

PROGRESS OF BANGLADESH POWER SECTOR ON PERSPECTIVE OF SDG7

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Abstract— Bangladesh is experiencing fastest GDP growth rate than anticipation in recent years. To maintain this pace of economic development, Government of Bangladesh (GOB) has successfully drafted energy policies to fuel the increasing energy demand by considering the targets of sustainable development goal 7 (SDG7). The measures taken in the seventh five-year plan of Bangladesh to achieve the targets of SDG7 are set out to enhance the energy accessibility of nation in affordable, reliable, sustainable way with modern technology. The aim of this paper is to explore the progress and challenges for Bangladesh toward seamless achievement of SDG 7. Analysis reveals that Government of Bangladesh is prone to solve the energy crisis on emergency basis rather than materializing the action plans of masterplan through appropriate policy, reforms and regulation. Consequently, Energy sector is driven to be costly, unreliable and unsustainable in long term. It is suggested that execution of fuel diversification plan, finalization of appropriate incentives and tariff policy for renewable energy market development, local as well as foreign fund allocation for energy efficiency improvement should be implemented to lead energy sector of Bangladesh toward sustainable development.

Keywords— Energy mix, power generation, SDG7, sustainable development, renewable energy

1. INTRODUCTION

The well-defined definition of sustainable development is given by Brundtland Commission as ability to fulfill present generations' requirement without compromising the ability of future generations to meet their own needs" [1]. This definition allows disparate resources to be assembled under its umbrella such as economic growth, equity in resource distribution, ecosystem, environment, culture etc. These resources are all interrelated and could not exist one without another. Therefore, sustainable development requires juxtaposition of economic growth, increased social equity, human development and environmental protection.

In 2015, United Nation (UN) generated an agenda 2030 named as Sustainable Development Goals (SDG) to create a sustainable world which ensures that its entire inhabitant gets equal development and wellbeing opportunity. The objectives of Sustainable Development's include different aspects of social development, energy security, environmental

protection and economic growth consist of total 17 goals with their 169 targets. Along with 193 countries, Bangladesh incorporated the SDGs into its perspective plan and two five-year planning. It is noteworthy that Bangladesh has successfully accomplished the agendas of Millennium Development Goal (MDGs) and transformed into lower middle-income country [2]. Surely, the adoption of SDGs will help Bangladesh to achieve its dream to migrate into middle income country by 2021 and developed country by 2040. Thus 7th five-year plan (2016-2020) of Bangladesh has been prepared considering all possible goals of SDG to realize its dream to be middle income country by 2021.

Tracking of SDGs are essential to achieve the target into desired time frame. There has been plethora of discussion and studies are found on progress of SDG 4, 8, 10, 13, 16 and 17 on Bangladesh's perspective [3, 4, 5, 6]. But few studies address the status of SDG7 (which about energy) in Bangladesh even though energy is considered as golden thread to connects all required development to support human race toward sustainable development. Therefore, the aim of this study is to determine the progress in SDG7 achievement, non-achievement, factors contributing if any, in Bangladesh.

2. SDG7 AND BANGLADESH

Access to energy is a paramount input to achieve success in poverty eradication, self-sufficiency in food production, desalination of water, development of education, creating economic opportunity etc. for developing countries. Surely this development should not be happened in exchange of environment, life of future generation on earth. Thus, UN has set out 5 targets which collectively known as SDG7 as given in table 1. Target 7.1 of SDG7 aims to ensure universal access to modern energy in terms of clean fuel and technology by 2030 whereas target 7.2 advocates for substantial penetration of renewable energy into final energy consumption such as electricity, transportation, cooking, cooling or heating etc. by 2030.

TABLE I. SUSTAINABLE DEVELOPMENT GOAL 7

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all	
7.1:	By 2030, ensure universal access to affordable, reliable, sustainable and modern energy services
7.2:	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3:	By 2030, double the global rate of improvement in energy efficiency
7.4a:	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.4b:	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective program of support.

TABLE II. INTEGRATION OF SDG7 INTO 7TH FYP OF BANGLADESH [2]

Targets	Actions to achieve the SDG targets within 7 th FYP (2016-2020)	Alignment with 7 th FYP (2016-2020) [7]
7.1	Access to affordable, reliable, sustainable and modern energy for all Generation of electricity to be increased to 23,000 MW Electricity coverage to be increased to 96% 10% of energy generation from renewable resources by 2020	Aligned
7.2	Increase global percentage of renewable energy	Aligned
7.3	Double the energy efficiency improvement rate	Partially Aligned
7.4a	Promote access, technology and investment in clean energy Expand and upgrade the energy services for developing countries	Partially Aligned
7.4b		Not Aligned

Further, Energy efficiency improvement rate has been promoted to be doubled in target 7.3 to preserve natural resources. In addition, research in renewable energy and energy efficiency as well as investment in energy infrastructure and clean energy technologies has been targeted in 7.4a and 7.4b respectively. The targets of SDG7 have been integrated into seventh five-year plan of Bangladesh (2016 to 2020) which is early critical stage for implementation of SDG. Among five targets of SDG7, only 2 targets are fully aligned, 2 targets are

partially aligned while 1 target is not aligned at all [7]. The measures taken in the 7th Five Year Plan (FYP) of Bangladesh to achieve targets of SDG7 have been as shown in table 2.

3. STATUS OF SDG7 IN BANGLADESH

A. Target 7.1

In Bangladesh, electricity generation capacity is increased significantly by 180 per cent from 2015 to September 2019 which accounts for 20786.38MW in total. Natural gas possesses major share in generation capacity about 56.85 % (11,781 MW) followed by High Speed Diesel (HSD) and Heavy Fuel Oil (HFO) which accounts for 21.11% and 10.46% respectively. No significant changes have been happened in coal and hydro based generation over the years while renewable energy installation is increased to 374.63 MW till to date. Present power generation mix has been shown in table 3. Additional Coal based 1380 MW capacity is in masterplan to be added by 2020. Therefore, the target set in 7.1b to augment generation capacity to 23,000 MW by 2020 is surely achievable within time frame. In addition, Bangladesh has achieved significant progress in electricity coverage reached at 93% which was 74.3% in 2016 during the preparatory period of action plan for achieving the target of SDG7 [10, 11]. The amount of people without electricity access has dropped to 849 million in 2019 from 1.2 billion in 2009. About 94.01% urban people have electricity access while 68.85% rural people have access to electricity to meet their light, fan, irrigation demand. It seems that Bangladesh would undoubtedly reach its target to bring 96% of population under electricity coverage by 2020.

B. Target 7.2

Present RE capacity is 374.48 MW which is 2.90 % of total generation capacity including off grid generation. Source wise renewable energy generation capacity both off grid and on-grid capacity is given in table 4. The potential of energy generation from wind and hydro is limited in Bangladesh since geographic position does not inherit these resources. Although agriculture crops, animal manure are abundant as an agrarian country, but these sources of energy is yet to be tapped in country [12]. Therefore, capacity expansions of renewable energy mainly rely on the solar energy and biomass development. Bangladesh has a success story of developing over 5 million rooftop solar system including solar home system (SHS) [13]. These rooftop solar systems are powering remote off-grid areas where no other means of electricity access is available and large domestic building in urban areas. At present the on-grid solar power generation capacity amounts to 39.01 MW including one solar park with 3MW capacity [13].

TABLE III. POWER GENERATION MIX IN BANGLADESH [8, 9]

Fuel type	2015		2019	
	Capacity (MW)	%	Capacity (MW)	%
N. Gas	7239.89	61.76	11,781.76	56.70
Coal	250.28	2.13	444.09	2.14
Diesel	956.16	8.15	2,180.85	10.49
Furnace oil	2357.54	20.11	4,609.82	22.18
Hydro	230.00	1.96	230.00	1.11
Renewable	188.23	1.61	374.63	1.80
Import	500.57	4.27	1,159.23	5.58
Total	11,721.78		20,780.38	

The GOB has approved proposals for establishing 19 on-grid solar power parks with generation capacity ranging from 5MW to 200MW and the cumulative power generation of all these installations would amount to 1070MW. Till now only six companies among all approved companies have been able to complete the primary negotiation for agreement [14]. Although development in renewable energy has got momentum than earlier, but this pace is not enough to achieve 10% of total capacity from renewable energy by 2020.

TABLE IV. ELECTRICITY FROM RENEWABLE ENERGY [9]

Technology	Generation capacity (MW)			%
	Off-Grid (MW)	On-Grid (MW)	Total (MW)	
Solar	297.64	72.91	370.55	98.91
Wind	2.00	0.90	2.90	0.77
Biogas to Electricity	0.63	-	0.63	0.16
Biomass to Electricity	0.40	-	0.40	0.10
Total	300.67	303.81	374.63	100%

C. Target 7.3

Resource constraints and rising demand of energy makes energy efficiency a concern. Energy intensity, measured in terms of primary energy and GDP, is considered as an indicator of energy efficiency due to heterogeneous nature of industries in economy. During the preparatory period of action plan for SDG7, the aim is set to improve energy efficiency to 10% by the end of 7th FYP. Energy intensity in 2015 was 3.63 in Bangladesh which have dropped to 3.56 in 2017 before rising to 3.67 in 2016 is clearly depicted into table 5.

TABLE V. ENERGY INTENSITY OF BANGLADESH [9]

Indicator of 7.3 target	2015	2016	2017	2018
Energy intensity (primary energy/GDP)	3.63	3.67	3.56	-

4. CHALLENGES

A. Energy mix

Power generation mix of Bangladesh as planned in PSMP-2010 have been failed miserably to be realized. For instance, the share of natural gas, coal and oil were planned about 25%, 50% and 5% respectively in total generation, [15] whereas natural gas and coal are contributing 56.85% and 2.13% respectively in real scenario. In planning, 30% coal supply was considering from domestic source and rest were from abroad but none of these have been materialized so far. The reason for failure is lack of policy finalization for domestic coal extraction as well as failure to materialize the plan to develop import infrastructure. Indigenous coal production using open pit method faces extreme protest from local peoples and environmentalist as this method will pollute the aquifer beneath the coal mine as well as the agriculture land in the coal belt [8]. Also, no visible measures are taken to explore on-shore and off-shore gas reserve on the threat of present gas reserve depletion [27].

TABLE VI. FUEL-WISE GENERATION COST OF ELECTRICITY IN BANGLADESH [17]

	Generation cost of electricity (BDT/kWh)				
	2012-13	2013-14	2014-15	2015-16	2016-17
Hydro	1.1	0.88	1.43	1.12	0.94
Coal	6.98	5.93	7.18	7.82	8.64
N.gas	2.12	2.15	2.09	2.14	2.57
Oil	24.63	33.77	27.4	27.5	26.87

Therefore, more and more oil-based power plant has been commissioned, beyond planning, to tackle the situation immediately which leads the share of oil fuel to 32-33% in primary energy mix [16]. In Bangladesh, power generation cost from oil products are about 11 times higher than natural gas and 5 times of domestic coal which subsequently leads government to raise electricity tariff than desired base case in Power System Master Plan 2010. Consequently, affordability of people living around marginal lifeline as well as target 7.1 comes in question. The table 6 illustrates fuel wise electricity generation cost in Bangladesh from 2013 to 2017.

B. Unwise Selection of Power Plants

At present, generation capacity of Bangladesh is 20,786 MW including imported electricity. According to Power System Master Plan 2010, projected peak electricity demand of Bangladesh in 2019 is 15,727 MW but in actual case, peak demand never exceeds 12,000 MW and base load remain around 9,000 MW in summer [18]. Thus, Bangladesh is having overcapacity than actual demand and ironically more than 50% of

capacity are peaking power plant. These peaking power plant cost Tk 8, 000 crore yearly as capacity payment on government which is one-third of yearly expenses [19]. In addition, state-run gas-based power plant, despite of being least cost generating plants after hydro power plant, are often remain shut down as stranded capacity due to fuel shortage, which accounts for 1700 MW [20]. As a result, capacity may have been augmented at a rate of 12 percent, but generation rate is not (at 6%). Consequently, average generation costs have been increased from 2.6 Tk/kWh in 2008 to 5.84 Tk/kWh in 2018 which has upscaled financial losses by 10 times for Bangladesh power development board (BPDB) [21]. Clearly, power sector is deprived of being operated at least production cost due to poor policy of plant selection as well as unwise distribution of fuels to power plants. Consequently, power sector is burdened with heavy subsidy leading the whole system to be unreliable and unsustainable in long term.

C. *Untapped Renewable Energy*

Development of renewable energy was given emphasize as a part of fuel diversification plan in PSMP- 2010 of Bangladesh. The goal was set to produce 5% of energy from renewable energy by 2015 and 10% by 2020. Unlike the planning, present installed RE capacity is about 2.9% of total capacity and generation is far below this proportion. Though potential of biomass, micro/mini hydro, tidal energy etc. are enormous in Bangladesh, only solar energy among all RE sources is getting more attention than ever before. Even the progress in solar energy production is in snail pace. The poor plant factor (10 - 12%) as well as high generation cost (about 30tk/kWh) is considered as obstacle for solar energy exploitation in Bangladesh to contribute appreciably in energy mix. But it is policy and regulations regarding tariff structure and incentive, project financing and insecure business environment for investors as well as insufficient local expertise are hindering the progress of solar development in Bangladesh [22]. Private investor for solar project does not receive any kinds of land assurance, finance assistance or power purchase agreement from government of Bangladesh. Besides as a densely populated country with high arable land, local people are very reluctant to provide land for solar power project which offers great challenges for large or medium size solar power project installation. Furthermore, a business initiator must bear all expenses from grid feasibility study cost, transmission line and power evacuation substation construction cost to various fees regarding permits, taxes etc. Though private investment is mainly aimed for up scaling the renewable energy capacity but solar IPP does not get capacity payment like conventional IPP to secure their fixed cost. Subsequently, local as well as foreign

investor does not get interested to investment for solar project in Bangladesh.

Present capacity of solar rooftop system is 248.29 MW which is 67% of total solar installed capacity in both urban and rural areas of Bangladesh. Study reveals that about 50 percent of the installed capacity is not in operation at all [23]. This is due to lack of local expertise with sound knowledge regarding system operation and fault which causes long downtime and, in some case, complete shutdown of these solar installment. Also lack of public awareness about solar system benefit, operation and maintenance are responsible for such scenarios [24]. Consequently, rooftop solar system in Bangladesh has become ornamentation rather than a fact of development in present time.

D. *Demand Side Management*

Energy efficiency and conservation master plan of Bangladesh has been finalized in 2016 with an aim to reduce 15% energy intensity by 2021 and 20% by 2030. The goal is set out through four actions such as mandatory energy audit and efficiency improvement program for large industries and manufacturers, standardization and labelling of electrical equipment's, energy efficient building programme and raising public awareness, however none of these plans have seen the light of actions. The challenges for implementation of plans for EE improvements includes lack of public awareness, energy pilferage, lack of funding source etc. requires complete restructuring of this sector. The concept of using efficient equipment's to reduce energy demand, conserve energy as well as to reduce utility bill is still an unknown concept to most people of country. People are tempted to buy cheapest electrical equipment's and electricity, or electricity and natural gas pilferage is a widely seen case to reduce bill irrespective of consumers capability. Bill manipulation or line tempting is much cheaper than conducting energy audit in the industrial or commercial facilities. Even the generating plants are operating at poor efficiency due to apathy of regulator, high operational officials. For example, steam turbine which is mostly used technology in power plants of Bangladesh (about 50% of generation plants used ST), operates at average 30% efficiency which is far less than state of the art [25, 27].

Lack of fund source is a vital drawback for realizing Energy Efficiency programme as visioned in EE&C 2016 by Sustainable and Renewable Energy Development Authority (SREDA) [28]. In a recent study shows that 200 garments factory invested BDT 136.92 crore in green technology and ended up been saved BDT 327.6 crore in five years [26]. But small and medium industries could not fund themselves for

tapping this scope of energy saving as well productivity enhancement. The fact that commercial bank does not provide any loan for EE programme. Thus, efficient loan providing policy should be formularized to support small and medium industries to invest into efficient and green technology.

5. CONCLUSION

It is high time to realize that only capacity augmentation does not ensure reliable, affordable, sustainable energy supply for all peoples of Bangladesh. To really achieve the goal to electrify whole nation, appropriate fuel diversification in energy mix needs to be ensured. This requires giving special attention to explore domestic natural gas to ascertain the actual reserve, fixation of domestic coal exploration strategy along with necessary infrastructure developments for coal and LNG imports for proper mix. Also, appropriate incentives or tariff mechanism is essential to create a favorable environment for private investment in RE project. Besides energy demand management program should be mobilized by ensuring fund, skilled manpower development program, awareness program among citizen are crucial at this moment. Furthermore, government should stick to the master plan to ensure long term sustainable development rather than hopping to instant solutions to solve crisis immediately. Once it is assured, Bangladesh can surely achieve SDG7 and much of its other developmental goals.

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