Energy Needs in Developing Countries and Sustainability

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Energy is an essential ingredient of growth and development, which are the fundamental aspirations of 70% of the people who live in the poor countries of Africa, Latin America, the Middle East, and Southeast Asia. However, such growth and development—irreversible features of our times—can be detrimental to the environment, and thus there is a basic potential conflict.

For developing countries, development means satisfying the basic human needs of the population, including access to jobs, food, health services, education, housing, running water, and sewage treatment. The lack of access of the majority of the people to such services provides fertile ground for political unrest, revolution, and the hopelessness and despair that lead to emigration to industrialized countries in the search for a better future. The rising wave of legal and illegal emigration to the United States and Western Europe is partly due to these factors. The promotion of economic growth is the watchword of any candidate for public office in the Third World, and political leaders are judged by whether they achieve it.

Despite the enormous progress that has been made around the world in all areas during the past few decades, the fact still remains that in poor developing countries, when compared with the industrialized countries, life expectancy is 30% shorter, infant mortality reaches numbers above 60 deaths per 1000 live births (compared with less than 20 in industrialized countries), illiteracy is higher than 40%, the total fertility rate (*1*) increases dramatically to five or six children as compared with two in industrialized countries (which is just enough to keep the population in equilibrium), there is a high degree of local pollution due to lack of sanitation, and more than 2 billion people lack access to electricity.

Per capita energy consumption can be viewed as a good proxy by which to measure the severity of these problems, and therefore energy policies should be viewed in that context. Per capita energy consumption in developing countries is about 0.5 ton of oil equivalent (TOE) per year of commercial energy, which is about 10 times less than in industrialized countries.

As a result, in 1993 only about 30% of all the commercial energy consumed in the world (oil, natural gas, coal, nuclear energy, and hydroelectricity) was used in the less-developed countries (LDCs) in which three-quarters of humanity lives. The remaining 70% of world energy was used by the populations of the industrialized countries (including Eastern Europe and the former Soviet Union), which make up 25% of the world population.

It could be argued that the picture in the LDCs is not as bleak as depicted above because the per capita commercial energy consumption of 0.5 TOE does not account for the fact that another 0.5 TOE comes from noncommercial renewable energy sources such as fuelwood, charcoal, dung, and agriculture residues (generally called biomass). The efficiency of energy use is particularly low for noncommercial biomass energy; there are, therefore, good prospects for the conversion of noncommercial sources of biomass to high-quality energy carriers (*2*). This is particularly important for reducing the environmental hazards of using biomass for indoor cooking, a very serious problem in a number of LDCs. The total share of commercial energy used by LDCs is, nevertheless, bound to increase dramatically in the next 30 years, for the following reasons: (i) Population growth is about 2% per year and will most likely double in the next three decades; population growth alone, in the aggregate of all developing countries, has been responsible for 50% of the annual growth of energy consumption. (ii) Economic growth is steady in most parts of the developing world (except some African countries). This growth is a result of political independence, integration into the world economy, and access to information through radio and television.

The combination of these two factors has resulted in a growth in commercial energy consumption of about 4% per year in LDCs in the past few decades, which is a doubling every 17 years. In industrialized countries, energy consumption grows at about 1% per year. As a consequence, if these trends continue, energy consumption in LDCs will surpass that of the industrialized countries around the year 2010 (Fig. 1).

If, during the next few decades, the industrialized countries and LDCs continue to rely heavily on fossil fuels as their primary energy supply, regional and global environmental problems such as acid rain and greenhouse warming (caused increasingly by developing countries) will be a serious cause for concern on the part of the industrialized countries, as it is in their self-interest to avoid being held to ransom, in environmental matters, by what happens outside their borders.

After the oil crisis of the 1970s, industrialized countries succeeded in reducing their dependence on fossil fuels through improvements in the efficiency of energy use and the structural changes that are leading them to develop postindustrial economies. As a result, the energy intensity (*3*) of industrialized countries has been falling by about 2% per year during the past few decades. In contrast, the energy intensity of developing countries is increasing, with the exception of China where it is falling (albeit from exceptionally high values) because of China's ongoing modernization process.

Promoting energy efficiency in developing countries will not, however, suffice. The growth in commercial energy consumption in developing countries is inevitable because of the need to build an industrial infrastructure, transportation, and urban growth. To avoid retracing the historical path of industrialization, early in the process of development it is essential to incorporate efficient and modern technologies that are now available, in order to "leapfrog" some of the steps followed in the past. LDCs are important theaters for innovation and leapfrogging, especially in the energy-intensive, basic materials industries (such as steel, chemicals, and cement), although demand in these sectors has reached saturation in the industrialized countries. Even if this is done, however, the problems of sustainability and environmental degradation will remain very serious, as pointed out above.

The way to address these problems is to promote the use of solar technologies, which by nature are renewable. Unfortunately, there are serious limitations in the developing countries on increasing the fraction of renewables that can be expected in

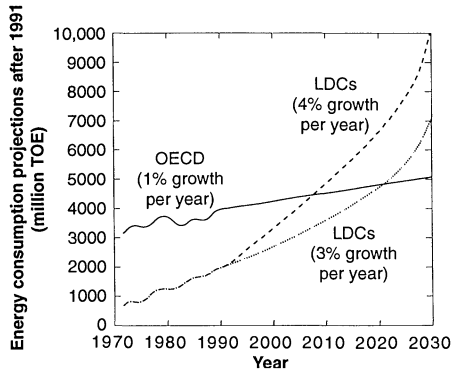

Fig. 1. Projections of primary energy consumption from 1991 to 2030 for LDCs and OECD countries. Up to 1990, effective consumption is indicated.

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the energy mix in the next 20 to 30 years. As shown by a number of recent studies, the balance will still have to come from fossil fuels, either locally produced or imported (Table 1).

The International Energy Agency (IEA) recently published its *World Energy Outlook* (4), which projects the world's energy demand and supply to the year 2010. In the absence of new policies, energy demand will grow by about 48%. Within the Organization for Economic Cooperation and Development (OECD) region overall, energy demand will grow by 28%, and the rest of the world will double its energy use. Although renewables make a relatively limited contribution to energy demand (less than 5%), their rate of increase is substantial.

The World Energy Council (WEC) (5) has constructed a number of scenarios ranging from "business as usual" to ecologically driven. In the latter scenario, even if the role of renewables and natural gas is increased and all opportunities for energy conservation are explored, there will be a 30% increase in the world's energy consumption. In addition, total energy consumption in industrialized countries remains essentially constant up to the year 2020 but with an appreciable reduction (25%) in the use of fossil fuels (oil, natural gas, and coal) through energy conservation and an increase in the use of renewables. In developing countries, all supply sources, including the contribution of fossil fuels, more than double in the period from 1990 to 2020.

In the renewable intensive global energy scenario (RIGES) (6), total consumption also grows by 30%, but the contribution of fossil fuels in industrialized countries is reduced more drastically (about 40%) and the difference is taken up by new renewable energy sources.

Both WEC's ecologically driven scenario and RIGES's, which requires the least amount of energy, incorporate the most testing and far-reaching assumptions for industrialized and developing countries alike, such as a rate of reduction of energy intensity far in excess of anything achieved historically, particularly in the industrialized countries; a lower rate of increase in energy demand in the developing countries than would be regarded by many as socially and economically acceptable; and very strong policies for promoting energy efficiency and the use of new renewable energy sources. It is unlikely that all these conditions will be met by the year 2020.

The projections quoted here are representative of the state of the art of energy-use forecasting, as reviewed extensively by the Intergovernmental Panel on Climate Change (7). In some of the projections, the price of fuels and electricity is assumed to increase by up to 50% by the year 2020, which would create additional problems for developing countries. Increases in fuel prices, however, are not necessarily reflected in the cost of energy, because of increased efficiency and new technological developments. For developing countries, indigenous fuels (and hydroelectric power) can reduce vulnerability, acting as insurance against increases in the price of imported fuels.

Table 1. Total energy consumption (GTOE).

Year	Scenario	Primary energy	Renewables
1990		8.8	1.6 (20%)
2010	OECD/IEA*	11.59	<0.6 (<5%)
2020	WEC (ecologically driven)	11.3	3.4 (30%)
2025	RIGES	11.2	5.0 (45%)

*Does not include noncommercial fuels such as wood and animal waste.

What one concludes from all this is that the simplistic idea that energy conservation and the enhanced use of renewables could solve the world's sustainability and environmental problems, particularly those of the developing countries, by the year 2020 is entirely unrealistic. All sources of energy will be needed, despite energy conservation efforts in LDCs and industrialized countries. The alternative for developing countries would be to remain at a dismally low level of development which, ironically, would generate additional, serious political problems and an unchecked population growth that would aggravate the problems of sustainability.

Not recognizing that energy conservation and development of new energy supplies (renewable and nonrenewable) are indispensable as an underlying principle in the energy debate has led to a number of false dichotomies that distract people from a constructive path. Some of these debates center on small versus big hydroelectric projects, renewable versus fossil (nonrenewable) energy sources, and energy efficiency versus new supply sources.

The real problem is the definition (which frequently cannot be made on the basis of purely technical arguments) of the priorities by which investments are to be made. Development and the increased use of certain types of energy sources, such as coal and large hydroelectric projects, might indeed be the cause of serious environmental problems, but so is underdevelopment, particularly at the local level. Large hydroelectric projects might be the best solution for some countries, whereas small hydroelectric projects might merit higher priority in others, mainly in isolated areas. On the other hand, photovoltaics and wind power might make sense in some parts of the world, even if they are more expensive than electricity generated by other means and even more so if the costs of environmental damage were internalized for fossil fuels.

A delicate balance between economic paralysis, with its grievous consequences, and development has to be sought, and ways will have to be found to promote development while minimizing, but not completely avoiding, environmental problems. Reaching such a balance is an urgent priority for larger funding agencies, such as the World Bank, which sometimes bows to pressures from conservationists. An example of such problems is the financing of large hydroelectric projects, which are under constant attack and threatened by demands for a moratorium on new projects. If such demands are met, they will undoubtedly soon be extended to all new, large supply sources based on fossil fuels. Such environmentalists might be moved by noble motives, but they fail to realize that lack of electricity and liquid or gas fuels will deprive entire populations of access to better living conditions and lead to even more deforestation and land degradation in many countries. To the suffering population of the Third World, this would cause more harm than good.

REFERENCES AND NOTES

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3. The energy intensity is a measure of the energy needed to produce one unit of gross domestic product.
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