

Study on Energy Situation in Bangladesh.

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Abstract

The present energy situation of Bangladesh about the reserves of the energy resources, present consumption trends and what to do from now onward for the future has been studied here. Available energy resources under classification and their possibilities have been studied with most updated data to understand the present energy situation of the country. Their contribution into the national power and energy grid has been stated with recent data and thus their demands have been understood. An important thing associated with energy and fuel consumption is the impact on the environment which is very important for Bangladesh. That's why, alternative energy resources have been studied extensively to find out and their feasibility has been also checked.

Keywords: Energy resources, Conventional energy resources, Non-conventional energy resources.

1. Introduction

As a promising and developing country, Bangladesh needs to use its resources and wealth's in a proper manner. For industrial and technological development and to elevate the overall living standard of the general mass of people, proper utilization of energy is necessary. For this reason, Bangladesh needs to account its energy resources.

2. Sources of Energy

The Energy prospect is generally assessed on the basis of available commercial resources of energy i.e., fossil fuel like gas, coal, oil etc. Natural Gas and Biomasses is significantly used as the main energy resources in Bangladesh.

3. Conventional Energy Resources

Conventional energy resources in Bangladesh are given below:

3.1 Bio mass

Biomass is biological material derived from living, or recently living organisms. Materials derived from plant and animal waste are especially prepared to convert into fuel which gives more heat with a small amount in comparison with typical fuels like wood or coal. There are five basic categories of material:

- Virgin wood, from forestry, arboricultural activities or from wood processing
- Energy crops, high yield crops grown specifically for energy applications
- Agricultural residues: residues from agriculture harvesting or processing.
- Food waste, from food and drink manufacture, preparation and processing, and post-consumer waste
- Industrial waste and co-products from manufacturing and industrial processes.

3.2 Natural Gas

Petro bangla, and more recently international oil and gas companies (IOCs) have established the existence of a significant energy source. In Bangladesh, natural gas is most important indigenous source of energy that accounts for 75% of the commercial energy of the country. So far in Bangladesh 23 gas fields have been discovered with the rate of success ratio is 3.1:1 of which two of the gas fields are located in offshore area. Gas is produced from 17 gas fields (79 gas wells). Oil was tested in two of the gas fields (Sylhet and Kailashtila). To reduce the dependency on natural gas, alternative energy resource must be explored.

3.3 Coal

Coal has a very small contribution to the power grid of Bangladesh. Its major fields of usage are electricity where it contributes negligible with respect to gas. Otherwise it's used as running the industrial furnaces and brick fields.

1. There is a thick layer (100m–200m) of soft, waterlogged sand lying over the coal reserves in Bangladesh.

2. The region is densely populated, as is Bangladesh in general.⁸ Coal exploitation would result in the need to evacuate, resettle and rehabilitate large numbers of people.

3. The soil over the coal-reserve areas in Bangladesh is extremely fertile, usually sustaining two or three crops a year.

4. The coal reserves in Bangladesh are situated in ultra-thick seams. This makes underground mining rather difficult.^[1]

3.4 Crude Oil

A mixture of hydrocarbons that exists in liquid phase in natural underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities. Bangladesh has remarkable crude oil reserve in Syhlet zone. Depending upon the characteristics of the crude stream, it may also include 1. Small amounts of hydrocarbons that exist in gaseous phase in natural underground reservoirs but are liquid at Atmospheric pressure after being recovered from oil well (casing head) gas in lease separators and are subsequently comingled with the crude stream without being separately measured. Lease condensate recovered as a liquid from natural gas wells in lease or field separation facilities and later mixed into the crude stream is also included; 2. Small amounts of non-hydrocarbons produced with the oil, such as sulfur and various metals; 3. Drip gases, and liquid hydrocarbons produced from tar sands, oil sands, Gilsonite, and oil shale. Liquids produced at natural gas processing plants are excluded.

3.5 Peat

Peat an unconsolidated deposit of semi-carbonized plant remains in a water saturated environment, such as a bog or fen and of persistently high moisture content. It is an early stage or rank in the development of coal; carbon content is about 60% and oxygen content is about 30%. Structures of the vegetal matter can be seen, when dried peat burns freely.^[2]

Peat Soil organic soils containing more than 20% organic matter in various degrees and states of decomposition. Deposits that are decayed slightly or not at all are termed peat, while those that are markedly decomposed are called muck.

4. Non-Conventional Energy Resources

Alternative energy is normally produced by harnessing the natural world around us and the elements. Usually it does not create pollution in the atmosphere or at least it only produces small amounts. Renewable energy is energy that comes from natural resources such as sunlight, wind, rain, tides, waves and geothermal heat. About 16% of global final energy consumption comes from renewable resources, with 10% of all energy from traditional biomass, mainly used for heating, and 3.4% from hydroelectricity.

4.1 Solar Energy

Solar power systems use the sun's rays- solar radiation-as a high-temperature energy source to produce electricity in a thermodynamic cycle. The need for Concentrating Solar arises because solar radiation reaches the Earth's surface with intensity (kW/m^2) that is adequate for heating systems but not for an efficient thermodynamic cycle for electricity. This means the density has to be increased, and the incoming solar radiation concentrated by using mirrors or lenses. Types of solar power system are given below:

- Solar Powered Irrigation System
- Roof-top Solar Power
- Solar LED Street Lighting

4.2 Wind energy

Wind energy has captured interest for a long time, of several options of renewable energy. Engineers and scientists has a wide array of experience in developing wind turbines, wind towers and wind farms to convert wind energy into electricity for a clean, quiet, non-polluting power. We have experience in the design, engineering, construction. Wind farms, a group of wind turbines used to generate electricity, are cost beneficial:

- Negligible fuel costs.
- Low maintenance costs.
- Lower capital cost.
- Can be employed in both urban and rural settings.
- We provide location analysis.

4.3 Tidal Energy

Bangladesh is fortunate to have access to the sea and tidal energy can be obtained from the changing sea levels. Generation occurs when the water is flowing both in and out, with the change in rotation occurring during low and high tide. It is a direct result of tide shifting from low to high. The tides rise and fall due to the gravitational tug-of-war between the Earth, the Moon and the Sun and if energy can be obtained it is inexhaustible. Experts say tidal energy can be obtained from three types:

- Tidal Barrage
- Tidal Fence
- Tidal Turbine

Bangladesh has a long coastal belt of 740 kilometers. Some of the coastal areas are protected by embankment and sluice gates from flooding. Bangladesh has some large tidal sites and many channels of low tidal sites where barrages and sluice gates already exist. Analysis of given sites according to a report indicates that Sandwip has a very good prospect of tidal energy. The 5-metre tides experienced at Sandwip are ideally suitable. Researchers say that Bangladesh may harness energy from tidal waves by application of two technologies:

- Low head tidal movements (2-5 m head)
- Medium head tidal movements (5 m or over) ^[3]

4.4 Hydroelectric power

Water has been used for thousands of years for energy source, with ancient civilization using water to drive mills thru the use of water wheels. Hydropower is the most moderately economical source of renewable electricity in Bangladesh. Prospective of hydro power in Bangladesh is a lot. Feature of these power:

- The production of power through use of the gravitational force of falling or flowing water.
- Most widely used form of renewable energy.
- Produces no direct waste, and has a considerably lower output level of the greenhouse gas, carbon dioxide, than fossil fuel powered energy plants.

4.5 Geo thermal Energy

Geothermal energy is a renewable energy source because the heat is continuously produced inside the Earth. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Geothermal energy is generated in the Earth's core. The core itself has two layers: a solid iron core and an outer core made of very hot melted rock, called magma. The mantle surrounds the core and is about 1,800 miles thick. It is made up of magma and rock. The crust is the outermost layer of the Earth, the land that forms the continents and ocean floors. It can be 3 to 5 miles thick under the oceans and 15 to 35 miles thick on the continents.

5. Assessment of Energy Resources in Bangladesh

Forecasting of energy plays a major role in optimal decision formula for government and industrial sector in Bangladesh. Renewable energy encompasses a broad range of energy resources.

5.1 Natural Gas

There are 23 discovered gas fields in Bangladesh of various sizes. The total reserve of 20 gas fields is about 26.84 Tcf (trillion cubic feet). Gas in most of the fields is dry, in a few fields it is wet, with considerable amounts of condensate, e.g. at Beanibazar (16 bbl/mmcf), Jalalabad (15 bbl/mmcf), and Kailashtila (13 bbl/mmcf). Currently, natural gas accounts for more than 70% of the total commercial energy consumption and the major part of the future energy demand would be met from it. ^[4]

Petrobangla has approximately 20 natural gas fields nationwide, half of which are active. The main fields include.

- Bibiyana (discovered by Unocal in Block)
- Titas (Second largest natural gas field in the countries)
- Habiganj
- Kailashtila
- Rashipur
- Jalalabad
- Sangs off shore natural gas field.

Other possible natural gas field includes Shaldanadi, Ferchuganj, Feni, Kumta and Shahbajpur.

- Unocol announced in March 2003 that it would begin development of the Moulavi Bazar field in Block 14.
- Shahbajpur, discovered by petrobangla subsidiary Bapex in 1995, is estimated to contain 330-400 of recoverable natural gas.

Jalalabad Field

This is the biggest gas field in Bangladesh.

(1)Unocal started natural gas production from the Jalalabd Field on Block 13 in February 1999.

(2)At a production rate of 80-100 million cubic feet of natural gas per day.

(3)Jalalabad supplies approximately 12 percent of the countries gas demand.

(4)The field contains an estimated 1.6 Trillion cubic feet of gas- in place. ^[5]

Bibiyana Field

- (1) Unocal discovered the Bibiyana gas field on block 12 in 1998.
- (2) The report concluded that Bibiyana is a world class accumulation of natural gas.
- (3) The Bibiyana field is estimated to hold as much as 5.5 trillion cubic feet (TCF) of recoverable reserves of natural gas and 30.7 million barrels of condensate.
- (4) The 3-D seismic survey is the first time this technology has been used in Bangladesh and provides a more accurate reserve than 2-D seismic surveys.^[6]

Moulavi Bazar Field

- (1) Unocal has signed a natural gas purchased and sales agreement with Petrobangla to develop the Moulavi Bazar Field.
- (2) Unocal expects to produce 70 to 100 million cubic feet of gas per day from the field beginning in the first quarter 2005.
- (3) Unocal discovered the Moulavi Bazar field on block 14.
- (4) The Moulavi Bazar 3 well set a record for drilling time and low cost.^[7]

5.2 Coal

Coal forms from compaction and indurations of variously altered plant remains similar to those of peat deposits.. Coal has a very small contribution to the power grid of Bangladesh. Its major fields of usage are electricity where it contributes negligible with respect to gas. Otherwise it's used as running the industrial furnaces and brick fields. The total coal reserves in 5 coal fields of Bangladesh are estimated to be 3500million tons (this energy is equivalent to 70Tcft of gas).^[8] First let's have a glance at the five coal fields of Bangladesh.

Table of Coal reserves in 5 Coal Fields in Bangladesh

[9]

Coal Field of Bangladesh	Depth(meters)	Estimated coal reserves in million tons(MT)	Proved amount of reserves(MT)
1.Barapukuria, Dinajpur	118-509	390	303
2.Khalaspeer, Rangpur	257-483	685	143
3.Phulbari, Dinajpur	150-240	572	288
4.Dighirpar, Dinajpur	328-407	600	150
5.Jamalganj, Jaipurhat	640-1158	1053	Yet to be known

5.3 Crude Oil

Bangladesh has discovered oil in two old gas fields in the country's northeastern region with an extractable reserve worth \$5.5 billion, the two finds at Kailashtila and Sylhet contain proven reserves of 137 million barrels of low sulfur crude oil, of which 55 million barrels can be lifted commercially. Low sulfur, or "sweet", crude oil is highly sought after and is more easily processed into gasoline than high sulfur crude. In the current market price, the value of this extractable reserve of 55 million barrels is 450 billion taka (\$5.5 billion). It's a very good news, coming at a time when are our oil import bill is growing fast.^[10]

5.4 Peat

In Bangladesh, peat soils occupy about 0.13 million ha and occur in the low-lying areas of the Gopalganj-Khulna region and also more locally in some of the eastern Surma-Kushiyara floodplain and the adjoining northern and eastern Piedmont plains. These are sedimentary peats. In general, organic materials occupy more than half of the upper 80 cm of the profile and sometimes in different layers within the same soil. Dark brown muck is the most common constituent of the soil. It has been mapped in a number of basin areas along the boundary between the Ganges river floodplains and the Ganges tidal floodplain. It occupies the Agro ecological Zone-14, i.e. Gopalganj-Khulna Beels. The area remains wet in the dry season, and is mainly deeply flooded in the rainy season. The Agro ecological Zone-14 occupies a number of separate basin areas in Madaripur, Gopalganj, Narail, Jessore, Bagerhat and Khulna districts.^[11]

5.5 Biomass

Bio power, or biomass power, is the use of biomass to generate electricity. There are six major types of bio power system: direct-fired, co-firing, gasification, pyrolysis and small, modular. Most of the bio power plants in the world use direct-fired systems. Two new ways include the use of micro turbines and fuel cells. Micro turbines have outputs of 25 to 500 kilowatts. Several bio power technologies can be used in small, modular systems. A small, modular system generates electricity at a capacity of 5 megawatts or less.^[12] Burning fossil fuel releases carbon dioxide but biomass fuel, on the other hand, releases carbon dioxide that is captured during photosynthesis and it tends to equal itself out. As biomass fuel is readily available, the reliance on external sources of fossil fuel can be reduced.

5.6 Solar Energy

In Bangladesh, more than one million households or about five million people are using solar energy generated by solar panels that are being installed on the rooftops, which have an incredible capacity to supply power. Since 60 per cent homes in Bangladesh are not connected to the electricity grid, they see solar power as a clean and viable option for lighting up their homes. The country's energy demand is actually growing annually at 14 per cent, and not as per government's estimation of 7.0 per cent.

500MW Solar Power Program

As part of the new generation expansion initiative in line with growing demand, Government has planned to enhance national power generation capacity to be 16000 MW by 2015.

Installation of Solar Irrigation Pumps

In the FY 2009-10, the agriculture sector of Bangladesh contributed 20.16% to the GDP (Bangladesh Economic Review-2010). Out of 11 million hectares of land under rice production, modern boro rice alone covers about 4.70 million hectares and nearly 98% of this area requires irrigation.

Solar Park

100-150MW of solar power is primarily assessed for solar park in different locations. Bangladesh Power Development Board (BPDB) will be the implementing agency.

Roof-top Solar Power Solution

A typical 10 KWp roof-top solar solution will require a roof space of about 1,000 square feet which can light around 200 no's of energy saving lamps. If installed in 5,000 buildings in the metropolitan areas of the country, a total of 16.5 million liter diesel/year or 100,000 units of electricity/year could be saved.

Solar electrification at Railway Stations

Under the proposed project, 25 MW Solar Power systems would be installed at the remote railway stations and 5 MW Solar Power systems would be installed at the roof-top of unutilized large railway stations.^[13]

5.7 Tidal Energy

Tidal power, also called tidal energy, is a form of hydropower that converts the energy of tides into useful forms of power - mainly electricity. Analysis of the given sites indicates that Sandwip has a very good prospect for tidal energy. The 5 meter tides experienced at Sandwip results in poor accessibility, with the island constantly surrounded by mud flats, except during high tides. During the night the excess power produced can be directed into battery charging. These batteries can be provided for households living off the grid. The installation of 75 KW turbines, generating 80% of full capacity for 23 hours per day, equates to the production of approximately 1,380 KW-hr per day. It is proposed that the manufacture and installation costs for one site will be in the order of 35 lakh Taka.

5.8 Wind energy:

Bangladesh is situated between 20°34'-26°38' North Latitude and 88°01'-92°41' East Longitude. The country has a 724 km long coast line and many small islands in the Bay of Bengal, where strong south-westerly trade wind and sea-breeze blow in the summer months and there is gentle north-easterly trade wind and land breeze in winter months.^[14] Some of the specific projects that could be undertaken were pointed out by the WEST study as follows:

- A pilot wind turbine plant may be set up and be linked with the existing 250 KW diesel power station at Kutubdia, to study the overall performance of a hybrid wind-diesel system in an isolated local grid.
- A demonstration wind power generating plant at Kuakata may be set up and connected to the existing grid to study the performance and efficiency of such a system.

5.9 Hydroelectric power:

The earth-filled dam Kaptai is an earth-fill dam. It is 45.7m (36m MSL or Mean Sea Level) high and 670.6m long. The maximum width is 7.6m and width at the foot is 45.7m. The 16-gated spillways, each 12.2m by 11.3m, can together pass a flow of 625,000 cusec. The average annual flow in the reservoir is approximately 15,646 MCM (Million Cubic Meter). The flood absorption capacity is 8.25 million Ac-ft and the flooded area at 33m MSL is 777 sq km.^[15] Hydraulic Turbines transfer the energy from a flowing fluid especially water to a rotating shaft. Turbine itself means a thing which rotates or spins. Hydraulic Turbines have a row of blades fitted to the rotating shaft or a rotating plate. Flowing liquid, mostly water, when pass through the Hydraulic Turbine it strikes the blades of the turbine and makes the shaft to rotate. While flowing through the Hydraulic Turbine the velocity and pressure of the liquid reduce, these result in the development of torque and rotation of the turbine shaft. Kaptai dam is the one and only dam of Bangladesh that is used to generate hydro-electric power. The only hydropower plant in the country is located at kaptai, about 50 km from the port city of Chittagong. This plant was constructed in 1962 as part of the 'Karnafuli Multipurpose Project', and is one of the biggest water resources development projects of Bangladesh. The water storage capacity of the Kaptai dam is 11000 km².

Starting of Kaptai Hydroelectric Power Plant in 1957, the initial phase of the construction was completed in 1962. By this time the dam, spillway, penstock and two 40 MW Kaplan turbine-generators were built within the power station. In August 1982 a 50MW generator was commissioned. In October 1988 the 4th and 5th generating units, both 50 MW Kaplan-type turbines, were installed which raised the **total generation capacity to 230MW**.^[16] The total cost of Unit 1, Unit 2 and a part of Unit 3 was Rs. 503 million and the total cost of extension was Tk. 1,900 million. The project was financed by the East Pakistan Government (at the time), United States and the Overseas Economic Cooperation Fund.

5.10 Geothermal Energy

Naturally occurring large areas of hydrothermal resources are called geothermal reservoirs. Most geothermal reservoirs are deep underground with no visible clues showing above ground. But geothermal energy sometimes finds its way to the surface in the form of: Volcanoes and fumaroles (holes where volcanic gases are released), Hot springs, Geysers

Units: Billions of barrels of oil equivalent

Crustal Heat—————79,000,000

Thermal Aquifers—————130

Oil Reserves—————5,300

Annual Global Energy Consumption——70

Plants for 200 MW are in the pipeline in the district of Thakurgain, one of the poorest in the country, near the northern border with India. Already it has secured favorable opinions from the Geological Survey of Bangladesh, the Ministry of Water Resources and the Ministry of Environment. Anglo MGH Energy conducted preliminary feasibility studies on an area of over 3,500 hectares, in order to identify the best site for the construction of the plant. The Geological Survey of Bangladesh and the Ministry of Water Resources and Environment have given favorable advice regarding the project.^[17]

6. Discussion

- Present situation indicates that we're traditionally heavily dependent on the conventional resources. This habit will worsen the present pollution problem and global warming issue in future.
- Fuel price hike is a severe problem at present. We have seen that the foreign companies are leading the gas production in Bangladesh. If government can strengthen the country owned companies technologically, it'll be easier to control the fuel price inside the country.
- Conventional energy resources are bound to be finished off one day. So, we need to gradually adapt renewable and eco-friendly resources. It will reduce the load from the conventional resources like gas and coal; on the other hand it will result in less pollution. It also alleviates the energy crisis which will result in smooth industrialization.

7. Conclusion:

The world has started experiencing energy crisis and pollution due to excessive usage of conventional energy. Competitive development of the countries will depend on the availability of energy. The future energy of the world will be non-conventional renewable energy. So, it's high time to adapt all possible sources of renewable energy.

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