A Comparative Analysis of Bangladesh's Energy Emissions: Implications for Carbon Neutrality and Sustainability

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Abstract

In March 2022, Bangladesh proudly achieved nationwide electricity coverage. Predominantly reliant on fossil fuels, the nation's energy sector faces challenges due to global political crises and a dwindling supply of cleaner fuels like natural gas from domestic fields. Consequently, the reliance on less environmentally friendly fuels such as coal and heavy fuel oil (HFO) has escalated, raising concerns about meeting Sustainable Development Goal 7: ensuring access to affordable, reliable, sustainable, and modern energy by 2030. This study fills a research gap by quantifying the electricity generated from various fossil fuels and the associated CO_2 emissions in Bangladesh from Fiscal Year 2016-2017 to 2022-2023. Data sourced from the Bangladesh Power Development Board underpins our analysis, revealing natural gas as the predominant fuel for electricity generation, accounting for 58% of the total. Other significant fuels include HFO, coal, and diesel. Our findings show a stark emission landscape: in the last 7 years, to generate 74897 MWh of electricity, 10395 kilograms of natural gas resulted in 4.39 tons of CO_2 emissions, while HFO, coal, and diesel led to 8039165, 9950976, and 2743311 tons of CO_2 emissions, respectively. Notably, coal combustion had the highest emission rate of 1892.586 kg of CO_2 per MWh of electricity generated. These insights offer a critical lens for policymakers to gauge the distance to carbon neutrality and sustainable energy goals. The evidence supports a strategic pivot towards renewable energy, ensuring that Bangladesh's electricity growth trajectory remains sustainable and efficient.

Keywords
Fossil Fuel, Electricity Generation, Carbon Emission, Pollution, Sustainability

1. Introduction

Fossil fuels remain a cornerstone in global electricity generation. The demand of energy exceeded the supply from renewable sources, resulting in an increase in coal and other fossil fuel usage. Specifically, coal generation rose by 1.1% to a record high of 10,186 TWh (Wiatros-Motyka 2023). This increase was notable in China, India, Japan, and the EU, although there was a decrease in the United States. Meanwhile, global gas generation saw a slight decline of 0.2% in 2022. In the U.S., gas generation increased, replacing coal, but other countries like Brazil, Türkiye, and India saw declines due to factors like better hydro generation and high gas prices. Overall, fossil fuel generation increased by 183 TWh in 2022, leading to a rise in CO_2 emissions of 160 million tons, a record high for the sector.

In Bangladesh, fossil fuels are pivotal for electricity generation, mirroring global trends (EMBER 2023). As of 2022, 98% of its electricity came from fossil fuels, with a heavy dependence on natural gas (59%) to meet its growing energy needs. This reliance was even more pronounced given the limited alternative clean energy sources (Debnath, Shakur et al. 2023). Notably, coal's contribution has increased from 3% in 2015 to 15% in 2022. Heavy-fuel oil (HFO) is also a highly used fossil fuel type in Bangladesh, and contributes more than 25% of the country's total electricity generation (Bari et al. 2022). Another highly used type of fossil fuel to produce electricity in Bangladesh is diesel.

Fossil fuel usage, crucial in global and national energy scenarios, poses significant environmental and health hazards (Siraj et al. 2023). Burning fossil fuels releases greenhouse gases, primarily carbon dioxide, exacerbating global warming and climate change (Payel, Ahmed, Taseen et al. 2023). This leads to rising sea levels, extreme weather events, and biodiversity loss. Locally, pollutants like sulfur dioxide and nitrogen oxides from fossil fuel combustion contribute to air pollution, causing respiratory problems and other health issues (Ahmed and Siraj 2023). Moreover, reliance on fossil fuels creates energy security risks, as countries depend on limited and geopolitically sensitive resources (Siraj et al. 2022). These challenges underscore the urgency for a transition towards cleaner, renewable energy sources.

Bangladesh's reliance on fossil fuels for electricity generation is driven by several factors. As a developing nation, it faces a rapidly increasing demand for energy to support economic growth and development (Debnath, Siraj et al. 2023). The country has substantial natural gas reserves, making it a readily available and economically viable energy source. This has led to a heavy reliance on gas for electricity generation. Additionally, limited investment in renewable energy technologies and infrastructure contributes to the continued dominance of fossil fuels (Payel, Ahmed, Anam et al. 2023). Coal usage is also rising, partially due to the challenges of meeting the growing energy demand solely with natural gas. These factors combine to make fossil fuels the primary energy source in Bangladesh's power sector.

An environmental management plan is crucial for industry as it provides a structured approach to manage and mitigate environmental impacts, ensuring sustainable operations while complying with regulatory requirements and enhancing corporate responsibility (Chowdhury et al. 2023). In formulating its environmental management plan, Bangladesh needs to assess the impact of each fossil fuel, including natural gas, coal, diesel, and HFO. Natural gas, while cleaner than other fossil fuels, still contributes to greenhouse gas emissions. Coal, with its higher emissions, is increasingly used due to rising energy demands. Diesel and HFO, often used in power generation and industries, pose additional challenges due to their high pollutant emissions, impacting air quality and public health. Understanding these varied environmental and health impacts is essential for Bangladesh to strike a balance between meeting its immediate energy requirements and pursuing long-term environmental sustainability.

In the current context, studying the specific emissions from different fossil fuels is vital. However, there's a notable gap in research regarding this. While existing studies focus on efficiency improvement and fossil fuel usage trends, they largely overlook detailed analyses of carbon emissions by fuel type in Bangladesh (Islam et al. 2022; Karmaker et al. 2020; Uzair Ali et al. 2022). This research aims to fill this gap by quantifying carbon emissions from each fossil

fuel over the past seven years. This will provide valuable insights for policymakers, helping them identify the most environmentally damaging fuels and make informed decisions for more sustainable energy policies.

1.1 Objectives

The objectives of this study are:

- To gather data on electricity generation from each type of fossil fuel in Bangladesh.
- To analyze the amount of each type of fossil fuel used to produce electricity.
- To determine the CO_2 emissions from each type of fossil fuel.

The rest of the paper is organized as follows: Section 2 will review the literature; Section 3 will describe the methodology, including data collection, calculation, and analysis; Section 4 will discuss the study's results; Section 5 will explore the implications of these results for carbon neutrality and sustainability; and Section 6 will conclude the paper, offering directions for future research.

2. Literature Review

The existing literature on fossil fuel emissions in Bangladesh predominantly focuses on general trends and efficiency aspects, with a noticeable gap in detailed emissions analysis. Studies have extensively explored the growth in fossil fuel usage, particularly natural gas and coal, and their economic implications (Murshed et al. 2021; Karmaker et al. 2020). However, these studies largely overlook the quantification of emissions from each fuel type, a critical factor for environmental management.

Research on the environmental impacts of fossil fuels in Bangladesh, such as the work of Uzair Ali et al. (2022), often discusses the broader implications of fossil fuel reliance, including air pollution and health hazards, but stops short of breaking down emissions by fuel type. This gap is significant, as different fossil fuels contribute differently to CO_2 emissions and other pollutants.

Moreover, while there is growing literature on renewable energy potential in Bangladesh (Siraj et al., 2022), the direct comparison of emissions between fossil fuels and renewable sources is not extensively covered. This comparison is crucial for understanding the full scope of Bangladesh's energy-related environmental challenges.

Global trends in fossil fuel emissions reveal a complex picture. As the world grapples with climate change, the role of fossil fuels remains significant yet contentious. Studies like those by the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC) highlight that, despite growing renewable energy adoption, fossil fuels still dominate global energy consumption (Aghahosseini et al. 2023). Coal, oil, and natural gas collectively account for a substantial portion of global greenhouse gas emissions, with coal being the largest contributor in power generation. The global push for carbon neutrality has intensified the focus on reducing fossil fuel usage, evidenced by commitments under the Paris Agreement (De La Peña et al. 2022). However, the transition is uneven, with some regions and countries continuing to rely heavily on fossil fuels due to economic and infrastructure constraints. This backdrop sets the stage for understanding Bangladesh's energy scenario within the global context, emphasizing the need for detailed emission analysis for informed policy decisions.

Our study, therefore, seeks to fill these gaps by providing a detailed analysis of CO_2 emissions from each type of fossil fuel used in Bangladesh over the last seven years. This novel contribution will offer valuable insights for policymakers and industry stakeholders, enabling a more informed approach towards achieving carbon neutrality and sustainability goals. The study will not only quantify emissions but also provide a comparative perspective against renewable energy sources, thus enhancing the current understanding of Bangladesh's energy emissions landscape.

3. Methodological Framework

This research utilized a numerical approach to analyze the gathered data on fossil fuel consumption for electricity generation in Bangladesh. The total methodological framework consists of two parts: data collection and calculation.

3.1 Data Collection

Data on total electricity generation was compiled using a secondary data collection model. The Bangladesh Power Development Board (BPDB) is the sole governmental authority responsible for maintaining records of the national

electricity grid in Bangladesh. BPDB's records include detailed information on the amount of electricity generated and the types of fuel used, distinguishing between fossil fuels and renewable energy sources. For this study, we accessed data from BPDB's open access website (https://bpdb.gov.bd/), focusing on the period from the 2016-17 fiscal year to the 2022-23 fiscal year. Our analysis specifically examines the quantity of electricity generated each year and the corresponding fuel types used. A comprehensive overview of the data we collected is presented in Table 1 and Figure 1 to 2.

Table 1. Electricity generation in MW-h

Type of fossil fuel	**2016-2017** (MW-h)	**2017-2018** (MW-h)	**2018-2019** (MW-h)	**2019-2020** (MW-h)	**2020-2021** (MW-h)	**2021-2022** (MW-h)	**2022-2023** (MW-h)
Gas	8810	9713	10877	10979	11450	11476	11592
HFO	2785	3443	4770	5540	6004	6329	6492
Coal	250	524	524	1146	1768	1768	4188
Diesel	880	1380	1370	1290	1290	1290	490
Total	**12725**	**15060**	**17541**	**18955**	**20512**	**20863**	**22762**

The data collected reveals that in the 2022-23 fiscal year, natural gas was the most utilized fossil fuel for electricity generation in Bangladesh, followed by HFO, coal, and diesel, in that order, based on the amount used. The data also indicates a yearly increase in coal usage and a decrease in diesel usage. This trend can be attributed to variations in fuel prices and their availability. Additionally, the data highlights a consistent annual increase in total electricity generation, which aligns with the country's economic and industrial growth.

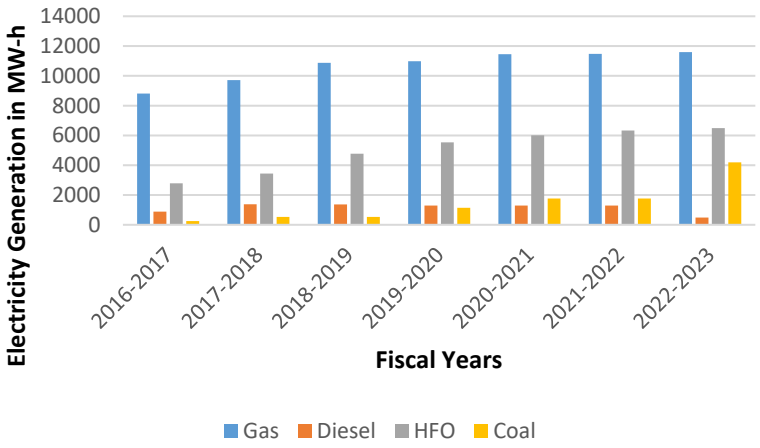

Figure 1. Electricity generation by different types of fossil fuel in different fiscal years

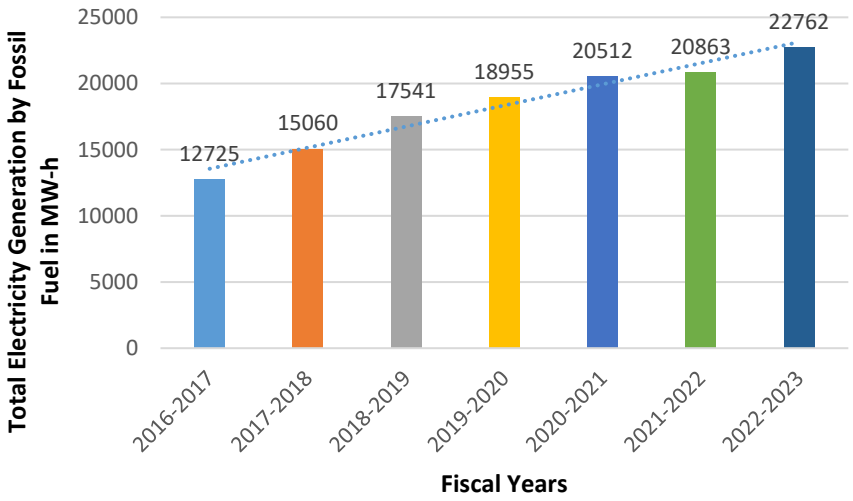

Figure 2. Growth trend in electricity generation by fossil fuel

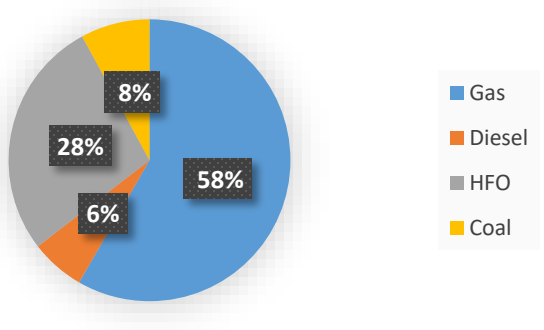

Figure 3. Percentage of different types of fossil fuel used in electricity generation in the last seven years.

3.2 Calculations

For our analysis, we examined the chemical combustion equations of each type of fossil fuel, as electricity generation involves the chemical reaction of combusting fossil fuels. These combustion equations consume fuel and oxygen, producing energy and carbon dioxide. The chemical reaction equations for the four types of fuel - natural gas, HFO, coal, and diesel - are as follows:

Natural gas: $\mathbf{CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O}$

In this reaction:

CH_4 (methane) represents natural gas.
O_2 is oxygen.
CO_2 is carbon dioxide.
H_2O is water.

This equation represents the complete combustion of methane in an ample supply of oxygen, producing carbon dioxide and water as products.

HFO: $\mathbf{C_nH_{2n+2} + (3n+1)/2\ O_2 \rightarrow nCO_2 + (n+1)\ H_2O}$

In this reaction:

C_nH_{2n+2} represents the hydrocarbons in the heavy fuel oil. The "n" here is a variable representing the number of carbon atoms in the hydrocarbon chain, which varies from 20 to 50 depending on the specific composition of the HFO.

O_2 is oxygen.
CO_2 is carbon dioxide.
H_2O is water.

This equation assumes complete combustion, where the fuel burns in an ample supply of oxygen, producing carbon dioxide and water as the main products. The actual combustion process can be more complex due to the presence of various other compounds in heavy fuel oil.

Coal: $\mathbf{C + O_2 \rightarrow CO_2}$

In this equation:

C represents carbon, the primary component of coal.
O_2 is oxygen.
CO_2 is carbon dioxide.

This equation represents the ideal combustion process, where carbon in the coal reacts with oxygen to produce carbon dioxide. However, it's important to note that actual coal combustion can be more complex due to the presence of various impurities in coal, such as sulfur and nitrogen compounds, which can lead to the production of sulfur dioxide (SO_2) and nitrogen oxides (NO_X) as additional byproducts. Additionally, incomplete combustion can result in the formation of carbon monoxide (CO) and particulate matter.

Diesel: $\mathbf{C_{12}H_{26} + 18.5O_2 \rightarrow 12CO_2 + 13H_2O}$

In this equation:

$C_{12}H_{26}$ represents dodecane, a common component in diesel.
O_2 is oxygen.
CO_2 is carbon dioxide.
H_2O is water.

This equation assumes complete combustion, where diesel burns in an ample supply of oxygen, producing carbon dioxide and water as the primary products. In real-world conditions, the combustion of diesel can also produce other emissions like nitrogen oxides (NO_x) and particulates, depending on the engine efficiency and the quality of the diesel.

According to the U.S. Energy Information Administration (EIA), producing 1 MWh of electricity requires 0.146 kilograms of natural gas, 269.5 kilograms of heavy fuel oil (HFO), 517.1 kilograms of coal, and 332.8 kilograms of diesel (https://www.eia.gov/tools/faqs/).

It is important to note that this is an average figure and actual amounts may vary based on the type of coal used, the efficiency of the power plant, and other operational factors. By integrating these amounts with Table 1, we obtain the quantities of each type of fossil fuel used in each fiscal year, as presented in Table 2 and Figure 4.

Table 2. Annual fossil fuel consumption by type

Type of fossil fuel	2016-2017 (kg)	2017-2018 (kg)	2018-2019 (kg)	2019-2020 (kg)	2020-2021 (kg)	2021-2022 (kg)	2022-2023 (kg)
Gas	1286	1418	1588	1603	1672	1675	1692
HFO	750558	927889	1285515	1493030	1618078	1705666	1749594
Coal	129275	270960	270960	592597	914233	914233	2165615
Diesel	292864	459264	455936	429312	429312	429312	163072

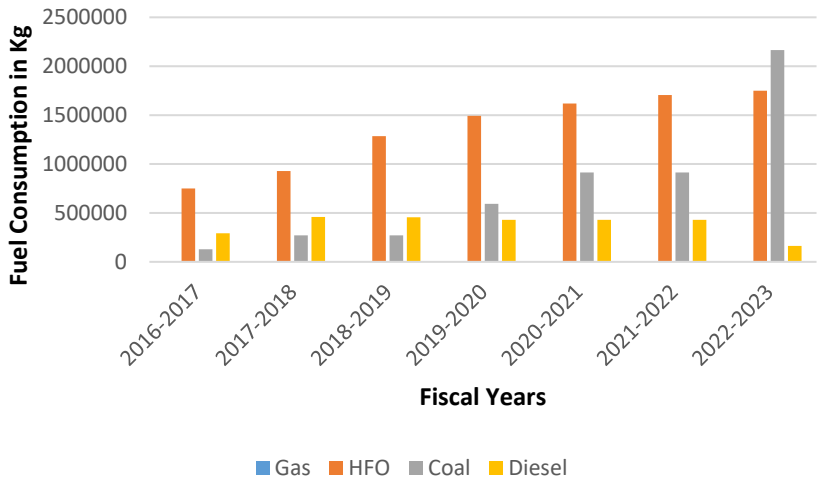

Figure 4. Annual fossil fuel consumption by type

According to the combustion equation mentioned above, theoretically, the burning of 1 kg of natural gas is responsible for 2.75 kg of CO_2 emissions, 1 kg of HFO for 3.13 kg of emissions, 1 kg of coal for 3.66 kg, and 1 kg of diesel for 3.10 kg of emissions. This implies that the generation of 1 MWh of electricity using natural gas will theoretically produce 0.402 kg of CO_2, while HFO will produce 843.535 kg, coal will produce 1,892.586 kg, and diesel will produce 1,031.680 kg of CO_2. Table 3 and Figure 5 depict the annual CO_2 emissions from each type of fossil fuel.

Table 3. Annual CO_2 emissions by each type of fossil fuel

Type of fossil fuel	2016-2017 (Ton)	2017-2018 (Ton)	2018-2019 (Ton)	2019-2020 (Ton)	2020-2021 (Ton)	2021-2022 (Ton)	2022-2023 (Ton)
Gas	0.516	0.569	0.638	0.644	0.671	0.673	0.680
HFO	633121.521	782706.426	1084376.896	1259423.061	1364905.426	1438788.548	1475843.775
Coal	244664.055	512815.860	512815.860	1121540.029	1730264.198	1730264.198	4098612.252
Diesel	302141.932	473813.484	470380.052	442912.604	442912.604	442912.604	168238.121

4. Results Discussion

Figure 1 displays a bar chart detailing the quantities of electricity generated from various fuel sources over several fiscal years, specifically from 2016-2017 to 2022-2023. The chart uses a color-coding scheme to differentiate between the fuel types: blue for gas, red for diesel, grey for heavy fuel oil (HFO), and yellow for coal. Gas, represented by the blue bars, is the predominant source for electricity generation, with its production towering over the others consistently across the years. Diesel, shown in red, while still a significant contributor, falls short of the electricity generated by gas. The grey bars, representing HFO, indicate a smaller, yet consistent production level throughout the observed years. Coal, marked in yellow, is the least utilized fuel source for electricity generation, with some fiscal years showing a very minimal contribution. This pattern suggests a heavy reliance on gas for electricity generation, with other fuel sources playing much smaller roles. The overall trend across the years does not show any major shifts in fuel usage for electricity generation, indicating a stable energy mix with a strong preference for gas.

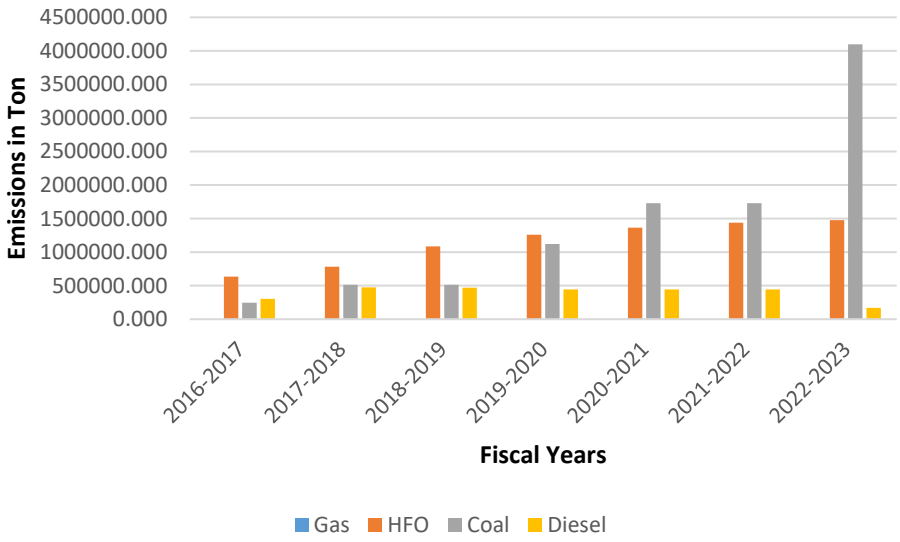

Figure 5. Annual CO_2 emissions by each type of fossil fuel

Figure 2 depicts a bar chart illustrating the total electricity generation by fossil fuel in Megawatt-hours (MWh) across several fiscal years from 2016-2017 to 2022-2023. Each bar represents a fiscal year, and the height of the bar corresponds to the total electricity generation for that year. The chart includes numerical labels at the top of each bar, providing precise values for each year's generation.

From 2016-2017, starting at 12,725 MWh, there is a noticeable upward trend in electricity generation over the years. Each subsequent fiscal year shows an increase in generation, with the only exception being a slight decrease between 2017-2018 and 2018-2019. After this period, the trend continues upward more strongly. The year 2021-2022, depicted with a green bar, shows a significant increase in generation to 20,863 MWh.

The dotted line connecting the tops of the bars suggests a projection or trend line, indicating that the general trend over these years has been an increase in electricity generation from fossil fuels. By the fiscal year 2022-2023, the electricity generation is projected to reach 22,762 MWh, which is the highest point on the chart. This suggests a continuous reliance on fossil fuels for electricity generation, with a growing demand or capacity for electricity produced from these sources over the observed period. The consistent year-on-year growth could reflect increasing energy needs, expansion of power generation infrastructure, or a lack of significant shifts towards renewable energy sources during these years.

Table 2 presents annual fossil fuel consumption by type, spanning from the fiscal year 2016-2017 to 2022-2023, with the quantities measured in kilograms (kg). Over these years, the consumption of each fuel type exhibits unique trends. Starting with gas, the numbers indicate a gradual increase in usage from 1,286 kg in 2016-2017 to 1,692 kg in 2022-2023. This steady climb may suggest a growing dependence or preference for gas as a fuel source.

Heavy Fuel Oil (HFO) shows more fluctuation, with a sharp rise from 750,558 kg to 927,889 kg between the first two fiscal years. It peaks at 1,930,330 kg in 2019-2020, followed by a general upward trend that slightly dips to 1,749,594 kg in 2022-2023. Such trends could be influenced by its availability, price changes, or shifting energy policies.

Coal consumption shows a significant doubling from 129,275 kg to 270,960 kg between 2016-2017 and 2017-2018, maintaining this level in 2018-2019. It then surges in 2019-2020, followed by a period of stability, and then another sharp increase to 2,165,615 kg in 2022-2023. This pattern could reflect changes in industrial activity or energy production needs.

Diesel consumption starts at 292,864 kg, rises markedly to 459,264 kg by 2017-2018, and maintains this higher consumption through 2020-2021. However, it then decreases significantly to 163,072 kg by 2022-2023, possibly due to advancements in fuel efficiency, the introduction of alternative energy sources, or a strategic shift away from diesel.

An intriguing observation from Figure 5 is that, although coal is ranked third in terms of electricity generation among fossil fuels, it is responsible for the highest emissions. This contrast becomes especially stark when coal's emissions are compared to those from other fossil fuels. For instance, natural gas, despite being the leading source for electricity generation, emits the least number of pollutants. This discrepancy can be attributed to the inherent chemical properties of these fuels. Coal, primarily composed of carbon, when burned, releases a higher concentration of carbon dioxide (CO_2), a potent greenhouse gas, per unit of energy generated. On the other hand, natural gas, which is predominantly methane (CH_4), burns more cleanly, producing less CO_2 and other pollutants for an equivalent amount of electricity produced. This makes natural gas a comparatively more environmentally friendly option for fossil fuel-based electricity generation. Nevertheless, it is essential to recognize that all fossil fuels contribute to greenhouse gas emissions, and the transition to cleaner, renewable energy sources is crucial for reducing our carbon footprint.

5. Implications for Carbon Neutrality and Sustainability

The findings of this comprehensive study provide a clear illustration of Bangladesh's current energy emissions profile and its implications for the country's pursuit of carbon neutrality and sustainability. As Bangladesh achieves nationwide electricity coverage, a historical milestone, the energy sector now stands at a crossroads where the choice of fuel sources will have long-term environmental and economic repercussions.

The data reveals a heavy dependence on natural gas for electricity generation, contributing to 58% of the total. Despite being the cleaner option among fossil fuels, the dwindling domestic supply raises concerns about future sustainability. The increasing shift towards coal and heavy fuel oil (HFO) as alternatives is particularly alarming. These fuels are less environmentally friendly and substantially increase carbon emissions, undermining global efforts to combat climate change and Bangladesh's commitments to Sustainable Development Goal 7.

Coal, while a significant energy source, has the highest carbon emission rate of 1892.586 kg of CO_2 per MWh of electricity generated, as identified by this study. This rate far exceeds that of natural gas, HFO, and diesel. The implications of this are multifaceted. First, there is the immediate environmental impact where increased coal usage contributes disproportionately to greenhouse gas emissions, exacerbating global warming and its associated climate impacts, which Bangladesh is particularly vulnerable to, such as sea-level rise and extreme weather events.

Furthermore, the reliance on high-emission fuels can have significant health impacts due to increased air pollution, which can lead to respiratory diseases and other health problems among the population. This not only affects the quality of life but also places a burden on the country's healthcare system and economy.

From an economic perspective, the shift to coal and HFO may have short-term benefits in terms of energy security, particularly given the global political crises that often influence the availability and pricing of fuels. However, the long-term economic implications are less favorable. As the world moves towards carbon taxation and stringent environmental regulations, Bangladesh may find itself facing trade barriers and financial penalties, which can negatively impact its economy.

The study's evidence supports a strategic pivot towards renewable energy sources. Bangladesh, with its ample sunlight and potential for wind energy, stands to gain significantly from investing in solar and wind energy infrastructure. Transitioning to renewables can provide long-term energy security without the volatility associated with fossil fuel markets. Additionally, renewable energy investments can generate employment, stimulate local economies, and contribute to a more diversified energy portfolio.

The implications for policy are clear: a concerted effort is required to transition Bangladesh's energy sector towards more sustainable practices. Policymakers must consider the environmental, health, and economic dimensions of energy consumption and production. There is an urgent need to incentivize renewable energy, improve energy efficiency, and phase out subsidies for fossil fuels.

The study's insights can serve as a clarion call for Bangladesh to accelerate its transition to renewable energy. The path to carbon neutrality is not only a commitment to global climate agreements but also a strategic economic decision

that can secure a sustainable future for Bangladesh. By embracing renewable energy, Bangladesh can ensure that its journey towards electrification and modern energy access continues to progress sustainably, setting an example for other developing nations in harmonizing economic growth with environmental stewardship.

6. Conclusions

This comprehensive analysis of Bangladesh's energy sector offers a critical perspective on the nation's journey towards achieving carbon neutrality and sustainable energy. While the milestone of nationwide electricity coverage marks a significant achievement for Bangladesh, the reliance on fossil fuels casts a shadow over the environmental sustainability of this progress. The study's findings lay bare the stark realities of the current energy mix and its implications for carbon emissions.

The predominance of natural gas as the mainstay for electricity generation is a double-edged sword; it's a cleaner burning fuel yet is in dwindling supply domestically. The shift towards coal and HFO, while addressing immediate energy needs, propels the nation further away from meeting its commitments to international climate goals and Sustainable Development Goal 7. The high CO_2 emissions from coal combustion, despite its lesser role in electricity generation, is particularly concerning, signaling an urgent need for policy interventions.

This analysis has quantified the emissions from different fossil fuels, revealing that to generate a unit of electricity, coal produces the most CO_2, followed by HFO and diesel, with natural gas being the least polluting. These findings point towards an imperative to reassess the current energy strategy. With the global community moving towards greener policies, the continuation of a fossil fuel-dependent energy framework may subject Bangladesh to economic and environmental vulnerabilities.

The path to sustainability and the achievement of carbon neutrality demands a multi-pronged approach. It is imperative to increase investment in renewable energy sources, enhance energy efficiency, and develop a robust policy framework that supports a sustainable energy transition. It is also crucial to engage in international partnerships and seek climate finance opportunities to support this shift.

Bangladesh's energy sector's future should be envisioned on the principles of sustainability, resilience, and inclusivity. Strategic planning and action today will ensure that the country's energy infrastructure is capable of supporting economic growth without compromising environmental integrity. As the nation moves forward, the insights from this study should inform a progressive energy policy that aligns with both national development and global sustainability objectives.

By capitalizing on its renewable resources and adopting innovative technologies, Bangladesh can create a sustainable energy ecosystem that not only powers its economy but also contributes to a cleaner and more sustainable world. The journey towards carbon neutrality is challenging, yet it offers the opportunity for Bangladesh to lead by example in the South Asian region, demonstrating that economic development can go hand in hand with environmental stewardship.

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