Global Scientific JOURNALS

GSJ: Volume 10, Issue 1, January 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

ENERGY AND ENVIRONMENTAL SECURITY

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KeyWords

Climate Change, Development Scenario, Environmenal Challenges, Energy Security, Energy Challenges, Energy Policy, Global energy demand

ABSTRACT

From the dawn of human civilization, energy has been the driving force which ensured the progress of mankind towards development. The important discoveries that shaped the modern society would have been impossible without energy. As the society advances towards modernization, the use of energy increases significantly. In order to sustain the living standard and technological development, uninterrupted energy supply is a must. Energy security has been a worldwide concern and recently it has received vital attention in the Millennium Development Goals (MDGs) and property Development Goals (SDGs). The main objective of this paper is the forthcoming steps for effective development in the energy sector of Bangladesh. This paper presents a broad summary of the energy and environmental security in Bangladesh perspective providing insights into the present situation and guidelines for the future.

Introduction

Energy security has been a priority for all the countries in the world. With modernization, the use of energy has been rising day by day that causes people's life and national economy to be largely dependent on the usage of energy.

So, for a secured future different attempts are being taken in the energy sector all over the world. it's so essential to take initiatives to confirm necessary energy supplies and their correct distribution in Bangladesh to maintain a steady socio-economic development.

Changing climate upon earth is now a longtime fact which is based upon scientific consensus that human activities haven't only contributed to it significantly, but that change is far more rapid and dangerous than thought earlier, according to the 2019 report of Inter-Governmental Panel on global climate change (IPCC). While global climate change results from activities all over the world, it may cause very different impacts in different countries, depending on regional environmental conditions and on differences in susceptibility to climate change —independent of the contributions to climate change of these countries. It is similar to undermine the sustainability of livelihoods as well as development. The worst impacts will largely affect poor and developing countries, particularly the Third World, which despite having enough natural resources are left to suffer due to their geographical location, poor infrastructural facilities, vulnerable social, economic, and political system together, paving the way for weak capacities of coping with emerging challenges. Though the natural resources are treated as 'common fund' of mankind, they have been used in an unequal manner causing uneven growth patterns in the world, and that causes a dangerous impact on each constituent of the environment. The developing countries of Africa, Asia & Latin America known as the 'Third World' have been the worst sufferer of the environmental degradation

caused by the industrial revolution and consequent imperialist policies adopted by the West as regards unrestrained extraction and excessive use of natural resources for commercial purposes, thereby causing adverse changes in climates and also hampering the uninterrupted supply of energy resources called 'energy security.

This paper is divided into five sections, and its organization is as follows. Section I describes the introduction. The overview of energy security and environmental impact are familiarized. Section 2 overviews the New Policies Scenario and the Sustainable Development Scenario mentioned in the World Energy Outlook 2018. Section 3 describes energy security and environmental impact from the perspective of South Asia. Section 4 outlines energy security and environmental impact from the perspective of Bangladesh. Section 5 concludes the study with conclusions and recommendations for further work.

Energy and Environmental Security

A. Global Scenario

The World Energy Outlook (WEO) doesn't aim to forecast the future but provides the way of exploring different possible futures, the levers that would bring them about, and the interactions that arise across a complex energy system. If there's no change in policies from today, as in the Current Policies Scenario, this results in increasing strains on the majority aspects of energy security and a major additional increase in energy-related CO2 emissions. New Policies Scenario broadens the scope to include policies and targets declared by governments. While the picture brightens, there's still no peak in global energy-related CO2 emissions. The gap between this outcome and the Sustainable Development Scenario, in which accelerated clean energy transitions put the planet on target to satisfy goals associated with global climate change.

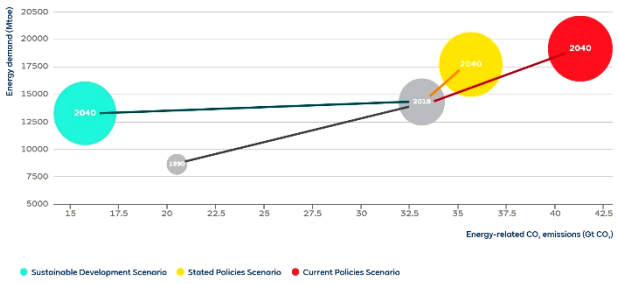

Fig. 1. World primary energy demand and energy related CO2 emissions by scenario

B. New Policies Scenario

Global energy demand grows by more than a quarter to 2040 in the New Policies Scenario, because of rising incomes and a worldwide population growing by 1.7 billion people, mostly in urban areas of developing economies. The increase in energy demand would be about twice as large if it weren't for continued improvements in energy efficiency, a robust policy tool to deal with energy security and sustainability concerns.

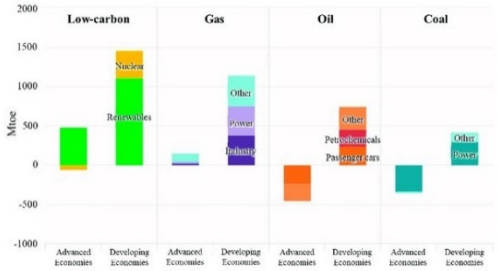

Fig. 2. Change in total primary energy demand, 2017-40 in the NPS

All the expansion comes from developing economies, led by India. Recently in 2000, Europe and North America are accounted for over 40% of worldwide energy demand, and developing economies in Asia are for around 20%. By 2040, this situation is completely reversed. Low-carbon technologies, led by renewables, and natural gas meet more than 80% of the increase in global demand. Electricity consumption increases twice as rapidly as overall energy demand.

The shale revolution continues to shake up the oil and gas supply, enabling the USA to drag away from the rest of the sphere because of the world's largest oil and gas producer. By 2025, nearly one in five barrels of oil and one in four cubic meters of gas in the world come from the United States. This adds to the pressure on traditional oil and gas exporters that depends largely on export revenues to support their national development.

C. Sustainable Development Scenario

To deliver the outcomes of this scenario, the power sector proceeds further and faster with the deployment of low CO2 emissions. Renewable energy technologies provide the main pathway to the supply of universal energy access. All economically viable avenues to enhance efficiency are pursued, maintaining overall demand in 2040 at today's level.

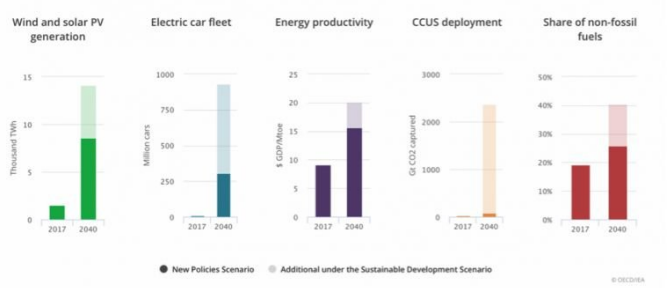

Fig. 3. New policy scenario and sustainable development scenario

Electrification of end-uses grows rapidly, but so too does the direct use of renewables – bioenergy, solar and geothermal heat – to supply heat and mobility. The share of renewables in the power mix increases from one-quarter today to two-thirds in 2040; in the provision of heat it increases from 10% today to 25% and in transport, it increases from 3.5% today to 19% (including both direct use and indirect use, e.g. renewables-based electricity).

Energy Security and Environmental Impact: South Asia

A. Energy Challenges in South Asian Countries

The South Asian countries are experiencing wide-ranging energy issues including lack of access to refined fuels, weak grid reliability, unaffordable energy prices, and import dependency. These challenges are hampering the socio-economic development of a

major section of the region's population. Owing to factors like a large and expanding population base, economic and infrastructure development, modernization, and urbanization, the region is predicted to experience a growth in energy demand much faster compared to the global average. The provision of sufficient, refined, and affordable energy is key to sustainable development mentioned in the SDGs. Large segments of South Asia's population have traditionally suffered from a scarcity of access to electricity and gas networks. Recently, however, considerable progress has been made in the case of rural electrification making the national electricity-access numbers quite promising, as shown in Figure 4.

The definition of electrification though is debatable. The definition adopted by the Indian government, for example, is that 10% of a village should have electricity to have it declared electrified. Despite the Indian government's claim of having electrified every village in the country, up to 305 million people are reported to be lacking access to electricity. In 2018 when India declared to have every village electrified, the average household electrification level in rural areas was around 80%, ranging from 47% to 100% across various states. It is also noteworthy that electrification isn't essentially an indicator of reliable and sufficient access to electricity. The reliability of the grid in many cases is feeble. Severe demand and provide issues are leading to lengthy power outages and load shedding even in urban centers and metropolitan cities. Issues with aging transmission and distribution (T&D) systems also are an acute problem in these countries.

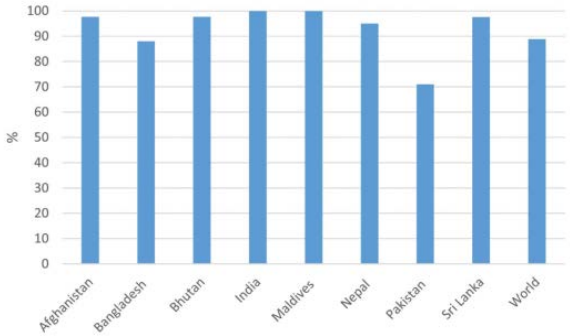

Fig.4. Electricity access in South Asian countries.

The fragility of the grid is also apparent in the form of power breakdowns and low voltages. These challenges have a major impact on South Asian countries' per capita electricity consumption as shown in Figure 5.

Lack of access to refined energy resources also proves the fact that over 1 billion people in South Asia meet their cooking requirements through unrefined and polluting energy sources like wood, animal dung, and crop waste as indicated in Table 1. In most SACs, biomass is the major resource for satisfying their cooking and heating requirements.

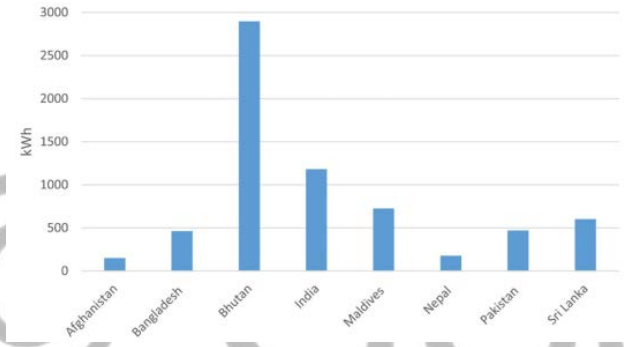

Fig.5. Electricity access in South Asian countries.

B. Environmenal Challenges in South Asian Countries

South Asia also suffers from acute environmental problems. It is one of the most vulnerable regions in the world in terms of the negative consequences of global warming and climate change. Higher temperatures as a result of global warming are fast melting Himalayan glaciers, a lifeline for freshwater supplies which satisfy the needs of the drinking water and agriculture in the region. Rising sea levels are causing numerous challenges to all of the SACs with coastal belts. Problems like seawater intrusion, loss of wetland and mangroves, and displacement of human settlements are common in these countries. The situation with Maldives and Bangladesh is especially critical in terms of a shrinking land area. In the case of Bangladesh, for example, some scenarios suggest that by 2050, one-third of the country could be underwater, making more than 70 million people homeless. Countries in the region are experiencing rising frequency and intensity of climate change-driven extreme weather events like seasonal disorder, flooding, drought, and heatwaves. The Global Climate Risk Index 2020 regarded Pakistan, Bangladesh, and Nepal as the fifth, seventh, and ninth most affected countries in the world from extreme weather-related natural catastrophe over the period 1999–2018. Climate change is also related to water and food shortages. Water shortages and droughts are becoming a severe problem for these countries. In 2016, India reported having around 330 million people affected by severe drought, in many cases forcing people into internal migrations.

Country	Population (Million)	People relying on biomass (%)
Afghanistan	24.60	63
Bangladesh	125.40	76
Bhutan	0.18	23
India	704.00	51
Maldives	0.01	1
Nepal	20.60	71
Pakistan	123.8	56
Sri Lanka	14.80	69
Total	1,013.40	

Table.1. Population Without Access to Clean Cooking Fuels

South Asian countries are also facing environmental challenges directly associated with their use of energy. Air pollution, especially as a result of the use of polluting fuels and unchecked industrial and transport emissions, is also a major concern in the region. Pollution caused by the use of crude energy resources and inefficient technologies is a major environmental concern for these countries. The use of biomass fuels as shown in Table 1 leads to severe environmental and health issues. According to the World Health Organization (WHO), annually around 4 million people die prematurely from illnesses attributable to household air pollution from inefficient biomass-based cooking.

Case Study: Bangladesh

A. Energy Scenario in Bangladesh

Bangladesh is known as one of South Asia's fast-growing economies. in the country, increasing population and social development have caused a rise in the demand for energy. With GDP recording 6.6 percent Compound Annual growth rate (CAGR) over the last five years, the energy demand for Bangladesh has increased sharply with a CAGR of 7.4% from 25.7 MTOE in 2013 to 37.38 million tons of oil equivalent (MTOE) in the year 2018. Due to gas shortages and insufficient capacity acquisitions, uncontrolled demand exceeded power generation capacity a couple of years ago and caused the Government to enact ambitious generation increase plans. Power generation capacity in 2018 was 17,801 MW in Bangladesh. the highest possession was occupied by Bangladesh Power Development Board (BPDB), which is (around 5300 MW).

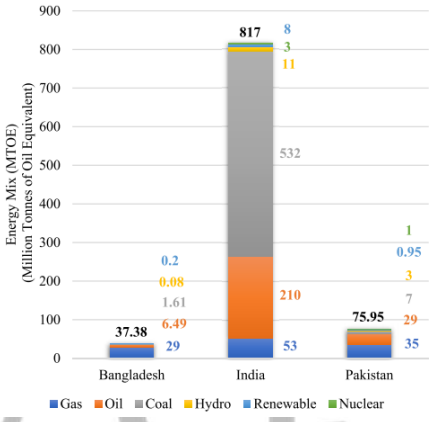

Fig. 6. Energy Mix of the countries for Year 2018/2019

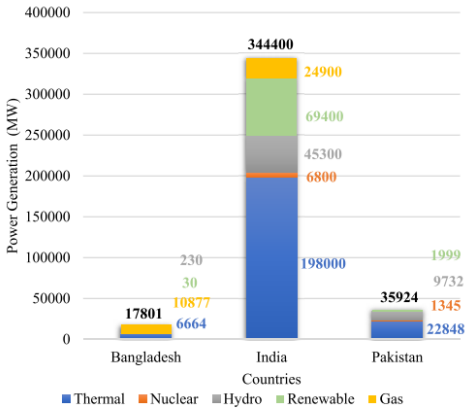

Fig. 7. Power Generation by Source for Year 2018/2019

Now a day's human development index is considered as a better indicator of development than per capita GNP. Energy has a determinant influence on HDI (Human Development Over 70 percent of power generation comes from gas power plants with thermal power that accounts for just 20 percent of the total capacity. Almost 62,925 GWh (Gigawatt hours) of power was generated in the year 2018, which was 9.8% more than the last year. By linking Bheramara and Tripura, around 4661 GWH of energy has been imported from India. By 2021 and 2030, the country's generation capacity of power would be boosted to 24,000 MW and 40,000 MW conferring to the Power Sector Master Plan of Bangladesh. Taking into account the retirement plans of the current power utilities, the de-rating of the power plants, the implementation of early retirement policy for obsolete power plants, and the construction of modern and effective facilities, energy stations with an extra capacity of 14,500 MW are anticipated to be installed by 2030. Karnafuli Hydro, with an installed capacity of 230 MW, is the only hydropower plant in Bangladesh.

B. Demand for Petroleum Products in Bangladesh

During the years 2013-2018, the demand for Petroleum, Oil, and Lubricants (POL) without LPG did rise at 4.7% CAGR in Bangladesh. Owing to the growing mandate for diesel and petroleum from the thriving transportation industry, in fiscal 2018 the growth remained to 8.7%. Escalated automobile growth joint with low fuel costs, mostly automobiles like motorcycles and cars widened the utilization of high-octane blending component (HOBC) and petrol by 12.4% and 7.6% in turn.

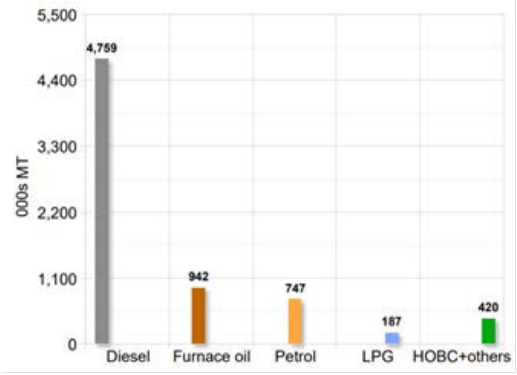

Fig. 8. POL demand in Bangladesh in 2018/2019

In 2018, consumption of diesel escalated by 11.2% year-on-year as a result of massive development in the transportation sector driven by robust GDP growth of 7.1%. Commercial vehicles, increasing diesel demand, reported a 15 percent growth in fiscal 2018 and a 12.3% rise in CAGR over the last five years. Fig. 8. depicts the demand for POL for years 2018/2019.

C. Renewable Energy Development In Bangladesh

The Government of Bangladesh has put special emphasis on the development Program of Renewable Energy under the Power Sector Development Plan. Bangladesh Power Development Board (BPDB) plans to leave fossil fuels and appearance towards renewable energy sources because the future sustainable and reliable power source. Although electrification tends to lag behind, the state had to depend upon conventional energy sources, over which they had technical proficiency to spice up power supply. Now, by 2022, as Bangladesh has planned to place all households connected to the grid therefore, the main emphasized area is going to be the rebalancing of the fuel mix. BPDB has mounted 270 kWh of solar systems on the rooftop of its offices, with a further capacity of 500 kWh in the pipeline. within the Kutubdia Island and Cox's Bazaar, small wind projects are installed. Solar streetlights are in eight cities of Bangladesh installed, and in Sylhet and Chittagong, solar charging stations are now being established. electric power of almost 870 MW is going to be added to the grid as there are 9 projects of renewable energy ongoing. A development financial institution owned by the state is dedicated to encouraging or provide financial support to the projects and infrastructure of renewable energies in Bangladesh, which is known as 'Infrastructure Development Company Limited (IDCOL)'.

D. *Energy Policy in Bangladesh*

Bangladesh depends largely on fossil fuels for its generation of power, and its future energy strategy is geared towards imports of fossil fuels. There are some policy approaches in the energy area, including involvement of private sector, energy efficiency and conservation, regional cooperation on cross border power trade, the variation of fuel mix, and validation of tariff etc. Till 2030, the country has made a master plan on energy conservation and efficiency, as they are vital elements for energy advancement in Bangladesh. In comparison to the base value, it is predicted that the power demand would fall down by capacity of 8 GW if the energy efficiency of 20% is enhanced by 2030. A cross border policy of trade is being established by India so that the Power Development Board of Bangladesh can get power from any Indian Company. To reduce the manufacturing cost of energy, the subsidy is given for the fuel by proposing electricity tariffs. To boost the country's economy, cheap prices of power are of great importance. Though the cost of power supply per unit has increased over time, the rate of growth is very little. To satisfy the rising demand for the nation, BPDB has planned to get power from self-governing power manufacturers and by mounting new power plants, which will lead to accelerating the price of power production. In the light of increasing energy prices, the bulk power tariff rate has actually raised from 2.50Tk in 2007 to 3.8 Taka in 2015 to minimize the economic loss of BPDB. Bangladesh's Government has also implemented electricity pricing slabs so those high-end consumers can reduce utilizing the subsidies. It can be minimized more efficiently if the losses of the system somehow are reduced. For this purpose, there is need to train the workforce efficiently and introduce some optimization techniques in the area of transmission, generation, and distribution. Energy conservation, reliability and efficiency are also very important for substantial development and growth in the country.

The Government of Bangladesh has provided a robust push to increase the production of renewable energies in the country. In the years 2015 to 2020, the objective was to produce 5% to 10% power from renewable energy resources. In 2014, for the promotion of energy efficiency and reliability, the government had established a department named Sustainable and Renewable Energy Development Authority (SREDA). The Government of Bangladesh is also seeking to follow Bangladesh's 'Private Sector Power Generation

Strategy' to draw private investment and guarantee a better cost for projects of power generation. As the cost of RE is reducing with time, a complete road map for binding renewable energy has also been intended in Bangladesh to pay emphasis on solar projects. On the initial stage, projects based on rooftop solar PV would be more attractive as there exists a land scarcity in the country. BPDB is also sectioning wide grid linked solar projects (more than 30MW) to promote further use of solar energy.

E. Institutional Framework of Energy Sector in Bangladesh

The energy sector of Bangladesh is under the regulations of the Ministry of Energy, Power and mineral resources. It is liable for regulations and rules designed to uplift the energy sector in areas like power, coal, gas and other primary fuels. In 1995, the established power cell was aimed to help the power sector for monitoring, designing, and facilitating reforms in the power division. It plays a big role in improving, reforming, and facilitating the private sector, starting regulatory commissions, assessing power tariffs and sector participation and contribution. Bangladesh Energy Regulatory Commission (BERC) was established in 2004, which aimed to frame the required standards, and codes to continue the transparency, efficiency and submission to management, and operations in the sectors of petroleum, gas and electricity. In 1972, to upgrade the power sector in the country, a public sector organization was created as Bangladesh Power Development Board (BPDB), which is an authoritative body that has all the rights to construct, plan, and operate and run power generation units all over the country also as power distribution in the urban areas. It sells power to customers and distribution companies after purchasing from generating companies as a single consumer. The central body: i.e., Energy and mineral resources, and Power ministry (MoPEMR) is also responsible and accountable for all the development, planning and differing types of commercial energy resources management, including power. Power Division and Resource Division (EMRD) are two divisions under the control of Mineral and Energy Resource. EMRD is the administrative authority and is liable for the administration of all the natural resource and energy resources containing gas, oil, coal, and other minerals of Bangladesh. Petrobangla, a Bangladeshi Oil, Gas and Mineral Corporation (BOGMC), is a shareholder of companies who is playing a role in the development and growth of gas and oil on behalf of the EMRD. Bangladesh Petroleum Corporation (BPC) is liable for all the measures which are required to be taken so as to uplift the petroleum industry like, crude oil processing, refining, lubricants blending, export, import, and advertising and marketing of products containing lubricants, and by-products. Bangladesh Petroleum Corporation (BPC) has 8 divisions –three distributions, one oil refinery and two lubricant blending plants, marketing companies, an LPG bottling and distribution plant.

F. Futue of Energy Security

Energy security means the uninterrupted supply of energy at reasonable prices, as defined by IEA, which relates to both external and internal dynamics. It may be ensured through local adequacy, that is, abundant and varied sorts of indigenous energy resources, but the countries that face local shortages and rely on import. However, internal measures could attenuate dependence on external sources.

The internal dimension of energy security requires funding for the maintenance of existing electricity networks as well as extension in light of the growing demand for electricity and also the government's goal to ensure access to electricity. Another internal dimension of energy security is to invest in resource exploration, comprising both traditional and alternative sources, which may sharply reduce imports.

Energy security also relates to the efficient utilization of resources. Energy efficiency improvement at the end-users does not only lower energy costs for them but also reduces the demand for production of the same. In the industrial sector, enhancing energy efficiency results in lesser use of energy per unit of production and consequently, helps in decoupling energy input and economic growth. While promoting energy efficiency by encouraging the adoption of efficient technologies, it's also essential to figure on energy conservation to attenuate wastage, be it because of behavioral or other reasons. In addition, there's scope to bring down transmission and distribution losses.

However, in the last decade, Bangladesh was generally infatuated with power security rather than long-term energy security. Against the growing demand and looming shortage of gas, the initiatives to explore local gas resources weren't ready to requirement. Following the settlement of maritime boundaries with Myanmar and India, Bangladesh has so far done little to explore gas. At the same time, the Government pays a way higher price to the private entities producing power from liquid fuels compared to the typical production cost of electricity. Now, LNG is being imported, costing significantly more than the cost of local gas. As things stand, the reliance on imported fuels would continue to be on the increasing trajectory unless the country makes a shift from business-as-usual to increase investment in gas exploration.

As far as transmission and distribution losses are concerned, from 2001 to 2018, there has been a significant improvement from 27.97% loss to 11.87% according to Power Cell. Nonetheless, this suggests, 11.87% of total electricity being generated doesn't reach the intended consumers. On the other hand, the worldwide average of combined transmission and distribution losses stood at 8.25% in 2014, which is on the downward trend also. As such, there's no scope for complacency on overall transmission and distribution losses.

While the efforts on solar and wind are yet to yield significant results, the net metering guideline of the Government would help the renewable energy sector generally. Business entities could undertake rooftop solar projects, particularly in cities, to get power from solar to satisfy their own demand and provide surplus electricity to the grid. This could, further, address the land problem in installing utility-scale solar projects in a land-constrained country.

The cost of solar energy, which is currently less than electricity generated from coal internationally, is favorable too. While the goal of generating 2,000MW electricity by 2020 won't be possible to satisfy, the net metering guideline along with the low price of solar energy would definitely boost the sector.

Energy efficiency provides many opportunities in the industrial sectors, commercial buildings, households, and so on. The Government also intends to reduce 8,000MW electricity by 2030, according to the energy efficiency and conservation master plan, through energy efficiency and conservation measures on the demand side.

However, there's a propensity among people to choose appliances and equipment supported the smallest amount cost option. The life-cycle cost assessment could help in that regard, but people are yet to be properly familiar with that analysis. Be that because it may, industries either with support from development agencies and local financial institutions or on their own are undertaking energy efficiency measures.

Local expert pools have been developed for energy audits. More importantly, the energy audit regulation has been approved by the government, and energy efficiency standards and labeling regulations are undergoing an approval process.

The next step should be enforcement of the regulations, as well as, organizing awareness-raising programs across the country. While absolute energy security might never be reachable, internal measures, exploring local reserves, harnessing renewable sources, particularly solar, and improving energy efficiency, could help reduce pressure on imports.

As the people are ready to deal with the pressure of accelerating demand for electricity within the last decade, the attention now should get on internal dimensions of energy security instead of power security only.

Conclusion

In summary, Bangladesh's energy security is a mixed bag—some achievements have been made but large gaps still exist. The future scenario will rely on how well Bangladesh tackles the threats. The probable issues which will pose as threats are:

a) international prices of LNG and coal;

b) the steadiness of supply which successively will rely on world stability especially that of the Middle East;

c) economic growth of the country; and

d) good governance both of the country and therefore the energy sector.

A significant aspect of the governance of the energy sector is the development of manpower for nuclear and supercritical coal power plants.

Bangladesh preferred a predominantly import-based energy sector. The proponents of this strategy cite examples of South Korea and Japan. To what extent such comparisons are justified is extremely debatable, but one thing is certain if we falter in achieving economic growth, our ability to import fuels will be greatly hampered leading to diminished energy security.

Acknowledgment

The authors acknowledge financial and technical aid for this research received from Bangladesh University.

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