

Climate change and residential sector growth in emerging countries

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In December 2007 in Bali, the United Nations Framework Convention on Climate Change (UNFCCC) adopted a programme of discussions with a view to defining an international climate change mitigation regime for the “post-2012” period. The debates focus on commitments by emerging countries, which are currently responsible for most of the growth in greenhouse gas (GHG) emissions. Nevertheless, industrialised countries clearly have a major role to play in climate change mitigation. Responsible for half of global emissions, despite

structure and building, stand to call into question the international community’s ability to meet the climate change challenge.

The current phase of development in emerging countries – urbanisation, industrialisation – is a major opportunity for building low-carbon economies. To do so, development priorities must be reconciled with climate concerns.

There are two main reasons for acting as a matter of priority in the infrastructure sector and thereby controlling the growth in energy demand.

The first is related to coal use. This abundant, low-cost energy currently meets the greater part of energy requirements in China, India and South Africa. If we accept that it will remain the inevitable basis of supply in these countries, then efforts must focus on managing demand in the energy end-use sectors. Opting for energy-efficient infrastructure means the future can be preserved. It provides long-term opportunities for pursuing climate change mitigation policies, especially by improving energy supply as technological progress is made and alternative resources become available.

The second reason is economic. It is in fact cheaper to act upstream when investments are being made than to renovate infrastructure already

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accounting for only 20% of the world’s population, they possess the technological, institutional and financial capacities for redirecting their development towards an energy-efficient, low-carbon growth path. Their willingness to act will be the deciding factor. But the continuous increase in CO₂ emissions in emerging countries, especially in high inertia sectors such as transport infra-

in place, as the industrialised countries now know from bitter experience. In this transition towards sustainable urban development, international cooperation has a key role to play in accompanying emerging countries.

The growing weight of the residential and service sector

Building energy consumption accounts for around 30 to 40% of all primary energy consumed in the world. Within the residential and service sector, housing represents the largest part of the energy consumed, at around two thirds in developed countries and four fifths in developing countries.

In 2002, the residential and service sector was the leading carbon-emitting sector in OECD countries (4.7 GtCO₂), coming second after industry in

developing countries¹ (see figure 1). If we extend current trends according to the International Energy Agency (IEA) reference scenario, the residential and service sector will become the top emitting sector everywhere in the world, with emissions reaching

7 GtCO₂ by 2030 in developing countries. These countries are experiencing rapid urbanisation and the building sector is one of the most dynamic. China is an interesting example in this respect.

The explosion of the residential sector in China

Since the housing reform of the 1990s, the building sector has enjoyed colossal investment, driven by economic growth and rapid urbanisation, particularly in the eastern provinces of China². The total building stock represented 40 billion m² in 2004. An estimated 13 billion m² more will be built in urban areas by 2030, in other words the equivalent of Europe's current housing stock.

However, the efforts that have enabled China to drastically reduce its energy intensity since the

1980s, especially in the industrial sector³, have not been made in the building sector. The majority of new buildings do not meet energy efficiency regulations. Energy consumption in Chinese housing is twice that of European housing, with the same climate and comfort.

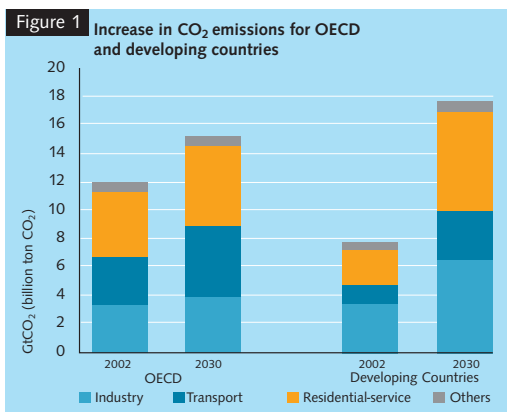
In 2004, residential sector energy consumption in China was 332 Mtoe (million tonnes of oil equivalent), including 113 Mtoe of conventional energy sources, while CO₂ emissions reached 280 MtCO₂ (plus 190 MtCO₂ due to electricity consumption in the sector). The cold region of China, which is home to 40% of the Chinese population, is set to triple its housing surface area by 2030, and represents a particular challenge where energy is concerned. It is estimated that according to the different constraints in terms of energy performance and a potential increase in temperatures inside buildings (19°C compared to 16°C), the energy consumption of the stock in 2030 could increase by between +50% and +170% relative to 2004, according to our scenarios. The difference in CO₂ emissions in 2030 between the high scenario⁴ and the low scenario⁵ would be 350 MtCO₂. Such a difference stresses the importance of energy efficiency policies in this region.

Furthermore, a prospective study by the Energy Research Institute (ERI) shows that energy consumption for heating could increase even more in China's intermediate climate zone, where heating requirements are today largely unmet. Finally, electricity consumption has been growing rapidly for the last 20 years: according to the same study, residential sector consumption could rise from 200 kWh today to 850 kWh per person in 2020, with air conditioning increasing the most.

Although households in emerging countries currently consume relatively little energy on average, a significant increase in this consumption should be anticipated in the next few years in line with rising incomes. According to the IEA⁶, the residential and service sector could account for 40% of the energy savings possible by 2030 and 68% of electricity savings, with housing showing the greatest potential.

Decoupling rising standards of living from energy consumption

Moving towards a fourfold reduction in GHG emissions in OECD countries implies decoupling rising household incomes from growth in energy consumption. So far, we have seen a high corre-



¹ According to the IEA World Energy Outlook 2004. These figures include indirect emissions from electricity consumption in the sector.

² From 20% city dwellers in 1980 to 40% today, the rate of urbanisation is expected to reach 54% in 2020, or around 180 million more people in cities in the next 15 years. Since 2000, around 1 billion additional square metres have been built every year. The building sector represents almost 9% of GDP and over 24% of gross fixed capital formation.

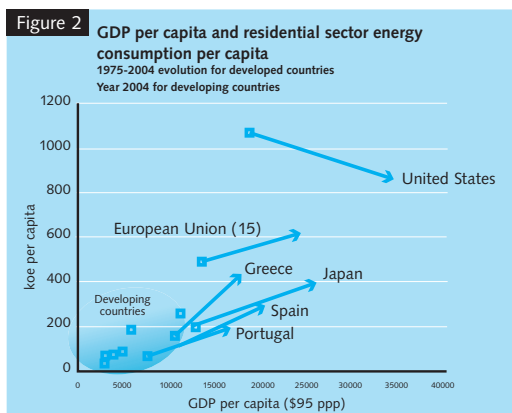
³ The industrial sector benefited from considerable investment and tax incentives that made it possible to reduce the sector's energy intensity by almost 4% per year in the 1980s and 1990s.

⁴ Scenario with no increase in standards and a low rate of application.

⁵ Scenario with considerable improvements in building and equipment performance.

⁶ IEA, World Energy and Environmental Outlook, 2006.

lation between the level of GDP per capita and energy consumption in the residential sector (see Figure 2). Only the United States has succeeded in reducing its energy consumption in the residential sector in 30 years, despite a considerable increase in GDP. However, per capita consumption in this country remains very high due particularly



to the fact that surface area per capita is almost double the European level.

In Europe, despite the development of thermal building codes following the oil shocks of the 1970s, per capita energy consumption in the residential sector has continued to increase in

all countries, except for Germany. This is mainly due to insufficient improvements in building performance in view of the expansion of built-up areas. With the rise in the standard of living, several factors lead to an increase in energy consumption: the reduction in household size, the increase in the floor space area per capita, expectations in terms of thermal comfort and the increase in the rate of household electrical appliances. Figure 2 thus highlights the fact that southern European countries, where the standard of living has risen more recently, have seen a dramatic increase in residential sector energy consumption.

Similarities in lifestyles among the richer population groups

The increase in household electricity consumption, which is revealing of lifestyles adopted, is marked by considerable disparities. The consumption gap varies by a factor of 3 between Europe (1 500 kWh) and North America (4 500 kWh⁷). At the bottom of the scale: India and Africa with a consumption of around 100 kWh, China and the rest of Asia with a consumption of over 200 kWh per person. These figures nevertheless conceal major inequalities within populations. In Brazil, for example, household electricity consumption per capita varies by a factor of 4 depending on the level of income (from 300 to 1 100 kWh per person for five income levels), and by a factor of 10 for air conditioning and lighting. In Shanghai, it varies between 490 and 1 100 kWh per person⁸.

Consumption among the richest groups is equivalent to the average European level. If no policy is implemented to counter this, consump-

tion should continue to grow due to rising income among an ever-greater proportion of the population in emerging countries. The middle- and high-income groups (over 500 million people in developing countries, with a large part in China) are equivalent to the European population and adopt similar consumption patterns.

Although the same correlation is observed everywhere between rising GDP per capita and residential sector energy consumption, the policies to be implemented differ. In industrialised countries, the urbanisation phase is over and cities are built; new buildings represent only a small fraction of the total stock. Efforts must therefore concentrate essentially on renovating buildings. In emerging countries, the energy performance of new housing should be the focus of decisions.

In order to decouple rising standards of living and energy consumption, the challenge is not so much financing research and development programmes as building an institutional framework that is favourable to the diffusion of energy efficiency technologies, which are adapted to each national context. Most of these technologies are now available, but they have not yet been widely disseminated.

Acting downstream in the energy system

To limit growth in residential sector CO₂ emissions, two options are available. Energy substitution is most often suggested: replacing coal by natural gas, for example, could lead to a 40% reduction in CO₂ emissions. However, given the respective prices of these energies, such a measure would result in household bills doubling. It would only be acceptable if accompanied by energy efficiency measures, or if applied progressively in a medium-term perspective, in favour of increasing household purchasing power and access to more efficient supply technologies. The other option consists in initially conserving coal supply, but at the same time improving building performance, improvements which would require an estimated additional investment of 10% at most. The carbon balance of such a measure is identical to that of the previous option, but the social cost is far lower. Moreover, this choice makes it possible to prepare for the introduction of alternative energies to coal where the economic conditions are favourable.

In China, the price of coal is currently low. Despite this, the higher the energy performance of buildings, the lower the global discounted cost of heat supply (taking account of insulation investment). From an economic point of view, not only is it possible to apply existing regulations, but stricter regulations may also be envisaged, in line with Canadian or French regulations.

Such measures, aimed at increasing the energy

⁷ This is a federal average; there may be considerable differences between States.

⁸ Estimations for three income levels.

performance of buildings as rapidly as possible, will avoid lock-in occurring, caused by the construction of inefficient stock that would be very difficult and costly to renovate.

Institutional obstacles to overcome

There are many barriers to the implementation of energy efficiency policies in consumer sectors: the large number of stakeholders involved, incomplete information, high transaction costs, a lack of coordination, and so on. One of the major obstacles is linked to the fact that the beneficiaries of energy efficiency measures are very often not those who bear the investment cost; for property developers, therefore, there is no incentive to comply with regulations, even if the return on investment is generally short. Outdated energy supply systems continue to be installed, especially in low-cost housing and social housing.

As for the planning of construction projects by architects and research consultancies, it is often too hasty due to insufficient funding. Finally, due to a lack of teams trained in efficient technologies, traditional practices remain the rule. Manufacturers of efficient materials, the only stakeholders with an interest in the development of energy efficiency measures, have little influence over decisions made.

To define construction programmes that include suitable means of energy supply, coordination between urban planners, developers, architects, energy companies and the different municipal services concerned is essential; today, however, it is all too rare. Many opportunities for optimising systems therefore remain unexploited.

Stepping up international coordination

The UNFCCC has established cooperation tools, including the Clean Development Mechanism (CDM). However, most of the 1 500 CDM projects it has registered concern energy production; very few deal with demand.

In the building sector, the projects are mainly small scale: decentralised electricity production, promoting solar cookers, energy efficiency and substitution in public buildings, etc. The CDM has so far proved unsuited to the implementation of sectoral energy demand management and GHG emissions policies. However, the definition of a programmatic CDM since the COP/MOP1 (Montreal 2005) should foster the implementation of energy efficiency programmes in consumer sectors.

The implementation of policies and regulations is now eligible through Programmes of Activities

(PoAs), if it is shown that the existing measures are systematically unapplied. Thus, a town council could play a prescriptive role and, within the framework of the CDM, develop a multiannual energy efficiency programme in new development zones, aimed at ensuring existing energy efficiency regulations are respected and/or preparing for the implementation of stricter regulations. Such programmes may consist in support for project management, material and equipment companies with inspections of products marketed, in training in the design and construction of efficient buildings (architects, technical offices, construction companies), in support for the banking sector in the design of financial tools, etc. Following up on these programmes and quantifying the reductions obtained remains the main obstacle to their development, but energy consumption monitoring programmes are possible and have already been tested in projects for the diffusion of efficient equipment.

The very dynamic economic sectors appear to be the most capable of accommodating CDM projects. The building sector can therefore find its place here, especially as it has an important role to play in limiting CO₂ emissions in the long term. Given that energy efficiency programmes in this sector contribute to economic development and energy security objectives, organisations like the Global Environment Facility or its French counterpart, the FFEM, could be mobilised. They would make it possible to develop these programmes on a large scale and to design methods suited to the CDM criteria, thus encouraging developments in the rules of this mechanism.

Conclusion

The choices emerging countries now make in terms of infrastructure and urban development will condition their future greenhouse gas emissions. Given that a house has a life span of around 100 years, we measure the impact of the energy efficiency of the mass housing being built today on the long-term CO₂ emissions of these countries. It is therefore essential to anticipate and to act now to adopt low-carbon growth paths.

The definition of a “post-2012” international regime must provide the opportunity of redefining international cooperation mechanisms in order to ensure they are suited to the different sectoral contexts. CO₂ emissions trading mechanisms should be supplemented by new measures, such as support for sustainable development policies within the framework of quantified, non-binding objectives for emerging countries. ■