Power Scenario of Bangladesh and Schemes of Sustainable Optimal Reduction in the Power System Loss

Dr. Khizir Mahmud[1], A.K.M. Mahmudul Haque[2] and Dr. Khizir Mahmud[3]

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Received: 8 February 2012 Accepted: 5 March 2012 Published: 15 March 2012

Abstract

The electricity supply with minimum possible losses is the challenge to the developing countries like Bangladesh. Limited energy sources, improper long term policies some major system losses are responsible for hindering this challenge. Considering these problems of Bangladesh, some solutions have been proposed but still those fail to mitigate that problem fully. So this paper emphasizes based on the proposed solutions the possible acceptance of the considerations which are applied in other countries.

Index terms— Bangladesh, FACTS devices, GDP, HVDC, Load Shedding, power, power generation, power system loss.

1 INTRODUCTION

roviding access to affordable and reliable electricity to all citizens by 2021 is a befitting national goal of the Government of Bangladesh. Latterly the per capita generation is 236 KWH **??**11]. Only 48.5 percent of the country's population has access to electricity, which is very low compared to other developing countries in the world. [2] The performance of Bangladesh power sector in last two decades fell short of expectation of our citizen. Incongruous short term policies and some key technical problems like system losses are leading the desire to the access of electricity to whole country to a fiasco. To fulfill the goal firstly a brief overview of current situation of power scenario of Bangladesh is presented in this paper. In the latter part, the reasons behind the power crisis of Bangladesh have been mentioned. The major power loss occurs for system loss which is around 14.02% at present in Bangladesh. Finally some congruous ways have been discussed to provide the rising demand of power and to mitigate these huge system losses.

A decreasing rate of electricity generation has resulted in the lower GDP growth. The current GDP growth of 6.66 percent might be the result of comparatively higher growth rate of electricity generation (6.19 percent) [2]. The average GDP between 2007 and 2011 was 6.22 percent whereas the average generation of electricity was 3748 MW [2]. Under the business as usual scenario, if an arbitrary calculation is made, it is observed that 603 MW generation of electricity might be required for the growth of one percent GDP. [2] The economy of Bangladesh is mainly depending upon agriculture, industrial, commercial and other economic development. On the other hand, these developments directly and indirectly depend upon the fluent supply of electricity. A decreasing rate of electricity generation has resulted in the lower GDP growth. The average GDP between 2007 and 2011 was 6.22 percent whereas the average generation of electricity was 3748 MW [2]. Under the business as usual scenario, if an arbitrary calculation is made, it is observed that 603 MW generation of electricity might be required for the growth of one percent GDP. Therefore, it is difficult to achieve the target of seven percent GDP growth with the current generation of electricity within this fiscal year (2011-12).

2 III. CURRENT SCENARIO AND FUTURE DEMAND OF ELECTRICITY, GENERATION AND LOAD SHEDDING

The average maximum demand for electricity was 3970 MW in 2007 which has increased to 4833 MW in 2011 (May, 2011) with an average increasing rate of 216 MW per annum. Under the business as usual scenario, the

average demand might stand at 5696 MW by 2015. On the other hand, the average generation was 3378 MW in 2007 which has increased to 4103 MW in 2011 (May, 2011) with an annual average increasing rate of 181 MW [2]. Continuation of this rate indicates that the average generation would be 4828 MW by 2015 which is far away from the vision of 11500 MW generations by 2015. Additionally, the average load shedding has been increased to 656 MW in 2011 (May, 2011) with an average increasing rate of 35 MW per year from 2007. If this increasing rate remains the same, the average load shedding might be stood at 795 MW by 2015. The lower increasing rate of generation (5.37 percent) than that of the demand (5.43 percent) Fig. **??** : Current situation and feasible future electricity demand, generation and load shedding. has accelerated the rate of load shedding which has increased at a rate of 6.72 percent per annum during the same period. [2] IV.

3 POWER SYSTEM LOSS SCENARIO IN BANGLADESH

Alike the developing countries Bangladesh economy has grown by nearly 6% a year since 2005 and it faces rapidly growing energy needs to sustain its growth particularly in the industrial sector [5]. Inadequate power generation capacity and fuel shortages and power system losses have resulted in electricity sales in Bangladesh growing by only about 7% per annum since 1990. In response, the government has decided to develop 9400 MW of power capacity by the end of 2015 to meet its existing and future demand requirements. But High levels of losses, as a result of both technical factors and nontechnical factors of power, have been a continuing issue in Bangladesh. Between 1994 and 2003 power system losses have ranged between 28.4% and 37.2%. Excessive losses appeared as a continuing theme in documents going back to the 1970s, when losses ranged between 34.6% and 42.5% [5]. For the past 4 years, system losses have been on a downward trend and the provisional estimate of 28.4% for 2003 [5]. Some of these losses arise from technical factors such as losses in stepping down power and in transmission and distribution. However, even after allowing for these factors, the system loss of 28.4% incorporates high levels of non-technical losses like electricity theft i.e. Frauds, Illegal connections, Meter tampering and some other administrative losses.

4 V. Different Nontechnical Power

Losses In Bangladesh a) Single Fuel Dependence About 85% of electricity in Bangladesh is produced from gas-based power plants [2]. Gas supply shortages have seriously impaired power generation, causing power cuts that have reduced economic output. Dependence on a single source of energy for power generation weakens energy security. Coal hydropower, heavy fuel oil (HFO) and diesel are the other sources of energy for power generation. Inadequate investment in upstream gas field development in recent years has resulted in a shortage of gas for the industrial sector and for electricity generation. This has constrained power generation with electricity utilities resorting to load shedding while industrial consumers have been using captive generation facilities that require diesel.

5 b) Improper Privatization Policy

In April 2010, 40 percent electricity was generated by private sector which has increased to 44 percent by April 2011 [2]. Rental, quick rental and peaking plants were under taken on a first-track basis to address the immediate power crisis. But mostly, second hand equipments and less efficient machineries are used in such plants so the tariff rises. Furthermore, there is a lack of transparency in tendering persists in that process. Thus, the establishment and timely commencing production of the major segments of the power plant, contracted to be established on 'quick rental' basis in the country, are failing gradually. Thus, it is not only causing huge amount of financial loss to the national exchequer but also increasing the suffering of the citizen of the country. Here, the government has to face two types of challenges. One is the higher subsidy due to the costly quick rental power plants and the other is the lower production that is expected.

6 c) Lack of Timely Implementation of Allocated money

The government has given highest priority to the development in power sector which has been reflected in the allocation of annual development program (ADP). The total allocation in the power sector was Tk. 7145.28 for the fiscal year 2011-12. Over the last few years, there was a significant gap between the allocation and the implementation of ADP in the power sector [2]. Considering the last fiscal year, only 29 percent of the allocated ADP had been implemented during the first eight months of that fiscal year. When a huge amount of allocated money is required to be implemented within a short period of time, there creates corruptions. That's why; the lack of timely implementation has reduced the proper development in the sector of electricity, especially, in the generation of the electricity.

7 d) Political Reason

In Bangladesh, the governments come and go and the issue of electricity remains a struggling one. In order to win the mind of voters, the politicians are very much interested in covering a lot of areas without thinking the existing generation. This may bear information about the huge coverage of the electricity but in reality, it creates crisis. This type of politics makes the crisis more acute.

8 e) Over Population

There has been an increase electricity ddemand in the recent years as a result of industrial development and population growth. One of the common matters in the country is over population which creates a lot of problem in various development sectors. More population means more consumption of electricity. Population is increasing but the generation of electricity is not increasing as required. After all, there is an improvement in the life style of the citizen in the country. With the improvement of the people's life standard, the demand for electricity has also increased. As the generation has increased with a slower rate than that of the demand for electricity, the crisis of electricity is on the rise. [2]

9 VI. DIFFERENT TECHNICAL POWER LOSSES IN BANGLADESH

The main factors that contribute to high technical losses is inappropriate conductor size, lack of reactive power control, Corona loss, Induction and radiation losses, operating the system at high voltage, power transformer losses, low voltage pockets and different types of distribution losses like overloading of lines, Abnormal operating condition of distribution transformer, operation of primary and secondary distribution system at low power factors, lose connections, Unequal load distribution among three phase in LT systems causing high neutral currents, low voltages at the consumers terminals causing higher drawl of currents by inductive loads etc. a) Lengthy Distribution Lines in Practice 11 KV and 420 volts lines, in rural areas are extended over long distances to feed loads scattered over large areas. Thus the primary and secondary distribution lines in rural areas; by and large radials laid, usually extend over long distances. This results in high line resistance and therefore high I 2 R losses in the line [1]. ear 2012 Y is used in Bangladesh [6]. Although the rationale of using three-phase lines for increased transmission efficiency is valid, this applies more to high-voltage, alternating-current transmission lines as well as to MV lines serving larger load centers. In these cases, the larger current-carrying capacity associated with threephase lines are essential. But most of the times losses occur due to the lack of fulfillment of this criterion [6]. c) Distribution Transformers not located at Load center Often distribution transformers (DTs) are not located centrally with respect to consumers.

Consequently, the far off consumers obtain an extremely low voltage even though a reasonably good voltage levels were maintained at the transformer secondary. This again leads to higher line losses in order to reduce the voltage drop in the line to the farthest consumers. Fig. **??** : System Loss of the Utilities at Different Voltage Level (Financial Year 2005-06) [3] d) Overrated Distribution Transformers and hence their Under-Utilization Studies on 11 KV feeders have revealed that often the rating of DTs is much higher than the maximum KVA demand on the feeder. Over rated transformers draw unnecessary high iron losses. In addition to these iron losses in over rated transformers the capital costs is also high. For an existing distribution system the appropriate capacity of distribution transformer may be taken as very nearly equal to the maximum KVA demand at good power factor (say 0.85). [1] e) Low Voltage Appearing at Transformers and Consumers Terminals Supply voltage varies by more than 10% in many distribution systems. A reduced voltage in case of induction motor results in higher currents drawn for the same output. For a voltage drop of 10%, the full load current drawn by the induction motors increase by about 10% to 15% the starting torque decreases by nearly 19% and the line losses in the distributor increases by about 20%. Power losses can be divided into two categories, real power loss caused by resistance of lines and reactive power loss caused by reactive elements. The total real and reactive power losses in a distribution system can be calculated using equation 1 and 2.

(1)?? ???????? = ? ?? ?? 2 ?? ???? ??=1 ??? ?? (2) ?? ???????? = ? ?? ?? 2 ??? ?? ?? ???? ??=1

Where n br is total number of branches in the system, â?"?Iiâ?"? is the mag nitude of current flow in branch I, r i and x i are the Resistance and reactance of branch i, respectively. Different types of loads connected to distribution feeders also affect the level of power losses. [1] Power Scenario of Bangladesh and Schemes of Sustainable Optimal Reduction in the Power System Loss

10 VII. PROBABLE SOLUTION OF POWER CRISIS OF BANGLADESH

There are three general solutions for solving the power crisis of Bangladesh. First one is control load demand by using compact fluorescent lamp (CFL), transformation of holiday, proper load management, encouraging Independent Power Producers (IPP) & reducing transmission losses. **??**8]. Second one is proper utilization of renewable energy. But using more renewable energy will put upward pressure on unit costs. Renewable energy doesn't have the same operating characteristics, load factors, cost-volume drivers, or "dispatch ability" of conventional energy, especially base load plants. Renewable energy will stress transmission grids differently and significant investment will be needed to reconfigure bulk power networks. And the third one is allowing free market economy to come into play in the power sector & to fully privatize power generation, distribution & supply [7]. For the purpose of solving the energy crisis, whatever we think, we must see the thought & technology of other countries & emphasis on our national energy policy. Exploring other countries considerations for meeting energy demand efficiently the following solutions should be fruitful for energy crisis of Bangladesh.

11 CONCLUSION

Power crisis is one of the great barriers in the development of developing countries like Bangladesh. So government and other organizations related to this should pay the greater attention to minimize this power crisis. Bangladesh has already taken some sustainable initiatives to solve the prevailing problems. There are many possible ways in which the desire to access the electricity to whole country should be implemented. The lacking to solve the power crisis, can be minimized by considering the combination of existing solutions and considerations used by developing countries. [1]

Figure 1: Power

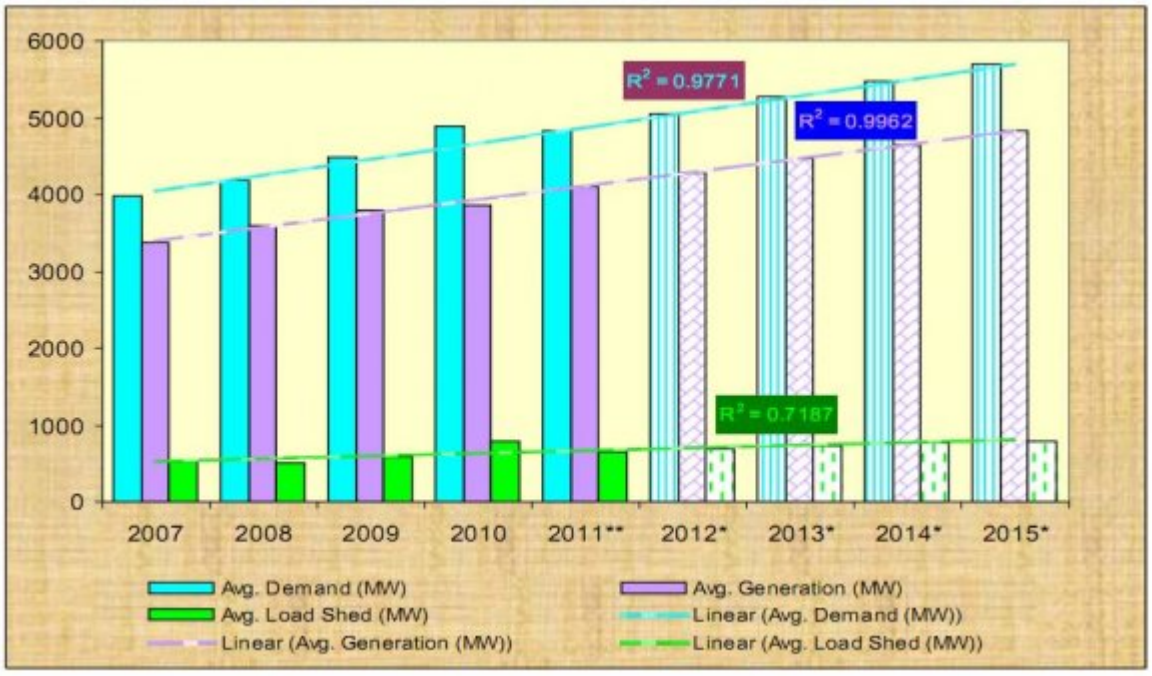

Figure 2: Power

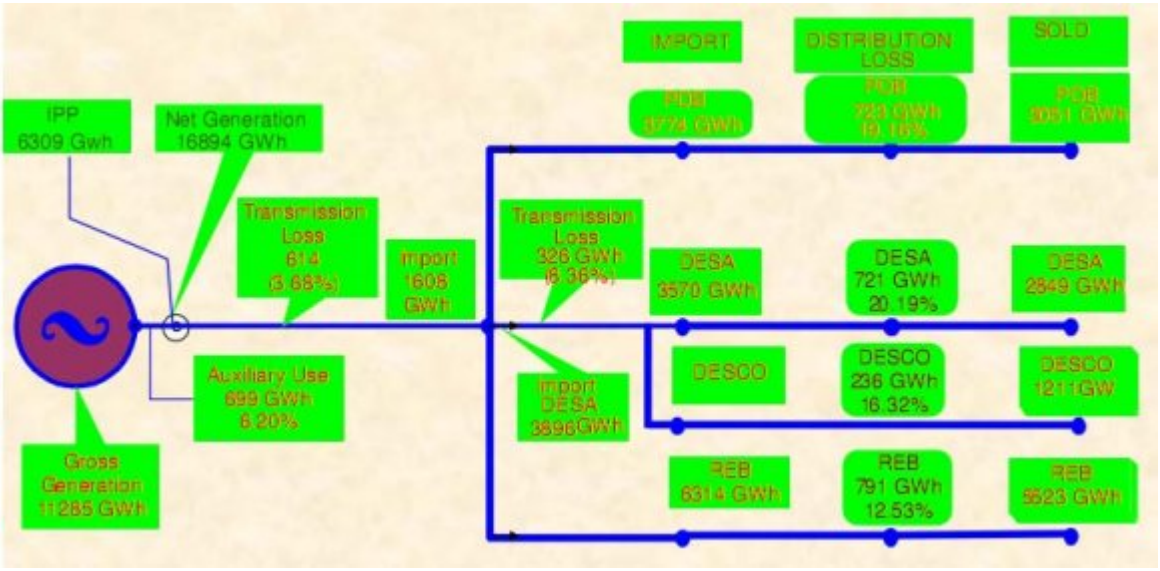

Figure 3:

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Financial Year	Actual Generation (MW)	Load Shedding (MW)	System Loss (%)
2001	3033	663	28.47
2002	3248	367	27.97
2003	3458	468	25.69
2004	3622	694	24.49
2005	3751	770	22.79
2006	3812	891	20.97
2009	3880	1000-1500	16.15
2012	6800	2000	14.02

Figure 4: Table 1 :

2

Organization	Transmission Loss (%)	Distribution Loss (%)	Total
PDB System	3.00	7.00	10.00
DESA System	2.00	7.50	9.50
System	0.50	8.50	9.00

b) Inadequate Size of Conductors
Rural loads are usually scattered and generally fed by radial feeders. But most of the cases feeder's conductor size is not adequate. Generally combination of copper, aluminum, and occasionally steel conductor

Figure 5: Table 2 :

1. Integration of renewable energy resources.
2. HVDC & FACTS for system interconnection & grid
enhancement.
3. Smart grid initiatives.
Reforming the power sector by controlling electricity
5. a) Energy Policy theft & improving revenue collection. Boost efficiency in transmission. A successful energy policy must satisfy many goals such as: 1. Energy policy must be concerned not only with current supply, but with the country's long term needs. 2. Energy policy must be concerned with efficiency of production and distribution, as well as quantity. 3. Energy policy must enable improvements in energy access among all Bangladesh citizens. 4. Energy policy must reduce the pressure placed on the country's physical environment. Realizing these goals requires several clear strategic decisions for the Government of Bangladesh. The six crucially important policies are: 1. Given what is known of natural gas and other mineral reserves, the Government of Bangladesh should not approve natural gas exports. 2. The Government of Bangladesh should place a very high priority on establishing the credibility of an energy regulatory commission. 3. The government should encourage the Rural Electrification Board (REB) to develop a network of small-scale (10 -100 MW capacity) gas turbine plants whose power would, on a priority basis, be distributed independently of the national grid. 4. The government should encourage the sale of coal for domestic cooking in rural areas. 5. The government should continue to facilitate substitution of CNG for liquid petroleum fuels. 6. VIII.

Figure 6:

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