6th Five Year Plan Analysis of Bangladesh Power and Energy Sector

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ABSTRACT
Bangladesh Govt. has prepared 6 Five Year Plan (FYP) to develop the country in planned way. But in most of the cases achievement could not made as per plan. Power sector has a great role in not only industrialization but also socio-economic development of the country. Now the socio-economic contribution of Power sector to GDP (Gross Domestic Product) is more than Tk-30 per KwH. Our target is to find reasons behind non-achievement and to pin point the inconsistency of planning.

Keywords
IPP, DNI, radioactive pollution, rental power plant, Biomass co-firing, secondary power unit, SMART Grid components.

1. INTRODUCTION
The frequency of power and gas outages is threatening citizen welfare and development prospects. The annual loss to production and income from power outages could well exceed 0.5% of GDP per year. The availability of domestic primary fuel supply is getting so scarce that it is forcing severe measures like shutting down fertilizer factories, rationing gas supplies for household and transport uses, and keeping idle installed power units.

Due to the severity of the power crisis, the Government has been forced to enter into contractual agreements for high-cost, temporary solutions, such as rental power and small IPPs, on an emergency basis, much of it diesel or liquid-fuel based. This has imposed tremendous fiscal pressure, as budgetary transfers are routinely made to the power sector in order to enable it to stay current on payments to power suppliers. The Government is aware that precious resources are being diverted to cover operating losses of the utility that arise from purchasing short-term high cost power which is not sustainable for the financial health of the sector in the long run. Therefore, the longer term strategy embedded in the Sixth Five Year Plan power sector plan is to use budgetary allocations to promote low-cost, sustainable expansion of power generation, transmission, and distribution capacity. In view of the prevailing low generation and consumption of energy, efforts should be made to develop this sector in such a way that the needs of all sectors can be met adequately, efficiently and economically.

Per capita consumption of energy in Bangladesh is on an average 160 kgoe (kilogram oil equivalent) while it is 530 kgoe in India, 510 kgoe in Pakistan, 340 kgoe in Nepal and 470 kgoe in Sri Lanka. The average consumption in Asia is 640 kgoe. It is evident that per capita average consumption of energy in Bangladesh is significantly lower than the average of Asia. Even it is lower than those of South Asian countries. On top of this low level of consumption, there is already a serious energy crisis [1].

A part of the reason for the past lack of investment in power is poor pricing policies that kept the publicly owned electricity industry in constant deficit and kept away private investment. It also caused poor maintenance practices, resulting in power losses and frequent breakdowns. Other constraints that have contributed to power crisis include difficult sector governance and inefficient management [2].

Electricity demand grew at an average rate of 11 per cent per annum during 1972-94; per capita generation increased from 15.6 kwh in 1973 to 170 kwh in 2010. Notwithstanding, the progress made to date, only about 47% population have access to electricity [2].

During the War of Liberation, power installations suffered extensive damage. As a result, at the worst case, peak demand dropped to 30 MW from the pre-liberation level of 225 MW (1970). So, after independence the immediate problem was rehabilitation of power supply. By the end of 1972-73, a rehabilitation and development programme was undertaken in the First Five Year Plan (1973-78). However, because of the shortage of fund the programme was carried over to the Two Year Plan (1978-80). Several projects, initiated before the Liberation War was completed and a number of new projects were undertaken during the periods. As a result, installed generation capacity increased to 822 MW from 545 MW, while the peak demand rose to 462 MW from 222 MW. Against a peak demand of 1640 MW in 1990/91 and 1970 MW in 1994/95, the installed capacity was only 2352 MW and 2908 MW respectively. The operational capacity (2133 MW) was again interrupted by occasional power outages owing to fluctuations in gas pressure, transmission and distribution faults. At the time of sixth five year plan declaration Installed Capacity was 5823 MW, Generation Capacity was 5271 MW & Highest Generation 4606 MW which now peaked up-to 4699MW.

2. OVERVIEW OF THE PLAN
The main target of the 6 FYP was to increase the private sector participation in power generation.

The other targets were increasing the efficiency of energy use as well as reducing system loss. Fuel diversity in power generation is also emphasized. SFYP was made in a view to making the power sector more efficient in terms of generation, transmission and distribution. Finding new oil and gas fields

in both offshore and onshore through extensive exploration Future.Develop renewable energy sources were also taken into concern as fossil fuel reserve will be at stack very soon

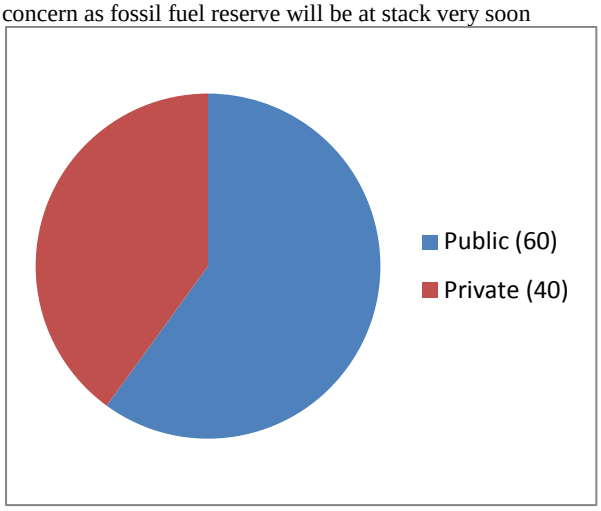

Fig 1: Electricity Production in Private and Public sector, April 2011

3. ACHIEVEMENTS SO FAR

About 1556 MW electricity has been added from 5271MW to the national grid. Production of gas has been increased 150 MMCF from 2000MMCF. The dependency rate of electricity production on gas has been reduced from 89 % to 82%. At present 44 % of total electricity production is being produced by the private sector, which was only 40% in April 2010. Solar panels have been established in 9 lac households [1].

3.1 GOVERNMENT TARGET ANDACHIEVEMENT SO FAR IN RENEWABLE ENERGY SECTOR

Table 1. Government target & Achievement so far in Renewable energy

Classification	Target upto 2015 (MW)	Achievement in 2011 (MW)	Status
Solar PV	200	50	Positive
Wind	200	1.5	Negative
Biomass	45	<1	Negative
Biogas	45	<1	Negative
Total	45		

3.1.1 SOLAR

Mainly Grameen Shakti, IDCOL, Rahim Afroz and in few industries are pioneer to solar home (SHS) setup. Around 300 NGO are working in this sector. In the new apartments, Government has ordered to share 15% load via using solar panel. Kaptai Solar of 5 MW by BPDB (to be implemented by 2013).7 MW by IPP (to be implemented by 2013).

3.1.2 WIND

Only wind power generation on process is 1MW in Kutubdia, 0.5 MW in Feni.Electricity from wind power 100MW by IPP (Not implemented)According to the above statistics and the ongoing project on the renewable energy sector it is evident would be continued to meet fuel demand for current and

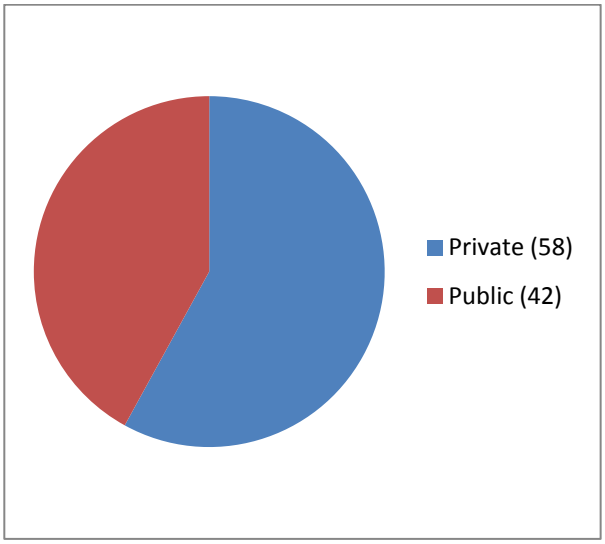

Fig 2: Projection of Electricity Production in Private and Public Sector in 2016

that only in the solar PV sector government can achieve the goal described in 6th FYP.

4. FACTORS AFFECTING THE RENEWABLE ENERGY SECTOR

From the survey it is known that DNI (Direct Normal Irradiance) value for desert is more than 2100 where Bangladesh has 1300 [3]. It requires 10 acres per MW for desert and around 15 acres per MW in Bangladesh. For generation of 1-10 MW photovoltaic cells are used and above that through parabolic type. Cost for photovoltaic type is 18 crore taka per MW. While 24 Crore taka per MW required for the parabolic type (without land). If we consider module of dimension (1600mmX1000mm) and 230W module (Optimum operating voltage 30.36V, optimum operating current 7.58 A) So**,** 37939modules required for 1MW power generation. In case of municipal waste as source of fuel it is processed via thermal converter to produce steam. Cost of 4MW power is 12 Million USD i.e. 6 crore taka per MW.

As it is reliable source and cost is low it is to be adopted.

5. CHALLENGES OF NUCLEAR POWER

The fuel cost and the capital cost on a nuclear plant is very high.

Table 2. Costing Of Power Generation Via Nuclear Fuel[4]

Topics	Quantity*Price $	Total $
Uranium	8.9 kg U_3O_8 x $146	1300
Conversion	7.5 kg U x $13	98
Enrichment	7.3 SWU x $155	1132
Fuel Fabrication	per kg	240
Total		2770

As 360,000 kWh electrical energy produced per kg by using nuclear fuel, hence fuel cost: 0.77 USD/kWh

Selection of sites is a major issue for establishment of nuclear power plant as it require safety and security from the radioactive pollution has to be ensured. Trained and efficient manpower is a must. Awareness among general people is also required.

Japan has shut down its last working nuclear reactor after tsunami triggered a meltdown at the Fukushima plan.

Considering above factors developed country like Japan failed to maintain nuclear power plants, so it would not be wise to rely on nuclear power plant in Bangladesh.

6. DIFFERENCE BETWEEN THE POWER GENERATION COST PER KWH BETWEEN THE GOVERNMENT PLANTS AND THE RENTAL PLANTS.(FUEL-FURNACE OIL)

Table 3. Operating Cost of 50MW Power Plant (Fuel-HFO) & Engine Generator [5]

Topics	Tk	Usage ratio	Rate	Tk
Furnace Oil (HFO) (ltr)		0.24	60	14.40
Carrying cost of FO to site				0.15
Liub oil (ltr)	167,500	0.000797619	200	0.16
Air Filter (pcs)	800	3.80952E-06	10000	0.038
Lub oil Filter (pcs)	1000	4.7619E-06	5000	0.024
Chemicals for Cooling Tower(kg)	5000	2.38095E-05	500	0.012
Maintenance & spares	20,000,000	0.095238095		0.095
Salary and Wages taka	2,664.000	0.012685714		0.013
HO Expenses	2,664.000	0.012685714		0.013
Depreciation (5.5%)	225.500.000	1.073809524		1.074
Interest on Loan (5%)	349.525.000	1.664404762		1.664
Tax & surcharge				0.358
Total				18.00

In case of Government furnace oil based power plant BDT per KWH is little less than the rental ones due to low transportation cost, low land price and little low fixed charge costs.

So we could draw an conclusion that these rental power plants are not overpaid by the government.

7. REASON BEHIND NOT ESTABLISHING COAL BASED POWER PLANT

The major reasons are it takes minimum 4 years to establish a coal based power plant. AID agencies are less interest in aiding in this type of power plant. There is no convenient fuel transportation arrangement so far developed. Mother vessel can not come to the port so coal import becomes tough (it takes 13.5m draft in port for the coal carrying ships). Coal import is becoming tough because of competitive international market condition. Large land is also required. Above all further increase of Baropukuria is not possible[6].

8. BIOMASS CO-FIRING IN COAL BASED POWER PLANTS & RECENT WORTHWHILE INITIATIVES IN POWER SECTOR

Biomass co-firing is among the least expensive and lowest risk option available co-fire power plants. US government has offered incentive to the public coal fired power plants to convert them into co-fired by biomass. Technologies for solid bio-mass gasification and firing it in conventional steam-electric power plants, though new, is commercially available [7].

Using the exhaust gas from the generator to produce steam and power is a new trend. Power plants away from industrial area are planning to set up Secondary power Unit by using exhaust gas of the engine.

Rental power plants are planning to use exhaust gas from the generator to produce steam and power. The power plants which are nearby Dhaka and Chittagong EPZ are planning to install secondary power unit to produce steam from the exhaust gas. It takes 700 kg exhaust to produce l MW power and this process will save 25-28% power.

Power plants away from industrial area are planning to set up secondary power unit by using exhaust gas of the engine. This way 5- % electrical power of the plant can be increased.

9. ASPECTS OF TRANSFORMING POWER PLANTS AS COMBINED CYCLE

In a steam power plant, turbine produces mechanical energy from the steam produced by burning gas at high temperature and high pressure. A Generator is used to transform the mechanical energy into electrical energy. The exhausted steams are then released in the air. These power plants are called Simple Cycle plants.

If this air at high temperature is reused to produce steam to rotate the turbine that could be able to produce a few more electricity which is then called a combined cycle power plants. A combined cycle plant can produce a half portion of the main production besides the production of the plant if it works as a simple cycle plant.

9.1 TRANSFORMATION OF SIMPLECYCLE INTO A COMBINED CYCLE

1. If the plant is old enough then it will be better to establish a new plant instead of transforming.
2. The expenditure of the transformation is about 0.7 million US $ per MW.
3. 2-3 years are needed for the whole process.
4. The amount of place is needed for the simple cycle; about the same amount of place is more needed to convert it to a combined cycle.
5. There may arise some technical problems if some new machinery is attached with an old plant to make it combined.
6. The electricity production should be off throughout the whole conversion process.
7. Expert manpower is needed for this procedure; otherwise the plant may shut down permanently.

8. Fund is not available for this kind of transformation process.
9. Proper examination, justification of probabilities, well planning, fund arrangement and sales procedure are important for transforming a simple cycle into a combined cycle.

9.1.1 CURRENT STATUS

The maximum production can be increased to 330 MW by making the simple cycles into the combined cycle power plants. The present Government took a step to establish new combined cycle plants of 4378 MW capacity.

10. GRID UP-GRADATION VIA SMART GRID COMPONENTS

Supervisory control and data acquisition systems (SCADA) was mentioned in FYP and implemented in the power sector but not in the gas distribution sector. For reducing loss in these sector Wide area monitoring system (WAMS), FACTS devices, STATCOM could be thought of [8].

11. DEPLETING GAS RESERVE

Country's recoverable proven and probable gas reserve is now around 16 trillion cubic feet (tcf), according to a Petrobangla official, which may run out in 19 years. Petrobangla estimated the gas reserve (2P) at 16.37 tcf, From recent data country's 23 gas fields had produced 10.51tcf gas till June this year against the total reserve of 26.88tcf. Reserved gas can be used for next 19 years if it is consumed at a present rate of 2.26 billion cubic feet per day, but the reserved gas will be available for 14 years if it is used at a rate of 3.04bcf per day. The Petrobangla official said they had suspended production in Begumganj, Kutubdia, Chhatak, Kamta and Feni gas fields which have around 715.8bcf of gas in reserve. At the end of last year, Hydrocarbon Unit with help of US-based firm Gustavson estimated the country's gas reserve at 28.2tcf. Petrobangla, the state-owned Oil, Gas and Mineral Resources Corporation, has been supplying around 2260mmcfd (million cubic feet per day) of gas against the requirement of 3043mmcfd. Currently, Bangladesh is facing severe gas crisis which may deepen in next five years. Petrobangla hope that due to ongoing augmentation activities, gas production will increase by 1440mmcfd by 2015. Petrobangla expects to produce additional 130mmcfd of gas in 2012, 420mmcfd in 2013, 580mmcfd in 2014 while it will be 310mmcfd in 2015. The government is planning on exploring 12 sea blocks oil and gas in the Bay of Bengal. Bapex also submitted a roadmap to produce oil and gas in onshore blocks by 2030. Most of the sectors, including power generation, industrial production and fertiliser factories, faced severe gas crisis. According to Petrobangla, the demand for gas per day will increase to 3,341mmcfd in 2013, 3,591mmcfd in 2014 and 3,746mmcfd in 2015 [9].

12. CONCLUSIONS

Proven gas reserve will be exhausted within 2025 if gas consumption remains as today. So emphasizing on fuel diversity due to limited gas storage in the country is a must. Existing gas using equipment & machineries to be made efficient to ensure no wastage of gas. All inefficient fertilizer and power plants needs to be closed down. Standardization of gas consumption for per unit of production to be set. Moreover, co-generation in private power plants should be encouraged.

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