RESEARCH ARTICLE

The transition to nuclear energy in Bangladesh: The interplay between climate-related urgency and geopolitical factors

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Abstract

One of the significant issues in contemporary international politics is to examine the contexts of energy usage of different countries, keeping in mind the looming climate threat. Energy transition not only highlights the central role of energy usage but also exposes the vulnerability caused by it. Given the context, Bangladesh has adopted nuclear technology to meet its economic demand and environmental requirements. As a middle-income country, eyeing to graduate to a developing nation by 2041, its choice of exploring nuclear energy has exposed the country to the question of the rationality of the decision. Nuclear energy has a distinguished history that accommodates several debates about its safety and sustainability. Though many developed countries are planning for a nuclear phase-out, Bangladesh's decision merits attention and explanation to embrace such a stand. Often, the economic priorities have been attached to Bangladesh's decision for the energy transition, while the discussion about nuclear energy in Bangladesh ignores the geopolitical purposes and international political agenda. This paper, therefore, aims to explore the internal and external climate-related urgency, and geopolitical concerns responsible for such a transition, which have remained unexplored in the existing literature.

Keywords

Energy, Geopolitics, Energy Transition, Nuclear Energy, Internal Political Agenda

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Introduction

Energy transition has become a crucial reality in every state's energy scenario. The current situation of environmental and economic factors demands a rapid transition into low carbon emissions that initially may jeopardize human welfare. The COP21 agreement[1] suggests the transformation of global energy systems to high standards of sustainability[2] that has revealed the essential role of energy in the development process as well as the vulnerability of the existing energy market.[3] As a developing country, Bangladesh has confronted a similar context while expected to perform a significant role by transforming its energy sector. Thus, in response to the situation, Bangladesh is actively considering exploring the nuclear option.

A country's decision to adopt a nuclear option is considered to be driven by the energy transition. Bangladesh has been recently marked by high economic growth while the rising price of fossil fuel and the depleting condition of the natural gas reserve suggest future struggles to meet energy demands.[4] Moreover, the problem of vulnerability towards climate change advocates the solution that is embedded in the energy transition.[5] However, power like nuclear energy is usually enclosed by complex political and economic factors.

The sole purpose of this paper is to identify whether energy transition is the sole driving factor behind Bangladesh's policy towards nuclear energy and to reveal the unexplored vibrant drivers behind this choice. The energy transition is frequently highlighted as an influential factor where few other aspects exist, and they contribute to making the decision nonetheless. For instance, Erşen and Çelikpala[6] emphasized the importance of geopolitical factors in understanding the energy dynamics that illustrate the interests of states participating in the agendas or the role of the national government in shaping energy policy.[7] The topic has been chosen

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[1] United Nations Framework Convention on Climate Change, *'THE PARIS AGREEMENT', FCCC/CP/2015/L.9/Rev.1* (United Nations, 2015).

[2] C. Breyer *et al.*, "On the Role of Solar Photovoltaics in Global Energy Transition Scenarios: On the Role of Solar Photovoltaics in Global Energy Transition Scenarios," *Progress in Photovoltaics: Research and Applications* 25, no. 8 (August, 2017): 727–45, https://doi.org/10.1002/pip.2885.

[3] V. Cantarero and M. Mercedes, "Of Renewable Energy, Energy Democracy, and Sustainable Development: A Roadmap to Accelerate the Energy Transition in Developing Countries," *Energy Research & Social Science* 70 (December, 2020): 101716, https://doi.org/10.1016/j.erss.2020.101716.

[4] R. Karim *et al., Social, Economic and Political Implications of Nuclear Power Plant in Bangladesh* (Penang, Malaysia, 2017), www.researchgate.net.

[5] K. Edberg and E. Tarasova, "Phasing out or Phasing in: Framing the Role of Nuclear Power in the Swedish Energy Transition," *Energy Research & Social Science* 13 (March, 2016): 170–79, https://doi.org/10.1016/j.erss.2015.12.008.

[6] E. Ersen and M. Çelikpala, "Turkey and the Changing Energy Geopolitics of Eurasia," *Energy Policy* 128 (May, 2019): 584–92, https://doi.org/10.1016/j.enpol.2019.01.036.

[7] "Government and Nuclear Energy," Nuclear Energy Agency, OECD, 2004, https://www.oecd-nea.org/jcms/pl_13860/government-and-nuclear-energy?details=true.

due to the high importance of identifying the drivers as they are vital to understand the dynamics.

This paper is going to explore both the internal and external urgency of climate change and geopolitical agendas as the significant drivers of their influence in the transmission process. It is assumed that Bangladesh has been "caught up" in an "aggressive Russian nuclear export drive"[8] where geopolitical reasons played a vital role. The current political setup, internal and international climate-related urgency, and aspirations of this country also contribute to accelerating this flourishment.

The concept of energy transition and nuclear energy

The concept of energy transition generally refers to the shift from fossil-based energy production and consumption systems to renewable energy sources.[9] The concept emphasizes reducing carbon emissions[10] and the reason for prioritizing such transformation is in its required velocity of change that is essential for implementation.[11]

The current energy transition is recognized as the fourth attempt in human history[12] and is considered unique. The previous transitions used new energy sources for new economic activities while this current transition requires the replacement of existing energy sources.[13] It incorporates the transformation of production technology and institutional structure, and insists on decoupling economic growth, energy conservation, and developing unconventional energy sources.

The current energy transition has embarked recently as a couple of studies show future inevitable energy crises due to instability, environmental pollution, and scarcity.[14] High energy cost is another concern. Another group of scholars considers it as an overestimation of the role of energy prices[15] as rising energy prices are not

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[8] R.F. Ichord, "Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Bangladesh," Atlantic Council (blog), January 9, 2020, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/transforming-the-power-sector-in-developing-countries-geopolitics-poverty-and-climate-change-in-bangladesh/.

[9] "What Is Energy Transition?," accessed October 26, 2021, https://www.spglobal.com/en/research-insights/articles/what-is-energy-transition.

[10] N. Trudeau *et al.*, "Energy Transition for Industry: India and the Global Context – Analysis," OECD/IEA, 2011, https://www.iea.org/reports/energy-transition-for-industry-india-and-the-global-context.

[11] *The Politics of Green Transformations. Pathways to Sustainability,* eds. I. Scoones, M. Leach and P. Newell (London, New York: Routledge, 2015).

[12] J.H. Perkins, *Changing Energy: The Transition to a Sustainable Future* (Oakland, California: University of California Press, 2017).

[13] W.E. Tyner, "Our Energy Transition: The Next Twenty Years," *American Journal of Agricultural Economics* 62, no. 5 (December, 1980): 957–64, https://doi.org/10.2307/1240292.

[14] Perkins, *Changing Energy: The Transition.*

[15] D.W. Jorgenson, "The Great Transition: Energy and Economic Change," *The Energy Journal* 7, no. 3 (July 1, 1986), https://doi.org/10.5547/ISSN0195-6574-EJ-Vol7-No3-1.

only caused by shortages of the cheapest fuel (for example, coal). To absorb the effects (such as health hazards, and environmental pollution) of using it is also a noteworthy matter to consider.[16] It is a policy decision guided by a country's social, economic, geopolitical, and environmental aspects[17] where scholars have identified several challenges.[18]

Nuclear energy provides an alternative to fossil fuels. Its most attractive feature is expanded fuel production with zero emissions. Commercial nuclear power plants started operation in the 1950s[19] and now provide 10% of the world's total electricity in more than 50 countries.[20] It is considered the second largest low-carbon energy source.[21] According to the International Energy Agency (IEA), it provides 2700 TWh while hydropower generates 4239 TWh and wind produces 1217 TWh.[22]

Despite strong evidence of damage from it, nuclear energy has gained popularity and is believed to save millions of lives if fossil fuel can be replaced by it.[23] Fossil fuel is one of the strongest reasons of global warming. The USA has cut down on 476 million metric tons of CO_2 emission in 2019 by using it.[24] It requires less space than any renewable energy. Wind farms require 360 times more space and solar requires 75 times more space to produce a similar amount of energy. It also requires less maintenance. In 2016, the USA's nuclear power plant's average capacity was 92.3% (operating 336 days per year) while the hydroelectric system was 38.2% (138 days), wind 34.5% (127 days), and solar 25.1% (92 days).[25] Moreover,

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[16] J.P. Holdren, "Energy in Transition," *Scientific American* 263, no. 3 (September, 1990): 156–63, https://doi.org/10.1038/scientificamerican0990-156.

[17] N. Janardhanan, "Energy Transition: Conceptual Outlook," *Transition to Energy Secure Future: Institute for Global Environmental Strategies*, 2012, https://www.jstor.org/stable/resrep00778.5.

[18] S.V. Valentine, M.A. Brown and B.K. Sovacool, *Empowering the Great Energy Transition: Policy for a Low-Carbon Future* (New York: Columbia University Press, 2019).

[19] E.O. Adamov and V.V. Orlov, "A New Concept of Nuclear Involvement in Overcoming World Energy Problems," *Atomic Energy* 81, no. 2 (August, 1996): 547–53, https://doi.org/10.1007/BF02415654.

[20] World Nuclear Association, "Nuclear Power in the World Today," Current and future generations, 2021, https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx.

[21] J. Parsons *et al.,* "A Fresh Look at Nuclear Energy," *Science* 363, no. 6423 (January 11, 2019): 105, https://doi.org/10.1126/science.aaw5304.

[22] "Nuclear Power in a Clean Energy System – Analysis," IEA, 2019, https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system.

[23] P.A. Kharecha and J.E. Hansen, "Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power," *Environmental Science & Technology* 47, no. 9 (May 7, 2013): 4889–95, https://doi.org/10.1021/es3051197.

[24] Office of Nuclear Energy, "3 Reasons Why Nuclear Is Clean and Sustainable," Energy.gov., accessed October 26, 2021, https://www.energy.gov/ne/articles/3-reasons-why-nuclear-clean-and-sustainable.

[25] R. Rhodes, "Why Nuclear Power Must Be Part of the Energy Solution," Yale Environment 360, Yale School of the Environment, 2018, https://e360.yale.edu/features/why-nuclear-power-must-be-part-of-the-energy-solution-environmentalists-climate.

it is commercially feasible. In France, 75% of electricity is supplied by nuclear fission, and as a result, the country has the lowest per unit electricity price in the world and the lowest per capita greenhouse gas emissions.[26] It offers additional benefits, such as creating jobs that have comparatively higher salaries and contribute to tax revenues. In the USA, the nuclear energy industry generates nearly half a million jobs and contributes approximately $60 billion to GDP each year.[27] It is an essential matter of national security and a vital issue of energy diplomacy, while also used as an effective tool to build relationships among countries.

Though many environmental organizations have opposed nuclear energy by claiming it unsustainable, uneconomic, unsafe, and related to the proliferation of nuclear power,[28] the International Atomic Energy Agency (IAEA) reveals that by 2035, developing countries will be accountable for 40 % of total global nuclear power generation.[29] While developed countries such as Germany and Switzerland are planning to phase out nuclear energy,[30] the decision to adopt nuclear energy in these developing countries has given rise to controversy. After being witnesses to nuclear accidents, these developed countries have planned nuclear phase out from their concern about the environmental risk embedded in it.[31] On the contrary, developing countries like Bangladesh have decided to explore nuclear technology to ensure their development process.

The concepts of geopolitics and the politics of nuclear energy

Understanding geopolitics is essential for evaluating activities and for comprehending global politics. It offers perspectives on how to perceive the world by analyzing the concerns approximately influence and power over space and territory, implementing frames to make sense of international politics, and gaining insights

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[26] B.W. Brook *et al.*, "Why Nuclear Energy Is Sustainable and Has to Be Part of the Energy Mix," *Sustainable Materials and Technologies* 1–2 (December, 2014): 8–16, https://doi.org/10.1016/j.susmat.2014.11.001.

[27] Office of Nuclear Energy, "Advantages and Challenges of Nuclear Energy," accessed October 26, 2021, https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy.

[28] Brook *et al.,* "Why Nuclear Energy Is Sustainable."; "10 Reasons to Oppose Nuclear Energy," Green America, accessed January 4, 2022, https://www.greenamerica.org/fight-dirty-energy/amazon-build-cleaner-cloud/10-reasons-oppose-nuclear-energy.

[29] J.P. Banks and K. Massy, "Nuclear Power in Developing Countries? Let's Talk about It," Brookings (blog), November 30, 2001, https://www.brookings.edu/opinions/nuclear-power-in-developing-countries-lets-talk-about-it/.

[30] L. Bretschger and L. Zhang, "Nuclear Phase-out Under Stringent Climate Policies: A Dynamic Macroeconomic Analysis," *The Energy Journal* 38, no. 1 (January 1, 2017), https://doi.org/10.5547/01956574.38.1.lbre.

[31] L. Mez and A. Piening, "Phasing-Out Nuclear Power Generation in Germany: Policies, Actors, Issues and Non-Issues," *Energy & Environment* 13, no. 2 (May, 2002): 161–81, https://doi.org/10.1260/095830502150-1155.

from state behavior.[32] The popular use of the term geopolitics refers to both as external[33] and internal geopolitics which are closely related.[34]

Geopolitics is also crucial regarding Bangladesh's endorsement of nuclear power.[35] The geopolitical perspective is particularly important in explaining the rationale for this plan's adaptation, the decision to pick a specific alliance, and the state's stance toward diversification. The opportunity to explore such sensitive technology and the support provided in doing so should be carefully considered. Geopolitical factors can describe it, particularly by highlighting internal and external geopolitical forces.

The notion of nuclear politics predominantly develops as a result of the prominent nations' restrictions on the flow of nuclear technology, which facilitates the creation of nuclear weapons.[36] Such aspirations were present in South Asia but they have also disappeared over time.[37] At present context, Bangladesh, like the other Asian nations, has incorporated it into its national energy mix.[38]

Methods

Thematic Analysis has been used here to identify and justify the argument as it considers the surrounding social and historical conditions. It is suitable to analyze quantitative data. It involves going over a collection of data and searching for patterns in its interpretation to identify the theme.[39] Among the various approaches to conduct it, a few steps like familiarization, generating, reviewing, defining, and writing up have been involved here.

As the source of information, I have used secondary data and text analysis. Secondary data have been collected from different journal articles from well-known journals like-Strategic Analysis, and the International Journal of Scientific &

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[32] K. Dodds, "1. What is geopolitics?," in *Geopolitics: A Very Short Introduction,* ed. K. Dodds (Oxford University Press, 2019), 1–14, https://doi.org/10.1093/actrade/9780198830764.003.0001.

[33] Use synonymous as "international."

[34] P. Subra, "La géopolitique, une ou plurielle ? Place, enjeux et outils d'une géopolitique locale," *Hérodote* 146–147 (2012): 45–70, https://doi.org/10.3917/her.146.0045.

[35] H.A. Shovon and M.H. Rahman, "Cold war redux in dhaka," *The Daily Star*, January 16, 2023, https://www.thedailystar.net/opinion/views/news/cold-war-redux-dhaka-3222666.

[36] R.R. Subramanian, "The politics of nuclear energy," *Strategic Analysis* 34, no. 6 (2010): 806–811, https://doi.org/10.1080/09700161.2010.512474.

[37] A.J. Tellis, "Striking asymmetries: Nuclear transitions in southern asia," Carnegie Endowment for International Peace, 2022, https://carnegieendowment.org/2022/07/18/striking-asymmetries-nuclear-transitions-in-southern-asia-pub-87394.

[38] T. Manpati, "Nuclear power trend in southeast asia and its contested discourses on climate change," Heinrich Böll foundation, southeast asia regional office, Heinrich-Böll-Stiftung, 2020, https://th.boell.org/en/2020/11/09/nuclear-power-trend-southeast-asia.

[39] J. Caulfield, *How to do thematic analysis | guide & examples,* Scribbr, May 5, 2022, https://www.scribbr.co.uk/research-methods/thematic-analysis-explained/.

Engineering Research published by renowned publishers (Taylor & Francis, Elsevier). Book chapters published by renowned publishers like Routledge, and Edinburgh University Press have been used here. Different national (for example- The Financial Express, Dhaka Tribune) and international newspaper (like- The Economics Times, Reuters) articles have also been used. Conference papers (International Conference on Green Energy, International Conference on Electrical Engineering and Information Communication Technology) are also used as a good source of information. Blogs like Green America, government reports, and websites of different organizations like- Bangladesh Power Development Board, and World Nuclear Association. To collect all these materials, I use various publishing hubs like- Science Direct, Research Gate, and search engines like Google Scholar, and Sussex Library Search. I also use the library database of the University of Dhaka and the University of Sussex. All of the included sources are written in English and current publications (published from 2018–2021) and academic writings have been given priority.

Results

Bangladesh's Energy Condition and its Nuclear perspectives

Energy plays a vigorous role in every aspect of this country as economic growth depends on the availability of energy. Hence, it is suffering from an energy shortage.[40] In the energy sector, Bangladesh is facing 'twin crises' (urban crises and rural crises) which are vital to resolve to speed up development.[41] The urban crisis is due to power shortages in urban areas[42] and the rapidly rising use of gas.[43] The Rural crisis is due to the lack of access.[44]

The current energy scenario confirms the financial strain that the country is under to meet energy demands, as the government has to be under immense pressure because of imported energy.[45] Bangladesh's energy demand has increased at an average rate of 10% over the last decade which is forecasted to increase further in the

[40] S. Islam and M.Z.R. Khan, "A Review of Energy Sector of Bangladesh," *Energy Procedia* 110 (March, 2017): 611–18, https://doi.org/10.1016/j.egypro.2017.03.193.

[41] IAEA, "Bangladesh 2019," Country profile, Country Nuclear Power Profiles, 2019, https://cnpp.iaea.org/countryprofiles/Bangladesh/Bangladesh.htm.

[42] E. Hossain, "Power Cuts Make Households, Industries Suffer in Bangladesh," *New Age*, 2020, https://www.newagebd.net/article/101874/power-cuts-make-households-industries-suffer-in-bangladesh.

[43] M.H. Shetol *et al.*, "Present Status of Bangladesh Gas Fields and Future Development: A Review," *Journal of Natural Gas Geoscience* 4, no. 6 (December, 2019): 347–54, https://doi.org/10.1016/j.jnggs.2019.10.005.

[44] Shetol *et al.,* "Present Status of Bangladesh Gas Fields."

[45] S. Khan, "Energy Import Soars, so Does Pressure on Economy," The Business Standard, January 27, 2020, https://www.tbsnews.net/bangladesh/energy/energy-import-soars-so-does-pressure-economy-39487.

near future.[46] Dependence on natural gas, its growing scarcity, increasing demand, and import reliance are suspected to lead to a bottleneck in the future.[47]

The huge population, economic development, and the country's future aspirations have contributed to the rising demand for energy. Besides, the government has committed to ensuring the affordable and reliable energy is available for every citizen by 2021.[48] With an 8.2% gross domestic product (GDP) growth rate in 2019, the country has been having a steady economic growth rate since 2010.[49] In 2015, it joined the lower-middle-income country category by fulfilling all three eligibility criteria[50] and now intends to reach the upper-middle-income category in the light of 'Vision 2021'.[51] This robust pattern of economic growth includes an enormous demand for energy.

The rising trend of oil prices and declining natural gas reserves raise questions regarding the energy security of Bangladesh. The international energy outlook predicted that the price of the oil market will reach $133 per barrel by 2035.[52] Natural gas is another vital source of energy whose production depends heavily upon the mature fields with declining production.[53]

The geographical position (higher solar irradiation)[54] and the changed climate pattern of Bangladesh have contributed to rising energy demand in the country. The

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[46] Ministry of Power, Energy and Mineral Resources, Government of Bangladesh, Bangladesh Power Development Board, "Annual Report 2018–19," 2019, https://www.bpdb.gov.bd/bpdb_new/resourcefile/annualreports/annualreport_1574325376_Annual_Report_2018-19.pdf.

[47] M. Shehab, "Bangladesh Power Sector – Filling the Gap in Demand," LightCastle Partners, July 14, 2019, https://www.lightcastlebd.com/insights/2019/07/bangladesh-power-sector-filling-the-gap-in-demand.

[48] SREDA & Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh, "Energy Efficiency and Conservation Master Plan up to 2030," 2015, https://policy.asiapacificenergy.org/sites/default/files/EEC_Master_Plan_SREDA_2.pdf.

[49] Bangladesh Bank, "Bangladesh GDP Growth Rate," Trading Economics, accessed October 28, 2021, https://tradingeconomics.com/bangladesh/gdp-growth.

[50] D. Bhattacharya and S.S. Khan, "CPD Policy Brief 1 - Bangladesh Becoming a Middle-Income Country, Ceasing to Be a Least Developed Country: Clarifying Confusion - CPD," Centre for Policy Dialogue (CPD) (blog), March 27, 2018, https://cpd.org.bd/bangladesh-becoming-a-middle-income-country-ceasing-to-be-a-least-developed-country-clarifying-confusion/.

[51] BSS, Dhaka, "Bangladesh to Become Higher Middle-Income Country Soon: PM," *The Daily Star*, March 6, 2019.

[52] U.S. Department of Energy, Energy Information Administration, "Annual Energy Outlook 2010: With Projections to 2035," Report, UNT Digital Library, April, 2010, https://digital.library.unt.edu/ark:/67531/metadc949175/.

[53] PricewaterhouseCoopers Private Limited, India, "Draft Final Report on Energy Security," 2016, https://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/c96429b5_a481_4ee3_8095_6746b376dcfd/TA%208839_Draft%20Final%20Report%20on%20Energy%20Security_Cover%20Note_Submitted_29th%20June.pdf.

[54] M.N.I. Sarkar and A.I. Sifat, "Global Solar Radiation Estimation from Commonly Available Meteorological Data for Bangladesh," *Renewables: Wind, Water, and Solar* 3, no. 1 (December, 2016): 6, https://doi.org/10.1186/s40807-016-0027-3.

peak summer temperature range (from 30 °C to 40 °C) is gradually rising due to the greenhouse effect.[55] It increases the demand for electricity as the weather requires additional refrigeration and cooling facilities.[56] Moreover, energy extraction and usage are responsible for two-thirds of the greenhouse gas emissions of the world.[57] Urban air pollution is another significant environmental issue here.[58]

One possible solution to fill up the energy gap between demand and production is cross-border energy trade. South Asian countries do the same by importing fuel from different parts of the world.[59] The power exchange between South Asian nations is frequently advised by experts to increase energy security.[60] Hence, it is considered the least economically integrated region in the world.[61] Due to the absence of a single energy hub and a coordinating system, the weak trade trajectory is highly prevalent here.[62] According to the Power Sector Master Plan 2016 (PSMP-2016) of Bangladesh, regarding cross-border trade, the total amount of imported power cannot exceed 15% of the total electricity generation capacity.[63]

The Bangladesh government is trying to develop renewable energy sources. Despite its efforts in the 2010s and goals to generate 10% of electricity from renewable energy sources[64] by 2020, It could secure only 5%.[65] Hence, the government has announced new goals to produce 15% by 2030, 40% by 2041 and 100% by 2050.[66]

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[55] "Climate of the World: Bangladesh," Weather online, 2020, https://www.weatheronline.co.uk/reports/climate/Bangladesh.htm.

[56] M. Taheruzzaman and P. Janik, "Electric Energy Access in Bangladesh," *Transactions on Environment and Electrical Engineering* 1, no. 2 (April 1, 2016), https://doi.org/10.22149/teee.v1i2.13.

[57] World Bank, "Energy and Environment," Development Impact Evaluation (DIME), The World Bank, 2020, https://www.worldbank.org/en/research/dime/brief/energy-environment.

[58] I. Hossain and M. Tamim, *Energy and Sustainable Development in Bangladesh* (Bangladesh: HELIO International, 2006), https://cleancooking.org/binary-data/RESOURCE/file/000/000/90-1.pdf.

[59] C.I.A. Siddiky, *The geopolitics of energy in South Asia: Energy security of Bangladesh, First Edition* (Routledge, 2021).

[60] Siddiky, *The geopolitics of energy in South Asia: Energy.*

[61] A. Ahmed, "South Asia least integrated region for trade," DAWN.COM, March 15, 2020, https://www.dawn.com/news/1541009.

[62] "World Energy Outlook 2019," International Energy Agency, 2019, https://www.iea.org/reports/world-energy-outlook-2019.

[63] M.T. Hossain *et al.*, "Challenges of Cross Border Power Trade with Neighboring Countries and Interest of Bangladesh," Ministry of Power, Energy and Mineral Resources, n.d.

[64] M. Alauddin, *Prospects of Renewable Energy in Bangladesh*, n.d., https://bpmi.portal.gov.bd/sites/default/files/files/bpmi.portal.gov.bd/page/bc0f0c3c_c487_463b_8873_6effb42cc584/2020-09-21-23-43-968e53f887c37b3b8cd1185812268367.pdf.

[65] M.S. Aaqib, "Renewing Bangladesh's energy transition," *East Asia Forum* (August 19, 2023), https://www.eastasiaforum.org/2023/08/19/renewing-bangladeshs-energy-transition/.

[66] Aaqib, "Renewing Bangladesh's energy transition."

Nuclear energy is expected as a good option for Bangladesh like South Korea which is marked as one of the rapidly growing economies that rely on nuclear.[67] As a developing nation, Bangladesh needs to sustain its rapid economic growth that can grow further.[68] As a country, Bangladesh aspires to set an example through its rapid development (It reached lower-middle-income status in 2015 and now trying to graduate from United Nation's (UN) least developed countries (LDCs).[69]

The energy security of Bangladesh is under threat due to insufficient gas reserves and high fuel prices in the international market. The gas reserve is predicted to be exhausted by 2026[70] and imported petroleum also puts a burden on the country's finances. In 2020 alone, Bangladesh imported 1.4 million tons of crude petroleum oil.[71] The nuclear option is expected to reduce the country's dependence on oil not only to save money but also in light of the situation of the rising price of oil in the international market.

Environmental factors are crucial for Bangladesh to choose the nuclear option. The nuclear power plant is assumed to be sustainable as it releases a small number of greenhouse gases[72] (while coal produces 1100 grams of CO_2 per kWh, nuclear produces 15 grams).[73] As an alternative major source of energy, Bangladesh might use coal with its adverse environmental impact if they do not embrace nuclear. For the last couple of years, it has also highlighted the poor quality of air[74] in the capital.[75] Thus, Bangladesh sees the nuclear option as a way to save the environment while not compromising its development.

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[67] E. Lim, "South Korea's Nuclear Dilemmas," *Journal for Peace and Nuclear Disarmament* 2, no. 1 (January 2, 2019): 297–318, https://doi.org/10.1080/25751654.2019.1585585.

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[69] World Bank, "Overview," accessed January 4, 2022, https://www.worldbank.org/en/country/bangladesh/overview.

[70] M.A.N. Abir and M.T. Rahman, "Energy Scenario of Bangladesh & Future Challenges," *International Journal of Scientific & Engineering Research* 9, no. 3 (2018), https://www.ijser.org/researchpaper/Energy-Scenario-of-Bangladesh-Future-Challenges.pdf.

[71] "1.4m Tons Crude Oil to Be Imported in 2020," *Dhaka Tribune*, January 2, 2020, https://www.dhakatribune.com/business/2020/01/02/1-4m-tons-crude-oil-to-be-imported-in-2020.

[72] R. Bhuiyan *et al.,* "Prospect of Green Power Generation by Using Nuclear Energy in Bangladesh," in *2015 3rd International Conference on Green Energy and Technology (ICGET)* (Dhaka, Bangladesh: IEEE, 2015), 1–4, https://doi.org/10.1109/ICGET.2015.7315086.

[73] A.R. Chowdhury, R. Ul Islam Shezan and M.A.R. Sarkar. "The Prospects of Nuclear Power in the Bangladesh," n.d., https://bea-bd.org/site/images/pdf/041.pdf.

[74] M.A.M. Molla, "Bangladesh Air Worst in World," *The Daily Star,* February 26, 2020.

[75] M.R.S. Pavel *et al.*, "Long-Term (2003–2019) Air Quality, Climate Variables, and Human Health Consequences in Dhaka, Bangladesh," *Frontiers in Sustainable Cities* 3 (July 19, 2021): 681759, https://doi.org/10.3389/frsc.2021.681759.

Materials on this issue reveal that scholars have seen it as a strategic option yet recognize several challenges.[76] For example, there are regulatory and legal concerns- The Nuclear Power Plant Act 2015 set the operating responsibility to Nuclear Power Plant Company Bangladesh Limited (NPCBL) while the owner is Bangladesh Atomic Energy Commission (BAEC)[77] and the law does not have any provision in the case of any disaster. Nuclear power plants require advanced and complex technology and without it, efficient production is impossible.[78] The issue of nuclear waste is concerning for all developed nuclear countries whereas Bangladesh does not have a comprehensive nuclear power plant yet. The technology of nuclear power production is similar to nuclear weapons which pose a threat to a region like this that has increasing terrorist activities.[79] Moreover, low competitiveness, uranium supply shortages (own only 0.25%),[80] environmental aspects like radiation, and production of CO_2 have made the nuclear perspective of Bangladesh challenged by the safety, security, and other concerns.

Energy diversification is another factor at play in Bangladesh's decision to use nuclear power. Diversification, also referred to as the energy mix, is crucial for ensuring energy security and work more effectively rather than exclusively relying on conventional energy sources.[81] The phrase describes the mixture of different basic energy sources utilized to satisfy energy needs in a certain geographic area.[82] It also enables a society to quickly absorb any shock.[83]

Understanding the role of geopolitics. Energy and geopolitics are closely related, especially in the reality of the energy transition. Though the previous century determined the winner by the accessibility of energy resources, this century is marked by several changes in energy patterns.[84] Energy has an enormous impact

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[76] R. Karim *et al.*, "Nuclear Energy Development in Bangladesh: A Study of Opportunities and Challenges," *Energies* 11, no. 7 (June 27, 2018): 1672, https://doi.org/10.3390/en11071672.

[77] M.I. Hosan, "Radioactive Waste Classification, Management and Environment," *Engineering International* 5, no. 2 (2017): 53–62, https://doi.org/10.18034/ei.v5i2.178.

[78] P.K. Bhowmik, S. Barua and S. Barua, "Prospect of Nuclear Power Plant in Bangladesh," Institute of Engineers Bangladesh (IEB) Dhaka, Bangladesh: www.researchgate.net, 2012, https://www.researchgate.net/publication/269984728_Prospect_of_Nuclear_Power_Plant_in_Bangladesh.

[79] Karim *et al.*, "Nuclear Energy Development in Bangladesh: A Study of Opportunities and Challenges."

[80] Karim *et al.*, "Nuclear Energy Development in Bangladesh."

[81] V. Yilanci *et al.*, "Energy diversification and economic development in emergent countries: Evidence from fourier function-driven bootstrap panel causality test," *Frontiers in Energy Research* 9 (2021): 632712, https://doi.org/10.3389/fenrg.2021.632712.

[82] "What is the energy mix?," Planete Energies, Total Energies Foundation, 2021, https://www.planete-energies.com/en/media/article/what-energy-mix.

[83] Energy education, "Energy diversification," n.d., retrieved July 3, 2023, https://energyeducation.ca/encyclopedia/Energy_diversification#cite_note-2.

[84] C. Pascual, "The New Geopolitics of Energy," *Center on Global Energy Policy*, 2015, https://legacy-assets.eenews.net/open_files/assets/2015/09/15/document_cw_01.pdf.

on development, security, environment, economy, and even the rise of great powers, alliance formation, or conflicts.[85] According to the Power Transition Theory, these achievements could fuel to challenge of the hegemonic power by a great power.[86] Again, the concept of Deterrence Theory has also failed to restrict the technology within European powers as its purpose also grows dim to be confined within traditional security purposes.[87] However, the geopolitics of energy has been considered a crucial driving factor in global security and prosperity while the energy transition introduces additional geopolitical challenges.

Energy has become symbolic of 21st century geopolitics[88] where nuclear power offers high energy density with a low carbon footprint. Since the technology of nuclear energy was invented, it has played a significant role in global affairs. Its technological challenges have kept it from being the dominant factor in the global energy mix so far. Hence, geopolitical issues lie at the heart of this strategic problem.[89] Recently, the global nuclear energy industry has become highly diverse and vibrant in a market that is dominated by the state-owned companies of Russia. This puts the nuclear industry of advanced industrialized countries under noteworthy pressure to remain competitive.[90] The Neoliberalist Theory of Energy Security, though states are unable to control energy price, it may affect significantly on global energy system by its choice to fulfill their needs.[91] The nuclear power plant in Bangladesh is a part of an international expansion project of the Rosatom State Nuclear Energy Corporation[92] (Rosatom) to include entrants to the civil nuclear sector. Asia is considered as the "Kremlin's pivot to the East" and Rosatom's primary target as the region faces rapid growth of energy demand.[93] To meet the

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[85] S. Tagliapietra, "The Geopolitical Implications of the Global Energy Transition," www.bruegel.org, Green Economy, 2019, https://www.bruegel.org/2019/03/the-geopolitical-implications-of-the-global-energy-transition/.

[86] D. Lai, "The power transition theory, THE UNITED STATES AND CHINA IN POWER TRANSITION," Strategic Studies Institute, US Army War College, 2011, 5–28, https://www.jstor.org/stable/resrep12113.7.

[87] *Security and development: The two sides of nuclear technology* (November 30, 2007), https://www.iaea.org/newscenter/statements/security-and-development-two-sides-nuclear-technology.

[88] "The Geopolitics of Energy," in *Axis of Convenience,* ed. B. Lo (Brookings Institution Press, 2018).

[89] N. de Blasio and R. Nephew, *The Geopolitics of Nuclear Power and Technology* (New York: Center on Global Energy Policy, 2017), https://energypolicy.columbia.edu/sites/default/files/The%20Geopolitics%20of-%20Nuclear%20Power%20and%20Technology%20033017.pdf.

[90] J. Nakano, "The Changing Geopolitics of Nuclear Energy: A Look at the United States, Russia, and China," Center for Strategic and International Studies, 2020, https://www.csis.org/analysis/changing-geopolitics-nuclear-energy-look-united-states-russia-and-china.

[91] L. Proskuryakova, "Updating energy security and environmental policy: Energy security theories revisited," *Journal of Environmental Management* 223 (2018): 203–214, https://doi.org/10.1016/j.jenvman.2018.06.016.

[92] "Rosatom State Atomi Energy Corporation ROSATOM Global Leader in Nuclear Technologies Nuclear Energy," accessed January 5, 2022, https://rosatom.ru/en/press-centre/news/rosatom-develops-cooperation-with-the-republic-of-bangladesh/?sphrase_id=2580001.

[93] Oxford Analytica Daily Brief, "Russia's Nuclear Plans Match Profit with Politics," 2018, https://dailybrief.oxan.com/Analysis/DB236119/Russias-nuclear-plans-match-profit-with-politics.

rising yearly electricity demand (7% increase yearly) and control environmental issues, Bangladesh decided to explore the nuclear option (the first contribution is expected in 2023 and will achieve approximately 7 GWe by 2041).[94]

Currently, Russia has become a dominant exporter of nuclear goods and services for both the traditional markets and any newcomers while considered as the world leader in fast neutron reactor technology.[95] Its resurrection of the last decade (2018's overseas orders were $133.2 billion)[96] after the setback of 1986 (the accident in Chernobyl)[97] was remarkable. Unlike traditional powers, Rosatom offers an integrated structure that helps them to get connected with overseas clients in changing market conditions. Another noteworthy approach of Russia is the spent fuel takeback that makes it attractive to countries with limited fuel management systems[98] and helps to safeguard against proliferation.

Russia's energy sector represents its political power and geopolitical influence while considered the pillar of its foreign policy and global status. In addition, Rosatom's connections with high authority (as the sole player in Russia's nuclear energy sector, key personnel, with objectives set by Russian President,[99] and, Russian laws increasing their political authority)[100] proves that "it is less of a corporate entity than the country's nuclear industry itself".[101] It has a long tradition of exploiting energy relations to achieve economic and political influence; for example, the project of the South Steam gas pipeline.[102] The international communities

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[94] World Nuclear Association, "Nuclear Power in Bangladesh," 2021, https://world-nuclear.org/information-library/country-profiles/countries-a-f/bangladesh.aspx.

[95] World Nuclear Association, "Nuclear Power in the World Today."

[96] Rosatom, "State Atomic Energy Corporation Rosatom Performance in 2018," 2018, https://www.report.rosatom.ru/go_eng/go_rosatom_eng_2018/go_eng_2018.pdf.

[97] "Chernobyl | Chernobyl Accident | Chernobyl Disaster - World Nuclear Association," accessed January 5, 2022, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx.

[98] N. Jawerth, "Under One Roof: Russia's Strategy for Spent Fuel Management," IAEA, August 2, 2019, https://www.iaea.org/newscenter/news/under-one-roof-russias-integrated-strategy-for-spent-fuel-management.

[99] N. Schepers, "Russia's Nuclear Energy Exports: Status, Prospects and Implications," EU Non-Proliferation and Disarmament Consortium, Non-Proliferation and Disarmament Papers, no. 61, 2019, https://www.nonproliferation.eu/wp-content/uploads/2019/03/EUNPDC_no-61_FINAL.pdf.

[100] "Russian Law Increases Rosatom's Political Authority," World Nuclear News, 2017, https://www.world-nuclear-news.org/NP-Russian-law-increases-Rosatoms-political-authority-28121701.html.

[101] Nakano, "The Changing Geopolitics of Nuclear Energy."

[102] J. Lough, "Russia's Energy Diplomacy," Chatham House, 2011, https://www.chathamhouse.org/sites/default/files/19352_0511bp_lough.pdf.

believe such a role will determine its geopolitical influences which caused anxiety as soon as the Rosatom's global presence was seen.[103]

Russia lockdowns countries and their market options through their nuclear strategy. Russia actively provides technical training that helps them to create a further network.[104] It helps them to get connected with technical experts as well as policymakers who are familiar with the Russian system and may prefer Russian projects in the future. Additionally, they are "locking out the competition" through their aggressive signing agreement that is more concentrated than Memorandum of Understanding (MoU).[105]

The Western concept always finds a close connection between Rosatom's nuclear power export and the geopolitical agenda of Russia often causing tension on other issues.[106] For example, in Turkey which has high strategic value to Russia, Rosatom's nuclear project has created complications in its relationship with the USA.[107] It frequently uses its energy resources to control its rivals. For instance, Russia has cut down Ukraine's gas supply several times.[108] It is suspected to use its nuclear power projects to "build spheres of energy dependence".[109] Such ventures are seen as a framework for further collaboration. For example, an arms agreement has been signed with Bangladesh parallel with the National Power Plant (NPP) project.[110] In 2017, turkey signed a $2.5 billion agreement to buy missile batteries while Russia is not their usual arms supplier.[111]

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[103] N. Minin and T. Vlcek, "Determinants and Considerations of Rosatom's External Strategy," *Energy Strategy Reviews* 17 (September, 2017): 37–44, https://doi.org/10.1016/j.esr.2017.07.001.

[104] E. Conant, "Russia's New Empire: Nuclear Power," Pulitzer Center, 2013, https://pulitzercenter.org/stories/russias-new-empire-nuclear-power.

[105] P. Murphy, "The Bear and the Dragon: The Competitive Challenges and Strategic Implications of Russian and Chinese Civilian Nuclear Deal-Making," Centre for Strategic and International Studies (CSIS) workshop, Washington, DC (December 10, 2019), 11.

[106] Schepers, "Russia's Nuclear Energy Exports: Status, Prospects and Implications."

[107] "Undue Influence: The Significance of Turkey's First Nuclear Power Plant," Power Technology, 2018, https://www.power-technology.com/features/undue-influence-significance-turkeys-first-nuclear-power-plant/.

[108] N. MacFarquhar, "Gazprom Cuts Russia's Natural Gas Supply to Ukraine," *The New York Times*, June 16, 2014, World, https://www.nytimes.com/2014/06/17/world/europe/russia-gazprom-increases-pressure-on-ukraine-in-gas-dispute.html.

[109] M. Freeman, "How Russia, China Use Nuclear Reactors to Win Global Influence," Defense One, 2018, https://www.defenseone.com/ideas/2018/07/china-and-russia-look-dominate-global-nuclear-power/149642/.

[110] S. Blank, "What Do Russia's Arms Sales to Bangladesh Mean?," Jamestown, *Eurasia Daily Monitor* 10, no. 17 (2013), https://jamestown.org/program/what-do-russias-arms-sales-to-bangladesh-mean/.

[111] T. Gumrukcu and E. Toksabay, "Turkey, Russia Sign Deal on Supply of S-400 Missiles," *Reuters*, December 29, 2017, Aerospace and Defense, https://www.reuters.com/article/us-russia-turkey-missiles-idUSKBN1EN0T5.

Russia has also been accused of inducing Russian presence and assets in regions of strategic importance.[112] These kinds of geopolitical involvement can be described as 'great power struggles' or 'new great game'[113] Russia's offer to not only build but finance and operate nuclear power plants is very exclusive for many countries, particularly those that do not have much economic strength or deficiency in the electricity sector, which is difficult to refuse.

The most vital geopolitical context of Bangladesh is its unique location. The prospect of serving as "a trade corridor and energy corridor in SAAARC, may find it lucrative for various regional and global powers.[114] The country's substantial setting with India's geostrategic frontier and close location to China has made it important to big powers. Russia has now acquired the capacity to encounter Western influence from every strategic region including South Asia where Bangladesh can be counted historically and obviously[115] as a part of it.

Russia's strategic intentions and Bangladesh's urge for a strategic partnership creates this match. Russia requires its strategic footing in important places including South Asia while trying to include more countries under its strategic bandwagon[116] using demands for energy. Bangladesh is looking for a strategic partnership with a big global power for security enhancement and development. Here, Russia has become a much better option with nuclear energy so that the country may increase its power with a solution to the energy problem.

Russia is considered the ideal partner for Bangladesh to obtain nuclear technology because of the more affordable price and facilities it provides. These other facilities include government loans with low payment rates for longer terms, equipment, and technical assistance.[117] According to Eve Conant, the "build-own-operate" (BOO) service is offered by Rosatom which is similar to the one-stop-shop concept and is "offered by no other country."[118]

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[112] N. Gallucci and M. Shellenberger, "Will the West Let Russia Dominate the Nuclear Market?," August 3, 2017, https://www.foreignaffairs.com/articles/russian-federation/2017-08-03/will-west-let-russia-dominate-nuclear-market.

[113] E. Ersen and M. Çelikpala, "Turkey and the Changing Energy Geopolitics of Eurasia," *Energy Policy* 128 (May, 2019): 584–92, https://doi.org/10.1016/j.enpol.2019.01.036.

[114] B.K. Bala, M.S. Alam and N. Debnath, "Energy Perspective of Climate Change: The Case of Bangladesh," *Strategic Planning for Energy and the Environment* 33, no. 3 (January, 2014): 6–22, https://doi.org/10.1080/10485236.2014.10781518.

[115] M.M. Rahman, "Does Russia Fit into Bangladesh's Geopolitical Matrix?," *The Daily Star*, May 28, 2011, https://www.thedailystar.net/news-detail-187478.

[116] Rahman, "Does Russia Fit into Bangladesh's Geopolitical Matrix?."

[117] R.K. Byron and F. Rahman, "Nuclear power plant to cost $13.5b," *The Daily Star*, October 28, 2015, https://www.thedailystar.net/frontpage/nuclear-power-plant-cost-135b-163351.

[118] E. Lecavalier, "Russian nuclear power: Convenience at what cost?," *Bulletin of the Atomic Scientists*, 2015, https://thebulletin.org/2015/10/russian-nuclear-power-convenience-at-what-cost/.

Investigating nuclear technology is a step toward energy diversity, which will lessen reliance on specific energy sources. Having failed to explore the sea bed of the Bay of Bengal, Bangladesh must rely on other nations for the import of oil. The arrangement of cross-border energy commerce by Bangladesh during the past decade has increased the vulnerability of the neighboring state.

Bangladesh's requirement is far more than nuclear technology. To meet the growing energy demand, the country will need to import oil and gas. As an energy exporter, the energy situation of Bangladesh is not unknown to Russia, and could be considered as a valuable consumer. This is the key source of Russian foreign exchange earnings. Moreover, through the relationship with Russia, Bangladesh may obtain more trade opportunities and expand its export items. Additionally, Russia is now facing labor shortages due to a declining population[119] whereas Bangladesh has abundant human capital that can be exported.

The presence of an arms race in South Asia and regional disputes is the undeniable reality of Bangladesh. Russia was revealed as a top arms supplier in Southeast Asia (US $6.6 billion sold between 2010 and 2017)[120] and in particular the "tripartite arms race" has made it a significant market. This works as an incentive for Bangladesh to improve its military capability and maintain its connection with powerful actors.

The geographical closeness and experience of nuclear technology have connected India with Bangladesh in this issue of nuclear energy.[121] Bangladesh has a lack of nuclear experience and expertise as a new consumer of nuclear energy while India doesn't. Additionally, they have their experience with Russian technology.[122] The close relationship as a neighboring country and India's previous connection with Russian technology might play a role here.[123] However, the involvement was criticized as India doesn't have any prior experience is equipment export.[124]

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[119] D. Pinchuk and M. Kiselyova, ""No Miracles": Labor Shortage Set to Hit Russia's GDP," *Reuters*, October 3, 2017, Summit News, https://www.reuters.com/article/us-russia-labour-demography-idUSKCN1C80CY.

[120] M. Tobin, "How Southeast Asia Fell into Russian Arms," *South China Morning Post*, October 12, 2019, https://www.asiaone.com/asia/how-southeast-asia-fell-russian-arms.

[121] A.S.M. Ali Ashraf and M.S. Islam, "Explaining Public Policy Choices: A Case Study of the First Nuclear Power Plant in Bangladesh," *Strategic Analysis* 42, no. 5 (September 3, 2018): 503–23, https://doi.org/10.1080/09700161.2018.1523076.

[122] M. Ahsan, "Bangladesh Readies Deals to Involve India," *New Age*, 2017, https://www.newagebd.net/article/29905/bangladesh-readies-deals-to-involve-india.

[123] D.R. Chaudhury, "India, Russia, Bangladesh Sign Tripartite Pact for Civil Nuclear Cooperation," *The Economic Times*, March 1, 2018, https://economictimes.indiatimes.com/news/defence/india-russia-bangladesh-sign-tripartite-pact-for-civil-nuclear-cooperation/articleshow/63127669.cms.

[124] Ashraf and Islam, "Explaining Public Policy Choices: A Case Study of the First Nuclear Power Plant in Bangladesh."

Thus, these external geopolitical contexts are included in the nuclear energy issue and influence it constantly. Ignoring such important context may lead to mistakes in understanding the actual situation.

Internal political agendas play a vital role in the state's decision-making where the goal is to achieve complex internal and external objectives. The leader must play a "two-level game between domestic and international"[125] while any kind of political system is motivated by two goals; retaining political power and maintaining policy coalitions.[126] They are so important that in case of conflict between the two interests (internal and international), the government emphasizes it.[127] In the case of adopting nuclear energy for Bangladesh, they undoubtedly play a significant role by influencing the key decision-makers of the country. However, the possibility of imprudent policy might be high if the choice is driven by security options instead of political ones.[128]

The present government in Bangladesh is frequently accused of becoming "authoritarian"[129] or a "dictatorship in democratic style"[130] due to its total control over state machinery and the politics of the country. The classical concepts of political parties also reveal the general "built-in tendencies of such organization to be autocratic".[131] It is also claimed that this framework might work as a significant element in nation-building if it is well-structured and committed to society.[132]

Nuclear energy is considered to play a crucial role in maintaining political stability and accelerating strong economic growth[133] while providing the dominant

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[125]Z.Z. Hussain, "The Effect of Domestic Politics on Foreign Policy Decision Making," E-International Relations (blog), February 7, 2011, https://www.e-ir.info/2011/02/07/the-effect-of-domestic-politics-on-foreign-policy-decision-making/.

[126]L. Neack, *The New Foreign Policy: Power Seeking in a Globalized Era*, 2nd ed., New Millennium Books in International Studies (Lanham, Md: Rowman & Littlefield Publishers, 2008).

[127]B. Farnham, "Impact of the Political Context on Foreign Policy Decision-Making," *Political Psychology* 25, no. 3 (June, 2004): 441–63, https://doi.org/10.1111/j.1467-9221.2004.00379.x.

[128]E.N. Saunders, "The Domestic Politics of Nuclear Choices—A Review Essay," *International Security* 44, no. 2 (October, 2019): 146–84, https://doi.org/10.1162/isec_a_00361.

[129]A. Riaz, "Bangladesh's Authoritarian Shift," *East Asia Forum* (January 17, 2020), https://www.eastasiaforum.org/2020/01/18/bangladeshs-authoritarian-shift/.

[130]D. Hossain, "Dictatorship in the Form of Democracy in Bangladesh," *New Age*, 2018, https://www.newagebd.net/article/56945/dictatorship-in-the-form-of-democracy-in-bangladesh.

[131]R. Michels, *Political parties; a sociological study of the oligarchical tendencies of modern democracy* (New York: Dover Publications, 1959); Cited in R. Jahan, "Political Parties in Bangladesh," Centre for Policy Dialogue, August 19, 2014, https://cpd.org.bd/cpd-cmi-paper-8-political-parties-in-bangladesh/.

[132]M. Monyani, "One Party State: Is It Good or Bad for Governance?," E-International Relations (blog), May 25, 2018, https://www.e-ir.info/2018/05/25/one-party-state-is-it-good-or-bad-for-governance/.

[133]E. Laws, "Dominant Party Systems and Development Programming," GSDRC, 2016, https://gsdrc.org/publications/dominant-part-systems-and-development-programming/.

party the ability to create a stable situation[134] that is more powerful than any Democratic party.[135] It is effective for a dominant political leader to emerge as a strong development proponent as it causes strong economic performance.[136] Bangladesh's current government-dominated political condition favored the selection of nuclear energy to secure the ongoing development process. The country is going to face several complex situations in the near future regarding population explosion, energy shortage, rapid development, environmental crises, and so on. The current political setting provides the government with significant decision-making power with executing capacity due to its pattern. This much more powerful position of the government is rare in the history of Bangladesh. Such an opportunity might work as a push to the central leaders to solve the upcoming inevitable problem of energy.

One of the key motivations of the decision-making of every political party is to retain political power where the decision of adopting a nuclear option is used as a very powerful tool.[137] Access to nuclear energy is considered to provide energy security as well as the assurance of the future development agenda to the people in this country.

Hence, it is assumed to have the political interest of the national leader. Ensuring energy security[138] is an effective way to maintain party popularity. Bangladesh has a long electoral history[139] and national leaders must ensure people's support to ensure governance (as Awami League[140] is proved to be the most favored among the poor citizens above the other political parties, where the majority of citizens emphasized energy security or access rather than climate change or nuclear waste).[141] Citizens usually use information about the party's position on issues to determine their position.[142] However, the Awami League is often challenged for its capacity.[143]

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[134] *Uncommon Democracies: The One-Party Dominant Regimes*, eds. T.J. Pempel *et al.* (Ithaca: Cornell University Press, 1990); Cited in Laws, "Dominant Party Systems and Development Programming."

[135] A. Arian and S.H. Barnes, "The Dominant Party System: A Neglected Model of Democratic Stability," *The Journal of Politics* 36, no. 3 (August, 1974): 592–614, https://doi.org/10.2307/2129246.

[136] D. Booth, *Development as a Collective Action Problem: Addressing the Real Challenges of African Governance* (London: Overseas Development Institute, 2012).

[137] Neack, *The New Foreign Policy: Power Seeking in a Globalized Era*.

[138] Ashraf and Islam, "Explaining Public Policy Choices."

[139] Jahan, "Political Parties in Bangladesh."

[140] "Journey of Bangladesh Awami League (1949–2016)," accessed January 5, 2022, https://publication.albd.org/Journey-of-Awami-League-1949-2016/#p=24.

[141] S. Uttom and R. Rozario, "Rise of Bangladesh's Awami League," ucanews.com, UCA News, 2019, https://www.ucanews.com/news/ rise-of-bangladeshs-awami-league/85552.

[142] "Elite Cues and Political Decision Making," in *Political Decision-Making, Deliberation and Participation*, 1st ed., ed. M.X. Delli Carpini, Research in Micropolitics (Amsterdam: Jai, 2002), 6.

[143] F.R. Raju, "Awami League Facing Serious Problems Maintaining Discipline," *Dhaka Tribune* (September 3, 2019), https://www.dhakatribune.com/bangladesh/politics/2019/09/03/awami-league-facing-serious-problems-maintaining-discipline.

In this circumstance, a lack of energy security will lead to public unrest and erode the government's standing while successfully extending energy production will enhance her popularity and chance to be re-elected.[144]

Energy is a crucial element of the international community, not only for its uses and demand but also for the politics involved in it. It has long been used as a tool of manipulation to gain different advantages. For example, as outlined previously, Russia has a history of using energy as a weapon.[145] However, energy relations can also act as a shield due to the existing relationship between the supplier and the consumer.[146] In a monopoly market, this relation causes political leverage that may prevent outside interference or ensure regime survival. Bangladesh is eager to develop economic relationships with key global powers through this relationship. It attempts to consolidate power and develop a well-equipped military force. For example, Bangladesh is seeking Russian support to resolve the Rohingya crisis[147] and also planning to get more global powers involved.

According to the Global Soft Power Index 2020, Bangladesh is ranked low (57th out of 60) which is detrimental as soft power is vital in international diplomacy.[148] As an alternative, Bangladesh is using its energy relations to achieve international political goals. For instance, Bangladesh is building 1,320 MW Payra coal-fired power plants by collaborating with Chinese firms.[149] The Meghnaghat 450MW combined-cycle gas-fired power plant was built by US-based Applied Energy Service (AES) Corporation and Bangladesh Power Development Board (BPDB) that was sold to UK company CDC Globeleq in 2003 and again to the Malaysian-based Pendekar Group in 2007.[150] The Haripur Power Plant was built with the assistance of Japan[151] and the Rampal Power Plant with the collaboration of India.[152]

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[144] Rooppur NPP Interviewee, cited in Ashraf and Islam, "Explaining Public Policy," 2017.

[145] G. Collins, *Russia's Use of the "Energy Weapon" in Europe,* Baker Institute, 2017, https://www.bakerinstitute.org/media/files/files/ac785a2b/BI-Brief-071817-CES_Russia1.pdf.

[146] R. Korteweg, European Parliament, and Directorate-General for External Policies of the Union, "Energy as a Tool of Foreign Policy of Authoritarian States, in Particular Russia," 2018.

[147] "Bangladesh 10 Notches down in Happiness Index, Ranks 125th," *The Financial Express*, 2019.

[148] M. Hossain and M. Bhuiyan, "Bangladesh Least Influential Country," The Business Standard, February 27, 2020, https://www.tbsnews.net/bangladesh/bangladesh-least-influential-country-48577.

[149] Liu, "First Unit of China-Funded Bangladesh's Mega Power Plant Goes into Operation Successfully," Asia and Pacific, 2020, http://www.xinhuanet.com/english/2020-01/14/c_138703819.htm#:~:text=Xi's Time-,First unit of China%2Dfunded Bangladesh's mega,plant goes into operation successfully&text=DHAKA, Jan.,has gone into operation successfully.

[150] Power Technology, "Meghnaghat Combined Cycle Gas-Fired Power Plant, Meghnaghat," 2020, https://www.power-technology.com/projects/meghnaghat/.

[151] JICA, "Activities in Bangladesh," accessed October 29, 2021, https://www.jica.go.jp/bangladesh/english/activities/activity06.html.

[152] "Indian Firm Wins Contract to Build Rampal Power Plant," *The Daily Star*, February 23, 2016.

Bangladesh's energy relations usually extend further with economically beneficial agreements. In the case of Bangladesh's nuclear energy agreement, another diverse contract can be followed. For example, in 2011 Rosatom signed the agreement with Bangladesh to build two nuclear power plants, in 2016 the bilateral trade volume exceeded $1.4 billion, and in 2017 an Intergovernmental Commission on Trade, Economic, Scientific and Technical Cooperation was signed.[153] Moreover, there are also arms agreements, as Russia also granted a $1 billion loan to Bangladesh to buy Russian arms.[154]

Therefore, as outlined in the sections above, the internal agendas influence the state's decision-making process. To create policies and understand the consequences, it is useful to look into the internal agendas.

Discussion

Understanding transmission factors

Transmission is a complex concept with a diversity of meanings. It is generally defined as the act of passing something from one component to another. Here, it is used to pass the technology of nuclear energy to those countries that do not possess it yet. The nuclear power industry was always concentrated where 22 countries owned 90% of the total nuclear power plants[155] and now the world is facing steady growth in nuclear power.[156]

In this decade, Russia has become the dominant exporter of nuclear technology as previously outlined and its initiatives have contributed to transmitting nuclear energy into the energy system of the developing world.[157] Though Bangladesh is a small economy (105th globally),[158] the driving factors are vividly existing here. With a serious deficit in the technology sector and a poor maintenance history, Russia's offer has made the dream of Bangladesh come true.

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[153] Embassy of the Russian Federation in the People's Republic of Bangladesh, "Bilateral Relations," accessed October 29, 2021, https://bangladesh.mid.ru/bilateral-relations.

[154] TASS, "Russia to Issue $1bln Loan to Bangladesh to Buy Russian Arms," accessed October 29, 2021, https://tass.com/archive/688328.

[155] B.K. Sovacool, "The Politics of Nuclear Power and Waste Storage in Asia," n.d., https://www.gu.se/digitalAssets/1291/1291657_Sovacool__paper_.pdf.

[156] Z. Ming *et al.*, "Nuclear Energy in the Post-Fukushima Era: Research on the Developments of the Chinese and Worldwide Nuclear Power Industries," *Renewable and Sustainable Energy Reviews* 58 (May, 2016): 147–56, https://doi.org/10.1016/j.rser.2015.12.165.

[157] S. Thomas, "Russia's Nuclear Export Programme," *Energy Policy* 121 (October, 2018): 236–47, https://doi.org/10.1016/j.enpol.2018.06.036.

[158] "Bangladesh's Economy Is Soaring - Here's Why," *World Economic Forum*, accessed October 29, 2021, https://www.weforum.org/agenda/2019/11/bangladesh-gdp-economy-asia/.

Among the driving factors, part of them is highly emphasized while a few are least discussed yet salient. Though it is important to consider every aspect while planning for foreign projects,[159] the rising concerns[160] are highly ignored.

High-lighted factors of nuclear energy transmission. Energy access is accepted as a crucial factor as more than 11% of the global population do not have it.[161] One of the key agendas of the sustainable development goals (SDGs)[162] (goal seven)[163] is closing this gap while energy subsidies in developing countries have become a burden.[164] Increasing energy access is considered as the way out of poverty as well as the basis of economic, international, and diplomatic development.[165] It is also essential to achieve basic social needs and is assumed as the key driver of economic growth, poverty reduction, and income equality.[166] Thus, in order to meet the increasing demand, nuclear energy has been chosen by populous countries like Bangladesh.

Energy is the primary precondition for development. 30 countries have recently shown interest in exploring nuclear energy and most of them are emerging.[167] This necessity of this has put energy at the heart of the countries' development strategies.[168] In Bangladesh, the decision to take the nuclear option is highly motivated by developmental factors.

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[159] A. Guseva and M. Koptelov, "Risk Assessment of Prospective Investment Projects for the Construction of Nuclear Power Plants Abroad," *International Journal of Engineering & Technology* 7, no. 2.23 (April 20, 2018): 251, https://doi.org/10.14419/ijet.v7i2.23.11953.

[160] "Rooppur Nuclear Power Plant: Unsafe, Not Viable!," *BdNews 24*, July 10, 2013, https://opinion.bdnews24.com/2013/07/10/rooppur-nuclear-power-plant-unsafe-not-viable/.

[161] World Nuclear Association, "World Energy Needs and Nuclear Power," 2021, https://world-nuclear.org/information-library/current-and-future-generation/world-energy-needs-and-nuclear-power.aspx.

[162] United Nations, Department of Economic and Social Affairs, *THE 17 GOALS | Sustainable Development*, accessed January 5, 2022, https://sdgs.un.org/goals.

[163] United Nations Development Programme, "Goal 7: Affordable and Clean Energy, Sustainable Development Goals," accessed January 6, 2022, https://www.my.undp.org/content/malaysia/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html?utm_source=EN&utm_medium=GSR&utm_content=US_UNDP_PaidSearch_Brand_English&utm_campaign=CENTRAL&c_src=CENTRAL&c_src2=GSR&gclid=Cj0KCQiAw9qOBhC-ARIsAG-rdn6iHja1Ke1I843O9Ssy2vztvMcM7Cfi3c24h0Db_BdVS5ozI6h5y-ioaAueSEALw_wcB.

[164] A.A. Farooquee, "Investing for Universal Energy Access," *The Journal of Private Equity* 21, no. 1 (November 30, 2017): 51–54, https://doi.org/10.3905/jpe.2017.21.1.051.

[165] M. Bazilian and R. Pielke, "Making Energy Access Meaningful," *Issues in Science and Technology* 29, no. 4 (2013): 74–78.

[166] S.A. Sarkodie and S. Adams, "Electricity Access, Human Development Index, Governance and Income Inequality in Sub-Saharan Africa," *Energy Reports* 6 (November, 2020): 455–66, https://doi.org/10.1016/j.egyr.2020.02.009.

[167] S. Krikoria, "IAEA Releases Country Nuclear Power Profiles 2017," March 15, 2018, https://www.iaea.org/newscenter/news/iaea-releases-country-nuclear-power-profiles-2017.

[168] G. Verlini, "Development and Nuclear Energy," June 15, 2010, https://www.iaea.org/newscenter/news/development-and-nuclear-energy.

Environmental concerns are the aspect that has made the transition urgent and influenced the nuclear decision. Bangladesh is especially vulnerable to climate issues not only because of its location but also because of its present atmospheric condition. It has been facing several extreme climate issues like erratic rainfall, floods, cyclones, salinity, rising water levels, and increasing temperatures frequently.[169] Heavily affected by pollution and environmental degradation, Bangladesh is now in a growth race[170] where compromising development cannot be the solution. So, the government seeks a way out through nuclear energy despite of its alarming concerns.

Energy security is considered the most attractive driver of nuclear energy in any country. The fear of future unavailability or unaffordability of fuel and its impact compels the countries to march towards nuclear energy despite the uncertainty. So, to secure energy security as well as maintain an unharmed environment, Bangladesh has opted to adopt nuclear energy.

Non-highlighted yet salient factors of nuclear energy transmission. States are major players in global politics and their behavior can better be clarified by understanding the international framework and the domestic context.[171] The global desire for the diversification of energy sources, aspiration to achieve the SDGs, and value in an environmental context are a few factors that fuel the recent resurgence of nuclear power.[172] As a member of the United Nations (UN) and as an active actor in current international politics and under the global United Nations Framework Convention on Climate Change (UNFCCC) obligation[173] Bangladesh is trying hard to achieve the SDGs[174] while acquiring requires uninterrupted power supply.[175]

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[169] M.A. Mojid, "Climate Change-Induced Challenges to Sustainable Development in Bangladesh," *IOP Conference Series: Earth and Environmental Science* 423, no. 1 (January 1, 2020): 012001, https://doi.org/10.1088/1755-1315/423/1/01200.

[170] World Bank, "For Higher Growth, Bangladesh Must Curb Environment Degradation and Pollution," accessed January 6, 2022, https://www.worldbank.org/en/news/press-release/2018/09/16/for-higher-growth-bangladesh-must-curb-environment-degradation-and-pollution.

[171] G.V.D. Kamp-Alons, "The State between Internal and External Pressure: Exploring the Impact of Power Structures at Different Levels of Analysis on State Preference Formation with Regard to Foreign Policy," *Undefined*, 2005, https://www.semanticscholar.org/paper/The-State-between-Internal-and-External-Pressure%3A-Kamp-Alons/52f2320610bd07f29ce79dc393072abf90857146.

[172] A. Adamantiades and I. Kessides, "Nuclear Power for Sustainable Development: Current Status and Future Prospects," *Energy Policy* 37, no. 12 (December, 2009): 5149–66, https://doi.org/10.1016/j.enpol.2009.07.052.

[173] "Bangladesh Pledges to Cut down Greenhouse Gas Emissions to 5%," *Dhaka Tribune*, April 17, 2019, https://www.dhakatribune.com/bangladesh/event/2019/04/17/bangladesh-pledges-to-cut-down-greenhouse-gas-emissions-to-5.

[174] S. Alam, "SDGs Implementation: Where Does Bangladesh Stand?," *The Financial Express*, 2019.

[175] M. Nilsson, P. Lucas and T. Yoshida, "Towards an Integrated Framework for SDGs: Ultimate and Enabling Goals for the Case of Energy," *Sustainability* 5, no. 10 (September 25, 2013): 4124–51, https://doi.org/10.3390/su5104124.

Energy's relationship with the state's internal politics is very intimated which could either bring stability or become a source of tension.[176] This is the salient reason for the recent resurgence of nuclear power.[177] Thus, in Bangladesh energy is highly related to internal peace that has played a vital role in exploring nuclear energy.

However, economic factors are the primary determining issue of nuclear energy.[178] Uninterrupted energy guarantees future growth whereas states often use energy relations to gain economic purposes. For Bangladesh, nuclear energy is expected to bring consistency in its economic growth along with connections with Russia- one of the great powers - as well as India, the neighboring power by which the country is surrounded. A relationship with Russia will provide internal and international support as well as economic support. For example, the bilateral trade volume in 2017 of the countries was $1.645 billion and they also seek direct market access.[179] For the Rohingya issue, Bangladesh is expecting Russia's "active and fruitful cooperation"[180] to engage Myanmar in the dialogue. Russia is also investing in Bangladesh's military development, education, infrastructural development, and so on.[181]

Regional factors usually play an important role in the state's decision-making process about nuclear energy as they may provide the context that encourages or discourages it. This region consists of developing countries with an insecure economy, vast populations, and alarming conflicts *inter alia.*[182] The nuclear policy preference can be seen if states find plausibility for security threats (non-traditional) of any kind.[183] South Asia is experiencing increasing nuclear capabilities.[184] In this region,

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[176] "Energy for Peace," International Peace Institute, May 29, 2013, https://www.ipinst.org/2013/05/en.

[177] Adamantiades and Kessides, "Nuclear Power for Sustainable Development: Current Status and future Prospects."

[178] K. Marvel and M.M. May, "Game Changers for Nuclear Energy," American Academy of Arts and Sciences, accessed October 30, 2021, https://www.amacad.org/publication/game-changers-nuclear-energy/section/8.

[179] "Bangladesh Seeks Direct Market Access from Russia," The Business Standard, November 14, 2019, https://www.tbsnews.net/economy/trade/bangladesh-russia-discuss-economic-cooperation.

[180] "Bangladesh Now Knocks on Russia's Doors Seeking Help in Rohingya Repatriation," South Asia Monitor, accessed January 6, 2022, https://www.southasiamonitor.org/bangladesh-bhutan/bangladesh-now-knocks-russias-doors-seeking-help-rohingya-repatriation.

[181] "50 Years of Russia-Bangladesh Bilateral Relations: Development, Assistance and Economic Ties," accessed January 6, 2022, https://m.theindependentbd.com/post/269853.

[182] H. Lecamwasam, "South Asia's Increasing Nuclear Capabilities," E-International Relations (blog), April 15, 2013, https://www.e-ir.info/2013/04/15/south-asias-increasing-nuclear-capabilities/.

[183] J.E.C. Hymans, *The Psychology of Nuclear Proliferation: Identity, Emotions and Foreign Policy* (Cambridge: Cambridge University Press, 2006), https://doi.org/10.1017/CBO9780511491412.

[184] N. Gunawardene, "Nuclear Energy Odds in South Asia," Asia & Pacific (blog), 2015, https://www.scidev.net/asia-pacific/column/nuclear-energy-odds-in-south-asia/.

India, China, and Pakistan have a growing nuclear arms program,[185] and Myanmar, Indonesia, the Philippines, Vietnam, Thailand, Laos, Cambodia, Malaysia, and Singapore are assumed to be the emerging nuclear energy countries.[186] Bangladesh's nuclear decision also can be described by cooperation. For instance, Bangladesh also connected with India through a nuclear agreement that is helping the country with its nuclear experience by supplying noncritical tools.

Nuclear technology is highly critical and effective but is difficult to achieve for developing countries. These difficulties are not only related to finance, but also security, risk, skilled manpower, infrastructure, and so on. It is undoubtedly lucrative to Bangladesh due to its offer from Rosatom with the whole structure and training included- all at a low cost which has made the offer undeniable for Bangladesh at the point of current high economic growth.

The international context regarding the game of great powers has a huge influence on nuclear energy transmission in Bangladesh. In the competition with great powers, Russia uses its energy relationship to gain might in the international arena. The geopolitical location of Bangladesh has made it significant and possesses so much to offer. The changed new nuclear market consists of new consumers along with new suppliers, with a developed model of technology where proliferation is less important to the consumer[187] and the supplier emphasizes geopolitics and economic issues.

All these factors have influenced the nuclear choice, all equally important. Without considering these salient factors, it is quite impossible to present the whole picture. Thus, to understand the situation, it is important to study the transmission with its factors as outlined above. This study has several limitations. For example, broad topics like transition, nuclear energy, bilateral relations, international support, and so on have been used frequently while it was impossible to bring their complete scenario.

Conclusions

The concept of the energy transition has become quite popular recently. With its uniqueness, energy security and environmental concerns are considered the most crucial factors while popular debates have made it quite complex to accomplish. The idea of nuclear power provides an alternative with a very intense energy source. Recently nuclear technology seems to have gained popularity, especially in the developing world despite its complicated records, like the possibility of accidents,

[185] E. Albert, Council on Foreign Relations, "Southern Asia's Nuclear Powers," 2015, https://www.cfr.org/backgrounder/southern-asias-nuclear-powers.

[186] "Nuclear Power Trend in Southeast Asia and Its Contested Discourses on Climate Change," Heinrich Böll Foundation, Southeast Asia Regional Office, Heinrich-Böll-Stiftung, accessed January 6, 2022, https://th.boell.org/en/2020/11/09/nuclear-power-trend-southeast-asia.

[187] Marvel and May, "Game Changers for Nuclear Energy."

misuses, or heavy management requirements. These countries have seen it as a mode of ensuring energy security, economic growth, and protection of the environment.

Energy has become a highly vigorous issue in Bangladesh when the country is facing rising energy demands with increasing population, rapid development, and the country's high aspirations. Energy security has become another hard reality in the rising trend of oil prices and depleting natural gas reserves where environmental issues have added further magnitude.

In this context, the transmission of nuclear technology in Bangladesh has been driven by several factors- some of them are highlighted often yet some of them are not. The highlighted factors are of utmost importance as the energy transition of states is mostly driven by these. The non-highlighted factors are also vital in this complex situation where international pressure is crucial, and states acting in global politics are bound by their circumstances to respond. The intimate relationship of energy with internal politics is also significant in influencing the decision to adopt a nuclear option.

Guseva and Koptelov stress on the importance of analyzing the planning of foreign projects properly[188] while a gap in acknowledging geopolitics and internal political agendas as an important driving factor has been noticeable in most literature. These factors have arisen partially with the challenges to the implementation of the project.

The current trend of the energy transition has demanded understanding it as it is connected with vital issues like the economy, stability, development, relations, and so on. The sensitivity of nuclear power also requires significant attention as well as the consideration of the consequences. Thus, it is essential to understand the decision-making process. The nuclear decision in Bangladesh is generally influenced by the transition factors like any other country while ignoring specific factors such as geopolitical and internal politics which may lead to a dearth of understanding of the process.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

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[188] Guseva and Koptelov, "Risk Assessment of Prospective Investment Projects for the Construction of Nuclear Power Plants Abroad."