

## **Implications of Bangladesh's Present Energy Transition on Energy Trilemma**

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### **ABSTRACT**

Although energy efficiency and renewable energy can enhance energy security, improve environmental performance and reduce Greenhouse Gas emissions, the energy transition of Bangladesh over last decade has rather been focused on imported fossil fuels. The transition has mainly been driven by economic growth and quick-fix strategy. This paper draws upon secondary data of last decade, relevant publications and existing policies to explore the status of ongoing energy transition of Bangladesh and its implication on energy trilemma, which is being measured on energy security, equity and environmental performance. Through analysis, diverse range of issues, i.e., options and pathways for sustainable energy transition and linkages of the transition with national climate policy and Sustainable Development Goals, are examined. The paper concludes with the necessity of creating an enabling environment and developing conducive policy instruments, also derived from present experience, to catalyze investment and attract private sectors for sustainable energy transition in Bangladesh.

Keywords: Energy Transition, Energy Trilemma, Renewable Energy, Energy Efficiency, Bangladesh.

### **1. Introduction**

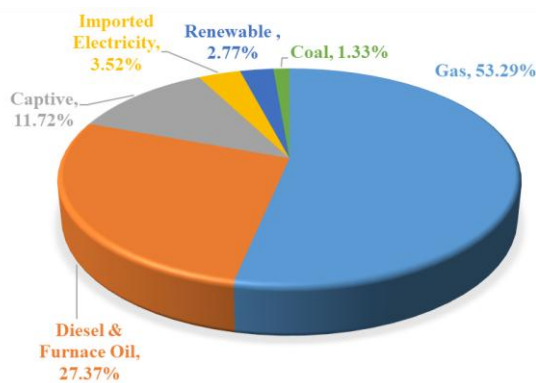
Major structural change or shift in utilizing energy resources in an economy to meet its demand can be treated as energy transition. Different countries went through this transition in the past mainly attributed to the necessity of enhancing economic performance but most of the countries are now in energy transition or are about to embark on energy transition, especially in light of negative impacts of anthropogenic climate change, limited stock of fossil fuels and concern for sustainability. For instance, German energy transition (*Energiewende*), one of the most notable national shifts in energy system in the world, includes, among other things, increasing use of renewable energy for electricity generation and reducing demand for energy, aided by energy efficiency measures. During 1990-2013, share of renewable energy in German electricity grid increased from 3% to 25% [1]. Germany has more ambitious goals to meet in the foreseeable future. In regional context, India has massive plan to exploit renewable energy resources to generate 175 GW electricity by 2022 of which 40 GW is expected from solar rooftop [2]. In fact, Bangladesh is also in energy transition due to the increasing demand for energy to propel the growing economy. It is quite obvious that energy demand would further increase in the coming days to ensure robust socioeconomic development. However, the relevant questions are: whether the present energy transition is sustainable and if it is not, what implications does the transition have and how can we shape the transition to a sustainable one? In that regard, the paper has reviewed the energy transition of Bangladesh over the last decade, analyzed secondary data and looked into the energy-climate policy landscape of Bangladesh. Additionally, the paper has investigated the energy

trilemma index, which is being measured on three interconnected parameters, i.e., energy security, equity and environmental performance, as defined by World Energy Council [3], to gauge the performance of present energy transition of Bangladesh.

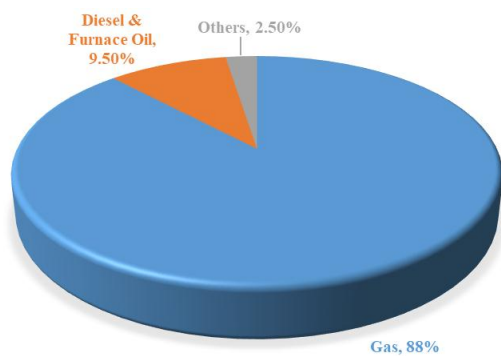
### **2. The ongoing Energy Transition in Bangladesh**

Over the last 5 to 6 years, electricity supply of Bangladesh has increased significantly, which is driven by the government's intention to fulfill the need of the demand side, including, among others, industries, households and service sectors. Another factor that has also triggered the necessity of increasing installed capacity of electricity is the lack of access to electricity in some parts of the rural areas. Overall, the installed capacity of electricity has increased by almost 100% during 2013-18, i.e., an increase from 9,713 MW in 2013 to 18,768 MW in 2018 [4-5]. Energy mix in electricity generation has been drastically changed. While the national grid is still being dominated by electricity generated from natural gas, it is not like the case of a decade back. In 2008, 88% of total installed capacity was natural gas based against 5.9% of that from liquid fuel [6]. However, today, share of gas to national grid stands at around 53% and that of liquid fuel is over 27% excluding captive generation. Share of renewable energy is paltry 2.77% [5]. Despite establishment of a Nodal Agency, namely, the Sustainable and Renewable Energy Development Authority (SREDA), with the mandate of promotion of sustainable energy, there has not been much success. As of now, the country has only an installed capacity of 519 MW based on renewable energy, consisting of 271 MW from small scale solar home systems, installed in

the off-grid rural areas by the households themselves, representing more than 50% of renewable energy in the energy mix of national electricity grid. In contrast, among the on grid renewable energy, around 17 MW is from solar and the remaining is almost entirely from hydro, which was installed during 1962-88 [5, 7]. Although the government has a target of generating 10% electricity from renewable energy by 2021 [5], it seems unlikely that the target would be achieved at the current pace. Moreover, the country has targets of reducing 15% and 20% demand for energy through energy efficiency by 2021 and 2030 respectively. Notably, another target of 10% energy efficiency by 2015 was set by the government, which despite being supported by low cost finance, has failed to produce desired impacts [3].



**Fig.1** Energy mix in national grid of Bangladesh in 2018 [6]



**Fig.2** Energy mix in national grid of Bangladesh in 2008 [5]

### 3. Implications on Energy Trilemma

Unfortunately, the present development path in the energy sector seems to be unsustainable, leading to further complex problems. Out of 130 countries, being indexed in Energy trilemma based on energy security, equity and environmental sustainability, Bangladesh is 113<sup>th</sup> [3]. Even though access to electricity has increased to 75.9% [8], still electricity is not fully reliable due to load-shedding. On the other hand,

increasing supply of electricity has been possible through installation of imported liquid fuel-based power plants, which have only exacerbated the energy security of the country. During last decade, reliance on local natural gas to generate electricity has decreased and dependence on imported liquid fuels has gradually increased. Over the period from 2008 to 2018, share of liquid fuels in fuel-mix of national grid has increased from 9.5% to 27.37%, putting increasing pressure on import. Additionally, 3.52% of total installed capacity has been brought to the national grid through cross-border trade [5-6]. While energy security in Bangladesh was never ensured, the transition from local natural gas to mainly imported liquid fuels has only increased more vulnerability of energy sector of the country. The present transition has also severely affected from environmental point of view and climate policy context of the country. Per capita Greenhouse Gas (GHG) emission of the country has been increased from 0.46 ton of CO<sub>2</sub> to 0.98 ton of CO<sub>2</sub> [9-10]. Although per capita GHG emission of the country is still much less compared to many developed nations and at the development phase of the country emission would increase, the government would face monumental challenge to meet GHG mitigation target under the (Intended) Nationally Determined Contributions (NDC), submitted to United Nations Framework Convention on Climate Change (UNFCCC) as part of the Paris Agreement. The projected increase in power, transport and industry, according to NDC, was 264% in 2030 compared to 2011 under business-as-usual (BAU) scenario [11] but in last four years, per capita GHG emission increased by more than 100%. Therefore, under BAU scenario, GHG emission of the stated sectors would automatically increase by more than 264% in 2030, posing serious challenge to meet NDC targets of reducing unconditionally 5% GHG emissions and conditionally 15% GHG emissions in those three sectors. Aside from increasing GHG emission, overall environmental situation of the country has significantly deteriorated. The country is 179<sup>th</sup> out of 180 countries in Environmental Performance Index, published in 2018 [12]. Understandably, overall environmental performance depends on many parameters, including management, where Bangladesh always lags behind but increasing emission because of switching to more polluting fuel has played a significant role on such a dismal environmental performance.

The present transition has also not helped the promotion of renewable energy in the country. Contrary to the fact that Bangladesh has more sunlight than many countries, Bangladesh generates much less electricity from solar energy. At a time when price of renewable energy is falling globally, renewable energy remains much expensive in Bangladesh and despite several round of price adjustments of electricity as well as fossil fuels in the recent years, national grid and fossil fuels are still subsidized. These twin problems, i.e., higher price of renewable energy resources and subsidized fossil fuels,

are plaguing the market development of renewable energy. The single digit loan scheme for renewable energy is the only incentive that the investors have but it has failed to provide necessary signal to the prevailing market to attract investment on renewable energy. As the investors have not come along with national policy target for renewable energy, there is very little progress on renewable energy front. With only small achievement in terms of solar energy, we are at the very bottom of the learning curve to harness renewable energy resources. As of now, energy efficiency has also not been a success, attributed to several factors. Absence of sufficient incentive for the industry management, presence of subsidy in both fossil fuels and electricity, lack of market readiness and absence of enabling environment have hindered promotion of energy efficiency in the country.

It is the impression that, due to lack of options, the government had to choose the quick-fix strategy, i.e., increasing power supply either from local resources or imported fuels, to meet increasing demand for electricity. The quick-fix strategy has only benefited the country in one dimension, i.e., increasing access to electricity and meeting part of growing demand, at the expense of energy insecurity and environmental performance. In fact, Bangladesh has become worse off in Energy Trilemma. The situation can partly be explained by the facts that energy sector had been neglected during the early part of last decade when almost no new generating capacity was added in any form, maintenance of age-old power plants was lagging and efforts to minimize transmission and distribution loss were not enough.

#### **4. Making Energy Transition Sustainable**

Primarily, it is essential to identify the technical solutions that can make the energy transition sustainable taking into account of national priorities and considering the Sustainable Development Goals (SDGs) and Paris Agreement. Energy efficiency is the most obvious and it is probably the cheapest as the cheapest energy is what we don't need to produce at all. On the one hand, energy efficiency would reduce demand for energy and on the other; it would help industrial expansion with the saved energy. This can further help in ensuring access to electricity in areas, which are not connected to grid. Study shows, there is an opportunity to reduce energy demand in the industrial sector, which is the largest energy consumer in the country, by 36% through implementation of energy efficiency measures, such as, efficient lighting, combustion control, waste heat recovery, improved insulation, implementing energy management system and the like. Commercial buildings also provide the opportunity of up to 50% energy savings [13]. Study, conducted in six major industrial sectors of Bangladesh, shows that 30% energy efficiency can be achieved in economically feasible way [14]. Although cost-benefit analysis shows that energy efficiency makes sense, its implementation poses lot of

challenges. Uptake of energy efficiency is heavily reliant on policy instruments. Notably, the draft energy audit regulation of Bangladesh is going through the government's approval process and the energy standards regulation for appliances is anticipated to be finalized soon. Once these regulations are in place, the challenge would be to implement the energy efficiency targets of the government, i.e., 15% by 2021 and 20% by 2030 respectively. Notably, cost savings alone are often inadequate to stimulate the adoption of energy efficiency measures. As such, policymakers must align the interests of industry owners and consumers and implement a combination of energy audit regulation, energy efficiency standards and incentives. Incentives would play significant role as industries, for instance, under BAU scenario are making profit and they don't have enough motivation for reducing energy consumption. Therefore, appropriate form of financing shall be made available to attract industries to be energy efficient and at the same time, energy efficient industries shall be rewarded. Although currently some energy efficiency financing facilities from Japan International Cooperation Agency (JICA) and the Central Bank of Bangladesh are available, overall demand for funding to make a complete transformation through energy efficiency would be billions of USD as 120 energy inefficient industries of six sectors, according to a study, would require an aggregate investment of USD 140 million to make them energy efficient [14]. In addition, subsidy from fuels and electricity shall be removed to reflect true price of electricity and fuels. Once these price distortions are reduced, energy efficiency measures would generate more cost savings compared to present situation, making energy efficiency projects more viable. These must be accompanied by raising awareness across all industrial sectors to focus on greater energy efficiency.

Apart from taking policy measures and creating enabling environment for energy efficiency, it is also necessary, for instance, to draw lessons from experiences of other countries on energy efficiency, particularly with regard to the rebound effect. The rebound effect appears when energy saved from use of efficient technologies is being offset by overuse of energy, such as, buying an energy efficient car and driving it more than normal. Another form of rebound effect arises when energy inefficiency is minimized by installing energy efficient technologies and the monetary saving is being used to maximize other utilities that consume more energy, ultimately leading to a state of no energy saving at all. As the country has been enjoying a sustainable economic growth and real income of people has increased, it is likely that rebound effect might occur in different sectors of the economy and therefore, target for energy efficiency as well as tariffs of energy might be adjusted over time.

While energy efficiency is one option, the other conduit to address energy trilemma and to make the energy

transition sustainable is to increase diversity in energy supply and electricity generation. Bangladesh can surely be benefited from diversity on the supply side of energy given that solar has proven potential in the country and the wind resource mapping, which is currently being undertaken in the country, would help identify the feasible locations to install wind turbines in future. These would help address the crisis that at times stifles business and keeps homes in the dark and help improve with regard to energy equity. Building on broad consensus, the policymakers need to set clear and straightforward goal on renewable energy, backed by supportive regulatory environment, instead of only fixing target like the present one of achieving 10% electricity from renewables by 2021. In tandem, it is necessary to adopt the policy instruments that can attract investment in the sector. Although, of late, a net metering guidelines has been drafted by the government to attract households and industries to generate electricity from renewables to supply to grid and adjust with own consumption [15], impacts of the policy would only be realized after couple of years of operation. In the meantime, some important issues need to be addressed. It is essential to reduce price distortion through removal of subsidy from fuels and electricity to encourage private sectors to invest in electricity production from renewable energy sources. Moreover, the present refinancing scheme of the Central Bank shall be made more friendly and attractive to the private investors.

On the other hand, SREDA, being the Nodal Agency for promotion of sustainable energy in the country, shall work on creating a conducive environment for accelerated implementation of energy efficiency and renewable energy projects and programs. It shall, therefore, look into the policy instruments to be formulated and adopted to foster sustainable energy in Bangladesh and share best practice cases amongst different stakeholders.

The energy transition, supported by energy efficiency and renewable energy, is not only about providing energy access by renewables or reducing demand by energy efficiency; both can drastically cut down GHG emissions and other pollutions, improving environmental sustainability. Furthermore, sustainable energy transition has strong interlinkages with other social, environmental and economic co-benefits, such as, opening up job opportunities, diffusion of low carbon technologies, technological innovation, less air pollution and reduction in import of fossil fuels etc. In summary, this transition would help Bangladesh in improving its position on energy trilemma due to possibility of better performance on both energy security, equity and environment parameters. In parallel, Bangladesh would be able to contain the sharp increase of GHG emission to the level where it might be in line with NDC projection, fulfilling the commitment under Paris Agreement. Finally, sustainable energy transition would

enable the government to achieve different SDGs, i.e., SDG 3, 7, 9 & 13, through reducing deaths and diseases from improved air quality (SDG-3), ensuring access to clean and reliable energy (SDG-7), sustainable industrialization (SDG-9) and combating climate change (SDG-13) [16].

In addition to energy efficiency and renewable energy, the unexploited off-shore gas can be pivotal to both increasing energy security of the Bangladesh and reducing air pollution and GHG emissions. It is particularly important in the face of fast depleting present gas reserve and can significantly change the current state of energy policy making. The settlement of dispute with neighboring countries on maritime boundary has also paved the way for the country to make an all-out attempt to unleash potential of offshore gas.

## 5. Conclusion

While energy transition of Bangladesh during last decade has been mainly aimed at increasing electricity supply to meet the demand within a short span, it has been mostly reliant on imported fossil fuels, deteriorating energy security of the country and negatively affecting environmental performance. The quick-fix strategy to solve the energy problem has taken its toll. Bangladesh is currently sitting almost at the bottom of the energy trilemma index and global environmental performance index. The country is also at the risk of failing to meet GHG mitigation targets under NDC and Paris Agreement. Against these backdrops, a sustainable energy transition, i.e., increasing use of renewable energy to generate electricity and application of energy efficiency on the demand side, could solve the problems of energy security, environmental problems and so on. It could also help achieve NDC targets and multiple SDGs. However, despite having policy targets, both energy efficiency and renewable energy are yet to be explored to the level of potentials and expectations. Both energy efficiency and renewable energy shall be backed by suitable policy instruments, for example, incentive mechanism and appropriate finance. In parallel, price distortion, i.e., subsidy, shall be removed to catalyze investment on energy efficiency and renewable energy and stimulate private sector participation. There should also have plan to explore our own offshore gas, which has so far been disappointingly untapped. At the beginning, it is likely to be challenging to shift from present energy transition to sustainable transition but SREDA, the Nodal Agency for sustainable energy promotion, shall play important role to make the transition happen. In order to achieve the desired results, it shall take care of the formulation and implementation of policy instruments vis-à-vis energy efficiency and renewable energy. It shall also carry out the awareness raising program on sustainable energy at all levels with a long-term vision, dedicated focus and clear message. With a strong push from the government, supported by enabling environment, it would be

possible to achieve a paradigm shift in the energy sector of Bangladesh from present energy transition to a sustainable one. In that regard, the ideas presented above can be taken forward in view of Bangladesh's energy and climate policies and related targets.

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