UN-DESA Policy Brief No. 24

Climate Change and the Energy Challenge

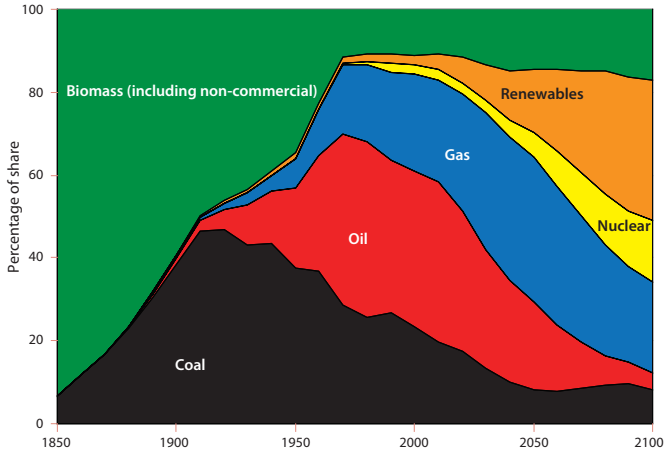
Breaking with the past and present

A temperature increase of 2°C above pre-industrial levels is the maximum target range established by the scientific community for stabilizing carbon concentrations at a level that prevents dangerous interference in the climate system. This corresponds to a target greenhouse gas concentration (in terms of carbon dioxide equivalents (CO_2e)) of between 350 and 450 parts per million (ppm) and to global emission reductions of the order of 50-80 per cent over 1990 levels, by 2050.

These targets cannot be met without a major transformation in the way energy is produced and consumed. The energy sector, broadly defined, accounts for 60 per cent of global emissions and a stable climate will require reduction in the rate of energy intensity and improvement in carbon intensity by a factor of between 2 and 3 with respect to their historical levels. Figure 1 depicts the historical evolution of the energy system and the kind of future development path which will be needed to keep below the 2 degree threshold.

Figure 1 is consistent with a stabilization scenario that delivers faster growth in developing countries while avoiding more drastic climate changes. It will, however, require a determined break with past policies, a renewed commitment to public investment and a concerted collective effort at the international level.

Figure 1. **Evolving energy system: Towards a low-emissions future**



Source: United Nations, World Economic and Social Survey 2009: Promoting Development, Saving the Planet (http://www.un.org/esa/policy/wess/wess2009.pdf), based on Nakicenovic, N., and K. Riahi, eds. (2007). Technological Forecasting and Social Change, vol. 74, No. 7 (September).
Note: a. History and a possible future of the global energy system in IPCC's B1 stabilisation scenario showing relative shares of most important energy sources.

Energy and Development

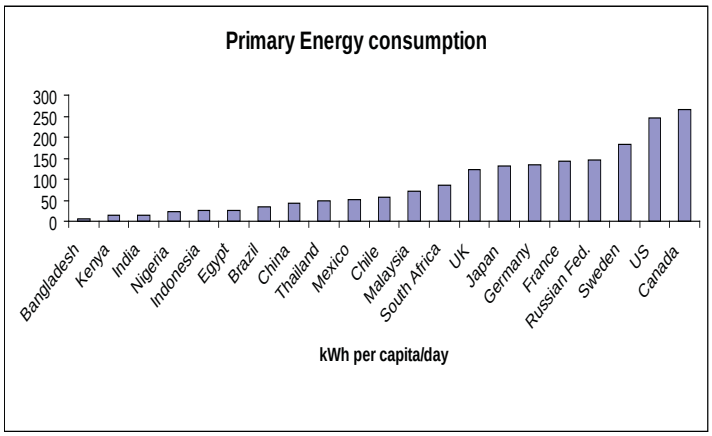
In most of the developing world, access to energy services is far below what is needed to achieve human development goals. About two billion people in the world, a third of the world population, are without access to modern energy and about 1.6 billion are without access to electricity while about 2.4 billion people still cook with traditional forms of biomass. Affordable access to modern energy services has a significant role to play in meeting development goals. However, modern energy services in the majority of developing countries are characterized by inequitable access, notably between the poor and affluent; as well as, between rural and urban areas. At the national level, this is demonstrated by the low levels of modern energy in the primary energy supply mix; low electrification levels; and, low electricity consumption levels.

Globally, approximately 31 million tons of oil equivalent are consumed in the form of primary energy every day, equivalent to 55 kilowatt hours (kWh) per person per day, with rich countries on average consuming more than twice that figure. Most countries from Africa, and all South Asian countries, consume well under 20kWh per capita per day. People in China consume far less than the global average and also most other emerging market economies consume less than a third the amount absorbed by advanced economies. Economic development in poorer countries will require not only closing the gap in energy consumption but also ensuring that consumption becomes more sustainable as part of a broader, integrated and inclusive development strategy to meet economic and human development goals.

100kWh per capita per day is considered to be the dividing line between energy poverty and energy sufficiency. Up to this level there is a very strong correlation between increased energy consumption and development goals. Such levels of energy consumption will, however, be out of reach of most poor countries unless the price of energy services drops significantly below current levels. Currently, the expansion in energy services in developing countries is impeded in part because the vast majority of the population is too poor to afford these services without some form of subsidy. Even populations with incomes of $10 per day would not be able to spend more than, say, $1-$2 every day on energy-related expenditures (electricity, cooking, heating, transport). If energy costs 10 cents per kWh, then $10 per day would be needed to consume the requisite levels of energy services. This is not just a problem for the bottom two billion; spending $10 per day on energy services would exhaust the per capita income of countries such as Angola, Ecuador and Macedonia. Most

OECD countries use over 120kWh per person per day (each person in the United States uses 246 kWh), while energy consumption in the vast majority of developing countries is under 15 kWh per person per day. In India it is a little under 15, but 45 in China. Half of China's energy consumption is for industrial production (as opposed to one quarter in most countries). Figure 2 below provides a sample of developing and developed countries and their per capita primary energy consumption – it displays the sort of large variance between the two groups of countries.

Figure 2. **Divergence of Energy Consumption**



Source: United Nations, World Economic and Social Survey 2009: Promoting Development, Saving the Planet (http://www.un.org/esa/policy/wess/wess2009.pdf.

An Operational Framework

In developing countries, the urgent task is to lower the cost of modern energy services in the short run so as to make them affordable for an expanding segment of the population, at least until income levels rise enough to make more expensive energy affordable. What is needed is a strategy that will bring a significant and timely reduction in the cost of renewable energy services.

To gain from economies of scale and the potential benefits of technological learning, large "upfront" investments would need to be made in new and advanced carbon-saving technologies, which would, after scaling-up and adoption, lower the mitigation costs and increase the mitigation potentials. Complementary investments in research and development and related skills development would also be needed to improve the performance of carbon-saving technologies and reduce their costs over time.

The potential size of the energy market in developing countries along with the possibility of making improvements to already installed capacity serves as an indication of how important investment opportunities could be. However, as the initial costs and risks are likely to deter private investors, the public sector would be left with a leading role, at least in the early stages of expansion: a massive public investment push, coupled in the short term with appropriate subsidies to offset high initial prices and targeted at the most promising technology options (e.g., solar and wind), would help trigger an early cost write down through innovation and scale economies, and give the private sector clear and credible signals, and encourage energy efficiency.

A globally funded public investment programme on clean energy could support developing countries making the transition to high-growth and low-emissions production processes. The incremental approach tried thus far through the cap-and-trade system and the project-oriented Clean Development Mechanism have not led to significant emission reductions. Moreover, the cap-and-trade system has been designed to conform to the policy experience, institutional capacity and economic conditions of developed countries and would not be sufficient and inappropriate to deal with the mitigation and energy challenge of most developing countries.

The scale of financing the energy transition is several orders of magnitude greater than that available through current financing arrangements (see Policy Brief 22) and will likely require more radical changes in the existing international architecture. Some possible measures include:

- ***A global clean energy fund.*** In light of the urgency of this challenge, a new global fund to address climate change mitigation in developing countries, established outside the existing multilateral financing institutions and with a governance structure acceptable to all parties to the United Nations Framework Convention on Climate Change, needs to be considered. In time, existing mitigation funds could become part of this larger mechanism.
- ***A global feed-in tariff regime.*** A global feed-in tariff programme could provide guaranteed purchase prices to producers of renewable energy in developing countries over the next two decades. This mechanism would lead to an automatic drawdown of subsidies over time as production and incomes increase. Delivery mechanisms would have to be carefully designed so as to ensure a level playing field for all competing technologies and on-grid and off -grid operators and benefit targeted low-income consumers.
- ***A reformed Clean Development Mechanism.*** The present deficiencies of the Clean Development Mechanism for facilitating large-scale resource transfers are widely acknowledged. Much attention has focused on reforming the Mechanism in such a way as to replace its project focus with a programmatic and/or policy focus, in the expectation of larger impacts, shorter funding cycles and lower transaction costs. ■

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