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ROLE OF NUCLEAR ENERGY IN MITIGATING CLIMATE CHANGE IN PAKISTAN

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Climate change is one of the rising and defining challenges of the modern era. The 2023 Climate Change report from the International Panel on Climate Change (IPCC) highlights an increase of 1.1°C in the global surface temperature from 2011 to 2020, which is significantly higher than the pre-industrial levels. Climate change is exacerbating the existing environmental challenges, impacting many aspects of social life, and leading to growing levels of insecurity. This commentary draws out the security implications of climate change for vulnerable states like Pakistan, and argues how a transition to nuclear energy can build Pakistan's resilience to climate change.

The outcomes of climate change are widespread and are significantly impacting South Asia. Countries like India and Pakistan have been hit by extreme heatwaves, with temperatures soaring above 45°C. Studies have shown that, as a result of climate change, these countries are 30 times more likely to experience extreme heatwaves compared to other parts of the world. In 2022 Pakistan experienced devastating floods with nearly one third of the country being impacted by this disaster. In the aftermath of these flood, Pakistan has been ranked as one of the most vulnerable countries to climate change. Recurrent torrents have severely impacted Pakistan's infrastructure, communication lines and businesses. More critically, due to the fragile infrastructure and stagnant water in the affected areas, people have suffered from diseases like dengue, malaria and cholera.

The case for nuclear energy

It is in this context that Pakistan needs to reduce its reliance on fossil fuels, primarily coal, and focus instead on the use of cleaner energies to mitigate the disastrous effects of climate change. Nuclear energy is considered as a clean source of energy and one of the mitigating options for the climate change. Enhancing its indigenous civilian nuclear energy programme under the guidelines of the International Atomic Energy Agency

(IAEA) is beneficial for Pakistan for several reasons. First, Nuclear Power Plants (NPPs) do not produce any greenhouse gas (GHG) emissions during their operations. Second, the operating/installed NPPs have an 18-month operating life under a single load, resulting in high-capacity power generation, that can save fuel for several months. This assists in lowering the state's dependence on imported oil and gas. Renewable energy sources, including solar and wind power, are also clean energy sources, but they are slow-paced and are influenced by seasonal fluctuations and weather conditions. Similarly, hydropower for energy production is less cost-efficient, and more difficult to transmit in mountainous terrains. In addition to this, seasonal variations may result in water shortage, which can reduce power generation.

Third, transition to nuclear energy can reduce Pakistan's reliance on hydrocarbon energy for electricity production and yet fulfill the country's energy requirement with an uninterrupted electricity supply. Having more dependence on nuclear energy in the overall energy mix will help lowering Pakistan's reliance on fossil fuels that emit GHG. Pakistan's energy mix is comprised of multiple energy sources including hydropower, thermal, nuclear and renewables. According to Pakistan's economic survey of 2024, the total electricity generation remains 92,091 GWh with hydropower (31.7%), thermal (45.9%), nuclear power (18.2%) and renewables (4.3%) energy sources. The installed NPPs has contributed approximately 16,753 GWh of electricity. The monthly share remained between 12.8% to 25.8% of total electricity generation with an installed capacity of 3530 MW.

Concerns and roadblocks vis-à-vis nuclear energy

For many states, the dual-use nature of nuclear technology is a serious concern, including the fear of diverting materials or technology for the development of nuclear weapons. However, the IAEA has already imposed stringent mechanisms to ensure the peaceful use of nuclear energy. Any country that aspires nuclear technology for peaceful purposes is mandated to follow these IAEA guidelines. It assures comprehensive cooperation by its members in terms of security, safety and safeguards. In this context, Pakistan has an enhanced and secure safety mechanism. The installed NPPs in Pakistan are under the IAEA safeguards with an enabling environment in terms of safe and secure institutions and an empowered human resource.

As per the IAEA's basic guidelines, Pakistan has established a robust and comprehensive institutional infrastructure that overlooks each aspect of NPPs and related material. The Pakistan Nuclear Regulatory Authority (PNRA) functions as an independent regulatory body, dedicated to ensuring nuclear safety, radiation protection, emergency preparedness, safe transport, decommissioning of NPPs, and waste management. The Pakistan Atomic Energy Commission (PAEC) established in 1956, is responsible for research and development, execution of developmental projects in related domains including power projects for electricity generation. PAEC also carries out other functions related to the peaceful use of nuclear energy as agreed between the government and the commission.

PNRA and PAEC oversee the decommissioning of NPPs and the safe management of radioactive waste. In fact, the other organisations that overlooks the safe operations of NPPs in Pakistan include China's National Nuclear Cooperation (CNNC), National Electric Power Regulatory Authority (NEPRA), National Transmission and Dispatch Company Limited (NTDC), and Central Power Purchasing Agency (CCPA).

In 2005, Pakistan and the IAEA signed an agreement for Nuclear Security Cooperation to establish and sustain an effective nuclear security regime in the country. In 1994, Pakistan signed the Convention on Nuclear Safety (CNS) that is committed to uphold high safety standards for the peaceful uses of nuclear technology and to adhere to fundamental safety principles established for all Contracting Parties. Islamabad also adheres to IAEA's facility-specific INFIRC/66/Rev.2 standard safeguard agreement. The agreement ensures safeguards for all the nuclear research facilities/reactors and NPPs. Pakistan has also concluded other bilateral cooperation agreements with the National Nuclear Safety Administration (NNSA), Nuclear Safety and Radiation Protection Center (NSC), and China Nuclear Power Operations Technology Corporation Ltd. (CNPO) to seek assistance in regulatory matters, experience and development and training.

Yet, in order to utilize the full potential of nuclear energy, Pakistan faces roadblocks at the international level. Most importantly, the discriminatory behaviour of Export Control Regimes (ECRs) such as the Nuclear Suppliers Group (NSG), has handicapped Pakistan's ability to achieve its full potential to use nuclear energy for peaceful purposes. Pakistan has already applied for the NSG membership in 2016, with the purpose of removing these hurdles. To make it more conclusive, China has adopted the stance that countries outside the NSG should be dealt with a criteria-based approach. However, so far the NSG has not only failed to address Pakistan's case efficiently, but it has also failed to adopt a criteria-based approach. And this is clear through the decision to give India a special NSG wavier. Pakistan is also facing economic challenges in developing an indigenous nuclear technology programme for peaceful purpose. In this regard, Pakistan is trying to manage its resources for utilizing the full potential of nuclear technology for peaceful uses.

Climate change is a global threat. It cannot be mitigated without cooperation among states and support of established international regimes. In this regard, the international community is working for major transformations in the energy sector to push states to produce clean energy. The Conference of Parties (COP 27) established a loss and damage fund that aims to assist nations like Pakistan who are vulnerable to climate change. However, this fund is yet to be collected and distributed. The future COP conferences should focus on establishing a committee for the collection of funds through mutual consensus. This would indeed facilitate climate affected countries to develop and sustain a more enhanced, resilient and environmental structure, including building of NPPs for energy production.

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This commentary is also published on the APLN website.

ABOUT APLN

The **Asia-Pacific Leadership Network (APLN)** is a Seoul-based organisation and network of political, military, diplomatic leaders, and experts from across the Asia-Pacific region, working to address global security challenges, with a particular focus on reducing and eliminating nuclear weapons risks. The mission of APLN is to inform and stimulate debate, influence action, and propose policy recommendations designed to address regional security threats, with an emphasis on nuclear and other WMD (weapon of mass destruction) threats, and to do everything possible to achieve a world in which nuclear weapons and other WMDs are contained, diminished, and eventually eliminated.


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