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Book Review

ASSESSING THE DEVELOPMENT AND CHALLENGES IN PAKISTAN'S CIVIL NUCLEAR PROGRAMME

ZOYA AKHTER FATHIMA

INTRODUCTION

In March 2021, K-2, the second unit of the Karachi nuclear power plant was connected to Pakistan's electricity grid which increased the contribution of nuclear power in the electricity generation of the country from 5 per cent to 9 per cent.¹ This development is in accordance with Pakistan's energy policies which seeks to significantly scale up its nuclear power capacity over sixfold in the coming decade.² Pakistan's intensifying nuclear drive, however, has raised several pertinent concerns regarding the safety of its reactors and the chances of nuclear weapons proliferation, despite the civilian nature of its projects. In this context, the paper assesses the development of

Ms. **Zoya Akhter Fathima** is Research Associate at the Centre for Air Power Studies, New Delhi.

1. Manpreet Sethi, "China rides on Pak to further its nuclear power export ambitions", *Sunday Guardian Live*, April 3, 2021, <https://www.sundayguardianlive.com/opinion/china-rides-pak-nuclear-power-export-ambitions>. Accessed on April 5, 2021.
2. Omar Yusuf, "Pakistan Streamlines its National Nuclear Power Programme with IAEA Support", IAEA.org, February 13, 2020, <https://www.iaea.org/newscenter/news/pakistan-streamlines-its-national-nuclear-power-programme-with-iaea-support>. Accessed on January 10, 2021.

civil nuclear programme in Pakistan and its emerging challenges and analyses if these concerns hold any merit.

History and Development of Pakistan's Civil Nuclear Programme

In the 1950s when Pakistan developed its civil nuclear programme, it was a newly formed country with an impoverished economy, marked with growing population and major energy scarcity. The escalating energy crisis led Pakistan to explore sustainable energy sources. Considering the numerous benefits of nuclear power, Pakistan began to develop its civil nuclear programme at a slow but steady pace alongside other electricity generating technologies. The energy deficit however has been an endemic issue that the country has been facing till date, which has also been exacerbating Pakistan's ongoing economic crisis. The dependency on energy imports has been adding increasing pressure on the country's budgets and reserves. The energy deficit also has a direct impact on the GDP of the country as several industries have plummeted due to shortage of electricity. In 2015 it was estimated that Pakistan's GDP faced a loss of about 7 per cent due to lack of electricity.³ This further leads to problems of unemployment and rise in prices. As uninterrupted electricity supply is imperative for economic development, nuclear power began to gain prominence in Pakistan's energy policies. The development of civil nuclear power in Pakistan can be examined in the following phases.

Inception and Preparation (1950s-1960s)

Pakistan's nuclear power programme began in the year 1954, inspired by US President Dwight Eisenhower's "Atoms for Peace" speech. In 1955, the government announced its decision to set up an Atomic Energy Institute. Towards this end, the Atomic Energy Commission (PAEC) was established under the leadership of Dr. Nazir Ahmad. In 1959, I. H. Usmani, a physicist, replaced Dr. Nazir Ahmad, under whose leadership Pakistan was able to acquire its first 5-megawatt light water research reactor, the PARR-1, from the US in

3. Manpreet Sethi, "Energy Cooperation Under CPEC: Light at the End of the Tunnel?", *Pentagon Yearbook. South Asia Defense and Strategic Perspective*, 2009.

1962.⁴ Pakistan also received considerable help from other countries in developing its civil nuclear programme. For example, in 1965 Pakistan acquired the Karachi Nuclear Power Plant (KANUPP) from Canada's *Canadian General Electric* (CGE) which attained commercial operation in November 1972. Similarly, Pakistan also gained support from countries such as the US, France and the UK.

Withdrawal of International Support (1970s and 1980s)

The 1970s marked a period of increased hostility between India and Pakistan. Although Pakistan claimed that its interest in nuclear power was solely for peaceful purposes, Pakistani interest in developing nuclear weapons is also known. For example, Zulfikar Ali Bhutto, as foreign minister in General Ayub Khan's cabinet, had pressed for a nuclear weapons programme. However, he was unable to convince Ayub Khan. He voiced his interest in nuclear weapons again after Pakistan's defeat in the 1965 war against India, when he famously stated "*If India builds the bomb, we will eat grass or leaves, even go hungry, but we will get one of our own*".⁵ After Pakistan's defeat once again in the 1971 war against India, its aspirations to develop nuclear weapons were furthered. In 1972, Zulfikar Ali Bhutto directed top nuclear scientists of the country to build a nuclear bomb.⁶

In 1974 India conducted a peaceful nuclear explosion after which there was a withdrawal of international support and development of stricter controls to prevent the proliferation of nuclear weapons. Consequently, with rising concerns regarding Pakistan's interest in developing nuclear weapons, countries such as Canada and France withdrew their support from Pakistan. It was decided that nuclear cooperation would only be extended to signatories of the Nuclear Non-Proliferation Treaty (NPT) or to the countries that complied with full-scope safeguards.⁷ But since Pakistan did not agree to either of these conditions, vendor support to Pakistan was stopped in 1976. Pakistan had relied heavily on foreign assistance until then,

4. Shalini Chawla, *Nuclear Pakistan* (New Delhi: KW Publishers, 2012), pp. 2-3.

5. *Ibid.*, pp. 8-9.

6. Shalini Chawla, n. 4, p. 10.

7. Asma Khalid, "China-Pakistan Nuclear Energy Cooperation: History and Key Debates", *South Asian Voices*, February 12, 2021, <https://southasianvoices.org/china-pakistan-nuclear-energy-cooperation/>. Accessed on January 31, 2021.

thus when these countries backed out several challenges emerged. For example, they had no replacement parts or fresh fuel assembly supplies. Operation of KANUPP also significantly declined with the performance level of the reactor not exceeding 48 per cent.⁸

Period of Self-Reliance

Having no choice, this eventually led Pakistan to become more self-reliant in the matter of their nuclear programme. PAEC began to get better and more efficient at maintenance and operations of the plant, in manufacturing of spare parts and in the development of indigenous fuels. While Pakistan approached other countries to engage in nuclear commerce within the IAEA safeguards, these plans did not take off. Pakistan, however, began to receive limited external support from other organisations such as the CANDU Owners Group (COG) and the World Association of Nuclear Operators (WANO), as concerns of nuclear safety grew after the unfortunate 1979 Three Mile Island accident. This helped the PAEC in improving the performance levels of the KANUPP reactor. PAEC also began receiving technical assistance from the IAEA. The PARR-2 reactor which was commissioned in 1974 was built completely under the expertise of PAEC scientists. By 1980, PAEC was also able to achieve domestic proficiency in CANDU fuel assemblies.

The Beginning of the China-Pakistan Nuclear Cooperation

The only country that agreed to help develop Pakistan's nuclear energy programme was China with whom it signed an agreement in 1986 for the transfer of civil nuclear technology. Within this agreement, China agreed to provide Pakistan with nuclear reactors and other products and services related to nuclear technology. In 1993 China began the construction of Chashma Nuclear Power Plant-1 (CHASNUPP-1 or C-1). This 325 MWe reactor came under the IAEA safeguards and was based on the indigenously developed Qinshan-1 power plant by the Chinese. The reactor went critical in 2000. This agreement marked the first case of South-South technology transfer in the field of nuclear power.

8. Zia Mian and Abdul H. Nayyar, "Pakistan and the Energy Challenge", sgs.princeton.edu., <https://sgs.princeton.edu/sites/default/files/2020-01/mian-nayyar-2009.pdf>. Accessed on February 2, 2021.

After witnessing the successful operations of CHASNUPP-1, the Nuclear Regulatory Authority permitted PAEC to sign an agreement with China National Nuclear Corporation (CNNC) for the construction of another reactor, the CHASNUPP-2. The construction of this unit began in December 2005 and was completed in 2011. As energy demands rose, the Pakistani government instructed the PAEC to set up more nuclear power plants with a target to produce 8,800 MW of electricity by 2030.⁹ In 2015, during the historic visit of Chinese President Xi Jinping to Pakistan, Beijing pledged US\$ 46 billion for energy and infrastructure projects in Pakistan.¹⁰ While both China and Pakistan claim these projects through the China-Pakistan Economic Corridor (CPEC) as the cornerstone of friendship between the two countries, their alliance, however, seems to be driven more out of economic and geostrategic factors.

One of China's main motives is to ensure stability in Pakistan, so that it would by extension provide stability in its own neighbouring Xinjiang province. This is an important part of China's BRI strategy since China intends to build an oil storage facility and a refinery at Gwadar port to enable the transportation of oil, through road and pipelines, into mainland China through the Xinjiang province.¹¹

In addition, hefty aid and generous investments are analogous to Beijing's strategy that creates long-term financial and energy dependency on China. China in fact has been signing energy cooperation agreements with numerous countries in the world, in a move that is largely perceived to be an attempt at creating spheres of energy dependencies. China's interest in Pakistan is also speculated to cultivate a strategic partner in the region, as a part of its larger balance of power strategy in South Asia vis-à-vis

9. "Nuclear Power in Pakistan", World Nuclear Association, <https://www.world-nuclear.org/information-library/country-profiles/countries-os/pakistan.aspx#:~:text=Pakistan%20has%20a%20small%20nuclear,fuel%20cycle%2C%20using%20indigenous%20uranium>. Accessed on February 28, 2021.

10. Atika Rehman and Beth Walkerhow, "CPEC Projects Will Increase Pakistan's Reliance on Coal—And Emissions", *The Wire Science*, October 10, 2020, <https://Science.Thewire.in/Environment/Cpec-China-Pakistan-Military-Environment-Coal/>. Accessed on February 24, 2021.

11. Simi Thambi, "The Energy Dynamics of CPEC in China-Pakistan Relations", Niti.gov.in, June 20, 2017, https://www.niti.gov.in/niti/writereaddata/files/document_publication/The%20Energy%20Dynamics%20of%20CPEC%20in%20China-Pakistan%20Relations.pdf. Accessed on March 2, 2021.

India. For Pakistan, with its current economic situation and the diminishing foreign aid and US investments, Chinese support is immensely helpful, at least for the short term. In addition, with regard to nuclear commerce, it is the only country willing to help Pakistan. A common enemy in India also appears to be a motivating factor for the two countries. Interestingly, a list prepared as a part of a report on the Parliamentary Committee of CPEC of the ways in which CPEC can benefit Pakistan, number two on the list stated that it could be a “counterweight to India by countering Indian pressure with the support of China”.¹² As Pakistan began to boost its nuclear power programme, it demanded an agreement similar to the India-US civilian nuclear agreement signed in 2008, which lifted the sanctions against New Delhi and permitted nuclear trade. However, it gained no traction. Some analysts in this regard have debated that the nuclear cooperation which led to the construction of C-3 and C-4 units in Pakistan, were in fact in response to the US-India civil nuclear agreement of 2008.¹³

The last decade has witnessed significant progress in Pakistan’s nuclear power programme. Partnership with China burgeoned as Hualong One reactors are being planned for Pakistan’s nuclear programme. The construction for Chashma Nuclear Power Plant Unit 3, or C3, began in 2011 and was connected to the grid in 2016. The following year, in 2017, Chashma Nuclear Power Plant Unit 4 also went critical.¹⁴ In 2013, the Planning Commission also announced intentions to build 2 more reactors near the Karachi unit 1, namely, KANUPP-2 and 3. Presently, Pakistan has six operable commercial nuclear power reactors which have a combined capacity of 2,332 MWe. They contribute 7 per cent to the country’s total energy mix.¹⁵ Currently, Pakistan’s civil nuclear cooperation is supported only by China, though it does get IAEA support for the safety of its reactors. For example, in 2018, the IAEA initiated

12. Manpreet Sethi, n. 3, p. 113.

13. “Why China struck N-deal with Pak 4 days after Indo-US deal”, *The Hindustan Times*, June 29, 2010, <https://www.hindustantimes.com/india/why-china-struck-n-deal-with-pak-4-days-after-indo-us-deal/story-iE7Gh5dEe1lxBJ7VNnFWsM.html>. Accessed on February 25, 2021.

14. *Ibid.*

15. “Nuclear Power in Pakistan”, n. 9.

a four-year programme through which it would coordinate with Pakistan's key nuclear energy institutions in making operations safe and more reliable.¹⁶

CHALLENGES AND CONCERNS REGARDING PAKISTAN'S CIVIL NUCLEAR PROGRAMME

Amidst the expansion process, several concerns regarding Pakistan's nuclear programme have been raised. Although the size and capacity of Pakistan's nuclear programme is small, the apprehensions surrounding it are serious. Several of these pertinent concerns are:

Concerns of Nuclear Safety and Security

All commercial reactors in Pakistan work within the IAEA safeguards and most international nuclear monitors too have given Pakistan's nuclear programme satisfactory reviews. Their nuclear power plants are said to have additional safety features, such as fail-safe control rod drops, highly developed filtration system and double containment structures that are capable of enduring the impact of an aircraft crash.¹⁷

However, concerns of nuclear safety still exist considering that Pakistan has witnessed several nuclear related accidents in the past. In 1989, for example, KANUPP lost almost a third of the heavy water in its reactor due to a spillage which led to the shutting down of the reactor for several months.¹⁸ At the time, it was claimed that there had been several other spilling accidents which were hushed up.¹⁹ Again, in 2008 a gas leakage at a heavy water plant near the Khushab town killed two people.^{20, 21} In 2011 there was a nuclear emergency after

16. Rabia Javed, "Nuclear energy of Pakistan", *The Nation*, <https://nation.com.pk/28-May-2020/nuclear-energy-of-pakistan>. Accessed on February 27, 2021.

17. Tim Craig, "Outcry and fear as Pakistan builds new nuclear reactors in dangerous Karachi", *Washington Post*, March 5, 2015, https://www.washingtonpost.com/world/asia_pacific/outcry-and-fear-as-pakistan-builds-new-nuclear-reactors-in-dangerous-karachi/2015/03/05/425e8e70-bc59-11e4-9dfb-03366e719af8_story.html. Accessed on January 20, 2021.

18. Mian and Nayyar, n. 8.

19. Ibid.

20. Farhan Bokhari, "Nuke Plant Accident Kills 2 In Pakistan", *CBSNews.com*, April 8, 2008, <https://www.cbsnews.com/news/nuke-plant-accident-kills-2-in-pakistan/>. Accessed on March 2, 2021.

21. The nuclear facilities at Khushab are not subjected to IAEA safeguards unlike those at Karachi and Chashma, since it operates its fleet of military reactors there.

heavy water leaked from a feeder pipe to the reactor. Fortunately, no radiation was reported. These incidents along with Pakistan's unsafe industrial safety records paint an unreliable future with regard to nuclear safety. In the nuclear industry, safety is paramount and anything less than top-grade safety arrangements could prove to be dangerous.

As the nuclear energy cooperation between China and Pakistan develops, there have been rising concerns with regard to the kind of reactors being manufactured and supplied by China. Chashma-1 for example, which was built by the Chinese proved to have several problems. It was based on the Chinese indigenous model of Qinshan-1, which too had proven to be mired with faults. For example, because the Chinese were unable to fix the problem in their reactor's nuclear vessel it eventually had to be repaired by American engineers from Westinghouse.²²

In addition, the ACP-1000 reactors projects have been mired in other problems. For example, several activists had filed a lawsuit against the PAEC and the Pakistan Nuclear Regulatory Authority soon after Nawaz Sharif's announcement to build the Chinese ACP-1000 reactor. These lawsuits claimed that the construction began without a satisfactory environmental impact assessment.²³

Another concern with regard to nuclear safety is the location at which the nuclear power plants are situated. For example, two nuclear reactors are situated just 40 km from the populous city of Karachi which has over 16,000,000 residents.²⁴ Such a densely populated region is usually an unfavourable spot for siting nuclear power plants. The US Nuclear Regulatory Commission guidelines recommends reactors to be sited in a place with population less than 500 people per square mile within a 20-mile radius. In comparison, the area around the Karachi powerplant has over 6,450 people per

22. Rina Saeed Khan, "Underpowered and unsafe, Pakistan's nuclear reactors are just big boys' toys", *The Guardian*, April 28, 2011, <https://www.theguardian.com/environment/2011/apr/28/unregulated-unsafe-pakistan-nuclear-reactors>. Accessed on March 1, 2021.

23. Tahir Siddiqui, "SHC stops PAEC from starting work on N-plants", *Dawn*, October 17, 2004, <https://www.dawn.com/news/1138514>. Accessed on February 26, 2021.

24. "Karachi, Pakistan Metro Area Population 1950-2021", *MacroTrends.net*, <https://www.macrotrends.net/cities/22044/karachi/population>. Accessed on February 25, 2021.

square mile.²⁵ An accident in these nuclear facilities thus could have a devastating effect as civilian evacuation could be very challenging. To make matters worse, Karachi is also situated around major tectonic faultlines. This makes it vulnerable not only to earthquakes but also to tsunamis.²⁶ This is especially alarming considering that traditional studies of tectonic faultlines may be outdated, as was in the case of Fukushima. A scientific research by Britain's National Oceanography Centre and Canada's Pacific Geoscience Centre, which came out in 2013, states that what was considered to be the largest earthquake in the Makram area could be much bigger than what the PAEC has anticipated. The study claims that the region could be susceptible to earthquakes of a magnitude as large as 9.2.²⁷ Not only would a nuclear accident result in huge casualties but would also crumble the economy since Karachi hosts a large number of industries in and around the city. Since it is Pakistan's main port, it contributes about 42 per cent of the national GDP.²⁸

The PAEC authorities have acknowledged the chances of a catastrophic nuclear accident taking place and have an emergency plan prepared. However, according to a press briefing given by the project manager of the new reactors, the plan extends only for people living out to 15 km from the site.²⁹ In this regard, the magnitude of a nuclear accident is difficult to predict and the question of whether a 15 km evacuation plans would suffice remains. It is no relief that Pakistan has a poor record in effective disaster management. The state machinery's response, as evidenced during the 2010 floods, have been poor which has created space for militant organisations to take part in relief operations, with the objective of gaining people's support.³⁰

25. Pervez Hoodbhoy, Zia Mian and A. H. Nayyar, "The Nuclear Shadow over Karachi", *Newsweek*, March 17, 2014, <https://www.newsweekpakistan.com/the-nuclear-shadow-over-karachi/>. Accessed on March 20, 2021.

26. Qasim A. Moini, "Karachi nuclear power plants heavily protected: IAEA chief", *Dawn*, March 15, 2018, <https://www.dawn.com/news/1395361/karachi-nuclear-power-plants-heavily-protected-iaea-chief>. Accessed on April 2, 2021.

27. *Ibid.*

28. "Tsunami could 'wipe out' Karachi", *The Express Tribune*, September 10, 2014, <https://tribune.com.pk/story/760436/tsunami-could-wipe-out-karachi>. Accessed on March 22, 2021.

29. Tim Craig, n. 17.

30. "In Pakistan, Militants Use Flood Aid to Seek Support", NPR.org, August 23, 2010, <https://www.npr.org/templates/story/story.php?storyId=129379169>. Accessed on March 8, 2021.

In addition to nuclear safety, which is a common global concern, nuclear security is another pressing concern in the case of Pakistan, especially considering the instability in the country.

While safety assurances were given by Yukiya Amano, the former Director-General of the IAEA, during his visit to Pakistan in 2018 who stated that the new KANUPP-2 and 3 plants are “very heavily protected”,³¹ concerns of nuclear security still persist. This is because the overall security situation of a country is an important factor when it comes to maintaining critical infrastructure, since they could prove to be a potential target for attacks by terrorists or other violent groups. In the case of Pakistan, it is known to be a hub for militant organisations. The 2020 Global Terrorism Index which measures the impact of terrorism on countries, ranks Pakistan in the 7th position out of 135 countries, just after Yemen.³²

In this regard considering the level of violence and instability in the country, nuclear power plants may become a target for attacks, not only in an attempt to steal fissile material in order to make dangerous explosives or blackmail the authorities, but also because it would make a symbolic statement considering its economic and national importance. This is not unlikely considering that terrorists have attacked heavily guarded establishments in the past. For example, in 2011 terrorists attacked PNS Mehran the headquarters of the Pakistan Navy's Air Arm, killing five people and setting several aircraft on fire.³³ In 2014 another attack took place in Karachi's international airport killing 18 people.³⁴ In the same year, Al Qaeda militants attempted to hijack a Pakistani navy vessel too.³⁵ A military takeover could also

31. Qasim A. Moini, n. 26.

32. “Global Terrorism Index 2020: Measuring the Impact of Terrorism”, Institute for Economics and Peace, <https://visionofhumanity.org/wp-content/uploads/2020/11/GTI-2020-web-1.pdf>. November 2020. Accessed on January 29, 2021.

33. “Terrorists attack Navy airbase in Karachi, destroy three aircraft”, *Dawn*, May 22, 2011, <https://www.dawn.com/news/630878/terrorists-attack-navy-airbase-in-karachi-destroy-three-aircraft>. Accessed on January 29, 2021.

34. Tim Craig, “At least 18 Pakistanis killed by assailants who stormed Karachi airport”, *The Washington Post*, June 9, 2014, https://www.washingtonpost.com/world/asia_pacific/pakistan-airport-attack-kills-5/2014/06/08/9fbbbe2a-ef46-11e3-914c-1fbd0614e2d4_story.html?tid=usw_passupdatepg. Accessed on March 1, 2021.

35. Syed Raza Hassan and Katharine Houreld, “In attack by al Qaeda, lines blur between Pakistan's military, militants”, *Reuters*, October 1, 2014, <https://www.reuters.com/article/us-pakistan-militants-attacks-insight-idUSKCN0HP2MM20141001>. Accessed on March 3, 2021.

be a possibility, considering the power the Pakistani military yields. Since the military already has control over the nuclear weapons facilities, and considering the close relation between Pakistan's civil and military nuclear infrastructures, this may be possible. The unreliability of the Pakistani military was proven in the 2011 PNS attack and the 2014 naval hijack attempt where it appears that the Al Qaeda has been able to infiltrate the Pakistani military.³⁶

Concerns of Nuclear Proliferation

One of the primary concerns regarding Pakistan's civil nuclear programme is if it is acting like a smokescreen for the expansion of their nuclear weaponisation programme. These concerns stem from Pakistan's history of proliferation as it has been linked to surreptitiously providing nuclear weapons technology to several countries through Pakistani scientist, Abdul Qadeer Khan's network. Pakistani investigators have admitted to A. Q. Khan's assistance to Iran's nuclear weaponisation programme in the 1980s, although they claim that this network functioned independently "for personal financial gains" and had no links to the Pakistani state or had any sort of official linkages.³⁷ These claims, however, have not been fully accepted by the international community and there are reasons to believe that the Pakistani state had abetted A. Q. Khan's proliferation activities. In addition, Pakistani sources have claimed that A. Q. Khan's nuclear cooperation with Iran emerged from what was supposed to be a benign sharing of nuclear technology for peaceful purposes.³⁸

Second, the line between a civil nuclear programme and a nuclear weapons programme is very thin. For example, with uranium, if enriched to low levels it can act as fuel to power nuclear reactors which can help in generating electricity; however, if uranium is purified in centrifuges for a long enough time to make it highly

36. Ankit Panda, "Al Qaeda's Worrying Ability to Infiltrate the Pakistani Military", *The Diplomat*, September 18, 2014, <https://thediplomat.com/2014/09/al-qaedas-worrying-ability-to-infiltrate-the-pakistani-military/>. Accessed on January 22, 2021.

37. John Lancaster and Kamran Khan, "Pakistanis Say Nuclear Scientists Aided Iran", *The Washington Post*, January 24, 2004, <https://www.washingtonpost.com/archive/politics/2004/01/24/pakistanis-say-nuclear-scientists-aided-iran/d895f104-8657-4152-955b-c80560bce200/>. Accessed on January 29, 2021.

38. Ibid.

enriched, it becomes fuel for a bomb.³⁹ In this regard, considering that Pakistan's civil and military nuclear facilities are closely linked, and both programmes are shrouded in secrecy, leaves much space for speculation.⁴⁰ Recently, there have also been reports of Pakistan's attempt at expanding the infrastructure of its nuclear weapons programme. A report by the Institute for Science and International Security has been tracing Pakistan's development in constructing a large-scale enrichment plant. Although it was stated that the enrichment plant was being constructed to make low enriched uranium for nuclear power reactors, there are reasons to speculate that their nuclear programme could work as a convenient camouflage. The report considers that it is likely that a large gas centrifuge plant was actually being constructed there, perhaps for military purposes.⁴¹ The opaque nature of Pakistan's nuclear programme makes it difficult to ascertain this.

Violation of International Norms

The Pakistan-China energy nexus has also been perceived by the international community as a challenge to the existing non-proliferation systems, specifically the Nuclear Suppliers Group (NSG). The NSG rules mandates that the recipient country should be a signatory to NPT and that all its nuclear related activities should be within the full scope of safeguards, if it wants to buy nuclear technology from any of its member states. Despite Pakistan being a non-signatory to the NPT, China, which became a member of the NSG in 2004, has been engaging in nuclear commerce with Pakistan. This nuclear cooperation has been objected to by several countries. However, China and Pakistan have argued that the new reactors being sold are an extension of the agreement signed between the two countries in 1986, way before China's entry to the NSG. This has been perceived by many scholars as China and Pakistan's attempt at

39. William J. Broad, "The Thin Line Between Civilian and Military Nuclear Programs", *The New York Times*, December 5, 2007, <https://www.nytimes.com/2007/12/05/world/middleeast/05weapons.html>. Accessed on January 18, 2021.

40. David Albright, Sarah Burkhard and Frank Pabian, "Pakistan's Growing Uranium Enrichment Program", Institute for Science and International Security, May 30, 2018, https://isis-online.org/uploads/isis-reports/documents/Kahuta_Update_30May2018_Final_with_time-lapse.pdf. Accessed on February 18, 2021.

41. *Ibid.*

flouting rules and trying to establish their own conventions. The nexus between Pakistan and China are further believed to be dangerous, taking in consideration the history of proliferation between the two countries.

Conclusion

Pakistan's drive to bolster its nuclear power capacity raises serious questions regarding the security of its nuclear power programme. The expansion of nuclear power to meet its goal of 8,800 MWe of nuclear power by 2030 for example may strain the oversight capacity of regulators and may result in compromising the safety of the plants. In this regard while nuclear power certainly offers several benefits to Pakistan, considering the unstable situation in the country, the economic and security trade-offs must be assessed, especially while planning a major boost in the civil nuclear programme.

In view of the increasing interest in developing renewable sources of energy in the country in the past few years and acknowledging the availability of resources, the scope of development of renewable power in Pakistan is immense. In this regard, a diverse energy basket may help Pakistan in achieving energy security. A small, but safe and effective, nuclear programme may thus add value to the country's energy policy. By helping in developing the energy security of Pakistan, nuclear power, by extension, could also help in promoting the economic development of the country. Economic development could go a long way in gainfully employing its citizens and providing more stability in the country by reducing the vacuums that have led to increasing violence in Pakistan.

It is difficult to ascertain if the proliferation concerns pitched against Pakistan hold any merit. This is because Pakistan's nuclear industry is shrouded in secrecy and deliberate ambiguity. There is no definite way of saying if these concerns are serious or not. The lack of transparency not only raises several safety concerns internally but also leads to a trust deficit vis-à-vis other countries' relations with Pakistan. If Pakistan wants to move beyond the nuclear pariah status and gain credibility, it would require to be more transparent in its activities. Increased transparency and communication can go a long way in gaining international confidence.

There are several challenges that restrict the growth and development of Pakistan's civil nuclear programme. One of these challenges is the lack of engagement with the global nuclear industry, which has been limiting the development of nuclear power in Pakistan. Pakistan has been seeking an agreement similar to the Indo-US deal of 2008. However, to earn such a concession, it is important for Pakistan to prove its credibility. With its aggressive nuclear posturing and continued support to terrorist organisations within and outside of the country, such a concession may in fact prove to be dangerous, as it may embolden Pakistan to go against global security norms without being held accountable. As long as Pakistan remains a country of concern from the nuclear security and proliferation point of view, the granting of an exemption to NSG rules appears to be a distant prospect.