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| **Title:** | Perspectives and pathways to a Carbon-free Advanced Power Network (CAPN) in Bangladesh for sustainable development | | |
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| **Published Journal Name:** | Cleaner Energy Systems | | |
| **Type of Publication:** | Journal | | |
| **Volume:** | 10 | Issue | 2 |
| **Publisher:** | Elsevier | | |
| **Publication Date:** | January 13, 2025 | | |
| **ISSN:** | 2772-7831 | | |
| **DOI:** | <https://doi.org/10.1016/j.cles.2025.100172> | | |
| **URL:** | [Perspectives and pathways to a Carbon-free Advanced Power Network (CAPN) in Bangladesh for sustainable development - ScienceDirect](https://www.sciencedirect.com/science/article/pii/S2772783125000044?via%3Dihub) | | |
| **Other Related Info.:** | Page 1-28 | | |
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| **Abstract:** |  |
| The twenty-first century is marked by an urgent need to combat global warming and environmental degradation, primarily driven by the extensive use of fossil fuels for energy production over the past two centuries. As the world faces the severe consequences of climate change, the transition to renewable energy (RE) has become a critical focus of sustainable development strategies. Renewable energy sources (RES) such as solar, wind, and biomass are not only environmentally friendly but also essential for achieving long-term energy security and economic stability. The importance of RE is underscored by the United Nations Sustainable Development Goals (SDGs), particularly SDG-7, which aims to ensure access to affordable, reliable, sustainable, and modern energy for all. SDG-7 highlights the necessity of increasing the share of RE in the global energy mix, improving energy efficiency, and promoting international collaboration to enhance clean energy research and technology. This research explores how Bangladesh can achieve a 100 % reliable and adaptable renewable energy (RE) output by 2050, focusing on the transition away from gas, coal, and oil-based power systems as the primary strategy for reducing fossil carbon emissions. The study examines the pathways to establishing a fully decarbonized and cost-effective energy grid in Bangladesh, emphasizing the challenges of converting the existing non-renewable power grid into a flexible and reliable RE system. From both technological and energy perspectives, the research investigates alternative methods and technologies to conventional fossil-dependent power systems and their potential to lead Bangladesh into a post-fossil fuel era. As a result, the proposed Carbon-free Advanced Power Network (CAPN) 2021–2050 model will offer the most cost-effective and environmentally friendly energy generation solution, with minimal greenhouse gas emissions and a fully carbon-free output. Intelligent energy management systems will play a key role in this transition. According to the suggested roadmap, there will be no need to construct new gas, coal, furnace oil, or nuclear power plants, and the existing fossil fuel capacity will be gradually phased out as it reaches the end of its technological lifespan. | |