

# **ENERGY POLICY AND ECONOMIC DEVELOPMENT: CHALLENGES AND RESPONSES**

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## **Summary**

Developing countries face major challenges in obtaining adequate supplies of high quality energy to fuel their economic and social development, without undue environmental damage. This paper outlines the nature of these challenges, and describes governments’ evolving policy responses to them.

### **1. Introduction: Energy and Economic Development**

Reliable, accessible energy is an essential ingredient of economic and social development. The close connection between energy and development is borne out by experience in virtually all countries. As economies expand, consumption of modern, commercial, forms of energy also rise. In the industrial countries, energy consumption rises typically by less than economic output.

But in developing countries, the focus of this article, commercial or modern energy consumption has invariably risen more rapidly than economic growth, due to several factors inherent in the development process.

First, most of the people living in developing countries rely mainly on traditional biomass fuels—wood, dung, and crop wastes—and human and animal power for the bulk of their energy needs. As commercial fuels become more readily available, and incomes rise, however, people substitute commercial for traditional fuels.

Second, developing countries are building industrial and commercial infrastructures, and experiencing rapid urbanization, both of which have major impacts on energy consumption. Infrastructure development requires energy-intensive materials such as steel and cement. Urbanization leads to intensified transportation networks, and higher productivity agriculture, both of which increase demand for commercial fuels.

Finally, people in developing countries have command over a wide range of consumer goods—for example, motorcycles, cars, air conditioners, refrigerators, kitchen appliances, TVs, and computers—at an earlier stage of development cycle than in the industrial countries.

Countries with per capita incomes of between US\$3000 and US\$6000, have rates of household refrigerator ownership which did not occur in the US until per capita incomes were at the US\$10 000 level. TV ownership in developing countries is high, even in the poorest households.

Clearly, as the developing countries continue on their development trajectory, their demand for energy services will increase rapidly. The International Energy Agency (IEA), for example, estimates that energy supplies in the developing countries will need to rise two and a half times over the 25-year period from 1995 to 2020.

These estimates already incorporate strong assumptions about the extent to which energy efficiency can be improved. If energy consumption were to track or exceed Gross Domestic Product (GDP), as in the past, supplies would have to increase even further.

The way in which the developing countries provide their energy services has global implications, as they will account for two thirds of the increase in global energy consumption over the next 25 years. The developing countries will be by far the biggest player in international oil markets, accounting for 70 percent of the increase in oil consumption from 1995 to 2020.

The financial needs of energy development will be large enough to represent a significant factor in global capital markets. Finally, developing countries will have a major incremental impact on global environmental quality in the coming years.

As much of their energy consumption is carbon intensive—both India and China are large coal users—their contribution to global carbon dioxide (CO<sub>2</sub>) emissions (the major greenhouse gas) will rise sharply. Developing countries' share of total CO<sub>2</sub> emissions is estimated to increase from 35 percent of the global total in 1995 to almost one half by 2020.

## **2. Evolving Energy Policies in Developing Countries**

Governments of developing countries realized from the earliest days that energy was critical to the development process, and became highly active in the energy policy arena. While approaches varied among countries, a number of common characteristics emerged:

- Most developing countries, like many industrial countries at the time, identified the energy sector as one of the ‘commanding heights’ of the economy, requiring comprehensive regulation under a system of public ownership. Government agencies were set up which typically controlled all aspects of energy resources, supply, distribution, allocation, and pricing of the different forms of energy.
- Energy policy emphasis was primarily on supply expansion, often in narrowly volumetric terms unrelated to quality.
- Efforts were made to bring energy to poor and remote populations through subsidies on energy products and rural electrification programs.

This model has faced severe and justified criticism in recent years, but it has a number of achievements to its credit. Many developing countries vastly expanded their output of all forms of energy and built up extensive energy infrastructures including large power grids.

Subsidized energy, such as kerosene and electricity, brought modern fuels to populations which otherwise would not have had access to them. Efforts were also made to aid rural populations through programs to improve use of traditional fuels, and to promote renewable energy.

But, as time went on, the rigidities and inefficiencies of these systems became more obvious. The emphasis on volumetric quantity of production led to a deterioration in the quality of energy supplies that imposed high costs on users (either in form of spoiled product, the need to provide back up equipment, or hold emergency stockpiles).

In manufacturing, which depends critically on reliable supplies of high quality energy, the damage from unplanned supply interruptions can be immense. It is estimated that electricity shortages in India (and Pakistan) have reduced GDP in recent years by between 1.5 and 2 percent. This circumstance led Prime Minister Gandhi of India to remark that ‘there is no more expensive energy than no energy’.

Furthermore, the energy sector in many countries became financially unsustainable. In principle energy systems should charge enough for their services to cover their costs and to make provision for system expansion. For a variety of reasons, the energy system in a wide range of developing countries is unable to meet this criterion.

The financial difficulties are partly due to high costs: Government owned entities, which enjoy a monopoly of service, have little incentive to keep costs down. But, more important, energy suppliers are typically required by governments to provide some classes of customers with energy (notably kerosene, diesel fuel, and electricity) at prices well below the costs of production and delivery.

In principle, suppliers are compensated for their inevitable financial losses by the government, out of general revenues, but often this has not taken place in a timely fashion. In any event funds for system expansion usually came from the central government as grants in aid at no, or below market, rate of interest thus removing an important incentive to fiscal discipline.

In addition, efforts to provide affordable energy to poor or remote populations were becoming increasingly ineffective, and it proved difficult to target subsidized fuels to the intended populations. Rather than acting as an instrument to reduce inequality, the major benefactors of subsidy programs too often turned out to be the more affluent groups of the population.

Despite major rural electrification programs, household connections have lagged. Large parts of the rural population and parts of the low-income urban populations continue to rely on traditional fuels, thus limiting opportunities to improve productivity, and to benefit from essential health and educational services.

Low, subsidized prices meant that energy users in turn had little incentive to use energy efficiently. One of the surprising aspects of energy use in developing countries is the high-energy intensity of their economies. Intuitively it might be thought that the industrial countries with their immense advanced industrial sectors and high standards of living and comfort would use very much more energy than developing countries, and on a per capita basis this is indeed so.

Commercial energy consumption per capita is on average 7 times higher in high-income countries than in low- and middle-income countries. However, when energy consumption is related to economic output (the GDP) rather than population, the developing countries turn out to be three times more energy intensive than the rich countries.

In the push to increase energy supplies, little attention was paid to mitigating environmental impacts, and many developing countries are now experiencing severe energy related environmental degradation. In rural areas, overuse of forestlands for fuel and other purposes has led to deforestation, desertification, and soil erosion. The widespread use of unimproved wood stoves exposes women and children to critically high levels of indoor air pollution.

In urban areas, rapid growth with few effective environmental controls result in high levels of pollution. Levels of sulfur dioxide, particulates, ground level ozone, and nitrogen oxides typically exceed those in the cities of industrialized nations. Many countries do have pollution control laws but in many cases these are not fully implemented.

Citizens and governments of developing countries are becoming increasingly aware of these problems. Faced with the need to attack existing problems and at the same time undertake a vast program of energy sector expansion, energy policies are beginning to change. Typically policymaking is addressed to the individual energy sub-sector—oil, gas, coal, and electricity—or driven by special social policy issues such as the

alleviation of poverty and the acceleration of the energy transition from traditional to modern energy supplies. This report examines the challenges and energy policy responses in each of these sectors.

### 3. The Energy Supply Sectors

Biomass (fuelwood, charcoal, crop wastes, and dung) is the largest single source of primary energy in the developing countries, accounting for about one third of total supplies. Oil provides about 28 percent of the total (and about 40 percent of commercial energy supplies), coal about 26 percent (or about 38 percent of total supplies), and gas and primary electricity (nuclear, hydro, and other renewables) for about 7 percent each (or 10 percent of commercial supplies).

In this section we examine the challenges and policy responses for oil, gas, and coal. Biomass is discussed in the section devoted to the energy supplies of rural populations and the urban poor, who account for virtually all biomass fuel use.

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#### Biographical Sketch

**Joy Dunkerley**, a consulting economist in the field of Energy Economics, has degrees from the London School of Economics, and, as a Fulbright Fellow, from Clark University, Worcester, Mass. She also studied at Stanford University. Her professional activities over much of the past 20 years have centered on a wide range of energy issues, particularly in developing countries. These activities include, at Resources for the Future Inc., the development of an economics based policy research program on energy in developing countries and co-authorship of the RFF book *Energy Strategies for Developing Nations*. As a Senior Analyst at the United States Congressional Office of Technology Assessment she directed an assessment on Energy Technologies for Developing Countries, whose findings were published in two reports *Energy in Developing Countries* (1991), and *Fueling Development* (1992), and contributed to an assessment of energy technologies for the former east bloc. She is presently engaged as a consultant on studies on rural energy supplies in India for the World Bank, and on global prospects for civilian nuclear power for the Atlantic Council.

She has published widely; consulted for many international organizations; served on the Committee for Research Grants of the US National Academy of Sciences; led a delegation of energy economists to the

P.R. of China; and was President of the International Association for Energy Economics in 1983. She received the 2000 United States Association for Energy Economics Adelman-Frankel Award for “Unique and Innovating Contributions to the Field of Energy Economics”. She is a member of the Cosmos Club, in Washington DC, and a Board member of the National Rehabilitation Hospital and the American Friends of the London School of Economics.

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