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Energy for Economic Development: A Case Study of North-East India

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Energy plays a significant role in economic development. In fact, a nation neglecting this sector will be just postponing its growth which it could ill-afford. Energy is the important component for improving the quality of life of the people. One of the indices of the measurement of prosperity in a country which is often being used, is the per capita consumption. This means that both energy production and energy utilisation are the indicators of a countrys' progress. Energy is an economic "good" and not an economic "bad." Therefore, one of the most important tasks of planning process is to ensure that there is sharp increase in the production of energy and its effective utilisation.

While developing countries are legitimately anxious to achieve high growth rates, they in fact find it very difficult to do so mainly due to underdeveloped resources and domestic markets. Most of the developing economies, moreover do not hav enough natural resources, especially minerals, and those thaido, have only partially exploited these (Mahajan : 1991). Thenorth-eastern region of India has, of course, an abundant suply of hydroresources but it is of no use unless such hydopotential is harnessed for energy generation. Similarly the existence of coal in the region is of little use because of remteness from the centre of industrial activity, as the region is idustrially backward. It may be of much use if the centre of idustrial activity is brought close to the coal mining areas, whih would facilitate the optimal operation of thermal plants, or here exists an efficient transport system for quick trarportation of coal to feed power plants located at a distance. Unfrtunately the region also lack in quick and efficient transport systm.

As developing countries seek to revitalise their economies, thei demand for energy will increase, whatever the dimensions of teir development. Thus we have to move toward higher genration of energy, as a corollary of development. Any shotage and imbalance will lead to adverse economic conequences. Further, the demand for energy in developing coutries is highly income elastic, per capita income elasticities for ie consumption of electricity, for example, are currently 2.0 or iore. As income rises in developing countries, energy use canbe expected to increase appreciably even with continued gain in efficiency (Anderson : 1996 : 10).

The conventional sources of energy available to us are in the orm of coal, oil, electricity and nuclear energy. The net reseves of coal, oil and gas in India amount to 80 billion tons, 500 million tons, and 45.5 million cu.m. respectively (Satanarayana : 1989), which are fast depleting. The choice of fuel then becomes crucial. The science and technology over the ong run must adapt to forms of energy whose use does not harn the environment.

The non-commercial sources of energy include firewood, cowdung and vegetable wastes. It is estimated that about 48 per cent of total energy supplies in India come from non-comercial sources, of which 85 per cent comes from firewood only to be used for domestic use especially in cooking, a major enegy consuming activity. Such energy demand is inelastic in natre at lower levels of income. According to the 28th round of NSS, the share of non-commercial energy is over 80 per cent in rural areas compared to 51 per cent in urban areas. About 88 per cent of non-commercial fuel used in rural areas is collected by the women and children while in urban areas the figure is 16.4 per cent. This need is met by burning animal waste with low efficiency or by cutting trees and burning wood (Murthy : 1990).

The use of fuelwood and dung (bio fuels) for cooking in rural areas result in deforestation, soil depletion and erosion. The indoor air pollution is one of the most severe environmental problems facing low income developing countries. It could be almost entirely eliminated by substituting gas, kerosene or electricity for the fuels used in cooking. Technologies and practices capable of addressing the environmental problems arising from energy use are either already available or in development. What is needed is broader recognition of their immense potential for abating pollution and supportive environmental policies based on economic principles (Anderson: 1996 : 13).

Indias' North-East Energy Scenario

Embracing a land surface of 25.5 million hectares the north-east region is connected with the rest of the country through a narrow strip of land in West Bengal. The region accounts 7.8 per cent of total land space of India and contains 3.8 per cent of total population. About 70 per cent of the area is hilly terrain. Consequently the topography is undulated in the bulk of the region. About two-third of the annual rainfall (250 cm. on an average) occur during the four monsoon months of June to September. The climate of the region varies from the temperate in the hilly region to tropical in the valleys and plains.

There are certain distinguishing characteristics of this area which should be noted for the purpose of considering power problems of the region and the various systems to meeting them. We may note dissimilarity in density of population, energy use pattern, and energy resource characteristics, etc.

Barring some parts of Assam and Tripura, most of other component units of the region have tribal population. The community structure in the tribal areas are, in general, very strong. Since the economy is agrarian, much of the energy requirements for drawing water, cultivation and harnessing, cooking and keeping house warm during winter season is generally met through collection of firewood by human being or animal waste.

Predominance of the primary sector in terms of its income contribution underlines the low level of development of the north-east. Big push in the investment is, therefore, called for to transform the economy. Cheap availability of power and matching development in infrastructural facilities may lead to the development of secondary and tertiary sector to bring prosperity in the region.

Installed Capacity, Demand and Consumption Pattern

The total installed capacity of power in the region in March, 1994 was of the order of 1,138.81 MW (effective capacity 1,101.56 MW) including 255 MW hydro power under central sector from Loktak, Khandong, and Kopili. The break-up includes 491.54 MW hydel power, 572 MW thermal based on coal and gas, and 75.47 MW diesel. The data released by the North-Eastern Regional Electricity Board shows net generation of electricity to the tune of 3,083.21 MU with import of 92.97 MU from eastern region to meet the regional requirements of 3,176.18 MU in 1993-94.

According to 13th Lead Survey of CEA (1987) there will be a surplus of 1,308 MU after meeting total requirement of 5,552 MU with a peak load deficit of 55 MU in 1994-95. The NCAER estimate (1988) indicate total requirement of power in the region up to 8,475 MU in 2,000 AD which may go upto 60,140 MU by 2,015 AD. It includes consumption of 38,555 MU by industry, 1,341 MU by agriculture, 813 MU by trade and commerce and 4,309 MU for domestic use (Ray : 1991).

The per capita power consumption in the region vary from 83.9 kwh in Tripura to 159.4 kwh in Meghalaya as against 330.6 kwh for all India in 1992-93. The proportion of villages electrified in the region rang from 49.20 per cent in Meghalaya to 98.87 per cent in Nagaland followed by Assam 97.66 per cent and Manipur 84.57 per cent as against 84.42 per cent for all

India in October 1993. Though the task of rural electrification is relatively difficult in hilly states but the use of advanced technologies for non-conventional power generation can meet the energy requirements of such isolated and sparsely populated villages (Agarwal : 1989).

The distribution losses in State Electricity Boards range from 10.9 per cent in Meghalaya to 29.8 per cent in Tripura as against all India average of 23.0 per cent in 1989-90. Some of the reasons for such a high percentage of T&D losses can be traced in mismanagement and inefficient distribution system. Theft of power from transmission lines by the users for domestic and industrial purposes is very common which can easily be controlled by effective supervision and monitoring at least in urban and semi-urban areas including on-road rural settlements.

Commercial Sources of Energy

These include coal, petroleum products and hydro potential.

Coal : The region has some coal deposits in the state of Assam and Meghalaya. Some other important coalfields are in Arunachal Pradesh and Nagaland. The estimated reserves of non-coking coal is around 900 million tons. The coal available in the region is generally very friable and contain organic sulphur content to the extent of 8 per cent. In general the ash content is less than 25 per cent. The high calorific value of coal can profitably be used in thermal power but the power stations has to be suitably designed to accept the available coal in the region. Such power stations should be set up preferably near the coalfields and big industrial establishments to use the power at an economic rate. The actual choice of such projects will, of course, depend on factors like terrain, seismicity of the area, submergence and rehabilitation problems and cost effectiveness.

The industrial and domestic use of fossil fuels as energy cause the most emissions of CO_2. Thermal electricity generation by using coal cause particulate matter emissions and acid deposition. Control of particulate matter emissions is possible through electrostatic precipitators by switching over to use of low sulphur coal and gas, by using combustion technologies—often known as "clean coal" technologies. The remarkable growth of commercially proven reserves of gas has also opened new opportunities for a very low polluting and efficient means of electricity generation (Anderson : 1996 : 11).

Oil and Natural Gas : The region is adequately gifted with petroleum. The oil fields of Assam are well-known besides recent opening up of oil fields in Arunachal Pradesh, Nagaland and Tripura. The region has reserves of 158.16 million tons of crude oil in 1993 and about 156.13 million cubic metres of natural gas. However, a good amount of natural gas is being flared away daily because of lack of planning to use it economically in the manufacture of chemical fertiliser and in generation of thermal energy (Agarwal : 1991).

Since the reserves of fossil fuels are limited, it could be preserved in view of the abundance of hydropotential in the region. The conservation of conventional energy has assumed great importance for the reasons like depletion of coal and forest reserves and high prices of petroleum products besides the environmental issues involved.

We have to move toward higher generation of energy, as a corollary of development, accompanied by greater use efficiencies. We look at the scope for increased use of renewable energy. The science and technology over the long-term must adapt to forms of energy whose use does not harm the environment.

Hydropower Potential and Constraints

There are two principal river systems in the region the Brahmaputra and the Barak. The mighty Brahmaputra flows in gently in westernly direction through the Assam Valley for about 450 miles receiving other important tributaries. The minimum annual run-off of the Brahmaputra may be taken as 452 million acre ft. The length of the Barak river in India is 350 miles with an average annual run-off 30 million acre ft. The Doyang river is one of the major river system draining the hills of Nagaland. The region is endowed with huge hydropotential to the extent of 50 to 80 thousand MW, of which about 500 MW has so far been tapped. Efforts have to be made to harness this inexhaustable potential for the economic development of the region.

The north-eastern region lies in a seismic zone. Therefore, after identification of the hydro-electric project, detailed investigation such as topographical, hydrological, and geotechnical should be carried out in a planned phase and comprehensive manner leaving no room for doubts while designing various structures, installation, etc. Submerge of large inhabited cultivable and forest areas under water due to dam construction to harness hydel power may cause displacement of many persons settled within the project area. It is natural that they will resent to leave their hearth and home. Therefore, they should be rehabilitated in a proper manner.

The constraints like geotechnical, land acquisition, adequate manpower, infrastructural facilities and finance, etc. should be taken care of while executing such projects. It is also essential to develop workshop facilities to provide the necessary back-up services at the construction site and thereafter maintenance purposes. In order to meet the growing demand of power due care has to be taken in selecting projects which can be completed quickly and economically to deliver cheap energy to the users without any adverse effect on the environment. It is also necessary to develop a suitable transmission system preferably national grid to transmit this power to the load centres of the country.

Micro-Hydel Power

Growing opposition to large hydel schemes for ecological reasons has given rise to wide recognition of microhydel power generation. Micro-hydel power stations are ideally suited to areas where power demand is low, population is scattered, water resources are available. The ground has raised areas and conventional power is not available (Ramachandran : 1992). All these conditions are existing in the region and the power so produced is comparatively much cheaper than the electricity generated through diesel gen-sets in remote hill tops. Their advantage also lies in cutting off heavy transmission cost and losses to such distant and sparsely populated areas and stop deforestation due to firewood requirements. The state governments are required to develop a suitable management for the village/block at the panchayat or village elders' level to maintain the plant after setting up of the project. Once the villagers get used to electricity it will go a long way in preventing indiscriminate felling of trees. Similar type of arrangement is also proposed to be provided to the army camps and para-army units set up at high altitudes to meet their energy requirements, presently being met from fuelwood and diesel.

There are a number of state and central agencies engaged in investigation and execution of hydro-electric projects in the region. These agencies should work together in close collaboration and co-ordination for pooling their resources especially the trained manpower, technology, machinery and equipment. This will ensure optimum utilisation of locally available resources thereby reducing the project construction period and cost over-run.

There is a great potential for non-conventional energy generation in the north-east with its rich endowments of biomass resources, abundance of solar energy in the valley and ridges and swift wind in its hilly terrain.

Solar and Wind Energy

It has been estimated that the developing countries could meet all of their current and future energy needs with solar energy. Solar photovoltaic system is an emerging technology that enable conversion of solar energy directly into electricity. But the system will work successfully in areas where sufficient sunny days are available from 150 to 250 days and solar energy insulation is 0.75 to 0.875 KW/M^2

There is dissimilarity in respect of availability of sunlight in different parts of the region. Most of the parts in the region get totally cloudless days from November to April for about 110 days and 5 to 10 sunny days approximately during each of the remaining months in a year. Therefore, total dependence on solar energy for use other than irrigation seems impracticable. However solar P.V. Pumps of 1/2 to 1 H.P. capacity with 50 per cent efficiency can be of use to the small and marginal farmers to get water for irrigation and drinking purposes. Similarly, solar driers of 500 kgs to 1 ton capacity per day can be installed over a wide area mainly for drying of crops and fish (Trivedi : 1984).

In some ridges and slopes of hills swift wind blows where wind energy can be profitably harnessed. Data on wind velocity is not available for the entire region. At Pasighat and Tuting in Arunachal Pradesh the average wind speed recorded is 9.5 KMPH while in many other areas of Nagaland, Mizoram, Meghalaya and Manipur it varies from 3 to 6 KMPH. In these areas low speed wind mills can operate.

The North-Eastern Council has sanctioned some pilot projects based on solar and wind devices to harness the potential on experimental basis in different parts of the region.

A hurdle still to be overcome is the cost of storage. In the case of solar and wind energy, it may be necessary to produce hydrogen through electrolysis and to use fuel cells or combustion to reconvert the hydrogen back into useful energy. Alternatively, solar energy can be stored in other ways; electrically by using batteries; kinetically (using ultra-high speed fly wheel devices with low friction bearings); thermally (using molten salts or even metals or heated bricks); thermochemically (using the high temperature of solar concentrates to create synthetic gases); hydraulically (by pumping water into reservoirs); by the storage of compressed air, which can later be used to drive turbines; or in the form of biomass. All of these options are under active research, and all are known to work. These developments in solar energy and related storage technologies show much commercial promise (Anderson : 1996 : 12).

Biogas Energy

Biogas is perhaps the most important component of renewable energy supplies. It is produced from anaerobic fermentation (in absence of air) of organic waste. The agricultural waste and vegetable waste can be used as raw material for generating biogas (methane gas) at the village or farm level to provide most efficient energy conversion of the resources available at present without destroying the intrinsic value of these materials are fertiliser or animal food.

The National Accounts Statistics (1991) reported that for the year 1988-89, 43.56 per cent of animal waste was used for decomposition and manure purposes in India and the remaining 56.64 per cent was used for catering to energy needs in the form of cow dung cake in rural areas (Mehla and Dubey : 1993). The total quantity of dung available from 12.5 million livestocks in the north-east is assumed to be around 87.5 million kgs with a potential of 113.75 million cft. of gas (Sharma : 1986). According to the estimates of the Advisory Board of Energy, about 8 per cent of the rural households of north-east are having adequate cattle population to instal a family type bio-gas plant *i.e.*, about 3.2 lakh rural families can use biogas energy. However, efforts have to be made to create the awareness amongst the rural masses of the region about the usefulness and the potential of biogas. It also requires provision like adequate quantity of building material at the construction sites, training to the local people regarding construction and maintenance of such plants involving the voluntary organisations to promote the available technologies to harness the biogas generation potential in the region.

For tapping non-conventional energy sources dissemination of transfer of technology from technology clinics to rural areas need to be increased. At micro level due care need to be taken as the development of non-conventional sources of energy require subsequent maintenance and repairing.

Conclusion

The energy planning in the region needs careful consideraticn of different issues like terrain, seismicity of the area, density of population and its energy requirement, available potential to tap the conventional and non-conventional energy from the source, adequate trained skill, infrastructure and finance, etc. Other issues like ecological imbalance and environmental upgradation are also important while tapping the energy from available fossil fuel and hydel potential.

The development of fossil fuel substitute would very much depend on the development of appropriate technologies. The availability of surplus land and also the existence of active government support and favourable market conditions. All this will take time, in the meantime, oil and products will continue to play a significant role in the energy market economy of developing countries. As such it would be appropriate to adopt measures which would help oil conservation and its better use.

Energy conservation is essential to avoid the wastage at the household and industrial level. This aspect too deserves attention just as the need to develop efficient technologies for production, supply, and use of energy. It is envisaged that energy conservation can be brought about by curtailing consumption through rationing, high pricing formula and through education on efficient use of energy and by evolving energy efficient devices, etc. Here developing economies could benefit from the experience of developed countries particularly in the use of alternative fuel in industries and efficient road transport system to save the wastage of diesel. All this, however, would need substantial investment and certain major changes in the energy-using sectors. We must minimise delays in the implementation of all projects connected with energy production and energy conservation.

It may be noted that if renewable energy were to become the primary energy source—for environmental or commercial reasons, or both—the transition would take decades. In this period, the options for using fossil fuels more efficiently and in less polluting ways will be of much importance. Emphasis on implementation the programme on the use of non-conventional sources of energy is essential for rural development.

No doubt constraints are there but with determined efforts much can be accomplished. The surplus of power so generated by effective harnessing of the existing potential in the region would not only meet the requirements of power deficit states of the country but would bring much needed revenue to the states of this region to boost the economic activities and accelerate economic development.

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