

## Policy Brief on

# Estimating Costs of LNG-based Power Generation and Devising Alternatives Pathways towards Green and Clean Energy

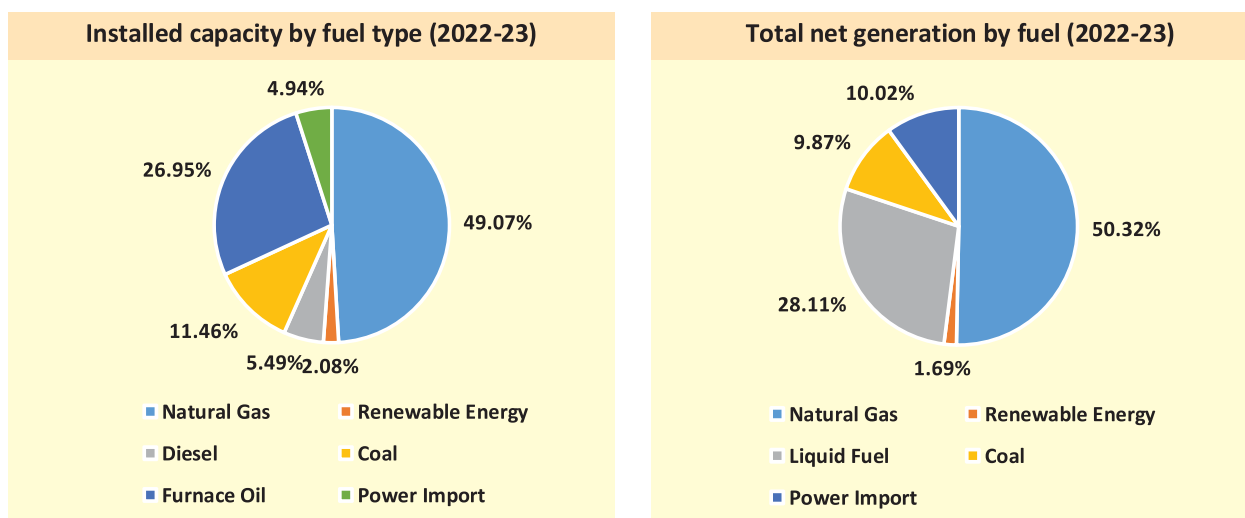
### Introduction and background

The power sector has played a crucial role in driving economic development and growth of Bangladesh over the years. In this connection, significant progresses have been made in expanding power generation capacity and improving access to electricity, resulting in an almost threefold rise in installed capacity and maximum generation over the last decade. However, the increasing reliance on imported LNG, coupled with the depletion of domestic natural gas reserves, poses a risk to the financial sustainability. Global energy price volatility and supply disruptions have further exposed vulnerabilities in the face of LNG imports. Therefore, appropriate analysis of costing, considering both the opportunity cost and the environmental cost along with other visible costs incurred from import to final use is necessary to determine the overall cost of energy sources. The cost-effectiveness of the available options should be explored and assessed thoroughly to understand and thereby to choose the optimal energy mix for the country. With a view to achieve its green and clean energy goal of 40 percent clean energy contribution in power generation by 2040 as outlined in the draft IEPMP(2022), the country must explore viable alternative energy sources and undertake necessary reforms to that end.

### The Structure of Power Sector of Bangladesh

Currently, fossil fuels dominate the electricity generation mix of the country, with natural gas and coal being the primary sources. The country relies heavily on subsidized domestic natural gas, which is depleting, leading to the alternative of increased LNG imports. The government is also depending on some coal-based and oil-based power plants. Though hydropower and renewable energy sources have a smaller share in the energy mix, the government is making efforts to promote solar and wind energy.

Figure 1: Fuel distribution in installed capacity and net power generation



Source: Power Division (Up to December 2022)

## Major Challenges of the Sector

The issue of balancing electricity supply and demand has been a longstanding problem for the country, leading to extensive load shedding, and thereby adversely affecting industrial production and economic activities. Due to rapid urbanization and industrialization, despite adding substantial power capacity to the grid to circumvent this problem, the demand and supply still imbalance persists. The key challenges in the power sector in this context, can be summarized in the following manner:



With projected GDP growth and subsequent electricity demand, a surplus power generation capacity of over 23 percent is anticipated by 2027. Such an overcapacity poses a potential fiscal burden as it requires the government to comply with the contractual obligations with power plants despite a lack of demand. Excessive dependence on fossil fuels and insufficient prioritization of renewable energy sources have constrained large-scale investments in the renewable energy sector. This overdependence on imported fossil fuels not only exacerbates the fiscal burden but also compromises the country's energy security and constrains Bangladesh's journey towards clean and green energy mix target.

## Overview of the Global LNG Sector

The global LNG market has experienced significant growth driven by increased demand from both emerging and developed markets. Investments in LNG infrastructure, including pipelines, port facilities, and Floating LNG (FLNG) technology, have surged to meet the rising demand. Europe experienced a reduction in Russian natural gas production and exports, driving a surge in LNG demand to replace Russian pipeline imports. This increased demand has put an upward pressure on the price as well. Global LNG investments are projected to peak at \$42 billion in 2024, and total LNG supply is expected to nearly double by 2030. Technological advancements, environmental concerns, and the search for reliable energy sources have further fueled the growth of the global LNG market. The market value is expected to reach USD 66.13 billion by 2027, with Asia-Pacific being the largest market, driven by demand from China and Japan. The ongoing conflict in Ukraine and increased global competition for LNG may further impact price dynamics. China's growing energy demand is also expected to influence global energy markets.

## Contemporary Energy Crisis and LNG Scenario in Bangladesh

Bangladesh has faced significant repercussions from the global energy crisis, including the instability of global LNG prices and supplies. Despite striving to maintain imports, the country reached a point in 2022 where imports had to be paused, leading the government to implement precautionary measures such as load shedding. The increasing dependence on imported fossil fuels for electricity generation worsens the volatility in the energy sector, adding to the nation's financial stress and triggering spikes in fossil fuel costs. These impacts extend to foreign currency reserves and substantial subsidy burdens. This situation is compounded by the decline in foreign reserves, which raises concerns about the feasibility of government-led projects. This erosion of confidence in the government's ability to finance spot market LNG imports affects the trust of companies in the state's financial capabilities. The energy crisis also

carries implications for the political economy, driving a focus on short-term gains over long-term stability. Consequently, the government grapples with a heavier subsidy burden, necessitating increased allocation of funds to the power and energy sector.

Simultaneously, the challenge of overcapacity obstructs significant investments in the expansion of the renewable energy sector in the near future.

## Cost and Feasibility Analysis

This study provides an in-depth analysis of the economic and environmental costs (social cost) associated with importing Liquefied Natural Gas (LNG) in Bangladesh. The accounting cost estimation involves considering various components such as LNG import cost, VAT, AIT, port service charge, regasification cost, and at-cost charge. By summing up these costs, the total accounting cost of LNG import in 2022 was estimated to be approximately 3992.0183 Million USD covering 1.43% of GDP at constant prices while the economic cost is 6823.357459 Million USD after considering the opportunity cost while the current energy mix is the alternative option, represents around 2.45% of GDP. If we delve into the opportunity cost while considering the alternative of domestic gas, the economic cost escalates further to 2.778% of the GDP, underscoring domestic gas as the most economical fuel source. Our in-depth analysis extends to an evaluation of an alternative energy mix proposed in the draft IEPMP. Projections indicate an accounting cost of 8.097% of the future GDP in 2030 for anticipated LNG use, with an overall economic cost surging to 10.88% of GDP at constant prices. This substantial economic impact of LNG is reinforced by a significant price disparity in generating 1 kWh of power. According to our computations, the LNG cost for Bangladesh is 41.50 BDT per kilowatt-hour, while solar energy costs stand at 12 BDT per kilowatt-hour. The data used for cost estimation is collected from the Rupantarita Prakritik Gas Company Limited (RPGCL), the sole LNG operator government agency in Bangladesh. On the other hand, the environmental cost associated with the emissions from LNG combustion in 2022 was estimated to be approximately 1.0198489 billion USD, which constitutes about 0.366% of the country's GDP. The emissions of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) from LNG consumption and the associated social cost were considered for the estimation.

## Gas Sector Prospects According to the Key Stakeholders

Bangladesh is facing an energy crisis primarily due to limited exploration activities in its gas sector. As outlined in the 2017 gas sector master plan, an increase in gas demand had been anticipated. This was expected to occur alongside relatively stable to slightly declining production from the existing fields, followed by a significant drop after 2022, a circumstance which we are presently facing. Amidst the persistent gas scarcity, attempts focused on exploration continue to fall short in adequately addressing the unexplored regions of the country. Gas-sector specialists highlight three stages of gas exploration, with Bangladesh being predominantly limited to exploring easily identifiable gas fields and neglecting the other two-thirds of potentially gas-rich areas. This has resulted in an acute shortage of natural gas, adversely impacting the production capacity of factories and power plants, leading to an over-reliance on costly imported LNG, coal, and oil. Experts believe that increasing exploration efforts could alleviate the shortages significantly. Currently, only one-third of the gas-rich areas, particularly in the Sylhet-Comilla regions, have been explored, and even from this limited exploration, remarkable gas fields have been discovered. In contrast, neighbouring countries like India and Myanmar have made progress in offshore exploration after resolving maritime disputes with Bangladesh. However, Bangladesh is lagging in this aspect due to low gas prices offered by the government, failing to attract foreign companies. Bureaucratic

complexities also hinder exploration projects. According to the experts, Bangladesh's exploration success rate stands at 33 percent, indicating the potential benefits of exploring more gas fields to address the energy crisis. Diversifying exploration efforts and tapping into untapped areas could significantly boost gas production and meet the rising energy demand of the country.

## Prospects of Renewable Energy

The advocacy for a 40% contribution from clean energy by 2040 in the draft IEPMP encompasses nuclear, hydro, solar photovoltaic (PV), wind, carbon capture and storage (CCS), ammonia, and hydrogen technologies. To fulfill this benchmark, Bangladesh is currently endowed with renewable resources including solar, wind, hydro, biomass, and biogas. However, according to key stakeholders in the energy sector, the prospects of renewable energy in Bangladesh, particularly solar and wind energy, present both challenges and opportunities. According to experts, the country's average daylight hours of 4.5 hours offer the potential to produce up to 2500 MW of electricity from solar energy. However, Bangladesh is currently producing only 500 MW of solar energy, indicating significant untapped potential. Academicians believe that Bangladesh can produce up to 4000 MW of solar energy by 2030. On the other hand, wind energy also holds potential in specific areas, with a 60 MW wind plant being built in the Chittagong - Cox's Bazar region. PDB predicts a capacity of 500-600 MW of wind power by 2050, while some studies predict up to 17,000MW.

While renewable energy offers immense promises and scopes, challenges like grid integration, storage, and infrastructure readiness associated with its installation need to be addressed. The current grid system may not be prepared to support a shift towards renewable energy, and the storage of renewable energy remains costly. Challenges faced in solar energy generation also include the issues of land scarcity and night-time availability constrain. Bangladesh needs to optimize its land use and consider allowing the private sector to use a small portion of arable land for solar projects without affecting food security significantly. Feasibility studies are required for candidate sites in the Delta plan. Furthermore, external funding may be necessary to achieve significant wind energy production. Additionally, addressing the issue of excess solar energy affecting the operation of base-load power plants necessitates a thorough evaluation of demand patterns and meticulous system optimization. Achieving a complete shift to 100% renewable energy in Bangladesh is not practical in the country due to cost limitations and the constraints of nighttime energy usage. Therefore, prioritizing grid enhancements becomes imperative to fully leverage the renewable energy output potential.

The current energy landscape underscores the necessity for Bangladesh to strategically diversify its energy mix towards more sustainable options. Fossil fuels, traditionally dominant in the country's energy portfolio, not only pose significant environmental risks but also leave Bangladesh vulnerable to volatile international market fluctuations. In contrast, renewable energy sources, particularly solar energy, offer a safer, more reliable alternative source of power. Embracing renewables enables Bangladesh to reduce its carbon footprint and mitigate the environmental impact associated with conventional energy production. Moreover, by investing in domestic renewable energy projects, Bangladesh can gain greater control over its energy resources. This autonomy is crucial, as it shields the nation from unpredictable changes in global energy prices and supply chain disruptions, thereby enhancing national energy security. Solar energy, with its relatively low operational and maintenance costs once installed, emerges as an economically viable and environmentally friendly option. By shifting towards renewables, Bangladesh not only addresses its immediate energy needs but also sets a foundation for long-term economic stability and environmental sustainability, crucial for the nation's growth and development in an increasingly eco-conscious global landscape.

## Recommendations

There is no denying that, prioritizing renewable energy sources, diversifying the energy mix, and encouraging large-scale investments in the renewable sector are essential for building a resilient and stable energy sector. In this connection, a number of policy recommendations can be made for ensuring energy security and environmentally sustainable economic growth as outlined below:

**Revisiting the Alternative of Domestic Gas Exploration:** Despite of possessing substantial gas reserve potential, the country has not fully explored its gas reserves, instead relied heavily on costly LNG imports. To enhance energy security, the government should increase the budget allocation for local onshore gas exploration and incentivize offshore exploration in the deep ocean. Exploring these untapped reserves will help in reducing the dependence on LNG and to ensure a stable domestic gas supply.

**Evaluating the Costs and Benefits of LNG versus Solar Plants:** The long-term economic and environmental benefits/costs should be considered while comparing LNG with solar power as power generation sources. The government estimates of the cost of LNG and solar are 13 BDT/kwh and 12 BDT/kwh respectively while according to our research the cost of LNG is 41. 50 BDT/kwh in 2022 as we have considered all operations of LNG in the country, from import to regasification and supply to national gas grid. Such huge cost difference indicates that Bangladesh can achieve cost stability in power generation and reduce its carbon footprint through solar power expansion, contributing to a greener and more sustainable future.

**Repurposing the Outdated Power Plants:** Certain public sector fossil-fuel-based power plants are outdated and inefficient. Instead of continuing to invest in these plants, the government can explore the possibility of repurposing them into solar energy installations. This approach can be facilitated through the development of an energy transition fund, allowing the workforce currently engaged in operating these plants to be reintegrated into the clean energy sector.

**Incentivizing the Solar-based Power Sector:** Despite the cost-effectiveness of rooftop solar installations, the widespread adoption of economically viable rooftop solar systems has been rather slow. To incentivize the solar power sector, the government should consider about import duty exemptions on solar accessories and also think about reducing taxes on solar energy materials. Also, ensuring the availability of high-quality inverters, establishing adequate testing facilities, and implementing effective market monitoring mechanisms, Bangladesh can foster a conducive environment for the widespread adoption of rooftop solar systems.

**Preparing a funding roadmap to secure financing for renewable energy:** To accelerate the transformation of the electricity sector, Bangladesh needs a comprehensive funding roadmap that utilizes both domestic resources and international channels. The government can collaborate with developed nations and explore partnerships with multilateral agencies, climate funds, global pension funds, private equity firms, and infrastructure funds in this regard.

**Optimizing Daylight Hours for Power Generation:** Bangladesh benefits from an average duration of daylight hours of approximately 4.5 hours, during which solar energy can swiftly generate 2500 MW of electricity. Load shedding on the other hand leads to a deficit of 2500 MW throughout the day. For the day-time power shortage, solar power generation through utilizing day-light would be a fruitful solution.



**Introducing Smart Grid Technology:** To effectively integrate renewable energy sources into the grid, accurate estimation of minimum baseload demand is essential. The government should invest in smart grid technologies and advanced monitoring systems to optimize renewable energy utilization. Smart grids allow for real-time monitoring and control of energy flows, enabling the efficient storage and distribution of surplus renewable energy. By integrating these technologies, a sustainable energy ecosystem that maximizes renewable energy utilization and ensures a reliable and stable power supply can be attained.

**Aligning Policy Plans:** Although a number of national policy plans have been formulated since 2008, a lack of alignment and central focus has jeopardized effective strategic planning. To provide clarity and consistency in policy direction, Bangladesh needs a comprehensive single-focused plan that outlines a clear roadmap for the sustainable transition of the energy sector.

**Creating a supportive business environment:** Effective incentive mechanism and modern energy transmission infrastructure are expected to attract substantial investments for the sector. In this regard, to streamline and accelerate renewable energy projects, an equitable business condition which intends to lower market risks for those projects should be created through effective policy framework. There is no denying that the financial entities such as the banks and other public and private financial establishments can play a pivotal role in establishing a conducive financial environment for green energy transition while steering their lending portfolios to expedite the shifts towards renewable energy.

**Shifting subsidy from fossil fuel to renewable energies:** Fossil fuel subsidies, encompassing direct financial support, tax advantages, and unaccounted health and environmental expenses obstruct the transition of the country towards clean energies. Redirecting energy subsidies from fossil fuels to renewables would not only reduce emissions but would also catalyse sustainable economic growth, employment, public health, and expected to ensure social equity while benefiting the marginalized population.

**Investigation of influential political economy for crafting successful strategies for the sustainable energy transition:** Analyzing influential political and economic factors for clean energy transition and reallocating resources among different industrial sectors and political groups are necessary to make successful strategies to induce the transition.

**Incorporating Feed-in-tariff schemes:** Individuals and businesses are provided economic incentives by the government in feed-in-tariff system, to generate electricity predominantly from renewable sources through their own initiatives. When effectively integrated, this strategy holds the potential to substantially enhance the renewable energy capacity of the national grid by deploying a multitude of decentralized, small-scale projects.

Implementation of the mentioned policy tools can embark on a successful energy transition journey, ensuring energy security, reducing dependency on imported fossil fuels, and contributing to global efforts in combating climate change. Embracing renewable energy, especially solar power, holds the promise of not just resolving immediate energy issues, but also laying the foundation for a future characterized by sustainable prosperity.

*This policy brief is based on the report titled, "Estimating Costs of LNG-based Power Generation and Devising Alternatives Pathways towards Green and Clean Energy". The authors are Dr Selim Raihan, Dr Sayema Haque Bidisha, Dr Kazi Maruful Islam, Md. Tuhin Ahmed, Israt Hossain, Omar Raad Chowdhury, Mohammad Asaduzzaman, Ekramul Hasan and Abdul Aahad. Report Link: <https://sanemnet.org/estimating-costs-of-lng-based-power-generation-and-devising-alternatives-pathways-towards-green-and-clean-energy/>*