

ENERGY OPTIONS FOR PAKISTAN IN A GEOLOGICAL PERSPECTIVE

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ABSTRACT

The modern industrial civilization which has principally developed during the last century differs from all previous civilizations in the amounts of energy it uses in sustaining its rate of growth. The most critical aspect of the present-day development scenario is that the rate of increase in energy-consumption is not simply arithmetical; it is geometrical and increases exponentially due to population increase coupled with a rising standard of living.

For a country like Pakistan, dependable and affordable supply of energy is of critical importance in order to industrialize the economy and to alleviate poverty. Although the energy related problems of Pakistan are formidable, but fortunately they are not entirely insurmountable, and geology holds the key to provide hope, options and solutions. The paper discusses the available energy-options for Pakistan in a geological context, and recommends measures which can hopefully ensure a better energy scene and thus a brighter future for Pakistan.

INTRODUCTION

Endowed with enormous potential for energy resources, Pakistan still remains an energy-deficient country. This is despite the fact that more than 70 per cent of the national territory is constituted by sedimentary rocks of various ages, which further extend into a large prospective off-shore region, through a 700km long coast in Sindh and Balochistan. The growth of the economy, combined with a high demographic rate and rising urbanization, has put the present energy-resources under pressure. It is, therefore, urgently needed that the rising energy-demand is met in consonance with the overall developmental goals and achievement of self-reliance through better supply position.

With an estimated population of 150 million people, growing at an alarming rate of 2.6 percent per annum, and an economy of US\$ 70.0 billion growing on an average of about 5-6 percent per annum, the country needs ever-increasing supplies of energy for its

developmental and socio-economic needs. Although since inception, Pakistan's per capita energy-consumption has increased 12 times from 0.22 to 2.6 barrels of oil equivalent, this level is still one-half of the average of the developing countries and 1/30th of that of USA. With continuing increase in population alongside an expansion in economic activities, the per capita consumption of energy is bound to rise substantially with severe demands of environmental sustainability.

ENERGY RESOURCES: POTENTIAL AND PROSPECTS

Pakistan's proven energy-resources are not commensurate with the prognosticated geological potential.

The remaining resources of crude oil in known areas are estimated at over 310 million barrels while the production is only about 60,000 barrels per day, of which 33 per cent comes from the Potwar region and the other 67 percent is from Badin and adjoining areas in Sindh. Similarly, exploitation potential of natural gas is estimated at over 26 trillion cubic feet, against which the obtained production is about 2,600 million cubic feet per day. Likewise, the exploitation-potential of coal in the country is about 176 billion tonnes (175 billion tonnes in Thar coalfield in Sindh alone), but the annual production is confined to a meagre 4 million tonnes.

The hydroelectric potential is variously estimated, ranging from 20,000 to 45,000 MW, but the installed hydel capacity is 5,000 MW, which is expected to increase to about 6,200 MW by the end of 2000. The two operating nuclear-power plants have an installed capacity of 462 MW. The total thermal base power-capacity in the country is around 12,000 MW based either on the natural gas or the imported furnace oil.

It is clear from the foregoing description that the known energy potential of the country is much larger than the present level of exploitation. If carefully planned and efficiently implemented and managed than this potential is sufficient enough to provide

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immediate relief to the national economy in short to medium term, i.e. from 5 to 10 years. During this breathing period, long-term policies ensuring sustainable energy-supplies can be drawn and implemented. These long-term policies should also take into account the new developments taking place in the realm of renewable energy resources, like solar; hydrogen/fuel-cell; wind & tidal; biomass; geothermal and the nuclear involving the new breed of safer and better performing reactors.

Presently, Pakistan consumes 45.7 million tonnes of oil equivalent (TOE) as primary commercial energy. This comprises 41 percent oil, 43 per cent gas, 10 per cent hydro, 5 percent coal and 1 per cent nuclear. Nearly 83 per cent of oil is imported at a cost of over US \$ 3.0 billion per annum. The import bill is likely to touch the 5 billion dollars mark within the next 3 to 5 years. It is, therefore, vitally important for Pakistan to further explore and develop its own resources of oil & gas; and also at the same time bring coal into major focus through coal-based power-generation; underground gasification; washing and briquetting; and as replacement-fuel in cement, sugar and other industries.

In the complex and interdependent world of today, the development-policies in a country cannot be drawn in isolation. It is, therefore, imperative for Pakistan to plan its energy-policies by taking a realistic account of what is happening all around the world, particularly in terms of new energy sources. It is almost certain that the era of fossil fuels, spanning over two centuries, is about to come to an end within the next 3-5 decades, not because of the depletion of resources but primarily because of cost factors and environmental considerations. Oil production in the world is likely to peak between 2007 and 2012. Thereafter, natural gas will start assuming the role of major source of commercial energy and this will be a transitional period, which will eventually give way to an altogether new 'era' of cleaner, safer and perhaps cheaper energy resources. This era is likely to be dominated ultimately by 'hydrogen' as the major player and with solar, wind, tidal and nuclear as the junior players. This R&D scenario is relevant to Pakistan, in the context that it provides some space to Pakistan to increase and expand its gas production and distribution network, with lesser worries now as to what will happen after 20 years or so.

When the energy scene of the world is viewed objectively and analyzed in its true scientific perspective, keeping in mind the human ingenuity factor, than it becomes clear that at least on a global scale the energy crisis is not really of resources but of perception. Nature is still bountiful (e.g. newly identified resources of gas hydrates), but the humankind has to be more compassionate and should exercise its options more carefully in an environmentally benign manner. Another critical aspect is that politicians and decision-makers, all over the world, should make a clear distinction between nuclear proliferation for weapon-use and the nuclear-power for meeting the energy-needs. If these aspects are taken into account and R&D efforts for harnessing new sources of energy and improving the use of existing resources are pursued vigorously, then the perceived energy- crisis can be resolved into '*an energy for all*' scenario. The alternative is a tense and divided world full of unpredictable and uncontrollable crises.

CONCLUSIONS AND RECOMMENDATIONS

Considered in a geological perspective, the overall picture of energy resources of Pakistan is not dismal, as is often projected. However, the country is confronted with the formidable task to explore and develop, as quickly as possible, all the available resources by readjusting priorities and making right choices for their rational use, both in power-generation, as well as, for other commercial purposes.

For the next 20 to 30 years, the transition of world's energy from the traditional mix of resources to a new blend of sources, the policy makers in Pakistan may consider the following suggestions with a view to augment energy supplies in the most economical and environment-friendly manners:-

1. Notwithstanding the policy and financial incentives and other concessions for foreign investment in oil & gas sector; concerted efforts should be made to develop a national pool of truly competent professionals to oversee and undertake all aspects of exploration and development of energy resources.
2. While R&D efforts may continue and be further accelerated on renewable energy resources, particularly solar, wind and tidal, the main thrust and focus of attention for immediate future should

- continue to be on oil, gas and coal. In this connection, the *Indus off-shore* region in Sindh and the sedimentary troughs between Ras Koh and the Makran hills; and in Kakar-Khorasan area in Balochistan should be given high priority for exploration.
3. The use of CNG should be further encouraged and at least 50 percent of the road transport be switched on to CNG by 2007.
 4. A re-assessment of hydel exploitation-potential should be made on proper scientific lines, particularly in view of the phenomena of global warming and the consequent shrinking of glaciers in the *Himalaya-Karakoram* region, which according to some computer modelling and climatological predictions are likely to melt in the next 40 to 50 years. The Indus river system depends heavily on glacial melt for its water flows. All this needs to be urgently and very carefully researched.
 5. In view of the huge coal exploitation-potential established at Thar in Sindh, and additional resources of coal identified elsewhere in the country, a comprehensive *National Energy Policy* should be formulated, in which coal should occupy a pivotal position for power generation as well as for in-situ gasification (UCG: underground coal gasification), briquetting and washing. All the production-plants of cement & sugar and other small to medium industries should be made coal-based, instead of using imported fuel.
 6. The setting up of small coal-based power-plants (5 to 25MW) in the country should be encouraged to provide locally available job-opportunities and a dependable source of power. This will also help strengthen the engineering industry in the country.
 7. Use of LPG and coal-briquettes should be introduced / encouraged in the mountainous regions of the country, with a view to save the precious wealth of forests.

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