The Chittagong University Journal of Social Sciences Vol.33, 2015 (P. 99-114)

Impact of COVID-19 on the Power Sector of Bangladesh

Md Safiullah Kayesh[1]

Abstract

The ongoing COVID-19 pandemic is one of the deadliest health crises that has afflicted almost every sector of the economy. The power sector is no exception and is going through a terrible time amid pandemics. Energy is one of the most crucial enablers of the modern economy, and COVID-19 has a notable impact on it. This impact is reflected in various social, economic, environmental, technological, and energy-related changes. Since the pandemic is an ongoing phenomenon, data and information are scarce. Therefore, the study aims to examine the influence of the COVID-19 pandemic on Bangladesh's power sector by utilizing the available information. This study revealed that annual electricity generation in Bangladesh dropped by 1.20% in 2019-20 compared to 2018-19. Additionally, the power-generating energy mix has changed dramatically during the shutdown. Here, the use of gas increased by 6.15%, whereas oil consumption decreased by 28.85% due to international trade disruptions. In contrast, coal consumption has grown by 144.38% over the preceding year. At the initial stage of the pandemic, Bangladesh has observed a 2.03% drop in power demand compared to the previous year's same month. This ongoing crisis has also altered people's lifestyles since they mostly stay at home and work from home. As a result, domestic power demand has significantly increased by 8.90%, whereas commercial and industrial power demand have decreased by 15.61% and 5.50%, respectively. Despite the devastation, the power sector faces new technical and economic challenges. Furthermore, this pandemic has slowed the Bangladesh government's progress toward achieving 100% electricity coverage by 2021. Given this, a power sector management plan is needed to tackle these ongoing challenges and threats. Thus, this study gives broad recommendations to the policymakers on how to deal with the current crisis, and it also provides ideas for future research in assessing the power supply and demand during an emergency, such as the COVID-19 pandemic.

Keywords: Bangladesh, COVID-19, Lockdown, Pandemic, Power Sector

---

[1]Assistant Professor, Department of Economics, University of Chittagong, Chittagong-4331, Bangladesh. Email: kayes.eco@cu.ac.bd

1. Introduction

Human civilization has endured numerous natural disasters and extreme pandemics throughout history. This time, a new type of coronavirus known as COVID-19 has invaded the world. According to Worldometers (2020) statistics, this virus is spreading worldwide, and 218 countries and territories have already been affected. As of December 27, 2020, at least 80,815,430 coronavirus cases and 1,766,796 deaths have been reported worldwide. This COVID-19 coronavirus pandemic has brought unimaginable shocks to almost every sector. The healthcare sector has been undeniably affected the most. However, the power sector is no exception, and several incidents have already raised concerns about achieving sustainable and clean energy goals. In most countries, governments are now attempting to restrict mass people's movement and economic activities by imposing a country-wide partial or complete lockdown to reduce the infection rate. As a result, global oil consumption has plunged to the lowest point ever, and overall power consumption has decreased substantially because of the lockdown. In the first quarter of 2020, at the beginning of the pandemic, global electricity demand fell by 2.5%, while the complete lockdown steps caused a regular decrease of at least 15% in the most affected European countries, including Italy, Spain, France, the USA, and the UK (IEA 2020).

In many countries, the ongoing new power plant construction work has been postponed or stopped because of labor and construction materials shortages. In particular, the progress of the global renewable energy sector has been seriously hampered. China has been a pioneer in renewable energy production and technology (Chiu, 2017). In addition, they have also extensively invested in the power sector in several emerging countries around the world. Bangladesh also has an investment relationship with China in the power sector, and many Chinese engineers and laborers are employed in the power sector. In Bangladesh, about 1,320 MW of Payra thermal power plant construction progress slowed down because of Chinese workers' absence (GCR, 2020). Undoubtedly, further delays by the Chinese workers would increase the project's duration and cost. As a result, this pandemic will delay achieving the UN's Sustainable Development Goals, including ensuring affordable, reliable, sustainable, and modern energy for everyone. In addition, this situation also affects the continuous economic growth of emerging countries like Bangladesh. Many governments have responded to the crisis by adopting various policies that aim to mitigate or avoid further damage. Since many countries struggle to combat the COVID-19 pandemic, it takes time to understand the policy measures'

implications. Specifically, the multifaceted implications of this pandemic are becoming apparent in the power sector.

In some countries, power regulator authorities have allowed customers to defer electricity bill payments, although, in other countries, authorities may temporarily waive late fees and interest rates (Mylenka, 2020). There will not be any late fees or extra charges for paying electricity and gas bills during the pandemic lockdown in Bangladesh. These short-term government measures have given some relief, but such measures' actual consequences are yet to be recognized. In addition, the government has to be vigilant about taking any steps; otherwise, present policy measures may hamper Bangladesh's future economic growth. The pandemic could also undermine the initiative to achieve 100% electricity access. Besides, it is vital to track and examine the different governments' regulatory measures in response to the pandemic. So, the outcome would let us know what could happen because of these actions.

Most existing research has focused on developed countries, whose energy sectors are far more diversified than developing countries. In these studies, satellite images, air quality data, and survey data have been used to analyze how the pandemic has affected the power sector. There has been very little research done in developing countries because of a lack of data and COVID-19 constraints. Thus, the main aim of this study is to shed light on the impact of the COVID-19 pandemic on Bangladesh's power sector. This paper provides a clear idea of the overall situation of the power sector in Bangladesh during the pandemic. This paper also helps readers narrow down an ongoing problem like a pandemic in the power sector that has not been previously studied. It could also help future research on the power sector during a pandemic because this study could show how to do it. The study relies on secondary sources such as published journal articles, newspaper reports, and annual reports published by the WHO and Bangladesh Power Division. The focus of this study is a new and ongoing phenomenon, such as the COVID-pandemic, and therefore, data gathering is challenging for several reasons. Thus, this study follows an exploratory research framework and uses quantitative data for the case of Bangladesh.

The remaining parts of the paper are: Section 2 discusses the review of related literature on COVID-19 and various aspects of the power sectors of several countries; Section 3 presents the objectives of the study; Section 4 captures the data and the methodology; Section 5 highlights the current COVID-19 pandemic in Bangladesh; Section 6 discusses the impact of the

COVID-19 pandemic on Bangladesh's overall power sector; and finally, Section 7 covers the concluding remarks along with recommendations and limitations.

2. Review of the Relevant Literature

The world has never experienced such a horrible pandemic as COVID-19 before. So far, there have been very few studies on the COVID-19 pandemic and energy-related issues.

COVID-19 and energy policy

Kelmes et al. (2020) studied the link between plastic waste, energy, and environmental footprint with the COVID-19 pandemic. Their study revealed that personal health care and medical equipment made of plastic increased significantly as the COVID-19 pandemic intensified. As a result, energy and environmental footprints related to COVID-19 have also increased in many countries. This study emphasizes the minimization of such footprints related to COVID-19.

Steffen et al. (2020) addressed different terms for policymakers regarding energy policy issues. They said that policymakers should not overreact to pandemics in the short term. Instead, they should take advantage of the new opportunities to change how much energy they use in the short term and focus on long-term policy development that can withstand future changes in the world.

Qarnain et al. (2020) reviewed the energy policies of the G20 countries during the pandemic and found that these countries emphasized uninterrupted power supply as a helpful strategy for a successful lockdown.

COVID-19 and electricity demand-supply

Cvetković et al. (2021) analyzed four simulation scenarios of the household of Kragujevac in Serbia. They ran a simulation and found that when there was an emergency, natural gas and electricity use went up by 21.62% and 58%, respectively, compared to the reference case.

Madurai Elavarasan et al. (2020) observed that the COVID-19 pandemic affected people's lifestyles. As a result, residential electricity demand has gone up a lot, while commercial electricity demand has gone down.

Siddique et al. (2020) mentioned that the newly emerged novel coronavirus has posed severe energy challenges worldwide and affected people's behavior.

Chofreh et al. (2020) mentioned that the COVID-19 pandemic triggered an energy crisis in many countries because of the gap between energy demand and supply.

COVID-19 and power generation

Kanitakar (2020) estimated the economic losses of the COVID-19 pandemic in India and found that India lost 10-31% of its GDP. The results of the paper revealed that a coal-based power plant reduced its daily capacity by 26% during the country-wide lockdown.

Meinrenken et al. (2020) conducted a study in New York City. They found that the overall power consumption in the manufacturing and commercial sectors decreased by about 7% during the pandemic period, while residential consumption increased by 23% and 10%, respectively, in March and April. Thus, the findings support the idea that people worldwide used much electricity at home during the peak of the COVID-19 pandemic.

3. Objectives of the Study

The broad objective of the study is to explore the COVID-19 pandemic's impacts on Bangladesh's power sector. However, the primary research goals are specified:

1. To explore the pattern of change in power demand and supply during COVID-19 and pre-pandemic periods.

2. To investigate the government's policy actions to mitigate the power sector's problems during the pandemic.

4. Methodology of the Study

The study will examine the impact of the COVID-19 pandemic on the power sector and provide recommendations for dealing with the short- and long-term ramifications. The study used quantitative methods and exploratory research tools. Initially, this study focuses on the pandemic's direct and indirect effects on the power sector on a national scale. The direct impact describes the changes in the power supply system that occurred during the pandemic, such as demand fluctuation and the consequent influence on energy costs; the indirect impact specifies the effects of the pandemic that revolve around parameters that eventually enhance the power sector's functioning. Most studies on this topic have been conducted in industrialized nations, where qualitative and quantitative approaches have both been employed. In this case, they have used satellite images and emissions data to examine the impact of a COVID-19 pandemic on the power sector and economic activity. However, in the case of

Bangladesh, the secondary data-based quantitative technique is more convenient and effective because of the ongoing pandemic constraints. Data is retrieved by extensively surveying the latest Scopus index journal articles and annual reports of various organizations and reputed web resources, such as WHO, Worldometer, IEA, BPDB, and national newspapers. The author used diagrams to better understand the changes in variables and looked into how governments and other bodies across the country were dealing with the effects.

5. Bangladesh's current COVID-19 situation

The first COVID-19 case was confirmed in China on December 8, 2019 (WHO, 2020). In Bangladesh, the first COVID-19 patient was found on March 6, 2020 (Paul, 2020). Then the government introduced a lockdown to control the rate of COVID-19 infection, and the lockdown started on March 26, 2020, in the name of "general leave," which continued until May 30, 2020 (Bodrud-Doza et al., 2020). The rate of infection remained stable during the lockdown. However, infections rise at the end of lockdown and peak in June and July. Since the first coronavirus case in March, the daily total number of new coronavirus cases has increased rapidly, and in July 2020, Bangladesh recorded the highest number of daily new cases at 4,019 (Figure 1). The number of active cases was too high at the beginning of the COVID-19 pandemic, as people struggled to get proper treatment. However, the total number of active cases has declined significantly since August 2020 (Figure 2). As of December 30, 2020, 512,496 COVID-19 cases have been confirmed in Bangladesh, and 456,070 people have recovered, whereas 6,531 people have died of COVID-19 (DGHS, 2020).

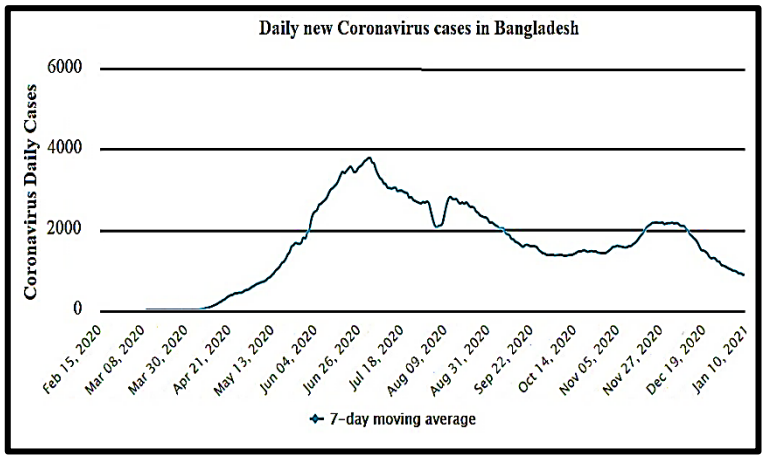

Figure 1. Daily new Coronavirus cases in Bangladesh
Source: Worldometers,2020

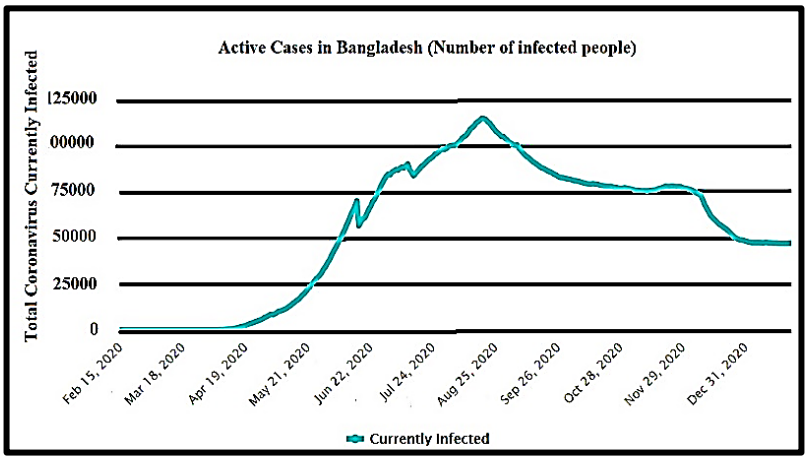

Figure 2. Active Coronavirus Cases in Bangladesh
Source: Worldometers,2020

Like in other countries, at the early stage of the pandemic, coronavirus infection increased at an increasing rate, then the infection rate has been increasing at a constant rate since early September 2020 (Figure 3). The coronavirus death rate was relatively low during the lockdown period, but the immediate death rate was high after the lockdown was moderated. However, the death rate is much more stable now (Figure 4). According to WHO (2020), Bangladesh's COVID-19 case fatality rate is around 1.46%. Currently, the COVID-19 pandemic is substantially under control in Bangladesh because of various policies. The government is trying buy and collect more COVID-19 vaccines from various sources. Bangladesh ranked 20th in Bloomberg's COVID-19 pandemic management ranking (South Asia Monitor 2020). Currently COVID-19 has been under control in many nations, while certain countries are still experiencing significant rates of infection.

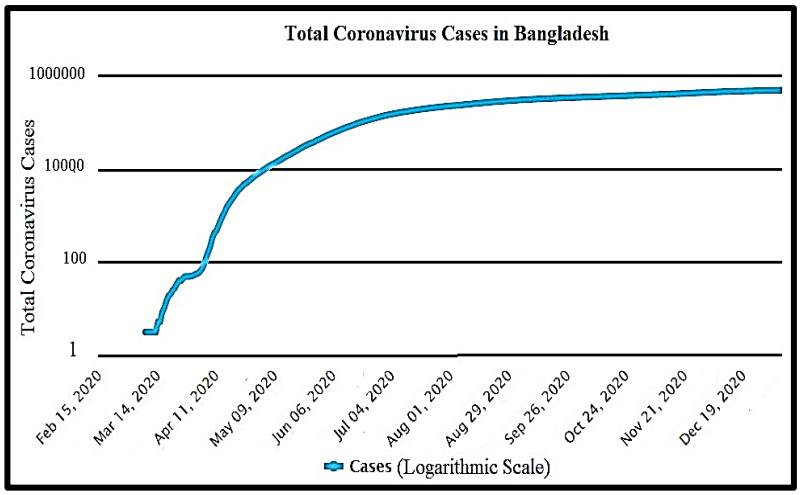

Figure 3. Total coronavirus cases in Bangladesh
Source: Worldometers, 2020

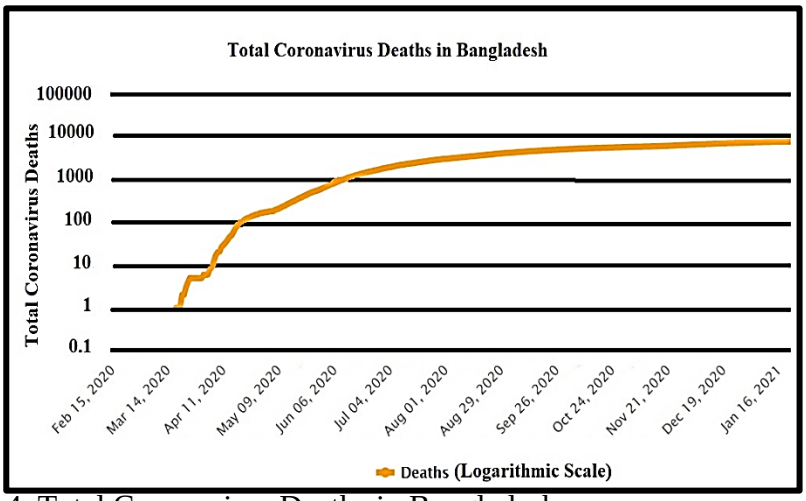

Figure 4. Total Coronavirus Deaths in Bangladesh
Source: Worldometers, 2020

6. Impact of the COVID-19 Pandemic on the power sector

The COVID-19 pandemic is an ongoing pandemic, and its short-run impacts on various sectors are becoming apparent. If this situation is prolonged, the long-term impact will also become apparent. However, the adverse effects of the pandemic on Bangladesh's power sector have already started. In particular, the construction activities at the ongoing and upcoming new power plants are the most affected by the COVID-19 pandemic, which could hamper the generation of 40,000 MW of electricity

by 2030 to achieve the energy-related UN SDGs. However, the demand and supply sides of the power sector have been badly affected because of the pandemic. These early impacts of the COVID-19 pandemic on Bangladesh's power sector include:

6.1 Impact of COVID-19 Pandemic on electricity generation

In Bangladesh, natural gas and imported fossil fuels are used in the majority of the power plants for electricity generation (Figure 5). However, there was a significant shortage of electricity generation in Bangladesh compared to demand. In the 2009-2010 fiscal year, the highest power generation was 4,606 MW, which has increased to 12,738 MW in the 2019-2020 fiscal year (Power Division, 2020). Thus, electricity generation has increased by around 2.8 times within the last decade. Despite a favorable trend in the growth rate of maximum power generation till the fiscal year 2018-19, the growth rate has plummeted to a negative in 2019–2020 due to this ongoing pandemic. The highest electricity generation in the fiscal year 2018–19 was 12,893 MW, but in the next fiscal year, 2019–20, it will be 12,738 MW (Figure 6). The power market, like other markets, may be affected by various factors other than the price of electricity. As power generation is related to power demand, the government sets an annual power generation plan for how much electricity will be generated to satisfy the power demand in the next year. However, due to the adverse situation of the COVID-19 pandemic, electricity demand was lower than projected in 2020.

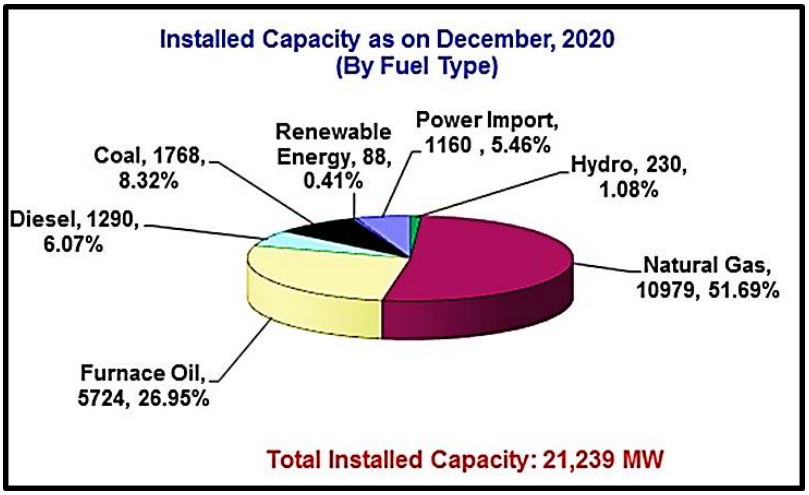

Figure 5. Contribution of different energy sources in power generation
Source: Annual Report 2019-2020, Power Division, 2020

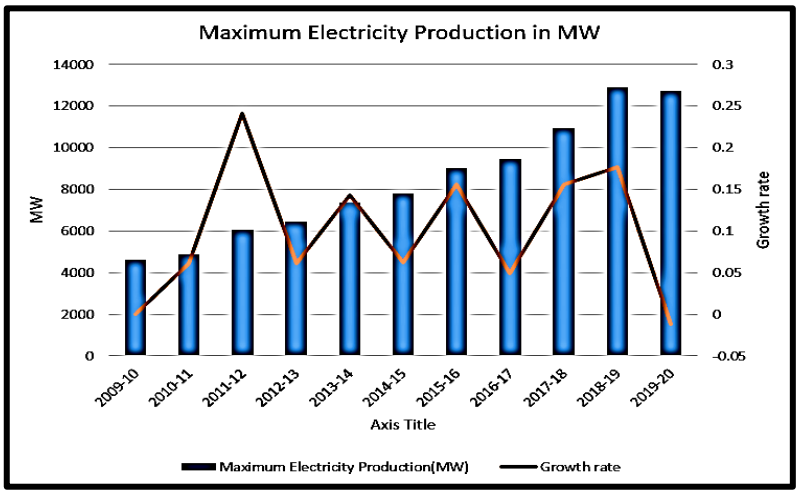

Figure 6. Maximum Electricity Production in Bangladesh (2009-2020)
Source: Annual Report 2019-2020, Power Division, 2020

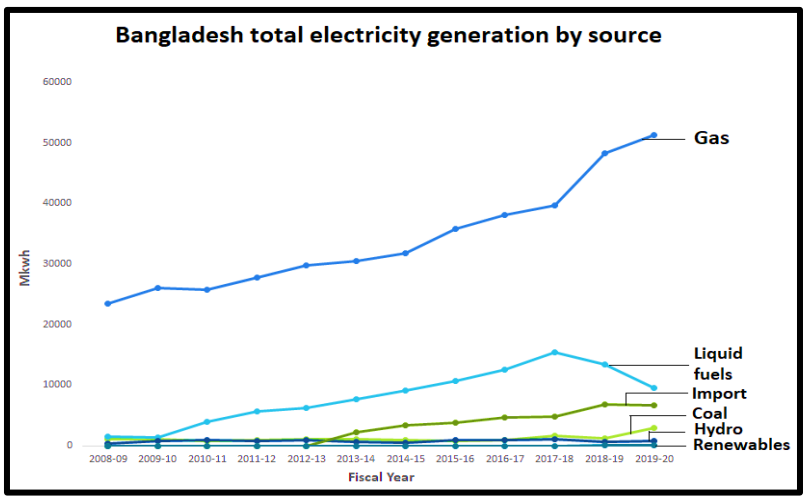

Figure 7. Total electricity generation by source (2008-2020) in million kilowatt hour (Mkwh)
Source: Annual Report 2019-2020, Power Division, 2020

Thus, COVID-19 has caused a drop in power generation, reducing the share of power generated by various sources (Figure 7). As a result, imported liquid fuel-based power plants curtailed their power generation in 2019-2020. Besides, the amount of electricity imported from neighboring countries has also declined during the pandemic. However, power

generation has increased in other source-dependent power plants. In the meantime, the amount of electricity generated by gas and coal-based power plants increased significantly (Figure 7).

6.2 Impact of the COVID-19 Pandemic on electricity demand

Electricity access in Bangladesh has improved significantly over the past few years, with 97% of the population having access to electricity as of 2019–20. Bangladesh still has very low per capita electricity consumption among the SAARC countries. In addition, the ongoing pandemic has slowed down the 100% electrification goal at an individual level. Moreover, the power demand has gradually declined in every sector during the lockdown, as highlighted in figure 8. In Bangladesh, electricity demand is highest in the domestic and industrial sectors during the summer and lowest in the winter. Other notable sectors are agriculture and commercial. Although power demand has changed in many sectors since the COVID-19 outbreak, domestic electricity demand has climbed dramatically, whereas commercial and industrial demand have declined significantly. However, electricity demand growth has been moderate over the last few years.

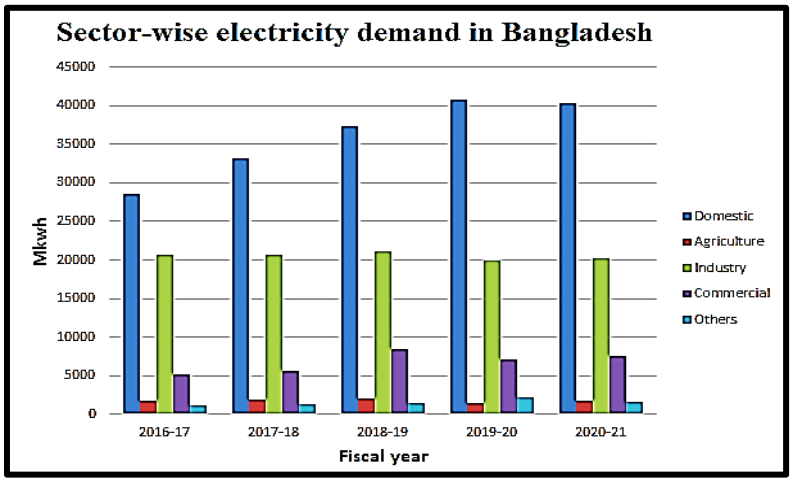

Figure 8. Sector-wise electricity demand in Bangladesh (2016-2021) in million kilowatt hour (Mkwh)
Source: Various Annual Reports, Power Division, 2021.

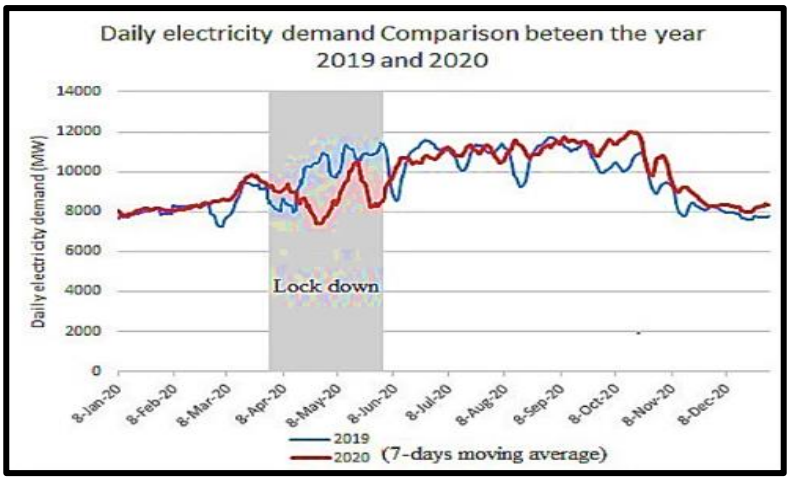

Figure 9. Daily Electricity Demand Comparison Pre and during COVID-19
Source: BPDB, 2020

At the beginning of the lockdown in March 2020, power demand was 8,969 MW, whereas on the same day last year, electricity demand was 9,155 MW (Figure 9). During this period, daily electricity demand has reached its lowest level. Daily electricity demand patterns have changed with the easing of the lockdown. According to BPDB (2020), electricity demand at the peak is around 12,000-13,000 MW during the summer, while demand falls to 8,800 MW during the winter. Overall, power generation is more than power demand, and many power plants have stopped power generation. Many consumers could not pay their electricity bills for an extended period. Therefore, Bangladesh's power sector would face a financial burden because of this pandemic.

6.3 Impact of the COVID-19 Pandemic on ongoing new power plants

In Bangladesh, China is the largest investor country in power generation, and it also provides the most assistance in the construction of power plants. According to the power division, the government approved 23 coal-based power plants in Bangladesh, and most of them are under construction; each of them is at a different stage. Before the coronavirus pandemic, about 1,600 Chinese engineers and laborers worked on various power generation projects in Bangladesh. Later, they went to China to celebrate the Chinese New Year holidays, but most could not return to Bangladesh for fear of contracting the coronavirus (Bangla Tribune, 2020). Because of COVID-19 restrictions, foreign workers from other countries could not return to Bangladesh. Thus, there has been uncertainty about the completion of the

project on time. However, Ruppur Nuclear Power Plant construction is normal during the pandemic, and they are expecting to finish the first unit of 1,200 MW by 2023 (Bashar 2020).

6.4 Impact of the COVID-19 Pandemic on power sector management and policy

Different countries have taken different managerial decisions considering the situation during this COVID-19 pandemic. Bangladesh is no exception. Most consumers pay their electricity bills through banks in Bangladesh, while others pay through mobile banking. Thus, the government delayed the electricity bill payment from February to April as an initial step in reducing COVID-19 infections (Tbsnews, 2020). During a lockdown, the government has designated power generation as an emergency to maintain an uninterrupted power supply. There has been an upsurge in demand for energy in hospitals because of the outbreak. As a result, the government has implemented electricity rationing to ensure a steady electricity supply. Additionally, the Bangladesh government has proposed 19 recovery packages to recoup economic losses caused by the COVID-19 pandemic in various industries (Raihan, 2020). Thus, it is expected that this financial package will increase economic activity and increase the industrial sector's power demand.

7. Limitations

This study has some potential limitations because of the research topic. This study focuses on the COVID-19 pandemic, an ongoing problem, and there is very little research in this area. Though the primary data-based quantitative research technique is most suitable for determining the potential pandemic impact, this study avoided using primary data because of health risks and budget constraints. Therefore, secondary data was collected from relevant and convenient secondary sources. Besides, this study omitted some crucial aspects of the power sector because of a lack of data availability. The study also does not predict the pandemic's future trend. The extent of the COVID-19 pandemic's impact and severity varies from country to country. So, the study cannot fully explain how the pandemic has affected the power sector in countries that have not been hit as hard.

8. Conclusion and Policy Recommendations

This study reviews the COVID-19 pandemic impact on Bangladesh's power sector from different aspects and future planning to face the challenges in the power sector. The ongoing pandemic has affected all aspects of human life. In addition, the government has imposed movement

restrictions and shutdowns, which have affected the overall power sector. This study has investigated the pandemic's impacts on the power sector, such as variations in consumer power demand and power generation, and the indirect effects on completing new power projects and investments. It has been found that residential electricity use rose to its highest level during the lockdown, while commercial electricity use fell to its lowest level. The annual power generation capacity dropped, and the electricity generation energy mix also changed. Import-based fuel supply has been disrupted, putting more strain on local energy sources like natural gas, which are already in short supply. Thus, the power sector has encountered various challenges in maintaining optimum operation during the pandemic. Hence, the government has taken policy initiatives to ensure a smooth electricity supply in this ongoing pandemic. The study further focused on the challenges the power sector faced in Bangladesh, including policy action to ensure a smooth power supply. From the analysis, Bangladesh's power sector handled this problematic situation efficiently, with little intervention in the power system. As soon as the lockdown was relaxed, the power sector returned to its normal condition.

Finally, the study suggested several policy recommendations to ensure a smooth power supply during the COVID-19 pandemic based on latest literature and policies taken by various countries for the power sector. Policy recommendations are:

The power sector was considered an important sector like the health care sector during the pandemic. So, it is essential to make sure that power sector workers get the same benefits as healthcare workers. This way, they can ensure that there will be no interruptions in power supply during a pandemic.

There should be at least a regressive discount on the electricity bills of all residential and home customers during the pandemic.

The pandemic has caused an imbalance between the demand for and supply of electricity. Thus, energy companies should use raw materials and electricity storage facilities. Power storage equipment can help the power sector stay stable in a pandemic and change the energy market.

It is important to reduce imported fuel dependency and diversify the power generation energy mix to ease pressure on a single energy source during a pandemic. Most power plants' financial burdens have escalated because many consumers cannot pay their electricity bills on time because of

pandemic restrictions. Thus, there should be a more affordable and efficient digital payment system to pay electricity bills.

There should not be an excessive dependency on foreign engineers and workers in power plant construction since the absence of these workers will increase project length and project expense. It is essential to improve the skills of engineers and workers in Bangladesh.

9. References

Bodrud-Doza, M., Shammi, M., Islam, A., & Rahman, M. (2020). Strategic assessment of COVID-19 pandemic in Bangladesh: Comparative lockdown scenario analysis, public perception, and management perspectives. https://doi.org/10.20944/preprints202004.0550.v1

Chiu, D. (2017). The East Is Green: China's Global Leadership in Renewable Energy. https://www.csis.org/. https://csis-website-prod.s3.amazonaws.com/s3fs-public/171011_chiu_china_Solar.pdf?i70f0uep_pGOS3iWhvwUlBNigJMcYJvX

Cvetković, D., Nešović, A., & Terzić, I. (2021). Impact of people's behavior on the energy sustainability of the residential sector in emergency situations caused by COVID-19. *Energy and Buildings*, *230*, 110532. https://doi.org/10.1016/j.enbuild.2020.110532

DGHS. (2020). COVID-19. www.dghs.gov.bd. https://dashboard.dghs.gov.bd/webportal/pages/covid19.php

GCR. https://www.globalconstructionreview.com/news/coronavirus-could-delay-major-chinese-projects-ban/

Global Construction Review. (2020). *Coronavirus could delay major Chinese projects in Bangladesh and other countries*.

IEA. (2020). COVID-19 impact on electricity. Retrieved December 27, 2020, from https://www.iea.org/reports/covid-19-impact-on-electricity

Kanitkar, T. (2020). The COVID-19 lockdown in India: Impacts on the economy and the power sector. *Global Transitions*, *2*, 150-156. https://doi.org/10.1016/j.glt.2020.07.005

Klemeš, J. J., Fan, Y. V., Tan, R. R., & Jiang, P. (2020). Minimising the present and future plastic waste, energy and environmental footprints related to COVID-19. *Renewable and Sustainable Energy Reviews*, *127*, 109883. https://doi.org/10.1016/j.rser.2020.109883

Madurai Elavarasan, R., Shafiullah, G., Raju, K., Mudgal, V., Arif, M., Jamal, T., Subramanian, S., Sriraja Balaguru, V., Reddy, K., & Subramaniam, U. (2020). COVID-19: Impact analysis and recommendations for power sector operation. *Applied Energy*, *279*, 115739. https://doi.org/10.1016/j.apenergy.2020.115739

Mylenka, T. (2020). *Impact of COVID-19 on the global energy sector*. pv magazine International. https://www.pv-magazine.com/2020/04/24/impact-of-covid-19-on-the-global-energy-sector/

Paul, R. (2020). *Bangladesh confirms its first three cases of coronavirus*. Reuters. https://www.reuters.com/article/us-health-coronavirus-bangladesh-idUSKBN20V0FS

Qarnain, S. S., Muthuvel, S., & Bathrinath, S. (2020). Review on government action plans to reduce energy consumption in buildings amid COVID-19 pandemic outbreak. *Materials Today: Proceedings*. https://doi.org/10.1016/j.matpr.2020.04.723

Raihan, S. (2020). Anatomy of the stimulus package in Bangladesh. *The Indian Journal of Labour Economics*, *63*(S1), 37-40. https://doi.org/10.1007/s41027-020-00253-2

Siddique, A., Shahzad, A., Lawler, J., Mahmoud, K. A., Lee, D. S., Ali, N., Bilal, M., & Rasool, K. (2020). Unprecedented environmental and energy impacts and challenges of COVID-19 pandemic. *Environmental Research*, 110443. https://doi.org/10.1016/j.envres.2020.110443

South Asia Monitor. (2020). *COVID-19 resilience: Bangladesh among top 20 nations*. https://southasiamonitor.org/bangladesh/covid-19-resilience-bangladesh-among-top-20-nations

Steffen, B., Egli, F., Pahle, M., & Schmidt, T. S. (2020). Navigating the clean energy transition in the COVID-19 crisis. *Joule*, *4*(6), 1137-1141. https://doi.org/10.1016/j.joule.2020.04.011

Tbsnews. (2020). No fine for delayed gas, electricity bill payment over corona. tbsnews. https://tbsnews.net/bangladesh/energy/no-fine-delayed-gas-electricity-bill-payment-over-corona-59638

Meinrenken, C. J., Modi, V., McKeown, K. R., & Culligan, P. J. (2020). *New data suggest COVID-19 is shifting the burden of energy costs to households*. State of the Planet. https://blogs.ei.columbia.edu/2020/04/21/covid-19-energy-costs-households/

Power Division. (2020). *Annual Report 2019-2020*. www.powerdivision.gov.bd. https://powerdivision.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/annual_reports/7d86d53d_5ebb_408d_8839_64d1a9eea653/ANNUAL%20REPORT-%202019-2020%20.pdf

WHO. (2020). *Novel coronavirus – China*. World Health Organization. https://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en/

Worldometers. (2020). *Coronavirus update (Live): 80,815,430 cases and 1,766,796 deaths from COVID-19 virus pandemic*. Worldometer - real-time world statistics. Retrieved December 27, 2020, from https://www.worldometers.info/coronavirus/?utm_campaign=homeAdUOA?Si