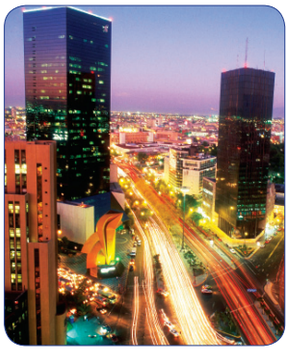

Energy innovation and urban growth

By Robert Schock,
Director of Studies, World Energy Council

The 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 2010 WEC report *Energy and Urban Innovation* examines business and policy actions that can be taken in order to meet these challenges. The report studies the growth, development, and energy-linked issues of large cities, and 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, Cape Town, Toronto, Shanghai, the London – Ile de France area, and the San Francisco Bay Area.

Rapid urbanisation 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. 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. Cities thus concentrate a large part of a nation's population and contribute disproportionately to the national and world economy.

Even without anthropogenic climate change, the rapid urban growth in emerging and poor countries is a massive sustainability challenge and involves bringing urban services to all, as well as dealing with local 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 need policies to retrofit existing buildings, reshape development to stop urban sprawl, and use a more systemic approach to energy networks. Cities, particularly coastal, do also have to anticipate their adaptation to the effects of climate change.

There are many technical solutions that are already mature and whose costs are known in different contexts. For example heat pumps, insulation, and high efficiency gas boilers can be used more effectively in buildings. Bus rapid transit (BRT), metro rail, tramways, and hybrid cars can move people and goods. Solar photovoltaics, energy from waste, and combined heat & power can be used to generate electricity. 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, dynamic changes, and financing possibilities.

Technologies alone are not sufficient to improve all the dimensions of an energy system. Sustainability demands different aspects (social, economic, environmental) that often cannot be entirely fulfilled. Efficient urban planning is required as technologies are dependent on usage and behaviour. For example, hybrid cars with an occupancy rate of 1.3 (average for Paris) yield congestion and significant emissions. Efficiencies in buildings are deeply dependent on household behaviour, for example, the heating and cooling level. Also, difficulties often remain because of immature markets (workforce education, lack of healthy competition between firms), transaction costs, coordination problems, or lack of planning. Efforts to better support the implementation of existing technologies (coordination, education, market transformation, investment mechanisms, etc.) are as important as those for technical innovation.

The challenge is to shape the rapid growth of cities in emerging countries and to reshape existing 'rich' cities. 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. Planning at the appropriate stage is an absolute necessity! While there is no 'ideal' city form, density thresholds do exist. There are, for example, robust density thresholds (50-150 inhabitants/per hectare), below which mass transportation systems are simply not economically feasible. Market forces and urban planning must also go hand-in-hand.

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 organisational 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 also have significant direct and indirect influence over policy areas such as land-use zoning, transportation, natural resources management, buildings, waste and water services.

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. ❑

Water: a complex vulnerability of the energy system

Human civilisation has always rested on the utilisation of water, and, more specifically, on access to water. To contribute to a better understanding of the critical linkages between water and energy – and the impact on both of climate change, the World Energy Council has identified areas of opportunity in its *Water for Energy* report, where investment and probably new regulations are needed in order to foster faster and more equitable global development.

Water is used in energy production and supply, and, in turn, energy is used for pumping, moving and treating water. In recent decades, the combination of more users, with more uses of water has transformed the traditional water-energy 'ladder' that underpins all human, social and economic development into an 'escalator'. As a result, as the linkages between both energy and water systems have grown more complex and interdependent, water must be viewed as a complex vulnerability of the energy system – and vice versa.

In addition, human-induced climate change is increasingly understood to be a key driver for change in energy and water availability, allocation, production and consumption. This carries significant implications for managing water and energy security challenges. Climate change impacts will likely exacerbate water stress in many countries, cities and communities, creating the prospect of greater competition between different uses, as well as individual users of water.

With the threat of water scarcity and water stress, exacerbated by climate change, two challenges have developed: Water for Energy and Energy for Water.

A situational analysis of the current 'water for energy' contexts in a variety of countries/world regions sets out the water needs of Africa, Asia, Europe, Latin America and the Caribbean, and North America in the context of their energy production, water withdrawal, and population size. By examining the growth of global population, changes in final energy consumption and water requirements needed to produce and generate the necessary amounts of energy over the next decades, the report identifies: the future water needs related to energy production and conversion are not beyond the expected available supply; other uses, in particular agriculture, are stressing the supply of useable water for everything, including energy, now and this stress will increase in the future as increasing populations require more and more food. In setting policies to make water available for food, governments need to ensure that water is also available for energy production and conversion. And as energy resources are stretched, increasingly unconventional sources become attractive. Many of these (for example oil sands, oil shales, deep gas shales) require large amounts of water, further stressing current and projected systems. When setting policies for energy production, policymakers must consider what water supplies are available: they need to consider the needs of these technologies and their impact on other uses.

At the same time, the increasingly integrated world of shared resources and trade requires a new paradigm of operation interregional and international (co-)operation between governments (regional and national), between businesses, as well as between governments and businesses.

Many existing and new technologies show promise for making water more available and its use more efficient. However, in order to accelerate the entry of these technologies and their benefits, policymakers in business and governments as well as independent institutions must carefully examine policy measures and conditions which will achieve this, while at the same time engage on a close level to maximise the efforts and reduce redundancy in their RD&D (Research, Development and Demonstration) efforts. ❑