

## NUCLEAR ENERGY: A PATH TO SUSTAINABLE DEVELOPMENT IN PAKISTAN

By  
**Abu Hurrairah**  
*Intern*

*Arms Control & Disarmament Centre, ISSI*

Supervised by  
**Ghazala Yasmin Jalil**

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*(Views expressed in the brief are those of the author, and do not represent those of ISSI)*



**Pakistan’s nuclear programme has been the top priority for every government. Many variables were at play that led them to launch the civil nuclear programme, including the fact that it is an affordable, clean energy source and can help achieve sustainable development goals. To that aim, numerous energy experts in Pakistan believe it is essential to lessen reliance on fossil fuels and fully utilise nuclear energy. The energy sector is where peaceful nuclear technology is most frequently used as a cost-effective, clean, and environmentally beneficial energy source.**

Pakistan sees nuclear energy as a cheap alternative to meet the country’s rising energy demand in the face of a developing energy crisis and the mounting economic costs of using fossil fuels to manage the energy gap. Coal, natural gas, hydropower, renewable energy sources and nuclear energy make up a sizable portion of Pakistan’s total energy mix.<sup>1</sup> Pakistan has a greater prospect of increasing its energy production from nuclear and renewable sources than hydro, coal and natural gas. As a result, the country is trying to rely more on these sustainable energy options.

Nuclear energy can assist us in minimising the effects of Climate Change in addition to meeting the needs of the electricity sector. The subcontinent-wide heat waves in April that caused power and water shortages, crop loss and fatalities are still impacting Pakistan.<sup>2</sup> Much of South Asia is set to pay

<sup>1</sup> “Pakistan, Country Nuclear Power Profiles,” International Atomic Energy Agency, <https://www-pub.iaea.org/MTCD/publications/PDF/cnpp2016/countryprofiles/Pakistan/Pakistan.htm>.

<sup>2</sup> Hannah Ellis-Petersen and Shah Meer Baloch, “We are Living in Hell: Pakistan and India Suffer Extreme Spring Heatwaves,” *The Guardian*, May 02, 2022,

disproportionate costs due to Climate Change, with Pakistan at number eight among the most affected countries in the last two decades.<sup>3</sup>

Even though Pakistan has a far lower carbon footprint than many countries,<sup>4</sup> the effects of global greenhouse gas (GHG) emissions on Pakistan are catastrophic. Currently, thermal sources that produce GHGs provide about 60 per cent of Pakistan's electricity. Nuclear energy is a chance for Pakistan to progress toward cleaner energy sources. An increase in nuclear energy's contribution to the energy mix gives Pakistan promising opportunities for sustainable power production.<sup>5</sup>

Pakistan's energy mix now includes 9.1 per cent nuclear energy,<sup>6</sup> in contrast to France, which has a 70 per cent share and produces electricity with low emissions.<sup>7</sup> Although nuclear energy has frequently been criticised for its initial construction costs, a 2019 MIT study<sup>8</sup> on energy production in the US found that nuclear power plants (NPP) can be more cost-competitive compared to wind and solar resources, which do not always produce electricity. This is especially true when combined with other renewable sources. Additionally, switching to nuclear energy does not always entail completely giving up non-renewable energy. Instead, replacing it with small-scale NPPs is a viable option to save Pakistan's energy system from future shocks.

### Benefits of Nuclear Energy

Nuclear energy is the most effective energy source to reduce GHG emissions and global warming. It does not produce harmful emissions like sulphides, dust, or GHG. Moreover, it has a low potential

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<https://www.theguardian.com/world/2022/may/02/pakistan-india-heatwaves-water-electricity-shortages>.

3 David Eckstein, Vera Künzel, and Laura Schäfer, "Global Climate Risk Index 2021: Who Suffers Most from Extreme Weather Events? Weather-Related Loss Events in 2019 and 2000-2019," *German Watch*, Jan 21, 2021, <https://reliefweb.int/report/world/global-climate-risk-index-2021>.

4 Hannah Ritchie, Max Roser and Pablo Rosado, "CO<sub>2</sub> and Greenhouse Gas Emissions," *Our World in Data*, 2020, <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>.

5 "3 Reasons Why Nuclear is Clean and Sustainable," Office of Nuclear Energy, March 31, 2021, <https://www.energy.gov/ne/articles/3-reasons-why-nuclear-clean-and-sustainable#:~:text=Nuclear%20is%20a%20zero%2Demission,byproducts%20emitted%20by%20fossil%20uels>.

6 Hussain Ahmad Siddiqui, "Nuclear Power Generation," *The News International*, March 2022, <https://www.thenews.com.pk/magazine/money-matters/941162-nuclear-power-generation>.

7 "France, Country Nuclear Power Profiles," International Atomic Energy Agency, <https://cnpp.iaea.org/countryprofiles/France/France.htm#:~:text=France's%20electricity%20generation%20has%20very,%25%20fossil%20fuel%20fired%20plants>).

8 Mark Dwortzan, "Getting to Net Zero," MIT Joint Program on the Science and Policy of Global Change, November 26, 2019, <https://globalchange.mit.edu/news-media/jp-news-outreach/getting-net-zero>

for global warming of just 1.02-1.12 per cent. Hence, nuclear energy is a power source that is more environment-friendly than any other means.<sup>9</sup>

Nuclear energy is an unbounded energy source compared to any conventional power generation source. Almost 17,000 cubic feet of natural gas, one ton of coal, or 149 gallons of oil are all required to produce the same amount of energy as one uranium fuel pellet.<sup>10</sup> Resultantly, nuclear energy is a substitute energy source that emits lesser carbon. Pakistan has adequate uranium deposits; therefore, choosing more nuclear energy in its overall energy mix will lessen the country's dependency on imported oil and increase the sustainability of its whole power generation portfolio.

Due to the lower cost of fuel, nuclear power generation has lower operating costs than thermal power plants. These plants have a 34 per cent efficiency, which is very high.<sup>11</sup> Pakistan would have a better opportunity to balance its diversity in the country's overall energy mix by increasing the share of nuclear energy.

Pakistan has an abundance of uranium reserves. Since the nuclear energy produced through uranium gives lesser emissions, it can be used as a secondary energy source. Currently, Pakistan is working hard to increase its nuclear share in the energy sector. At present, the Pakistan Atomic Energy Commission runs six NPPs in Pakistan. Two are located in Karachi and four are at Chashma. By 2030, Pakistan intends to increase the percentage of nuclear energy in its overall energy mix to 8800 MW, which will prove to be a reliable alternative energy source. Additionally, while helping to fulfil future electricity demand, it will also help to lower the country's overall GHG emissions.<sup>12</sup>

The power sector is responsible for two-thirds of the total GHG emissions in the environment worldwide, which is a serious concern related to Climate Change. These emissions are comparable to renewable energy sources like wind and hydropower. Nuclear power emits 29 tonnes of CO<sub>2</sub> equivalent per GWh, compared to 888 tonnes of coal, 499 of natural gas, 85 of solar, 26 of hydro, 26

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<sup>9</sup> Sikander Ali Abbasi, "Is Nuclear Power Generation a Viable Alternative to the Energy Needs of Pakistan?: SWOT-RII Analysis," *International Journal of Energy Economics and Policy*, May 2021, <https://www.econjournals.com/index.php/ijeeep/article/download/11122/5952>.

<sup>10</sup> Thaddeus Swanek, "Nuclear 101: An Introduction to Nuclear Energy for the New Congress," Nuclear Energy Institute, January 10, 2019, <https://www.nei.org/news/2019/nuclear-101-an-introduction-to-nuclear-energy>.

<sup>11</sup> Ibid.

<sup>12</sup> "Nuclear Power in Pakistan," *World Nuclear Association*, March 2022, <https://world-nuclear.org/information-library/country-profiles/countries-o-s/pakistan.aspx>

of wind, and 1054 of lignite.<sup>13</sup> It is clear from these numbers that nuclear power generation is a clean source of energy that has no adverse effects on the environment.

### Challenges

The use of nuclear energy, however, is complicated by several challenges. Pakistan has expressed frustration with what it perceives as unfair international policies, notably when the Nuclear Suppliers Group (NSG) awarded India a special waiver despite India's non-signatory status to the Nuclear Nonproliferation Treaty (NPT) while denying Pakistan.<sup>14</sup>

The globe has seen numerous states starting their nuclear programmes for electricity requirements only to transform them later for non-civilian uses. The international community became more concerned about nuclear proliferation due to this circumstance. Any country-led nuclear energy plan is therefore met with scepticism. So, the states like Pakistan frequently do not receive adequate assistance to increase their power needs through nuclear power.

There is a widespread belief that radiation emitted by nuclear reactors harms human health. The public has a negative perception of nuclear power plant construction. As a result, the public does not welcome it during the commissioning and operational phases, which is another obstacle to effectively using nuclear energy for sustainable development in Pakistan.

In addition to the aforementioned challenges, another key challenge for Pakistan is the widespread misconceptions about the cost of constructing NPPs, even though studies have proven NPPs to be cost-competitive with thermal plants. The studies that claim nuclear power is more expensive than thermal power largely ignore the environmental harm that has been caused. Due to this, policy practitioners make a serious error by mistakenly portraying thermal power facilities made of coal and natural gas as less expensive options.

### The Way Forward:

Pakistan has the tools and the will to tackle these challenges, despite the severe backlash they may cause. According to Nuclear Security Index (NTI), which measures a country's ability to secure nuclear materials, Pakistan made the most progress last year, rising 25 points since its inception.<sup>15</sup>

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<sup>13</sup> "Nuclear Power Economics and Project Structuring: 2017 Edition," World Nuclear Association, January 2017, <https://world-nuclear.org/our-association/publications/online-reports/nuclear-power-economics-and-project-structuring.aspx>

<sup>14</sup> "Preferential treatment for India undermines NSG credibility: FO spokesman," *Dawn*, June 28, 2017, <https://www.dawn.com/news/1341953>

<sup>15</sup> "The NTI Index for Pakistan," *NTI Nuclear Security Index*, <https://www.ntiindex.org/country/pakistan/>

Pakistan's research and power reactors are all under International Atomic Energy Agency safeguards.<sup>16</sup> Pakistan has an exceptional nuclear safety and security record of NPPs. It has over 50 years of experience in generating nuclear power and not a single accident.

The rising levels of GHGs act as a wake-up call for Pakistan to intensify efforts to increase the percentage of nuclear power in its energy mix. If Pakistan wants to become carbon neutral by 2050,<sup>17</sup> it must make rapid development in the short term because one NPP construction takes at least seven years to complete. Despite all obstacles, Pakistan has planned to grow its nuclear energy share to 40,000 MW by 2050, which is a step in the right direction, according to the Energy Security Plan of Pakistan.<sup>18</sup>

Conclusively, all these measures guarantee lower emissions, consequent environmental cooling, fewer heatwaves and overcoming the energy crises. As a result, both energy prices and demand will decline. Using clean energy and affordable costs will raise citizens' quality of life. Only an integrated energy ministry working cooperatively to attain carbon neutrality goals by 2050 can make this happen. To mitigate the adverse effects of Climate Change, Pakistan should consider ways to expand its nuclear energy generation capacity. These combined efforts and timely implementation of plans can construct our path to sustainable development for us and our future generations.

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<sup>16</sup> Mansoor Ahmad, "Addressing South Asia's Fissile Material Conundrum," *South Asian Voices*, June 12, 2019, <https://southasianvoices.org/addressing-south-asias-fissile-material-conundrum/>.

<sup>17</sup> Jamila Achakzai, "Initiative launched for carbon neutrality by 2050," *The News International*, September 02, 2021, <https://www.thenews.com.pk/print/886642-initiative-launched-for-carbon-neutrality-by-2050>.

<sup>18</sup> "Future Expansion Plan," Pakistan Atomic Energy Commission, <https://paec.gov.pk/Parameters/Future/>.