

DAWN

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The Power Generation Expo & Conference

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THE life blood of a nation is without doubt ample supply of energy. This energy may be in the form of electricity, natural gas, oil or nuclear energy. Recently solar, wind or geo-thermal energy is increasingly contributing to the energy needs of the world. Countries such as Korea; Japan and USA are even probing the possibility of tapping methane (similar to natural gas) trapped in the sea bed or in deep coal mines.

Pakistan is gifted with substantial hydro electrical potential, natural gas resources and one of the largest deposits of coal in the world as well as un-limited energy available from the sun and wind. However, before exploiting this potential, the cost economics has to be kept in mind. Hydro electricity, wind energy and solar energy need a capital investment of approximately 2.3 to 2.5 dollars per KWH.

This is fairly high investment but in the long run cost of power generation is very low. It can even-out during the life of the power generation plant. Most hydro electric, solar power stations and wind mills have a life between 30 to 50 years. These are however not consistent energy sources and are strongly dependent on seasonal fluctuations.

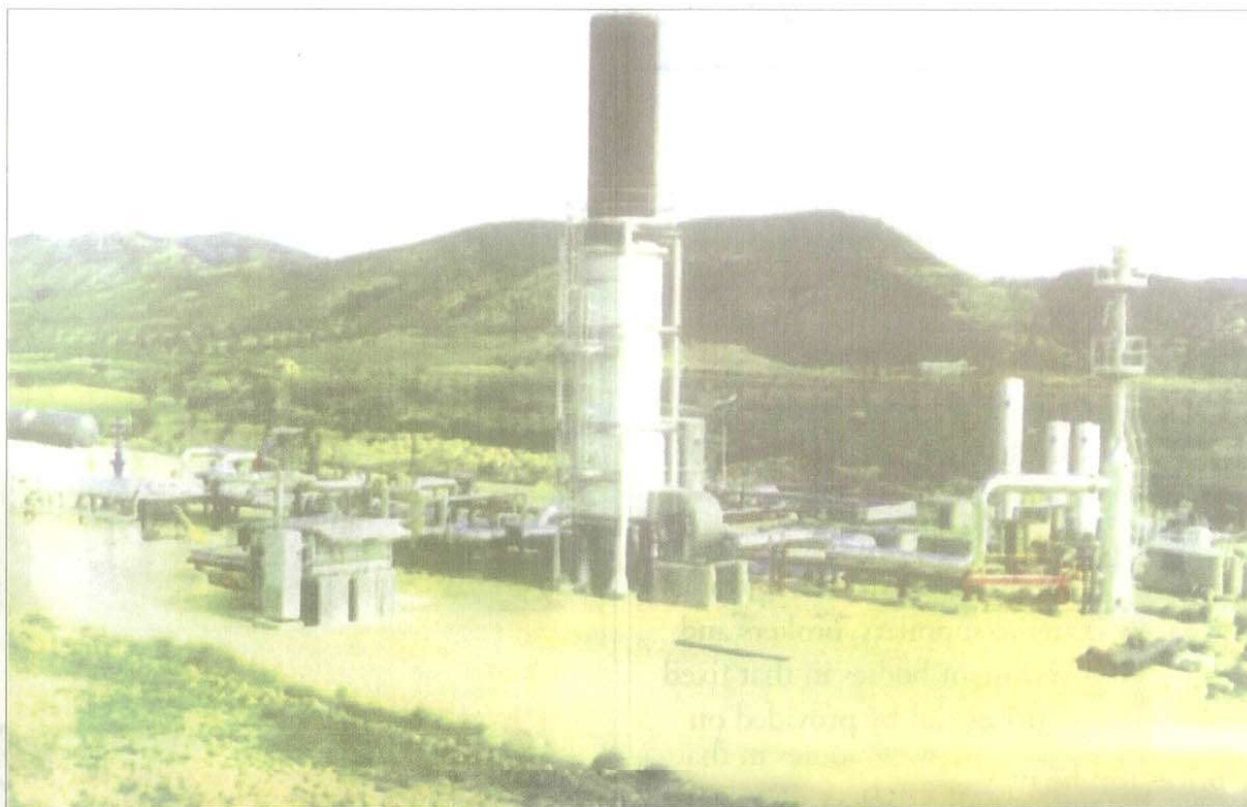
Electricity generation based on natural gas is dwindling drastically because of depleting resources of natural gas in the country. In recent years the country has witnessed gas load-shedding. The preference is now to have gas for the domestic consumers and for the industry.

Its availability for power generation is now minimal. Power generation plants based on natural gas have a capital investment of about one dollar per KWH and power generation costs are between rupees 3 to 5 per KWH. These will require new gas reserves to be discovered. Import of natural gas only supplements 14% of our demand gap.

Power plants based on furnace oil have a capital cost of approximately 1.5 to 1.6 dollar per KWH. This investment is not too high but there are issues of environmental pollution. Furnace oil has high content of sulphur and after 4-5 years of operation, the plant boilers corrode with the result that the generation capacity is almost reduced to 50%. The cost of power is about 9-10 rupees per KWH.

Efficiencies of any power generation system, whether it is nuclear or conventional ranges between 28 to 33%. These systems normally use heat from the nuclear reactors, from burning natural gas, from burning of furnace oil or coal to boil water and generate steam. This steam is then utilized to rotate a steam turbine which is coupled to an electrical generator.

Energy deficit of Pakistan



These days a break-through in power generation has occurred, where-by the power generation efficiencies can be increased to 58% and the life of the plants can extend to 50 years. In these plants, there is a pre-requisite to have either natural gas or coal gas as fuel. This gas burns in a gas turbine which is coupled with an electric generator that produces electricity.

The hot gases which came out from the gas turbine after combustion are then passed through a heat exchanger which generates steam and which runs a steam turbine and power generator. This combination of two turbines is called integrated gas combined cycle power generation system or IGCC system and achieves efficiencies of 58%.

Pakistan has installed capacity of about

19500 MW. Hydel power generation accounts for about 8000MW, whereas the remaining generation capacity of 11500 MW is dependent on thermal power plants which use natural gas/furnace oil, furnace oil only or coal (Lakhra Power Plant). Since natural gas is almost not available for power generation and Lakhra is running at 25% of its capacity, 60% power stations are now based on furnace oil.

These power stations run on imported fuel which is high in sulphur content and therefore the life of these plants has been drastically reduced and they are running at 30 to 50% of their installed capacity. The efficiency of electricity production is also low and ranges between 28-33% as mentioned earlier. The end result of this scenario is that power generation costs are

high (about Rs. 10 to 12 per KWH) and their capacities are low. There are serious environmental problems associated with the burning of furnace oil high in sulphur and the International Protocols are becoming increasingly strict in the enforcement of regulations against spreading of pollution.

A way out from this dismal scenario is to convert the existing power generation units from furnace oil to coal gas, which is produced from surface coal gasification plants. Indigenous or imported coal may be used. These coal gas power stations based on IGCC plants will generate electricity with the 58% efficiency at about rupees 5 per KWH.

A project has been envisaged in the Planning commission for the conversion of

underground coal in Tharparker into coal gas (UCG) without bringing coal out of the ground. Several holes are drilled in the coal field and steel casings are inserted in these holes just as is seen in normal tube-wells. Every hole reaches from the surface into the coal seams lying at a depth of between 160 to 175 meters. Coal at the bottom is ignited and compressed air is injected with steam.

The coal gas comes out from the adjoining wells which have not been ignited. In this manner several pairs of UCG producing gas wells are created. Heavy air compressors drive the fire wells and UCG from hundreds of wells is collected into a large diameter pipeline. This gas is then passed through a chemical plant which removes ash, tar, carbon dioxide and hydrogen sulphide from the UCG. UCG is now available for generation of electricity in an IGCC plant running at 58% efficiency.

The capital investment at a UCG based power generation system is about one dollar per KWH for small plants of less than 100 MW and about 0.8 dollar per KWH for larger plants of 500 MW capacity. The electricity production from these plants costs between rupees 3.5 to 4.5 per unit. There are no environmental problems associated with the burning of UCG as any carbon dioxide gas produced can be easily captured.

Any source of power generation based on our Thar coal deposits will be cheap and produce electricity at a constant level during the year. There is no seasonal dependence of power generation as is witnessed in hydel electricity plants.

Several thousand MW of power generation is being done in the world, in Russia, in Central Asian Republics, Europe, UK, Canada, Australia, China and South Africa from Underground Coal Gasification. UCG is also generating 1,60,000 barrels of diesel per day just from the SASOL plant in South Africa at a price between 17-20 dollars per barrel.

If we produce UCG from Thar coal, we can very conveniently meet our oil requirements and save valuable foreign exchange. The Thar coal field extends over 9500 square kilometers and has an estimated 175 billion tons of coal. These energy deposits can generate 50,000 MW of electricity and 100 million barrels of oil every year for next 500 years.

This energy reserve is 100 times the energy reserve in the Middle East, Iran and Iraq combined. Pakistan has no reason to stay poor after cheap generation of electricity and oil production. Our industries and agriculture will flourish and become very competitive in the world resulting in a huge leap forward in economy. The need of the time is that the government should focus its manpower and financial resources on the exploitation of this great gift of God to Pakistan.