

# Sustainable Urban Energy Planning

*A handbook for cities and towns  
in developing countries*



About ICLEI, UN Habitat and UNEP. . . . .	4
Why this handbook was written . . . . .	5
Acronyms . . . . .	6
Introduction – Urban centres, energy and climate change in developing countries . . . . .	7
<b>Chapter 1 – Why is sustainable energy planning for your city important?</b> . . . . .	11
<b>Chapter 2 – Developing a Sustainable Energy Plan for your city or town.</b> . . . . .	14
<b>Step 1. Designating a lead office, finding champions</b>	16
<i>Case Study 1: A pioneering municipal official: Osman Asmal, South Africa, Cape Town</i> .....	17
<b>Step 2. Establishing partnerships</b> .....	17
<i>Case Study 2: An External Partnership: The London Energy Partnership, London, England</i>	18
<i>Case Study 3: An Internal partnership: Sustainable Energy for Tshwane, Tshwane, South Africa</i> .....	18
<b>Step 3. Finding the hooks</b> .....	19
<i>Case Study 4: Finding the hooks to develop a Solar-Powered City, Rizhao, China</i> .....	20
<b>Step 4. Conducting an energy and greenhouse gas (GHG) emissions audit</b> .....	20
<i>Case Study 5: CCP: Using Milestone 1 to conduct a baseline emission inventory for your city, ICLEI, USA</i> .....	22
<b>Step 5. Analysing your data and developing a draft plan</b> .....	22
<b>Step 6. Building public and internal support: your participation process</b> .....	26
<i>Case Study 6: A Community Engagement Framework, Maribyrnong, Australia</i> .....	28
<b>Step 7. Finalising the plan</b> .....	28
<i>Case Study 7: Fossil Fuel Free Växjö, Växjö, Sweden:</i> .....	29
<b>Step 8. Implementing and financing the plan</b> .....	29
<i>Case Study 8: Implementing through a city agency – The Barcelona Energy Agency, Barcelona, Spain</i>	30
<i>Case Study 9: Implementing Renewable Energy in Woking Borough Council, Woking, U.K.</i> .....	30
<i>Case Study 10: Financing your plan – Toronto Atmospheric Fund, Toronto, Canada</i> .....	31
<i>Case Study 11: Municipal Energy Fund, Ann Arbor, U.S.A.</i> .....	31
<b>Step 9. Monitoring and evaluating your plan</b> .....	34
<b>Step 10. Publicising the benefits</b> .....	35
<i>Case Study 12: Energy efficiency advice for residents, Auckland, New Zealand</i> .....	35

<b>Chapter 3 Implementing energy efficiency and carbon mitigation measures</b> . . . . .	36
<b>3.1 Energy services and housing</b> .....	36
<i>Case Study 13: Providing hot water to Lwandle’s low income community using solar water heaters Somerset West, South Africa</i> .....	37
<i>Case Study 14: Meeting energy needs in Kuyasa public housing project using CDM Khayelitsha, South Africa</i> .....	37
<i>Case Study 15: More energy efficient homes in Puerto Princesa City, Puerto Princesa, Philippines</i> ..	38
<i>Case Study 16: Cuba’s Programme for Low Energy and Material Consumption for Housing, Villa Clara Province, Cuba</i> .....	38
<i>Case Study 17: Cash transfer programme to mitigate the impact of fuel price hikes, Jakarta, Indonesia</i> ..	39
<b>3.2 Public and commercial buildings</b> .....	39
<i>Case Study 18: Retrofitting Municipal Buildings, Ekurhuleni, South Africa</i> .....	39
<i>Case Study 19: Reducing municipal buildings energy use through a co-ordinated plan, Leicester, UK</i> .....	40
<i>Case Study 20: 15 Million Square Feet Retrofit Programme for public buildings, Chicago, USA</i> ...	40
<i>Case Study 21: Office occupants reduce energy use by 20% in local government building, Cape Town, South Africa</i> .....	41
<i>Case Study 22: Guidelines for building better, San José, U.S.A.</i> .....	41
<i>Case Study 23: Learning from termites to cool and heat naturally, Harare, Zimbabwe</i> .....	42
<i>Case Study 24: Retrofitting Hotels, Bamako, Mali</i> ...	42
<b>3.3 Water services, wastewater and sanitation</b> .....	43
<i>Case Study 25: Saving water, saving energy, saving money, reaching more people, Fortaleza, Brazil</i> .....	43
<i>Case Study 26: Technical interventions to save energy while delivering water, Ahmedabad, India</i> ..	44
<i>Case Study 27: Drinking Water pumped up by the sun, Kayrati, Chad</i> .....	44
<i>Case Study 28: Rainwater harvesting can save energy, Delhi, India</i> .....	44
<i>Case Study 29: Reducing energy intensity in delivery water and sanitation services, Veracruz, Mexico</i> ....	45
<i>Case Study 30: Improving access to water and saving energy in India, Vishakhapatnam, India</i> .....	45



**3.4 Waste management & methane recovery.....46**

- Case Study 31: Recovering Waste Materials and reducing GHG emissions, Naga City, Philippines...*46
- Case Study 32: Landfill-to-Electricity project using CDM, EThekweni, South Africa .....*47
- Case Study 33: Integrated waste management, Edmonton, Canada.....*47
- Case Study 34: Landfill gas recovery at Mtoni Dumpsite, Dar Es Salaam, Tanzania.....*48
- Case Study 35: Production of Biogas and Bio-Fertilizer while reducing carbon emissions, Laholm, Sweden .....*48
- Case Study 36: Reducing CO<sub>2</sub>e while making Organic Fertilizer and Liquid Detergent Production from waste, Thungsong, Thailand .....*49
- Case Study 37: Using wastewater to power a seafood processing plant, Ratnagiri, India .....*49

**3.5 Public lighting ..... 50**

- Case Study 38: Energy efficient street lighting in India, Guntur, India .....*50
- Case Study 39: Retrofitting Streetlights, Jabalpur, India .....*51
- Case Study 40: Solar streetlights as part of regeneration plans, Johannesburg, South Africa.....*51
- Case Study 41: Public Lighting, Odorheiu Secuiesc, Romania .....*52
- Case Study 42: Combining solar power with LED bulbs for energy efficient traffic lights, Cape Town, South Africa .....*52

**3.6 Public transport & city planning.....53**

- Case Study 43: Bus Rapid Transit System reduces air pollution, carbon emissions, accidents and travel time, Mexico City, Mexico .....*53
- Case Study 44: Putting commuters on the TransMilenio saves energy, Bogotá, Colombia .....*54
- Case Study 45: Urban mobility plans, Kisumu, Kenya .....*54
- Case Study 46: Assistance to purchase bicycles, Lima, Peru .....*55
- Case Study 47: Public bicycle rental programme, Paris, France.....*55

- Case Study 48: Reducing vehicular volume and GHG emissions, Baguio City, Philippines.....*56
- Case Study 49: Pedestrian Ordinance, Busan, Korea .....*56
- Case Study 50: Zero-Carbon Masdar, Masdar, United Arab Emirates .....*56
- Case Study 51: Compact City Planning, Essaouira, Morocco.....*57

**3.7 Air Quality Management..... 57**

- Case Study 52: Banning Motorcycles, Guangzhou, China .....*58
- Case Study 53: Two-Stroke Engine Retrofits reduces energy use and carbon emissions, Puerto Princesa, Philippines .....*58
- Case Study 54: Vehicle Inspection Programme reduces air pollution, Cairo, Egypt.....*59
- Case Study 55: 'Tarjeta Negra', Santiago, Chile.....*59
- Case Study 56: Adapting Tuk-Tuks, Dhaka, Bangladesh .....*60
- Case Study 57: EPM approach in Air Quality Management, Shenyang, China.....*60

**3.8 Green energy sourcing ..... 61**

- Case Study 58: Geothermal Power supplied to the National Grid, Nairobi, Kenya.....*62
- Case Study 59: Geothermal Energy, Manila, Philippines.....*62
- Case Study 60: 10% Renewable Goal, Cape Town, South Africa .....*63
- Case Study 61: Public involvement in München Solar Programme, München, Germany.....*63
- Case Study 62: Solar City, Dezhou, China .....*64
- Case Study 63: Zoning plan for wind turbine development, Wieringermeer, The Netherlands.....*64

**3.9 Urban greening ..... 65**

- Case Study 64: Tree planting with Trees for Africa, Potchefstroom (Tlokwe), South Africa.....*66
- Case Study 65: Utility-Supported Tree Planting, Sacramento, U.S.A.....*66
- Case Study 66: Green Trust Movement, Seoul, Korea .....*67



<b>3.10 Fleet management.....</b>	<b>67</b>
<i>Case Study 67: Solar powered municipal bus fleet, Adelaide, Australia .....</i>	<i>68</i>
<i>Case Study 68: Buses Powered by Biogas Produced in the Municipal Wastewater, Lille, France .....</i>	<i>68</i>
<i>Case Study 69: Green Fleet Strategy, DENSO Sales UK Ltd, UK .....</i>	<i>69</i>
<i>Case Study 70: Downsizing the Fleet, Denver, USA.....</i>	<i>69</i>
<i>Case Study 71: Creating a Green Fleet Policy, Whitbread Group Plc, UK.....</i>	<i>70</i>
<i>Case Study 72: Natural Gas Vehicles, Brazil, South America .....</i>	<i>70</i>
<b>3.11 Green Purchasing.....</b>	<b>71</b>
<i>Case Study 73: The Mayor of London’s Green Procurement Code, London, UK.....</i>	<i>71</i>
<i>Case Study 74: Training Municipal purchasers to buy green, Lille, France .....</i>	<i>72</i>
<i>Case Study 75: Changing procurement patterns of the Municipal Administration of Pori, Pori, Finland.....</i>	<i>72</i>
<i>Case Study 76: City leads on green purchasing, City of Richmond, Canada.....</i>	<i>73</i>
<b>Chapter 4 – Support organisations, programmes and resources . . . . .</b>	<b>74</b>



## About ICLEI, UN Habitat and UNEP



### ICLEI – Local Governments for Sustainability

**ICLEI – Local Governments for Sustainability** is an international association of local governments and local government organisations that have made a commitment to sustainable development. Over 1000 cities, towns, counties and their associations worldwide comprise ICLEI's growing membership. ICLEI works with these and hundreds of other local governments through international performance-based, results-oriented campaigns and programs to support local government in the implementation of sustainable development at the local level. In the Climate and sustainable energy field, ICLEI runs one of the largest global climate change programmes for local governments, Cities for Climate Protection (CCP) Campaign, which aims to assist cities to adopt policies and implement quantifiable measures to reduce local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability. ICLEI is also active in the field of Adaptation through programmes focusing on the development of local capacity to identify and to reduce the vulnerabilities associated with climate change.

The **ICLEI Africa Secretariat** was the lead ICLEI partner for the development of this guidebook and is one of many ICLEI Regional Offices, works across the African Continent and collaborates closely with the global ICLEI network and other regional offices around the world, in sharing tools, materials and strategies and good practices specifically designed and implemented at the local level.

For more information, see: [www.iclei.org](http://www.iclei.org)

### UN HABITAT

#### UN-HABITAT

UN-HABITAT's mission is to promote socially and environmentally sustainable urban development with the goal of providing adequate shelter for all. In the field of the urban environment, Sustainable Urban Development Network (SUD-Net) is an innovative network of global partners promoting a multilateral and inter-disciplinary approach to sustainable urban development. UN-HABITAT supports local and national governments through SUD-Net and its component the Cities in Climate change initiative to address key urban environmental issues related to Climate Change.

For more information, see: [www.unhabitat.org/sudnet](http://www.unhabitat.org/sudnet)



#### UNEP

UNEP is the voice of the environment within the United Nations system. In the field of urban environment, UNEP supports national and local governments to address key environmental issues with a focus that have both a local and an international dimension. In cooperation with partners, UNEP assists national and local governments by providing awareness raising materials, organizing workshops and trainings, developing tools and involving cities in international meetings. UNEP Division for Technology, Industry and Economics (DTIE) encourages decision makers in government, local authorities and industry to develop and implement policies, strategies and practices that are cleaner and safer, make efficient use of natural resources, reduce pollution and risks for humans and the environment: energy, transport, building and construction as well as urban issues at local level are some of the key areas DTIE deals with in the context of sustainable development.

For more information, see: [www.unep.org/scp](http://www.unep.org/scp)



The main purpose of this handbook is to assist people who are working in or with local government to develop **sustainable energy and climate action plans and implementation programmes**. There can be no single recipe for all cities – so it is up to each local government to develop its own innovative and appropriate plans based on local resources and needs. We, at ICLEI and UN-Habitat, hope this handbook will go a long way to helping you to do this and allow you to take full advantage of the opportunities inherent in such planning.

## This handbook is for you if you are working in an urban context with or as part of a local government, and your primary areas of concern include:

- Delivery of services to citizens
- Economic development
- Strategic development planning
- Land use planning, zoning, building plans approval
- Housing and poverty issues
- Environmental management
- Management of local government resources and systems
- Fiscal responsibility and risk management
- Water resource and waste management
- Public health
- Transportation management

## What you will find in this handbook

- The **Introduction** addresses the challenges of energy consumption, climate change and development in developing countries. It deals with the role of urban centres and local governments in defining a sustainable development path and a new energy future in their countries. It includes an explanation of the greenhouse effect and a mini-history on climate change.
- **Chapter 1** is an explanation of why it is important for urban centres in developing countries to engage in sustainable energy planning.
- **Chapter 2** provides in some detail a step-by-step process to developing and implementing a sustainable energy plan, illustrated by relevant case studies.
- **Chapter 3** offers a range of case studies from developed and developing urban centres covering all the major areas of local government responsibility.
- **Chapter 4** provides an extensive list and information on support organisations and resources.



## Acronyms

CACP	Clean Air and Climate Protection (ICLEI software)
CCP	Cities for Climate Protection, a programme of ICLEI- Local Governments for Sustainability
CDM	Clean Development Mechanism
CO <sub>2</sub> e	Equivalent carbon dioxide
ESCO	Energy Services Company
GHG	Greenhouse gas
GWh	Gigawatt hour
ICLEI	Local Governments for Sustainability (previously International Council for Local Environmental Initiatives)
ITDG	Intermediate Technology Development Group (recently renamed to Practical Action)
kV	Kilovolts
kW	Kilowatt
kWh	Kilowatt hour
LED	Light Emitting Diode
MW	Megawatt
NGO	Non-governmental Organization
R&D	Research and Development
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-HABITAT	United Nations Human Settlements Programme
USAID	United States Agency for International Development

kWh = kilowatt-hour  
GWh = gigawatt-hour (1,000,000 kWh = 1 GWh)  
1 GWh = 3600 Gigajoules (GJ)  
1 kg coal = 1.89 kWh  
1 kWh = 0.963 kg CO<sub>2</sub>  
1 kWh = 1.26 Litres of water used

A kilowatt-hour (kWh) is one unit of electricity; one 60 Watt light bulb burned for one hour will use 0.06 kWh (60 Watts) x (1 kilowatt/1000 Watts) x 1 hour) = 0.06 kWh

**Greenhouse gases** are the gases present in the atmosphere which reduce the loss of heat into space and therefore contribute to global temperatures through the greenhouse effect. Greenhouse gases are essential to maintaining the temperature of the Earth; without them the planet would be so cold as to be uninhabitable.



**“The climatic world is one world even if politically we are not.”** R.Bryson

### What is the future for energy and development?

The global energy crisis coupled with the threats of climate change bring into sharp focus both opportunities and challenges for developing countries. Developing countries have to address the increasing energy demands of growing economies, as well as address energy poverty issues often highlighted by extreme disparities in income. They also need to deal with the real and potential impacts of climate change. In addition to these challenges is the global imperative to reduce carbon emissions in order to prevent climate change. While developing nations have thus far been sheltered from obligations to reduce carbon emissions, we cannot anticipate that this situation will continue. Within this context developing nations need to follow a very different development path from that established by first world countries. This development path is a low energy, low carbon, and generally a resource efficient one.

Economies across the world need to change the assumptions of this paradigm in order to build a sustainable reality. As financial and environmental impacts soar, the real costs of resource inputs and of waste generation need to increasingly be taken into account. These factors are making efficiency, conservation, reuse, recycling and renewable energy sources primary considerations for a healthy economy. In an attempt to reduce resource inputs and environmental impacts, some developed nations have managed to ‘decouple’ economic growth from energy consumption – essentially resulting in energy inputs that decrease with economic growth. This has been achieved through technology and behaviour change to improve efficiency, and by closing the energy loop in production (e.g. recapturing heat energy released in the production process to then power production). Energy-poor countries, such as Japan, have been very successful at achieving this. Implementation of high energy efficiency and the use of renewable resources are also evident in energy-poor developing countries such

as the island states of Reunion and Mauritius. As such, under conditions of necessity, pursuing efficient and renewable energy paths is possible.

There is potential to greatly improve energy efficiencies and reduce carbon emissions in many upper-middle income developing countries which have a substantial industrial base. For example, South Africa produces a mere US\$1.06 in economic value for every 1 kWh of electricity consumed – Brazil manages twice and Mexico four times this level of energy efficiency.<sup>1</sup>

### What is happening in our cities?

Over the last 20 years, urban centres have experienced dramatic growth. Today half of the world’s total population (around three billion people) live in urban settlements. Developing countries in particular are undergoing rapid change from rural to urban-based economies as they are transformed by their urbanising populations.

There are marked differences in the level and pace of urbanisation within less developed regions of the world. Latin America and the Caribbean are highly urbanised, with 78% of their populations living in cities in 2007. Asia and Africa are less urbanised, both with

around 40% of their populations living in urban areas. While currently less urbanised, Africa and Asia are experiencing rapid rates of urbanisation. Consequently by 2050, about 62% of their inhabitants will live in urban areas. At that time, 89% of the population of Latin America and the Caribbean will be urban.<sup>2</sup>

In addition, over the next 30 years population growth will be nearly entirely concentrated in urban areas in the developing world. Much of the current debate regarding sustainable cities focuses on the formidable problems for the world’s largest urban agglomerations. However, smaller urban settlements are also growing rapidly and the majority of all urban dwellers reside in such smaller urban centres.

### Cities, energy and climate change

While cities command an increasingly dominant role in the global economy as centres of both production and consumption, this rapid urban growth throughout the developing world is outstripping the capacity of most cities and urban centres to provide adequate services for their citizens.<sup>3</sup>

“The overriding concern of developing countries is economic growth and poverty eradication and you cannot expect developing countries to engage on the question of climate change and harm those overriding objectives.”

**Yvo de Boer**, Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC) April 2008

<sup>1</sup> How efficiently does South Africa use electricity? Kevin Lings, Chief Economist, STANLIB Asset Management 26 Feb 2008. The countries chosen all fall into the upper middle income group, have reasonably reliable economic data especially electricity usage data, have a similar size of industry.

<sup>2</sup> **World Urbanization Prospects: The 2007 Revision** prepared by the United Nations Population Division, [www.un.org](http://www.un.org)

<sup>3</sup> Cohen B 2006





While there is no 'typical' city in terms of their energy needs and energy use, they do have a lot in common. Cities run on energy and require land – their burning of fossil fuels and their contribution to land clearing combine to contribute massively to the concentration of greenhouse gases in the atmosphere – they are also extremely vulnerable to energy scarcity, to energy price rises and health impacts of very poor air quality. In developing countries many urban citizens experience extreme energy poverty and their access to transport and so to urban goods is constrained.

While the energy transition challenges faced by developed and developing urban centres are fundamentally the same – to stabilise a growing hunger for secure energy supplies, avoid polluting and wasteful industries and power systems, and shun development paths that condemn citizens to high transport costs – urban centres in developing countries face additional challenges. These can include serious finance, governance, capacity and resource problems – and yet the fluidity of development and the rapid changes that are occurring may make opportunities of some of these challenges.

These cities, while they may have fewer resources than those in developed countries, are not so 'set in their ways' – they have the potential to establish new and different development paths.

There is no doubt that it will be far less costly to avoid the outcomes of climate change, than to live with its consequences or to repair its damage.

## Leapfrogging

One of the more obvious opportunities for cities in developing countries is that of 'leapfrogging' – where countries skip inferior, less efficient, more expensive or more polluting technologies and industries and move directly to more advanced ones. In terms of energy planning, developing countries need not repeat the mistakes of highly industrialised countries in creating an energy infrastructure based on fossil fuels, but "jump" directly to renewable energy sources and more efficient technologies.

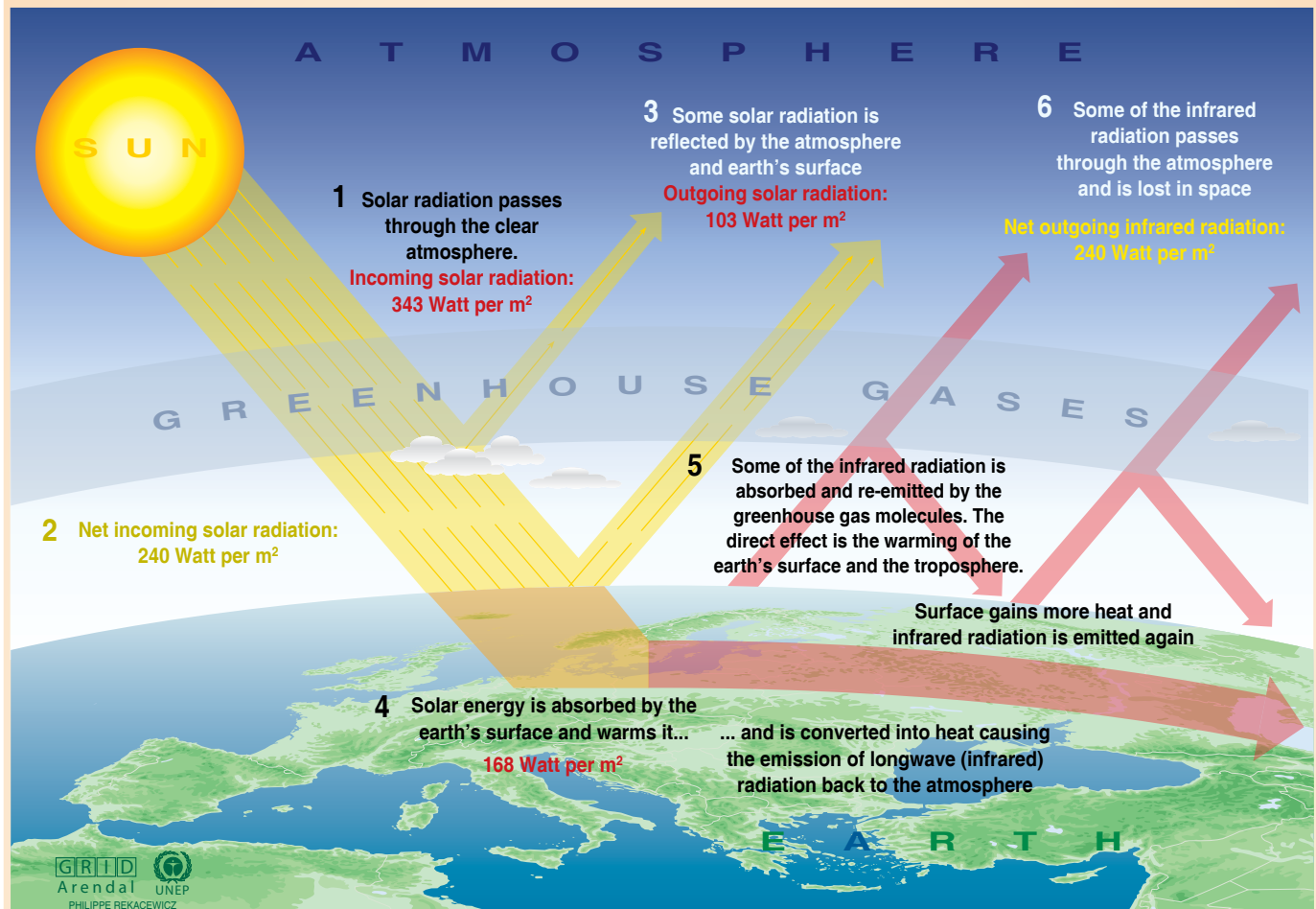
## Some of the advantages of sustainable energy action planning:

- **Improvements in local air quality** – Energy management initiatives are among the most cost-effective actions that local authorities can take to reduce the air pollution that causes serious environmental and health problems within their cities.
- **Financial savings** – While many local authorities are faced with budget deficits, the appeal of saving money is often the starting point for municipal energy management initiatives. Improved efficiencies in municipal energy consumption offer plentiful opportunities for reducing operating costs.
- **New jobs** – Inefficient energy systems represent important investment opportunities in the community, and such investments are among the most effective ways to create new employment. When energy management reduces expenditures on fuel and electricity, the savings can then be re-spent within the community.
- **Local economic development** – The energy management industry itself is a growth industry and its promotion can be an effective component of local economic development strategies in the community. In addition, big business is increasingly considering the livability of a city an important factor in deciding where to locate – access to urban goods and transport efficiencies (and so spatial development and public transport provision) are critical to creating livable cities.
- **New partnerships** – Utilities, private enterprises, financial institutions, and levels of government other than municipal are all pursuing energy management for various reasons. They have recognised that urban governments are well suited to deliver the type of integrated programmes often required to achieve energy efficiency and renewable energy objectives.



# What is climate change and what does it mean for the planet?

## The Greenhouse Effect



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

## People and the climate

Humanity is changing the climate of the earth. As a global average, surface temperatures have increased by about 0.74°C over the past hundred years. Since record keeping began in 1880, the five warmest years on record have occurred since 1997 (IPCC, 2007).

In 2005, atmospheric levels of CO<sub>2</sub> were 379 parts per million (ppm) – this is a 20% increase on levels since measurements began in 1959. In 2006, global carbon dioxide output approached a staggering 32 billion tons, with about 25% coming from the United States, and 20% from China.

Projections of further temperature increases in the 21st Century vary considerably, between a minimum of 1.4°C and a maximum of 5.8°C depending on the level

of stabilization of carbon emissions, the pace of decarbonization of the global economy, and the patterns of demographic and economic development. Even if the global mean temperature only increases by 1.4°, this will be a greater rise than over the last 1,000 years where global temperature variability has remained below 0.5°C.

Already there is much evidence of the impact of climate change, with glaciers melting, sea ice disappearing, deserts advancing, wildfires stripping vast areas, and rolling extreme climate events. Radical action is required to reduce carbon emissions into the atmosphere and so keep climate change within a range to which nature can adapt.



UN talks by Oxfam International/flickr.com

## Climate change: A timeline

**1827:** French scientist Jean-Baptiste Fourier is the first to consider the “greenhouse effect,” the phenomenon whereby atmospheric gases trap solar energy, increasing Earth’s surface temperature.

**1896:** Swedish chemist Svante Arrhenius blames the burning of fossil fuels (oil, gas and coal) for producing carbon dioxide (CO<sub>2</sub>), the most polluting of the greenhouse gasses now blamed for climate change.

**1950s onwards:** Global warming science begins and grows with increasing information on impact of greenhouse gases on climate; development and growth of environmental movements

**1979:** World Climate Research Programme is launched to coordinate international research

**1988:** The United Nations sets up a scientific authority to vet the evidence on global warming, the Intergovernmental Panel on Climate Change (IPCC).

**1990:** First IPCC report says levels of man-made greenhouse gases are increasing in the atmosphere and predicts these will cause global warming.

**1992:** Creation of the UNFCCC (United Nations Framework Convention on Climate Change) at the Rio Summit. The UNFCCC now (2008) has 192 member countries.

**1997:** UNFCCC members sign the Kyoto Protocol. Under its first phase, industrialised countries must cut emissions of six greenhouse gases so they are 5.2 percent lower than 1990 levels by the end of 2012.

**2001:** The United States abandons the Kyoto Protocol, with President George W. Bush calling the treaty too expensive for the US and unfair as developing countries escape binding emissions cuts. Kyoto signatories minus the US agree on the treaty’s rulebook, opening the way to a ratification process.

**2005:** Kyoto Protocol takes effect on 16 February.

**2007:** Landmark report by the IPCC delivers blow to climate sceptics. It says the evidence for global warming is “unequivocal” and forecasts warming of 1.8-4.0 degrees Celsius by 2100 and a rise in sea levels. Nobel Peace Prize awarded to IPCC and former US vice president Al Gore, whose documentary “An Inconvenient Truth” raises climate change awareness. UNFCCC members including the US agree after marathon talks in Bali, Indonesia, to launch negotiations on a new treaty to replace Kyoto, which expires in late 2012.

**2008:** Negotiators from up to 180 countries meet in Bangkok from March 31 — April 4 for the first round of negotiations that should pave the way for a new international treaty in 2012 to take over from the Kyoto Protocol. Outcome termed “The Bali Road Map”.

**2009:** Copenhagen – the next round... Preparations are underway. A major focus of this meeting will be the role of Local Government. ICLEI are assisting local governments around the world to prepare for this meeting.



## The energy sector and carbon mitigation have to be at the centre of any sustainable development strategy.

**'Although it was national governments that signed the Climate Change Convention, the real global leadership for reducing carbon emissions and energy conservation is coming from municipal leaders.'** Dr Noel Brown, former Director of the North American region at the UN Environment Program.

The use of energy, the types of energy used and the lack of access to sufficient energy have far reaching implications for a city's economic development, its environmental health and for the poor. The burning of fossil fuels to provide energy is the major contributor to excess carbon in the atmosphere which is the cause of global warming. Cities which implement sustainable energy and climate action plans reduce their vulnerability to energy scarcity and to energy price rises; they have less traffic congestion and lower energy input costs; they have cleaner air and their low-carbon economies can afford them a competitive economic edge globally. And, specifically for cities in developing countries, a sustainable energy and climate action plan should consider the users' needs first – this means that poorer households and small energy users should be prioritised.

**"The global effort for sustainability will be won or lost in the world's cities where urban design may influence over 70% of people's ecological footprint"**

Wackernagel 2006

## Local governments, energy and climate change

As local governments manage or oversee all city activities and city development, they should play a central role in determining the energy and carbon emissions picture of their cities. They also have direct access to their citizens and are best placed to know

their needs and to influence their behaviour. Every city is different – it has different resources at its disposal, different needs, different development paths and different mandates and powers. A city's energy plan must be built on its particular needs and the resources at its disposal.

These are some of the ways in which local governments play a central role in the energy picture of their cities:

- They plan and manage city development and growth
- They establish and enforce building codes and approve building plans
- They are the primary providers of basic services such as water, waste management, street lighting and other related services
- They are responsible for transport planning and management across and within a city
- They are usually responsible for the distribution of electricity and for billing, and may be responsible for some generation capacity
- They are big energy users themselves – in their fleets and buildings
- As they are major employers, they can directly influence their employees energy use patterns
- They are engaged in significant procurement – of paper, fuel, building materials, light bulbs, vehicles and so on

**Local governments can make significant energy savings in their own operations, thereby saving money, setting a good example and even testing new technologies.**

## The Sustainable Energy Path for Cities

- Reduce carbon emissions
- Reduce dependence on fossil fuels
- Introduce cleaner fuels
- Increase use of renewable energy
- Promote diversification of energy sources
- Support local and decentralised power supply
- Focus on energy efficiency and provide support and information to users
- Make efficient resource use the basis of economic development
- Ensure that citizens have appropriate access to energy services and information on best energy use practises to reduce poverty
- Plan for efficient spatial development
- Develop efficient and accessible public transport using cleaner fuels
- Communicate! Create a sustainable and low-carbon energy vision for the future.



## Sustainable energy action planning

The aims of sustainable energy action planning are optimal energy efficiency, low- or no-carbon energy supply and accessible, equitable and good energy service provision to users. Planning is based on consideration of the broader concerns of the whole economy, environment (particularly carbon mitigation) and society, not just a 'least financial cost' focus. And, it is led by the demand for energy services.

These are the key characteristics of sustainable energy and climate action planning:

- all energy sources and energy related activities are considered as a whole system
- carbon mitigation is a key determinant in the development of the plan and choice of project options
- the demand for energy services, rather than what energy can be supplied, is the basis for planning
- energy conservation, energy efficiency and demand-side management are considered prior to supply-side solutions
- environmental and social costs are clearly considered
- energy sector linkages with the economy are included
- the plan is flexible and can anticipate and respond to change

## Establish a vision

It is important to create a vision for a sustainable energy and climate action future and establish measurable goals according to this vision. This vision needs to be well communicated and loudly debated in the public realm. A clear vision backed up by implementation plans will empower and motivate city employees, citizens, business and industry. It also provides a bench mark against which progress can be measured.

### Key elements of a sustainable system

- **Consistent:** the short term actions are compatible with long-term goals and the viability of the system
- **Renewable:** the system depends on renewable resources and operates using environmentally benign technologies
- **Diverse:** the more diverse a system is, the more able it is to adapt to needed change
- **Inclusive:** all elements of the system are valued and used for the good of both the individual parts and the whole
- **Interdependent:** each element of the system is both dependent on and depended on by several other elements; the greater the interconnection, the stronger the system.



## Why a demand-led approach to energy planning is important:

### Understanding the needs of the users

Good energy planning needs to be informed by the right kind of information. It is fairly easy to gather supply information (how much oil, electricity, gas etc. the city uses), but it is more difficult to gather information on who uses what energy sources, how they use these and why. This kind of energy information is very important for sustainable energy planning, because your focus needs to be on meeting energy users' needs in the best way possible. There are very significant economic, social and environmental benefits which can be gained by planning according to people and industry needs: these therefore must determine a city or town's energy plan.

The needs of energy supply industries and the energy sources which they supply often dominate energy planning. The supply industries are also often very powerful so they can push their needs over the needs of users. Sustainable energy and climate action planning

requires a very different approach: first of all it must put the **energy service** needs (such as the need for a warm or a cool house, hot water, cooked food, transportation of goods, welding, public lighting etc) of the users and the city first. This is because energy service needs do not necessarily need to be met with a supply of energy. Take for instance the need for a warm house in winter or a cool house in summer – this can be met by installing a ceiling and insulation or by overall energy efficient design for new build; the need for hot water can be met by installing solar water heaters. A supply-led regime would just assume that the household could use electricity for heating or make some other plan from the energy sources available. A demand-led approach would also plan at a much more local scale and try to create closed/no waste systems: for example the energy input required by an industry for production may be able to be supplied by the waste energy and waste products produced by that same industry or by an adjacent industry.

A good demand-side database is important in order to develop energy action strategies and evaluate implementation.

Deficiencies of a supply-led approach	Benefits of a demand-led approach
<ul style="list-style-type: none"> <li>● A disproportionate focus on the needs of the supply industry leading to inadequate consideration of the needs of the consumers.</li> </ul>	<ul style="list-style-type: none"> <li>● Consumer needs lead the way so supply is planned to fit needs.</li> </ul>
<ul style="list-style-type: none"> <li>● A focus on income from the sale of energy sources and so a resistance to energy efficiency or fuel-switching measures.</li> </ul>	<ul style="list-style-type: none"> <li>● Energy efficiency and appropriate means to meeting energy service needs (cooking, warm house etc) become all important.</li> </ul>
<ul style="list-style-type: none"> <li>● Potential for misjudging the future demand on energy supply.</li> </ul>	<ul style="list-style-type: none"> <li>● Energy demand changes are tracked and can be anticipated timeously.</li> </ul>
<ul style="list-style-type: none"> <li>● A poor understanding of suppressed demand – for example households may be able to afford solar water heaters if proper financing were available: a supply-side focus would miss such opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>● As the focus is on a range of ways of meeting energy service needs, a wider range of users can satisfy their energy service needs.</li> </ul>
<ul style="list-style-type: none"> <li>● Little attention given to the management of demand (including behaviour change).</li> </ul>	<ul style="list-style-type: none"> <li>● Attention is focused on managing demand – and demand-side management is considered prior to supply side solutions</li> </ul>
<ul style="list-style-type: none"> <li>● The majority of users have no voice in the system.</li> </ul>	<ul style="list-style-type: none"> <li>● There is constant interaction with users and users are empowered to make energy decisions and choices.</li> </ul>
<ul style="list-style-type: none"> <li>● The emphasis on supply makes the system vulnerable to energy scarcity and to escalating energy costs. In addition, users have little control over their energy expenditure.</li> </ul>	<ul style="list-style-type: none"> <li>● The emphasis on diversity of means of meeting energy service needs and on efficiency means that the system is more flexible and robust. Energy users have much greater control over their energy expenditure.</li> </ul>



# Chapter 2 Developing a Sustainable Energy Plan for your city or town

## The planning process

This planning guide uses a 10-step process as a framework for local action. This is of course *not a linear process* – take a look at the diagram to the right for a more dynamic view of the process. Remember that Step 6 and Step 10 (which have to do with public participation, building support and publicity) are ongoing throughout the process. The rest of this Chapter takes you through each of these steps in more detail.

1. Designate a lead office and find a champion.
2. Establish partnerships
3. Find the 'hooks' in the vision, goals, policies of your city
4. Conduct an energy and greenhouse gas (GHG) emissions audit of your city / local authority
5. Analyse your information and develop a draft plan
6. Build public and internal support
7. Finalise the plan
8. Implement and finance the plan
9. Monitor and evaluate the plan
10. Publicise and communicate the benefits

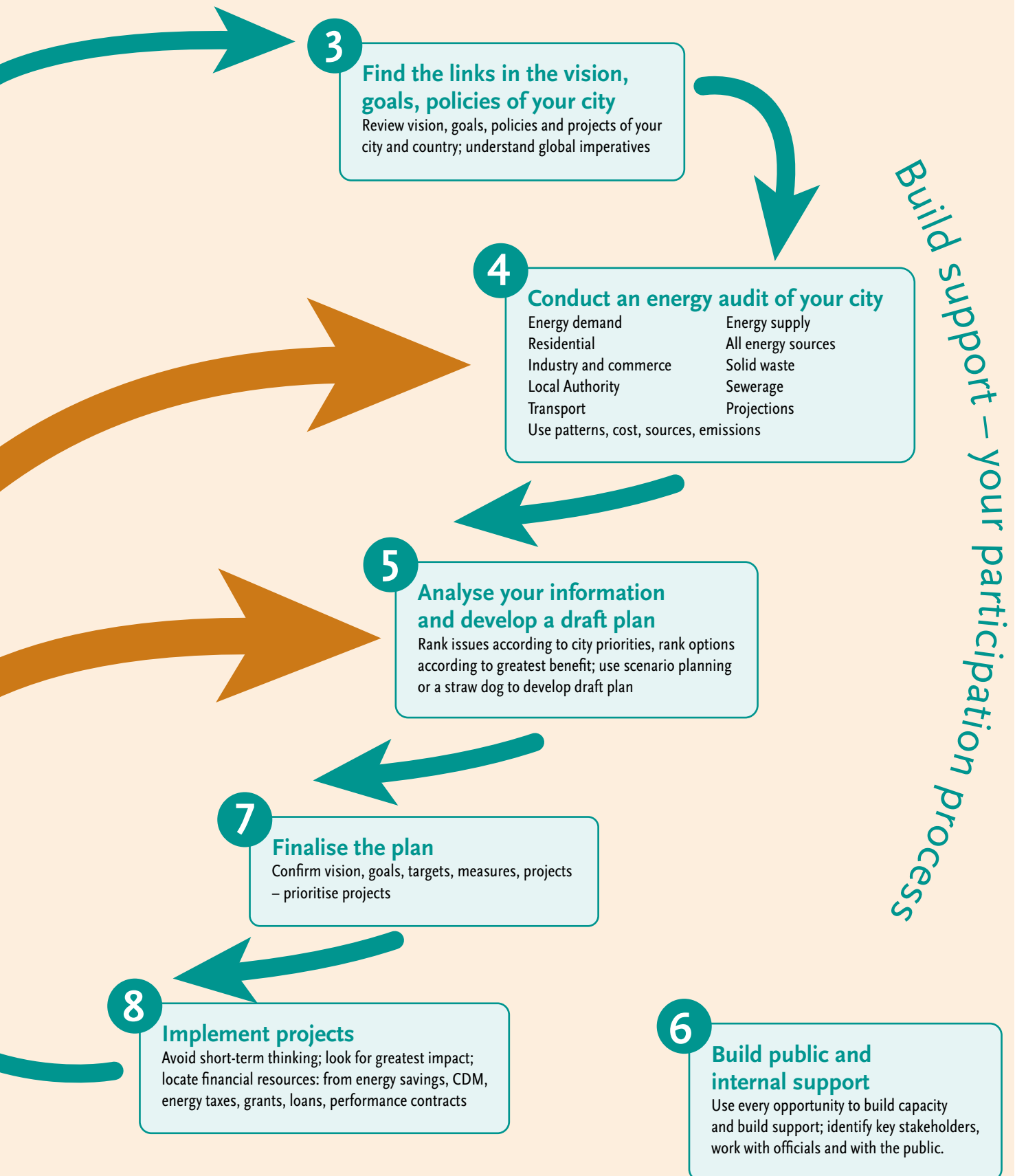
### A journey of a thousand miles begins with a single step

Your local authority may be very new to this field of sustainable energy and climate action planning and it may seem to have little capacity to take meaningful action. Don't be disheartened – start with small steps. There is a saying that those who do things will make mistakes, but they never make the biggest mistake of all – doing nothing.

## City energy plan process

### Steps to a Sustainable Energy Plan for your city









## Environmental Planning and Management (EPM) Approach

The environmental planning and management (EPM) approach of the Sustainable Cities Programme (SCP) addresses the urban challenge by promoting the sustainability of cities. The EPM approach is based on and supports the efforts that cities make in developing their environments by improving their environmental information and expertise; their strategies and decision-making; and their implementation of strategies. Each city-level project is adapted to the particular needs, priorities, and circumstances of that city; nonetheless, all projects follow the same general approach and all are implemented through the same series of activities. The SCP Source Book Series provides detailed operational guidance. The volumes include the following: Volume 1: Preparing the SCP Environmental Profile Volume 2: Organising, Conducting and Reporting a SCP City Consultation Volume 3: Establishing and Supporting the Working Group Process Volume 4: Formulating Issue-Specific Strategies and Action Plans Volume 5: Institutionalising the EPM Process Volume The emphasis in this Series is on relevance and realism. These volumes are the product of field-level experience gained over the past years in SCP city projects around the world. Precisely because it is drawn from the lessons of experience in so many different cities, the information contained in these volumes is not city-specific but can readily be adapted and applied to the tasks of urban environmental planning and management (EPM) in virtually any city context. The source book can be downloaded at: [www.unhabitat.org/scp](http://www.unhabitat.org/scp).

Another methodology for environmental assessments is to develop a Global Environment Outlook (GEO) for your city. This GEO Cities initiative was launched by the United Nations Development Programme (UNEP) in 2000. It extends the Global Environment Outlook assessment and reporting process to the urban level. The objective of GEO Cities is to build capacity on the preparation of integrated assessments on the state of the urban environment including linkages between environmental conditions and human activities. Based on this assessment the most critical environmental problems are identified to make it possible to formulate and implement urban strategies and plans to help cities improve urban environmental management.

UNEP and UN-HABITAT have been supporting GEO Cities in several cities of Latin America and the Caribbean and in three cities in Africa. After the success of GEO Cities, GEO seeks to implement a similar process at the local level in other regions: cities of countries in transition in Eastern Europe, the Caucasus and Central Asia region have a particular need for environmental monitoring and improvement.

The GEO Cities planning document can be downloaded from: [www.pnuma.org/deat1/metodologias.htm](http://www.pnuma.org/deat1/metodologias.htm).

## Step 1. Designating a lead office, finding champions

Climate change and energy affects every city department and it is therefore vital to build support amongst staff across all the city's responsibilities. The involvement of every city department will optimise the potential for successful planning and implementation at local level. Leadership and direction need to come from one primary office (or department). Be strategic about selecting your lead office: look at where you are likely to get most support, which office has the ear of council, and which office has the strength and motivation to do the work – it could be the office of the Mayor, a strategic planning section, the planning department, the environmental department or even the electricity department (although these are usually too narrow in their focus to lead the way at this stage).

“Champions” – people with charisma, commitment and power – will play a vital role in capturing people's imagination and obtaining buy-in. It is important to find both political and staff champions. The political champions need to build political will and lead the councillors, the staff champions are vital for bringing the departments on board and for building the sustainability of the programme beyond the electoral terms of councillors. These people will have to lead and convince their community, their electorate and their peers to change the way they think about things, to change from a business-as-usual approach, and to embrace a new, innovative way of thinking about issues and finding brave new solutions. You may need a champion for each key sector (residential, transport, electricity, commerce etc.) – a sector can also be led by a suitable external organisation as well.

A steering committee or task team that brings all the necessary players together will help build commitment and keep everyone on the same page. This team or committee should be made up of staff (in decision-making positions), political champions and relevant local government stakeholders who will be able to support and drive the process. This committee should ensure that a common vision and clear goals are agreed on, while allowing a flexible platform for diverse groupings to unite and combine forces.



## CASE STUDY 1



Capetown by cyberdees/flickr.com

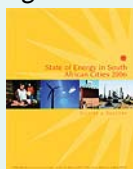
### **A pioneering municipal official: Osman Asmal South Africa, Cape Town**

In 1995, Osman Asmal joined the Environmental Planning Management Team of the City of Cape Town, the department he now directs. Here he was responsible for coordinating the Local Agenda 21 initiative – a cities programme arising out of the Rio Summit and focusing on local level sustainable development. In 1998, under his leadership, the City of Cape Town (then Tygerburg Municipality) joined Sustainable Energy for Environment & Development (SEED), a programme being run by an NGO, Sustainable Energy Africa. The aim of the SEED programme was to build capacity to do sustainable energy work in the municipalities and in related NGOs. Through his enthusiasm and leadership, Osman enabled the City of Cape Town to become the first city in South Africa to develop an Energy and Climate Change Strategy in 2003, based on a thorough energy audit. Under his leadership the Environment Department was restructured to include energy and climate change posts -another first in South Africa.

In 2004 Osman transferred to another municipality (Ekurhuleni near Johannesburg) where he again led the local government to develop its Energy and Climate Change Strategy.

Source: Sustainable Energy Africa. 2006. *State of Energy in South African Cities*. SEA.

Available on [www.sustainable.org.za](http://www.sustainable.org.za)



## Step 2. Establishing partnerships

Partnerships bring expertise, resources, support and information to your process. As energy and climate change impacts cut across all sectors, we need a partnership approach if we are serious in addressing these challenges head-on. Ask yourself what NGOs, community groups, businesses, utilities, associations, funders and government bodies can support your planning and implementation efforts? Which groups can help build your in-house capacity and provide additional expertise? National and international energy and climate change programmes can provide valuable support, and so can other cities which already have sustainable energy and climate action plans in place (see page 19 for support programmes internationally).

### Questions to ask as you get started:

- What city department should lead your planning activities?
- Who should champion the process?
- Should a city council resolution be passed to kick off planning activities?
- What city departments might be the most active participants in the process?
- Who will you approach to be your planning and implementation partners?
- What can you do from the beginning that will help your plan turn into action?

## CASE STUDY 2



Solar Powered boat by redjar/flickr.com

### **An External Partnership: The London Energy Partnership London, England**

The London Energy Partnership (LEP) was established as an independent body to provide coordination and synergy between the many groups, organisations and networks working on energy issues in London. It provides a vehicle for the delivery of the City's energy policy. Until the formation of the Partnership, London lacked an adequate mechanism to enable broad collaboration that is required to tackle these crosscutting issues.

Through a consensual process with energy stakeholders, the LEP guided the development of the City's 2004 Energy Strategy. In 2007, the City developed a Climate Change Action Plan to further strengthen action in this area. The Plan aims to achieve a 60% cut in CO<sub>2</sub> emissions by 2025. The LEP is responsible for implementing and reviewing the City's Energy Strategy and Action Plan.

LEP activities are directed by the LEP Steering Group. Task Groups are responsible for driving the implementation of the Energy Action Plan. The *London Energy Forum* is a broader grouping of stakeholders which functions as a networking and discussion forum and feeds into the LEP.

The main aims of the partnership are to:

- Assist in the delivery of London's CO<sub>2</sub> reduction, fuel poverty and security of supply targets for 2010, 2016 and 2050.
- Provide a single voice for sustainable energy in London and achieve a shift in thinking about sustainable energy by key stakeholders.
- Enable a number of high-profile, London-wide initiatives that deliver social, environmental and economic benefits.
- Create commercial opportunities in sustainable energy and help to build London's green economy.

Website: [www.lep.org.uk/about-us.htm](http://www.lep.org.uk/about-us.htm) and [www.london.gov.uk/mayor/environment/energy/](http://www.london.gov.uk/mayor/environment/energy/)

## CASE STUDY 3

### **An Internal partnership: Sustainable Energy for Tshwane Tshwane, South Africa**

Sustainable Energy for Tshwane (SET) is an interdepartmental committee co-ordinating energy and climate change initiatives within the Tshwane municipality. It is led by the Social Development Department's Environmental Health Unit. Other participating units included Energy and Electricity (newly named to include all energy sources), Transport, Environmental Resource Management, Housing, Local Economic Development, Integrated Development Planning, Spatial Planning, Waste Management, and Water and Sanitation.

This committee was made possible through top-level direction from both councillors and senior managers. Through support from Sustainable Energy Africa (SEA), a local NGO, the municipality became part of the Sustainable Energy for Environment & Development (SEED) programme which focuses on building capacity in municipalities around energy issues.

Initially the committee experienced some challenges. The Social Development Department was frustrated by the lack of commitment within the committee, some departments did not incorporate SET into their own lines of decision making and the relevance of the energy issues was not always immediately apparent to departments such as the Housing department. These barriers were overcome through good communication and championship. Once the concern over the lack of co-operation was raised, leaders from the different departments clarified relationships between the departments and the committee. Strategic workshops have kept the concept of integrated sustainable energy planning and practice in the foreground and built cooperation between the staff on the ground, top-level management and political leaders. In 2005 the SET committee initiated a project to supply 500 households with gas cookers and 30kg gas cylinders. This means that poor people who are not connected to grid electricity are also able to access their free basic energy quota of the equivalent of 50 kWh per month.

Source: Sustainable Energy Africa. 2006. *State of Energy in South African Cities*.

Available at: [www.sustainable.org.za](http://www.sustainable.org.za)

For more on the SEED programme visit:

[www.sustainable.org.za/seed/urban-sustainable-energy-for-environment-development-programme.html](http://www.sustainable.org.za/seed/urban-sustainable-energy-for-environment-development-programme.html)



### Step 3. Finding the hooks

In addition to linking into national and international objectives, conventions and laws, the sustainable energy and climate action plan must be clearly linked to your city's core goals and action plans. This ensures that the city's energy and climate action strategy is regarded as core city business and will ensure relevance, buy-in and allocation of resources. Most of the city's goals and issues will have an energy component as energy is key to the delivery of all basic services. Find the 'hooks' or links and make them clear. You need to work across all your city's long-term and short-term plans and strategies: from economic development to environmental management, from land use planning to waste management, from housing to poverty alleviation and health programmes.

**For example:**

City goal	Hook
Poverty alleviation and adequate housing goals	Energy efficiency housing can contribute towards these goals by improving the quality of the housing and reducing costs to the residents.
Economic development	Improving energy security (ensuring that there is an adequate and consistent supply of energy to meet your city's needs) by supporting local independent power producers and energy business development (such as the solar water heater industry) will contribute to this objective.
Access to work & urban facilities	Improving access by better public transport systems will contribute to this.
Financial sustainability	Saving energy in municipal activities will provide significant cost savings in the short and long term.
Clean air	All strategies which reduce the burning of fuels will contribute to this.

Look out for these types of connections. Every sustainable energy and climate action strategy can help meet at least one or two other goals for your city. It is a good idea to dovetail with other programmes and projects. Do be strategic though, and choose activities and programmes that are strong and well-placed, with enough actual or potential resources, community buy-in and political will behind them.

### Identifying issues

You will be able to start identifying energy issues as you collect data and engage in public participation. Filter these issues through local and national (and international) energy and climate change visions and policies so that you can prioritise and develop energy goals that meet local needs. Focus group workshops are a good way of identifying important issues and links between energy and other primary local issues. Such workshops will also increase the visibility of your plan and build support for the future. Participants can identify and rank the energy links associated with major city issues. They can help draft energy policy statements and specific goals for the policies. If at all possible, try to get 'energy for sustainable development' accepted as a key driver for strategic planning activities in the city (this may not be possible early on, but keep bringing it up with the strategic planning teams and processes).

### Steps to identifying the hooks

- Become familiar with your city's long- and short-term strategic objectives and vision for the future
- Make a list of your country's relevant energy policies and regulations
- Understand and stay on top of the global climate change and energy agenda and where links can be made with your country and city

### International energy related conventions which can support your plan

<b>United Nations Framework Convention on Climate Change (UNFCCC) 1992</b>	This is an intergovernmental treaty developed to address the problem of climate change and which sets out an agreed framework for dealing with the issue. (ICLEI has formal observer status and actively engages with the UNFCCC Secretariat on behalf of Local Government)
<b>Kyoto Protocol to the UN FCCC 1997</b>	The Protocol does not commit developing countries like South Africa to any quantified emissions targets in the first commitment period (2008-2012).
<b>Millennium Development Goals 2000</b>	The eight Millennium Development Goals (MDGs) form a blueprint agreed to by all the world's countries and leading development institutions. One of these goals is to ensure environmental sustainability. (ICLEI focuses particular on Goal Nr 7, that of ensuring Environmental Sustainability)
<b>Johannesburg Plan of Implementation World Summit on Sustainable Development 2002</b>	The Plan highlights areas of key importance in terms of meeting sustainable development in terms of economic development, social development and environmental protection. The key focus areas put poverty, sustainable development and Africa high on the global agenda.
<b>2009 Post Kyoto – The Copenhagen Plan?</b>	A new global climate-change pact is to replace the Kyoto Protocol in 2012. This should be defined in Copenhagen in 2009 and ICLEI is actively working on a "Roadmap to Copenhagen" for Local Governments.

## CASE STUDY 4



Solar powered by saucy\_pan /flickr.com

### Finding the hooks to develop a Solar-Powered City Rizhao, China

Rizhao, which means City of Sunshine, is a city of 3 million people in northern China. It has over a half-million square meters of solar water heating panels. 99% of households in the central districts use solar water heaters and more than 30% do so in the outlying villages while almost all traffic signals, street lights and park illuminations are powered by photovoltaic solar cells. In addition 6,000 households have solar cooking facilities and more than 60,000 greenhouses are heated by solar panels, reducing overhead costs for farmers in nearby areas. At his appointment in 2001, Mayor Li Zhaoqian recognised that Rizhao, with a lower per capita income than most other neighbouring cities, would have to focus on increasing the efficiency and lowering the cost of solar water heaters. The Shandong provincial government provided subsidies for this. Instead of funding the end users as is the case in most industrial countries, the government funded the research and development activities of the solar water heater industry which now cost the same as electric alternatives while saving the users on energy costs.

Mayor Li Zhaoqian and the Rizhao Municipal Government have adopted several measures and policies aimed at popularising clean energy technology, including the Regulations on Implementing Solar Energy and Construction Integration that standardise the use of solar energy—particularly solar water heaters—in new buildings.

The achievement of Solar-Powered Rizhao was the result of an unusual convergence of three key factors: a government policy that encourages solar energy use and financially supports research and development, local solar panel industries that seized the opportunity and improved their products, and the strong political will of the city's leadership.

Website: [www.renewableenergyworld.com/rea/news/story?id=48605](http://www.renewableenergyworld.com/rea/news/story?id=48605),

[www.nycclimatesummit.com/casestudies/energy/energy\\_rizhao.htm](http://www.nycclimatesummit.com/casestudies/energy/energy_rizhao.htm) and

[www.worldchanging.com/archives/007060.html](http://www.worldchanging.com/archives/007060.html)

## Step 4. Conducting an energy and greenhouse gas (GHG) emissions audit

A vital step in developing your sustainable energy and climate action plan is to collect energy information about your city. This process is known as an 'energy and greenhouse gas emissions audit'. Use your review of your city's goals and policies to help decide what information you should prioritise. Remember that this is the beginning of a process, so while your information may be far from perfect now, engaging in this process will ensure that the quality of the data improves year by year.

Collecting energy information will help to:

- Identify the energy-use areas that are most important in your city
- Assess the energy-use areas that are the highest GHG emitters and assess priority areas for mitigation projects
- Describe the size and shape of the resource-related problems facing the city
- Identify unsustainable trends resulting from current market forces, social conditions, government procedures, regulations and programmes
- Identify organisational mechanisms and partners that can help implement strategies
- Provide base data for evaluating and tracking your city's progress
- Project energy needs into the future.

### The Energy Audit

Apart from basic data on your city's climate, geography, population, economy, housing, businesses, energy and so on, your focus will be on energy demand and energy supply information. You want to have data on energy use and GHG emissions by sector and by energy source.

**Energy use by fuel type:** how much petrol, gas, electricity etc. is consumed by your city.

**Carbon emissions by fuel type:** how much carbon is emitted by each of the different fuels (you can also include local air quality emissions such as nitrogen and sulphur oxides).

**Energy use by sector:** how much fuel of what type is used by the residential sector, the transport sector, industry, local authority operations and so on.

**Carbon emissions by sector:** how much carbon is emitted by each sector.



### Energy demand information:

Residential	Industry and commerce	Transport
Energy-use profile for different groups & areas; Electricity connections; Energy use & expenditure; End use patterns <sup>1</sup> ; Prices.	Employment and energy use by sector; Relative energy intensity (energy used per unit of production).	Modal split; Trip length and time; Cost and subsidies; Energy use and emissions by mode.
Local authority	Energy demand projections	CO <sub>2</sub> Equivalent* emissions
Energy use, cost and emissions by energy source and sector: buildings, streetlights, water supply, vehicle fleet, solid waste, sewerage treatment.	Current growth rates in energy consumption from all sectors; Estimates of use at a future target date.	Calculate the CO <sub>2</sub> equivalent for each sector, sub-sector and overall.

\*This is a way of standardising the measurement of all GHGs. The CACP software (see box below) can be used to convert emissions to CO<sub>2</sub>e, track emissions and reductions of GHGs.

### Clean Air and Climate Protection

ICLEI and National Association of Clean Air Agencies, NACAA, (formerly STAPPA and ALAPCO) have joined forces to build a software product to help state and local governments develop harmonised strategies to combat global warming and local air pollution. The **Clean Air and Climate Protection (CACP)** software tracks emissions and reductions of GHGs (carbon dioxide, methane and nitrous oxide) and air pollutants (nitrous oxide, sulfur oxide, carbon monoxide, volatile organic compounds and particulate matter) associated with electricity and fuel use and waste disposal. This tool can help cities to:

- Create emissions inventories for the community as a whole or for the government's internal operations.
- Quantify the effect of existing and proposed emissions reduction measures.
- Predict future emissions levels.
- Set reduction targets and track progress towards meeting those goals.

The software contains thousands of emission factors that are used to calculate emissions based on simple fuel and energy use data, or by using information on waste disposal.

CCP participants and members of NACAA can use the CACP tool by visiting [www.cacpsoftware.org](http://www.cacpsoftware.org)

### Energy supply information:

All supply to the city	Energy sources	Energy source ownership and distribution
Coal, liquid fuels, natural gas, electricity, renewables.	Electricity generation sources: coal, nuclear, hydro, renewables.	Who owns / is responsible for what energy source; Who is responsible for distribution?
Solid waste	Sewage	
Tonnes of waste generated and dumped; State of city landfill sites.	Millions of litres per day.	

Summaries of the information will give you an overview of energy demand and supply. Each of these urban centres will require very different strategies to address their needs.

### Energy projects

Identify current energy projects across all sectors, who is responsible for them and the stage that they are at.

### Finding the information

These questions will help you find the information you need.

- Do the social welfare, housing, health or air quality departments collect information on energy use?
- Who else is interested in this information?
- Who pays for or taxes the resource?
- Who manages or plans the resource?

### Some tips:

When making estimates, *be explicit about your sources and the assumptions* you are making. Tend towards too much information rather than too little. Consider constantly the accuracy of your data: find out how the data was generated, examine the methodology. Try to gather data from a range of sources to improve its accuracy.

*Don't be afraid to ask questions about the data you are getting* – how the information is collected? who collected it and for what reason? is the data projected from a small data-set? how accurate do they think the data is?

<sup>1</sup> End use patterns refer to the energy used for specific services (or end uses) such as lighting, space heating, cooking. Separating this income group can also be very useful as it will help you identify what energy efficiency projects you need where – such as time-of-use tariffs to encourage big energy users to save, ceilings in low-income houses and solar water heater by-laws in higher income areas.



*Gather facts and anecdotes that make the information real to city leaders and the community: how much does a household spend on home energy use? how much on transport? what proportion is this of their household income? what perceptions do people have of different energy sources? how does this affect their energy use? how much local air pollution is caused by energy use? Look for opportunities to piggy back your energy questions on surveys that are being carried out by other departments or external organisations.*

### Problems you may encounter...

- No data or inaccessible data
- Energy supply information is good, but demand information is poor
- No centralised collection of energy data and no standardisation of collection systems
- Data is collected by region, not by city
- Some very basic data is missing or data is lumped together
- Good data on one sector for one year, but for no other sectors for that same year
- Different departments don't communicate with each other.

### No time for a lengthy energy audit?

At a minimum you need to know the kinds and quantities of energy used in your city, a breakdown of the big energy users and some idea of who is using what – a quick survey of households can give you a picture of what energy sources poor households are using and how much energy is costing them.

## CASE STUDY 5

### CCP: Using Milestone 1 to conduct a baseline emission inventory for your city ICLEI, USA

Understanding how and where energy inputs are used within a city in relation to the level of services provided is important information for good city management. The Cities for Climate Protection Program (CCP) of ICLEI – Local Government for Sustainability, can assist local governments in conducting their baseline emission inventories and their emission forecasts, helping the city understand how and from whom to collect the necessary data. The first of the five milestones that local governments commit to undertake when joining the CCP Program involve conducting a baseline emissions inventory and forecast. Based on energy consumption and waste generation, the city calculates greenhouse gas emissions for a base year (e.g. 2000) and for a forecast year (e.g. 2015). The inventory and forecast provide a benchmark against which the city can measure progress.

Website: [www.iclei.org/index.php?id=1247](http://www.iclei.org/index.php?id=1247)

## Cities for Climate Protection (CCP) 5 milestones

ICLEI's Cities for Climate Protection (CCP) campaign sets out a 5 milestone process for reducing greenhouse gas emissions from their local government operations and throughout their communities.

**Milestone 1.** Conduct a baseline emissions inventory and forecast.

**Milestone 2.** Adopt an emissions reduction target for the forecast year.

**Milestone 3.** Develop a Local Action Plan.

**Milestone 4.** Implement policies and measures.

**Milestone 5.** Monitor and verify results.

The five milestones focus particularly on emissions reduction targets. It provides simple, standardised means of calculating GHG emissions, of establishing targets to lower emissions, of reducing GHG emissions and of monitoring, measuring and reporting performance. ICLEI has developed several software tools that help cities / local authorities comply with the methodology. [www.iclei.org/index.php?id=810](http://www.iclei.org/index.php?id=810)

## Step 5. Analysing your data and developing a draft plan

You have been gathering a lot of information and developing relationships with many people. Now it's time to start putting the two together.

Firstly, identify the critical energy issues under each sector.

Secondly, rank these issues according to your city's particular priorities.

Thirdly, on the basis of this list, develop your draft plan of what must be done to promote a sustainable energy future for your city: list the possible measures (projects and programmes) which can address these issues and identify those that will yield the greatest benefit. These are the measures which you will ultimately include in the plan. Remember to list current projects as some of these can provide a springboard for implementation. Make your motto, "Be ambitious and realistic!"



### Overall Energy Issue Ranking — example

Energy issue	Ranking
Access to energy sources by poor Affordability of energy Public transport – improvement and access Air quality – indoor and local	High
Renewable energy Energy efficiency Economic competitiveness (relating to energy cost) Job creation	Medium
Nuclear power Accommodating private car use	Low

This process gives you a framework for ranking of the more specific or detailed energy issues.

### Specific energy issue ranking — examples

Demand overview	Ranking
Energy related data necessary for planning is lacking – particularly demand data	Medium
As energy is a cross-cutting issue, there is currently no department responsible for or system for the collection of energy data and so on...	Medium
Households	
The costs of meeting a household's energy needs is a significant burden on poor households and a major contributor to poverty	High
Access to convenient, appropriate, affordable, clean and safe energy sources is limited for many poorer households – even electrified households use a mix of energy sources to meet their needs and fit their pockets. A best-mix approach should inform energy supply and management for all households	High
Many low income houses are of extremely poor quality – and, as these households are often dependent on dirty and unsafe energy sources to heat their homes, indoor air quality is often very poor. The installing of ceilings would go a long way to addressing energy costs, air quality and health (this measure would also reduce mould which has been found to exacerbate such illnesses as TB)	High
and so on...	

### Analysis

#### The scoring matrix

You will find it helpful to develop a matrix to compare measures using the following factors below. (place the measures along the x axis and give each measure a score for each factor on a scale of say 1 to 5):

#### Factors:

- Compatibility with city goals
- Support of city's growth paths
- Social benefits
- Energy efficiency
- Carbon emissions reduction
- Local air quality improvement
- Local economic development
- Job creation
- Contribution to sustainability
- Contribution to energy security (reduction in energy demand, increase in energy supply diversity)
- Costs of programme implementation
- Funding availability
- Availability of data
- Potential for programme replication

#### Example of scoring matrix outline 1

	Solar Water Heaters	Energy Efficient Lighting	Ceilings	Etc.
Compatibility with city goals	5	5	3	
Support of city's growth plans	4	4	5	
Etc.				
Totals				

You can use several other analytical and quantitative tools to assist with analysis, such as cost-benefit analysis, economic and environmental impact assessments, scenario planning and integrated resource planning. LEAP or the Long-range Energy Alternatives Planning System is extremely helpful in modelling alternatives and impacts. ICLEI's **Harmonized Emissions Analysis Tool (HEAT)** supports local GHG and air pollution emission reduction planning. See the box on LEAP and HEAT on page 25. To test whether your measures contribute to sustainability, review them against the key elements of a sustainable system as indicated in the box on page 24.





## Remember the key elements of a sustainable system

**Consistent:** the short term actions are compatible with long-term goals and the viability of the system

**Renewable:** the system depends on renewable resources and operates using environmentally benign technologies

**Diverse:** the more diverse and appropriate your system, the more able it is to adapt to change

**Inclusive:** all elements of the system are valued and used for the good of both the individual parts and the whole

**Interdependent:** each element of the system is both dependent on and depended on by several other elements; the greater the interconnection, the stronger the system.

## Your draft plan

Your draft plan will grow from this analysis. This plan should contain the following information:

- Energy vision statements – grown from the city's vision
- Energy goals – linked to each vision statement
- Targets – linked to each goal
- Measures – what can be done to achieve these goals
- Projects – existing and potential

### Example

**Energy vision:** A city with an efficient and equitable transport system, based on public transport and compact planning to enable all residents to access the benefits of urban life

Goal	Focus area	Target	Measures	Projects — existing and potential
An energy efficient public transport system which discourages private car use	Transport	Total transport modal split increase of 10% for the rail, bus and taxi transport share by 2012. Numbers of private vehicles commuting into city centre decreased by 10% by 2012 (Baseline year 2005)	<i>Short term (2 years)</i> Establishment of Metro Transport Authority to ensure coordination of public transport projects Priority given to rail transport to improve standard of service. Improve facilities at public transport interchanges. Rapid bus transport corridors on incoming high ways to be identified and implemented <i>Long term</i> Dedicated bus and taxi lanes on all major commuter routes. Development of nodes and activity spines	Rapid bus transit project Park and ride Non-motorised transport linkages Parking charges programme in central city etc.  Spatial development planning to support public transport systems etc.

## Debating the sustainable energy and climate action plan

In order to put the implications of your sustainable energy and climate action plan up for debate, it can be very effective to use scenarios which compare your city in the future under business-as-usual, middle- and high-road scenarios (see the box on the facing page about the LEAP system a useful software tool in the development of energy scenarios).

A 2020 high-road scenario may be based on targets such as:

- 20% private car use reduction
- No days exceeding World Health Organisation air quality standards
- 20% reduction in carbon emissions
- 15% city power from renewable energy sources
- All low cost housing to have ceilings and efficient lighting
- All households to have access to basic electricity with poverty tariffs in place
- Mandatory green building standards for all new buildings
- Mandatory solar water heaters in new build over a certain value; all replacement geysers in houses over same value to be solar water heaters.



## LEAP

LEAP or the **Long-range Energy Alternatives Planning System** is a widely-used software tool for energy policy analysis and climate change mitigation assessment developed at the Stockholm Environment Institute. LEAP allows one to develop a 'business as usual' energy model of a study area such as a city by entering current energy data, economic and population growth rates, household sizes etc. Various alternative scenarios can then be modelled, usually over a 20 to 30 year time frame, and their impact measured from an energy, environmental and economic perspective.

The outputs of this software also allows one to measure the impacts of the mass rollout of a particular intervention, such as installing solar water heaters, against a 'business as usual' alternative. LEAP is distributed at no charge to not-for-profit, academic and governmental organisations based in developing countries.

A full description of LEAP, its applications and a User Guide can be found at [www.energycommunity.org](http://www.energycommunity.org)

## HEAT

ICLEI developed the **Harmonized Emissions Analysis Tool** (HEAT) online software to support local GHG and air pollution emission reduction planning. This software provides capacity to local governments to seek to reduce GHG emissions based on sound governance, economic development, improved waste management, energy efficiency, better urban mobility, and better air quality. Beyond being a planning tool, this site offers consultants, NGOs, government agencies, academics, and others free tools to translate energy, transportation and waste activities into pollution emissions.

In general the software will:

- Build an emissions inventory based on local energy use, transportation demand, and waste practices
- Help a user/city build a simple emissions forecast
- Set a target/goal for reducing emissions (e.g., reduce GHG emissions by 10%)
- Quantify emission reduction activities and their co-benefits
- Develop, report, and track progress made in meeting that target.

The tool is available on-line, and data can be uploaded to contribute to the growing pool of data, which in turn can be compared, analysed and used for cumulative reporting by ICLEI.

Website: [www.iclei.org/heat](http://www.iclei.org/heat) and [www.iclei.org/documents/Global/Programs/CCP/HEAT\\_Brochure\\_final.pdf](http://www.iclei.org/documents/Global/Programs/CCP/HEAT_Brochure_final.pdf)



Gate by Plant Design Online/flickr.com

## Urban Air Quality

UNEP and UN-HABITAT have developed an online software toolkit, with an accompanying handbook, which is simple to use and easily accessible to all city managers, even those from developing nations. The toolkit will be of genuine help when implementing the Air Quality Management process. The tools are drawn from 'good practice' around the world and support strategy development, action planning and implementation of Air Quality Management. The toolkit includes city case studies, mathematical models, maps and spreadsheets.

Advisors to policy-makers and non-technical government staff will be able to use this toolkit. The authors have ensured that expert knowledge is not necessary for implementation of Urban Air Quality Management. The process includes a three step approach: improving knowledge and expertise about Urban Air Quality Management, improving strategy formulation and action planning and improving implementation and institutionalisation.

The Toolkit and accompanying Handbook can be downloaded from the UNEP website at: [www.unep.org/urban\\_environment/Publications/index.asp](http://www.unep.org/urban_environment/Publications/index.asp)



## Step 6. Building public and internal support: your participation process

This 'step' is of course part of a vital and ongoing process, which should start right at the outset and should be continued with throughout the development and implementation of the action plan<sup>2</sup>. Developing and implementing a sustainable energy and climate action plan is, to many cities and local authorities, pioneering work. You will need to engage with and educate the public, city staff and political leaders on the plan's purpose and value. You will need help getting tasks done. You will need financial resources and you will need allies. You will also need to change mindsets and get your residents and political leaders to accept that a new way of thinking about energy is not a "nice-to-have", but an essential step towards medium and long-term resilience and ultimately, survival.

Changing the way people live and perceive reality is a difficult and long-term process, and very often the most neglected and under-valued part of processes like this one. Often, it is also the most under-budgeted component of a programme and this is the main reason why so many well-intended initiatives fail. Building support is one of the most critical aspects of your planning effort and active engagement, community empowerment, buy-in, ownership and participation are all key to an effective plan. Achieving this is often challenging as people, businesses and municipal departments may view energy and climate change policy as secondary to their core and everyday activities. It is very important therefore that your energy objectives share the concerns of the broader city and community.

### Examples of co-operative projects

Function	Their goals	Your goals	Joint project
Traffic management	Reduce congestion	Save energy	Rapid transit lanes
Fleet management	Reduce expenditure	Save energy	Procurement of hybrid vehicles
Housing / Services	Provide affordable services, improve health	Save energy	Install ceilings in low cost housing
Finance	Reduce operating costs	Save energy	Energy efficient retrofitting of city-owned buildings
Air quality	Reduce polluting emissions	Save energy	Cleaner public transport and cleaner vehicle fuels
Street lighting	Reduce cost of lighting	Save energy	Install energy efficient street lights
Traffic lights	Reduce operational costs	Save energy	Install light emitting diodes

## Identifying stakeholders

There are internal and external people you will need to interact with in order to develop a good energy and climate action plan. Make a list of stakeholders from whom you need to get information and buy-in. *Remember that organisations don't make decisions – people do, so focus on developing personal relationships. This is not a short-term process, so look after those relationships for the future too.*

Work with those local government departments and agencies that should care about sustainability. Each department may require a different strategy, which will also be shaped by the politics and structure of your local government. You need to assess the barriers you have with certain departments. These barriers generally fall into four categories:

### Information

There may be a lack of knowledge and information or the information may be outdated or wrong. Remember, you are now working in a rapidly developing field and information keeps on changing as new technologies and scientific findings inform policies. Again, consider joining support organisations such as ICLEI and SUD-Net to ensure that you stay abreast of developments. Make sure departments and staff have easy access to updated and factually correct information and use mediums they will engage with, e.g. web-based information, brochures, technical reports, popular information documents and other mediums which are also sensitive to cultural and language differences.

<sup>2</sup> For additional helpful hints and tools on how to build public and internal support, please refer to The SCP Source Book Series: Establishing and supporting a working group process.



### **Institutional**

Local government systems can be rigid and averse to change or risk; responsibilities for certain services (such as transport) may be split between city, regional and national governments, making it very difficult to implement changes at the local level. Institutional barriers can be the most difficult to deal with. Commitment from top decision makers is required and even institutional change may be needed.

Many cities internationally have established semi-independent energy entities to drive and implement their sustainable energy projects in order to overcome the barriers within local government systems. See the section in Step 8 on Energy Agencies as well as case studies of these agencies in Chapter 4.

### **Personal**

Staff might be feeling overworked. They may feel overwhelmed by the challenges of introducing something new. They may also perhaps feel personally threatened by the implications of change. Help bring these fears into the open so they can be properly addressed. Also look at ways of capacitating a group of core staff members who can lead this process into the future. There are many opportunities to share best practice, skills and learn lessons from other cities who are already implementing energy and climate change programmes and action plans at local level.

### **Financial**

City financial constraints are very real, so it is important to quantify and argue the financial benefits of sustainable energy and climate change programmes and place the upfront capital requirements of some energy projects in the context of savings over time. A very difficult situation is if your local government is dependent on income from electricity sales and the electricity department is tasked with selling electricity – they will not look on electricity saving projects kindly.

## **Interacting with stakeholders**

### **Set up task / partnership teams**

A task team is an effective way to get people with a range of technical expertise and experience involved in the planning process. Decide whether an internal or a multi-stakeholder team is best for your context. You could set up a *City Energy Partnership* at this stage consisting of key stakeholders – this could form the seeds of a future dedicated energy implementation body.

### **Meet with key leaders**

Meet with key leaders of businesses, utilities and interest groups to tie your work in to their specific needs – show them how promoting sustainability can help them achieve their goal. Don't try to convert them – listen to their needs and then tie them in with yours.

### **Link with existing groups, hold focus group workshops and public meetings**

Linking energy into existing groups' meetings is an excellent way of obtaining and sharing information, as well as finding allies. You could also conduct focus group workshops with government, community and business leaders. When you have a draft of your energy plan, hold at least one public meeting with good media coverage as an overall wrap up of the consensus-building process. Don't underestimate the role that youth groups, schools and religious groups can play in mobilising communities to tackle challenges and to enable communities to accept change.

### **Use the media**

Use the media to publicise your work and any public meetings. It is vital to make your work visible and to keep it visible. Tangible energy success stories in daily papers will capture people's attention and imagination. Piggyback your work on other public events or media activities. Use clear, simple language and good graphics that tell a story and illustrate a point. Spend time learning more about, and understanding your audience in order to enable you to make informed choices when it comes to which messages and mediums will be most effective when targeting them.

### **In conclusion**

A good public participation process will provide you with:

- early opportunities to discover allies and work together on difficult issues
- public ownership of the process and content
- a willingness to support subsequent implementation and to embrace change
- community empowerment through awareness and education.

Without a public participation process during your planning you may find:

- unanticipated opposition at the public hearing or adoption phase
- little or no support for the adopted plan, and apathy amongst community groups
- failure to identify issues that community members consider important.

Work closely with those who don't support you – try to understand the conflict between your efforts and their goals – common ground can usually be found for at least some areas of your planning effort.

## CASE STUDY 6



The Maribyrnong by sneedy/flickr.com

### **A Community Engagement Framework Maribyrnong, Australia**

Maribyrnong has a formal Community Engagement Framework that outlines Council's commitment to actively engage the community in the decision-making activities of Council, particularly in decisions that directly impact on how citizens live, recreate, work, study, use services and do business.

The Framework includes a set of principles, objectives and strategies for engaging the community. There are also a specific set of objectives and strategies related to residents from culturally and linguistically diverse communities. The Framework is a 'working' document, reviewed annually to allow for any necessary modifications.

Website: [www.maribyrnong.vic.gov.au](http://www.maribyrnong.vic.gov.au)

## **Step 7. Finalising the plan**

From your participation process you will now have a lot of input on your draft plan and /or your different scenarios. You will have a list of current and potential projects and you will have analysed their advantages and disadvantages. Now your city must decide on a set of reasonable objectives that can be implemented in the short and longer term. Your next step is to identify priority projects that fit these objectives.

### **Identifying priority projects**

There are several approaches you can take to select priority projects and the approach that works best will depend on the nature of your city. Remember that it is very important to value what is being done already. Each project and programme has both benefits and costs that are a mix of economic, social, political and environmental impacts. The process of deciding which impacts to rank or which should be assigned more weight should be done as a staff/stakeholder process that is approved through political processes if you want to adopt a long-term, sustainable plan. Decision-makers often value short-term gains at the expense of longer term gains, low financial cost and political acceptability. Aim to have decisions based on the following criteria:

### **Analyse direct and indirect economic benefits**

It is important to evaluate the cost of programme options in energy savings, business generated, jobs created, and tax revenue generated. Also, to the extent that it is possible, consider indirect economic benefits such as avoided health costs, avoided fires and destruction of dwellings, reduced impacts from rising energy costs, lower risk of energy supply interruptions, local economic development, job creation and devolution of economic power.

### **Evaluate sustainability and impact on GHG emissions**

Using the key elements of sustainability (refer to the Key Elements of Sustainability in Step 5 on page 24), evaluate the options for their contribution to a sustainable energy system. Some options may have significant longer term benefits, but high upfront capital costs. There may be projects which are critical to making other projects happen. The income from carbon emission trading on a project may provide a useful financial input to make a project financially viable. See page 33 on the Clean Development Mechanism and carbon trading.

### **Prioritise projects**

When identifying priority projects, describe and quantify the related impacts and benefits to a reasonable level of detail, but be careful of using up too much of your limited resources determining those impacts. Use a simple scale of ranking, such as 1 to 5, to sort the projects. Base the score on your own or a group's opinion supported with data from your energy audit. You could use a similar scoring matrix to that outlined in Step 5 on page 23.

### **Sorting options**

The analysis you have just completed will help you considerably in identifying priority projects. Many of the answers will become apparent as you develop your support in and out of local government. It is important to keep in close contact with your supporters during this process as you will be developing and changing implementation strategies along the way.

### **Adopting the final plan**

As soon as you have a high level of agreement (which you should have after all your support-building efforts), take your sustainable energy and climate action plan to your city council for formal adoption (you will have kept them abreast of developments along the way, so no surprises here). Inform all the role players. It is also important to engage the media as soon as possible and arrange for opportunities for formal recognition of all who worked on the plan.



## CASE STUDY 7



Växjö, Sweden by urbanlegend/flickr.com

### Fossil Fuel Free Växjö Växjö, Sweden

Fossil Fuel Free Växjö is an overall programme initiated by the City of Växjö to reduce human impact on global climate change. In 1996, the city council of Växjö unanimously decided that local emissions of greenhouse gases should be cut by half by 2010 compared with 1993 levels, and that the municipality shall become fossil fuel free. Between 1993 and 2005 CO<sub>2</sub> emissions from fossil fuels were reduced by 24% per inhabitant and the share of renewable energy is now over 50%.

The Fossil Fuel Free Växjö programme incorporates different types of activities, such as biomass-based district heating and power generation, smaller scale district heating, district cooling, biomass boilers for households, energy efficient street lighting, energy efficient building design and construction, solar panels, cycle paths, environmental friendly cars, biogas production, etc.

Political leadership was an important starting point for the progress achieved in Växjö. All political parties have unanimously supported the targets set and researchers, industries and local policy makers collaborated around common goals. The programme has strengthened regional competitive advantage and provided multiple benefits. The town has provided an important example to other municipalities in Sweden and abroad.

Website: The City of Växjö: [www.vaxjo.se/english/](http://www.vaxjo.se/english/)

Additional source: The City of Växjö – a successful sustainable energy program in Sweden:  
<http://unep.org/GC/GCSS-IX/Documents/Swedish-1A.pdf>

## Step 8. Implementing and financing the plan

Now what do you do? It is all very well having a plan, but it only means anything if it follows through to implementation. You may find that there are severe capacity and institutional barriers to implementation. There may be financial hurdles to overcome. It is important to be fully aware of these constraints and build your Action Plan accordingly. You will need people to do the work and it helps enormously if the institution is structured in a way that enables it to assist. Remember that energy is a cross-cutting sector – so the institutional structure needs to reflect this by bringing the different sectors together.

### Capacity and Institutional development

It is vital to answer these questions:

- Who is going to be responsible for driving and facilitating the implementation of the plan? (Clarify roles and responsibilities from the outset).
- Where is this implementation 'driver' to be located?

The 'driver' will probably start off small. You may aim for a structure something like this:

- A high level political body such as a Mayoral Committee on Energy for Sustainable Development.
- A Task Team of senior managers coordinating and overseeing Project Teams dealing with specific sectors (energy efficiency in buildings, transport, business, residential, access to energy for the poor, local government operations and communication).
- It may be helpful to establish an external dedicated energy agency based on public-private partnerships to manage implementation (see the adjacent box on Energy Agencies).

### Energy Agencies

Many of the cities that have had success with implementing sustainable energy and climate action plans have done so through the establishment of a dedicated energy agency. These agencies can be set up to achieve very particular purposes according to the needs and capacities of your city. The Board or Steering Committee of such an agency would likely include your city, business, the local university, utility, and national government. The role of the unit may be to:

- coordinate and mobilise the range of energy stakeholders around an Action (implementation) plan
- advocate and lobby for policy and legislative changes
- raise and manage energy funds (from energy savings, carbon sales, government etc.)
- support the development of local energy business and related skills training
- educate and provide information to particular groups such as residents, business and industry

It is a good idea to establish public-private partnerships and set up sector task groups which draw together those involved in particular sectors to carry out implementation in those sectors (such as housing, transport, renewable energy power production). See agencies case studies on facing page.

## CASE STUDY 8



Solar Forum Barcelona by Stefan Gara/flickr.com

### Implementing through a city agency – The Barcelona Energy Agency Barcelona, Spain

The Barcelona Energy Agency was established as a consortium in 2002 with its origin lying in the European Union energy policies as established in the *White Paper on Energy* (1997). It is made up of various administrations that are directly involved in energy and environmental management: the **Barcelona City Council**, the **Metropolitan Body for Hydraulic Services and Waste Treatment**, the **Catalan Institute for Energy** and the **Institute for Energy Diversification and Savings** (a Spain-wide institute). With the aim to build knowledge and research, the **University of Barcelona** and the **Catalan University Technical College**, also form part of the Consortium.

The president of the Consortium is the Deputy Mayor and Chair of the Barcelona City Council's Commission for Sustainability, Urban Services and the Environment. The main objectives of the Agency include: fostering local renewable energy sources and energy efficiency, supporting the public sector in its energy work (providing information, technical support and advice) and providing information and advice to business and citizens.

This is implemented through the Barcelona Energy Improvement Plan (PMEB), which forms the general framework for the work of the **Barcelona City Council** in matters of energy policy and its environmental impact on the city. Within this context, the Energy Plan includes an energy-related and environmental analysis of the present-day Barcelona and its future trends (to the year 2010), which allows prediction of the increase of the city's energy consumption and its repercussions according to different scenarios. Consequently, the PMEB establishes a set of local action measures addressed to the achieve energy savings, an increase in the use of renewable energies, and energy efficiency.

Website: [www.barcelonaenergia.cat/homeeng.htm](http://www.barcelonaenergia.cat/homeeng.htm)

## CASE STUDY 9

### Implementing Renewable Energy in Woking Borough Council Woking, U.K.

Woking Borough Council is at the forefront of decentralised city energy supply in the UK. It has pioneered the development of a network of over 60 local generators, including cogeneration and tri-generation plant, photovoltaic arrays and a hydrogen fuel cell station, to power, heat and cool municipal buildings and social housing.

The council has achieved this through the establishment of Thamesway Ltd, an Energy and Environment Services Company solely owned by Council which enters into public/private joint ventures to deliver its energy and environmental strategies and targets. Although Woking had been successful in implementing small scale local community energy systems, to fully capitalise on its sustainable energy innovation, it needed the finance and expertise of the private sector to implement large scale projects. The Council formed these two special purpose vehicles (companies) in 1999 – Thamesway Ltd and Thamesway Energy Ltd.

Developing a private network enabled Thamesway Energy Ltd to avoid charges usually associated with the use of the grid. By circumventing these costs, it has been able to fund wires and generation to deliver low emission electricity in competition with conventional suppliers.

Decentralising their energy has enabled Woking Council to cut energy use by nearly half, and council CO<sub>2</sub> emissions by a massive 77%, since 1990. The key to the Council's success is the combination of technical innovation (such as combined heat & power (CHP), absorption cooling, private wire systems etc.); partnership with the private sector; financial/commercial innovation; and, the use of a local electricity balancing and trading system.

Website: [www.greenpeace.org.uk/MultimediaFiles/Live/FullReport/7468.pdf](http://www.greenpeace.org.uk/MultimediaFiles/Live/FullReport/7468.pdf) and [www.woking.gov.uk/council/about/wbcresp](http://www.woking.gov.uk/council/about/wbcresp)



## CASE STUDY 10



### Financing your plan – Toronto Atmospheric Fund Toronto, Canada

The City of Toronto was one of the first cities in the world to commit to a target reduction of local GHG emissions: in 1990, Toronto City Council resolved to reduce community-wide CO<sub>2</sub> emissions 20 % by 2005. The following year the Council voted to establish the Toronto Atmospheric Fund (TAF) with an endowment from the sale of city land to assist in achieving this goal. At the request of Toronto City Council, the Government of Ontario officially enacted legislation incorporating TAF in 1992.

The fund was established to promote global climate stabilisation by financing local projects that reduce GHG emissions, promoting energy efficiency, educate the public and foster partnerships with senior levels of government, business, educational institutions, and non-governmental organisations. In 2000, City Council expanded TAF's mandate to include promotion of better air quality.

Like other City of Toronto agencies, boards and commissions, TAF is an arm's-length agency. City Council appoints the Board of Directors and reviews and approves the annual budget, but the operations are conducted autonomously. TAF funds projects through grants and loans from revenue that comes from its own \$26 million endowment and not from the municipal tax base. Projects financed by TAF loans have saved the City \$17.5 million – over \$2.7 million annually – in cumulative energy and maintenance costs.

TAF's current granting priorities fit under the following strategic program areas:

- **FleetWise** – accelerating hybrid & electric vehicle solutions
- **LightSavers** – advancing low-carbon lighting
- **TowerWise** – improving energy efficiency in high-rise homes
- **SolarCity** – building local solar generation capacity

Website: [www.toronto.ca/taf/index.htm](http://www.toronto.ca/taf/index.htm)

## CASE STUDY 11

### Municipal Energy Fund Ann Arbor, U.S.A.

Since its establishment in 1998, the Ann Arbor Municipal Energy Fund has provided city facilities with a source of capital for energy efficiency retrofits. The Energy Fund provides initial capital for new projects and receives 80 % of projected annual energy savings from each installed project for five years. The five-year payment plan allows projects that have a shorter payback to help support projects with a longer payback, and all savings accrued beyond the first five years remain with the departments implementing the improvements.

The Energy Commission, appointed by the Mayor together with council approval, developed the concept for the Municipal Energy Fund. When the idea for the Energy Fund was first presented to Council, Mayor Sheldon strongly supported it, recognising the potential to save valuable tax dollars as well as precious energy resources. She actively participated, providing opening remarks at dedication ceremonies for a wide range of energy projects and programmes.

The Ann Arbor Energy Office developed the Municipal Energy Fund from a concept to a reality and is responsible for its administration under the supervision of a three-person board, which must approve all projects. The Energy Office provides the board with information from energy audits along with applications from facility managers for projects requesting energy funds. The board reviews all applications and makes final decisions on what projects to fund each year. Decisions are based on energy saving potential, improvement of the facility environment, and educational or demonstrational value of the project. The Energy Office then implements the projects, often serving as the project manager.

The Fund was started with five annual investments of \$US 100,000, and quickly became self-sustaining. Most installed measures have had payback periods of three to six years, and projects supported by the Fund have yielded a total of 685 tons of annual e-carbon dioxide emissions.

Website: [www.a2gov.org/government/publicservices/systems\\_planning/energy/Pages/EnergyFund.aspx](http://www.a2gov.org/government/publicservices/systems_planning/energy/Pages/EnergyFund.aspx)





## Some advice for implementation

### **Be practical, but avoid short-term thinking**

Do what can be accomplished given the support and resources available at the moment. This means looking for connections between your interests and those who make financial decisions. A risk is that you can fall into short-term thinking. Short-term plans can not only create environmental problems, but can also entrench poverty and unsustainable livelihoods: housing land for the poor being allocated on the outskirts of cities furthest from urban opportunities is a distressing example of this.

### **Long payback periods**

Long payback periods do not suit the way in which city politics works, however it is possible to obtain programmatic support for interventions that have long payback periods. Be careful of using up your resources on easy, cheap projects or 'low-hanging fruits', as this may be at the expense of projects which are more difficult, but have greater impact.

### **Focus on projects with the greatest impact**

Identify options that are visible and show significant cost savings, while building a more sustainable urban system. If possible target a range of different sectors simultaneously to build a broad commitment and understanding of a sustainable energy future.

### **Locate financial resources**

Fortunately, projects that rate highly in sustainability terms are often in line with other environmental and social goals. If projects meet several community goals and provide benefits to a broad group of residents, they will be easier to fund. Energy improvements are an investment that can help cities and communities improve their financial sustainability. Before looking for money think of all the ways the project will benefit the community and who will be interested in those benefits.

### **Multiple benefits of energy projects**

A ceilings installation project for low-cost housing can offer:

- energy savings for the household
- reduced energy demand on the energy supplier
- reduced carbon emissions
- training and employment for residents
- improved health for residents
- photo opportunities for political and business leaders
- technology and business development in ceiling manufacture

Funding for this project may come from utilities, government housing, health and social services departments, local lending institutions, international funders, buyers of carbon credits. Universities may carry out research and monitoring.

The Portland Oregon Energy Office instituted a 1% fee on all city government energy bills. This fee was used to hire an energy management coordinator for city facilities. That coordinator implemented more than three times this fee in energy savings in the first year.

### **Generate funds**

#### *Taxes or levies*

With sufficient support you may be able to acquire general funds or generate revenue from taxes or levies such as carbon tax on activities such as conferences, tax on parking bays, a levy on electricity use by business, industry and larger residential users.

#### *Grants and loans*

Some local governments offer revolving loan funds to support the development of small business – it may be possible to access these for energy efficiency projects.

Grants and matching grants may be accessible from funders for projects.

#### *Borrowing*

Some local governments use borrowed money to do energy efficient retrofits in their own facilities. The money is paid back from the energy savings, with

the total cost less than the energy amount saved. It may be possible to obtain some form of 'green loan' where an institution is prepared to lend more at lower interest rates because the intervention means that the borrower's capacity to repay is enhanced.

#### *Performance contracting*

As local government can represent substantial and attractive sales potential, performance contracting allows local government to try projects without making any up-front capital investment and with minimal risk. Under this arrangement, a third party such as an energy utility provides a service package that includes the financing, installation and maintenance of energy-saving capital improvements. The customer then uses the resulting energy savings to pay for the improvements. Performance contracts are usually structured as a lease but with a guarantee that payments will not exceed energy savings.

#### *Carbon trading*

You may be able to trade in the carbon credits of your projects – these can be traded upfront or during the project life-cycle and can make a useful financial input to the project (they are unlikely to cover the full cost of projects). You can trade on the voluntary market or through the Clean Development Mechanism (CDM).

Try to get a balanced mix of grants, loans, investment funding, carbon financing and so on to spread the risk. When approaching funders for larger projects it can certainly help to cross the risk threshold if the project is ring-fenced.



## Carbon trading: The Clean Development Mechanism

### Project Development Phase

Preparation of the Project Design Document (PDD)

Obtaining the Letter of Approval

Validation

Registration

### Project Implementation Phase

Monitoring

Verification

Certification

Issuance of CERs

Forwarding

### History

The Clean Development Mechanism (CDM) is an arrangement under the **Kyoto Protocol** allowing industrialised countries with a **GHG** reduction commitment (called **Annex 1** countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

### How it works

A **carbon project** can only be registered if it would not have occurred without the additional incentive provided by emission reductions credits. According to Article 12 of the Kyoto Protocol, apart from helping **Annex 1** countries comply with their emission reduction commitments, CDM must assist developing countries in achieving sustainable development.

CDM is supervised by the CDM Executive Board (EB) and is under the guidance of the Conference of the Parties (COP/MOP) of the **United Nations Framework Convention on Climate Change** (UNFCCC). Countries

wishing to participate in CDM projects require a Designated National Authority (DNA) – this usually sits with a country's Energy Department. The main task of the DNA is to assess potential CDM projects to determine whether they will assist the country in achieving its sustainable development goals, and to issue formal host country approval.

### Outline of the project process

An industrialised country that wishes to get credits from a CDM project must obtain the consent of the developing country hosting the project that it will contribute to sustainable development. Then the applicant (the industrialised country) must make the case that the **carbon project** would not have happened anyway (establishing additionality), and must establish a baseline estimating the future emissions without the project. The case is then validated by a third party agency, called a Designated Operational Entity (DOE), to ensure the project results in real, measurable, and long-term emission reductions. The CDM Executive Board (EB) then decides whether to register (approve) the project. If a project is registered and implemented, the EB issues credits, called **Certified Emission Reductions** (CERs), commonly known as **carbon credits**, where each unit is equivalent to the reduction of one ton of CO<sub>2</sub>e, i.e. CO<sub>2</sub> or its equivalent, based on the monitored difference between the baseline and the actual emissions.

### Some concerns:

- Establishing additionality and the baseline
- Financial risks and profiteering
- Forestry has been excluded – for now
- The inclusion of large hydro projects which many consider unsustainable
- False credits (credits from projects which would have happened anyway)
- Excessive payments for emission reductions
- Sustainability of projects

There are a number of other organisations that offer support, training and tools around CDM and sustainable financing for energy projects – See Chapter 4 for more information on these.

In response to these concerns the **World Wide Fund for Nature** devised a 'Gold Standard' methodology to certify projects that applies strict standards. This can be found on the WWF website: [www.panda.org](http://www.panda.org)

### CDM projects to date

CDM gained momentum in 2005 when the Kyoto Protocol entered into force. By November 2007, 828 projects have been registered by the CDM Executive Board. These projects reduce greenhouse gas emissions by an estimated 171 million tons of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) per year. There are about 2,600 projects in the pipeline which could by the end of 2012 produce over 2.5 billion tons CO<sub>2</sub>e reductions. The current emissions of the EU-15 are about 4.2 billion tons CO<sub>2</sub>e per year.



## Step 9. Monitoring and evaluating your plan

Your Strategy and your Action Plan should be living documents with short-term plans being evaluated and updated every two or three years and long-term plans every five years. The energy and climate change field is such a rapidly developing and evolving area of work, so it is important to regularly check your plan with latest national, regional and international progress and new developments.

You need to evaluate your progress in order to:

- Track and quantify what has been done, measured against your targets
- Measure positive results, which will help you maintain city support
- Detect problems and make necessary changes
- Provide information for the updating of your Strategy
- Adjust your Action Plan
- Plant the seeds of future challenges

### Monitoring

Remember that your evaluation can only be as good as your monitoring. Make sure that you have an effective and sufficiently resourced monitoring plan for the programme right from the beginning – and stick to it. Most projects will require both quantitative and qualitative monitoring and evaluation. Many development programmes are frequently undermined by poor monitoring.

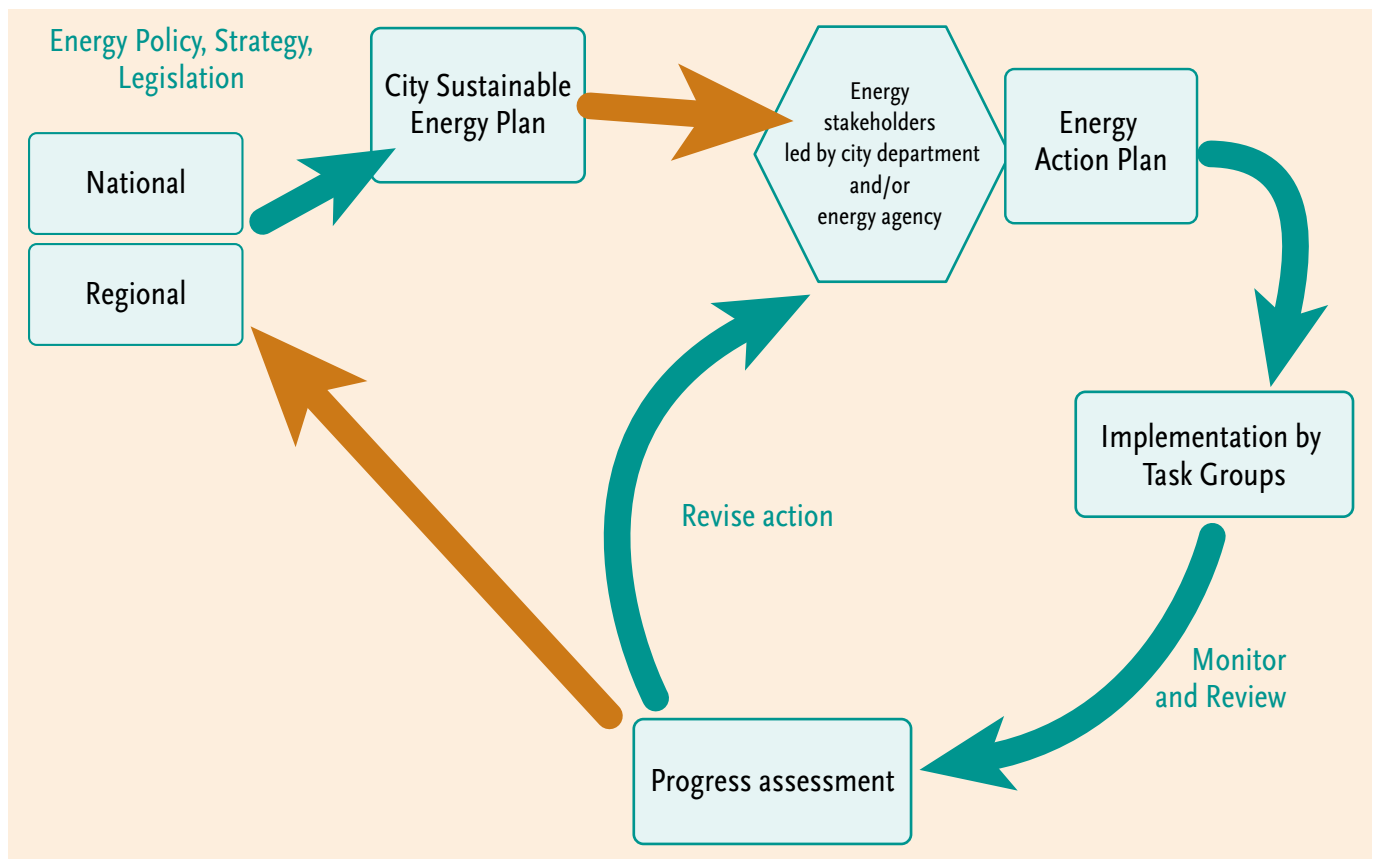
### Evaluation

Evaluations can do two things:

1. Help improve the planning process, and
2. Help you decide whether to continue particular programmes and projects

For the first, you need to

- identify strengths and weaknesses in the process
- determine which participants or groups are benefiting the most or least from the projects



### The process may look something like this:

The evaluation process must compare your objectives against your results. You want to measure both the quantity and quality of your progress.



## CASE STUDY 12

For the second, you need to

- determine whether the project is reaching its objectives
- analyse the cost/benefit ratio of the project
- decide if the project is still appropriate
- identify who should participate in the continued project

Look for specific measurable results such as energy saved, costs saved, poverty alleviation, environmental benefits and lessons learned. Do be sure to clearly identify unforeseen benefits as well as problems.

### Response

Be ready to adapt your approach and to let go of projects which are not working. Go back to your efforts in developing programme options and investigate new methods of achieving your goals.

## Step 10. Publicising the benefits

**This step, like 'Step 6. Your participation process', needs to start from day 1** Why do you need to tell everyone about your projects? To build support for your sustainable energy goals and to change people's behaviour. To build pride, enthusiasm and a feeling of ownership and empowerment while building a more sustainable future. Education and publicity should be on your mind all the time – don't hold back! This is an area which lends itself to many creative and innovative ways of ensuring public engagement and ownership.

### Using projects

Make use of people's natural curiosity and of their need to save money. An energy audit and retrofit of council offices can educate staff about energy efficiency – information they will take home to their families and children will take to their schools. There are a number of energy audit and carbon footprint measurement tools for individuals, households, schools and so on available on the web.

### Using the media

You have a vast array of communication methods at your disposal and they don't all cost huge amounts of money. Piggy-back on other media initiatives wherever you can. Use journalists' need for stories. Apply for awards. Make presentations to council portfolio committees. Get onto the radio and even engage radio stations to partner with you through competitions aimed at households and schools. Distribute information with the council's monthly accounts. Let people know that you have provided more service for less money and do practical demonstrations to show them how much money they can save. Build trust and credibility by actively demonstrating gains.

An evaluation is a great leaning opportunity. Be open, be honest. Those activities that did not go 'according to plan' can often teach you more than those that went 'right'.



Auckland Viaduct, Auckland, New Zealand by Sandy Austin whanau/flickr.com

## Energy efficiency advice for residents Auckland, New Zealand

The residential sector accounts for nearly 13 % of New Zealand's total consumer energy use, and while more energy efficient technologies are being incorporated into homes, this percentage is increasing in large cities like Auckland, as a result of the increase in the level of indoor comfort and amenities in homes. On average, Auckland households use about 7970 kWh of electricity each year – compared to the New Zealand average of 7800 kWh.

Auckland City Council has contributed \$12,500 to the EcoWise energy efficiency advice programme to help residents save energy, reduce costs and create drier healthier homes. The programme involves energy advisers visiting homes to conduct a free energy audit. The audit provides the resident with an accurate measure of energy consumption and losses, and includes measuring the power consumption of common appliances such as heaters, fridges and computers. The adviser later provides the resident with an energy efficiency plan, containing information and advice on energy use and where savings can be made.

The City's Council's support of this initiative fits in with the development of the sustainability strategy, the Mayoral Taskforce for Sustainable Development and the City's environmental policy. Auckland City Council has also employed an energy manager to improve the organisation's energy efficiency and use of renewable energy technologies.

Website: [www.aucklandcity.govt.nz/news/council/200703/11/a08.asp](http://www.aucklandcity.govt.nz/news/council/200703/11/a08.asp)



## Chapter 3 Implementing energy efficiency and carbon mitigation measures

Now that you have been introduced to the ten steps necessary to develop and implement a sustainable urban energy plan, it will be helpful to your work to consider various best-practice projects and processes that have been undertaken by cities and towns around the world. The range of case studies presented in this chapter cover all aspects of a local governments responsibilities and activities from city-wide planning, to transport, service provision and environmental planning.

Local governments are involved to a lesser or greater degree in the following range of activities:

- development and delivery of public housing;
- ownership and management of public buildings;
- passing of building plans;
- water supply;
- management of waste and wastewater;
- installation and maintenance of public lighting and traffic lights;
- spatial planning and management of city development;
- transport planning and provision of public transport;
- air quality management;
- distribution of electricity and in some cases energy generation;
- major procurement including paper, fuel, building materials etc;
- public open space management and beautification; and
- management of vehicle fleets including busses, refuse collection trucks and cars.

All of these activities require energy and many of them are very energy intensive. Local governments are tasked with acting in the public good and to this end must deliver services to city residents, businesses and industries while protecting the environment and the resources on which human development depends. The case studies highlight the benefits accrued by these projects including reduced costs and carbon emissions, improved service delivery, cleaner air and improved security and consistency of energy supply.

### 3.1 Energy services and housing

Making public housing more energy efficient and implementing sustainable ways to meet poor homeowners' energy needs has multiple benefits. Impoverished urban dwellers are often condemned to high energy costs to keep their homes warm or cool when houses are poorly built and no consideration is given to energy efficient construction. Attached or compact housing that takes advantage of passive solar design and includes insulated ceilings will be a direct benefit to residents who have little money to spare. Passive cooling is based on the interaction of the building and its surroundings and usually costs nothing. Before adopting a passive cooling strategy, you must be sure that it matches your local climate. Strategies will normally include natural ventilation, evaporative cooling and high thermal mass with night ventilation. In practice this means include ensuring windows have sufficient overhangs, letting breezes flowing through windows, having where physically possible: amounts of stone and earth absorbing daytime heat. Implementing more efficient ways to heat water and cook will also help save money in the long run. There is a huge divide between the energy use patterns and problems of the wealthier and poorer sections of the population. The poor often are burdened with inadequate, unsafe and inconvenient energy sources, while the wealthier sector over-consume and are highly inefficient in their use of energy. A significant proportion of urban households continues to used traditional biomass—wood and dung and there are multiple benefits to moving to cleaner fuels such as liquefied petroleum gas or kerosene.



## CASE STUDY 13



Solar Heating System by Abri Beluga/flickr.com

### Providing hot water to Lwandle's low income community using solar water heaters Somerset West, South Africa

The Lwandle hostel is situated in a township in Somerset West in the Western Cape. The hostel, owned by the then Helderberg Municipality, originally served as a single men's accommodation for the Gants food and canning factory, which was closed in 1980. Unemployment was high and poverty extreme, with whole families living in single bunk spaces. Through an extensive community participation process motivated by the closure of the Gants factory, the community announced their primary needs as being jobs, privacy, toilets and hot water.

A community development project, led by the local municipality, was started in 1995 and came to be known as the Lwandle Hostel to Homes Project. Through the engagement of a project manager who was also a very proactive champion, the hostel was converted into family units (with some provision for singles), giving rise to 967 units owned by the local authority and available for a low rental fee. In order to meet the expressed need for hot water, 305 solar water heaters, (without electricity back-up), were installed to provide hot water to 610 homes. The provision of solar water heaters was made possible through the local authority securing a low interest loan from the Development Bank of Southern Africa. Residents pay an additional fixed amount on their rentals in order to service the loan.

This is still the largest solar water installation initiative in South Africa – made possible by a supportive municipality, a proactive project manager, a cohesive community and the securing of a low interest loan.

Source: Sustainable Energy Africa and REEEP. 2007. *How to implement renewable energy and energy efficiency options – support for local governments*. p 24

## CASE STUDY 14

### Meeting energy needs in Kuyasa public housing project using CDM

#### Khayelitsha, South Africa

Housing units in Kuyasa, a low income housing settlement in Khayelitsha, Cape Town, are being retrofitted with solar water heaters, water-efficient showers, hot taps and drains, ceilings and ceiling insulation, and energy efficient lighting. This project is a partnership between the City of Cape Town and SouthSouthNorth (SSN), a network-based organisation operating in Bangladesh, Brazil, Indonesia and South Africa. SSN builds capacity among public and private stakeholders to deal effectively with the Clean Development Mechanism (CDM) projects.

After a 3 year process of project design by the City of Cape Town and SSN, The Kuyasa Low Income Urban Housing Energy Project was registered as a CDM Project with the Executive Board of the United Nations Framework Convention on Climate Change (UNFCCC) in August 2005. This development project has been recognised by the United Nations as a *Gold Standard Clean Development Mechanism Project* and is the first of its kind in Africa and one of fewer than 50 in the world. The energy efficiency measures in the project will result in a 5% temperature increase within the buildings in winter, a 5% decrease in summer; all the measures can be translated as a potential 40% reduction in electricity usage per household and emission reductions of approximately 2.85 tonnes of CO<sub>2</sub> per household per year. The Project will receive carbon emission reduction credits over a 21 year period.

The Project has been slow to take off due to the following reasons:

- lead time to secure additional funds;
- municipality institutionally not set up to deal with the legal and assets aspects of CDM projects; and
- internationally the programmatic approach to CDM is just being finalised.

Currently the project has managed to secure funding from a number of partners, including the provincial government, ICLEI and the National Department of Environment and Tourism through its Poverty Alleviation Fund. CDM funding only accounts for 20% of the Kuyasa project costs. A concern with the CDM is that it is extremely costly to package a project application and that it favours industrial projects which have greater carbon impacts and can therefore receive higher levels of finance through the mechanism.

Website: 1) [www.dme.gov.za/dna/pdfs/pdd\\_kuyasa.pdf](http://www.dme.gov.za/dna/pdfs/pdd_kuyasa.pdf)  
2) [www.capetown.gov.za/wcmstemplates/ERM.aspx?cluid=465&catparent=7105&IDpathString=6239-7095-7104-7105](http://www.capetown.gov.za/wcmstemplates/ERM.aspx?cluid=465&catparent=7105&IDpathString=6239-7095-7104-7105)

**CASE  
STUDY 15**

Honda Bay, Puerto Princesa by Storm Crypt/flickr.com

### **More energy efficient homes in Puerto Princesa City**

#### **Puerto Princesa, Philippines**

Puerto Princesa is a multi-awarded and pioneer city for environmental initiatives in the Philippines. It is the capital and chief seaport and airport of the Province of Palawan.

The rising urban population of Puerto Princesa has led to congestion in the city's bay area, threatening the people's quality of life and coastal reserve areas. Housing projects on the coast in Puerto Princesa City have been designed to reduce energy demand through increased natural light, improved ventilation, the cooling effect of the roofing material, and strategically planting at least one fruit tree per household.

The anticipated annual energy savings from the use of Compact Fluorescent Lamps (CFL) instead of incandescent bulbs alone is 21,414 kWh (equivalent to US\$35,106) and have reduced energy bills by 64%. The potential annual carbon savings is estimated to be at least 72 tonnes for the 330 households.

Other green features of the housing projects include the installation of a rainwater catchment facility that reduces the demand for water pumping; prohibiting the use of wood for the roof and interior frames; and an appropriate disposal system for non-recyclables and non-biodegradable.

Website: [www.iclei.org/fileadmin/user\\_upload/documents/SEA/Case\\_Studies/Puerto\\_Princesa.pdf](http://www.iclei.org/fileadmin/user_upload/documents/SEA/Case_Studies/Puerto_Princesa.pdf)

**CASE  
STUDY 16**

### **Cuba's Programme for Low Energy and Material Consumption for Housing**

#### **Villa Clara Province, Cuba**

With housing resources scarce in Cuba due to the economic crisis in the early nineties affecting the production of building materials, and aggravated by recurring hurricanes, a national Programme for Low Energy and Material Consumption for Housing was established.

As a result of this programme, over 50,000 new homes have been built since 1992 using the scarce resources available in a rational and sustainable manner. The technologies developed are geared towards small-scale production, with a focus on stimulating the local economy through the creation of new job opportunities

The Programme has an innovative process of technology development and transfer, which has resulted in a set of appropriate technologies for the manufacture of building materials 'ecomaterials' – building materials made with low embodied energy, often through recycling wastes at municipal level. The whole process has been organised as a south-south endeavour, as machinery and know-how come from Cuba and other countries in Latin America. Ecomaterials workshops are carried out that include personnel training and a post-sale advisory service. These new techniques have been applied not only in the construction of the new housing but also in reconstruction and rehabilitation of old housing stock. Around 20 Cuban municipalities are now using these alternative building techniques.

In Villa Clara Province, for example, innovative and environmentally sustainable building materials are being manufactured locally in small workshops, creating job opportunities and constructing an estimated 2,300 housing units. These eco-materials use recycled waste products and include micro-concrete roofing tiles, lime-posolana cement, pre-cast hollow concrete blocks (where Portland cement has been partially replaced by CP-40), using bio-wastes as fuel, and the use of bamboo in construction.

External funding of US\$ 387,000 in foreign currency has been raised from a range of donor agencies including the European Commission, GTZ, Swiss Development Cooperation and private foundations for the goods that needs to be purchased in foreign currency, such as certain building materials, machinery, fuel for local transport, etc. The local governments have matched these funds with local currency, which has been used for the purchase raw materials, investments in infrastructure and the payment of salaries in the workshops. The total amount of funds provided by the local governments in the Villa Clara province is estimated to be 2 million Cuban pesos (equivalent to US\$ 90,000). Funds for south-south technology transfer, through workshops carried out by CIDEM and the EcoSur network, have been provided by the European Union, the Cuban government and German NGO 'Werkhof Verein'.

A total of approximately 200 new direct jobs have been created, as well as a large number of indirect jobs (in masonry, carpentry), as a consequence of the boost in the local construction market.

The energy benefits of this intervention include low energy input, minor transportation costs, and substantial energy savings by the usage of an alternative binder for cement, as well as using alternative fuel and producing lower carbon emissions.

Website: 1) [www.worldhabitatawards.org/winners-and-finalists/project-details.cfm?lang=oo&theProjectID=8CF5995B-15C5-F4Co-997B214C8DFB72F7](http://www.worldhabitatawards.org/winners-and-finalists/project-details.cfm?lang=oo&theProjectID=8CF5995B-15C5-F4Co-997B214C8DFB72F7) 2) [www.bestpractices.org/bpbriefs/housing.html](http://www.bestpractices.org/bpbriefs/housing.html)



## CASE STUDY 17

### Cash transfer programme to mitigate the impact of fuel price hikes

**Jakarta, Indonesia:**

The number of Indonesians living on less than US\$1.55 a day is 39 million, out of a total population of 222 million. With the recent fuel price hikes, it is the urban poor that are suffering the most as their meagre earnings buy them less food than before. To mitigate the impact of the fuel price hikes, the government has allocated Rp14.1 trillion for a cash transfer programme to 19.1 million low-income households nationwide, comprising 76.4 million people. Each household is to receive Rp100,000 per month and 15kg of cheap rice until the end of this year (2008).

According to the government, the cash transfer, disbursed through post offices, is proceeding smoothly and the benefits had been received by almost 95 per cent of the targeted households. The well-meaning scheme, however, has drawn criticism from community leaders and local government officials who say it might cause conflict and create social jealousy.

The recent fuel price increase enabled the government to save US\$3.8 billion for the 2008 fiscal year, of which US\$1.6 billion will be ploughed into the cash transfer. However, as oil prices continue to climb, efforts to balance the budget and stabilise the economy are continuing in Indonesia as well as the rest of the region.

Website: [www.nst.com.my/Current\\_News/NST/Wednesday/Columns/2275890/Article/pppull\\_index.html](http://www.nst.com.my/Current_News/NST/Wednesday/Columns/2275890/Article/pppull_index.html)

### 3.2 Public and commercial buildings

Local governments can lead by example through reducing energy use in their buildings and by making use of better design or more efficient technologies. It is more cost effective to build “greener” from start, but retrofitting existing buildings and changing user behaviour can usually show results within an acceptable time frame. Efficient building encompasses several areas from efficient design and orientation through to the technology used inside a building to make lighting, space heating and cooling more efficient. Passive solar design is used to reduce energy consumption and thus the need for extra equipment such as air conditioning, and to ensure comfortable accommodation.

## CASE STUDY 18

### Retrofitting Municipal Buildings Ekurhuleni, South Africa

The Ekurhuleni Metropolitan Municipality (EMM) has successfully implemented various cost-saving and energy-saving measures in three municipal buildings, a result of the city’s adoption of a Policy on Energy Efficiency in Council Buildings and on Council Premises of Ekurhuleni. The project of improving energy efficiency in EMM buildings started in June 2005 with the call to submit quotations to carry out the work to achieve the objective of saving energy and reducing greenhouse gas (GHG) emissions. The leading department was Environment and Tourism but other departments were involved, including the Municipal Infrastructure department (Electricity directorate) and Roads and the Transport and Civil Works department (Building Maintenance section). ICLEI secured a grant totalling R242,761 (US\$40,000) from the United States Agency for International Development (USAID) to fund this project.

The mechanisms focused on lighting and water heating including the replacement of conventional incandescent lights with compact fluorescent lightbulbs (CFLs), the replacement of cool-beam down lighters with light-emitting diodes (LED) lights, the replacement of urns and kettles with hydroboils, and the installation of geyser and lighting timers. CFLs are very efficient and inexpensive with high return on savings after the initial investment. They have been designed to screw into standard sockets, which allow them to be used very easily instead of incandescent light. LEDs are small, solid lightbulbs, which are extremely energy efficient. The Zip hydroboil is a wall-mounted, instant-boiling water heater. It cuts down on water bills, as there is no evaporation due to escaping steam. It also saves electricity/energy because it consumes less compared to urns. Geyser timers regulate when the water can be heated by connecting electricity to the geyser at specified times. This saves energy because water is not heated throughout the day.

This relatively small-scale retrofit project resulted in an energy savings of 328,988 kWhs in one year, with a payback period of 1.2 years. The co-benefits were greenhouse gas (GHG) emissions reductions of 308 tonnes of CO<sub>2</sub>e, 3 tonnes of SOX, and 1 tonne of NOX. The project itself did not require a long time to implement. However, in municipally-owned buildings and municipal operations, the council procedures and policies need to be followed and this added time to the process. Since the energy efficiency technology and equipment was relatively new on the South African market, it was not easy to find experienced tradesmen to provide the necessary services.

Website: [www.peponline.org/publications/Ekurhuleni%20EE%20Case%20Study%204\\_06.pdf](http://www.peponline.org/publications/Ekurhuleni%20EE%20Case%20Study%204_06.pdf)



## CASE STUDY 19

### Reducing municipal buildings energy use through a co-ordinated plan

#### Leicester, UK

Leicester City Council has been at the forefront of the sustainable energy agenda since 1990 when Leicester's first strategic energy action plan was developed.

An energy audit conducted by Leicester determined that offices and buildings owned by the municipality consumed over 170 GWhs of energy each year. As part of the larger Energy Action Plan, in 1990 Leicester announced its commitment to reduce energy use in municipal buildings by 50% by the year 2025, through increased investment in retrofit measures, as well as the design of new buildings to improved lighting, heating and ventilation standards.

The Town Hall that was built in 1876, for example, was retrofitted in 1994 under the Council's energy investment programme. As a result, gas usage was reduced by over 20%, representing a saving of over half a million kWh and 90 tonnes of CO<sub>2</sub> emissions in two years.

Leicester has also invested in Intelligent Metering systems, installed in over 300 administrative buildings throughout the city, to provide half-hourly monitoring of gas, electricity, water and heat consumption data. This real data is used to engage building users to make savings through changes in their behaviour.

Responsibility for delivering these improvements as set out by the Energy Action Plan is held by the Energy Management Section, which is based at the Energy Efficiency Advice Centre. The Centre also provides information and a range of energy efficient products to the general public, while the Leicester Energy Agency (LEA) gives practical assistance to small businesses on energy related matters.

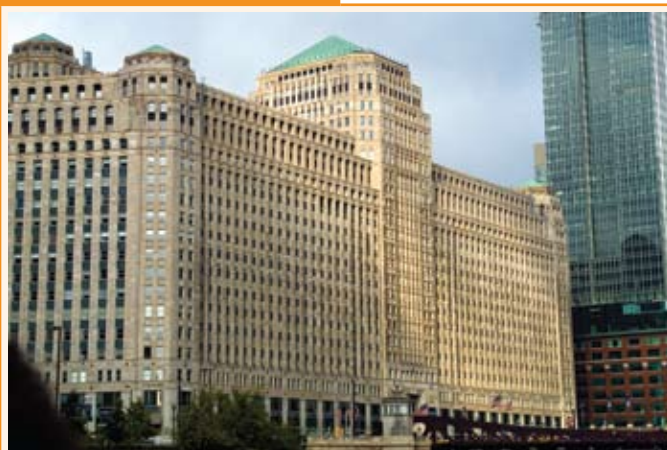
LEA was developed in 1996 as a partnership between Leicester City Council and The Institute of Energy and Sustainable Development at Montfort University. The Agency aims to improve the energy efficiency of up to 5,000 businesses, to set up an Energy Services Company and to achieve a reduction in energy consumption of between 340-840 TJ<sup>2</sup> in Leicester overall.

Website: 1) [www.leicester.gov.uk/your-council--services/ep/the-environment/betterbuildings](http://www.leicester.gov.uk/your-council--services/ep/the-environment/betterbuildings)

[www.leicester.gov.uk/index.asp?pgid=15769](http://www.leicester.gov.uk/index.asp?pgid=15769)

2) Leicester City Council Climate Change Action Plan

## CASE STUDY 20



Merchandise Mart - Downtown Chicago by mdesisto/flickr.com

### 15 Million Square Feet Retrofit Programme for public buildings

#### Chicago, USA

The City of Chicago began to audit and retrofit 15 million square feet (4.572 square metres) of public buildings with efficient equipment for heating and cooling, lighting, ventilation, and appliances. The 15 million square feet are made up of police stations, libraries, fire stations, park facilities, transit facilities, health centres, community/cultural centres, colleges and other types of facilities that are owned by the City, the Chicago Park District, the Chicago Transit Authority or the City Colleges of Chicago.

As of June 2004, more than 5 million square feet (about 1.5 million square metres) of city-owned facilities had been audited and retrofitted. When the project is done, energy savings to the city and its sister agencies are estimated to be \$US 6 million annually, with US\$ 2 to 3 million in savings for the City alone. The annual savings upon completion is estimated to be 30,000 tonnes of CO<sub>2</sub> emissions, 84 tonnes of nitrous oxides, and 128 tonnes of sulphur dioxide.

The City of Chicago and The Clinton Climate Initiative (CCI) will also work with the Merchandise Mart, the world's largest commercial building and largest wholesale design centre, and the Sears Tower, the tallest building in America, to complete audits and subsequent overhauls to increase their energy efficiency and reduce their carbon footprints. In addition, CCI is developing a targeted programme for energy retrofits of privately-owned, multi-tenant housing in Chicago. Under the auspices of the City's Department of Housing, building owners will jointly contract for energy performance contracts and use future energy savings to finance the project implementation.

Website: [www.cityofchicago.org/Environment](http://www.cityofchicago.org/Environment)

<sup>2</sup> There are 1000 Gigajoules in a Terrajoule ( TJ )

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 greenhouse gas (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 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.

**Table 1: Total savings**

	<b>Saving/mth</b>	<b>Saving/yr</b>
kWh/month	12 000	144 000
Tons CO <sub>2</sub>	13.2	158.4
Rands	3 240	38 880

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) per year and 158.4 tonnes of carbon emissions avoided 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 of 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: Sustainable Energy Africa and REEEP. 2007. *How to implement renewable energy and energy efficiency options* – support for local government. SEA. p. 46



CASE STUDY **22**

**Guidelines for building better San José, U.S.A.**

The city of San José, the third largest city in California and home to a million people, experiences temperatures ranging from 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 Jose 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 degrees west and 45 degrees east of true south. Because houses in a subdivision usually face the street, planners in San Jose found that the easiest way to achieve solar orientation was to orient the streets with 30 degrees of the true east-west axis. Homes in such a subdivision would have good solar orientation by default.

In 1998 The San Jose City Council also approved a recommendation to create a Green Building Taskforce that would recommend a Green Building Policy for the City of José. Creation of this Taskforce 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 maximize the health of the occupants and minimize 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.

Website: 1) [www.sanjoseca.gov/esd](http://www.sanjoseca.gov/esd);  
2) [www.sanjoseca.gov/esd/natural-energy-resources/gb-background.htm](http://www.sanjoseca.gov/esd/natural-energy-resources/gb-background.htm)

## 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<sup>3</sup> 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 of 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. These efficiencies translate directly to the bottom line: 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.

Website: 1) [http://en.wikipedia.org/wiki/Eastgate\\_Centre,\\_Harare](http://en.wikipedia.org/wiki/Eastgate_Centre,_Harare);  
2) [www.inhabitat.com/2007/12/10/building-modelled-on-termites-eastgate-centre-in-zimbabwe/](http://www.inhabitat.com/2007/12/10/building-modelled-on-termites-eastgate-centre-in-zimbabwe/)

## CASE STUDY 24



Bali by Sean Mcgrath/flickr.com

### Retrofitting Hotels Bamako, Mali

In May 2006, an International Finance Corporation (IFC) – financed cleaner – production audit of the Chaîne Acalai Hotels in Bamako 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.

Website: [www.ifc.org/ifcext/media.nsf/Content/African\\_Hotels\\_Energy\\_Water\\_Savings](http://www.ifc.org/ifcext/media.nsf/Content/African_Hotels_Energy_Water_Savings)

### UNEP Sustainable Building and Construction Initiative (SBCI)

The UNEP Sustainable Building and Construction Initiative provides stakeholders with a common platform to promote the adoption of sustainable construction principles. Industrials, construction companies, real estate developer, financiers, architects and local authorities are working with UNEP and its partners to propose energy efficiency and CO<sub>2</sub> 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 process in 4 steps.

#### 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<sub>2</sub> 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 to key stakeholders the adoption of the above tools and strategies which will be evaluated through pilot projects.

Source: [www.unepsbci.org](http://www.unepsbci.org)

<sup>3</sup> This is the study of nature's best ideas and how to imitate these great designs or processes to solve human challenges

## CASE STUDY 25

### 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 your carbon footprint.



Praia do Fortaleza by wbuechel/flickr.com

#### Saving water, saving energy, saving money, reaching more people

##### Fortaleza, Brazil

The Companhia de Água e Esgoto do Ceará (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, maximizing 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 savings 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, maximizing existing pump systems efficiency, and increasing storage capacity to allow the shutdown of pumps during peak hours. Creating an operations procedure manual to serve as a reference for daily performance to operations crews and CAGECE management was also implemented. 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: Optimize operations to reduce energy costs; improve system management by centralizing 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.

Website:

[www.watery.org/resources/casestudies/fortaleza\\_brazil.pdf](http://www.watery.org/resources/casestudies/fortaleza_brazil.pdf)



## CASE STUDY 26

### Technical interventions to save energy while delivering water

#### Ahmedabad, India

Capacitors<sup>4</sup> 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 its 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.

Website: [www.egovamc.com](http://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 a photovoltaic panel array. 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: CHAD: 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](http://www.povertyenvironment.net/?q=chad_national_rural_drinking_water_supply_and_sanitation_programme)

## CASE STUDY 28



Monsoon by Michael Foley Photography/flickr.com

### 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.

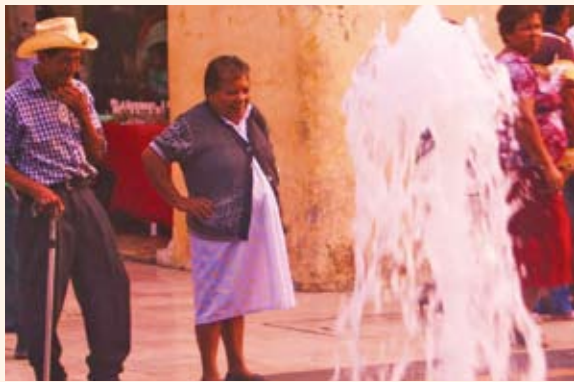
The Municipal Corporation of Delhi has given instruction to make rainwater harvesting mandatory in all new buildings with a roof area of more than 100 m<sup>2</sup> on plots exceeding 1,000 m<sup>2</sup>.

The potential of rooftop rainwater harvesting is approximately 125,000 litres for a plot size of 250 m<sup>2</sup> based on an annual rainfall of 1,000mm. 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 1m rise in ground water level is around 0.40 kW per hour 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

<sup>4</sup> 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 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 Río 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, at the same time improving 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<sup>5</sup> taken at the beginning of the programme was 0.48 kWh/m<sup>3</sup>. Over the development of the programme, the energy intensity had been reduced to 0.39 kWh/m<sup>3</sup> resulting in US\$394,000 in savings for the utility.

Website: [www.watergy.org/resources/casestudies/veracruz\\_mexico.pdf](http://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 upwards of 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 savings 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<sub>2</sub> emissions by about 2,400 metric tonnes. The simultaneous reductions in municipal water waste, through more effective supply and distribution, will allow the municipality to deliver water to more homes.

Website:

[www.watergy.org/resources/casestudies/vishakhapatnam\\_india.pdf](http://www.watergy.org/resources/casestudies/vishakhapatnam_india.pdf)

<sup>5</sup> The amount of energy needed to move a cubic metre of water



## CASE STUDY 31



Garbagetruck by Pip Wilson/flickr.com

### 3.4 Waste management & methane recovery

Good waste management practices by local governments can significantly reduce energy consumption and greenhouse gas (GHG) 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 product (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.



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 fertilizer. 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 wastes collected everyday from the city, of which 40% are recyclable, about 13, 862 tonnes of CO<sub>2</sub>e emissions are reduced annually.

Website: 1) [www.iclei.org](http://www.iclei.org): ICLEI case study – Local Waste Diversion: Naga City. 2) [www.naga.gov.ph](http://www.naga.gov.ph)

## CASE STUDY 32



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

### Landfill-to-Electricity project using CDM EThekweni, 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 eThekweni 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 (DSW), the municipal agency responsible for management and operation of multiple landfills in the EThekweni metropolitan area, will function as the technical advisor and the operational entity of the project.

Website: 1) [www.durban.gov.za/durban/services/departments/environment/enviromews/greenpast](http://www.durban.gov.za/durban/services/departments/environment/enviromews/greenpast)  
2) [www.jiqweb.org/durban.htm](http://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.

Website: [www.edmonton.ca/portal/server.pt/gateway/PTARGS\\_o\\_2\\_271\\_213\\_o\\_43/http%3B/CMSserver/COEWeb/environment+waste+and+recycling/waste/edmonton+waste+management+centre/Landfill+Gas+Recovery.htm](http://www.edmonton.ca/portal/server.pt/gateway/PTARGS_o_2_271_213_o_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<sub>2</sub> 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 to the company, Consorzio Stabile Globus, the rights to capture and burn all biogas produced at the “Mtoni Dumpsite” for 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.

Website: 1) [www.cd4cdm.org/sub-Saharan%20Africa/Tanzania/First%20National%20Workshop/LandfillGasRecovery\\_Chinamo.pdf](http://www.cd4cdm.org/sub-Saharan%20Africa/Tanzania/First%20National%20Workshop/LandfillGasRecovery_Chinamo.pdf)

2) <http://cdm.unfccc.int/Projects/DB/DNV-CUK1169853184.14>

## CASE STUDY 35



by Mimsan – Marie Reiderskold/flickr.com

### Production of Biogas and Bio-Fertilizer while reducing carbon emissions

#### Laholm, Sweden

The Laholm Biogas Plant was built in 1992 as a measure to reduce the increasing eutrophication<sup>6</sup> 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-fertilizer 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 usable fertilizer.

Laholm has a biogas plant that turns animal manure and different kinds of organic waste into bio-fertilizer 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](http://www.biogasmax.eu/media/1_biogas_upgrading_075624200_1207_19042007.pdf)

<sup>6</sup> 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<sub>2</sub>e while making Organic Fertilizer 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 level, 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 fertilizer 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 fertilizer production from household sewage and livestock manure, and organic fertilizer and liquid detergent production from market waste.

The carbon offsets from the organic fertilizer production is estimated at 29 tonnes of equivalent CO<sub>2</sub>. The organic fertilizer replaces unhealthy chemical fertilizers, 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.

Website: [https://www.iclei.org/fileadmin/user\\_upload/documents/SEA/CCP\\_Projects/Tungsong.pdf](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 Maharashtra about 400km from Mumbai, to treat the wastewater from the manufacture of seafood in order to generate biogas. The plant generates 13,000 m<sup>3</sup> 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 waste water to reduce water consumption in the plant. During treatment of waste water, 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 is preventing large quantities of methane, a powerful greenhouse gas, being emitted to atmosphere.

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

Website: [www.lr.org/NR/rdonlyres/948387B9-63A2-40ED-A902-5FE419B5C4AA/38985/MethaneRecoveryfromwastewatertreatmentinSeafoodInd.pdf](http://www.lr.org/NR/rdonlyres/948387B9-63A2-40ED-A902-5FE419B5C4AA/38985/MethaneRecoveryfromwastewatertreatmentinSeafoodInd.pdf)



## CASE STUDY 38



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

### 3.5 Public lighting

Converting streetlights and traffic signals to low energy systems typically provide significant energy and operating costs 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; these run twenty-four hours a day and consume 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 \$800,000 annually in energy, materials and labour costs. In terms of emissions reduction and public health, this program 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.



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 Rs. 1,072,074 (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 Saver 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% to 30% reduction in energy consumption. It is produced, a company in the field of Power Electronics. The devices in the four demonstration areas regulate voltage after peak hours, and automatically reduced voltage during low traffic flow.

The pilot project was supported by ICLEI under an agreement with Guntur Municipal Corporation (GMC), which provided 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 or ESCO.

These devices resulted in an overall energy savings of 35%, saving 22,900 kWhs of electricity, and reducing CO<sub>2</sub>e by 23 tonnes per year.

Website: [www.iclei.org/index.php?id=1636](http://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 streetlighting 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 tube lights were installed. The cost of the project was Rs 50,000 (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 street light system with an energy efficient tube-light system. Jabalpur streets, walkways and parks are commonly lit with 40 Watt fluorescent tube lights with ballasts that consume an additional 10-13 watts. To reduce energy consumption, 28 Watt T-5 retrofit tube lights 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 Rs 35/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 an existing 33,000 tube-lights with new efficient 28 Watt tube-lights, resulting in a reduced energy consumption of 3 million electrical units annually

Website: [www.iclei.org/index.php?id=1637](http://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 street lights 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 meant independence from the power utility Eskom’s coal-based generation of power, which in turn meant cost savings and environmental gains. An evaluation that was done jointly by Broadwing Technologies and JDA, to monitor performance, showed that the solar street lights 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 street lights that are retrofitted.

Website: [www.engineeringnews.co.za/article.php?a\\_id=131170](http://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 street lights in Odorheiu Secuiesc have now reached European standard.

Website: [www.bestpractices.at/main.php?page=programmeme/europe/best\\_practices/odorheiu\\_secuiesc\\_romania&lang=en](http://www.bestpractices.at/main.php?page=programmeme/europe/best_practices/odorheiu_secuiesc_romania&lang=en)

## CASE STUDY 42

### 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 four square metre solar panel – mounted on a lamppost height pole to prevent theft – charges the battery buried underground. It can generate 500W. Currently an average traffic intersection uses about the same amount of power during a month as an average 3 bed roomed 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.

Website:

- 1) [www.capetown.gov.za/press/Newpress.asp?itemcode=2318](http://www.capetown.gov.za/press/Newpress.asp?itemcode=2318)
- 2) [www.southafrica.info/about/sustainable/ctgreen-021007.htm](http://www.southafrica.info/about/sustainable/ctgreen-021007.htm)



### 3.6 Public transport & city planning

There is an obvious link between reduced vehicular travel and reduced fossil fuel use and therefore greenhouse gas (GHG) emissions. Local governments need to vigorously support a shift from private to public and non-motorized 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 GHG 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. One public transit system, 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 bio-diesel. Local governments might even consider starting a citywide waste vegetable oil collection service to run the buses. Bio diesel 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 biofuels production is often also be water intensive and bring other problems associated with mono-culture 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<sub>2</sub>. 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-kilometer 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 minibuses 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 ten more MetroBus lines to be initiated.

Website: 1) [www.df.gob.mx](http://www.df.gob.mx)

2) [www.metrobus.df.gob.mx/web.pdf](http://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 year 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 bus ways, 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 6000 articulated buses providing five million trips per day. In addition to exclusive busways, the City of Bogotá has 230km of bike lanes with plans to increase this to 350km expanded side walks and a 17km pedestrian zone. Among the travel demand management (TDM) 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 week day 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 UN Framework Convention on Climate Change (UNFCCC) 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.

Website: [www.transmilenio.gov.co/transmilenio/home\\_english.htm](http://www.transmilenio.gov.co/transmilenio/home_english.htm)

Source: Ward, S. & Mahomed, L. 2003. *Energising South African Cities and Towns – a local government guide to sustainable energy planning*. SEA

## 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 involve making improvements to the main arterial road in Kisumu, Jomo Kenyatta Highway, to (1) increase the comfort, efficiency and safety of boda-boda bicycle taxi operations, (2) increase the efficiency of matatu mini-bus operations, and (3) to increase the safety of pedestrians. The Jomo Kenyatta highway traverses in the 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

### 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, 'Programma 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.

Website: [www.ibike.org/library/america.htm](http://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 250m 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 Delanoë 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.

Website: <http://en.wikipedia.org/wiki/V%C3%Aglib'>

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/1000population. This is far below the 3.9km/1000population 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.

Website: [https://www.iclei.org/fileadmin/user\\_upload/documents/SEA/CCP\\_Projects/Baguio.pdf](https://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 multi-faceted, multi-billion 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 six square kilometre 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.

Website: [www.masdaruae.com](http://www.masdaruae.com)



The main square at Essaouira, Morocco by jonh1973/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 ecosystem 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 by-laws 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 Eco Mobility

The Global Alliance for Eco Mobility 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-motorized 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 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)

Source: [www.ecomobility.org](http://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 has dropped by 40% since motorcycles were banned in the downtown area.

Website: [www.itdp.org/index.php/projects/update/guangzhou\\_bans\\_motorcycles/](http://www.itdp.org/index.php/projects/update/guangzhou_bans_motorcycles/)

## CASE STUDY 53

### **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 (DI) fuel injection retrofit kit, which is estimated to reduce carbon monoxide emissions by 76%, CO<sub>2</sub> 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 (LUG's) 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 where 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.

Website: 1) [www.cleanenergyawards.com/top-navigation/nominees-projects/nominee-detail/project/37/](http://www.cleanenergyawards.com/top-navigation/nominees-projects/nominee-detail/project/37/)  
2) [www.envirofit.org/two\\_stroke\\_retrofit.html](http://www.envirofit.org/two_stroke_retrofit.html)

## CASE STUDY 54

### 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.

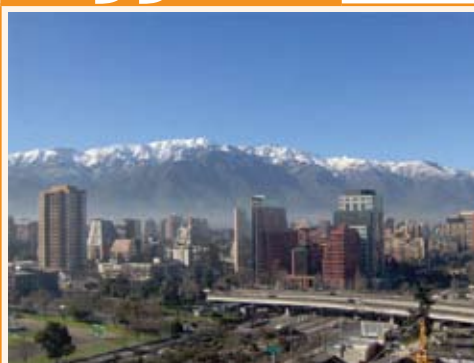
This vehicle testing programme aims to regulate emissions from more than one million vehicles in and around Cairo. The programme requires drivers in the Cairo districts of Giza and Qalyoubia to receive inspection certificates from one of 19 emissions testing stations before they can register their cars. 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.

Website: <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 (PM) combustion emissions, and various other types of air pollution. Of some 830,000 vehicles in the metro area, heavier diesel vehicles and busses 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 Ringelmann opacity scale printed on it to rate visible smoke emissions from 0 (low) to 5 (high). The Ringelmann 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 belching out black smoke, but has raised public awareness.

Website: 1) [http://pdf.dec.org/pdf\\_docs/PNADB317.pdf](http://pdf.dec.org/pdf_docs/PNADB317.pdf)

2) [http://findarticles.com/p/articles/mi\\_moCYH/is\\_/ai\\_89924474](http://findarticles.com/p/articles/mi_moCYH/is_/ai_89924474)



**CASE STUDY 56****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 (over 80%) due to the 50,000 or so baby taxis that used highly polluting two-stroke engines, which mixed their lubrication oil, usually bought loose and adulterated, 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, and there are now plans to extend it to other Bangladeshi cities.

Website: 1) [www.opendemocracy.net/globalization-climate\\_change\\_debate/article\\_2499.jsp](http://www.opendemocracy.net/globalization-climate_change_debate/article_2499.jsp) 2) [www.dhakacity.org](http://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 as well.

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 tons raw material loss and pollutants, and creating an economic benefit of RMB 100 million Yuan.

Website: [www.unhabitat.org/list.asp?typeid=15&catid=540](http://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 (also called micro-generation, distributed or decentralised energy) 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<sub>2</sub> 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

### 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. 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 1960's. From 1967, the United Nations Development Programme (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 lower 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<sub>2</sub> 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.

Website: 1) [www.kengen.co.ke](http://www.kengen.co.ke) 2) [www.renewableseastafrica.de/uploads/media/1314\\_Geothermal%20Industry.pdf](http://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 has a capacity of 1930 megawatts 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 for fish processing, salt production, and the drying of coconuts and fruit, all major economic activities of the Philippines.

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

Website: 1) [www.geothermal.marin.org](http://www.geothermal.marin.org)

2) [http://en.wikipedia.org/wiki/Geothermal\\_energy#Philippines](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 the most from the national electricity grid which is dominated by coal-generation plants. The city does have 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 gigawatt hours (GWH) (13 200 megawatt hours) of electricity using four turbines of 1,3 MW in size each. One megawatt hour (MWH) is approximately 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<sub>2</sub> 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 5USc 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.

Website: 1) [www.capetown.gov.za](http://www.capetown.gov.za)

2) [www.capectown.gov.za/eng/pubs/news/2007/feb/152595](http://www.capectown.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 SWM (Stadtwerke München), 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 co-operation with the München electrician's guild, in which the customers were informed about interested and qualified electrician's 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 kilowatt 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.



**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 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 growing up, with over 3 million m<sup>2</sup> 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 got to 100 million m<sup>2</sup>. The total output of solar heaters in Dezhou added to 16 million m<sup>2</sup>, sharing 16% of Chinese market. Dezhou has carried out projects of Million Solar Roofs and 100 Rural Solar Bathrooms, which have improved the life quality of the farmers. In 2005, China Solar Energy Society and other two 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 Center 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 spear headed 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.

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

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

**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 through 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<sub>2</sub>-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 (1.65 MW each) new turbines 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.

Website: [www.energie-cites.org/db/wieringermeer\\_139\\_en.pdf](http://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<sub>2</sub> 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 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<sub>2</sub>e). 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<sub>2</sub> they are allowed to emit. In 2006, about \$5.5 billion of carbon offsets were purchased in the compliance market, representing about 1.6 billion metric tonnes of CO<sub>2</sub>e 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 \$91 million of carbon offsets were purchased in the voluntary market, representing about 24 million metric tons of CO<sub>2</sub>e 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<sub>2</sub>) from the atmosphere. The term "sinks" is also used to describe agricultural and forestry lands that absorb CO<sub>2</sub>, the most important global warming gas emitted by human activities. Agricultural and forestry practices can also release CO<sub>2</sub> and other greenhouse gases to the atmosphere.

Sequestration activities can help prevent global climate



Tree Planting in Philly, Philadelphia /flickr.com

change by enhancing carbon storage in trees and soils, preserving existing tree and soil carbon, and by reducing emissions of CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

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're 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's 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 nonnative species.



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 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 sequester CO<sub>2</sub>.

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 2900 trees were then supported and was implanted by February 2006. This municipality has already planted 8 370 trees, with 12, 5 tonnes CO<sub>2</sub> sequestered or absorbed.

Website: 1) [www.trees.co.za/index.php?option=com\\_content&task=view&id=111&Itemid=74](http://www.trees.co.za/index.php?option=com_content&task=view&id=111&Itemid=74)

2) [www.potch.co.za/council/departments/health/home.htm](http://www.potch.co.za/council/departments/health/home.htm)

### **Utility-Supported Tree Planting Sacramento, U.S.A**

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 the Sacramento Municipal Utility District (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).

Website: 1) [www.aceee.org/utility/7bsmudshadetree.pdf](http://www.aceee.org/utility/7bsmudshadetree.pdf)

2) [www.smud.org/residential/trees/](http://www.smud.org/residential/trees/)



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 square metres of park space per citizen, while a city like New York provides 14.12 square metres.

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 square metres 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 square-meter 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.

Website:

[http://english.seoul.go.kr/gover/initiatives/inti\\_o6trust.htm](http://english.seoul.go.kr/gover/initiatives/inti_o6trust.htm)

### **3.10 Fleet management**

There are 4 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 optimize 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 the United Nations Environment Programme (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

Source: [www.unep.org/tnt-unep/toolkit/](http://www.unep.org/tnt-unep/toolkit/)



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.

Website: 1) <http://altfuelsaustralia.wordpress.com/2007/12/15/adelaide-home-to-the-tindo-solar-powered-bus/>  
2) [www.adelaidecitycouncil.com/scripts/nc.dll?ADCC:STANDARD::pc=PC\\_151048](http://www.adelaidecitycouncil.com/scripts/nc.dll?ADCC:STANDARD::pc=PC_151048)

### Buses Powered by Biogas Produced in the Municipal Wastewater

#### Lille, France

The CUDL (Urban Community of Lille) is a public inter-municipal co-operation 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 slightly 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 waste water 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<sup>3</sup> of biogas produced on a daily basis by the waste water 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 remaining was burnt off. To provide an alternative option to wasting the remaining 3,000 m<sup>3</sup>, the CUDL decided to clean them to obtain a daily volume of 1,200 m<sup>3</sup> 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.

Website: [www.energie-cites.org/db/lille\\_575\\_en.pdf](http://www.energie-cites.org/db/lille_575_en.pdf)

## CASE STUDY 69

### 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> emissions, the company has seen the petrol dominant fleet of 2000 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.

Source: [www.energysavingtrust.org.uk/uploads/documents/fleet/ACFMBAoTaaAt.pdf](http://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 program in the U.S.A.

The program 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 program called for the elimination of over 50 vehicles. Due to the reduced number of vehicles, Denver is also saving \$US 40,000 annually in maintenance and capital costs. The program alone has reduced 10 to 15 tons of CO<sub>2</sub> emissions annually.

Website: [www.greenprintdenver.org/energy/greenfleet.php](http://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:

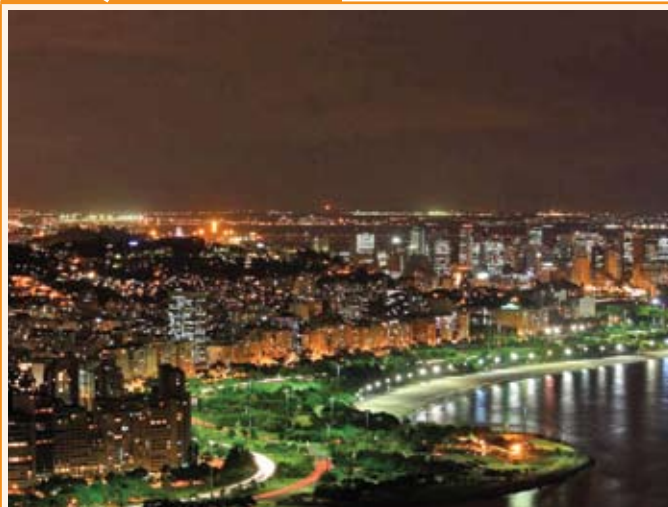
- **Car Choice List** – if drivers could be influenced to choose more environmentally-friendly vehicles, this would have an immediate effect on emissions.
- **Mileage Reimbursement Rates** – taking control of these and managing them in tandem with the actual fuel efficiency of the fleet would reduce 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 mileages 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 White bread 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<sub>2</sub> less than it would have done had the fleet been the same size in 1999.

Website: [www.energysavingtrust.org.uk/fleet/organisations/vehicles50/informationcentrepages/](http://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 Sao 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.

Website: [www.ngvglobal.com/en/market-developments/10-growth-forecast-for-natural-gas-vehicles-in-brazil-01916.html](http://www.ngvglobal.com/en/market-developments/10-growth-forecast-for-natural-gas-vehicles-in-brazil-01916.html)



## CASE STUDY 73



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).



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<sub>2</sub> 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.

Website: [www.greenprocurementcode.co.uk/?q=node/42](http://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.

Quite 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.

To date, 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 ecolabels, a glossary of terms used by the "experts" and a CD on ecodesign. The City carried out this work in partnership with the research offices Ecoeff and Cartes Vertes Internationales, the Steering Committee and the Technical Committee.

Website:

[http://ec.europa.eu/environment/gpp/pdf/press\\_en.pdf](http://ec.europa.eu/environment/gpp/pdf/press_en.pdf)

**CASE  
STUDY 75****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 only on 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

Website: [www3.iclei.org/egpis/egpc-061.html](http://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 on-going 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](http://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

#### CD4CDM

The United Nations Environment Programme (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](http://cd4cdm.org/unep_cdm.htm)

#### CDM Bazaar

The United Nations Framework Convention on Climate Change (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 I members of the UNFCCC.

Website: <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 co-ordinate these efforts in Africa, Central and Eastern Europe, Europe, Latin America, North America, South Asia, and Southeast Asia.

Website: [www.climatenetwork.org](http://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 programs 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.

**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.  
Website: [www.c40cities.org](http://www.c40cities.org)

Website: [www.clintonfoundation.org](http://www.clintonfoundation.org)

### **ICLEI: Cities for Climate Protection 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 has run and/or 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.

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.

Website: [www.iclei.org/wmccc](http://www.iclei.org/wmccc)

Website: [www.iclei.org](http://www.iclei.org)

### **Institute for Transportation and Development Policy (ITDP)**

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 U.S. 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 multi-lateral institutions away from an exclusive focus on road projects and toward more multi-modal 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, strengthening the bicycle and rickshaw industries.

Website: [www.itdp.org](http://www.itdp.org)

### **Renewable Energy and Energy Efficiency Partnership (REEEP)**

The Renewable Energy & 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. The REEEP currently has regional secretariats covering Central and Eastern Europe and Turkey, East Asia, Latin America and Caribbean, North America, Russia and FSU, South Asia, South East Asia and Pacific, and Southern Africa. The REEEP International Secretariat is based in Vienna (Austria).

Website: [www.reeep.org](http://www.reeep.org)

### **SouthSouthNorth (SSN)**

SouthSouthNorth (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, the United Republic of 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. SouthSouthNorth 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.

Website: [www.southsouthnorth.org](http://www.southsouthnorth.org)

### **Sustainable Energy Finance Initiative (SEFI)**

SEFI is the UNEP 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

Website: <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 multi-lateral and inter-disciplinary 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

Website: [www.unhabitat.org/categories.asp?catid=570](http://www.unhabitat.org/categories.asp?catid=570)

### **The Cities in Climate Change Initiative**

As an initial component of SUD-Net, the Cities in Climate Change Initiative 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 organizations, the private sector, among others.

Website: [www.unhabitat.org/content.asp?typeid=19&catid=570&cid=6003](http://www.unhabitat.org/content.asp?typeid=19&catid=570&cid=6003)

### **UNEP 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) 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.

Website: [www.unep.org](http://www.unep.org)

### **UNEP 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 analyzing 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.

Website:

[www.uneptie.org/energy/about/about\\_the\\_division.htm](http://www.uneptie.org/energy/about/about_the_division.htm)

### **Watergy Program**

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: 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 six countries: 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 and locale, 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.

Website: [www.watergy.net/overview/](http://www.watergy.net/overview/)



## Further resources

### **Localised support groups with information to share**

These networks share solutions, best practice and tools on issue 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.

Website: [www.apolloalliance.org](http://www.apolloalliance.org)

### **Climate Alliance – Local Governments:**

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

Website: [www.klimabuendnis.org](http://www.klimabuendnis.org)

### **Energie-Cités:**

Energie-Cités focuses on European cities including those in the states in transition. 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.

Website: [www.energie-cites.eu](http://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<sub>2</sub> by 20% of 1990 levels by 2010.

The EST is working to:

- Address the damaging effects of climate change
- Cut CO<sub>2</sub> 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 study and tool development.

Website: [www.energysavingtrust.org.uk](http://www.energysavingtrust.org.uk)

### **Further information:**

Climate Change Information Kit;  
[www.unep.ch/iuc/submenu/infokit](http://www.unep.ch/iuc/submenu/infokit)

Energy Savings in Cities – Issues, Strategies & Options for Local Governments UNEP's Latest Urban Management Series, 2003; [www.unep.org](http://www.unep.org)

Green Fleets: Increasing Efficiency and Reducing Emissions Commuting in Greenhouse: Automobile Trip Reduction Programs of Municipal Employees; ICLEI

Landfill Methane Outreach Program; United States Environmental Protection Agency [www.epa.gov/lmop](http://www.epa.gov/lmop)

Orford Margie, 2003. *Climate Change and the Kyoto Protocol's Clean Development Mechanism*. SouthSouthNorth

Sustainable Transport website  
[www.sustainable.org.za/transit](http://www.sustainable.org.za/transit)

The Economic Significance of Cycling: A study to illustrate the costs and benefits of cycling policy;  
[www.vnguitgeverij.nl](http://www.vnguitgeverij.nl)

Understanding Climate Change: A Beginners Guide to the UNFCCC;  
[www.undep.ch/iuc/submenu/begin/beginner.htm](http://www.undep.ch/iuc/submenu/begin/beginner.htm)



### **Recommended Manuals and Guidebooks**

Alliance to Save Energy March 2007. **Guidelines for Financing Municipal Energy Efficiency Projects in the Commonwealth of Independent States.** REEEP. Available online at [www.reeep.org](http://www.reeep.org) under Publications

Apollo Alliance 2006. **New Energy for Cities. Energy saving and job creation for local governments.** Available at: [www.apolloalliance.org/downloads/resources\\_new\\_energy\\_cities.pdf](http://www.apolloalliance.org/downloads/resources_new_energy_cities.pdf).

Grütter, J.M. 2007. **CDM in the transport Sector: A sourcebook for policy makers in developing cities.** GTZ. Available at: [www.gtz.de/de/dokumente/en-cdm-transport-sector-2007.pdf](http://www.gtz.de/de/dokumente/en-cdm-transport-sector-2007.pdf)

TCPA & CHPA. April 2008. **Community Energy: Urban Planning for Low Carbon Future.** Available at: [www.localpower.org/documents/reporto\\_chpa\\_comenergy.pdf](http://www.localpower.org/documents/reporto_chpa_comenergy.pdf)

Pembina Institute, **A User's Guide to CDM**, Feb 2003; Available at: [info@pembina.org](mailto:info@pembina.org); [www.pembina.org](http://www.pembina.org)

Rai Kavita IT Power 2005. **Monitoring and Evaluation of the impact of Renewable Energy Programmes. A Toolkit for Applying Participatory Approaches.** REEEP, available at: [www.reeep.org](http://www.reeep.org) under Publications

Snover A K, L Whitely Binder, J Lopez, E Willmott, J Kay, D Howell, and J Simonds 2007. **Preparing for Climate Change: A Guidebook for Local Regional and State Governments.** In association with and published by ICLEI.

Stadtwerke Saarbrücken; 1997, **Urban Planning Maximising the use of Renewable Energies: manual for Urban Planners.** European Commission.

Ward, Sarah 2008. **The New Energy Book for urban development in South Africa.** Sustainable Energy Africa.





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 – 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:

- The first is 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.
- Second, 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.
- Third, Cities can help shape long-term development patterns in order to promote location efficiency and reduce the effects of urbanization 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 contextualized and scaled to suite 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.



