Energy investment in developing countries

by Y. Rovani*

Although the developing countries currently consume less than one-quarter of the world's total energy, they are likely to represent the fastest growing component of global demand over the next two decades. Between now and 1995, their energy consumption is expected to grow by nearly 5% per year, while that of the industrial countries will increase by less than 2% annually. By 1995 the developing countries will account for nearly one-third of the world's total energy consumption, yet they will remain net exporters of energy to the rest of the world. In fact, their share of total energy production is likely to grow from an estimated 38% in 1980 to around 43% in 1995.

These aggregate figures mask dramatic differences among both developing and industrial countries. The few oil-exporting countries are clearly affected in a very different way than the many oil-importing countries by the 600% increase in the relative price of oil witnessed in the last decade. For the developing world, the increase in import costs resulting from the 1979—80 oil price increase alone, amounted to around US $30 billion per year, or 15% of the export earnings of the oil-importing countries.

The energy constraint on the growth of these countries is not easily bypassed. Increasing use of energy is an essential part of the development process. Per caput use of energy is about 420 kg coal-equivalent (kce) in low-income countries and 960 kce in middle-income developing countries compared to over 4000 kce in the industrial-market economies. While some scope for improving the energy efficiency of use undoubtedly exists, such savings will be dominated by a rapid increase in demand for energy as national incomes increase. It is worth noting that the percentage of households with access to electricity is still exceedingly small in developing countries, often less than 10%. Moreover, it is inevitable that, at least in the medium term, most of the required increase in energy supply will have to be from conventional, commercial energy rather than fuelwood (which is becoming critically scarce in many countries) or from other renewable technologies such as solar, wind, or even biogas. These latter three technologies are still relatively expensive and difficult to harness except under specific circumstances.

The basic philosophy underlying the World Bank's approach to the energy sector is that an accelerated development of conventional indigenous sources of energy is absolutely vital if developing countries are to attain a satisfactory rate of economic growth. This is a difficult process. For some countries, it means increasing exploration and development of oil and gas and promoting large and diversified gas markets. For others, it means developing remote hydroelectric resources. For still others, it means developing or importing coal. For most, it also includes paying more attention to the efficient use of energy — especially in industry and power generation — in order to limit imported oil as rapidly as possible to its most essential uses, primarily as fuel for transport.

High cost of energy investments

Progress in the energy sector is beset with problems. The first and most striking is the high capital cost of replacing imported oil with domestic sources of energy. For example, even in those developing countries blessed with oil, the World Bank's estimates show that production costs are generally between US $10 and US $20 per barrel. While this is well below the cost of oil imports, it still means an investment cost of US $15 000 to 20 000 per daily barrel. Similarly with gas, the cost of production in developing countries is generally well below the costs of the imported oil that it would replace, but large initial investments are required for production and transmission.

The magnitude of the swing from recurrent costs of imports to capital costs for development of indigenous energy is even more dramatic if one considers the cost of developing other sources such as coal, lignite and hydro-power. The capital cost of a lignite development and a thermal power station at the mine-mouth is around US $2500 per kilowatt, and hydro projects costing US $3000 per kilowatt or more are now appearing in investment programmes. It is important to remember that these costs are drawn from examples of projects which, taking account of the cost of capital, are economically viable because of fuel cost savings.

* Mr Rovani is Director of the Energy Department of the World Bank, 1818 H Street NW, Washington DC 20433, USA. The views expressed in this article are those of the author and do not necessarily reflect the official position of the World Bank.
At these costs, energy investments claim a large share of developing countries' investable resources. The Bank estimated several years ago that the investment required for energy sector development in the developing countries was of the order of US $40 to 50 billion a year, at 1980 prices, or about 3 per cent of their gross national product (GNP). For the institutions that have to undertake these investments, the mobilization of resources is a formidable task. The Bank sees this very clearly with the electric power utilities that it finances: their percentage contribution from internal resources towards financing their investment needs has declined markedly during the last decade. The size of the investments in the energy sector for developing hydro sites or gas fields poses an especially serious problem for small African countries where the cost of a single project may amount to as much as a quarter of annual GNP.

External financing

The high cost of energy investments, coupled with the high economic benefits they bring, points to the importance of mobilizing adequate external financing to assist developing countries increase their energy investments. Although these investments have a high priority in governments' investment programmes, and energy projects are relatively attractive to export credit agencies and commercial banks, the scale of the investments needed in this sector is so large that they are limited by aggregate financial constraints. Multilateral and bilateral official agencies have significantly stepped up their lending for energy investments, but further growth is constrained by available resources. Private commercial financing can be tapped, but given past commercial borrowings and the tight terms on which they are available, excessive reliance on commercial sources of finance can create debt servicing problems. There is no alternative to a significant expansion of official lending for energy financing, both at concessional and market terms.

During the last fiscal year, the World Bank (including IDA) lent US $3.4 billion for energy projects, representing about one-quarter of total Bank/IDA lending. This share is up from 19% two years ago and 15% five years ago. The Bank could continue to expand and diversify its energy programme. The need and the opportunities for preparing attractive projects, and for mobilizing other external sources - private and public - to help finance them, are there. The Bank is, however, constrained by the size of its total lendable resources and cannot exceed the current ratio of energy lending to total Bank/IDA lending, as this would mean reducing unacceptably loans to other high priority sectors. Together with member governments, the Bank is seeking ways to increase the volume of energy investments in developing countries. However, the World Bank's own energy lending can rise only in step with aggregate lending.

Given the financial constraints, the World Bank tries to stretch its money as far as possible. More than half of its projects have explicit arrangements for external co-financing. As energy lending has expanded, the Bank has stepped up its efforts to attract additional project funding from export credit agencies, commercial banks and other official donors. In the power sector, Bank lending has risen very little in real terms over the past decade while developing countries investment needs have expanded significantly. The Bank estimates that its current planned lending over the next five years will meet about 3.5% of the investment needs of the energy sector.

Need for technical assistance

Although finance is critical, it is not enough. Management of the energy sector is now much more complex than it was a decade ago. In a period when imported oil was cheap, there was little incentive carefully to survey a country's resource endowment and to establish the availability of its energy resources. Consequently, investment strategies must now be developed based on only scanty knowledge of the resources, such as the quantity of natural gas or the quality of lignite available in the country. There are technological risks involved in undertaking unprecedently large mining operations, or in introducing newer technologies in power generation, or in attempting an accelerated development of hydro sites without adequate hydrological information.

This lack of foresight has also produced economic uncertainties resulting in a wide range of plausible estimates for the growth of demand for energy, especially electric power. The choice between alternative investments is made yet more difficult by the
uncertainties surrounding the long-term price forecasts of oil and coal. Furthermore these risks are compounded by the long gestation periods of up to a decade for coal, large hydro and nuclear power projects. Mistakes can be big and correspondingly expensive. All this makes it necessary that investments are carefully designed in terms of engineering and economics; and that they fit into a comprehensive sectoral strategy.

An integral part of the World Bank's role in the energy sector is to advise and help developing countries cope with these management problems and devise policies accordingly. This is done partly through the Bank's project preparation, appraisal and implementation. In addition, it has launched a programme of country energy assessments, financed jointly with the United Nations Development Programme (UNDP). These assessments provide a rapid diagnosis of the energy problems facing a country, and a pragmatic evaluation of the options open to it. They analyse, in a macro-economic context, the scope for changes in pricing, and in institutional and other policies to encourage greater production from indigenous energy sources and greater efficiency in the use of energy; they assess the investment priorities in the energy sector; and they provide a framework for multilateral and bilateral technical assistance in the sector. During the past 18 months, 10 assessments financed under the joint UNDP/World Bank programme have been completed, a further 10 are in various stages of preparation, and 12 are planned to start during the next year.

Power sector issues

Effective management is especially critical in the power sector. In many countries it absorbs more than half the total energy-investment, and constitutes an important vehicle for replacing oil by other energy sources. The Bank recently reviewed the power investment prospects for 100 developing countries and found that all but 12 were likely to be investing in additional hydro-power capacity over the next 15 years. In around 30 developing countries the Bank foresees an expanded role for gas-based power. In about 15 countries the Bank expects geothermal resources to be developed. All this will mean that by 1995 the percentage of oil-based electricity production in developing countries will be around 6%, compared to 24% in 1980.

In the larger developing countries, the contribution from nuclear energy toward this goal of oil replacement by economically superior alternatives is expected to increase. The economics of nuclear power will continue to limit its attractiveness to a few developing countries, perhaps growing from fewer than 10 at present to around 15 by the turn of the century. For most of the smaller countries, the economies of scale inherent in nuclear power, the relative costs of hydro development and/or coal (indigenous or imported), and the sizeable requirement for highly skilled operating personnel, will combine to push the threshold year for the introduction of nuclear power into the next century. Nonetheless, the Bank's projections for 100 developing countries show that by 1995 the proportion of electricity produced from nuclear facilities will be around 6%, or approximately the same as that from oil-fired plants.

In addition to the high investment cost in power justified by oil savings, there is still a widespread need for expanding coverage. Given current trends, even by 1990 only one-fourth of the people in developing countries will have access to electricity. Their per caput consumption will still be one-twentieth that of the industrialized countries. For all of these reasons, the Bank estimates that a desirable level of power investments in its developing member countries should average around US $60 billion per year (in 1982 dollars) during the next decade. This compares with the World Bank's lending of US $2.1 billion in the last fiscal year. The task of mobilizing resources, both internal and external to the country, is overwhelming.

The joint UNDP/World Bank energy assessment programme

An energy assessment report
Reviews the existing and potential energy supply situation and the institutional, policy, and planning capability in the energy sector, identifying the major energy issues and highlighting significant gaps in energy policies, programmes and institutions;
Identifies the most appropriate energy subsectors to be developed;
Assesses existing and planned energy assistance activities by multilateral and bilateral agencies;
Analyses manpower and training needs in the energy sector;
Identifies additional financial and technical assistance needed in the energy sector.

Countries covered since November 1980

<table>
<thead>
<tr>
<th>Energy assessment reports published</th>
<th>Energy assessment reports in progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burundi</td>
<td>Bangladesh</td>
</tr>
<tr>
<td>Haiti</td>
<td>Bolivia</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Fiji</td>
</tr>
<tr>
<td>Kenya</td>
<td>Morocco</td>
</tr>
<tr>
<td>Malawi</td>
<td>Nepal</td>
</tr>
<tr>
<td>Mauritius</td>
<td>Niger</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>Nigeria</td>
</tr>
<tr>
<td>Rwanda</td>
<td>Peru</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Senegal</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Solomon</td>
</tr>
<tr>
<td></td>
<td>Sudan</td>
</tr>
<tr>
<td></td>
<td>Turkey</td>
</tr>
<tr>
<td></td>
<td>Uganda</td>
</tr>
<tr>
<td></td>
<td>Zambia</td>
</tr>
</tbody>
</table>

IAEA BULLETIN, VOL. 24, No. 4
The task of optimizing the use of those resources is equally formidable. The high investment cost of alternative generation has strengthened the case for tariffs based on long-run marginal costs. As power generation has become more expensive, it has become urgent to introduce facilities for load management and to re-examine the design of power distribution systems to reduce losses. Some of the Bank’s recent research has shown, for example, that economically optimal loss-levels in the power delivery system (i.e. transmission and distribution) in developing countries may be as low as 5%, compared to the usual rule of thumb of 10%. Even after allowing for unrecorded electricity consumption, the corresponding loss-levels in many developing countries’ networks today approach 20%, indicating that there is scope for large savings in this area.

The World Bank’s role

In the aftermath of the substantial increases in the relative price of oil that took place during the last decade, there are today many opportunities for high-return investments by which the developing countries can increase indigenous energy production and introduce more efficient technologies in energy-consuming sectors. These investment opportunities, if realized, would greatly enhance the longer-term development prospects of the many countries that currently spend 40 to 50% of their export earnings on imported oil. There are also private sources of funds to be tapped — in the form of export credits and commercial loans for the middle-income developing countries — to help finance the large investments required.

For the poorest developing countries, of course, commercial money is neither affordable nor available. Additional sources of concessional finance must be found. One of the most important roles of the World Bank is to harness those financial resources — both commercial and concessional — to the investment opportunities. To do so often requires major policy analysis and pre-investment effort in order to prepare bankable projects and credit-worthy institutions. It also requires careful follow-up during project development, and assistance in technology transfer. In many cases, the World Bank’s longer-term funds are a necessary catalyst for private financial participation.

The current scale of the Bank’s resources, however, is not commensurate with the expanded investment needs of the energy sector. To some extent, the gap can be met by increased efforts to mobilize financing from other official and commercial sources. Failure to meet these financing requirements is likely to make it more difficult for developing countries to realize their growth potential.