The Road to Renewable Energy: Obstacles and Opportunities for Bangladesh in Achieving an Equitable Energy Transition

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Abstract. Bangladesh faces significant challenges in transitioning to renewable energy due to its reliance on fossil fuels, socio-economic barriers, and infrastructural constraints. This research examines the obstacles and opportunities related to achieving a fair energy transition. This research seeks to identify critical strategies that might facilitate Bangladesh's transition to renewable energy, ensuring sustainability and equity. This study employs a mixed-methods approach, combining an extensive literature analysis with surveys of key stakeholders. Data is assessed using graphical representations and analyses of Bangladesh's energy sector regulations to ascertain their impact on renewable energy uptake. The study demonstrates that legislative reform, enhanced finance options, and community engagement are crucial for accelerating Bangladesh's shift to renewable energy. These variables significantly influence the successful implementation of sustainable energy solutions. This research possesses practical relevance for policymakers, energy strategists, and development organisations in Bangladesh. It informs sustainable energy policy, guides infrastructure investments, and supports the establishment of community-oriented renewable energy projects.

Keywords: Renewable Energy, Sustainable Development, Energy Regulation.

1 Introduction

Access to energy is essential for national development, supporting industrial expansion, technical advancement, and human welfare. Bangladesh, with a population over 170 million, has achieved universal power coverage by 2022. This milestone conceals a profound structural dependency: more than 85% of the nation's power is produced from fossil fuels, chiefly natural gas—a limited resource anticipated to be exhausted within the next decade.[1]

This dependence poses a multifaceted difficulty. In addition to local resource depletion, Bangladesh confronts rising import expenses, environmental deterioration due to coal-dependent energy, and increased vulnerability to climate-related hazards. In this environment[2], renewable energy presents a feasible option, ensuring a cleaner and more resilient energy future. Nonetheless, its contribution remains negligible, accounting for less than 4%[3], of the national energy composition.

The obstacles to widespread adoption are well-documented: substantial capital expenditures, insufficient infrastructure, restricted technological capability, and disjointed policy execution. Nevertheless, the social fairness aspect of the change remains little examined. Contemporary renewable programs frequently exclude marginalised groups, exacerbating existing inequalities in energy access and economic prospects.Comparative worldwide experiences, including those of Germany, China, and India[4], illustrate that transitions to renewable energy need cohesive plans that include policy change, institutional coordination, and inclusive funding. Bangladesh has begun commendable initiatives, such as the Solar Home Systems program; nonetheless, advancements are inadequate to satisfy increasing demand or significantly reduce reliance on fossil fuels.[5]

This report rigorously analyses the problems and possibilities in Bangladesh's transition to renewable energy, emphasising regulatory, financial, and socio-economic aspects.[6] It seeks to delineate implementable policies that emphasise sustainability and equity, guaranteeing that the transition advantages both metropolitan hubs and marginalised rural and low-income populations.[7]

2 Method

This study employs a mixed-methods approach to investigate the challenges and opportunities for achieving an equitable energy transition in Bangladesh. By combining qualitative and quantitative research techniques, the methodology ensures a comprehensive understanding of the socio-economic, regulatory, and technical dimensions of renewable energy adoption.

3 Result and Discussion

When evaluating Bangladesh's renewable energy aspirations, it is essential to evaluate the socio-political, infrastructural, and regulatory frameworks [8] of its energy environment. The goal of universal electricity availability by 2022 is commendable; yet, it conceals a critical reliance on fossil fuels that predominate the national energy composition. In 2023, fossil fuels, predominantly natural gas, supply almost 85% of electricity, and renewable energy constitutes 4.5%, with solar energy supplying 67.61%. This statistic underscores the legal, economic, and physical impediments to a fair and sustainable energy transition, as well as a significant shortfall compared to the national objective of a 10% renewable contribution by 2020, established under the Renewable Energy Policy of 2008. [9]

3.1 Technical and Infrastructure Challenges

Bangladesh The limited availability of land and elevated population density (1,265 individuals per square km) in Bangladesh obstruct the deployment of renewable energy. Solar energy [10] is plentiful but needs extensive land for large-scale deployments. In energy-deficient rural and coastal regions, agriculture and housing are prioritised above large-scale solar energy development. The proposed 500 MW

floating solar facility on Kaptai Lake is appealing; nevertheless, policymakers have not prioritised or funded in floating solar technology.

Wind energy remains underdeveloped. Inland wind velocities, typically under 5.5 m/s, are insufficient for commercial activities. Bangladesh possesses just 2 MW of wind energy facilities in coastal regions such as Feni and Kutubdia. Offshore wind and tidal energy have long-term potential in the Bay of Bengal[11]; nevertheless, substantial capital expenditures, insufficient local technical expertise, and uncooperative regulatory frameworks hinder its implementation.

Hydropower, a low-emission energy source, has been underutilised due to ecological concerns and displacement challenges, particularly along major rivers like as the Karnaphuli and Sangu. The national grid's battery storage capacity, projected to be under 100 MW, constrains the incorporation of intermittent renewable sources such as solar and wind.[12] Alternative legal frameworks and targeted infrastructure design are essential to facilitate hybrid systems and microgrids, particularly in off-grid regions.

3.2 Regulatory and Policy Limitations

Bangladesh's renewable energy legislation is antiquated and favours fossil fuels. The 2008 Renewable Energy Policy, while innovative, is inadequate for the current energy transformation. It does not need technology-neutral procurement, competitive bidding, or incentives for emerging technologies such as floating solar, offshore wind, or hybrid solar-storage systems. No legal criteria align with Bangladesh's Nationally Determined Contributions under the Paris Agreement.

The Quick Enhancement of Electricity and Energy Supply (Special Provisions) Act, 2010, accelerates licensing for fossil fuel power projects by circumventing environmental safeguards and public involvement. This act establishes a regulatory disparity that benefits fossil fuels over renewable energy, deterring private investment in clean energy.

The revised Integrated Energy and Power Master Plan (2023) prioritises energy security but does not include a legally binding decarbonisation strategy. It acknowledges the significance of renewable energy but does not mandate timeframes for the phase-out of fossil fuels or responsibility from agencies. Reports indicate that the Sustainable and Renewable Energy Development Authority (SREDA), responsible for executing renewable policy directives, operates with less than 30% of its allowed personnel and possesses little regulatory authority and financial resources. [13]

3.3 Governance, Transparency, and Institutional Challenges

Outdated Institutions are deficient without a consolidated, publicly accessible renewable energy project database. Restricted transparency in procurement, financial distribution, and project oversight diminishes private investor confidence and the efficacy of foreign donors.[13] Bureaucratic impediments and redundant agency tasks have postponed the execution of BADGE ($17.2 million) and the Bangladesh Climate Change Resilience Fund allocations.

Donor priorities may contradict local requirements. Extensive solar parks get substantial financing, but rural regions, which may gain more from decentralised mini-grids or solar home systems, are generally overlooked. This discrepancy results from a top-down planning approach that marginalises community perspectives, necessitating institutional reforms based on participatory governance.

3.4 Mitigating Socioeconomic Inequities and Reinforcing Legal-Enabling Structures

Bangladesh's shift to renewable energy must address entrenched social inequalities and systemic access constraints. Although the Solar Home Systems (SHS) initiative has benefited over 20 million customers, a considerable number of ultra-poor households remain marginalised owing to unaffordable financing. Women, although being pivotal in biomass collecting, are significantly under-represented in the renewable energy profession. Community-owned solar mini-grids in areas such as Haor have illustrated the socio-economic advantages of inclusive, locally administered frameworks. To achieve such outcomes, legislative reforms must require competitive auctions, net metering, and a gradual phase-out of fossil fuels. A Green Energy Fund, funded by reallocated subsidies and climate money, in conjunction with gender-responsive financial instruments and vocational training, is important. Transparent governance, facilitated by centralised oversight and independent audits, is essential for regulatory legitimacy and the maintenance of donor confidence.

4 Conclusion

The renewable energy transition in Bangladesh illustrates a significant conflict between developmental objectives and structural impediments. Notwithstanding ubiquitous power availability, its 85% reliance on fossil fuels presents significant environmental and economic hazards. Despite renewables accounting for just 4.5%, infrastructural, regulatory, and socio-economic difficulties persist. This report advocates for enforceable renewable objectives, reallocated subsidies, and inclusive, community-driven solutions. Investments in floating solar, tidal energy, and gender-sensitive funding are crucial. Enhancing institutions and transparency frameworks will restore confidence and galvanise support. Realising the 2041 objective of 40% renewable energy necessitates not just financial investment and innovation but also a governance transformation grounded in both fairness and sustainability.

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