakeholders.

Source: www.unepsbci.org

Praia do Fortaleza by wbuechel/flickr.com

Case Study 26

Technical interventions to save energy while delivering water
Ahmedabad, India

Capacitors[5] on water pumps in Ahmedabad are reducing power consumption by 12.6%, resulting in financial savings of over 2.6 million rupees or US$50,000 a year. The city also replaced it steel water pipes with bigger diameter polyvinyl chloride pipes, which reduced friction in the pipes and improved energy efficiency. This change alone reduced energy consumption by an estimated 1.7 million kWhs each year, saving the city more than 4.48 million rupees (about US$100,000) annually.

www.egovamc.com

Case Study 27

Drinking water pumped up by the sun
Kayrati, Chad

The rural population of Chad in 2003 was estimated at around 6.6 million living in 28,500 villages, with only 27% of all rural communities having access to a modern water point. In order to provide safe drinking water to some villages solar water pumps have been employed.

A solar-powered water pump and holding system was installed in Kayrati in 2004 as compensation for land lost to oil development. This solar-powered water tower provides clean drinking water to the 1,700 inhabitants of the Kayrati community. This system utilises a standard well pump powered by photovoltaic panels. Panels soak up rays from the sun to power an electric pump that raises water from a borehole. The water tower then brings up clean drinking water by gravity into public taps in the village.

Although a rural project, many cities have peri-urban communities that need access to clean water and this may be an option.

Source: Trying to make oil wealth work for the people, IRIN News, October 2004 and Chad National Drinking Water Supply and Sanitation Programme (PNEAR): Appraisal Report.

www.povertyenvironment.net/?q=chad_national_rural_drinking_water_supply_and_sanitation_programme

Case Study 28

Fetching water a well, India. www.usi.edu

Rainwater harvesting can save energy
Delhi, India

Rapid urbanisation and population growth have resulted in Delhi facing acute water shortages and a drastic drop in the groundwater table. A number of measures are being promoted to address the falling groundwater levels. One of these measures involves a Ministry of Water Resources programme for rainwater harvesting and recharge of the groundwater system.

The Municipal Corporation of Delhi has given instructions to make rainwater harvesting mandatory in all new buildings with a roof area of more than 100 m^2 on plots exceeding 1,000 m^2.

The potential of rooftop rainwater harvesting is approximately 125,000 litres for a plot size of 250 m^2 based on an annual rainfall of 1,000 mm. If the scheme is implemented throughout the city of Delhi the additional recharge to groundwater will be around 76,500 million litres per annum. If the water level rise from this recharge is as expected, this will amount to a saving of US$16,000 per day. Over and above this saving on conventional water supply, there will be a very significant energy saving. In floodplains the energy saving for a 1 m rise in ground water level is around 0.40 kW due to the reduced pumping needs.

Source: Measures for Ensuring Sustainability of Rainwater Harvesting, Water for Asian Cities Programme Rain Water Harvesting and Artificial Recharge to ground water: A Guide to follow. 2008

[5] A capacitor is an electronic device that can store energy in the electric field between a pair of conductors (called 'plates'). The process of storing energy in the capacitor is known as 'charging' and involves electric charges of equal magnitude, but opposite polarity, building up on each plate. Capacitors are often used in electric circuits as energy-storage devices.

Case Study 29

Veracruz, Mexico by Johnny Shaw/flickr.com

Reducing energy intensity in delivery of water and sanitation services
Veracruz, Mexico

The Metropolitan System of Water and Sanitation at Veracruz (SAS), the water utility in Veracruz, Mexico, was motivated to undertake significant steps to become more energy efficient because energy costs ranked second in total operating costs and because their service was sporadic with severe interruptions. The system serves 628,000 users and provides water and sanitation in the municipalities of Veracruz, Boca del Rió and Medellín in the state of Veracruz.

Before the project, parts of the system experienced severe interruption of service lasting up to five hours at a time. The project goal was to increase the energy-efficiency of the operating system, improve the conditions of operation and provide better service to the customer. The plan they developed helped to improve energy and water supply efficiency, while at the same time improve water service.

The project achieved savings primarily from basic supply side strategies using a variety of methods:

- Optimisation of electromechanical efficiency resulting in savings of 153,254 kWh/month, with a payback period of 1.7 years
- Leak detection and water conservation resulting in savings of 35,500 kWh/month.

The baseline energy intensity[6] taken at the beginning of the programme was 0.48 kWh/m^3. Over the development of the programme, the energy intensity had been reduced to 0.39 kWh/m^3 resulting in US$394,000 in savings for the utility.

www.watergy.org/resources/casestudies/veracruz_mexico.pdf

Case Study 30

Improving access to water and saving energy in India
Vishakhapatnam, India

Indian municipalities are facing the challenges of rapid urban expansion, increasing power tariffs and acute water shortages. At present only about two-thirds of the urban population has direct access to clean, affordable and reliable drinking water services. At the same time, municipal water utilities in India spend up to 60% of their budgets on energy used for water pumping.

Vishakhapatnam, with a population of 1.2 million, is the second largest city in the southern Indian state of Andhra Pradesh. The city has a severe shortage of water. 213 million litres per day (MLD) are required by the city, which in turn requires 340 MLD to be pumped from the source, due to waste that occurs at various points in the system. However, only 190 MLD was being supplied to the city and in some areas drinking water is supplied only once every two days.

Vishakhapatnam Municipal Corporation (VMC) wanted to augment the water supply by bringing water from a reservoir of the River Godavari from a distance of nearly 200 km. The distance from the river to the reservoir is another 56 km. VMC spent US$94 million to lay the transmission pipeline from the river to the reservoir and another US$23 million to integrate the new water received into the existing supply system.

VMC has also allocated US$3.4 million for reduction of water losses, energy efficiency and other measures. In partnership with the Alliance to Save Energy, the VMC:

- Implemented a water and energy audit study of VMC's bulk water supply system
- Built in-house technical and managerial capacity of VMC to oversee energy audits and implement energy-saving measures
- Incorporated energy-efficiency measures in the design stage of its new Godavari water works by adapting tender documents and redefining the technical specifications of pumps and motors.

VMC implemented energy-efficiency measures with an investment of only US$24,500 from its operations and maintenance funds. The measures included retrofitting pumps and motors, optimising the use of contracted demand, segregating low tension and high tension and trimming impellers. As a result of these measures, VMC is accruing an annual energy savings of 1.4 million kWh and an annual financial savings of approximately US$60,400. This has reduced VMC's annual energy bill for pumping water by about 5.4% and has reduced CO_2 emissions by about 2,400 metric tonnes. The simultaneous reductions in municipal wastewater, through more effective supply and distribution, will allow the municipality to deliver water to more homes.

www.waterway.org/resources/casestudies/vishakhapatnam_india.pdf

[6] The amount of energy needed to move a cubic metre of water

3.4 Waste management and methane recovery

Good waste management practices by local governments can significantly reduce energy consumption and greenhouse gas emissions. Recycling and re-using materials reduces the energy needed to:

- dispose of these products through the waste stream (including reducing the need to transport waste) and
- produce and transport new products (also called embodied energy).

When organic waste, such as paper, cardboard, garden and food remains decompose, it produces methane, a powerful greenhouse gas. This gas produced in landfills can be captured and used as a source of energy. This is a significant means to reducing carbon emissions and is the type of project where the carbon emissions are fairly easily traded.

Garbagetruck by Pip Wilson/flickr.com

Case Study 31

The Streets of Naga City by hellochris/flickr.com

Recovering waste materials and reducing GHG emissions

Naga City, Philippines

To reduce the amount of garbage brought to the landfill or dumped into the river stream, Naga City formulated the concept of establishing materials recovery centres in 1999. The city started off with community-based and small-scale materials recovery facilities, which worked their way toward a city-wide materials recovery facility (MRF) launched in February 2004.

The facility serves as a waste processing and recycling plant that converts biodegradable waste to organic fertiliser. Low-grade composts are sold at markets for a minimal price while high-grade composts are on average US$3.50/bag. Non-biodegradables recovered by the facility are either sold or recycled. Housed at a former dumpsite converted into a controlled landfill, waste collectors who live in the area now work at the facility as waste segregators.

The MRF is made possible through a build-operate-transfer (BOT) agreement with Lacto Asia Pacific Corporation. In implementing this project, the local government invested 3.75 hectares of land, 3.5 million pesos (US$64,000) for the machineries and equipment, 5 million Pesos (US$91,000) for the infrastructure and an estimated 14 million pesos (US$250,000) every year for operational costs (i.e. collection and delivery). The partner organisation provides the equipment such as trolley, garbage bins, trommel mill, screener and conveyors.

From an average of 60 tonnes of waste collected everyday from the city, of which 40% is recyclable, about 13,862 tonnes of CO_2e emissions are reduced annually.

www.iclei.org (ICLEI case study – Local Waste Diversion)

www.naga.gov.ph

Case Study 32

eThekwini – Durban, South Africa by antiguense/flickr.com

Landfill-to-electricity project using CDM
eThekwini, South Africa

The Durban landfill-to-electricity Clean Development Mechanism (CDM) project aims to enhance the collection of methane at three landfill sites of the eThekwini Municipality: the Mariannhill site, the La Mercy site and the Bisasar Road site. Two of these sites (Mariannhill and Bisasar Road, which opened in 1997 and 1980 respectively) already collect and flare methane, but this takes place at an efficiency rate of a mere 7.4%. The CDM project aims at a collection efficiency rate of 85% at the highest level (to be reached in 2012) and of 45% at the end of the project's commercial lifetime.

The project's methane recovery will take place through the installation of approximately 180 production wells for landfill gas extraction at the three sites. Subsequently, the gas will be used for electricity generation. It is envisaged that the project will install a total electricity generation capacity of 10 MW gas-fired generators (in units of 1 MW each) at the three sites, which will produce 74.5 GWh per year. The electricity will be delivered to the South African grid, based on a power purchase agreement for 10 years with options for two additional 5-year extensions.

Durban Solid Waste, the municipal agency responsible for management and operation of multiple landfills in the eThekwini metropolitan area, will function as the technical advisor and the operational entity of the project.

www.durban.gov.za/durban/services/departments/environment/environews/greenpast

www.jiqweb.org/durban.htm

Case Study 33

Integrated waste management
Edmonton, Canada

The City of Edmonton's approach to waste management is comprehensive, integrated and sustainable. Based on public input, Edmonton developed a 30-year Waste Management Strategic Plan in 1994 that provides the overall framework for the ongoing development and improvement of waste management practices. Working in part with private sector partners, the implementation of the waste management strategy has succeeded in enabling Edmonton to divert approximately 70% of its residential waste from landfill.

Key components include household participation in recycling, a state-of-the-art co-composting facility, a materials recovery facility, a leachate treatment plant, landfill gas recovery and public education programmes. These programmes and technologies have provided an opportunity for Edmonton to work with private sector and academic partners to develop a waste management centre of excellence with a focus on education, research and technology.

Edmonton's Clover Bar Landfill Site is 1 of 33 landfills in Canada that has an active gas recovery system. It is the only site in Alberta that both recovers gas and uses it to generate electricity and 1 of only 13 such sites in Canada. The methane produced at the landfill is converted into enough electricity to meet the power needs of approximately 4,600 homes.

www.edmonton.ca/portal/server.pt/gateway/PTARGS_0_2_271_213_0_43/http%3B/CMSServer/COEWeb/environment+waste+and+recycling/waste/edmonton+waste+management+centre/Landfill+Gas+Recovery.htm

Additional Source: ICLEI Case Study – City of Edmonton, Canada: Comprehensive and Integrated Approach to Waste Management. August 2001.

Case Study 34

Sunset Dar es Salaam by phunko82/flickr.com

Landfill gas recovery at Mtoni Dumpsite
Dar Es Salaam, Tanzania

In 2004, Dar Es Salaam City Council, an urban authority, started planning for the closure of Mtoni Dumpsite. In 2005, a private firm from Italy approached the city authority to establish a gasflaring project. An initial study estimated the total avoided CO_2 emissions over a 10-year period to be about 1,033,209 tonnes, a good basis for a CDM project.

The private company and Dar Es Salaam City Council signed a concession contract in March 2005 in which Dar Es Salaam City Council grants the company, Consorzio Stabile Globus, the rights to capture and burn all biogas produced at the 'Mtoni Dumpsite' for a 10-year period. Throughout the duration of the contract, Consorzio Stabile Globus will be responsible for the construction and management of the gas extraction and flaring system, including any required investment. Dar Es Salaam City Council will continue to own and manage the landfill site.

Consorzio Stabile Globus will capture the biogas produced at Mtoni Dumpsite by setting up and operating an extraction plant comprised of a network of wells and connected pipes, running into blowers and then into torches to flare it.

www.cd4cdm.org/sub-Saharan%20Africa/Tanzania/First%20National%20Workshop/LandfillGasRecovery_Chinamo.pdf

http://cdm.unfccc.int/Projects/DB/DNV-CUK1169853184.14

Case Study 35

Marie Reiderskold/flickr.com

Production of biogas and bio-fertiliser while reducing carbon emissions
Laholm, Sweden

The Laholm Biogas Plant was built in 1992 as a measure to reduce the increasing eutrophication[7] of the Laholm Bay on the west coast of Sweden. Prior to the establishment of the plant in 1992, manure in Laholm created significant environmental problems in the area. Nitrogen was leaking into the bay, polluting it for drinking and recreational purposes and killing off marine species. As such, the goals for the project were also to produce biogas for the city of Laholm and to produce a certified bio-fertiliser for the farmers in the area. With the establishment of the plant there is now adequate storage for manure and the manure is turned into energy and fertiliser.

Laholm has a biogas plant that turns animal manure and different kinds of organic waste into bio-fertiliser and biogas. As a result, biogas is replacing around 25% of the city's natural gas consumption and is reducing GHG emissions by 3,700 tonnes per year.

The biogas feeds into the district heating network, heating industries and houses. A portion of the biogas is also sent to filling stations, to provide fuel for a growing number of light-duty vehicles and trucks. The biogas plant, Laholm Biogas AB, is a company owned jointly by the local power utility company Södra Hallands Kraft AB, the local farmers association (Vallberga Lantmän) and the City of Laholm. An upgrade of the plant in 2000 has made it possible to use 100% of the biogas, thereby avoiding previous challenges involving flaring of gas during periods when heat demand is low.

Source: Injection of Biogas into the Natural Gas Grid in Laholm, Sweden, IEA Bioenergy Task 37.

www.biogasmax.eu/media/1_biogas_upgrading__075624200_1207_19042007.pdf

[7] Eutrophication means an increase in chemical nutrients – typically compounds containing nitrogen or phosphorus – in an ecosystem. It may occur on land or in water. The term is however often used to mean excessive plant growth and decay and further effects including lack of oxygen and severe reductions in water quality, fish and other animal populations.

Case Study 36

Thailand Street Market by Atelier Teee/flickr.com

Reducing CO_2e while making organic fertiliser and liquid detergent production from waste

Thungsong, Thailand

The Municipality of Thungsong has identified and implemented measures aimed at not only managing their waste sustainably to reduce local GHG emissions, but also to benefit from the economic possibilities.

The Municipality of Thungsong collects organic wastes from the fresh market stall owners, after which they are grounded, mixed with molasses and composted for 10-20 days. This produces 3,000 litres of liquid detergent and 1,000 kg of ground fertiliser every month, providing the municipality with an estimated annual income of US$1,200 from the sale of these products.

Aside from establishing a materials recovery facility, the municipality has also initiated successfully hazardous waste management (i.e. coating of Para rubber of dangerous waste before storage), organic fertiliser production from household sewage and livestock manure and organic fertiliser and liquid detergent production from market waste.

The carbon offsets from the organic fertiliser production is estimated at 29 tonnes of equivalent CO_2. The organic fertiliser replaces unhealthy chemical fertilisers and the detergent produced is used to clean the market floor.

This initiative depends largely on sustaining waste segregation practices. Ensuring that this practice is sustained entails multiple and innovative community incentives.

https://www.iclei.org/fileadmin/user_upload/documents/SEA/CCP_Projects/Tungsong.pdf

Case Study 37

Fishing Boats by JoVivek/flickr.com

Using wastewater to power a seafood processing plant

Ratnagiri, India

An effluent treatment plant was installed in Ratnagiri, a district in Mahrashtra about 400 km from Mumbai, to treat the wastewater from the manufacturing of seafood in order to generate biogas. The plant generates 13,000 m^3 of biogas daily, replacing 4,7 kilolitres of oil from furnaces per day.

The effluent is treated in an anaerobic digester followed by further processes that allow for the re-use of the wastewater to reduce water consumption in the plant. During treatment of wastewater, biogas is generated with high percentage methane which is converted into thermal energy for the plant's in-house requirements. Not only is water consumption and energy use therefore reduced, but the closed system prevents large quantities of methane, a powerful greenhouse gas, from being emitted into atmosphere.

This is a joint project between the Ministry of Environment and Forests in India and Gadre Marine Export Pvt Ltd.

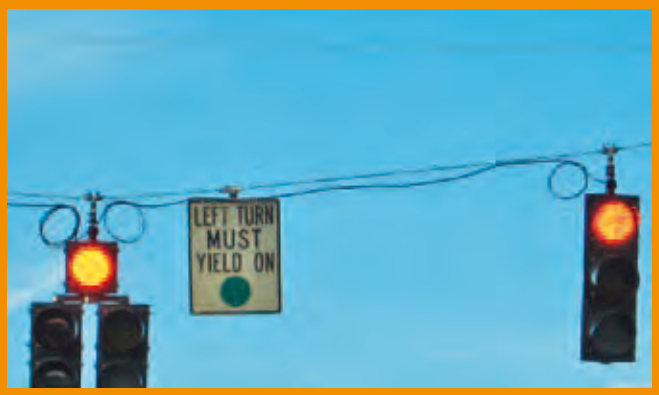
www.lr.org/NR/rdonlyres/948387B9-63A2-40ED-A902-5FE419B5C4AA/38985/MethaneRecoveryfromwastewatertreatmentinSeafoodInd.pdf

3.5 Public lighting

Converting streetlights and traffic signals to low-energy systems typically provide significant energy and operating cost savings for a local authority. These are usually considered 'low-hanging fruit' as they are quite easy to tackle and show results quickly. Traffic signals are owned and operated by local governments and run 24 hours a day, consuming a significant amount of energy. Historically these signals have used incandescent bulbs, but recently cities have taken the initiative and begun replacing incandescent signals with more efficient light emitting diode (LED) signals, which use 90% less power, last ten times longer and appear brighter than traditional incandescent bulbs. For example Denver, Colorado saves nearly US$800,000 annually in energy, materials and labour costs. In terms of emissions reduction and public health, this programme reduces pollutants by an amount equivalent to the effects of planting more than 777 acres of trees or the permanent removal of 371 cars from local roads.

Motorcyclist at night by (nz)dave/flickr.com

Case Study 38



LED lighting by 92wardsenatorfe/flickr.com

Energy-efficient street lighting in India

Guntur, India

Relative to the provision of other public services, street lighting in India consumes an immense amount of energy. The municipal corporation of Guntur was spending Rs1,072,074 (US$26,360.31) (based on the monthly average for electricity bills in 2002) for street lighting alone. An analysis suggested a significant scope for energy savings through providing an energy-efficient street lighting system in the corporation area.

A pilot demonstration project 'the Energy Efficient Street Lighting System' was initiated in March 2003. This involved using power saving instruments in four strategic locations, each device calibrated for that location's unique lighting load.

The Servo Max Power (produced by Servomax India Limited) saver devices, installed at switch points, guarantees a 25% -30% reduction in energy consumption. The devices in the four demonstration areas regulate voltage after peak hours and automatically reduces voltage during low traffic flow.

The pilot project was supported by ICLEI under an agreement with Gunter Municipal Corporation (GMC), which agreed that once the results of the pilot project were substantiated GMC would implement its recommendations across the entire city in a phased approach through an Energy Services Company (ESCO).

These devices resulted in an overall energy saving of 35%, saving 22,900 kWhs of electricity and reducing CO_2e by 23 tonnes per year.

www.iclei.org/index.php?id=1636

Case Study 39

Chaat shop blues by Sajith T S/flickr.com

Retrofitting streetlights
Jabalpur, India

With 20% of its energy bill coming from street lighting alone, ICLEI along with the Municipal Corporation of Jabalpur (MCJ) proposed an energy efficient street lighting pilot project to reduce the expenditure and improve the energy-efficiency in the existing system.

The 'Retrofit Street Lighting Pilot Project' was launched in 2002. The project was located at two important locations in Jabalpur, namely Nehru Garden, MCJ and Janki Nagar Residential Area, where 51 energy-saving retrofit tubelights were installed. The cost of the project was Rs50,000 (US$1,208.75) 70% of which was shared by ICLEI, with the remaining 30% contributed by the project consultant, Asian Electronics Ltd.

The basic concept for the project is a retrofit of the conventional streetlight system with an energy-efficient tubelight system. Jabalpur streets, walkways and parks are commonly lit with 40-W fluorescent tubelights with ballasts that consume an additional 10-13 W. To reduce energy consumption, 28-W retrofit tubelights have been introduced on the pilot project sites.

The data gathered after six months of monitoring and observations suggests that the savings associated with the retrofit is Rs35/month/tube (US$0.85) according to 10-hour illumination/day and including maintenance and labour charges. This will also lead to an annual reduction of 7 tonnes of GHG emissions.

The city is studying the feasibility of replacing 33,000 existing tubelights with new efficient 28-W tubelights, resulting in a reduced energy consumption of 3 million electrical units annually.

www.iclei.org/index.php?id=1637

Case Study 40

South Africa, Johannesburg: Night lights by kool_skatkat/flickr.com

Solar streetlights as part of regeneration plans
Johannesburg, South Africa

The streets of inner city Johannesburg might be lit by solar-powered streetlights as the Johannesburg Development Agency (JDA) adopts an environmentally-friendly lighting strategy. Established in April 2001 as a limited liability company, the JDA is an agency of the City of Johannesburg that stimulates and supports area-based economic development initiatives throughout the Johannesburg metropolitan area in support of Johannesburg's Growth and Development Strategy.

As part of an initial pilot project, three locally manufactured solar streetlights have been installed on Kenmare Street in Yeoville by Broadwing Technologies. If the pilot is a success more lights will be installed in surrounding areas and the rest of the city.

Renewable energy from the sun means independence from Eskom's coal-based power utility, which in turn means cost savings and environmental gains. An evaluation that was done jointly by Broadwing Technologies and JDA to monitor performance showed that the solar streetlights compare favourably with the cost of installation of conventional streetlights. The lifecycle maintenance costs of the installation are also favourable as the LED bulbs used in the streetlights use a lower voltage to produce a brighter light and can be used without replacement for about 20 years.

According to figures estimated by Broadwing Technologies, the City would be able to achieve a saving of 1 MW for every 12,000 or 15,000 streetlights that are retrofitted.

www.engineeringnews.co.za/article.php?a_id=131170

Case Study 41

Council Square at night, Brasov, Romania by cod_gabriel/flickr.com

Public lighting

Odorheiu Secuiesc, Romania

During communist rule, street lighting was very inefficient, if it was provided at all. In 1996, Odorheiu Secuiesc did an audit of its outdoor street lighting to find that only 42% of the light standards were in good working order.

This urged the European Commission to make an offer to the communities by establishing the collaboration CLEEN (Communal Lighting and Energy Efficiency Network), with the help of the Energie Cites Project. A pilot project was introduced to assess the feasibility of acquiring energy-saving lamps from abroad which had a much longer lifespan than domestic products. The next step was to get the consent of the government-owned electricity company to implement far-reaching changes in the lighting network. This was difficult to begin with, as the company, for obvious reasons, was not interested in reducing energy consumption.

The energy company was put in charge of acquiring high-pressure sodium vapour lamps for the city lights. Money saved was then re-invested to improve the lighting network. 75% of streetlights in Odorheiu Secuiesc have now reached European standard.

www.bestpractices.at/main.php?page=programmeme/europe/best_practices/odorheiu_secuiesc_romania&lang=en

Case Study 42

Solar-powered traffic lights by Bruce Sutherland, City of Cape Town

Combining solar power with LED bulbs for energy-efficient traffic lights

Cape Town, South Africa

The City of Cape Town embarked on a pilot project to power traffic lights by sunlight rather than electricity. Working together with the National Energy Efficiency Agency, the City installed light emitting diodes (LED) traffic lights powered by solar panels. This initiative will improve traffic flow during electricity black outs, reduce operational costs and reduce greenhouse gas emissions.

The eight-traffic light intersection in a busy industrial and commercial hub was retrofitted with energy-efficient LED lights, a monitoring unit, a solar panel and batteries as part of a three-month assessment period.

The 4 m^2 solar panel (mounted on a lamppost-height pole to prevent theft) charges the battery buried underground. It can generate 500 W. Currently an average traffic intersection uses about the same amount of power during a month as an average three-bedroomed house. Based on this, it is estimated that Cape Town's traffic lights draw the same amount of power as 1,200 three-bedroom homes. This means potential energy savings in the future would be sizeable if all traffic lights changed from halogen lights to energy-efficient LED clusters powered by the sun. These LED lights use seven times less electricity than conventional light bulbs in traffic lights and also last for at least five years, as opposed to three months.

If the pilot project, funded by the major power utility Eskom, is a success, these solar-powered traffic lights will be rolled out throughout other municipalities across the country.

www.capetown.gov.za/press/Newpress.asp?itemcode=2318

www.southafrica.info/about/sustainable/ctgreen-021007.htm

Case Study 43

3.6 Public transport and city planning

There is an obvious link between reduced vehicular travel and reduced fossil fuel use and therefore greenhouse gas emissions. Local governments need to vigorously support a shift from private to public and non-motorised transport for daily commuters. In cities where a significant percentage of commuters walk, traffic-calming measures aimed at reducing traffic speed and protection of pedestrians and cyclists are vital.

Urban form has a direct impact on energy use – and on greenhouse gas emissions. The development of compact, mixed-use neighbourhoods increases energy efficiencies, as do the increasing of densities around transport nodes and activity spines. These approaches to city planning also reduce infrastructure and service delivery costs.

Mass transit is at the heart of any smart growth policy, because it allows people to get from home to work in the most efficient, least environmentally-harmful way possible. Mass transit in the form of buses or rail can save energy, reduce pollution, reduce the need for parking, alleviate congestion and provide economical transportation alternatives. In many congested cities using mass transit can also be faster than driving a car. Bus Rapid Transit, has proven to be both cost efficient and popular with riders. In these systems, buses run on a dedicated lane separated from traffic, with its own timed traffic signals. Allowing buses to bypass car traffic congestion dramatically speeds up bus travel and makes buses highly competitive with private cars for commuters.

Cities can also run buses on biodiesel. Local governments might even consider starting a citywide waste vegetable oil collection service to run the buses. Biodiesel has many downsides however, if it is made with edible food crops such as maize or soya. When fuels are manufactured from grains and other staple crops it can push up prices of food and thus impact most on the poor. The production of feedstock for biofuel production is often also water intensive and brings other problems associated with monoculture farming.

As cities encourage downtown, transit-friendly development, they should also try to limit aggressive suburban sprawl. Limiting sprawl helps cities conserve energy and resources by decreasing commute times and thus improving air quality and community health. Finally, managing sprawl helps to keep central city residents closer to labour markets, which has overall benefits to the urban economy.

Mexico City bus by travellingred/flickr.com

Bus Rapid Transit System reduces air pollution, carbon emissions, accidents and travel time

Mexico City, Mexico

The transportation sector is the primary source of emissions in Mexico City. In 2000 the city generated 51 million tonnes of CO_2. Of this total, the transportation sector accounted for 37%. As transportation is also the largest source of air pollution emissions, many of the measures undertaken by the city focus on vehicle and other transport improvements.

In 2002 EMBARQ, the World Resources Institute's Centre for Sustainable Transport, initiated a partnership with the Government of Mexico City and the Centro de Transporte Sustentable de Mexico (CTS-Mexico) to develop the 20 km Bus Rapid Transit system. Mexico City's Bus Rapid Transit system, MetroBus, was officially opened to the public in June 2005. It transports an average of 260,000 passengers a day during the week through 36 stations on the city's longest street.

The system has replaced 350 older microbuses with 97 brand new articulated diesel buses that have eliminated 35,000 tonnes of GHG emissions and reduced passenger exposure to tailpipe emissions by 23-59%.

The system has also managed to reduce travel time by an average of 33% as well as decrease accidents by 30%. Newly elected mayor, Marcelo Ebrard and his administration are considering initiating ten more MetroBus lines.

www.df.gob.mx

www.metrobus.df.gob.mx/web.pdf

Case Study 44

Putting commuters on the TransMilenio saves energy
Bogotá, Colombia

Fifteen years ago the Colombian capital Bogotá suffered from heavy traffic congestion, no rail, no formal bus system and no plan for changes. The use of private cars was a major cause of congestion and air pollution. Although approximately 71% of motorised person trips were made by bus, 95% of road space was used by private cars, which transported only 19% of the population.

By the end of the 1990s, a new Bus Rapid Transit (BRT) system, named TransMilenio was designed and partially implemented to solve these large inefficiencies of mass transit in Bogotá. TransMilenio was launched in 2000 with the first phase comprising 40 km of exclusive busways, 57 bus stations, 305 km of roads for feeder buses, 29 plazas and sidewalks and a control centre.

One important factor in the success of TransMelinio has been the city government's strong leadership with careful design and planning. Under the leadership of then mayor, Enrique Penalose, Bogotá was transformed into a leading model for innovative, efficient and accessible transportation networks worldwide. This leadership has combined with the mobilisation of necessary funds, state-of-the-art technologies adopted to run the system, the establishment of a good management company, a sound investment in infrastructure and an efficient single fare pricing system.

By 2015, TransMilenio will have 22 lines and 6,000 articulated buses providing five million trips per day. In addition to exclusive busways, the City of Bogotá has 230 km of bike lanes with plans to increase this to 350 km of expanded sidewalks and a 17 km pedestrian zone. Among the travel demand management measures instituted are forbidding private cars to operate in Bogotá central business district during the morning and evening peak. Parking fees were increased by 100% and fuel taxes were increased by 20%. A key promotion measure is 'car-free day' held once a year on a weekday and car-free Sundays on particular roads.

The TransMilenio public transport system has become the first mass transit system in the world to be considered a clean development mechanism (CDM) in accordance with the Kyoto Protocol. The UNFCC has approved Andean Development Corporation CAF's methodology to consider the TransMilenio scheme as having a CDM component. This means that it is officially accepted that the TransMilenio system reduces the emission of greenhouse gases because of its greater efficiency in transporting passengers and due to the partial substitution of private means of transport by high quality public services. The UNFCCC-approved methodology presented by CAF and TransMilenio is applicable to other mass public transport systems in Colombia, such as the MIO in Cali, Transcaribe in Cartagena, Transmetro in Barranquilla and Megabus in Pereira. It could also be applied to similar transport systems in other countries.

www.transmilenio.gov.co/transmilenio/home_english.htm
Source: Energising South African Cities and Towns – a local government guide to sustainable energy planning. Sustainable Energy Africa. 2003.

Case Study 45

Kisumu City by Victor O'/flickr.com

Urban mobility plans
Kisumu, Kenya

Following a city consultation held in August 2004, the Kisumu City Council in collaboration with Sustainable Cities Programme (SCP), ITDG, IHE-UNESCO and the various stakeholders finalised an environmental profile and developed a city-wide urban mobility strategy that will provide a framework for area-specific action plans for selected hotspots. This is done under a new component of the SCP Programme, the Sustainable Urban Mobility (SUM) initiative.

One of these action plans involves making improvements to the main arterial road in Kisumu, Jomo Kenyatta Highway, to increase the comfort, efficiency and safety of boda-boda bicycle taxi operations; increase the efficiency of matatu mini-bus operations and to increase the safety of pedestrians. The Jomo Kenyatta highway traverses in a SW-NE direction and forms the division and backbone of the internal road network within the Kisumu Central Business District (CBD).

Improvements that were most beneficial to pedestrians included covered boda-boda waiting areas at regular intervals and raised zebra crossings to allow for safer crossings.

The SUM initiative is aimed at strengthening the technical knowledge of local authorities and their partners in the area of low-cost mobility (walking and cycling) and to institutionalise it through the SCP/environmental planning and management process.

Source: UN Habitat Sustainable Cities Programme, Sustainable Urban Mobility Component.

Case Study 46

Non-motorised transport by Shona Young

Assistance to purchase bicycles

Lima, Peru

In 1990, the Municipality of Lima set up a micro-credit programme to help low-income citizens purchase bicycles. The programme, 'Programmea de Transporte Popular de Vehiculos No Motorizados', is scheduled to extend to the year 2020.

The programme was developed in harmony with the city's Transport and Infrastructure and Urban Development Plans. The main objectives of the programme are to:

- increase bicycle use as a complementary or alternative means of transport
- reduce transport costs for low-income groups by facilitating access to bicycles
- reduce automotive environmental pollution and improve health and
- provide safe, convenient and direct non-motorised transport (NMT) infrastructure.

Public transportation costs about US$25 per month, workers earning US$ 200 per month can see their income effectively rise by 8% during the repayment period and by more than 12% once the loan is paid off.

Supported by a World Bank loan, current activities include construction of bicycle lanes, provision of credit facilities for bicycle purchase by the poor, reviews of traffic regulations to include NMT and bicycle promotion and educational campaigns for all road users. Local institutional capacity has been strengthened and the city's NMT office is developing a bikeway design manual meeting country-specific requirements.

www.ibike.org/library/america.htm

Additional Source: Alternative Urban Futures: Planning for Sustainable Development in Cities and Cities Turning to Bicycles to Cut Costs, Pollution and Crime, WorldWatch Institute. 1998.

Case Study 47

Velib' bikes, Paris by the noggin_nogged/flickr.com

Public bicycle rental programme

Paris, France

In July 2007, the city of Paris launched a new self-service 'bicycle transit system' called Velib'. Parisians and visitors alike will be able to pick up and drop off bicycles throughout the city at 750 locations – offering a total of 10,648 bikes. By 2008, there will be a 'Velib' station approximately every 250 m for a total of 1,451 locations and 20,600 bikes.

In order to use the system, users need to take out a subscription, which allows the subscriber an unlimited number of rentals. Subscriptions can be purchased by the day, week or year, at a price of, respectively, US$1,5, US$8, or US$45. With a subscription, bike rental is free for the first half hour of every individual trip and then costs one to US$6 for each subsequent 30-minute period. The increasing price scale is intended to keep the bikes in circulation.

Velib' is part of a wide-ranging plan drawn up by Paris Mayor Bertrand Delanoe to encourage residents to leave their cars at home and reduce both the pollution and the heavy traffic congestion that often affects the city's broad boulevards. The system is owned and operated by the city authorities and financed by the JCDecaux advertising corporation, in return for Paris signing over the income from a substantial tranche of on-street advertising.

http://en.wikipedia.org/wiki/V%C3%A9lib'

Source: Paris Set for Bike-Share Scheme to Cut Congestion, Planet Ark. June 2007.

Case Study 48

Reducing vehicular volume and GHG emissions
Baguio City, Philippines

Pollution from motor vehicles accounts for 62% of Baguio City's annual GHG emissions. In recent years, smog and the high particulate matter content of the city's air have threatened not only the health of the city's populace but also its main source of income – tourism.

Aside from the 23,803 motor vehicles registered in the city, some vehicles registered in neighbouring municipalities also operate within the city perimeter. In 2002, road density was recorded at 1.25 km/1000 population. This is far below the 3.9km/1000 population road density standard set by the National Economic and Development Authority.

As a result of this, in 2003 Baguio City aimed to reduce vehicular volume within their central business district by 20% through a number coding scheme. While government vehicles are allowed to pass through this district at all times, vehicles that are privately-owned and public utility vehicles are designated one day off every week from Monday through Friday, for a 12-hour period on specific routes. The last digit of the plate number determines the day-off schedule.

This practice has resulted in reducing the city's GHG emissions by 9% and saving 7.5 million litres of fuel annually.

www.iclei.org/fileadmin/user_upload/documents/SEA/CCP_Projects/Baguio.pdf

Case Study 49

Pedestrian ordinance
Busan, Korea

The city of Busan has a civic ordinance that establishes a safe and comfortable walking environment by providing for the guarantee of pedestrian rights. Some of these rights include the right to a safe and comfortable pedestrian environment and the right to actively participate in the development of improvements.

A pedestrian improvement plan is established every five years, along with an annual operational plan. The plan includes planned improvements, the establishment and expansion of pedestrian corridors, a review of current operations, operating costs and suggested financial resources.

Source: Ordinance on the Guarantee of Pedestrian Rights and Improving Environment for Pedestrians, City of Busan.

Case Study 50

Masdar World Futur Energy Summit & Renewable Carbon Free Exhibition by Arend Kuester/flickr.com

Zero-carbon Masdar
Masdar, United Arab Emirates

The Emirate of Abu Dhabi, capital of the United Arab Emirates, has taken a bold decision to invest in a long-term strategic development programme for alternative energy and sustainable energy technologies.

In April 2006, Abu Dhabi launched Masdar, a multifaceted, multibillion dollar investment project in renewable and alternative energy and clean technology. Masdar is helping to explore, develop and commercialise such future energy sources, including solar and hydrogen power. In 2008, the building of Masdar City is to begin – this is to be the world's first zero-carbon, zero-waste, car-free city, which will eventually be home to 1,500 businesses and 50,000 residents.

The development will be an integrated 6 km^2 energy, science and technology community that will be car free, with a compact network of streets that will encourage walking and complemented by a personalised rapid transit system. Surrounding land will contain, wind, photovoltaic farms, research fields and plantations, enabling the city to be entirely self-sustaining.

www.masdaruae.com

Case Study 51

The main square at Essaouira, Morocco by jonl1973/flickr.com

Compact city planning

Essaouira, Morocco

The town of Essaouira in Morocco is a port city with limited capacity for expansion or urban sprawl. The city is confined geographically and ecologically by the sea on one side and a dune forest on the other. Since its establishment in the late 1700s, the city has been carefully planned and constructed around the central *medina* which follows a geometrical pattern.

Subsequent development over time has been confined to functionalist extensions which have avoided urban sprawl, a trend which is characteristic of other developing cities. Instead, the city planners have created zones for industry, housing and civic life. The zone for housing consists of high density low-cost and middle-cost housing estates. This type of development is necessitated by the unsustainable soil conditions.

However, in recent years, continued city expansion is threatening the fragile ecosystem of the city and, with severe development constraints, a group of specialists have developed the Urban Pact of 1996. There is new emphasis on renewal of the central *medina* and the creation of a 'museum city' through the renovation and restoration of this important tourist artefact. The specialists have emphasised that the unique cultural, ecological and historical heritage of the city must be maintained and that future development must be selective and respectful of this. Further development must be absorbed and excess growth must be accommodated in satellite centres. These strategies are to ensure that the city boundary remains constant.

Source: Loeckx, A., Shannon, K., Tuts, R. and Verschure (eds) Urban Triologues: Localising Agenda 21. UN-HABITAT: Nairobi.

3.7 Air Quality Management

Climate change and air quality problems such as smog and acid rain are closely related issues. In many parts of the world, climate change is expected to result in hotter summer temperatures from global warming. Because smog forms more quickly on hotter days, climate change will inevitably lead to increased smog production. Poor air quality, combined with heat stress from hotter summer weather, will increasingly pose serious health challenges to human populations and flora and fauna.

Climate change and air quality problems are largely caused by the same activity – namely the burning of fossil fuels. In fact, burning fossil fuel such as coal, oil and natural gas is the source of virtually all emissions causing acid rain and global climate change.

Although climate change, smog and acid rain largely share a common cause, different solutions may be required to reduce these pollutant emissions. The challenge is whether we can find creative solutions that address all these problems simultaneously.

Local governments often have control over local ordinances and bylaws that govern air quality management. Through enforcement mechanisms linked to these and other powers local governments can control the burning of various fuels and vehicle specifications and thus reduce greenhouse gas and other emissions.

The Global Alliance for EcoMobility

The Global Alliance for EcoMobility is a cross-sectoral partnership for the integrated promotion of walking, cycling, wheeling and use of public transport to improve health and the urban environment, to mitigate global climate change. The initiating partners are ICLEI – Local Governments for Sustainability and Shimano Inc. Other partners in this initiative are UNEP and UN-HABITAT.

EcoMobility describes mobility without dependency on the private car. It includes:

- **walking-cycling-wheeling:**
  non-motorised means of transport such as feet, walking aids, bicycle, tricycle, velomobile, wheelchair, scooter, skates, skateboard, push scooter, trailer, hand cart, shopping cart, carrying aids and the above vehicles with supporting electrical drive (preferably powered by renewable energy)
- **'passenging':**
  using means of public transport such as escalator, elevator, bus, tram, monorail, subway, lightrail, train, cableway, ferry, collective taxi, taxi (preferably with low-emission drives)

www.ecomobility.org

Case Study 52

River and PC mall, Guangzhou, China.JPG by gruntzooki/flickr.com

Banning motorcycles
Guangzhou, China

Air pollution has become a major problem in Guangzhou, with 1.7 million tonnes of vehicle exhaust fumes emitted in Guangdong Province every year and continuing at a very high rate of increase, 10% every year.

Motorcycles, which still accounted for nearly a third of all non-walking trips in 2003, have been completely banned in the City of Guangzhou since January 2007. The ban was announced in 1998 and was implemented in phases, beginning with a moratorium on new licenses, extending to various roads and time periods, culminating nearly nine years later in a total ban.

As a result, many motorbike riders have shifted to bicycles and buses, a development that has in turn increased pressure to expand and improve bicycle facilities and bus services. Bike parking facilities are currently being retrofitted at metro stations and officials have stressed that the Bus Rapid Transit (BRT) system should include high quality bicycle and pedestrian facilities. New forms of para-transit access to bus stops like cycle rickshaws have also emerged as a popular substitute for motorcycle taxis.

According to traffic information issued by the Guangzhou traffic bureau, traffic problems in Guangzhou have been reduced by 50% and road accidents have dropped by 40% since motorcycles were banned in the downtown area.

www.itdp.org/index.php/projects/update/guangzhou_bans_motorcycles/

Case Study 53

Taxi in Philippines by Trishhhh/flickr.com

Two-stroke engine retrofits reduces energy use and carbon emissions
Puerto Princesa, Philippines

Commonly used to power taxis throughout cities in Asia, two-stroke engines are one of the largest sources of vehicular emissions in the world. There are nearly 100 million two-stroke vehicles in Southeast Asia – each producing approximately 50 times the pollution of a modern car.

A retrofit kit that significantly improves fuel efficiency and reduces emissions in two-stroke engines is being sold to taxi drivers in Puerto Princesa and Vigan, with the local governments offering micro-loans to spur adoption.

Envirofit International developed the direct in-cylinder fuel injection retrofit kit, which is estimated to reduce carbon monoxide emissions by 76%, CO_2 emissions by 35% and hydrocarbon emissions by 89%. At the same time, fuel consumption is reduced by 35% and oil consumption by 50%. Approximately half a million people are expected to benefit from this project through higher incomes and better health.

This project has required the collaboration of a diverse set of organisations. The Local Government Units (LUGs) of Vigan and Puerto Princesa have been instrumental proponents by supporting clean technologies with legislation, while international organisations such as the Asian Development Bank, World Bank and Clean Air Initiative for Asian Cities were beneficial partners. Academic institutions of Colorado State University and Don Bosco Technical College in Manila helped develop and support initial implementation.

Although two-stroke engine types have traditionally been used for motorcycles in developing countries due to the lower purchase price and the availability, in many parts of the world this technology is being phased out. These engines are replaced with four-stroke engine types, emitting much less pollutants and having lower fuel consumption.

www.cleanenergyawards.com/top-navigation/nominees-projects/nominee-detail/project/37/

www.envirofit.org/two_stroke_retrofit.html

Case Study 54

Traffic in Cairo, Egypt

Vehicle Inspection Programme reduces air pollution
Cairo, Egypt

The Government of Egypt committed itself to solve the growing problem of air pollution in the early 1990s. Since then, the United States has joined forces with the Ministry of State for Environmental Affairs and its technical arm, the Egyptian Environmental Affairs Agency (EEAA), the Ministry of Petroleum and the governorates of Cairo and Qalubeya, as well as the private sector. In 1997, the United States and the Government of Egypt initiated a new Cairo Air Quality Programme to reduce lead emissions from local smelters. As part of that programme they introduced natural gas-fueled buses which reduce diesel emission particulate pollution and instituted a vehicle emissions testing and certification programme.

This vehicle testing programme aims to regulate emissions from more than one million vehicles in and around Cairo. The programme requires drivers in the Cairo districts of Giza and Qalyoubia to receive inspection certificates from one of 19 emission-testing stations before they can register their cars. The new testing programme is part of an integrated approach to dramatically reduce the amount of pollutants in Cairo's air. Air pollution is blamed for between 15,000 and 20,000 deaths in the capital each year.

In Giza and Qalyoubia, where 650,000 vehicles are registered, car owners pay three Egyptian pounds – roughly US$50 cents – to have their cars tested. If they exceed emissions standards set by the Egyptian Environmental Affairs Agency, owners get 30 days to tune their engines or risk getting their registrations permanently cancelled.

Testing stations will eventually serve the entire Egyptian capital. Just under half of the country's motor vehicles navigate Cairo's streets each day.

http://egypt.usaid.gov/Default.aspx?pageid=15

Case Study 55

Santiago, Chile by Patrick_coe/flickr.com

'Tarjeta Negra'
Santiago, Chile

With its air trapped in a valley between mountain ranges, Santiago, with over 5 million residents, suffers from excessive particulate matter combustion emissions and various other types of air pollution. Of some 830,000 vehicles in the metro area, heavier diesel vehicles and buses account for 13% of the metro fleet, but contribute over 40% of the particulate matter.

One of the measures government use to examine the actual emissions from vehicles is through enforcement tools. Enforcement requires 'foot soldiers' deployed on the streets of the city in the form of police officers (or other authorities) with the responsibility of checking vehicles. Another possible way to strengthen the enforcement effort is to enlist citizens to contact authorities and report vehicles emitting large quantities of smoke.

In Santiago, municipal authorities provide citizens with Tarjeta Negra ('black card'), a simple card with a Ringelman opacity scale printed on it to rate visible smoke emissions from zero (low) to five (high). The Ringelman chart is a standard measure of black smoke density and was later adapted for grey, white and other colours of smoke plumes. Citizens can use this chart to determine if a transit bus is in violation of opacity standards.

If a bus number is called in, authorities quickly track down the bus and perform a snap acceleration test for opacity. The programme has not only resulted in a significant decrease in the number of buses emitting black smoke, but has raised public awareness.

http://pdf.dec.org/pdf_docs/PNADB317.pdf

http://findarticles.com/p/articles/mi_moCYH/is_/ai_89924474

Case Study 56

Tuk tuk by Luca & Vita/flickr.com

Adapting Tuk-tuks
Dhaka, Bangladesh

The number of motorised vehicles in Dhaka city has greatly grown since the mid-1990s, with a considerable increase in air pollution, especially during the dry winter months. Air pollution, especially from particulates, was mainly due to the approximately 50,000 baby taxis that used highly polluting two-stroke engines, which mixed their lubrication oil, along with the gasoline fuel creating lots of smoke.

NGOs and the media worked together to build public opinion against the polluting two-stroke three wheelers. This led to the government, with assistance from the World Bank – under its Dhaka Urban Transport Project – to start a phase-out plan for the two-stroke baby taxis, which were all imported from India. The plan involved an initial ban on further imports of the two-stroke engines (but allowed the cleaner four-stroke alternative) along with the importation of new three-wheelers that ran on compressed natural gas (CNG) instead of petrol, called Tuk-tuks. The Tuk-tuks were originally imported from Thailand, but are now manufactured at a plant near Dhaka.

The phase-out took effect from January 2003 and was immediately followed by some problems as there were not enough replacement engines available. However, with the rapid import of better engines, especially the CNG-powered ones, the situation improved. Since late 2003 almost all the polluting two-stroke engines had been replaced by less polluting ones and measurements of air pollution have shown considerable improvement over this period.

The citizens of Dhaka have strongly supported the efforts to clean the air in the city despite the great hardship endured by most as a result of the sudden transition. There are now plans to extend it to other Bangladeshi cities.

www.opendemocracy.net/globalization-climate_change_debate/article_2499.jsp

www.dhakacity.org

Case Study 57

EPM approach in air quality management
Shenyang, China

Shenyang is the political and economic centre of North East China and has a total population of 6,750,000. The city has a very cold winter climate that requires substantial heating over a period of four to five months. Shenyang was the first industrial area of modern China. Highly polluting heavy industries are concentrated there, especially metallurgy, chemicals, heavy machinery and similar activities.

Key factors affecting air quality in Shenyang include the continuing dominance of older, heavily-polluting industries, energy consumption that is increasing and the dependency on coal. The population is also steadily increasing, with motor vehicle numbers and use rising very rapidly.

The Shenyang Municipal Government (SMG) joined UNEP/UN-HABITAT's Sustainable Cities Programme in 1997 to improve environmental planning and management (EPM). Activities undertaken included:

- Collection and analysis of the air quality information as part of preparing an environmental profile (EP) for the city
- Setting up (in mid-1997) a cross-sectoral consultative group on air pollution management, consisting of 16 members from key governmental departments, peoples' congress, political consultative conference, enterprises, institutes and communities.
- Review of a proposition paper on air quality by 300 representatives who attended the Shenyang City consultation in May 1998.
- In 1996, six enterprises in Shenyang – machinery, chemical, pharmaceutical and light industry – piloted cleaner production techniques. In 1998, cleaner production audits were conducted for 100 products in 86 enterprises.
- In mid-1999, Shenhe District also set up environmental protection and disturbance complaint stations in 10 resident areas.

Air pollution in residential areas was addressed by the Air Environment Working Group. Polluting enterprises discharging large amounts of smoke and dust, particularly during the winter, were investigated for potential violations. Both municipal and district environmental protection departments coordinated supervision and management responsibilities to perform road inspection and selective inspection of motor vehicle tail gas exhaust. The use of non-leaded gasoline was incorporated to reduce lead pollution discharged from motor vehicles. All petrol stations abided by governmental notices and discontinued the sale of leaded gasoline resulting in a reduced lead discharge by 93.6%.

Since execution, prominent environmental and economic benefits have been achieved. At the same time, many enterprises established cleaner production teams to accept relevant training and guidance on cleaner production and to implement cleaner production consultations within their enterprises. In 1998, after addressing the actual conditions of enterprises, a cleaner production auditing goal aimed to audit 100 product types – reducing 10,000 tonnes of raw material loss and pollutants and creating an economic benefit of RMB 100 million Yuan.

www.unhabitat.org/list.asp?typeid=15&catid=540

Esplanade and Photovoltaic Power Plant by racEcar_yayas/flickr.com

3.8 Green energy sourcing

Electricity that is generated from renewable energy sources such as wind, solar, biomass, geothermal and small hydro, is often referred to as 'green power' or 'clean energy'. Unlike fossil fuel-based power, these sources of energy emit no or low GHG emissions. Cities around the world are taking advantage of their natural resources to source cleaner electricity. Some cities are also trying to buffer themselves against energy price volatility and ensure energy security by supporting or generating power locally using local resources.

Large cities can promote renewable and cleaner energy through the following roles they usually (not all) perform:

- Distributor or delivery of energy or electricity services or supplies to its citizens
- Owner of generation facilities
- Regulator of things like land use or building specifications
- Buyer of energy for own use
- Land or building owner

Local governments are significant purchasers of energy services and can therefore act as a catalyst for renewable energy projects. Leading by example local authorities also have the potential for their portfolio of buildings to provide long-term supply contracts as security for local renewable energy projects. Planning and developing local energy solutions involves exploring which combination of technologies makes most sense at different scales – looking at the opportunities for new and existing building typologies and uses and the relationship of a town or city to its rural hinterland. For example, small-scale microgeneration technologies such as solar PV (photovoltaic) can be complemented by efficient forms of generation.

There is an increasing need to focus on the role that smaller scale decentralised energy generation could play. Local energy (also called micro-generation, distributed or decentralised energy) is energy produced by individuals, businesses or communities for their own consumption, be it space or water heating or electricity. Such 'local energy' encompasses a broad range of technologies that are capable of helping to reduce CO_2 emissions, either because they are renewable, or because they use fossil fuels more efficiently. Examples include roof-top wind turbines, solar-heated water and household combined heat and power (CHP) systems that generate electricity in the home and use the resulting thermal energy for domestic heating. Whilst the primary aim of such energy production is for own-use there is also the potential for surplus generation to be sold for use elsewhere. The concept of local energy represents a fundamentally different approach to the current centralised mode of delivery for electricity. Changes in technology have reduced the cost of smaller scale means of energy production and made it easier for the networks to manage the connection of a larger and more diverse range of generating units. At a time of heightened concern over climate change and energy security, the potential for individuals and communities to make a direct contribution to tackling these issues is increasing.

Case Study 58

Olkaria III, Naivasha. www.emergingafricafund.com

Geothermal power supplied to the national grid
Nairobi, Kenya

There are not many examples of local level green energy projects. Most of these pertain to national level strategies. However, the following case studies are important nonetheless as they can act as examples of green energy strategies that can be implemented at both local and national government level.

Geothermal energy is playing an important role in Kenya, with about 120-MW capacity already installed. A range of further projects for 2 to 3,000 MW are under development or in a planning phase.

Exploration for geothermal resources in Kenya began in 1956 and gained momentum in the 1960s. From 1967, the UNDP in collaboration with the then East African Power and Lighting Company Ltd, conducted geological and geophysical surveys in the area between Olkaria and Lake Bogoria. The studies identified Olkaria as the most prospective area for geothermal power.

The Olkaria power stations in the Rift Valley are currently Africa's largest geothermal power stations. They generate electricity by pumping water down to volcanic hot areas and using the steam produced to drive turbines. The power generated is transmitted to the national grid via a 220-kV double circuit line to the city of Nairobi.

Geothermal is one of the low-cost energy sources of electricity generation in Kenya and currently contributes 127 MW to the national grid. KENGEN, a 100% state owned corporation, owns two power plants, Olkaria I power plant (45 MW) and Olkaria II power plant (70 MW). The third power plant is owned by Independent Power Producers (IPPs), Orpower and currently generates 12 MW.

Compared to a diesel plant generating the same amount of energy, this geothermal station would avoid several million tonnes of CO_2 emissions over the life of the project. Electricity generated by the plant will be sold under a 20-year power purchase agreement with the national power transmission and distribution utility, Kenya Power and Lighting Company Limited.

www.kengen.co.ke
www.renewableseastafrica.de/_uploads/media/1314_Geothermal%20Industry.pdf

Case Study 59

Manila (Philippines) by eesti/flickr.com

Geothermal energy
Manila, Philippines

According to the International Geothermal Association (IGA), worldwide, the Philippines ranks second to the United States in producing geothermal energy. As of the end of 2003, the Philippines had a capacity of 1930-MW of geothermal power.

Early statistics from the Institute for Green Resources and Environment stated that Philippine geothermal energy provides 16% of the country's electricity. Manila, a city of over 10 million people, gets a significant portion of its electricity from geothermal power. Geothermal operations are the most developed on the island of Luzon, where Manila and other large centres are located.

Geothermal power supplies 7% of the electricity needed for the whole island of Luzon, the most heavily populated of the Philippine islands, currently home to 43 million people. Additionally, geothermal heat is also used directly used for fish processing, salt production and the drying of coconuts and fruit, all major economic activities in the Philippines.

This is an example of an energy project driven nationally. Local governments can advocate for projects like these that have spinoffs of jobs and local economic development while being more sustainable in their area.

www.geothermal.marin.org

http://en.wikipedia.org/wiki/Geothermal_energy#Philippines

Case Study 60

10% Renewable goal
Cape Town, South Africa

As part of Cape Town's Integrated Metropolitan Environmental Policy (IMEP), which was adopted in 2001, a draft energy strategy for the city was completed in October 2003. The strategy sets out a number of vision statements, sectoral campaigns, targets and timeframes. One of the targets is to source 10% of its energy from renewable sources – which would include solar and other forms of energy – by the year 2020.

Currently, Cape Town generates very little of its own electricity, purchasing most of it from the national electricity grid which is dominated by coal-generation plants. The city has a wealth of untapped renewable energy resource potential – in wind, photovoltaic, solar thermal and also potentially tidal wave power. In pursuit of its goal to source 10% of its energy from renewable sources by 2020, the City of Cape Town has undertaken to become the anchor customer of the country's first independent commercial wind farm, Darling, for a period of 20 years. This has enabled the Darling Wind Farm project to go ahead, with a partnership between the Central Energy Fund, the Development Bank of Southern Africa, the private sector, Darling Independent Power Producer and the South African and Danish Governments. The City will sell the green electricity to consumers who specifically want to purchase green energy.

Darling Wind Power will generate 13,2 GWh (13,200 MWh) of electricity using four turbines of 1,3 MW in size each. One MWh is enough to supply the energy needs for one middle-income house per month or enough energy to heat the water for 1,200 baths.

It is estimated that the wind farm will prevent about 254,000 tonnes of CO_2 from being released into the atmosphere during its lifetime. Consumers purchasing this green electricity, which is to be sold at a premium of less than US$5 cents per unit (kWh) above the normal cost of electricity,

Purchases of green electricity will be provided with certificates providing proof of purchase of this energy and a strict audit process will ensure that the City does not sell more green electricity than it has purchased from the Darling Wind Farm.

www.capetown.gov.za

www.capegateway.gov.za/eng/pubs/news/2007/feb/152595

Case Study 61

Public involvement in München Solar Programme
München, Germany

The promotion of renewable sources of energy in München started in the late eighties when the municipality of München drew up an energy savings concept. In 1997, an additional instrument was created, in the shape of the München Energy Agency (MEA), which has assumed an important role in implementing the energy-saving programme called the 'München Solar Programme'. At first the focus of support activities in München was on solar thermal systems. Since 1995, photovoltaic systems were also the target of several subsidy measures.

In late 1995, the München City Council decided to promote electricity generation from solar panels in an unusual way. In order to obtain a favourable price for individual residents, 200 standard 1.1 kWp units were purchased and sold without any mark-up to private electricity customers of Stadtwerke München (SWM) in the course of the year. Because of the great interest, further wholesale purchases were made. From February to December 1996, SWM – the power utility previously owned by the municipality – advised 320 of their customers comprehensively and impartially on the installation of the kits. In on-site consultations, the location, energy yield to be expected and integration into the existing system (reversing metre earthing system for protection against overvoltage etc.) were discussed. In order to make rapid and inexpensive installation possible, a special campaign was launched in cooperation with the München electrician's guild, in which the customers were informed about interested and qualified electrician firms. The operators of the solar-panel units could also sign ten-year supply contracts with SWM, which specified a full-cost compensation of up to 1 Euro (US$1,5) per kWh for solar power, among other things.

The objective of the wholesale purchase of solar-cell modules by the municipal utility was to help this relatively new technology establish itself on the market rapidly by inexpensive prices. In 1991, the erection of a unit still cost US$19,261 to US$22,343 per installed kWp on average, while in the first year of the München Solar Power programme this dropped to about US$11,557. Public involvement was further encouraged in 1997 when electricity customers of SWM were able purchase shares in a 37-kW peak solar-panel unit on the roofs of the Pasinger Fabrik culture centre.

The München Solar Power programme has been a great success with over 2-MW peak of solar-cell systems installed. The solar-cell market in München is also well established, thanks to the subsidising of solar-cell arrays of up to US$1.5 per kWh supplied to the grid.

Case Study 62

Solar panels in China. www.itsgettinghotinhere.files.wordpress.com

Solar city
Dezhou, China

Responding to the central government's requirement of saving power and reducing resource consumption, Dezhou CPC Party committee and Dezhou municipal government determined and implemented a solar city strategy. The main goal of the strategy is to develop a solar economy, build a solar city brand and foster solar culture. It has greatly improved the sustainable development of Dezhou.

Dezhou founded the China Solar City Strategy Promoting Committee with the mayor as the director and over 20 departments and organisations as members. The municipal government issued several documents on generalising solar energy and implemented favourable policies to facilitate solar industries. More than 100 solar enterprises are rapidly going up, with over 3 million m^2 of output of solar water heaters and an increase of 30% per annum. According to statistics, by the end of 2007, the total installed solar heaters in China reached 100 million m^2. The total output of solar heaters in Dezhou added to 16 million m^2, sharing 16% of the Chinese market. Dezhou has carried out the projects Million Solar Roofs and 100 Rural Solar Bathrooms, which have improved the quality of life of the farmers. In 2005, China Solar Energy Society and two other national authorities awarded Dezhou the title 'China Solar City'.

The China Solar Valley project in Dezhou is one of the biggest solar power projects in China. Once completed, it will become a solar R&D and testing centre, a manufacturing centre, a scientific popularisation and education centre, a tourism centre and a conference communication centre.

The city itself has been chosen to host the 2010 Solar Cities congress at the world's largest solar building, the International Exchange Centre for Renewable Energy, now under construction. Future plans for Dezhou include the creation of a Renewable Energy University – one that focuses on research and development of alternative energy technologies.

The entire project is spearheaded by the Himin Solar Group. To facilitate the growth of solar energy in the city, the government has given preferential tax benefits to the Himin Group and this company is able to funnel 30% of its net profits into its projects.

http://itsgettinghotinhere.org/2008/02/26/china-looks-to-the-sun/

Additional Source: International Solar Cities Initiative brochure. China Solar City, Dezhou.

Case Study 63

Wind turbines by Bruce Sutherland

Zoning plan for wind turbine development
Wieringermeer, the Netherlands

Wieringermeer is ideally suited to wind energy and by 1996 there were already 44 wind turbines scattered throughout the area with a total capacity of 12.3 MW. 35 of these are small, privately-owned turbines with an approximate size of 80 kW. In this area a 1.65 MW turbine will produce on average 3,300 MWh and thereby save 1880 tonnes in CO_2 emissions.

There has however been considerable resistance throughout the Netherlands to the erection of a large number of turbines in this flat and open landscape due to the fears of the local population regarding the impact of wind turbine development on the landscape. The municipality had originally prepared a special wind energy plan, the *Inrichtingsplan Windenergie Wieringermeer*, but as wind energy technology developed, this became increasingly out of date. Therefore the opportunity was taken to review the plans for wind energy during the renewal of the *bestemmings plan* (local plan). In particular it was felt that a review was needed of the implications in landscape and wind resource terms of policies giving preference to different sizes of wind turbines.

A study that was commissioned by a consultancy for this review looked at the impact of different control policies on the potential wind energy capacity of the area with a view to proposing a formal zoning plan (local plan). In the preparation of the zoning plan the municipality drew on this study to propose eight areas for wind turbine development. New development was restricted to large MW size turbines in a series of five linear arrays along drainage channels and at three sites in smaller groups of turbines. Turbines may not be erected outside these zones but existing turbines may be replaced by new, modern ones, while new regulations identify the characteristics of these replacement turbines.

The plan was finally published in December 1997. In the light of public reaction it has been decided that only 5 of the total of 8 sites will be developed. By the end of 2002, 31 new turbines (1.65 MW each) were ready to operate. If all the planned wind turbines are installed, the electricity production would be sufficient to supply approximately 50,000 normal households. Although there are no direct incentives, the municipality actively helps citizens in their applications to erect wind turbines.

www.energie-cites.org/db/wieringermeer_139_en.pdf

3.9 Urban greening

Planting trees and vegetation have a significant role in reducing greenhouse gas (GHG) emissions. Through photosynthesis, the leaves absorb CO_2 and release oxygen. It is therefore a natural carbon offsetting measure. Shade from trees also contributes significantly in reducing the energy needed for cooling in the warm months.

A carbon offset is a financial instrument representing a reduction in GHG emissions. Although there are six primary categories of greenhouse gases, carbon offsets are measured in metric tonnes of carbon dioxide-equivalent (CO_2e). One carbon offset represents the reduction of one metric tonne of carbon dioxide, or its equivalent in other greenhouse gases.

There are two primary markets for carbon offsets. In the larger compliance market, companies, governments or other entities buy carbon offsets in order to comply with caps on the total amount of CO_2 they are allowed to emit. In 2006, about US$5.5 billion of carbon offsets were purchased in the compliance market, representing about 1.6 billion metric tonnes of CO_2e reductions.

In the much smaller voluntary market, individuals, companies, or governments purchase carbon offsets to mitigate their own GHG emissions from transportation, electricity use and other sources. For example, an individual might purchase carbon offsets to compensate for the GHG emissions caused by personal air travel. In 2006, about US$91 million of carbon offsets were purchased in the voluntary market, representing about 24 million metric tonnes of CO_2e reductions.

The commercial system has contributed to the increasing popularity of voluntary offsets among private individuals, companies and organisations into reforestation and tree planting projects around the world. Offsets may be cheaper or more convenient alternatives to reducing one's own fossil-fuel consumption. However, some critics object to carbon offsets and question the benefits of certain types of offsets.

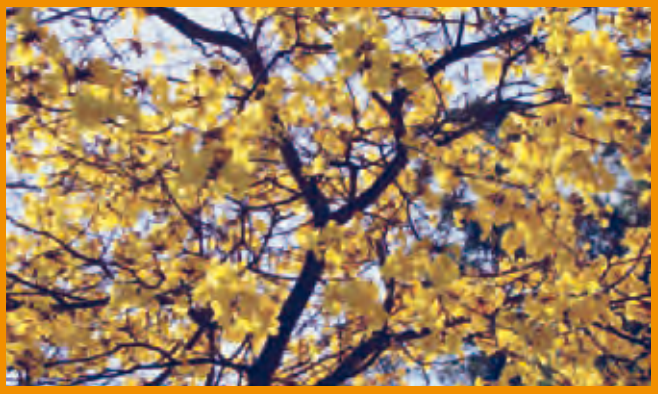
Carbon sequestration is the process through which agricultural and forestry practices remove carbon dioxide (CO_2) from the atmosphere. The term 'sinks' is also used to describe agricultural and forestry lands that absorb CO_2, the most important global warming gas emitted by human activities. Agricultural and forestry practices can also release CO_2 and other greenhouse gases to the atmosphere.

Sequestration activities can help prevent global climate change by enhancing carbon storage in trees and soils, preserving existing tree and soil carbon and by reducing emissions of CO_2, methane (CH_4) and nitrous oxide (N_2O).

The critics argue that planting trees and preserving forests is a 'cop out' allowing the polluters to continue polluting. It is, they argued, far more important to reduce emissions and become more energy efficient than preserving forests and reforestation. The latter is complex and controversial, since it depends on a variety of factors such as where the planting is taking place, the species used and the ultimate use of the trees. Trees also grow slowly and when they are small, they don't sequester much carbon. Tree-planting offsets typically indicate a 40-year maturity. Another concern with tree-based offsets is permanence. An offset is only an offset if the reduction is real and ongoing which does not happen when trees die or are cut down. A third concern, after timing and permanence, is measurability. It is fairly complicated to measure the amount of carbon absorbed by a forest. Some planting practices can actually result in a net release of carbon from the soil. Another concern is 'leakage,' which means that the new trees just displace deforestation, rather than reduce it. Finally there are issues of monocultures of non-native species.

Tree Planting in Philly, Philadelphia /flickr.com

Case Study 64



Yellow Tree by Stephen Downes/flickr.com

Tree planting with Trees for Africa
Potchefstroom (Tlokwe), South Africa

Potchefstroom aims to lead the way in limiting the greenhouse gases emitted by the City Council. The Tlokwe City Council (TCC) has set an emissions reduction target of 10% by 2012. To meet this target the city drafted a Climate Change Action Plan which includes planting a minimum of 15,000 trees to sequestrate CO_2.

The City partnered with Food and Trees for Africa (FTFA), a national NGO greening organisation, to assist with the tree-planting project using the Trees for Homes programme that also provides training and skills development and short-term employment towards poverty alleviation.

The first greening of the Potchefstroom Project was made possible by the TCC in association with USAID, Willards Batteries, the Department of Water Affairs and Forestry and FTFA.

The process started with the planting of 1,000 trees in Potchefstroom's underserved communities. Three community members from each ward were selected and trained in tree planting and maintenance and to serve as community-based educators.

The project grew rapidly and over 4,000 indigenous shade trees were supplied to this community, 3,000 more than initially planned. The TCC together with the trained community-based educators completed the tree distribution in all wards. The distribution and planting of a further 2,900 trees were then supported and was implanted by February 2006. This municipality has already planted 8,370 trees, with 12,5 tonnes CO_2 sequestrated or absorbed.

www.trees.co.za/index.php?option=com_content&task=view&id=111&Itemid=74

www.potch.co.za/council/departments/health/home.htm

Case Study 65

Sacramento, USA. www.sacramentoscoop.com

Utility-supported tree planting
Sacramento, USA

Sacramento Municipal Utility District (SMUD), through its contractor, the non-profit, community-based Sacramento Tree Foundation (STF), provides free-shade trees to its residents.

The shade trees are planted to directly shade buildings, thus reducing air-conditioning loads. To receive the trees, residents simply call SMUD, the publicly-owned power company. STF's community foresters visit customers' homes and help customers choose and site the trees. When strategically sited and mature, these trees will reduce air-conditioning needs by up to 40%. The programme also includes customer education on proper tree planting methods and care.

The Shade Tree Programme was initiated in 1990 at a time when SMUD was embarking on a massive build-up of its energy-efficiency resources. The long-term programme objective is to mitigate the urban heat island effect, thereby conserving energy resources and reducing air pollution resulting from power generation.

Also as part of this programme, SMUD funds another urban heat island mitigation effort, Community Shade. SMUD offers free trees for planting in public areas such as parks, playgrounds and schools.

Since its inception in 1990, SMUD's Shade Tree Programme has given about 375,000 shade trees away to city residents in the past 16 years and there are plans to plant at least 4 million more. At the end of 2002, these shade trees were reducing an estimated 1.95 MW and 4.8 million kWh annually in direct cooling load, according to the American Council for an Energy-Efficient Economy (ACEEE).

www.aceee.org/utility/7bsmudshadetree.pdf

www.smud.org/residential/trees/

Case Study 66

Cheongun Park, Seoul, South Korea by US Army Korea – IMCOM/flickr.com

Green Trust Movement
Seoul, Korea

To protect its limited green areas, the City of Seoul in Korea created the Seoul Green Trust Movement, whereby the municipality purchases, landscapes and manages parks and green zones. By population, the city of Seoul only provides 4.53 m^2 of park space per citizen, while a city like New York provides 14.12 m^2.

The goals of the movement include establishing at least one park in each ward of the city, establishing green roofs in major buildings such as hospitals and apartment complexes, having each citizen plant a tree to support greening initiatives, purchasing of approximately 3.3 m^2 of green space per household and contributing funds to build up to six ecological parks in Seoul.

The Seoul Green Trust Movement also partners with public and private organisations and cooperates with the National Movement for Forests for Life.

During 2004, the Seoul Metropolitan Government held an event at which about 2,000 Seoul citizens and city officials planted trees on the 19,836 m^2 of land reserved for the establishment of Seoul Forest. During the event, participants planted a total of 21,800 trees including pines and oaks and donated 745,9 million Won worth of money for Seoul Forest that is due to be established in the Ttukseom area put forward by the city government through the Seoul Green Trust movement.

http://english.seoul.go.kr/gover/initiatives/inti_06trust.htm

3.10 Fleet management

There are four major ways in which local authorities can improve fleet management and reduce energy consumption and GHG emissions:

- Improved travel and route management
- Fitting the vehicle size to the task
- Alternative fuels
- Eco-driving

The management of a local government's fleet vehicles is a key determinant of the fleet's overall efficiency. Travel should be scheduled so that multiple tasks can be accomplished with one trip. Routes must be designed for maximum efficiency (computer programs can be used to optimise fleet vehicle routes so achieving large reductions in fuel use and emissions). Matching duty requirements of staff to the smallest possible vehicle for the task is also fundamental to increasing the efficiency of a fleet.

The use of alternative fuels is another way to significantly reduce GHG emissions, as well as dependence on oil imports. There are a number of alternative fuels available that have a range of air quality and greenhouse gas impacts depending on the type of vehicle technology and how the fuel is produced. Some of the most commonly available alternative fuels are bio-diesel, compressed natural gas (CNG), electricity, ethanol and hydrogen.

When local governments address issues of local pollution due to transport, a great additional benefit is carbon emission reductions. Car-free days are also an effective short-term measure as well as vehicle inspection, maintenance schemes and various incentives and discentives to control congestion.

The UNEP/TNT Toolkit for clean fleet strategy development:

The UNEP/TNT Toolkit for clean fleet strategy development is a toolkit, meant to help develop a strategy for reducing the environmental impacts of vehicle fleets. The Toolkit was developed by UNEP and TNT in 2006 and field tested by TNT Turkey and humanitarian fleets.

The Toolkit contains a number of tools that help fleet managers to:

- evaluate the impacts of their fleets on the environment and human health and
- with minimal information and inputs, develop practical strategies and scenarios for corrective and cost-effective action.

www.unep.org/tnt-unep/toolkit/

Case Study 67

The City Loop Bus. Adelaide. SA by amandabhslater/flickr.com

Solar-powered municipal bus fleet
Adelaide, Australia

The Adelaide City Council has introduced the world's first solar-powered carbon neutral electric bus. New Zealand company Designline International have developed and manufactured an electric bus, which is currently being operated in Adelaide and is recharged using a BP solar recharging station. The bus doesn't have a combustion engine, which makes it a very quiet, zero-emissions vehicle.

The bus, known as 'Tindo' (the local Aboriginal word for sun), has a range of 200 km and seats up to 42 passengers, with 25 standard seats, two seats especially designed for disabled passengers and room for 15 standing passengers in air-conditioned comfort. Even better, the bus is entirely free to ride, as it is part of the Adelaide Connector Bus service. Power is provided from the largest solar-power system in the state, pumping 70,000 kWh of electricity back into grid.

It features high quality, state-of-the-art components sourced from some of the world's leading transport and technology companies including MAN and Siemens. The solar electric bus and the recharging system at the Adelaide Central Bus Station represent a significant investment by the Adelaide City Council into a sustainable future for the City of Adelaide, while providing leadership in sustainable public transport options for cities around Australia.

http://altfuelsaustralia.wordpress.com/2007/12/15/adelaide-home-to-the-tindo-solar-powered-bus/

www.adelaidecitycouncil.com/scripts/nc.dll?ADCC:STANDARD::pc=PC_151048

Case Study 68

Buses powered by biogas by Erich Iseli

Buses powered by biogas produced in the municipal wastewater
Lille, France

The CUDL (Urban Community of Lille) is a public inter-municipal cooperation body that gathers 87 local authorities from the Nord-Pas-de-Calais Region, France. Its scope of competencies includes the provision of services and amenities to the urban community in the following areas: town planning, road infrastructure, mobility and parking facilities and urban transport systems for passengers. The Urban Community is home to just over 1 million inhabitants. The future mobility policy of the Urban Community is determined by the objectives specified in the town planning and land-use master plan.

The Urban Mobility Plan (Plan de Déplacements Urbains, PDU), adopted by the Urban Community Council on 14 March 1997, set the objective of promoting less polluting energy sources for private cars as well as for public transport systems and goods transportation. The CUDL responsibilities include looking after the public urban transport network and managing several wastewater treatment plants which, for some of them, produce a gas with a high methane content as a result of sludge treatment. By the end of 1990, the CUDL launched a project, the first of its kind in Europe, to provide an energy use to this local renewable source. The aim of this experimental project was to use the biogas produced by the Marquette sewage plant in the suburbs of Lille to power urban transport buses.

In 1990, 80% of the 15,000m^3 of biogas produced on a daily basis by the wastewater treatment plant (i.e. the equivalent of 6,000 litres of petrol every day) was used internally to supply the treatment plant with heat and power and the remainder was burnt off. To provide an alternative option to wasting the remaining 3,000 m^3, the CUDL decided to clean them to obtain a daily volume of 1,200 m^3 of biogas usable as fuel in public transport vehicles. The first bus operating on such biogas was introduced in March 1994. Further ones were introduced in the years thereafter to obtain a share of 50% biogas-fuelled vehicles in the entire municipal bus fleet.

www.energie-cites.org/db/lille_575_en.pdf

Case Study 69

Hybrid eco-bus by Comyu

Green Fleet Strategy
DENSO Sales UK Ltd, UK

DENSO Sales UK Ltd works within the automotive industry selling a range of DENSO products to major car manufacturers. In particular, it is involved in the development of engine management systems, air conditioning systems and intelligent transport systems for its customers.

In 2000, the company decided to make a commitment to a green strategy and joined Motorvate, a greener fleet certification scheme, to reduce the impact of their fleet on the environment. During the three years of DENSO Sales UK Ltd Motorvate membership there have been a number of internal changes, but fleet management has continued to be a key issue. The Motorvate targets that were set for the company's fuel use and mileage, included a reduction of business mileage by 26,128 (3%) and reduction in CO_2 emissions by 35,414 kgs (12%).

As part of their overall green fleet policy and to help achieve the targets set by Motorvate, the company has placed environmental criteria on vehicle choice through fuel consumption and CO_2 emission limitations. Employees are encouraged to select diesel models, with the company paying the extra monthly leasing costs for a diesel vehicle. As a result of careful vehicle-selection systems, which encourage fuel efficiency and low CO_2 emissions, the company has seen the petrol dominant fleet of 2,000 transformed to an almost balanced diesel/petrol fleet.

As part of their drive to reduce business mileage, DENSO Sales UK Ltd has promoted the use of both car-sharing and video-conferencing between employees, instead of frequent travelling.

During the three years of the company's membership of Motorvate, the total number of business miles undertaken by their car fleet has reduced by 76,475 miles – a cut of almost 9%. This, coupled with their new fuel-efficient vehicle selection policy, has resulted in DENSO Sales UK Ltd reducing their fuel consumption by 50,638 litres.

www.energysavingtrust.org.uk/uploads/documents/fleet/ACFMBAoTaaAt.pdf

Case Study 70

Denver, USA by jeff_Prod/flickr.com

Downsizing the fleet
Denver, USA

The city of Denver began greening its fleet on Earth Day 1993, creating the first green fleet programme in the USA.

The programme called for a reduction in carbon emissions and fuel expenditures by having the city adopt a number of environmentally-friendly strategies, including reducing vehicle size, reducing kilometres travelled and using alternative modes of transportation and alternative fuels.

Additionally, the programme called for the elimination of over 50 vehicles. Due to the reduced number of vehicles, Denver is also saving $US40,000 annually in maintenance and capital costs. The programme alone has reduced 10 to 15 tonnes of CO_2 emissions annually.

www.greenprintdenver.org/energy/greenfleet.php.

Case Study 71

Creating a Green Fleet Policy
Whitbread Group Plc, UK

Whitbread is a leading UK leisure business. Its expertise is in creating, developing and building popular branded businesses in growing segments of the UK leisure market.

The company has restructured in the last 3 years with US$5.8 billion transactions. The Whitbread fleet now consists of 950 vehicles, 900 cars and 50 light commercials (mostly minibuses. However, even though the fleet has reduced in size, it still has a major environmental impact. In 1999, the manager of Whitbread's fleet identified a major opportunity for Whitbread to save money and display its concern for the environment by developing a Green Fleet Policy.

As there were no conventional tools for monitoring fleet environmental performance at the time and business mileage was based on pay-and-reclaim, other tools had to be established. These included:

- ***Car choice list*** – if drivers could be influenced to choose more environmentally-friendly vehicles, this would have an immediate effect on emissions.
- ***Mileage reimbursement rates*** – taking control of these and managing them in tandem with the actual fuel efficiency of the fleet would reduce costs and influence driver behaviour.
- ***Publicity*** – telling the drivers about the work the company was doing would also help to influence behaviour.
- ***Ways of working*** – Whitbread was embarking on a process to move around 500 managers and staff to field-based working which reduced mileage considerably.

Given the initial lack of tools, the biggest challenge the company faced was how to measure its success. In discussion with the Motorvate team, several key measures were identified that Whitebread could use. These included the overall fuel efficiency of the fleet based on manufacturers' combined figures and the total miles driven annually.

Given the lack of detailed information on actual business mileage precise fuel and financial savings are not available. However, Whitbread believe they are saving well in excess of US$390,000 per annum. The company has also calculated that its fleet now produces 1,600 tonnes of CO_2 less than it would have done had the fleet been the same size in 1999.

www.energysavingtrust.org.uk/fleet/organisations/vehicles50/informationcentrepages/

Case Study 72

Rio de Janeiro by Márcio Cabral de Moura/flickr.com

Natural gas vehicles
Brazil, South America

Brazil has the world's third largest fleet of natural gas vehicles (NGV). In June 2008, the fleet numbered 1.5 million, which represents 10% of the total Brazilian fleet. The states of Rio de Janeiro and São Paulo have the two largest fleets, at 655,540 and 377,416 vehicles respectively. The state government in Rio de Janeiro gave tax incentives to companies in order for them to convert to NGV, although this sparked controversy from the Ministry of Mines and Energy who requested that the government only use NGV for public transport.

South America is currently the world's leader in NGV, with a global market share of 48%. It is possible to retrofit vehicles for bi-fuel operation, although an increasing number of vehicles are being manufactured to run on compressed natural gas.

A NGV uses compressed natural gas as a clean alternative to other fuels. Natural gas has the highest energy/carbon ratio of any fossil fuel and thus produces less carbon dioxide per unit.

www.ngvglobal.com/en/market-developments/10-growth-forecast-for-natural-gas-vehicles-in-brazil-01916.html

GreenPurchasing by Canton Public Library/flickr.com

3.11 Green Purchasing

In addition to owning and regulating large amounts of land, buildings and transportation infrastructure, local governments also purchase a large number of products - everything from paper to paint, motor oil to HVAC (heating, ventilating and air conditioning) systems. These goods all require energy and resources to produce, package, transport, use and dispose. Through their daily purchases, local governments exert substantial power over the market. Choosing products with minimal life-cycle impacts can save energy, reduce emissions, increase the market for high performance products and even save money. Environmentally preferable purchasing policies encompasses a wide range of products – from recycled paper to less toxic cleaning materials to locally grown food as well as energy. Purchasing greener municipal service vehicles as early as possible also ensures that municipalities are not locked into assets that might be inefficient and carbon intensive for the life of that vehicle (usually 10 – 20 years).

Case Study 73

Recycle station by sara~/flickr.com

The Mayor of London's Green Procurement Code
London, UK

The Mayor of London's Green Procurement Code is a free support service for London-based organisations committed to reducing their environmental impact through responsible purchasing. This Procurement Code provides practical advice and online resources to help embed green purchasing into all aspects of an organisation, including sourcing green products.

London's businesses, as major consumers of products and producers of waste, can sign up to the Green Procurement Code to commit to reducing the effects of their activities on the environment. The combined purchasing power of these London-based companies has huge potential to positively tackle the capital's waste problem, reduce carbon emissions and contribute to the Mayor's Climate Change Action Plan. Organisations signed up to the Green Procurement Code commit to achieving progressive environmental targets and are awarded bronze, silver or gold status as a mark of their success.

Since its launch in 2001, members of the Green Procurement Code have spent US$738 million on green products and diverted 1.3 million tonnes of waste from landfill. In 2006, the purchase of green products resulted in 175,000 tonnes of CO_2 savings, the equivalent yearly emissions of over 29,000 households.

The Green Procurement Code is supported by £3 million (US$5,845,776) from the London Development Agency and is delivered by London Remade.

www.greenprocurementcode.co.uk/?q=node/42

Case Study 74

Lille, France by freefotouk/flickr.com

Training municipal purchasers to buy green
Lille, France

In 2000, the City of Lille adopted its 'list of Agenda 21 commitments' as part of its aim to make a contribution to the introduction of certain actions which promote sustainable development, included in the Agenda 21 adopted at the Rio Earth Summit in 1992.

High on this list of actions is the crucial role of local authorities in the emergence of 'responsible, future-friendly production and consumption', by encouraging sustainable public procurement. In order to promote such procurement, the City of Lille decided to concentrate its efforts on two critical links in the awarding of public contracts chain: the preparation of specifications and the training of municipal purchasers.

Specifications were drawn up for six categories of products: wood, paint, cleaning products, paper and printer ink. For each of these categories, environmental criteria were included.

Since 2003, over 50 buyers have been trained. This training, which is still being conducted, includes an eco-buying awareness day and a one-day course in preparing specifications. Several documents have also been circulated which provide information on French and European eco-labels, a glossary of terms used by the 'experts' and a CD on eco-design. The City carried out this work in partnership with the research offices Ecoeff and Cartes Vertes Internationales, the steering committee and the technical committee.

http://ec.europa.eu/environment/gpp/pdf/press_en.pdf

Case Study 75

Paper recycling bins

Changing procurement patterns of the municipal administration of Pori

Pori, Finland

The goal of the sustainable procurement project in Pori was to change the procurement patterns of the municipal administration to follow the principles of sustainability, by avoiding unnecessary consumption and minimising waste production. The reparability, durability and environmental impact of purchased goods were considered together with the returnability, recyclability and discharge of the package.

The project was a joint initiative between the Environmental Protection and Procurement departments – later led by a coordinating group. The essential partners for the success of the project were the City Hall and the departments of Education, Construction, Social Service and Health.

Initially each sector concentrated on only a few products, which were selected either because they had very harmful environmental impacts or the amount of products purchased was high. Much of the project resources were used for training and publicity. All the municipal employees received a leaflet informing them about the project and 550 (out of 6,000) employees received training sessions and lectures. By using concrete examples, the personnel were able to apply the principles of sustainability in their own working environment.

The following changes have taken place in Pori:

- use of paper has decreased because of electric file transfers
- all printing is made on chlorine-free or recycled paper
- paper recycling is close to 100%
- use of biodegradable chemicals has increased
- use of non-packed food stuffs has increased
- waste accumulation from the kitchen has decreased to 1/10 of the previous amount
- use of one-way products has been reduced and in some cases abandoned totally
- spray cans have been abandoned
- instead of painting, metal structures are treated with zinc
- an electric recycling centre for administration has begun in the computer network.

www3.iclei.org/egpis/egpc-061.html

Case Study 76

Richmond by Meri Tosh/flickr.com

City leads on green purchasing

City of Richmond, Canada

The City of Richmond has earned a reputation as a 'green' municipality by demonstrating leadership for the environment through a variety of policies, plans and actions. Two recent initiatives, the adoption of an Environmental Purchasing Policy and preparation of the Environmental Purchasing Guide, are concrete examples of their ongoing commitment to the environment.

The Environmental Purchasing Policy states that environmental considerations should be included in contract and tender specifications wherever possible. It allows for the consideration of environmentally-labelled products. The Policy commits the City of Richmond to look at all life-cycle stages of products and purchase those that are more environmentally responsible. The Policy does however stipulate that cost and quality must not be compromised for the sake of environmental attributes.

The Environmental Purchasing Guide puts the tools needed to implement the Environmental Purchasing Policy into the hands of staff.

The guide includes specific purchasing guidance for the following areas:

- general building maintenance
- janitorial products
- vehicles and maintenances
- furniture and office systems
- office equipment and related services
- office supplies
- lighting and lighting systems
- construction, renovation, demolition
- parks, recreation amenities and landscaping and
- special programmes.

The guide also includes the Environmental Purchasing Policy, general guidance on environmental purchasing, sample specifications and reference materials.

Source: Environmental Purchasing Guide: City of Richmond. www.city.richmond.bc.ca/webnews/city/0629_purchasing.htm.

CHAPTER 4
Support organisations, programmes and resources

This chapter provides information and website addresses on organisations which provide support to local governments in their work on sustainable energy and climate mitigation projects and programmes. It also indicates a range of useful resources and recommends a number of manuals and guides.

International support organisations and programmes

Capacity Development for the Clean Development Mechanism (CD4CDM)

UNEP has launched the project Capacity Development for the Clean Development Mechanism (CD4CDM).

The project aims to help establish GHG emission reduction projects that are consistent with national sustainable development goals, particularly projects in the energy sector. It will do this by developing national capabilities so that persons in the countries are, at the project's conclusion, capable of analysing the technical and financial merits of projects and negotiating possible finance agreements with Annex 1 countries or investors.

The project aims at, firstly, generating in participating developing countries a broad understanding of the opportunities offered by the Clean Development Mechanism (CDM) and, secondly, developing the necessary institutional and human capabilities that allows them to formulate and implement projects under CDM.

Participating countries include:

North Africa: Egypt, Morocco, Algeria

Latin America: Ecuador, Guatemala, Bolivia, Peru, Nicaragua, Suriname

Sub-Saharan Africa: Ghana, Cote d'Ivoire, Mozambique, Uganda, Mauritius, Tanzania

Asia: Cambodia, Philippines, Vietnam, Bangladesh.

Website: http://cd4cdm.org/unep_cdm.htm

CDM Bazaar

The UNFCCC Secretariat and the UNEP Risoe Centre on Energy, Climate and Sustainable Development (URC) have set up the UNFCCC CDM Bazaar.

The CDM Bazaar is a global 'virtual information exchange place' open to all interested parties. It is a facilitating initiative to help to reduce transaction costs in the CDM project cycle as well as to support increased information exchange among project participants and other market players. As such, the Bazaar enhances the capacity of Non-Annex 1 members of the UNFCCC.

http://cdmbazaar.net/about.asp

Climate Action Network (CAN)

The Climate Action Network (CAN) is a worldwide network of over 430 NGOs working to promote government, private sector and individual action to limit human-induced climate change to ecologically sustainable levels.

CAN's mission is to support and empower civil society organisations to influence the design and development of an effective global strategy to reduce GHG emissions and ensure its implementation at international, national and local levels. CAN members work to achieve this goal through the coordination of information exchange and NGO strategy on international, regional and national climate issues.

The Climate Action Network promotes a parallel three-track approach to mitigating climate change which includes a Kyoto track, a 'greening' (decarbonisation) track and an adaptation track. The goal of this approach is to facilitate action that will prevent harmful climate change and keep global warming as far below 2°C as possible.

There are seven regional CAN offices which coordinate these efforts in Africa, Central and Eastern Europe, Europe, Latin America, North America, South Asia and Southeast Asia.

www.climatenetwork.org

Clinton Climate Initiative (CCI)

President Clinton launched the Clinton Foundation's Climate Initiative (CCI) in August 2006 with the mission of applying the Foundation's business-oriented approach to the fight against climate change in practical, measurable and significant ways. In its first phase, CCI is working with the C40 Large Cities Climate Leadership Group.

To enable its partner cities to reduce energy use and GHG emissions, CCI is:

- Creating a purchasing consortium to pool the buying power of cities in order to lower the prices of energy-efficient products and to accelerate the development of new energy-saving technologies.
- Mobilising the best technical experts in the world and creating local capacity to develop and implement programmes that result in reduced energy use and greenhouse gas emissions. This includes the CCI Energy-efficiency Building Retrofit Programme, which joins together cities, leading energy service companies, global financial institutions and green building organisations in a landmark effort to significantly reduce energy use in public and private buildings worldwide. CCI is also working with cities in areas including waste management, transportation, clean energy production and ports.
- Developing common measurement and information flow tools that allow cities to track the effectiveness of their programmes and share what works and does not work with each other. These tools will enable cities to take an inventory of their GHG emissions and measure their progress.

www.clintonfoundation.org

Clinton Foundation – C40. C40 is a programme supported by the Clinton Foundation working with the 40 largest cities to tackle climate change. All of these cities have pledged to reduce carbon emissions and increase energy-efficiency in large cities across the world and serve as models for other cities, starting with building efficiency. Membership to the C40 is currently restricted to the 40 largest cities in the world.

www.c40cities.org

Cities for Climate Protection (CCP) Campaign

ICLEI is a membership-driven association of local governments working together to tackle global problems by working on solutions at the local level.

ICLEI's members all have access to ICLEI programmes, tools and assistance to help deliver local results. Programme areas relevant to climate change and its impacts are climate protection, climate resiliency, urban biodiversity, water resource management, disaster management and sustainability management instruments, among others.

The Cities for Climate Protection (CCP) Campaign was initiated by ICLEI in 1993 and works with local governments to improve urban management and address economic, environmental and social concerns. In doing so, local governments achieve the additional benefits of reducing air pollution, waste and GHG emissions.

The campaign is based on a performance framework structured around five milestones that local governments commit to undertake. The milestones allow local governments to understand how municipal decisions affect energy use and how these decisions can be used to mitigate global climate change while improving community quality of life. The CCP methodology is compliant with international standards and provides a simple, standardised way of acting to reduce GHG emissions and of monitoring, measuring and reporting performance.

ICLEI currently runs this successful and widely-recognised campaign either regionally or nationally in Australia, Canada, Europe, Japan, Latin America, Mexico, New Zealand, South Africa, South Asia, Southeast Asia and the United States, with more than 800 local governments participating. CCP participants have exclusive access to the CCP Club of the ICLEI's website which serves as a networking tool for cities to link into.

www.iclei.org

The **World Mayors Council on Climate Change (WMCCC)** is an alliance of committed local government leaders whose concerns about the effects of climate change on their communities has prompted them to foster international cooperation and to advocate for effective climate protection policies.

www.iclei.org/wmccc

Institute for Transportation and Development Policy (IDTP)

Founded in 1985, the Institute for Transportation and Development Policy (ITDP) has become a leading organisation in the promotion of environmentally-sustainable and equitable transportation policies and projects worldwide.

ITDP was created by sustainable transport advocates in the US to counteract the export to developing countries of costly and environmentally-damaging models of dependence on the private automobile. In its first ten years, ITDP successfully advocated for the redirection of lending activity by the World Bank and other multilateral institutions away from an exclusive focus on road projects and toward more multimodal transport solutions.

In more recent years, the institute have focused on working with municipalities and non-governmental organisations in developing countries to implement projects that show how air pollution, carbon emissions, traffic congestion and accidents can be reduced, or how the basic mobility of the poor can be improved.

ITDP primarily focuses on work in the following programme areas: developing high-quality, low-cost mass transit; planning and advocacy for cycling and walking and strengthening the bicycle and rickshaw industries.

www.itdp.org

Renewable Energy and Energy-efficiency Partnership (REEEP)

The Renewable Energy and Energy-efficiency Partnership's (REEEP) goal is to accelerate the global market for sustainable energy by acting as an international and regional enabler, multiplier and catalyst to change and develop sustainable energy systems. REEEP works with governments, businesses, industry, financiers and civil society across the world in order to expand the global market for renewable energy and energy-efficiency technologies.

Partners are organisations who have signed the REEEP mission statement and who agree to provide the partnership with knowledge and tools to facilitate change. All partners must be formally approved by REEEP's governing board.

Government who are partners are working with REEEP to promote local, regional and international market conditions for the accelerated deployment of energy-efficiency and renewable energy technologies. REEEP provides funding and are committed to ensuring that policies and regulations are introduced to reduce the risk of investing into clean energy in their respective country.

REEEP currently has regional secretariats covering East Asia, Latin America and Caribbean, North America, South Asia, South East Asia and Pacific and Southern Africa.

www.reeep.org

South*South*North (SSN)

South*South*North (SSN) is a network-based non-profit organisation which builds capacity in developing countries through the implementation of climate change projects, both adaptation and mitigation.

This unique southern network of organisations and applied-research institutions operate in Brazil, South Africa, Mozambique, Tanzania, Bangladesh and Indonesia. Through the processes of sharing, peer review, self-monitoring and iteration, SSN assists these countries in seeking to find workable solutions and new ways to benefit within the climate context.

South*South*North pursues direct structural poverty reduction and the sustainable development of poor communities of the South who suffer the most from the impacts of climate change. At the same time, the programme aims to pioneer solutions to global climate change. SSN also contributed to the development of the International Gold Standard label which ensures the highest standards of practice throughout CDM project development and implementation.

www.southsouthnorth.org

Sustainable Energy Finance Initiative (SEFI)

SEFI is UNEP's Sustainable Energy Finance Initiative – a platform providing financiers with the tools, support and global network needed to conceive and manage investments in the complex and rapidly changing marketplace for clean energy technologies.

SEFI aims to foster investment in sustainable energy projects by providing up-to-date investor information, facilitating deal origination, developing partnerships and creating the momentum needed to shift sustainable energy from the margins of energy supply to the mainstream.

http://sefi.unep.org/english/about-sefi.html

Sustainable Urban Development Network (SUD-Net)

UN-HABITAT's Sustainable Urban Development Network (SUD-Net) is an innovative network of global partners working with actors and networks to promote a multilateral and interdisciplinary approach to sustainable urban development. The overall aim is to work at the local level to build the capacities of national governments, strengthen the power of decision-makers of local authorities and by promoting the inclusion of the community in the decision-making process.

SUD-Net activities will be carried out in close consultation with other agencies to:

- Mobilise partners/networks
- Build smart partnerships and synergy
- Implement innovative, pro-poor demonstrations
- Undertake targeted capacity-building activities and demonstrations and
- Stimulate learning and knowledge sharing and exchange of good practices.

www.unhabitat.org/sudnet

The Cities in Climate Change Initiative (CCCI)

As an initial component of SUD-Net, the Cities in Climate Change Initiative (CCCI) seeks to enhance climate change mitigation and climate change preparedness of cities in developing and least-developed countries. The CCCI seeks to provide support towards the development and implementation of pro-poor and innovative climate change policies and strategies and to develop tools for enhancing capacities of local governments.

The main aims of the CCCI include the following:

1. To promote active climate change collaboration of local governments and their associations in global, regional and national networks.
2. To enhance policy dialogue so that climate change is firmly established on the agenda of local governments.
3. To support local governments in implementing the necessary changes.
4. To foster the implementation of awareness, education and capacity-building strategies in close collaboration with a wide range of partners.

Key partnerships have been built and will continuously be strengthened. Partners include UN agencies, governments at all levels, NGOs, communities, institutions of research and higher learning, capacity-building and training agencies, land and property organisations, the private sector etc.

www.unhabitat.org/ccci

Urban Environment Unit

The Urban Environment Unit in UNEP is the agency's focal point for issues related to cities and the environment. It aims to integrate the urban dimension in UNEP's work, with a focus on environmental issues that both have a local and an international dimension. These include air pollution, coastal areas, waste, biodiversity and climate change. In cooperation with partners, UNEP supports governments to address key urban environmental issues.

The main activities the Urban Environment Unit are involved in include:

- The Partnership for Clean Fuels and Vehicles (PCFV) which is the leading global programme promoting better urban air quality in developing countries through cleaner fuels and vehicles.
- Local-global linkages: The role of cities in national and global environmental issues is increasing. UNEP is supporting local and national governments to address global issues such as biodiversity loss and climate change.
- Cities Alliance is a coalition of partners through which UNEP supports cities in poverty reduction and sustainable development.
- Cooperation with UN-HABITAT: UNEP and UN-HABITAT are working together on sustainable urban development.
- GEO Cities is a methodology to assess the state of the environment in cities.
- Eco-housing is a concept that applies sustainability principles to the entire lifecycle of a housing project – from design, through construction and maintenance to the 'end of life' activities.

www.unep.org

UNEP's Energy Branch

- The goal of UNEP's Energy Branch is to bring a longer-term, environmental dimension into energy sector decisions. UNEP's activities help decision-makers to improve their understanding of the link between the energy choices they face and broader sustainable development issues.
- The Branch's emphasis is on increasing the human capacity to create opportunities for development while reducing the harmful effects of energy production and use.
- Working with a wide range of partners, UNEP helps countries develop and use tools for analysing energy policies and programmes, climate change mitigation options, energy sector reforms and the environmental implications of transport choices. A special focus is put on helping financial institutions improve their understanding of investment opportunities in the renewable energy and energy-efficiency sectors.

UNEP is, also a member of UN Energy, the coordinating mechanism on energy matters involving UN agencies.

www.uneptie.org/energy/about/about_the_division.htm

Watergy Programme

The term 'Watergy™' was coined by the Alliance to Save Energy to describe the strong link between water and energy in municipal water distribution systems. The programme helps cities realise significant energy, water and monetary savings through technical and managerial changes in water supply systems, providing consumers with quality water while using a minimum of water and energy. Currently all Watergy™ projects are in developing countries, where efficiency measures repay themselves quickly and the resulting savings in money and water reap many rewards such as immediate improvements in water service, increased water delivery, reduced water and energy consumption and more revenue for desperately needed system upgrades and new customer connections.

Watergy™ has been implemented in over 40 cities around the world and is currently active in India, Mexico, Brazil, Philippines, Sri Lanka and South Africa. The Alliance custom designs every project to the needs and socio-economic conditions of each country, but at the core of all projects is the strategy of designing projects to build capacity locally so the benefits of any intervention continue long after the project has ended.

www.watergy.net/overview/

Further resources

Localised support groups with information to share

These networks share solutions, best practice and tools on issues of climate change and sustainable energy.

The Apollo Alliance for good jobs and clean energy:

The Apollo Alliance aims to improve America's security, technological leadership, economic strength and shared prosperity by achieving sustainable American energy independence through efforts at the national, state and local level. Named after President Kennedy's challenge in the 1960s to land a man on the moon within a decade, the new Apollo Alliance has a bold strategy to direct US$300 billion in targeted investments towards achieving sustainable energy independence within a decade. Some of Apollo's most exciting work takes place at the state and local level, where they bring together labour, environmentalists, business, civil rights activists, elected officials and their constituents to implement high-performance policies. These state and local Apollo groups work on specific job-generating policies and projects to increase energy-efficiency and renewable energy use and build the transportation, utility and other infrastructure needed to support sustainable, efficient energy practice. These state and local alliances pursue specific legislative and administrative reforms to increase investment in energy efficiency, renewable power and other clean energy strategies.

www.apolloalliance.org

Climate Alliance – Local Governments:

Through the Local Governments Climate Partnership, local governments in Germany, Japan and the USA are setting up, designing and developing city partnerships on climate protection.

www.klimabuendnis.org

Energie-Cités:

Energie-Cités focuses on European cities. Their website has good case studies that local governments from around the world could learn from. With over 150 members in 24 countries and representing more than 500 towns and cities, Energie-Cités is an association of European local authorities for the promotion of local sustainable energy policies. Energie-Cités provides resources for and case studies on sustainable energy and climate change in local governments in Europe.

www.energie-cites.eu

Energy Savings Trust:

In 1992, the Earth Summit in Rio de Janeiro highlighted, for the first time, the real threat of climate change on a global scale. The following year, the UK Government established the Energy Saving Trust (EST) and set a target for reducing UK emissions of CO_2 by 20% of 1990 levels by 2010.

The EST is working to:

- Address the damaging effects of climate change
- Cut CO_2 emissions from household energy consumption and road transport
- Improve air quality in our cities and towns

Through their programmes they provide expert and impartial advice and information as well as grants to encourage the more efficient use of energy in homes and vehicles across the UK. They work in partnership with local authorities in the UK and support them through training workshops, case studies and tool development.

www.energysavingtrust.org.uk

Recommended Manuals and Guidebooks

Alliance to Save Energy. March 2007. Guidelines for Financing Municipal Energy-efficiency Projects in the Commonwealth of Independent States. REEEP. www.reeep.org (under publications)

Apollo Alliance 2006. New Energy for Cities. Energy saving and job creation for local governments. www.apolloalliance.org/downloads/resources_new_energy_cities.pdf.

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Conclusion

Cities worldwide are linked to global networks for their food, energy, raw materials, consumer goods and economic output and these long distance transactions generate significant GHG emissions. Though developed countries take the biggest share on the GHG emissions, this is also true for cities in developing countries.

The corollary to this is that cities are in a position to play a critical role in advancing policies for the reliability, affordability and environmental sustainability of its energy supply. The regulatory and institutional landscape makes cities critical in promoting efficient energy use within the built environment. Furthermore, cities have strong reasons to promote what can be considered sustainable energy planning practices.

There is no doubt that cities in the developing world face profound challenges to achieving sustainability on all fronts. Local action, with regards to energy-related concerns, is strongly driven by the need for economic development, energy security and social cohesion. However, cities also face formidable obstacles to greater participation that create risk and uncertainty. These obstacles include:

- Lack of political will
- Governance and
- Scale.

Together these obstacles reinforce one another, creating an environment that prevents many cities from taking advantage of most of the available opportunities or sometimes from even taking the first step. The lack of political will can result in energy plans and strategies being shelved. Smaller cities are very often faced with issues of governance resulting in little or no progress in developing sustainable energy practices and strategies.

Albeit the challenges, cities can engage in sustainable energy planning in three primary ways regardless of size or governance structure:

- Firstly, within their own operations. Cities are often large consumers of energy in buildings and public facilities, in water systems and in other capital infrastructure such as streetlights. Efficient energy use within the public realm is directly tied to cost reductions and provides the most direct incentive for local action.
- Secondly, cities can promote efficient energy use and alternative resources in the private sector through their dominant role in shaping the built environment. Potential areas for action include improving building efficiency in existing construction, promoting energy efficiency in new buildings (in both commercial and residential sectors) and incorporating energy-efficient site planning and urban design in new development.
- Thirdly, cities can help shape long-term development patterns in order to promote location efficiency and reduce the effects of urbanisation on the energy system and the environment in general.

It is imperative for cities to draw on what already exists in the energy planning arena by using best practice examples and building on them where needed lessons need to be contextualised and scaled to suit the local environment. This will allow for rapid development and implementation of strategies that will assist cities in achieving not only energy, but overall sustainability. Ultimately cities in developing countries will embrace a future where economic growth, population growth and energy consumption are delinked and energy is consumed in a manner that promotes social cohesion.

This handbook was developed as a tool for local governments in developing countries to learn from their counter-parts in both the developing and developed world. It gives an indication of the challenges and approaches for implementing sustainable energy programmes and projects in urban settings, given the important role that local governments play in both the emission of GHG and the mitigation of these. Following the 10-step process, learning from existing case studies, as well as focusing strategically on areas of local government responsibility will certainly help cities to become leaders in energy sustainability.

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