

Energy and Urban Innovation

Executive Summary
World Energy Council



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People generally prefer to be in a city slum rather than in a remote rural area, as the city provides more economic opportunities and better health and education benefits.

Introduction

This report outlines the energy-related challenges that cities, particularly large and “mega-cities”, will face during the coming decades. It analyses the technical and policy actions that must be taken to meet these challenges and the role the energy industry and business can play in designing and implementing efficient solutions. The report is the result of a bottom-up process in which World Energy Council members carried out case studies on a comprehensive set of large to “mega” cities, both in the developed and emerging world. It is complemented by an extensive literature study.

An expanding number of large cities face significant energy-related challenges now and in the future. **Technical and policy actions must be taken in order to meet these challenges.** In this context, energy companies play a crucial role in the design and implementation of efficient solutions. The report studies the growth, development, and energy-linked issues of large cities, develops concepts for a secure and sustainable energy supply and distribution system, including transportation, and recommends norms and the necessary steps to ensure sustainability. Cities studied include Tokyo, Mexico City, Delhi, Toronto, Shanghai, Cape Town, London and Paris (a comparison), and the San Francisco Bay Area. The report contains data, facts, analysis and proposals concerning: urbanisation and the challenges for a sustainable energy supply (Chapter 1), assessments of the potential and costs of innovative urban technologies (Chapter 2), and descriptions of the “policy packages” aimed at

overcoming the problems associated with cities (Chapters 3 to 5).

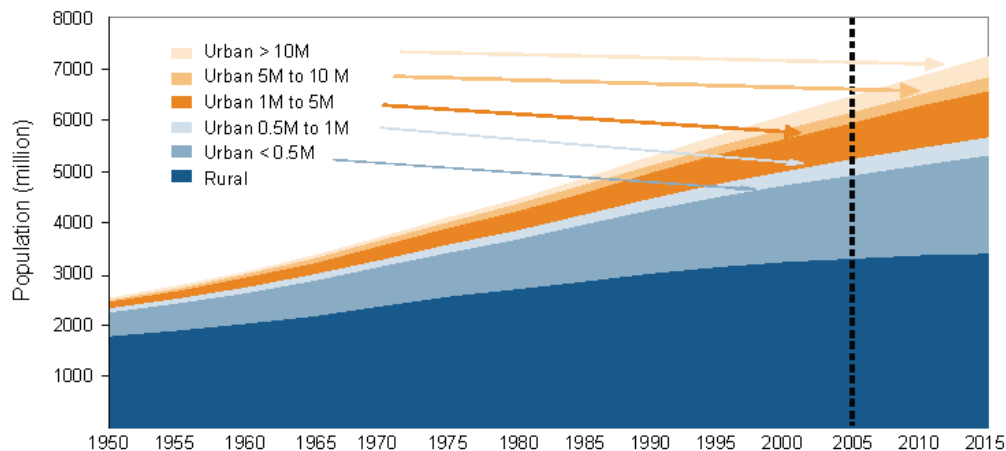
Rapid urbanization of the world population, already taking place, will be a widespread and strong trend during the coming decades. In the next 20 years, the equivalent of seven cities with ten million people will be added every year. This is partly driven by people’s general preference to be in a city slum rather than in a remote rural area, as the city provides more economic opportunities and better health and education benefits. The effect of this migration is complemented by a rapid urban population growth in many cities. As a result, cities concentrate a large part of a nation’s population and contribute disproportionately to the national and world economy.

At the city level, local authorities have options to reduce greenhouse gas (GHG) emissions. They can target the emissions over which they have direct control as an organizational entity (energy use in public buildings, public transport fleet, etc.). They can use their capacities and policy levers to reduce the GHG emissions stemming from those socio-economic activities over which they have administrative influence. Local authorities generally have significant direct and indirect influence over policy areas such as land-use zoning, transportation, natural resources management, building efficiency, waste and water services.

Even without anthropogenic climate change, the rapid urban growth in emerging and developing countries, mainly in the South, is a massive sustainability challenge and involves bringing urban services to all, as well as dealing with local

Distribution of Global Population between Urban and Rural Areas

Source: UN, The State of the World's Cities 2004-2005: globalization and urban culture, 2004



pollution of air and water, and the production of solid waste. On the other hand, the mature and more slowly growing cities of the developed world, mostly in the North, need policies to retrofit existing buildings, reshape development to stop urban sprawl, and use a more systemic approach to energy networks. Cities, particularly coastal, also have to anticipate their adaptation to the effects of climate change.

Technology solutions

Many energy technologies which can improve the energy sustainability of mega-cities and smaller cities are found on the energy-demand side. **There are many mature technical solutions. The main difficulties lie in their adoption.** These mature technological solutions have costs that are well documented in many different geographic, social and political contexts. Nevertheless, there is the potential for these costs to decrease through incremental innovation and economies of scale. Technical solutions that are already mature for buildings include insulation, heat pumps and high efficiency gas boilers. Bus rapid transit (BRT), metro rail, tramways, and hybrid cars can move people and goods. Solar photovoltaic, energy from waste, and combined heat & power can be locally used to generate energy. Yet costs and potentials vary widely and there are no “best solutions” for all cities. In implementing technologies, consideration needs to be given to building stock, climate, urban shape, cultural behaviour, and financing possibilities.

Technology adoption is always a big challenge anywhere. Economic maturity (i.e., profitability

within existing regulations and fuel prices) is never enough for a sustainable technology to be widely and rapidly adopted. Difficulties in adoption are rooted in immature and imperfect markets (inadequate workforce education, absence of competition between firms), in transaction costs, and in coordination problems and lack of planning. Institutional innovations to support the adoption of existing technologies (coordination of actors, education, market transformation, investment mechanisms, financing schemes, etc.) are therefore as important as purely technical innovation efforts.

Research, development and demonstration (RD&D) is still required to lower the cost and enhance the social acceptability of many “urban” energy technologies. In particular, RD&D is needed in the areas of high-temperature heat pumps, solar photovoltaic collectors, batteries for hybrid and electric cars, design concepts for electric cars, innovative insulation materials, multifunctional building materials (e.g., integrating cost-effective photovoltaic electric generators), lighting, domestic appliances, IT equipment and, more generally, RD&D focused on information technologies, which will become pervasive in cities. Although not only an urban problem, technical innovations are also needed in sustainable energy supply, notably in the “greening” of electricity generation.

Policy solutions

The challenges are to provide energy to all, to combat energy poverty, and to shape the rapid growth of cities in emerging countries and reshape

Cities should be given the power to experiment.

existing “rich” cities in order to curb GHG emissions and local, energy-related pollution. In doing this, **the strength of market forces on the land and building markets, as well as on the city’s labour market, must not be underestimated. But urban planning at the appropriate stage is always an absolute necessity.** While there is no “ideal” city form, density thresholds do exist. There are, for example, robust density thresholds (50-150 inhabitants/ha), below which mass transportation systems are simply not economically feasible.

Policies are always packages of measures. It is not enough for technically and economically mature solutions to be available “off-the-shelf”. Policy action plans are always a complex package of public investment, private investment and technical, institutional (to coordinate different types of actors), regulatory and financial measures.

Regulations must always be combined with incentives, information and other actions, aimed at improving market efficiency.

Since providing energy to all, combating energy poverty, curbing GHG emissions and local, energy-related pollutions do not only depend on municipal and local policies, coherence across levels of government is required, with a clear distribution of tasks. Before defining local policies, an assessment of the jurisdictional capacity to act of local authorities is needed, followed by a shift of capacity to act towards the most appropriate policy level, if necessary. At the very least, a clarification of the responsibility among actors for each topic is needed. In many cases, cities should be allowed increased jurisdictional capacity to act on a number of energy-based issues. In particular, cities should

be given the power to experiment. Everywhere, **cities must strongly improve their capacity for coordination, including internal coordination among municipal services, coordination between adjacent municipalities, and Public Private Partnerships (PPPs).**

The main outcome of PPPs is in transferring technologies and management efficiency to public services or dispersed small private businesses, to improve the overall efficiency of the process. PPPs also allow leveraging private-sector capital. However, even if they can greatly help, they generally cannot by themselves solve the financing problems of extending the basic services to the poor and curbing the GHG emissions. Public money is still needed. In any case, PPPs require a clear and stable legal and regulatory framework as well as setting up independent regulatory authorities, and substantial investment in social and human capital within the public administration.

Investment

Ambitious programmes to curb energy related pollution are often costly. In most cases, these imply large investments to substitute technical capital to replace fossil fuels and/or unskilled labour, but also complementary (as large if not larger) investments in human and social capital. Without the latter, the best technical solutions will fail. The ability to invest is therefore a strong constraint, contrary to the claim that there still exists everywhere a large potential of emission reduction whose cost is negative. Such a claim tends to neglect the transaction costs and the investments in social and human capital needed to

The challenges can be met with a package of technical, institutional, policy and financial measures. Regulations must be combined with incentives, information and other actions, aimed at improving market efficiency.

achieve the required institutional changes. From this point of view, **it would be fair to differentiate the burden between developing, emerging, and rich cities, and ask less of poorer cities.** For example, it is possible that urban governments in developing countries could be asked to choose Bus Rapid Transit (BRTs) over metro systems, since the former are much less capital intensive, although they emit more.

There are ways to increase the funds available to a municipality, particularly in the South:

- Increase land and properties taxes in a progressive way;
- Tax the capital gains on land and buildings streaming from public investments and regulation changes (both imply the setting-up of a minimal land registry and monitoring of the property market);
- Use of carbon finance, in order to sell emission rights to parties in the North, and, more generally, to benefit from future North-South transfers aimed at lowering the cost of curbing emissions and sharing responsibilities;
- Charge users the full cost of urban services.

However, the dilemma on tariffs and subsidies is still pending. The main idea of the 1990s, that the customer must pay the full cost of the urban services, has proved difficult to implement in the early part of the twenty-first century. **It is now clear that services for the poor will have to be subsidized for a long period of time if access rates are to improve rapidly.** In theory, these

subsidies should take the form of budgetary transfers to the poorest, with the market price set at full cost in order to deliver the right economic signal. This kind of budgetary transfer is often difficult to implement, so that current practice of subsidizing energy prices indiscriminately for both rich and poor is usually the norm.

Conclusions

Instruments available to local-level governments include direct policy actions, enabling different groups involved in the policy process, as well as providing the information necessary to foster behavioural change by consumers. Policies instituted should be packages of measures. It is not enough for technical solutions to be available if no one can afford them. Strong and early public intervention is required to meet the challenges of urban development. And objectives must be kept simple and stable.

The challenges can be met with a package of technical, institutional, policy and financial measures. Regulations must be combined with incentives, information and other actions, aimed at improving market efficiency. Policies dealing with funding and financing cannot be separate from policies for design and/or implementation. Governance and accountability with appropriate targets must go hand in hand. Sustainability policies must be part of a coherent policy framework. Finally, regulations must be based on long-term and stable objectives, not short-term ones.

The complete report is available for download at www.worldenergy.org/documents/EUI_2010.pdf

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