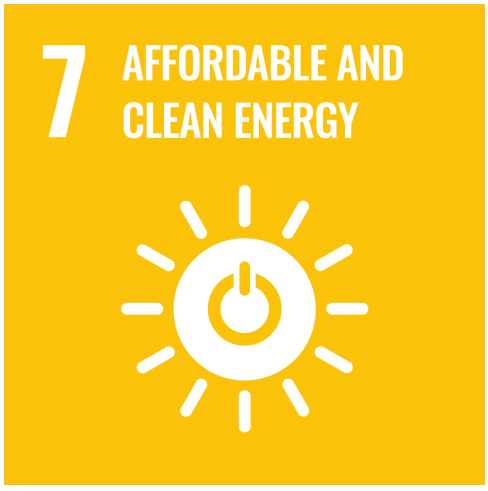
NOAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY

Noakhali - 3814, Bangladesh.

SDG PROGRESS REPORT 2024



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Comprehensive Report: SDG 7 - Affordable and Clean Energy

Noakhali Science and Technology University

December 2024

Introduction

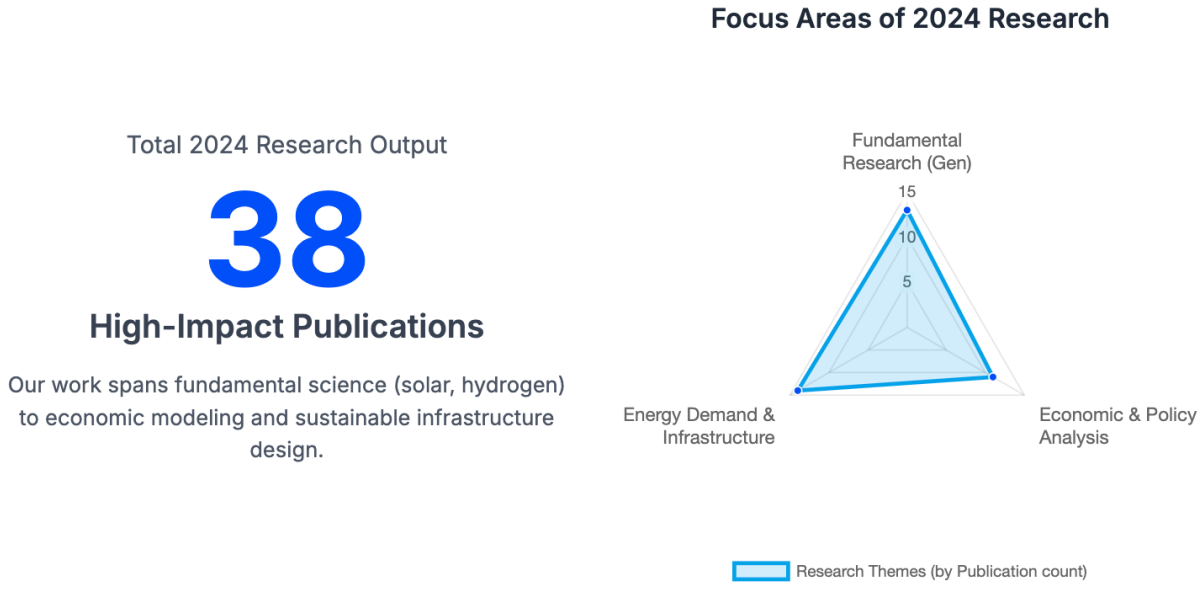
Noakhali Science and Technology University (NSTU) is fully dedicated to advancing Sustainable Development Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all. We recognize that energy is the golden thread connecting economic growth, social equity, and environmental sustainability.

Our 2024 contribution demonstrates this commitment through a two-pillar strategy:

1. **Research and Innovation:** A high-impact 2024 research portfolio (38 publications) pioneering new energy technologies and analyzing the economic, environmental, and policy frameworks for their global implementation.
2. **Operations and Community Engagement:** A responsible approach to on-campus energy efficiency, divestment from carbon-intensive industries, and active knowledge-sharing with the local community.

This report details our 2024 accomplishments across these critical pillars.

Pillar 1: Research for a Clean Energy Future (2024)



Pillar 1: Progress through Research and Innovation

Our 2024 research portfolio, comprising 38 diverse publications, demonstrates a comprehensive, multi-layered strategy for this goal. Our researchers are not only pioneering the fundamental science of new energy technologies but also analyzing the frameworks necessary for their global implementation.

Section 1.1: Fundamental Research in Clean Energy Generation (Targets 7.2, 7.a)

A significant portion of our 2024 research involves foundational R&D to increase the share of renewable energy.

- **Advanced Solar Power:** We have a major research cluster focused on improving solar technology, including prospecting for Concentrating Solar Power (CSP) in Bangladesh (Mia, M.S. et al.) and designing high-efficiency triple-junction, perovskite, and organic solar cells (Sifat, M.I. et al.; Acharjee, K. et al.; Kundu, C.S. et al.).
- **Green Hydrogen and Fuel Cells:** Our institution is a leader in the hydrogen economy, with research on platinum-free electrocatalysts (Islam, F. et al.), advanced membranes for fuel cells (Das, A. et al.), and a proof-of-concept for producing green hydrogen from human urine electrolysis (Im, K. et al.).
- **Bioenergy and Energy Harvesting:** We are exploring diverse energy sources, including the techno-economics of agricultural biomass-based energy (Akter, M.M. et al.) and wearable piezoelectric energy harvesters (Islam, A.J. et al.).

Section 1.2: Economic & Policy Analysis of the Energy Transition (Targets 7.2, 7.3)

Alongside technology, we produce high-level economic analysis to guide the transition to sustainable energy systems.

- **Modeling Renewable Energy Impact:** Our studies analyze the dynamic impact of renewable energy on GDP (Rahman, M. et al.) and its role in mitigating CO2 emissions in various countries (Rahman, A.A. et al.; Borsha, F.H. et al.; Alam, M.B. et al.).
- **Promoting Energy Efficiency:** Our work directly supports Target 7.3, including modeling drivers for energy-efficient textile manufacturing (Tushar, S.R. et al.) and estimating energy balance in agriculture (Deb, N.C. et al.).
- **Green Finance and Technology Policy:** We are researching the mechanisms to enable the transition, including the impact of geopolitical risk on green technology adoption (Voumik, L.C. et al.) and the role of Green Bonds (Kumar, B. et al.).

Section 1.3: Analyzing Energy Demand and Sustainable Infrastructure (Targets 7.1, 7.b)

Our research provides a crucial understanding of how energy is used and how to build the sustainable infrastructure of the future.

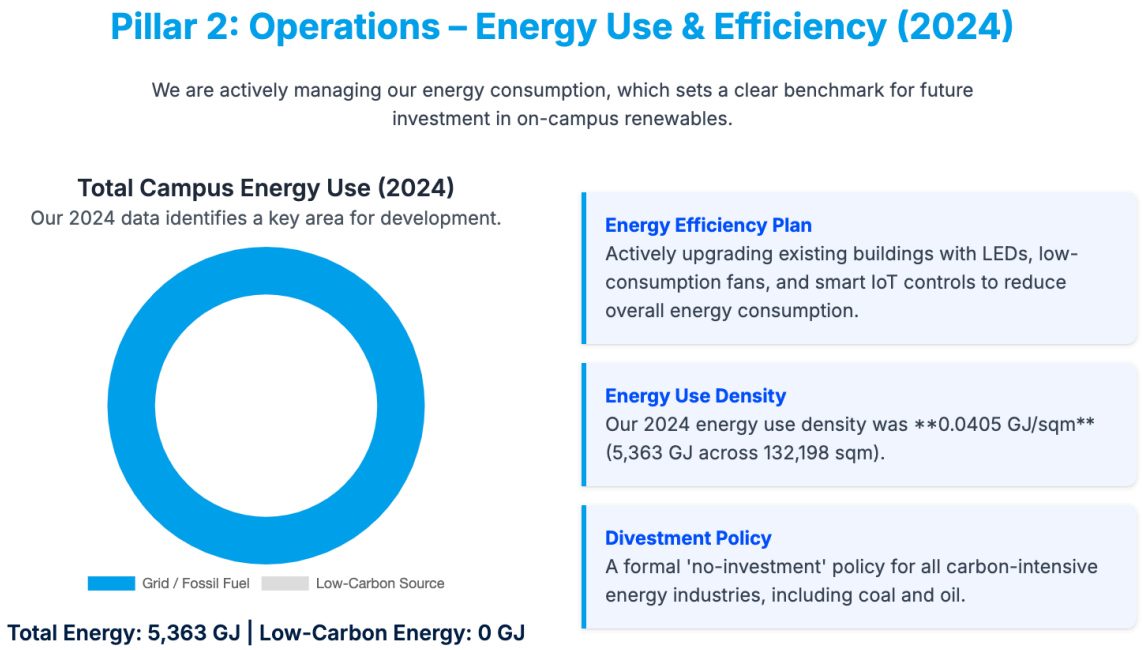
- **Analyzing Energy Demand:** We analyze the key drivers of energy consumption, including studies on the impact of tourism (Ridwan, M.K. et al.) and urbanization (Tahrim, F. et al.).
- **The Energy-Environment Nexus:** We investigate the environmental impact of energy choices, including the health impacts of energy choices (Kaya, F. et al.) and the complex relationships between energy, agriculture, tourism, and CO2 emissions (Akther, T. et al.).
- **Designing Sustainable Systems:** Our researchers are designing practical infrastructure, including models for hybrid power plants (Ahmed, S. et al.) and frameworks for transforming institutional buildings into "Green Libraries" (Tanzin, M. et al.). This is complemented by future-facing research, such as using ML to identify optimal EV charging station locations (Ahmed, M. et al.).

Pillar 2: Progress through University Operations and Community Engagement

NSTU's operational strategy translates our research commitment into direct action, focusing on campus efficiency, responsible finance, and community education.

Section 2.1: Energy Efficiency and Carbon Management

NSTU has an energy efficiency plan in place to reduce overall consumption. We are progressively upgrading existing buildings by replacing traditional lighting with energy-efficient alternatives, installing low-consumption fans, and integrating IoT-based smart control systems. The university also conducts internal energy reviews to identify areas of high wastage, such as inspections of residential halls to address the overuse of high-wattage personal appliances. While a formal carbon management process is not yet in place, these efficiency measures form the basis of our emission reduction strategy.



Section 2.2: Divestment from Carbon-Intensive Industries

NSTU has a formal policy on divesting investments from carbon-intensive energy industries. While the university does not hold investments in external industries beyond traditional bank deposits, the policy commits to:

- A formal no-investment and no-engagement stance with coal, oil, and other carbon-intensive energy sectors.
- Preferentially selecting banking or financial products that support sustainable and green financing where options exist.
- Ensuring any future investment opportunities undergo sustainability screening to ensure alignment with low-carbon practices.

Section 2.3: Energy Use Density and Low-Carbon Energy (2024)

In 2024, the total energy used on campus was **5,363 GJ** across a total floor space of **132,198 sqm**. This results in an energy use density of **0.0405 GJ/sqm**.

The total energy used from low-carbon sources (e.g., solar, geothermal) in 2024 was **0 GJ**. This has been identified as a primary area for future investment and development, aligning our operational goals with our research strengths in renewable energy.

Section 2.4: Energy and the Community

NSTU actively engages the community on energy topics through several initiatives:

- **Public Education:** The student-led NSTU EEE Association organizes multiple events annually, including seminars and demonstrations, to promote renewable energy and efficient electricity use to both students and the local community (images attached below).

- **Industry Services:** EEE faculty and students regularly visit local facilities to provide free and paid technical consultations and preliminary energy-efficiency assessments (e.g. MUH service), supporting cleaner industrial operations.
- **Policy Support:** Through expert discussions and industry engagement, the EEE department actively informs and supports local and regional government bodies in clean energy and energy-efficient technology policy development.
- **Start-up Assistance:** The university provides informal support and expertise for start-ups focused on developing and fostering low-carbon technologies.

Conclusion

Our 2024 research on SDG 7 is robust and comprehensive, spanning the entire energy landscape—from the foundational science of solar and hydrogen to the macroeconomic modeling of renewable integration and the practical design of sustainable infrastructure. Operationally, we are implementing a clear strategy for energy efficiency and divestment, while actively engaging our community to promote clean energy. Our 2024 data, which shows 0 GJ of low-carbon energy use, has provided a clear benchmark and institutional imperative to begin investing in on-campus renewable energy generation, creating a powerful synergy between our research expertise and our operational practices.

Appendix: SDG 7 Targeting 2024 Publications Referenced

1. Kaya, F., Voumik, L.C., Rashid, M., Kochański, K., Zimon, G. (2024). Energy choices to health outcomes: A multidimensional analysis of risk in BRICS via PMG-ARDL approach. *Plos One*.

2. Shakil, J.A., Saikat, S.P., Bhattacharjee, N., Uddin, J., Chowdhury, F.I. (2024). DFT/TD-DFT study of novel triphenylamine-based dyes with azo moieties and π-spacer variations for enhanced dye-sensitized solar cell performance. *Chemical Physics Impact*.

3. Ridwan, M.K., Akther, A., Al-Absy, M.S.M., Yağiş, O., Jaheer Mukthar, K.P. (2024). The Role of Tourism, Technological Innovation, and Globalization in Driving Energy Demand in Major Tourist Regions. *International Journal of Energy Economics and Policy*.

4. Islam, R., Abdur, R., Ashraful Alam, M., Islam, D., Jamal, M.S. (2024). Modulating Mn-doped NiO nanoparticles: structural, optical, and electrical property tailoring for enhanced hole transport layers. *Nanoscale Advances*.

5. Tahrim, F., Hasan, M.A., Akter, S.M.S., Das, M.K., Pattak, D.C. (2024). Impact of urbanization, economic growth, FDI, and trade openness on energy demand in Ireland: an ARDL approach. *Progress in Energy*.

6. Rahman, M., Keat, N.W., Masud, M.A.K., Albaity, M.S.A. (2024). Powering Growth: The Dynamic Impact of Renewable Energy on GDP in ASEAN-5. *International Journal of Energy Economics and Policy*.

7. Islam, F., Ahsan, M., Islam, N., Maiyalagan, M.T., Hasnat, M.A. (2024). Recent Advancements in Ascribing Several Platinum Free Electrocatalysts Pertinent to Hydrogen Evolution from Water Reduction. *Chemistry an Asian Journal*.

8. Rahman, M., Hasan, K., Siddique, M.A.B., Tariq, S., Ibrahim, M.K. (2024). Particulate matter concentrations around natural gas-fired power plants and their associated health impact assessment. *Journal of King Saud University Science*.

9. Dia, R.B., Mallick, J., Aziz, T., Chu, R., ISLAM, A.R.M.T. (2024). Comparative Trend Variability Analysis of Reference Evapotranspiration in Bangladesh Using Multiple Trend Detection Approaches. *Theoretical and Applied Climatology*.

10. Tushar, S.R., Imtiazh, M.S.A., Noor, R.B., ISLAM, A.R.M.T., Kabir, M.M. (2024). An Intuitionistic fuzzy approach to modeling the drivers to promote Energy-Efficient textile Manufacturing: Implications for sustainable development. *Journal of King Saud University Science*.

11. Akther, T., Selim, M.M.I., Hossain, M.S., Kibria, M.G. (2024). Synergistic role of agriculture production, fertilizer use, tourism, and renewable energy on CO2 emissions in South Asia: A static and dynamic analysis. *Energy Nexus*.

12. Das, A., Im, K., Kabir, M.M., Shon, H., Nam, S.Y. (2024). Polybenzimidazole (PBI)-based membranes for fuel cell, water electrolysis and desalination. *Desalination*.

13. Deb, N.C., Basak, J.K., Paudel, B., Kang, M., Kim, H. (2024). Estimation of Energy Balance throughout the Growing–Finishing Stage of Pigs in an Experimental Pig Barn. *Agriculture Switzerland*.

14. Ahmed, T., Suzauddula, M., Akter, K., Hossen, M., Islam, M.N. (2024). Green Technology for Fungal Protein Extraction—A Review. *Separations*.

15. Raihan, A., Hasan, M.A., Voumik, L.C., Akter, S.M.S., Ridwan, M.K. (2024). Sustainability in Vietnam: Examining economic growth, energy, innovation, agriculture, and forests' impact on CO2 emissions. *World Development Sustainability*.

16. Voumik, L.C., Ghosh, S., Rashid, M., Esquivias, M.A., Rojas, O. (2024). The effect of geopolitical risk and green technology on load capacity factors in BRICS. *Utilities Policy*.

17. Rahman, M.M., Mohanty, A.K., Rahman, M.H. (2024). Renewable energy, forestry, economic growth, and demographic impact on carbon footprint in India: does forestry and renewable energy matter to reduce emission? *Journal of Environmental Studies and Sciences*.

18. Rana, S.S., Faruk, O., Robiul Islam, M., Zaman, K., Wang, Z.L. (2024). Recent advances in metal-organic framework-based self-powered sensors: A promising energy harvesting technology. *Coordination Chemistry Reviews*.

19. Borsha, F.H., Voumik, L.C., Rashid, M., Stępnicka, N., Zimon, G. (2024). An Empirical Investigation of GDP, Industrialization, Population, Renewable Energy and CO2 Emission in Bangladesh: Bridging EKC-STIRPAT Models. *International Journal of Energy Economics and Policy*.

20. Rahman, A.A., Murad, S.M., Mohsin, A.K., Wang, X. (2024). Does renewable energy proactively contribute to mitigating carbon emissions in major fossil fuels consuming countries? *Journal of Cleaner Production*.

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23. Alam, M.B., Hossain, M.S. (2024). Investigating the connections between China's economic growth, use of renewable energy, and research and development concerning CO2 emissions: An ARDL Bound Test Approach. *Technological Forecasting and Social Change*.

24. Voumik, L.C., Islam, M.A., Nafi, S.M. (2024). Does tourism have an impact on carbon emissions in Asia? An application of fresh panel methodology. *Environment Development and Sustainability*.

25. Kundu, C.S., Adhikary, A., Ahsan, M.S., Murad, S.A., Ahmed, F. (2024). Design and analysis of performance parameters for achieving high efficient ITO/PEDOT:PSS/P3HT:PCBM/Al organic solar cell. *Journal of Optics India*.

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