



# Megacities and climate change

Sustainable urban living in a changing world

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## Preface

For the first time in human history, more people are living in urban areas than rural ones. This unprecedented and ongoing transition coincides with alarming degradation of the natural environment. With so many cities already experiencing the early impacts of climate change there is an urgent need for action.

As climate change becomes more apparent it will have massive implications for urban living across the world. Key urban services like transport, water, energy and land use will all be adversely affected. But while “business as usual” points to a disastrous future, there are opportunities to be had from a different approach. With the right leadership, cities offer the potential to be critical leverage points for achieving a transition towards a more sustainable future. If we can work towards making cities respond to the coming challenges in a radical and far sighted way, the implications for sustainability could be deep and profound.

How can cities adapt to the coming changes? How can cities point the way to a different kind of low-carbon future? What lessons can be learnt from experiences in the South and North? What kind of leadership is required to identify, promote and deliver the required changes?

Building on the diversity of experience, which is the trademark of the global LEAD network, this publication brings together LEAD Fellows who are working in the front line of efforts to promote sustainability and urban living in very different contexts around the world, to explore some of the challenges and potential solutions to what needs to be done.

Focussing on the importance of leadership, LEAD’s main aim is to contribute to the debate by promoting an exchange of views about the role leadership plays in addressing climate change in large cities and urban areas. We hope we can inspire and inform stakeholders and decision makers to rise to the leadership challenge and act to secure a sustainable future for our cities and the people who live in them.

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## Foreword

The birth of the 21st century inaugurated the first age of cities, the Urban Age. With over half the world’s population now living in an urban centre, questions about how we live, work, and move are increasingly focused on the physical form of cities and their greater metropolitan regions. As centres for knowledge, cities are incubators for change. They are also the testing ground for cultural regeneration and social integration, providing jobs, access to education and healthcare for a large percentage of the poor and the emerging middle class. As the largest emitter of carbon emissions, cities exert an enormous influence on environmental pressures resulting from climate change. And with the intuitive rural-urban migration continuing unabated, cities are the battlefield on which the future of humanity will be fought.

Which urban forms best accommodate the increasingly diverse constituencies living in cities today? And how can the rule of law reconcile the tensions between spatial and social disorder? Urban Age, a joint initiative of the London School of Economics and Political Science and Deutsche Bank’s Alfred Herrhausen Society, is establishing a new agenda for the future of cities in order to promote the growth and sustainable development of global cities in the developed and developing world. This agenda is being created in partnership with government agencies, research institutions, private corporations and civil society organisations at the international, central, regional, state and local levels. By integrating transversal themes such as housing, migration, transport infrastructure, inequality and violence, including the impact these issues have on the creation and maintenance of public space, Urban Age is charting the future of cities and climate change is at the forefront of this agenda.

Urban growth patterns and networks define the global political economy. United Nations projections for a world population of nine billion by 2050 could see as many as 75 per cent living in cities. Africa and Asia are the main drivers of this increase as Latin America, Europe and North America have been over 75 per cent urbanised since 2000. Even so, both small and large cities across

the developed and developing world pose difficult questions about how to manage urban growth in the 21st century. Avoiding the mistakes made in North American cities, where urbanisation coincided with a love affair with the car is proving to be one of the most complex challenges. Food shortages, natural disasters and widespread inequality pose even greater threats to the 40 percent of the world’s population living on less than US\$2 a day. The most vulnerable live in the developing world, where those least able to protect themselves contribute the least to the worldwide total emissions of greenhouse gases. The UN’s Human Development Report cites that on an average annual basis, one in 19 people living in the developing world was affected by a climate disaster in the first years of the 21st century.

Temperature increases and depletion of the earth’s natural capital will only exacerbate the intensity and frequency of climate disasters. That better living conditions can be ameliorated by advances in sustainable urban development is poorly understood. Too often policymakers, practitioners and community activists lack the knowledge and skill-set to create more socially and economically cohesive communities. This is because of the deep fragmentation that exists within the professions and between various levels of government, but also because the planning process and development policies typically do not adequately integrate environmental considerations or prioritise social infrastructure early enough. It takes a multi-sector approach, one synthesising financial and social imperatives as well as the environment and physical form, to respond to the unpredictable challenges caused by climate change.

Coordinated action, paired with immediate interventions and long-term goals, offers convincing results about the effectiveness of integrated development plans. Evidence is found in the Alexandra Renewal Plan in Johannesburg, where accountability to joint administrative and political bodies recognises that regeneration fails when approaches to city building are uncoordinated. Congestion charging in London provides an exemplary model for sustainable urban development, with private car ownership tamed in favour of increased investment in public transport and public space. Further evidence can be found in the case of Bogotá's TransMilenio bus rapid transit system, first implemented in the smaller scaled Curitiba and then adopted in the mega-metropolis of Mexico City, which cut commuting times in half. This bold move demonstrated how social and economic mobility can improve quality of life while also reducing the impact of human activity on the earth.

Cities contribute over 80 per cent of the world's carbon emissions. Pollution from industrial activity and transport, inefficient building performance or fuel efficiency standards, and poor management of the earth's natural capital can seem like insurmountable tasks. Yet as recently as 20 years ago, New York City dumped the majority of the city's raw human waste directly into its river network. Although this practice continues in cities across the globe, local and international environmental groups, recognising their role as watch-guard, are helping to change behaviour. Civic participation, in a multitude of forms, is fundamental to effective governance. Participatory budgeting and community advocacy facilitate increased communication, individual accountability and collective activism to support a culture of shared responsibility.

Policies which combat sprawl and institute better water management and land use policies can create more cohesive urban environments and improve quality of life. Since buildings consume close to half the world's energy, technological innovations and material applications, as well as increased self-sufficiency, can help reduce energy demands and each citizen's ecological footprint. But we do not have to start from scratch. Recycling spaces, materials and infrastructure, remediating brownfields and increasing density are readily available tools which help retrofit our urban environments for increased population growth and better designed environments. Recycling increases the wealth of all urban citizens. Conservation strategies need not be a characteristic only of the poor, born out of necessity or public mandate. It can be a cultural value shared by all.

Leadership, of course, makes the difference. Better governed cities are better equipped to deal with the threats of climate change since the most vulnerable cities are those in which development does not work. Yet the challenge confronting policy makers and practitioners is not to get development right first, and adjust for the impact of climate change after. Policies and agencies must be aligned and government leaders must ensure that development priorities are integrated and monitored throughout all stages of a project. Ecologically and economically sustainable communities can only be created through the active participation from a wide range of community stakeholders from the beginning. Governments must be willing to share information and ideas, and allow for continuous investment in a flexible, adaptive urban infrastructure.



Opposite: As recently as 20 years ago, New York City dumped the majority of the city's raw human waste directly into its river network.

Integrated planning – allowing people to live closer to where they work, providing public transport near housing, jobs and the requisite social infrastructure – are vital elements for the creation of sustainable cities. Compact, mixed-use, well-connected. These qualities, paired with a shared responsibility among multiple government agencies, business leaders, policy makers, academics and urban practitioners and facilitated by intergenerational exchange, will produce dynamic and rewarding results in the world's financial and cultural nerve centres. Our common task is to fulfil the hopeful promise of urban life, and not let our cities become hopeless failures. The next generation must be brought into this effort early. Through the push and pull between governments and citizens, private interests and public intervention, public participation through all the stages of city making will ease the challenge of getting the details right.

**Urban Age Programme**  
**London School of Economics and**  
**Political Sciences – Deutsche Bank's**  
**Alfred Herrhausen Society**

## Introduction

*“When we see very dark clouds up the hills, we expect heavy rains to come. So we get ourselves prepared by transferring our valuable things on our very high beds which are reached by climbing ladders. Also children who sleep on the floor are transferred to the high beds.”*

Mrs Fatu Turay, Kroo Bay community, Freetown, Sierra Leone.<sup>1</sup>

During the past 50 years most low and middle-income nations have experienced exceptional demographic growth with some cities undergoing massive physical expansion. This process has been accompanied by a large increase in the number of urban dwellers living in poverty and lacking provision of the basic infrastructure and services that should protect them from most of the early impacts of climate change. More than one billion urban dwellers live in poor-quality, overcrowded housing in ‘slums’ or informal settlements, and a high proportion of these settlements are on sites at risk from flooding or landslides.

Many low and middle income countries are now undergoing rapid urbanisation, and due to their particular social and economic development characteristics, this process poses distinctive challenges to policy makers. Low income nations are faced with urbanisation in the form of emerging cities which have high population growth rates in largely informal settlements and are often unsupported by established infrastructure or services. With growth rates between 3% to 6% per year, these emerging cities are typically found within countries undergoing demographic transition from rural to urban areas. People living in these cities tend to be younger, predominately male with low levels of education and they experience considerable inequalities in wealth, health, education and political power. In middle income nations, established cities also face continued population growth but at

lower rates (typically 2% to 3%). These countries are usually better financially and organisationally equipped to respond to the governance and infrastructure challenges of such growth and provide services like transportation, water, energy and security.<sup>2</sup> In both cases, public administrations face considerable challenges due, not only to lack of resources, but also to lack of capacity where it matters most, at the local the level.

In the next 50 years, when global population growth stabilises due to a drastic reduction in both birth and death rates, the most densely populated, populous and socially fragmented of these urban agglomerations will be located in the developing world. Already more than half of the world's population now live in urban areas and at the beginning of this century, almost one in ten of us was living in one of 35 megacities, 20 of which are located in Asia, ten in the Americas, three in Europe and two in Africa.<sup>3</sup>

This scenario raises concerns, particularly when we consider the anticipated impact of climate change. Climate change will require adaptations in the way cities are managed in order to ensure they maintain living standards and remain attractive to the investment and human resources necessary to support sustainable development. Megacities, as well as rapid growing cities in the South are more vulnerable to such impacts and are less well equipped to adapt, both organisationally and financially.

### Competitiveness and vulnerability of Megacities

Two interrelated factors will affect the way megacities in the developing world may respond to the challenges posed by climate change in the coming years. On one hand, megacities are the engines of globalisation, driving the flow of people, goods, knowledge, and money around the world. On the other hand they also embody huge inequalities in the distribution of wealth, economic opportunity and exposure to risks. Ten of the world's most economically important cities are responsible for 20% of the global gross domestic product (GDP) and in several countries megacities contribute to a considerable portion of the country's output. For example, Tokyo is home to 28% of the Japanese population, and accounts for 40% of the country's GDP. In the developing world, Lagos is home to 8% of Nigeria's population but contributes 30% of the country's output. Considering their

importance for national economies and growth, megacities have to remain competitive in order to attract investment. To attract investment, these cities need modern, efficient infrastructures. They require effective transportation systems, modern information and communication technology (ICT) and provision of basic services such as water and sanitation, access to quality housing, education and electricity. Equally important is the availability of skilled labour and governance systems that ensure an environment attractive to investors.

#### How Climate Change may affect urban competitiveness

The most influential driver for urbanisation is where new or increasing private investment flows. The flow of investment has a strong influence on how individual urban areas develop, and their competitiveness largely depends on how attractive they are to investors. Urban areas vulnerable to disruption from the impacts of climate change will clearly be less attractive as they represent a higher investment risk. Such disruption also poses a threat to urban economies as existing businesses and investors may decide to move elsewhere to mitigate disruption to their operations and risk to their investments. Even if such operations are not directly affected by an extreme weather event, the indirect impacts and disruption to infrastructure and supply-chains or inconvenience to staff may encourage movement elsewhere or the choice of new locations when enterprises expand.<sup>4</sup>

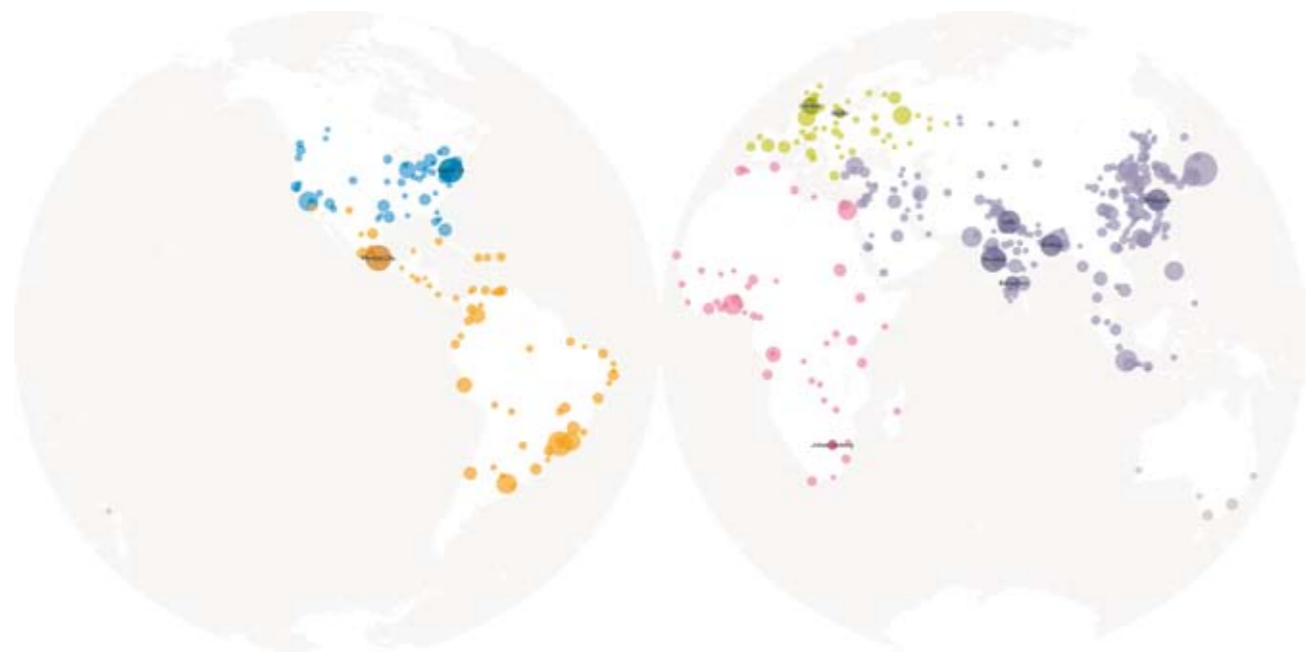
#### How climate change will increase urban vulnerability and affect the poor

The vulnerability of urban populations to extreme weather events has been vividly highlighted in recent years by the increase in casualties and major economic losses resulting from hurricanes, storms and floods. Scientific evidence predicts that such events will reoccur with increasing frequency and be accompanied by other impacts such as heat waves, reductions in freshwater availability and sea-level rise, which is a particular challenge for coastal cities. The majority of damage caused by such events has had far greater impact on low and middle income populations, largely due to their increased vulnerability from living in hazardous conditions with poor infrastructure and inadequate housing. According to Satterthwaite<sup>5</sup>, lower income groups will be affected hardest because they are more exposed to hazards and possess less capacity to adapt. They have less state provision to help them cope, less legal protection and less protection from insurance. In urban areas, such groups often

have to live in sites more exposed to danger from climate change impacts. They are often unable to move to less dangerous areas as the more vulnerable sites are often the only places where the urban poor can find affordable housing or build their own homes. Major changes are therefore urgently required in how governments (particularly those in low and middle income countries) improve the resilience of their infrastructure and economies to deal with the scale of anticipated climate change impacts. National and city governments need to focus not only on improving their ability to respond to the early impacts of climate change, but also support measures which reduce their vulnerability to future risks.

#### Leadership and climate change in rapidly urbanising settings

Leadership to cope with the challenges presented by climate change have to take place across all sectors and levels. Local authorities, businesses and communities all have a crucial role to play in this process as adaptation to climate change requires local knowledge, local skills and local capacity to ensure solutions are as sustainable as possible. We need households and community organisations with the knowledge, capacity and will to act and a willingness among local authorities to pay special attention to the vulnerability of lower-income groups. To be successful in adapting to climate change, a profound shift needs to happen in the way local authorities engage with low-income urban dwellers, who are the ones most severely affected by its impacts.



While every region of the world has a number of cities with over 1 million inhabitants, new megacities with over 10 million people are developing across Asia, Africa, Central and South America.  
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The majority of damage caused by climate change has had far greater impact on low and middle income populations, largely due to their increased vulnerability from living in hazardous conditions.

#### What lies ahead: challenges and constraints in addressing urban vulnerability to climate change

Some innovative policies and practices (largely developed by community based and urban poverty organisations) have shown that it is possible to reduce vulnerability to the impacts of climate change at relatively low cost. There are also an increasing number of examples where local governments working in partnership with low-income groups have successfully improved infrastructure, housing conditions, and developed new, good-quality settlements. Even though climate change often competes with other demands placed on city governments and national ministries, like the provision of basic infrastructure, services and adequate housing, we believe these issues should be approached from an integrated perspective and addressed taking climate change into consideration.

This publication explores how megacities and rapidly growing cities are responding to the urban development challenges presented by climate change. It provides examples and case studies of successful initiatives highlighting the leadership required to tackle this global problem. The following chapters offer a range of insights and examples of innovative solutions to challenges in four areas of urban development that will be significantly affected by climate change: water and sanitation; energy; transport and urban mobility; land use and urban planning.

Equally, leadership is required from the private sector because of the important contributions that businesses and investors can make in enabling the implementation of adaptation measures. This includes not only adapting their own operations and infrastructure but also in developing goods and services that enable individuals, communities and governments to adapt. Extending appropriate financial services (particularly to lower-income groups) can help households to invest in safer homes and build better livelihoods which in turn strengthen resilience and the ability to adapt. Insurance whilst not only protecting buildings and infrastructure – if appropriately structured – can also be used to encourage risk reduction.<sup>6</sup>

Finally, civil society and citizens organisations have an important role to play. Participation must fully take into account, and allow for, the involvement of diverse communities and those representing excluded groups such as women, the elderly and the young. New technologies and methods of communication can encourage and support more interactive policy environments; bringing government closer to the people it serves. The institutional and financial arrangements required to cope with climate change must be designed to ensure a high degree of equity and equal opportunity among the diverse social groups which make up urban populations. This will also require greater pooling of resources.

<sup>1</sup> Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin McDonnell, Louise McLean and Jack Campbell (2008), 'Unjust waters: climate change, flooding and the urban poor in Africa', Environment and Urbanization, Vol. 20, No. 1.  
<sup>2</sup> For a comprehensive description of megacities archetypes see the report 'Megacities Challenges – a stakeholder perspective' by Globescan and MRC McLean Hazel.  
<sup>3</sup> Graizbord, B. 'Megacities, Metropolitan Areas and Local Governments' LEAD Mexico, El Colegio de Mexico.  
<sup>4</sup> Satterthwaite, D. et al 'Adapting to Climate Change in Urban Areas: The possibilities and constraints in low- and middle-income nations' Human Settlements Group and the Climate Change Group at the International Institute for Environment and Development (IIED) 2008.  
<sup>5</sup> Satterthwaite, D. et al op. cit.  
<sup>6</sup> Satterthwaite, D. et al op. cit.

# Energy



A person living in one of the world's highest income countries uses around 22 times as much energy as someone living in one of the world's lowest income countries.

## Context

**Nick Harrison and Melita Rogelj**

Of all human activity known to contribute to climate change, satisfying our demand for primary energy is by far the greatest. Generating over 70% of this energy by burning fossil fuel oil, coal and natural gas,<sup>1</sup> energy generation of this kind is now responsible for around 60% of our greenhouse gas emissions worldwide.<sup>2</sup> With the majority of our (fast growing) population and energy demand now concentrated in urban areas, the way we use energy in our cities currently represents one of the single biggest causes of global climate change today. Hence anyone considering the role of cities in climate change needs to begin by considering how cities use energy.

We use energy in cities in a multitude of ways. Some are obvious such as illumination, heating and cooling, motive power, and electricity. And some are less obvious such as energy which is hidden or 'embedded' in the production of buildings, infrastructure, food, clothing and all the other stuff we use to satisfy our needs and desires for security, comfort and fulfilment. Of all these uses, providing electricity and heating is responsible for around one quarter of all human-induced greenhouse gas emissions.<sup>1</sup>

It will come as little surprise that there is considerable variation in the intensity with which energy is used across the planet. As with greenhouse gas emissions, energy use generally correlates with a country's income and level of development. For example, during 2004 a person living in one of the world's highest income countries used around 22 times as much energy as someone living in one of the world's lowest income countries. Similarly, in that same year, someone living in a high income country was responsible for emitting around 14 times as much carbon dioxide as someone living in a low income country.<sup>3</sup>

The supply and control of fossil fuels has played a defining role in shaping the political and economic landscape of the world over the past two centuries. Many of today's most economically and politically powerful countries consume more energy and produce more greenhouse gas emissions per person largely because harnessing the energy released through burning fossil fuels is what enabled them to become so powerful in the first place. The pivotal role fossil fuel energy has played – through industrialisation – in enabling the rapid economic and social development of a fortunate minority, has therefore led to the widespread belief that such sources of energy are a prerequisite for economic and social development.

However, it has become increasingly apparent even for the fortunate minority, that this fossil fuel powered approach to development suffers from two major flaws. Firstly, fossil fuels are becoming scarcer, more expensive and will soon be unable to satisfy the increasing energy demands of a growing global population. Secondly the process we use to transform these fuels into products and services we value is causing destabilisation of the global climate making parts of the planet increasingly inhospitable for human beings to survive. These two flaws are currently among the most demanding development challenges we face as a global community. We know the energy sources we've used to enable economic and social development are finite and we know that using them in the ways we have, and on the scale we have, is causing dangerous (and possibly irreversible) imbalances in global ecosystems. Yet we continue to grow in number, and so too does our thirst for energy.<sup>3</sup>

Our current path is clearly unsustainable and this is largely because we are making a mess of how we manage energy.<sup>4</sup> Therefore, a major part of how we solve these problems must involve changing how we manage energy. In particular how we manage it in our cities. We need practical solutions and we need to implement them very quickly. We need to stop the release of greenhouse gases from burning fossil fuels and switch to supplies of energy which are environmentally benign and sustainable. We need to reduce demand for energy by improving efficiency in end-use technology;<sup>5</sup> and we need to decentralise our generation and supply infrastructure.<sup>6</sup>

Fortunately many solutions to these problems already exist. For decades now, people across the planet have been working to develop and implement them. New technologies, economic and policy tools along with new approaches to influence and change social, organisational and individual behaviour all exist and have demonstrated that they can work. So what are the challenges we need to overcome to implement these solutions in cities across the world?

China has recently surpassed the United States as the world's biggest carbon dioxide emitter and it is developing renewable technologies expected to supply 10 per cent of its energy needs by 2020.  
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## Challenges

Across the world, most cities already have or are in the process of developing strategies, policies and plans addressing climate change and future energy needs. But implementing these many and varied frameworks – in ways leading to actual emissions reductions – is still generally at an early stage (EPC, 2008). Clearly the scale and type of transformation demanded by our current situation represents huge challenges both organisationally and politically. Challenges such as the tendency to obfuscate the causes and potential solutions; poor leadership; silo-working; and absent or dysfunctional incentives must all be overcome if we are to succeed.<sup>7</sup>

In the remainder of the chapter we examine some specific challenges faced in implementing solutions to managing energy better in our cities. We illustrate with examples drawn from the work of LEAD Fellows how these challenges are being successfully overcome to ensure more sustainable energy use in cities around the world.

### Supplying Clean Sustainable Energy

We have at our disposal many methods of supplying energy (in useful forms like heat and electricity) which would considerably reduce our greenhouse gas emissions. They include those commonly referred to as 'renewables' (Biomass, Geothermal, Hydro, Ocean, Solar and Wind) and Nuclear fission. Each has relative advantages and disadvantages and all face various challenges to playing a larger role in the global energy supply mix. Carbon capture and storage also has a significant and immediate role to play as a transition technology enabling us to continue using energy released from burning fossil fuels in ways which curtail emissions of greenhouse gases in the process.<sup>8</sup>

One of the biggest challenges to developing the supply of sustainable energy has been to overcome its cost disadvantage against (often heavily-subsidised and environmentally polluting) fossil fuel energy supplies. Establishing 'Power Purchase Agreements' and 'Feed-in Tariffs' which place a legal obligation on utility companies to buy electricity from sustainable sources at a premium rate over a guaranteed period are approaches which have proved successful in a number of countries already. They make the installation of sustainable energy systems a more secure and viable investment and often lead to the creation of whole new domestic industries. In Germany for example, the introduction of Feed-in Tariffs catalysed the development of its solar industry leading the country to become a world leader with 40,000 now employed in the sector.<sup>9</sup> Without the support of such legislation, while investment may be available for large projects with evident profit margins, it is not always easy to secure such investment for early project development (such as capacity measurements, community assessments or skills training) all of which are necessary to enable equitable deployment of renewable energy technology. As a result of legislative changes such as these, global investment in sustainable energy is growing rapidly. In 2007 the amount of new investment increased 60% on the previous year to \$148.4 billion<sup>10</sup> and recent reports indicate an increasing number of countries are now putting them in place.<sup>11</sup>

Legislation can also be a challenge to implementing sustainable energy and one such example is the obligation often placed on public authorities to deliver services at the lowest financial cost to the tax-payer. This is often cited as a barrier to action, but can be overcome through changes in how we value ecosystem services. For example, an approach being taken by Mexico's state-run electricity company CFE, is to pursue principles of full cost accounting which emphasise cost to the tax-payer not only in financial terms but also in terms of cost to society and the environment.<sup>12</sup>

Aside from changing legislation, governments themselves also offer great potential to lead the take-up of renewable energy technology through changes in their own procurement policies. For example, across Europe, an increasing number of governments are now progressing in this way by financing the construction of renewable energy projects using public finance. In some cases, cities are working with local municipal utilities to construct wind turbines. In other cases, they are working with privately owned utilities and renewable energy developers to construct solar arrays on city buildings, schools, and homes. A number of cities are beginning to incorporate renewable energy requirements into their contract renewals with privately owned local utilities. Places like Güssing and Linz in Austria, Apeldoorn in the Netherlands and Freiburg in Germany, are all examples of where community and government led efforts are having considerable success.



## Case study 1

**Case study** Solar Cities Initiative  
**Location** Sao Paulo, Brazil

### Overview of problem and solution

São Paulo in Brazil introduced municipal laws in 2008 requiring the installation and use of Solar Water Heaters (SWH) in all new buildings. The legislation is a major step to encourage a widespread shift to a decentralised, sustainable energy supply in one of the largest cities on earth.

Rich in solar resources, the entire country receives over 2,200 hours of direct sunlight each year. However, electricity is still used considerably more than SWH to supply hot water. Shower heads and water heaters currently represent around 6% of Brazil's total electricity consumption and around 25% of the system's peak demand. The electricity to supply this consumption is generated mainly by hydroelectric facilities, which often put pressure on the environment and traditional communities re-located during construction. The expansion of the country's generation system has recently involved investments in diesel, gas and coal-fired thermoelectric plants which increase greenhouse gas emissions, contributing to global warming and increasing air pollution.

The new laws will help to overcome some of the barriers faced in the implementation of SWH technology such as the relatively high initial cost of installation (compared to electric heaters) and the lack of low interest credit for financing such installations. Other benefits (besides reducing carbon emissions) include better use of hydroelectricity in Brazil's energy matrix, the creation of skilled jobs and the reduction of resources needed for building electrical generation, transmission and distribution infrastructure.

### Leadership which made it possible

The new law came about as a result of the efforts of the Brazilian Solar Cities Initiative – a joint project of the Vitae Civilis Institute, a non-governmental organisation managed by LEAD Fellow Rubens Born and the Brazilian SWH manufacturers association (DASOL Abrava). The creation of São Paulo's solar law coincided with the creation of other laws to boost SWH in the Brazilian cities of Porto Alegre, Belo Horizonte, Campina Grande and 12 others. The initiative has also begun discussions with many other Brazilian municipalities who are now considering following Sao Paulo's lead and introducing similar laws that oblige or create incentive programs for installing SWH.

The environmental concerns of customers together with the introduction of these new municipal laws and special installation loans have led to a boom in the sales of SWH across Brazil. As a consequence, SWH manufacturers are busy preparing to supply the growing demand, forecasting growth of more than 30% this year with some planning to double their production by 2009.

The rapid growth in membership of the Solar Cities Initiative network and the number of projects motivated by its work is clear evidence of its impact and importance. The initiative aims to continue promoting SWH until at least 2010 when it hopes to see solar laws initiated across 40 Brazilian cities.

**Further information**  
[www.vitaecivilis.org.br](http://www.vitaecivilis.org.br)



We need to make a transition to more decentralised energy infrastructure and this requires new emphasis in the development and regeneration of our towns and cities.

### Improving Energy Efficiency & Reducing Demand

Most of the energy we demand in cities is used within and by buildings and while many innovative examples of energy efficient buildings now exist, their relatively high initial cost has historically acted as a strong disincentive to widespread deployment. Governments have begun to address this challenge by implementing standards and targets requiring new buildings be designed and constructed to use energy much more efficiently (e.g. the UK's government's energy performance certificates and targets for all new buildings to be zero-carbon by 2016). In some cases governments are using their own buildings to showcase good practice (e.g. the California State Department of Water and Power and Department of Transport have incorporated energy efficiency and renewable energy technology into new and existing office buildings).

Whilst this is becoming an increasingly effective mechanism to drive demand and innovation, a shortage of skills and knowledge (in built environment professions) needed to meet this demand, remains a challenge in the short-term. What is perhaps even more challenging is how to improve the efficiency of existing buildings. In the City of Berkeley, California the government has successfully used its legislative powers to introduce Energy Conservation Ordinances<sup>13</sup> ensuring when a property is sold on it legally has to be refitted with energy conservation measures. These ordinances are proving to be an excellent approach to housing stock renewal, ensuring a rapid transition to widespread improvements in energy use efficiency in buildings across the city.

But it's not just the buildings themselves which use energy it's also the end-use technologies within buildings which need improving. Many innovations in end-use technologies such as air conditioning and refrigerators exist but their higher initial cost is often a barrier to widespread adoption. In Mexico City, a programme operated by a government backed trust fund (FIDE) and the state-run electricity company (CFE) has demonstrated how innovative use of subsidies can help overcome this challenge making such end-use technologies more price competitive.<sup>14</sup> The approach uses the cost savings accrued from operating new, energy efficient technology to pay off a loan provided to cover the additional cost of purchasing the new technology. The scheme covers lighting, insulation, refrigeration and air conditioning and over the past 15 years, has funded the replacement of over eight million refrigerators with new energy efficient versions.

Setting tough efficiency standards for manufacturers of end-use technology such as lighting, computers and televisions also poses a significant challenge for governments, particularly when resisting efforts by industry to lobby for lower (cheaper to implement) standards. Japan's 'Top-Runner Programme'<sup>15</sup> which was introduced in 1998 is an example of a practical and effective regulatory mechanism which ensures manufacturers continually work to improve the energy efficiency of their products. Rather than just setting minimum efficiency performance standards, the top-runner programme continually searches for the most efficient model currently on the market and stipulates that this become the country's industry standard minimum in a given number of years. Covering products in over 21 categories, the programme is a world leading approach in driving up efficiency standards.

Another key challenge to reducing demand is promoting behaviour change among energy end-users and in many countries considerable efforts are being made to influence user behaviour with some degree of success. For example, in Tokyo more than 2 million citizens have voluntarily pledged to reduce their personal energy-use through a novel online scheme which is having considerable impact. Nonetheless changing user's behaviour particularly in high income countries where a doctrine of high consumption prevails is a formidable challenge and relying on voluntary reductions alone is unlikely to succeed.

### Decentralising Energy Supply

Climate change is an energy issue, energy is an infrastructure issue, therefore climate change is an infrastructure issue, according to energy expert Walt Patterson<sup>16</sup> who argues that changing our energy infrastructure is key to tackling climate change. Conventional energy infrastructure tends to generate electricity in large centralised power stations, transmitting it over long distances to its end-use in a way which is not only inefficient but also lacks flexibility and makes users dependent and vulnerable to widespread power-outs. So we need to make a transition to more decentralised energy infrastructure and this requires new emphasis in the development and regeneration of our towns and cities. In places where little or no existing infrastructure currently exists, it may simply be a question of ensuring development follows a decentralised design. What may be more challenging is retrofitting a decentralised design to existing (centralised) infrastructures.

Providing incentives to do this is shown to be working in many places as we have seen with Feed-in Tariffs making the deployment of localised energy supply infrastructure more financial viable. Another approach is direct subsidies such as California's million solar roofs campaign<sup>17</sup> which has dramatically increased demand and take-up of solar powered electric generation technology by providing \$3bn state government support for installation. Other approaches focus on encouraging the inclusion of local or on-site generation in new developments. A good example of this is an approach pioneered by the London Borough of Merton in the UK. The Merton Rule<sup>18</sup> is a planning policy which states that all residential developments above 1,000 square meters are expected to incorporate renewable energy technology to generate at least 10% of predicted requirements on-site. The policy, endorsed by the UK government in 2006 is now seeing widespread adoption in cities across the UK.



California Department of Transport building showcases cutting edge low-energy design © 2007 Nick Harrison

## Case study 2

**Case study** Decentralising Urban Energy Supply  
**Location** Woking, UK

### Overview of the problem and solution

To combat the inefficiencies and vulnerabilities of a centralised energy supply infrastructure, it is essential we find ways to decentralise. Woking in the UK is an excellent example of how it is possible to make the transition to a decentralised, sustainable energy supply system in an urban setting. With a population of just 100,000, it has installed nearly 10% of all UK solar photovoltaic capacity and is home to the first fuel cell combined heat and power system in the country.

Part of the solution was to establish a network of private electricity wires owned and operated by a local Energy Service Company (ESCO) which was established and majority owned by the local government, Woking Borough Council. These private wires connect together the dispersed generators creating a local supply network and by 2003 the council's electricity infrastructure became over 99% independent of the national grid. Woking was able to raise capital for energy infrastructure development initially through energy efficiency savings. This was achieved by establishing a fund into which savings (below a benchmark of expected energy expenditure) accrued from energy efficiency measures were reinvested, year on year, into further energy-saving measures. The substantial financial savings accrued, allowed the council to invest millions in energy supply innovation. The ESCO (Thameswey Energy)<sup>19</sup> subsequently attracted investment from pension companies who recognised the steady low-risk return the initiative offers.

### Leadership which made it possible

The municipal government, driven by the leadership of its chief engineer Allen Jones, pioneered the development of a network of over 60 local generators which included photovoltaic arrays and a hydrogen fuel cell station to power, heat and cool municipal buildings and social housing. Decentralising their energy supply has enabled Woking council to slash their energy use by nearly half, and CO<sub>2</sub> emissions by over 75%, since 1990.

Developing a private, locally owned electricity network enabled the ESCO to avoid charges usually associated with the use of the national electricity grid. By circumventing these costs, it has been able to fund wires and generation to deliver low emission electricity which is cost competitive with conventional suppliers. Local ESCOs of this kind are currently being developed across the UK, most notably in London where Woking's pioneering chief engineer was subsequently recruited by the mayor of London to implement the UK capital's energy strategy.<sup>20</sup>

### Further information

Examples of many of the systems installed can be found on the Woking website: [www.woking.gov.uk/environment/Greeninitiatives/sustainablewoking](http://www.woking.gov.uk/environment/Greeninitiatives/sustainablewoking)

The challenges highlighted here are just a few among many that need to be overcome if we are to tackle climate change and ensure sustainable energy supply in our cities. Many are now dedicated to this task and recent economic and policy shifts are also helping. The growing global price of fossil fuels is making alternative energy sources and reductions to demand all the more politically and economically attractive. Meanwhile, the growing stability of the carbon markets and progress towards more widespread legislative 'caps' to greenhouse gas emissions is driving more investment in, and demand for, innovative renewable energy and energy efficiency ('greentech') technology than ever before.<sup>21</sup> So where some see a challenge, others see opportunity.

Yet the scale of the task before us remains huge and it requires leadership both to initiate the solutions and to overcome the challenges if we are to make the transition to cities of the future where energy is generated and used locally, efficiently and sustainably.



- 1 World Energy Outlook 2006. International Energy Agency. [www.worldenergyoutlook.org](http://www.worldenergyoutlook.org)
- 2 World Greenhouse gas emissions by sector. UNEP. <http://maps.grida.no/go/graphic/world-greenhouse-gas-emissions-by-sector>
- 3 Fighting climate change: Human solidarity in a divided world. United Nations Development Programme Human Development Report 2007/2008. <http://hdr.undp.org/en/>
- 4 Patterson, W (2008). Managing Energy Wrong. Chatham House. [www.chathamhouse.org.uk/publications/papers/view/-/id/629/](http://www.chathamhouse.org.uk/publications/papers/view/-/id/629/)
- 5 Froggett, A (2008). The International Climate Agenda: Opportunities for the G8. Chatham House. [www.chathamhouse.org.uk/publications/papers/view/-/id/620/](http://www.chathamhouse.org.uk/publications/papers/view/-/id/620/)
- 6 Patterson, W. (2007). Transforming our energy within a generation. Chatham House. [www.chathamhouse.org.uk/research/eedp/papers/view/-/id/496/](http://www.chathamhouse.org.uk/research/eedp/papers/view/-/id/496/)
- 7 Baseman, Max, H. (2006) Climate Change as a Predictable Surprise. Negotiation, Organisations and Markets Research Papers. Harvard University. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=785990&rec=1&srcabs=869644](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=785990&rec=1&srcabs=869644)
- 8 Nature (2008). Electricity without Carbon. Vol. 454. p816-823 [www.nature.com/news/2008/080813/pdf/454816a.pdf](http://www.nature.com/news/2008/080813/pdf/454816a.pdf)
- 9 Lander, M (2008). Germany Debates Subsidies for Solar Industry. New York Times. <http://tinyurl.com/3za69n>
- 10 Global Trends in Sustainable Energy Investment 2008 Report. SEFI/UNEP/BAE/UNF. <http://sefi.unep.org/english/globaltrends.html>
- 11 Renewables 2007 Global Status Report. REN21. [www.ren21.net/globalstatusreport/default.asp](http://www.ren21.net/globalstatusreport/default.asp)
- 12 [www.energypolicyclimate.org](http://www.energypolicyclimate.org)
- 13 Residential Energy Conservation Ordinances, Berkeley, USA. [www.ci.berkeley.ca.us/sustainable/residents/ResSideBar/RECO.html](http://www.ci.berkeley.ca.us/sustainable/residents/ResSideBar/RECO.html)
- 14 The Electric Power Saving Trust Fund, Mexico [www.fide.org.mx/index2.html](http://www.fide.org.mx/index2.html)
- 15 The Top-Runner Programme, Japan [www.eccj.or.jp/top\\_runner/index.html](http://www.eccj.or.jp/top_runner/index.html)
- 16 Patterson, W. (2007). Keeping the lights on: towards sustainable electricity. Chatham House/Earthscan.
- 17 Million Solar Roofs Campaign. California, USA. [www.environmentalcalifornia.org/energy/million-solar-roofs](http://www.environmentalcalifornia.org/energy/million-solar-roofs)
- 18 The Merton Rule, UK. [www.themertonrule.org](http://www.themertonrule.org)
- 19 [www.woking.gov.uk/environment/climate/Greeninitiatives/sustainablewoking/thamesweyenergy](http://www.woking.gov.uk/environment/climate/Greeninitiatives/sustainablewoking/thamesweyenergy)
- 20 Examples of decentralising supply on a larger scale can be found on the London Climate Change Agency's website: [www.edfenergy.com/lesco](http://www.edfenergy.com/lesco)
- 21 Carbon 2008: Post-2012 is now. Point Carbon. [www.pointcarbon.com/research/carbonmarketresearch/analyst/1.912721](http://www.pointcarbon.com/research/carbonmarketresearch/analyst/1.912721)

# Transport

and Urban Mobility



By 2030 there is expected to be more vehicles in the developing world than in developed countries. This rapid rise in vehicle ownership and use is particularly predominant in emerging economies and is largely the result of rising income levels.

## Context

**Erin Silsbe and Tiyyok Prasetyoadi**

According to the United Nations, virtually all population growth from now until 2030 will be concentrated in the urban areas of the world; most occurring in the least developed regions.<sup>1</sup> This development trend has significant implications for climate change policy. City governments are responsible for a wealth of public policy decisions covering areas as diverse as emergency management, land use and buildings codes, energy supply, public health and safety, waste, water, public transportation and transport infrastructure. Decisions around these local governance issues can have significant impacts on a region's carbon footprint as well as its ability to respond to climate related events.

As cities grow and become more involved in global trade, the efficient movement of people and goods is critical to its economic well-being. Transportation systems are seen as one of the biggest challenges in accommodating the growth of cities as they provide the fundamental infrastructure which enables competitiveness. Transportation modes can be divided into two major systems; public and private. Public transportation in cities includes trains (subway, elevated), buses and taxis, while private transportation modes include cycling, walking and motor

vehicles (motorcycle, truck, car). Road transportation is responsible for most of the transport sector's impact on human health and the environment in OECD countries and is at the heart of two daily challenges being faced by cities: air pollution and traffic congestion. In most cities, the impact of the transportation sector on climate change (and vice versa) is generally not the greatest concern given these other seemingly more pressing issues. However, strategies to reduce greenhouse gas emissions often have many other co-benefits including improving air quality.

This chapter will focus on the connections between transportation and climate change and some of the challenges being faced by cities in implementing sustainable transportation policy.

### Transportation and Mitigation

The transportation sector alone is responsible for 14% of the world's greenhouse gas emissions, 10% of which come from road transportation (the remaining from air, ship, and rail).<sup>2</sup> Emissions from road transportation are governed by three factors: vehicle efficiency, fuel efficiency, and vehicle kilometres travelled (VKT). To date, much of the climate policy discussion and mitigation activity in the transportation sector has focused on improving fuel efficiency and promoting cleaner fuels. While these are necessary steps, the emissions resulting from the steep growth in VKT, especially in the developing world, will far outstrip any reductions gained by these two measures.

By 2030 there is expected to be more vehicles in the developing world than in developed countries. This rapid rise in vehicle ownership and use is particularly predominant in emerging economies and is largely the result of rising income levels –

as cities grow, average incomes tend to grow which in turn leads to increases in car ownership – and urban development patterns. Megacities, most common in the developing world, are often characterised by sprawling, disconnected, low-density, land use patterns with rapidly growing populations. This pattern often makes the provision of a balanced transportation network too costly to maintain and subsequently encourages the use of private vehicles. Both of these factors can also contribute to weakening demand for public transport and a consequent decline in service levels, patronage and financial viability. Infrastructure for pedestrian and other non-motorized transport also suffers as public funds tend to be focussed on road maintenance and expansion.

Vehicle use is also encouraged, either directly or indirectly, through such things as property taxes, fuel subsidies, and near-term planning horizons. For example, politicians tend to focus on short term fixes such as expanding roadways to alleviate traffic congestion even though this is a battle that cannot be won given the rapid development of cities. A recent study in the United States found that through the implementation of sustainable land use policy alone (i.e. policy that focuses on compact development featuring a mix of land uses, interconnection of streets, pedestrian and transit-oriented design) total US transportation related CO2 emissions could be reduced by 7–10 percent by 2050.<sup>3</sup> Given that the US is amongst the world's top greenhouse gas emitter, this analysis highlights the critical importance of travel demand measures, such as 'Smart growth', in the fight against climate change.

Transit-oriented development is a good example of sustainable land use planning. This is a regional planning concept developed by Peter Calthorpe, about 15 years ago during the start of the 'new urbanism' movement in the United States. It channels growth into discrete nodes along light-rail and bus networks and exploits a basic relationship between transportation and land use: put more origin and destination points within an easy walk of a transit stop and more people will use transit<sup>4</sup> (See Jakarta, Indonesia case study).

Coupled with other transportation mitigation strategies such as fuel and vehicle efficiency, road tolls, congestion pricing, establishing no-drive days or no-drive zones, other fees and taxes on driving or parking, the transportation sector can and must play a significant role in climate change mitigation strategies.

### Transportation & Adaptation

The transportation sector, both its infrastructure and users, are highly vulnerable to climate change.<sup>5</sup> Changes in precipitation patterns for example, may lead to increased erosion, landslides, and flooding which can in turn cause damage to roadways, bridges and seawalls. In coastal regions, port activity will be affected by rising sea levels, storm surges and flooding. Airports are often disrupted by severe storms and flooding especially in low-lying areas. Flooding of urban underground rail systems has already caused serious damage and disruption to service in cities around the world including Prague, Boston, New York, Seoul, and Taipei. On warmer days, non air-conditioned public transportation can be unbearable for many and can in turn be an incentive for driving. Warmer temperatures also lead to the creation of more smog, a significant public health concern, which is further exacerbated by increased vehicle usage.

A study carried out in the Gulf Coast of the United States on the impacts of climate change and variability on transportation systems and infrastructure, found that the region's entire transportation network would be exposed to potentially devastating consequences if any significant sea level rise were to occur. Impacts included: 75% of the port facilities would be vulnerable; eight major airports would be inundated; and 25% of the interstate highway would be flooded.<sup>6</sup> The study concluded that practical steps needed to be taken to build the resiliency of the transportation system such as hardening, raising, or even relocating structures and expanding redundant systems.<sup>7</sup>

Adapting to the impacts of climate change can either be reactive or anticipatory. Given that infrastructure and land use decisions being made today could have an impact on the footprint of a region for the next hundred or more years, incorporating climate change considerations into decision making processes is an urgent priority. Depending on how quickly global emissions are stabilised, the climate impacts we could face over the coming century could be significant. Cities that are designed and built to provide multiple transportation choices for its citizens such as planning which allows people the choice to walk, bike, or take transit, to meet their basic needs will enable that city to be more resilient in the face of new challenges associated with the changing climate. This type of holistic urban planning strategy will help local governments define more sustainable pathways for their future growth and in doing so facilitate a host of other benefits like improved air quality, improved liveability and energy savings. Specific transportation adaptation strategies that may be incorporated into an overall sustainability plan might include: storm water retention ponds; higher capacity drainage; pervious paving material; building standards that optimize natural heating and cooling; cooling centres; information campaigns and flood warning systems.

Given that adaptation is a relatively new concept for most local governments, the development of new models, tools, and data about the potential impacts and vulnerabilities from climate change on the transportation sector, are urgently needed. In fact several local governments<sup>8</sup> around the world are leading the way on this emerging issue (see Toronto, Canada case study). With critical information in hand including newly developed best practices, urban governments will be in a better position to build their resiliency in advance of any major or enduring climate related events. While availability of information is a significant challenge, it is only one of many being faced by local governments attempting to implement more sustainable policy options. The following section outlines in more detail some of the other key challenges.

## Challenges

Growth of the world's megacities seems inevitable and as a result, transportation networks will have to expand to meet growing demand. Living in the city offers a compromised quality of life in many countries. Citizens have to cope with congestion, air pollution and lack of open space along with the increasingly apparent impacts from climate change including flooding, intense heat, severe and unpredictable weather. A significant challenge for local governments is to balance the availability of amenities in the city, ensuring it is not only a place for economic activities, but also has amenities to enable citizens to enjoy a good quality of life. Sustainable land use planning, including travel demand measures, is essential.

With increasing demand for more homes and office space, cities tend to sprawl as developers search for cheaper land to build affordable residential housing. Development should be concentrated in the city centres to encourage a reduction in travel to and from economic and recreational activities. The city has to grow and density has to be controlled. It is a challenge to integrate transportation networks with city land use policy, existing development and zoning regulations for example, can be a significant barrier to new or innovative policies. Transit oriented development is one approach that can help address this challenge.

Coordination between various stakeholders is also a significant challenge. Cities are often subdivided into multiple jurisdictions. Overlay this with multiple private and public sector transportation operating agencies and the degree of difficulty in developing and implementing a sustainable land use plan, can become particularly complex.

Governments need to encourage people to use public transport by providing an efficient, safe and reliable public transportation system. The basic difference between private and public transportation is willingness to share. Also, whilst public transportation gets people almost to their destination, private vehicles get people exactly to where they want to go (door to door). To successfully encourage people to change their transportation mode from private to public transport, a safe, reliable, and convenient public transportation system is needed. This relies heavily on patterns of land use, government vision, strategic planning and regulation.

Another barrier to public transportation can also be public perception. Buses for example, are often seen as only for those who cannot afford their own vehicle. The convenience of driving a private motorised vehicle is also very hard to challenge. Since the mass production of the automobile and the increase in average income, people seem to fall in love with driving their own car. Driving is also often apparently cheaper compared to travel using public transportation. However, like many environmental problems, there is a hidden (public) cost that is often not accounted for by vehicle ownership and use. The air pollution from vehicles for example, contributes to a host of environmental and

Growing the mode share of public transportation and non-motorised modes as well as meeting the new challenges associated with the changing climate will place increasing strain on already limited resources. Sustainable land use planning, which includes travel demand measures, and strategies to address climate change are not mutually exclusive.

health issues. Clearly, the use of public transportation over private vehicles will help reduce air pollution. The fossil fuels needed for most automobiles also compete with other energy needs. Private vehicles also waste vast land resources for road and parking spaces even though for most of the day, a (private) car will either be parked on the street or in a parking building. People will typically only use a car for 2-4 hours a day. This public property (road) could better be used as (green) open space.

Another challenge is developing adequate pedestrian areas in the city. As people get off the public transport system there needs to be a pedestrian network that is safe, comfortable, and easy to navigate in order to encourage walking. Pedestrian activity is also affected by the climate. While the provision of a pedestrian network will be different from one city to another, in tropical areas for example, it is desirable to have a pedestrian network which is shaded from the sun.

The main challenge for a city is determining how its limited resources can be shared equally and fairly among citizens. In the transportation sector, managing congestion, safety, air quality, maintenance and expansion of infrastructure is already a significant challenge. Growing the mode share of public transportation and non-motorised modes as well as meeting the new challenges associated with the changing climate will place increasing strain on already limited resources. Sustainable land use planning, which includes travel demand measures, and strategies to address climate change are not mutually exclusive.



Cycling is also a growing trend in many urban areas. People have started to use bicycles for their daily activities because of the sharp rise in fossil fuel prices. © Erin Silsbee.

## Case study 1

**Case study** Integrating pedestrian corridors with Bus Rapid Transit  
**Location** Jakarta, Indonesia

**Overview of problem and solution**  
 Jakarta is the capital city of Indonesia, with an official population of around 8.5 million people. The actual population is estimated to be as much as 12 million as many commute into the city during the day, from the surrounding area, also known as Jabodetabek (Jakarta-Bogor-Depok-Tangerang-Bekasi). Jakarta is a city of dramatically contrasting images and building standards, which to the western eye may appear irrational and chaotic. Such conflicts appear not only in the built environment but also in the transport system, utilities and basic urban services. Various types of transport are in common use across the city, ranging from three-wheeled Bajaj (motorised passenger/goods carriers), to trains and private luxury automobiles. These vehicles compete with each other, with pedestrians, cyclists and road-side hawkers (goods sellers) for increasingly limited road space.<sup>9</sup>

Improving pedestrian and public transport accessibility is an important part of reducing private car use and the greenhouse gas emissions which cause climate change. In Jakarta, provision of pedestrian thoroughfares is very limited as pavements are often shared with other infrastructure such as electricity poles, bridge columns, telephone booths and other modes of transportation including motorcycles (using the pavement to beat the traffic), pushcarts; and street hawkers. With limited pavement space and lack of maintenance, pedestrians are often forced to walk on the road, not only in traditional market places but also in busy main roads. This makes car use a more desirable and safe mode of transport and therefore a challenge to reducing greenhouse gas emissions and improving pedestrian health, safety and quality of life.

Although these challenges need to be addressed through design improvements, the attitude of pavement users and effective law enforcement are also key issues which need to be addressed. Some of the key challenges to providing adequate pedestrian facilities in Jakarta include:

- 1 Inadequate space for pedestrians to walk (pavements often too narrow)
- 2 No provision for people with different physical ability (i.e. disabled people)
- 3 Uncoordinated infrastructure in pedestrian areas
- 4 Inappropriate use of the pavement by other modes of transport (e.g. motorbikes)
- 5 Informal sectors (e.g. Hawkers) reclaiming pedestrian space
- 6 Pedestrian security
- 7 Lack of shade from the sun
- 8 Lack of connections to other pedestrian networks
- 9 Inconsistent pavement width



The project aimed to address many of these issues through providing improved pedestrian access along the length of Jakarta's new rapid bus transit system. The main objective was to introduce pedestrian corridors which encourage people to walk in a tropical climate and to provide links connecting them to other pedestrian networks and modes of transport across the city. As well as improving key transport infrastructure, this large public project also promised to attract investment and increased commercial activity along the newly constructed pedestrian areas. Costing around US\$1m and covering both sides of a 1.4 km stretch of road, the project covers an area of approximately 2,800 square metres around a major thoroughfare where approximately 10,000 people live and work.

Integrating with Jakarta's new 'Transjakarta' bus rapid transit (BRT) service (which was recognised by the C40 Climate Leaders Group)<sup>10</sup> was also a catalyst contributing to the project's success. Both complement each other as improving the pavement area increases use of the BRT and vice versa.

### Leadership which made it possible

Government leadership has proven to be crucial to avoid pitfalls previously faced in similar projects in Jakarta. Widening the pedestrian area drew strong resistance from building owners and a key element of success with this project has been the effective negotiation with private land owners. Lack of adequate finance was also a problem in the past, particularly when the financial crisis hit Indonesia. Lastly and perhaps most importantly was the strong support from the city Governor in backing up the agency responsible for the project.

### Further information

Project website:  
<http://pertamanan.jakarta.go.id/>  
 (in Indonesian)

Project publication / further research or case studies:  
[www.thejakartapost.com/news/2003/01/30/city-plans-widen-jl-thamrin039s-sidewalks.html](http://www.thejakartapost.com/news/2003/01/30/city-plans-widen-jl-thamrin039s-sidewalks.html)



- 1 [www.unpopulation.org](http://www.unpopulation.org)
- 2 World Resources Institute (2006) Climate Analysis Indicators Tool (CAIT) on-line database version 3.0., Washington, DC: World Resources Institute, available at <http://cait.wri.org>
- 3 [www.smartgrowthamerica.org/documents/growingcoolerCH1.pdf](http://www.smartgrowthamerica.org/documents/growingcoolerCH1.pdf)
- 4 Calthorpe, Peter. (1993) The Next American Metropolis: Ecology, Community and the American Dream. New York: Princeton Architectural Press.
- 5 Only a handful of reports have been done on the impact of climate change on the transportation sector, the UK Department of Transportation is one: [www.dft.gov.uk/pgr/scienceresearch/key/thechangingclimateitsimpact01909?page=7#a1007](http://www.dft.gov.uk/pgr/scienceresearch/key/thechangingclimateitsimpact01909?page=7#a1007)
- 6 [http://climate.dot.gov/publications/impact\\_of\\_climate\\_change](http://climate.dot.gov/publications/impact_of_climate_change)
- 7 [http://climate.dot.gov/publications/impact\\_of\\_climate\\_change/html/chapter\\_06.html](http://climate.dot.gov/publications/impact_of_climate_change/html/chapter_06.html)
- 8 CCAP's Urban Leaders Adaptation Initiative: [www.ccap.org/index.php?component=programs&id=6](http://www.ccap.org/index.php?component=programs&id=6)
- 9 Giles T. R. Clarke, (1985) Planning to Solve Urban Conflicts - Jakarta, Indonesia. Cities in Conflict Studies in the Planning and Management of Asian Cities edited by John P. Lea
- 10 John M. Courtney THE WORLD BANK Washington, D.C., U.S.A.
- 10 [www.c40cities.org/bestpractices/transport/jakarta\\_bus.jsp](http://www.c40cities.org/bestpractices/transport/jakarta_bus.jsp)
- 11 [www.toronto.ca/teo/pdf/ahead\\_of\\_the\\_storm.pdf](http://www.toronto.ca/teo/pdf/ahead_of_the_storm.pdf)

Pedestrian Corridor, Jakarta  
Tiyok Prasetyoadi

## Case study 2

### Case study A Strategy for Building Resilience to the Impacts of Climate Change Location Toronto, Canada

#### Summary

In 2007, the City of Toronto adopted its Climate Change Action Plan which includes a targeted reduction in greenhouse gas emissions of 80% by 2050. In adopting the plan, the City Council also called for the development of a comprehensive climate change adaptation strategy and is one of the first cities in the world to do so. In 2008, the City of Toronto released 'Ahead of the Storm - Preparing Toronto for Climate Change', a document designed to engage stakeholders in understanding what can be done to prepare for climate change in order to minimize its impact on Toronto's environment, health and economy. Toronto's leading efforts to address adaptation alongside mitigation will provide a useful case study for other cities around the world.

#### Detail

Toronto City Council has committed over one billion dollars over the next five years to fund projects that will help reduce greenhouse gas emissions. Its comprehensive strategy to respond to climate change, known as the 'Climate Change, Clean Air and Sustainable Energy Action Plan', focuses on activities that reduce greenhouse gas emissions and help prepare for climate change (mitigation and adaptation). Toronto understands that mitigation and adaptation strategies are often complementary and should be developed in tandem in order to best utilise resources and achieve maximum benefit.

Released in 2008, Toronto's first adaptation report 'Ahead of the Storm - Preparing Toronto for Climate Change'<sup>11</sup> focuses on short-term adaptation strategies including those that the city is already undertaking, along with other planned and potential short-term actions. The report also discusses its longer term adaptation strategy by outlining key steps the city will take over the next few years which include:

- 1 Creating the internal mechanisms and processes for the development of a comprehensive, multi-year adaptation process
- 2 Engaging the public, businesses and other stakeholder groups
- 3 Incorporating climate change adaptation into city policies and high level plans
- 4 Use best available science to analyse and forecast how the climate is changing locally
- 5 Use this analysis to identify Toronto's vulnerabilities to climate change
- 6 Conduct a risk assessment to identify priority impacts requiring adaptation action
- 7 Identify and assess adaptation options to reduce the risk
- 8 Develop and implement climate change adaptation strategies
- 9 Monitoring climate change and evaluating the effectiveness of adaptation initiatives to protect the city from continuing changes, adjusting strategies when necessary.

This comprehensive approach will involve stakeholders from across the government, the private sector as well as the general public and will ensure that climate change considerations are incorporated into all of Toronto's policies and programs in future. In recognition of Toronto's role as a world-leading environmental city, Mayor David Miller was appointed chair of the C40 Cities Climate Leaders Group which is a global partnership of major international cities committed to tackling climate change.

#### Further information

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Toronto's Adaptation Strategy Website,  
[www.toronto.ca/teo/adaptation.htm](http://www.toronto.ca/teo/adaptation.htm)  
 Live Green Toronto, [www.toronto.ca/livegreen/](http://www.toronto.ca/livegreen/)



# Water and Sanitation



Context

Patricia Avila

During the 20th Century, many cities developed in places with limited availability of water and in order to satisfy the needs of a growing population, they had to exploit surface sources (e.g. spring, rivers, lakes), subterranean sources (e.g. aquifers) and in some cases (e.g. the middle east) to desalinate seawater. This resulted in ongoing water crises in some cities where at times, supply wasn't available to meet demand. Such cities are referred to as "thirsty cities"<sup>1</sup> and they include: Mexico City, Los Angeles, and Cairo, which have all suffered high water stress due to limited availability and high demand.

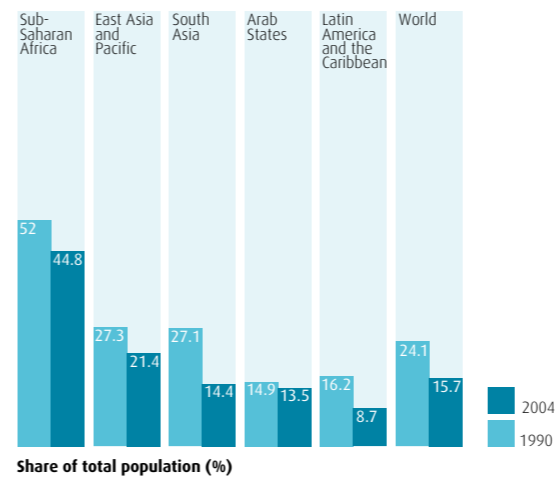
According to the UN<sup>2</sup> the problems of inadequate water and sanitation are most acute in developing countries. In 2004 reports suggest that around 1.1 billion people had inadequate access to water and 2.6 billion lacked sanitation with above

average difficulties experienced in Africa and Asia (figure 1). In most developing countries, water and sanitation crisis is considered above all, a crisis for the poor. Almost two out of three people who lack access to clean water globally have to survive on incomes of less than US\$2 per day, with one in three living on less than US\$1 a day. More than 660 million people who lack sanitation live on less than US\$2 a day, and 385 million live on less than US\$1 a day.<sup>2</sup> In cities, the lack of water for drinking and sanitation largely affects the poor who are forced to live in settlements where water supply is intermittent or unavailable. This forces many to buy bottled water at high relative cost, placing additional financial burden on already limited incomes.<sup>2</sup>

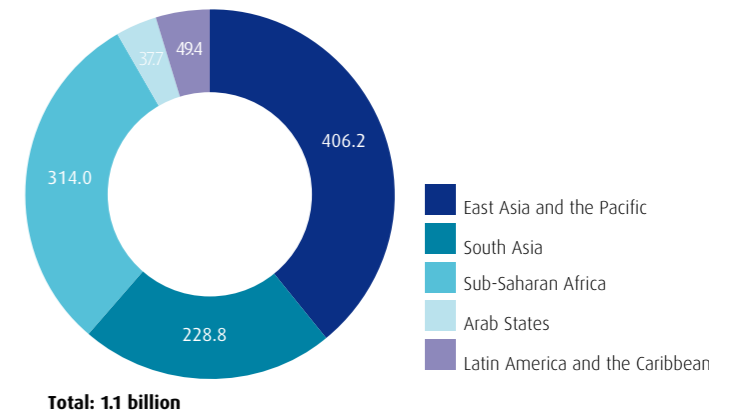
In addition to this situation, in the 1990s, international initiatives introduced by the World Bank and other intergovernmental agencies advocated new forms of water management encouraging greater participation from the private sector. As a consequence, social tensions and civic movements emerged, opposing the privatisation of water and the participation of transnational businesses in its management. One example is the Water War in Cochabamba in Bolivia, where protests around high costs and inadequate service led to civil unrest and demands for the private operator to leave. Another similar example can be found in Uruguay where widespread protest led to parliament passing an amendment to the constitution preventing future private sector participation in the water sector.

Nevertheless, the current trend remains toward a greater presence of the private sector in the urban management of water, a trend which is of concern to many civic initiatives which maintain that fair access to water should be considered a human right.

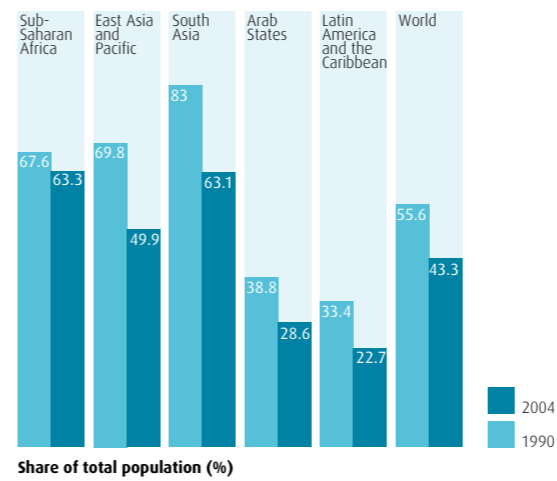
People with no access to an improved water source



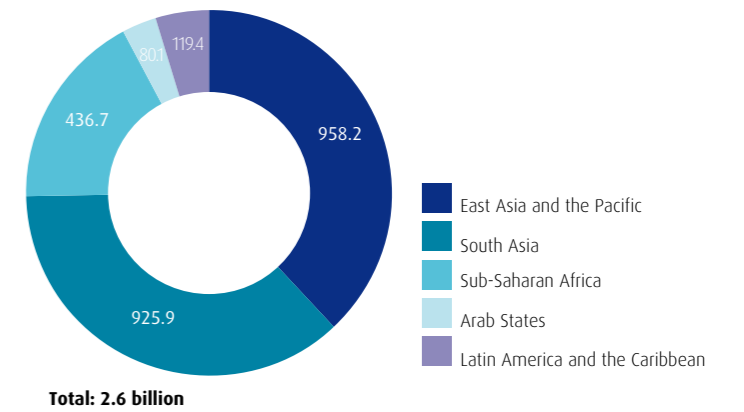
People with no access to improved water in 2004 (millions)



People with no access to improved sanitation



People with no access to improved sanitation in 2004 (millions)



Source United Nations (2006), Human Development Report <sup>40</sup>

In general, vulnerability to climate change impacts will largely depend on the capacity of each city or country at the technological, social, political, and economic levels to mitigate their exposure to risk.

## Challenges

As urban populations grow over the coming decades, so too will demand for water and where supplies are limited, this will lead to increased water stress. Growing populations will also increase the volume of sewage produced which, if not appropriately managed, could lead to increased contamination of rivers, lakes, aquifers and oceans. Social conflicts will also emerge and intensify in cities where economic difficulties prevent the development of adequate water and sanitation services.<sup>3</sup>

The challenge of providing clean water and sanitation in cities becomes more complex still when we also consider the impacts of climate change.<sup>4</sup> Cities will be more exposed to risk from the increasing frequency of extreme weather events causing droughts and floods. Rising sea levels will present particular challenges for coastal cities threatened by flooding and saline contamination of the aquifers relied on for water supply. Climate change will also affect the availability of water in many cities which rely on rivers formed by the glacial melt water in mountainous regions like the Himalayas and the Andes. In general, vulnerability to climate change impacts will largely depend on the capacity of each city or country at the technological, social, political, and economic levels to mitigate their exposure to risk. Capacity to mitigate risk and recover from disasters caused by climate change will therefore differ between developed and developing countries.

Effective governance of water resources will require the introduction of new forms of urban management which ensure the human right to water is maintained for all. Sustainable water management will require long term vision, effective conflict resolution, joint management (public, social,

private) and civic participation in decision making to ensure equitable access to increasingly strained resources. Effective appraisal of ecosystem services will also be required in city planning (such as the provision and the regulation of water) to ensure a balance is struck between environmental conservation (e.g. of forests, mangrove swamps, lakes) and the demand for adequate water supply.

Over the coming years, it will be necessary to move beyond the current approach to satisfying growing water demand through technological approaches such as exploiting deeper aquifers; building larger storage facilities, diverting and channelling water from more distant sources. Instead, the challenge will be to ensure more efficient and sustainable use of existing water supplies. This may be achieved through improving distribution networks (to reduce losses from leaks), introducing water saving devices, enhancing water re-cycling systems and processing more urban waste with less water. Rather than focus on increasing supply, it is fundamental that we focus our efforts on reducing water demand in our cities and adopting a culture of care and protection of water resources, at urban and domestic level.

<sup>1</sup> Anton, Danilo (1996), *Ciudades sedientas: agua y ambientes urbanos en América Latina*, UNESCO CIID-Nordan, Ottawa

<sup>2</sup> United Nations (2006), *Human Development Report: Beyond scarcity: power, poverty and global water crisis*, UNDP.

<sup>3</sup> UNESCO (2006), *Urban Water Conflicts*, International Hydrological Program.

<sup>4</sup> Intergovernmental Panel on Climate Change. (2008) *Climate change and water*, WMO-UNEP.

<sup>5</sup> Marañón, Boris. (2004). 'Participación del sector privado en la gestión del agua en el Distrito Federal' in Tortajada, Cecilia et al, *Hacia una gestión integral del agua en México: retos y alternativas*, Miguel Angel Porrúa, México.

<sup>6</sup> CNA, *Statistics on water 2005: water of the valley of Mexico and the Cutzamala System: region XIII*, Semarnat, Mexico, 2006.

<sup>7</sup> Ávila, Patricia. (2007) 'La cuestión del agua en las ciudades mexicanas' in *Ciudades*, núm. 73, enero-marzo, Red Nacional de Investigación Urbana, México.

<sup>8</sup> Castelan, Enrique. (2002) *El manejo del agua en la zona metropolitana de la ciudad de México*, Research report, Third World Centre for Water, Mexico.

<sup>9</sup> Magaña, Víctor y Carlos Gay García. (2002) 'Vulnerabilidad y adaptación regional ante el cambio climático y sus impactos ambientales, sociales y económicos' en *Gaceta ecológica*, núm. 65, México.

<sup>10</sup> Ávila, Patricia. (2008) *El manejo del agua en territorios indígenas en México*, Serie del Agua en México, vol. 4, World Bank, México.

<sup>11</sup> The author was a member of the jury of the Latin American Water Tribunal in March of 2006, in which 13 cases of water conflicts in Latin America were analyzed.



## Solutions must consider social and environmental impact and strike a balance between the needs of urban and rural areas.

### Case study 1

**Case study** Resolving water crisis and conflict between Mexico City and its rural surroundings.  
**Location** Mexico City, Mexico

#### Overview of the problem and solution

The metropolitan area of Mexico City (MAMC) is the largest urban settlement in the country and dates back to pre-Hispanic times. Settled in the Mexico Valley in a closed basin, the city was established in an area which included several lakes such as lake Texcoco. In the 17th Century, in order to prevent flooding, the city's Spanish inhabitants began to desiccate the lakes with the construction of the Nochistongo Tajo canal to drain water from the Mexico Valley. During the 19th Century, other projects were undertaken to drain the lakes and channel and export residual waters to the Cuautitlan-Tula river.<sup>5</sup> This new infrastructure altered the hydrological characteristics both within and outside the basin and generated numerous social and environmental changes including the loss of wetlands and biodiversity.

Following the Mexican Revolution of 1910, the city experienced unprecedented demographic and urban growth eventually covering much of the former lake basin. In the late 20th century the MAMC had spread to cover an area of over 5000 km<sup>2</sup>, with 35 municipalities and 20 million inhabitants, becoming the world's most populated city.<sup>6</sup> To supply water to this growing population, the city adopted a hydraulic model that made use of new technology to extract groundwater from the deep wells in the Valley of Mexico and to import it from the nearby Lerma and Balsas river basin using dams, channels and pumping networks.<sup>7</sup>

Today, the MAMC consumes over 62 cubic metres of water every second (m<sup>3</sup>/s), 42m<sup>3</sup>/s of which comes from the deep well network (within the basin) and 20m<sup>3</sup>/s imported from the Lerma and Balsas river basins.<sup>8</sup> However, almost one quarter (13 m<sup>3</sup>/s) is lost through leakage in the drinking water distribution network<sup>5</sup> and less than 5% of the water consumed in the MAMC is reused.<sup>6</sup>

In terms of water stress, the MAMC ranks very high, demanding more water (108%) than is actually available within its own basin. Water availability in the MAMC is around 84 m<sup>3</sup>/inhabitant/year compared to around 4,505 m<sup>3</sup>/inhabitant/year nationally.<sup>6</sup> To remedy this stress, the amount of water imported from other basins is increasing.

The hydraulic model implemented in the MAMC is having serious social and environmental implications both within and outside the basin. Aquifers are being overexploited (more water is extracted from deep wells than is being replaced by rainfall) and this is contributing to the city's subsidence (7.5 m in 100 years).<sup>8</sup> Importing water from outside of the basin is leading to ecological damage of wetlands and increasing poverty among the indigenous population. Much of the wastewater (49 m<sup>3</sup>/s) from the MAMC is drained into the Cuatitlan-Tula river (in the Pánuco river basin) and is highly polluted by urban and industrial waste. This causes damage to ecosystems, agricultural production, and public health and requires a considerable amount of energy to pump the wastewater towards the Pánuco river basin.

The transfer of water from the Balsas river basin to MAMC demands a considerable amount of energy for pumping and re-pumping water. For example, in the Cutzamala system which is one of the largest pumping systems in the world, water needs to be pumped over 140km and raised over 1100m to supply the MAMC. To achieve this, 102 pumping stations use nearly 4,000 million Kwh/year.<sup>8</sup> Energy use in the Cutzamala system cost US\$130m in 2004<sup>6</sup>, representing around 86% of the system's total operating cost.

The MAMC is highly vulnerable to the impacts of climate change. Decreased rainfall can exacerbate water supply shortages both within its own, and in neighbouring basins.<sup>9</sup> Extreme climatic events, such as storms and extraordinary precipitation could potentially cause the collapse of deep drainage systems and result in dramatic flooding to critical level – a situation aggravated by the fact that the MAMC is settled in a zone that was part of a lake system until just a century ago. The MAMC is also vulnerable to energy crisis as it depends on the national electricity network, supplied by hydroelectric dams (which are themselves vulnerable to climate change) and thermoelectric plants which are dependent on fossil fuels. Likewise, the MAMC is vulnerable to changes in land use and increased deforestation inside and outside the basin, which can lead to decreased infiltration and increased runoff.

The current problems with water are critical and increasingly becoming the source of conflict as inhabitants of the MAMC and its surrounding basins have diminishing access to water, which hampers development and increases poverty. As a consequence, water conflicts have arisen, largely as a result of the transfer and drainage of water between basins. For example, in recent years the Cutzamala system has been a source of social conflict with the indigenous population of the Mazahua region. With springs and rivers increasingly polluted, the Mazahua are suffering water stress, with agricultural water use being restricted to just rainwater.<sup>10</sup> As a result, the Mazahua have mobilised and confronted both Federal and State government in Mexico through collective action which has included the occupation of offices, food and water strikes, street demonstrations and permanent protest camps at water system facilities.

#### Leadership which made it possible

Social mobilisation has been supported through the collective leadership of an indigenous women's movement. The women have demanded more equitable access to drinking water, along with compensation for damage caused by 30 years of having their water supply diminished to feed the growing thirst of Mexico City. They have also been demanding better ecological protection of the basin through the regeneration of forests which are the main water recharge areas. Despite the efforts of the Mazahua women's movement who have proposed the implementation of a program for sustainable regional development, economic support provided by the State has been minimal. This lack of support is largely due to the absence of a policy for compensation and a lack of a formal system for valuing the ecosystem services provided by supplying water from indigenous people's territory. In a recent World Bank evaluation of public policies in indigenous regions, the Mazahua region was reported to have received US\$5 per inhabitant, per year, for drinking water and sanitation infrastructure, an amount that is insufficient for solving the current problems.<sup>10</sup>

Faced with lack of recognition for the human right to water and the absence of a policy for compensating the Mazahua region for the benefits it has provided to Mexico City, the movement turned to the Latin American Water Tribunal which whilst not legally binding, is an ethics tribunal established to resolve water conflicts and support environmental and human rights. During the first session of the Tribunal in 2006, representatives of the Mazahua women's movement presented their case, documenting how human rights had been violated by federal and state governments in the Cutzamala system. Members of the jury<sup>11</sup> analysed the case and reached a final verdict emphasising the need to respect the human right to water and recommending the cancellation of project expansions of the Cutzamala system and the awarding of compensation to indigenous inhabitants for the damages incurred by the transfer of water to Mexico City. This verdict lends strong support to the Mazahua's proposals for environmental justice, may assist future negotiations and draws wider international attention to their worsening situation.

On their own initiative, the Mazahua women have promoted a number of projects as part of a plan for sustainable regional development. These include projects supporting water infrastructure development, the introduction of firewood saving stoves, greenhouses, organic agriculture and reforestation. Through these initiatives, Mazahua women are demonstrating their local capacity and the importance of more inclusive public policies which benefit rural as well as urban populations. Their efforts emphasise the importance of taking longer-term perspectives which guarantee water security, forest conservation, and organic agricultural production.

In summary, when dealing with water problems such as the MAMC's, it is important to take into account not only the likely impacts of climate change but also the wider social and environmental impacts of sourcing water for expanding urban populations. Individual and collective leadership is essential and solutions must consider social and environmental impact and strike a balance between the needs of urban and rural areas.

# Land Use

## and Urban Planning



It is not always population or poverty alone that drives land use changes but often how a community responds to economic opportunities and how such responses are mediated by various institutional factors.

## Context

**Bharati Chaturvedi and Theresa Subban**

The 2005 Millennium Ecosystems Assessment<sup>1</sup> states that during the second half of the twentieth century, global ecosystems underwent greater changes than at any other time in recorded human history. Largely as a result of human activity, many of these critical changes have occurred as a result of human activity which has converted over 24% of the Earth's terrestrial surface into cultivated systems. For example, in the 30 years after 1950, more land was converted for growing crops than in the entire period 1700–1850.

The massive urban population growth of the past fifty years has placed huge pressures on ecosystems as the growth of cities demands increasing quantities of land for industry, transport and leisure activities across the world.<sup>2</sup> In China about five million

hectares of farmland were transformed into towns and cities during 1972–1992 and in the USA around 400,000 hectares of farmland are lost to urbanisation every year.<sup>3</sup> Clearly this trend is unsustainable and the desire to satiate human wants and lifestyles in this way and at this rate is far exceeding the wise use of natural resources. If we are to manage land use development more sustainably, it is essential that we better understand the key drivers for land use change.

Reasons underlying changes in land-use are often over-simplified and as a consequence provide a flawed basis for environmental and development policy. It is not always population or poverty alone that drives land use changes but often how a community responds to economic opportunities and how such responses are mediated by various institutional factors. Some drivers operate on different spatial and temporal scales, and this makes their assessment and management more practically and politically complex. For example in a country like South Africa, where the majority of the population have long been deprived of access and rights to land, changing concepts of social justice have become a strong driver which could have significant implications for future changes in land use. However, while opportunities and constraints for new land use are created by local as well as national markets and policies, it is often global forces which become the main determinants as they amplify or attenuate local factors.

Land degradation problems are directly related to land use practices, especially where city boundaries have extended into urban sprawl to accommodate new housing development, industry, and intensive agricultural practices. Therefore a call for innovative land use management and spatial planning systems is paramount to reverse the unwise and unsustainable use of land resources.

## Challenges

Whilst there has been much recognition of the negative impacts human activity has caused through changes in land use, initiatives designed to prevent or slow land degradation through better land management have often demonstrated little success. If we are to ensure more sustainable land use management and planning there are still many challenges which need to be addressed.

For example, development priorities for poorer countries tend to focus on what are considered more pressing issues such as unemployment, low economic growth, poverty alleviation, provision of infrastructure and affordable housing. As a result dedicated efforts to move towards integrated planning are often compromised. Conventional land use planning has also frequently failed to produce substantial improvements in land management or to satisfy the priority objectives of land users. In recent years planning has come to be viewed as just one step in the land resource management process and more as a mechanism for decision support than a technical evaluation procedure. An improved approach should call for integrated planning to enable sustainable management of land resources.

Land use information is critical for making well informed decisions and for undertaking studies to help us understand issues such as food security, desertification, land degradation and climate change. However, many countries suffer from a paucity of such land use information and the quality, availability and applicability of locally produced land use data can be severely limited. Sustainable land management also increasingly requires knowledge of land use dynamics over time in order to simulate

economic, social and environmental development scenarios. Remote sensing data can provide objective, exhaustive and consistent information which is essential for generating such simulations. As with land use information, in many developing countries availability of such data is often limited due to shortages in the necessary skills and capacity to gather and use it. This is a particular challenge at the local government level where most land management issues are practically addressed.

Spatial planning needs to move beyond traditional land use planning and be deployed as a tool to integrate land use policies. To create sustainable communities, we must move beyond a narrow, sectoral approach to land management and find new ways of thinking to ensure better stakeholder collaboration, communication, training, knowledge, learning, and ways of working. Planning practices are changing and city planning with integrated land use and spatial plans will be pivotal in coordinating, managing and orchestrating change to create sustainable growth paths for cities.



Opposite Large sections of the Mexico City Centro Historico and new suburban centres are heavily guarded by the police and private security firms creating an atmosphere of tension in the public spaces of the city.  
© Paolo Rosselli - Courtesy of Urban Age, London School of Economics, www.urban-age.net

## Case study 1

### Case study eThekweni Municipality Location Durban, South Africa

#### Overview of the problem and solution

The move towards integrated local action to address climate change in the city of Durban in South Africa represents an important shift towards a more innovative approach to building sustainable communities. This case study reviews the process being undertaken in Durban and its surrounding urban municipality, exploring how strong leadership enabled a more integrated, transdisciplinary approach to be implemented at local government level. It focuses on efforts being undertaken both in the city and the wider urban municipality of eThekweni, which is the local government authority responsible for governing the growing population of 3.5 million in a rich mix of racial, cultural and natural resources.

The relationship between urban form and sustainability is currently one of the most hotly debated issues on the international environmental agenda. This is particularly the case given the strong link between spatial planning, land use and climate change. The way cities should develop in the future, and the effect their form can have on resource depletion and social and economic sustainability, are central to this debate. Integrated Development Planning is the leading local planning instrument now used in South Africa. It provides municipalities with a tool to align budgeting and project implementation with strategic priorities. It also allows for linkages and coordination across the growing number of sectoral plans, programmes and projects at the municipal level. The Integrated Development Plan (IDP) was first introduced in 1996 in an

amendment to the Local Government Transition Act.<sup>4</sup> The timing of the legislative requirement that all transitional local councils prepare an IDP is significant, as 1996 was the year when the attention of the new African National Congress (ANC) led government shifted away from the reconstruction of national and provincial government towards the creation of a new system of local government.

eThekweni's IDP is a document produced through the coordinated effort and outputs of the city's many different sectors. More importantly, it is developed in consultation with other government and civil society partners and a range of different stakeholder groups representing: Business; Labour; Women's groups; People with Disabilities (PWD's); Ward committees; Amakhosi (traditional leadership); Non-governmental organisations (NGOs); Faith based organisations (FBOs); Provincial, National and Parastatal organisations. Transdisciplinary teams are drawn together to work on projects with urban planners at the forefront leading the process by drawing on a mixture of strategic planning and transdisciplinary training backgrounds.

In a historical context, this is a significant shift for a place where the majority of the population used to be excluded from the city on purely racial grounds. This approach seeks to break down traditional disciplinary boundaries and involve many of the people and organisations who are able to contribute to, or are likely to be affected by the plan and encourages a stronger sense of ownership and integration across the city. Integrated spatial planning, land use and climate change are all identified as strategic focus areas within the IDP, thereby reflecting their significance at the highest level of city strategy in the municipality.

Within the context of the South African IDP, development and investment choices are guided by a Spatial Development Framework (SDF). At the next level down, Spatial Development Plans (SDPs) cover specific regions of the municipal area in greater detail with Local Area Plans (LAPs) providing guidance at district level.

The SDF is the underlying document that steers the implementation of the all the city's special development programmes, integrating municipal spatial strategies covering economics, transport, environment and society. By connecting resources, expenditure and action across the municipal area, it is hoped that the city will facilitate sustainable growth, whilst ensuring that the inequitable, inefficient and unsustainable consequences of past development patterns are avoided in future.

Durban promotes a 'compact city' model, advocating increasing the density of inner city development whilst ensuring 'urban edges' are defined to limit sprawl and encourage stronger scrutiny of any proposed extension of infrastructure into rural agricultural land. Defining an 'urban edge' not only helps to protect environmental assets but also prevents inefficient expenditure on infrastructure. The concept indicates the boundary within which it is both optimal and sustainable to provide additional services and serves as a decision support tool to ensure more efficient public service expenditure in the municipal area. An important and significant innovation to the SDF is the requirement that all development proposals demanding the extension of infrastructure into new areas, will need to be filtered through an assessment framework to ensure the cost effectiveness, sustainability, and best interests of the city are maintained.

A key requirement of the compact city is that residential, employment and recreation developments must be co-located, where possible through the development of mixed use zones. In this regard, the city's land use management system is a crucial component of the integrated spatial planning system, ensuring appropriate land use zones and controls are in place to implement these mixed use zones. Accordingly, a single land use scheme framework is now being developed for the city to replace the former apartheid planning schemes which were characterised by urban sprawl, low density development and fragmentation of the urban space. This scheme will help begin to improve historically under-invested areas, which were formerly excluded from official city boundaries, bringing them into a land use management system which ensures their appropriate and sustainable management. Aligning with the hierarchy of plans, the single land use scheme will support greater intensity of urban land use and offer more opportunity for sustainable lifestyle choices. For example, better provision of infrastructure for cycling and walking, offering potential for reductions in air pollution and greenhouse gas emissions. In this way and in others, an integrated land use management system can be play a key role in mitigating the city's impact on global climate change.

#### Leadership which made it possible

The development of this plan showed the important role played by urban planners who have led many of these processes with strong trans-disciplinary working teams and is a clear example of how leadership can stimulate positive action addressing climate change.

In response to Durban's adaptation plans and processes at a municipal level, the city's environmental management department has also taken a lead role. The department has worked collaboratively with the IDP team to locate climate change as a strategic priority in the IDP and initiate the 'Climate Future for Durban' programme together with the Council for Scientific and Industrial Research (CSIR).

The 'Climate Future for Durban' programme was undertaken from 2004–06 over three phases. Firstly, it began by reviewing and developing local understanding of global and regional climate change science and the implications of climate change for Durban. Secondly, a 'Headline climate change adaptation strategy' was developed for the city, to highlight how key sectors within the municipality should begin responding to the unavoidable impacts of climate change. Thirdly the programme began a process of incorporating climate change impacts into long term city planning. The municipality and CSIR worked with the UK based Tyndall Centre for Climate Change Research to develop a model enabling the simulation, evaluation and comparison of strategic urban development plans in light of anticipated climate change impacts. Helping to develop a deeper understanding of the effects of greenhouse-gas emissions, the model will enable better technical assessment of alternative strategic approaches to climate change mitigation and adaptation.

## Case study 2

### Case study St. Petersburg's Green Spaces Location St.Petersburg, Russia

#### Overview of problem and solution

Since 2000 the problem of diminishing areas of green space in St. Petersburg has become increasingly concerning. New housing developments, integrated within existing residential areas (or so called "compressing construction") is increasingly encroaching into parks, sidewalks and other public spaces. These together with other pressures on public green spaces such as legal (and illegal) parking lots are now familiar to any large city, particularly during periods of economic or demographic growth. In St. Petersburg the deterioration of green areas has risen to as much as 30% losses a year in some of the most prestigious districts and is largely due to the lack of appropriate land use regulation, zoning and enforcement regulations. Almost all land in the city has traditionally been managed by the state, with few privately owned properties and parks and few delimited borders, many valuable sites were not even officially considered to be parks. In 2003, citizens groups were struggling to protect around 100 hotspots across the city from urbanisation, many of them small gardens threatened to be built on as they were not officially recognised by the state.

In 2001, the St Petersburg Society of Naturalists (ECOM), concerned about this issue, undertook three years of public discussions, research and campaigning, leading to a solid understanding of the problem and the recognition that there was a need for effective municipal regulation. Following several unsuccessful attempts, in 2003 ECOM made contact and began working with deputies in the city government to develop legislation that would protect green areas. The legislation entered into force in June 2004, establishing various rules and obligations and directly prohibiting any construction on sites deemed to have recreational function. However, the problem wasn't entirely overcome, as there was still debate and uncertainty around which plots should be granted protected area status. Immediately following approval of this first legislation, the working group in the city

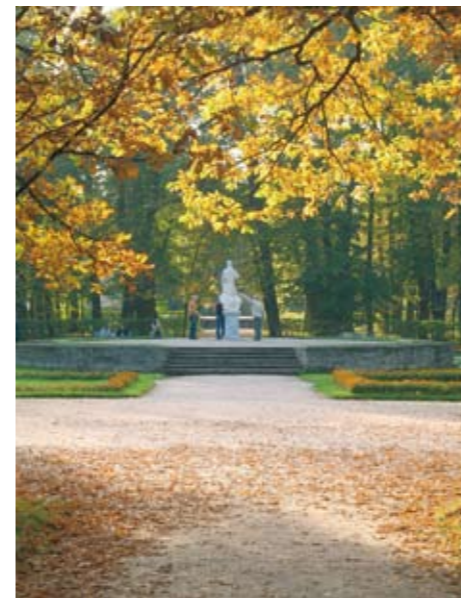
government's legislative assembly (LA) launched an initiative to protect all existing (but formerly unrecognised) city parks and gardens. This was a challenging task as it was expected that designation would be undertaken as part of the land use zoning process carried out by local administrative authorities. Unfortunately, this additional role was not highly prioritised by local authorities, since the lack of explicit rules and guidance provided them with opportunities to decide issues through private agreements which would lead to inconsistent implementation across the city.

#### Leadership which made it possible

Therefore, the legislative assembly decided to take the lead assigning around 1.2 million rubles (US\$400,000) for an initial study – an unprecedented sum for any legislative work. The study identified 1800 sites to be included in the list of 'green spaces for public use' and a final list comprised 2440 plots. ECOM was responsible for promoting a public campaign and citizen involvement. During the first phase they mobilised volunteers to check the green spaces list and later prompted for an open public review of the law while it was being discussed in the city parliament. As a result of this massive campaign, the legislative assembly unanimously approved the legislation, despite political clashes and the lobbying of developers, the Governor supported and signed it off. The law entered into force November 2007.

Prepared by LEAD Fellow Alexander Karpov.

Public activism played a key role in protecting and increasing green areas and parks in St. Petersburg, Russia. © Victor Radzvin





## Case study 3

**Case study** The New Delhi Municipal Council's Waste Management System  
**Location** New Delhi, India

### Overview of the problem and solution

The New Delhi Municipal Council (NDMC) is one of the three municipalities in Delhi. Waste disposal has always been one of its bigger concerns. The challenge for the NDMC was to design and implement a win-win solution for existing informal sector waste recyclers, waste generators and optimize environmental benefits. The NDMC did so by outsourcing door-to-door waste collection to Chintan, a non-profit organisation that facilitated waste-pickers for such waste collection. Thus, the livelihoods of the poor improved, recycling rates increased, and solid waste handling improved considerably. This combination of actions is likely to have a positive impact in the reduction of green house gas emissions.<sup>5</sup>

A new trend in India is seeing the increasing privatisation of solid waste management at almost all the levels-collection, transportation, recycling, disposal. Before this, collection and disposal was primarily the work of municipalities, who collected waste from formal collection points across neighbourhoods. The citizens generating waste were expected to deposit it at these informal dumps where waste-pickers scavenged for paper, plastics, metals etc. All recycling was and continues to be undertaken by the informal recycling sector, saving the municipalities in Delhi over 600,00 rupees each day in labour costs alone.

In the NDMC area, the informal sector waste recyclers collected up to 59% of the waste in the NDMC area, segregated it and sold on to the recycling trade. Such recycling diverted waste being taken to landfills and reduced the associated environmental costs. There was no system to prevent neighbourhoods from disposing of their waste on street corners, where it was either burned or putrefied when collection services were slow. The waste-pickers also worked in unsafe conditions, with huge health risks, often brutalised as illegal entrants into waste management and forced to pay bribes. The sector, through NGOs, is demanding that waste pickers should be included in plans for waste management as equal partners. The NDMC embarked on an inclusive waste management system. A series of contracts were signed with Chintan, which stipulated that the waste pickers would be at the core of the service delivery, for which high performance standards were agreed upon. In all, over 70,000 establishments and households were covered under these plans. The income and occupational safety of the waste pickers increased, as did the recycling rates.

Waste and climate change are closely linked. In India, 60% of total disposable waste is organic, which can rapidly decompose, and release methane gas during the process. Moreover, it is recognised that recycling results in reducing the need for raw materials. In cases such as aluminum, recycling plays an important role by reducing the amount of energy required for its production and also eventually reduce green house gas emissions.<sup>6</sup>

Waste pickers, who are not recognised as formal stakeholders by the recycling sector, undertake both recycling and extensive repair/reuse, making their inclusion in any waste management plan essential. Some estimates suggest that approximately 1% of the urban population in the developing world is engaged in recycling. Many of them are poor minorities, migrating from the rural regions, where ecological and economic collapse is underway. Therefore, their inclusion in such plans is essential both from an environmental and poverty alleviation point of view.

### Leadership which made it possible

The case of NDMC's linkages with Chintan and waste pickers was successful due to leadership at multiple levels. The cornerstone of the project was the leadership displayed by the NDMC. The NDMC is the legal owner of waste once it reaches the neighborhood bins. Any decision related to inclusion is therefore dependant on the NDMC. Moreover, the area where services are being provided by the project is home to politicians, senior officials, policy makers, judges and others decision makers. Therefore, the NDMC is cautious about any new ideas for fear of failure and retribution.

The new laws related to solid waste require segregation of waste and its efficient recycling. Despite intense awareness, very few residents ever separate their recyclable from their organic waste. Bolstered by the guidelines of the Supreme Court that suggest (but does not make mandatory) doorstep collection of waste, the NDMC made this service available to local neighbourhoods. The choice to opt for waste-pickers instead of existing contractors displayed leadership because it involved taking risks by supporting a new idea that was to operate using people severely discriminated against which involved doorstep interactions of such people with senior government officials. This also implied disturbing the embedded linkages between municipal workers and the informal sector, a potentially thorny issue. It is notable that the two other municipalities of Delhi have not displayed the same level of leadership.

The initiative could not have been successful if the waste pickers had failed to deliver efficient services. In many parts of the country, NGOs have complained about their inability to train waste pickers to deliver services according to agreed standards. Since waste pickers now have to comply with standards and collection criteria, the new work is actually a shift away from traditional waste picking. Chintan invested in waste-pickers social organisation, so leadership amongst this group had already been nurtured. This raised waste-pickers' profile to a level which led NDMC to notice and acknowledge their role as environmental service providers. This in turn helped them to work collaboratively and ensure standards were met leading to optimal performance. Success was also largely due to the efforts of a few leaders who realised the sense of urgency and the opportunity for action. This process was made possible by the facilitation role played by Chintan who established a relationship with NDMC. Chintan is a non-profit organisation that addresses issues of urban sustainability and environmental justice.<sup>7</sup> It works with the informal recycling sector at both the grassroots and advocacy levels. Helping the wastepickers to shift from being scavengers to managers is a goal of the organisation. Therefore, its leadership was essential to build technical capacity at grassroots level and complement NDMC's own leadership.

<sup>1</sup> The Millennium Ecosystem Assessment (2005). [www.millenniumassessment.org](http://www.millenniumassessment.org)  
<sup>2</sup> UNEP (2002). The Global Environment Outlook Report 3.  
<sup>3</sup> UNFPA (2001). [www.unfpa.org](http://www.unfpa.org)  
<sup>4</sup> Republic of South Africa, 1996: Local Government Transition Act, Act 209 of 1993, Government Printer, Pretoria.  
<sup>5</sup> CHINTAN ENVIRONMENTAL RESEARCH AND ACTION GROUP. Wasting Our Local Resources – The Need for Inclusive Waste Management Policy in India. 2007  
<sup>6</sup> CHATURVEDI, B. Why waste a chance? In Down to Earth. January 15, 2008  
<sup>7</sup> [www.chintan-india.org](http://www.chintan-india.org)



Opposite Tokyo, Japan. © Nick Harrison

## Key messages **1** **2**

### **Build capacity, competency and accountability of local government institutions**

The impacts of climate change, along with many of the solutions required to tackle it, are felt at the local level. Climate change needs to be considered in all aspects of urban development, including any new policy, program or investment. Local governments and local leaders around the world must recognise this and ensure climate change is seriously considered when making decisions about critical urban development and land use.

### **Improve adaptive capacity amongst the poor**

Governments need to be able to better engage and forge partnerships with low income populations. Such groups are likely to be the most harshly affected by climate change and capable local governments are vital to increase cities' resilience to climate change. National and city governments need to focus not only on improving their ability to respond to the early impacts of climate change, but also support measures which reduce their vulnerability to future risks.

## 3

**Integrate climate change into urban network services provision**

Climate change presents new and significant obstacles to the creation of sustainable network based services in urban areas. Competing demands for limited public resources will be further strained by the new challenges associated with climate change. Fortunately sustainable land use planning and strategies to address climate change are not mutually exclusive. Improving diversity, availability, efficiency and attractiveness of network based urban services which are reliable, safe, convenient and affordable are effective approaches to climate change mitigation and adaptation.

## 4

**Adopt innovative and integrated approaches to urban planning**

It is not always population or poverty alone which drives land-use change. Instead it is communities' responses to economic opportunities mediated by institutional and legislative context. Therefore sustainability depends a lot on the innovation and organisational change required to shift away from the traditional 'business as usual' and move towards more intergraded approaches in the provision of urban infrastructure with participation from other sectors.

## 5

**Decarbonise, decentralise and improve efficiency in how we supply and use energy**

Carbon dioxide and other greenhouse gas emissions produced to supply energy are largely responsible for global climate change and we therefore urgently need to make the transition to cleaner, more sustainable energy supplies. Cities are major centres of energy use and therefore governments need to enforce standards ensuring buildings, infrastructure and end-use technology is constructed and operated using energy much more efficiently. Conventional energy supply infrastructure tends to generate electricity in large centralised power stations, transmitting it over long distances which is not only inefficient but lacks flexibility, making end-users dependent and vulnerable to widespread power-outs. We need a rapid transition to more decentralised energy infrastructure and this requires new emphasis in the development and regeneration of our towns and cities.

## Useful links

**British Council Zero Carbon City**

A two-year global campaign concerning global warming and the environmental impact of city living and urban industry, ZeroCarbonCity sponsors events in 60 cities worldwide and a website to educate and involve urban dwellers in climate change mitigation. [www.britishcouncil.org/zerocarboncity.htm](http://www.britishcouncil.org/zerocarboncity.htm)

**International Energy Agency (IEA) Policies & Measures Database.**

A database of over 1,500 records dating back to 1999, the database provides an excellent source of information on climate change mitigation policies (climate change, energy efficiency, renewables and energy) in IEA member countries and also includes some information on policies in Brazil, China, the European Union, India, Mexico, Russia and South Africa. [www.iea.org/textbase/pm](http://www.iea.org/textbase/pm)

**BBC Special Feature**

[http://news.bbc.co.uk/1/hi/in\\_depth/world/2006/urbanisation/default.stm](http://news.bbc.co.uk/1/hi/in_depth/world/2006/urbanisation/default.stm)

**BBC Interactive Map – urban population growth**

<http://news.bbc.co.uk/1/shared/spl/hi/world/06/urbanisation/html/urbanisation.stm>

**London Renewables Toolkit**

A toolkit for planners, developers and consultants providing guidance on integrating renewable energy into new developments. [www.london.gov.uk/mayor/environment/energy/docs/renewables\\_toolkit.pdf](http://www.london.gov.uk/mayor/environment/energy/docs/renewables_toolkit.pdf)

**ICLEI Local Governments for Sustainability**

ICLEI Local Governments for Sustainability is an international association of national and regional government organisations that have made a commitment to sustainable development across over 800 cities and towns they manage. Website includes useful case studies, publications, technical guidance and toolkits. [www.iclei.org](http://www.iclei.org)

**Cities for Climate Protection**

The Cities for Climate Protection (CCP) Campaign assists cities to adopt policies and implement quantifiable measures to reduce local greenhouse gas emissions, improve air quality, and enhance urban livability and sustainability. <http://www.iclei.org/co2>

**C40**

The C40 group of the world's 18 leading cities feature energy related best practice examples on their website. [www.c40cities.org/bestpractices/energy/](http://www.c40cities.org/bestpractices/energy/)

**European Urban Knowledge Network**

The European Urban Knowledge Network (EUKN) shares knowledge and experience on tackling urban issues and the e-library includes various resources around energy. [www.eukn.org/eukn/themes/index.html](http://www.eukn.org/eukn/themes/index.html)

**ManagEnergy**

An initiative of the European Commission Directorate-General for Energy and Transport, which aims to support the work of actors working on energy efficiency and renewable energies at the local and regional level. Includes sectoral advice, training, workshops and online events. Over 600 case studies, good practice guides and information on EU legislation and programmes. [www.managenergy.net](http://www.managenergy.net)

**Intelligent Energy**

European Union programme for funding action to improve market conditions to save energy and encourage the use of renewable energy. [http://ec.europa.eu/energy/intelligent/index\\_en.html](http://ec.europa.eu/energy/intelligent/index_en.html)

**Energy and the city person**

[www.yale.edu/ynhti/curriculum/units/1981/5/81.05.08.x.html](http://www.yale.edu/ynhti/curriculum/units/1981/5/81.05.08.x.html)  
[www.ren21.net/](http://www.ren21.net/)  
[www.reegle.info](http://www.reegle.info)  
[www.worldchanging.com/cities/](http://www.worldchanging.com/cities/)  
[www.biofuel-cities.eu/](http://www.biofuel-cities.eu/)  
[www.renewableenergyworld.com/rea/news/story?id=48605](http://www.renewableenergyworld.com/rea/news/story?id=48605)  
[http://concertoplus.eu/CMS/component?option=com\\_frontpage/Itemid,239](http://concertoplus.eu/CMS/component?option=com_frontpage/Itemid,239)  
[www.concerto-sesac.eu/](http://www.concerto-sesac.eu/)  
[http://ec.europa.eu/energy/intelligent/index\\_en.html](http://ec.europa.eu/energy/intelligent/index_en.html)

**Sustainable energy communities**

[www.belief-europe.org](http://www.belief-europe.org)

**Sustainable Energy Europe**

[www.sustenergy.org](http://www.sustenergy.org)

**Energie-Cites**

[www.energie-cites.eu/](http://www.energie-cites.eu/)  
[http://ec.europa.eu/energy/intelligent/index\\_en.html](http://ec.europa.eu/energy/intelligent/index_en.html)  
[www.bise-europe.org](http://www.bise-europe.org)

**European energy award**

[www.european-energy-award.ie](http://www.european-energy-award.ie)  
[www.zayedfutureenergyprize.com](http://www.zayedfutureenergyprize.com)

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### Bharati Chaturvedi, LEAD India

Bharati Chaturvedi is the founder and director of Chintan Environmental Research and Action Group. Her idea of founding Chintan was an attempt to engage in a partnership between the urban poor in the informal sector and people like herself (English speaking, urban elite, with community organising, policy advocacy and research interests). The objective was to find ways to foster a sustainable city, but also one that could put the poor at the centre of its decision making. Bharati felt the need for a Chintan-like space because it would allow her intellectual freedom, and offered her freedom from the rhetoric of received wisdom and politically correct constructs. Apart from her daily involvement with Chintan, Bharati also writes on environmental and development issues. You can read her weekly column, Earthwatch, published every Monday, in the Hindustan Times. She talks about these issues widely, in India and internationally, as part of her advocacy and outreach. Prior to Chintan, Bharati was one of the founders of Srishti, an environmental group that finds its origins in Delhi University, formed by students to address various environmental concerns. This enabled her to research and address issues of the urban environment and toxics when they were relatively new in the Indian context. Bharati has a Master's Degree in History from Delhi University as well as a Masters in International Public Policy from the School of Advanced International Studies (SAIS), Johns Hopkins University.

### Nick Harrison, LEAD Europe

Nick has worked for over a decade in public, private and non-governmental sectors researching, developing and promoting skills, knowledge and behaviour for delivering sustainability and tackling climate change. He has broadcasted and published widely and received numerous awards for innovation. In 2007 whilst training with LEAD Europe, Nick was also awarded a fellowship from the Norfolk Charitable Trust and undertook a study tour travelling internationally to explore the views of leaders in government, business and civil society about climate change and energy policy in the global economy ([www.energypolicyclimate.org](http://www.energypolicyclimate.org)). As Head of Evidence at the South West Centre for Excellence in Sustainable Communities, Nick coordinated & steered various projects for the UK Office of the Deputy Prime Minister championing organisational change among local strategic partnerships and NGOs to improve the sustainability of regeneration and

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### Tiyok Prasetyoadi, LEAD Indonesia

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### Melita Rogelj, LEAD Europe

Melita's primary focus is developing entrepreneurial strategies for organisations to shift operations towards environmental, social and financial sustainability using sustainable development strategies and policies. At the Regional Environmental Centre for Central and Eastern Europe (REC), her responsibilities grew to the successful management and coordination of projects of a large number of donors and other stakeholders including the European Commission's Phare and Tacis Programmes, the World Bank, the OECD and UNEP. Currently she is working on project development and assistance to renewable energy providers to install solar, wind, hydro and biomass in Europe, including South East Europe, Western Balkans, Central Asia and Russia. Her ongoing work is in education, training and development projects including policy reviews and assistance to EU candidate countries and regions towards developing eco-innovations, entrepreneurship and fully integrated sustainable development strategies. Within that context she is introducing sustainable development principles, innovations and policies into education curriculum in MBA programs in several universities in Europe by defining correlations between scientific and technological with social and organisational innovations translated into social responsibility practices and entrepreneurial projects in renewable energy and sustainable consumption.

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Erin currently works as a Senior Policy Analyst with the climate change negotiations group at Environment Canada. Prior to joining the Government of Canada, Erin worked for the Center for Clean Air Policy (CCAP), a Washington DC based environmental policy think-tank. At the Center, Erin contributed to both the international and domestic climate change policy programs undertaking work ranging from developing guidance for the Government of New Zealand on national GHG mitigation policy to analysing the feasibility of sustainable transportation initiatives as CDM projects under the Kyoto Protocol. As the Program Manager for CCAP's Urban Leader's Adaptation Initiative, Erin worked with several large city and county governments to increase their capacity to build resiliency to the impacts of climate change through effective policy and investment decision-making. Erin holds a Master's of Environmental Design (Urban Planning) from the University of Calgary and an Honours Bachelor of Science (Environmental Science) from Queen's University.

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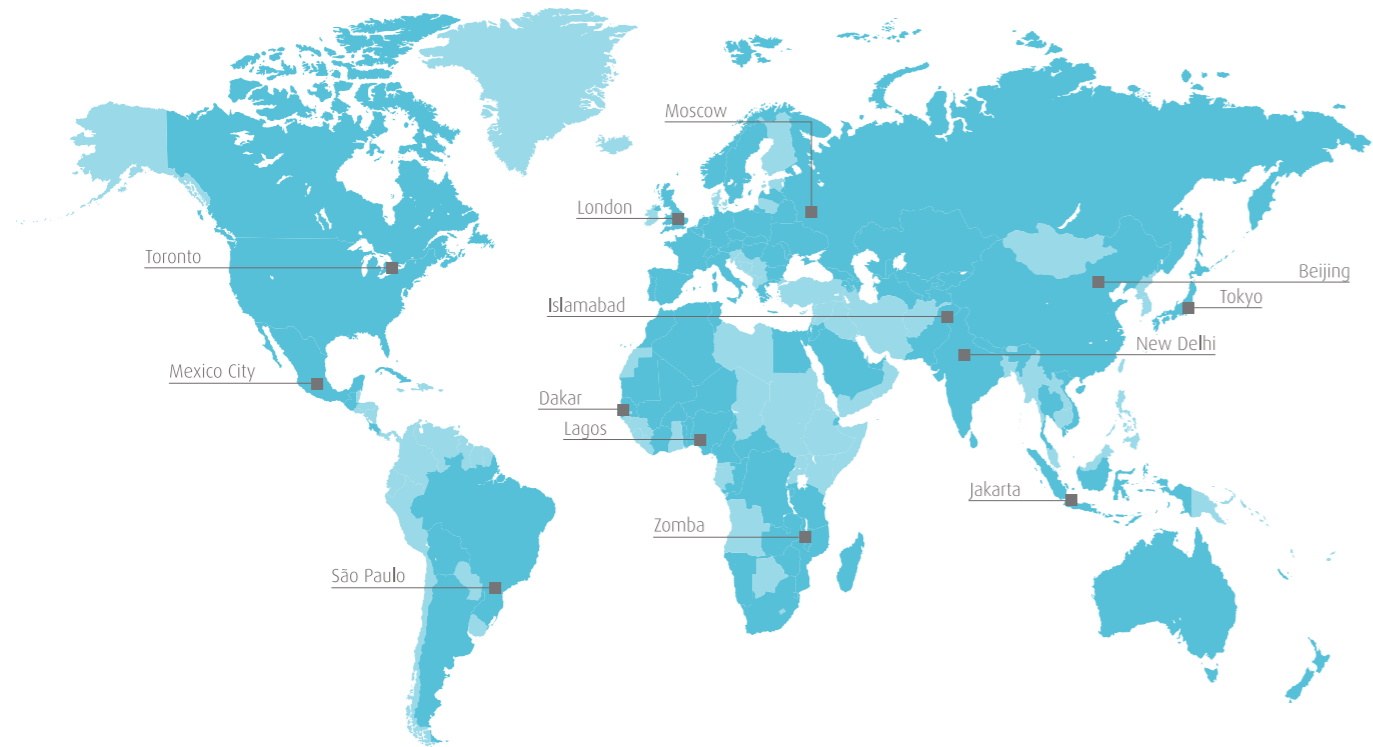
## About LEAD

LEAD is the largest non-profit organisation in the world focused on leadership and sustainable development. Founded in 1991, LEAD's main objective is to train emerging leaders from different sectors, cultures and nationalities around the world to play an active role in making sustainable development a reality. LEAD does this through its 13 national and regional Member Programmes, coordinated by LEAD International in London. LEAD has an alumni of 2,000 Fellows who have been through the training programme.

LEAD also runs short courses and provides training services to both public and private sector organisations. In order to maximise its impact on sustainable development, LEAD works with its Fellows to deliver projects and programmes in four key areas:

- **Leadership and Climate Change**
- **Sustainable Cities**
- **Sustainability in Business**
- **Poverty alleviation and Environment**

LEAD strongly believes that sustainable development is achievable if the new generation of leaders from business, government, NGOs, academia and the media across the world can be motivated, equipped and linked to make it happen. This is our mission.



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