

# *Pakistan on its Path for the 2050 Carbon-neutral Targets: An Ambitious Three Directional Plan Under the PM Initiatives*

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## Abstract

*Pakistan is a developing country and as such its power supply has become a challenging task. To support its growing middle class, industrial outputs, and to reduce pollution, Pakistan is pursuing its energy transition through renewables. The addition of Nuclear Power Plants to its grid shows its commitment to the Paris agreement for 2050.*



With the drive for industrialization, population explosion, and lack of urban planning; electricity shortages have reached crisis proportions. During summer months, extended hours electricity outages add more miseries to everyday life and in many cities temperatures reach into triple digits. These power outages not only make people less productive, but also hamper productivity and the economic growth. The root causes of this crisis are lack of planning, policy mistakes, dilapidated power plants (pre/non-NPPs) with crumbling transmission lines, and a history of unpaid bills by every member of the society (the consumers, politicians, industrialists, and government officials)! Thus, there is no money for the power providers for the fuels' purchase, maintenance, and capacity increase. As a matter of fact, the power outages go back to the days of the creation of Pakistan. According to Sind Observer newspaper of that time, Mr. Jinnah was invited to speak to the Sind Assembly in 1947 (just a few days before the Independence Day) where he was anonymously chosen as the President of the Constitutional Assembly. Just before he was ready to speak, the power went out, the microphone went dead, and it was all but impossible to hear him. Since then, every government has promised to solve the electricity shortage but until this day, the power outages and the load shedding are common. During President Ayub Khan's period, Nobel laureate,

Dr. Abdus Salam, then his Science Advisor, convinced him to build Pakistan's first commercial nuclear power reactor (KANUPP) in Karachi. Later, Zulfiqar Ali Bhutto, during his first visit to China as Prime Minister, successfully initiated NPPs

technical exchange program between the two countries. This was the beginning of the nuclear power as

the strategic source for Pakistan's fast growing power needs. Since then, China and Pakistan have been cooperating in many fields, including the nuclear power plants. Their friendship is based on mutual respect, trust, cooperation, and commitment to support each other in times of needs. With the passage of everyday, the friendship between China and Pakistan is getting stronger and reaching to its new highs, unparallel to any other friendship.

With the K2 nuclear power plant's inauguration late last month, Pakistan is on its way to improving its anemic power supply that has been causing persistent blackouts and load shedding since the creation

of the country in 1947. Another identical plant is on its way to come on stream in early next year and with this peed of the clean power additions, soon the perpetual blackouts and load shedding will become things of the past! This is a remarkable and an exemplary friendship achievement between China and Pakistan allowing access to the latest nuclear power technology from a carbon-neutral source, the first of its kind in the world. The K2 plant joins the five already existing nuclear power plants that are operating in various parts of Pakistan and is going to be also managed by Pakistan Atomic Energy Commission (PAEC). Since the launch of the first nuclear power plant (indigenous) in 1974 and its continuous operations, Pakistan has demonstrated following an extremely high standard protocols for the safety, security, and overall maintenance of the nuclear power plants. The third unit (K3) will be ready to start supplying the electricity early next year. The technology used for both of these plants is called "Hualong One" and has been provided by China National Nuclear Corporation (CNNC) which is marketed in the international market as HPR1000. According to the reports, Hualong One is a third-generation nuclear power technology and its innovative security system meets the highest international standards. Currently, CNNC is building six more HPR1000 reactors, mostly for the BRI member countries.

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Construction of the K2 plant was started in 2015 and it was completed in February of 2021. In March of this year, after successful commissioning safety tests, the plant was connected to the main grid. The plants initial life has been designed for 60 years and it can be extended for an additional 20 years, if needed. It has a refueling cycle at about 18 months' time intervals. According to the initial contract that was signed between CNNC (China) and PAEC (Pakistan) in 2013, the total cost for both of these plants (K2 & K3) will be 9 billion U.S. dollars. The design capacity of the plant is 1100 megawatts and its addition to the grid will greatly help to reduce the frequent load shedding, especially during the smoldering summer months. Additionally, this capacity will definitely help to meet the target of 8800 megawatts of nuclear power by 2030 and 40,000 megawatts by the year 2050 by building 32 additional nuclear power plants.

Both these plants are under the watch of the International Atomic Energy agency's safeguards. According to the CNNC, the project will produce about 10 billion kilowatt hours of power on an annualized basis once it is operating at its full capacity. It will not only help to provide electricity continually to the consumers but will also support in new job creations, higher industrial activities, and increase in exports due to more competitive cost structure through lower electricity rates.

Prior to the K2 plant, combined electricity capacity of all five (one in Karachi and four in Chasma) operated nuclear power plants was around 1400 megawatts. With the K2 capacity of 1100, total nuclear power plant capacity will be about 2500 megawatts.

On the global scale, USA and France are the front runner countries that are deriving major part of their electricity needs from the nuclear technology. According to the nuclear industry report, as of 2019 USA was using 97 reactors and deriving just over 19 percent of its electricity needs while France was deriving over 70 percent of its electricity generated from 58 nuclear reactors. To some industry estimates, France has the most experience in operating NPPs in the world.

Even though the nuclear power plants are cost intensive, they have longer lives. Over their life span period, their operating efficiency is usually over 90 percent, and they operate over 90 percent (336 days) time of the year, and the balance of the time (29 days) is used for their scheduled yearly maintenance. Thus, based on the total cost structure, technology efficiency, and the maximum operating capacity level, the NPPs are the most cost-effective power plants. At an operating rate of about 95 percent capacity, the nuclear power generated electricity on the average cost is about Rs11.16 (~7.4 cents) per Kilowatt hour, by all means making it the most competitive electricity source against the other viable sources of electricity in Pakistan.

When it comes to the nuclear power plants discussion, the Chernobyl (Russia) and 3 Mile Island (USA) accidents come to peoples' minds. However, as Pakistan is a newcomer in the nuclear power nations, to date in its more than 49 years history since embarking its journey in 1974 on the path of nuclear power by building its very first nuclear reactor KANUPP (K1) in

Karachi, has built its own standards in the absence of the foreign assistance, that in many cases exceeds the International Standards. Miraculously, since the day one starting at KANUPP (K1), Pakistan has proven an impeccable operational record of safety, security, and maintenance. Since that day, more than 14 billion kilowatts hour of electricity have been generated through its five plants located in different parts of the country. Additionally, two of its reactors (Chasma units 2 & 4) have set new milestones in their sustainability, safety, and security by operating non-stop and round the clock for an entire year! This undoubtedly speaks to the intellectual capacity of Pakistani scientists & engineers, their research, training and capabilities and safety & security of the plants. This also clearly shows that even in chaotic time and during political instability, Pakistani nation can achieve excellence, no matter how difficult it may sound, but only if it puts its passion, dedication, commitment, and focus to pursue it! Because of all these attributes, Pakistan has been recognized globally for its outstanding achievements in developing its own safety protocols and training its staff with the best safety & security practices. As a result of these outstanding and unparalleled performance, one of PAEC's facilities (PIEAS) has been recognized by the world body (IAEA) as one of its collaborating centers. As a matter of fact, in 2018, a former IAEA's Director General, Mr. Yukiya Amano, after visiting several Pakistani nuclear facilities was overly impressed with their safety and security protocols.

As the world is moving to its ambitious goal of carbon neutrality by 2050 through the collaboration of every nation, Pakistan is also relentlessly following the same course. Like in many other countries, regardless of their socioeconomic standings, many of its major cities are becoming centers for unprecedented chronic and upper respiratory illnesses. To address this widespread health crisis, PM Imran Khan's government has already embarked on a many-fold strategy. 1) Campaign of planting 10 billion trees across the country and forest restoration of more than a million hectares. These initiatives will help significantly in absorbing carbon dioxide emitted by automobiles and industrial activities using fossil fuels, major sources of atmospheric pollution that creates global warming. 2) Adaptation of new paradigms for mobility as part of transportation landscape modernization. Under this scheme, mass transportation players and the citizens are encouraged to buy the Electric Vehicles, as they become available. This initiative will greatly help and will have a significant impact in reducing the carbon dioxide and other pollutants from their exhaust and will be visible in a shorter period of time. 3) To meet its ever-increasing electricity needs, following a major change in its energy mix by building more NPPs is the right way to reduce its carbon footprint. Not only is the electricity generated from the NPPs cheaper than the other sources but is also a carbon neutral source. With this kind of landscape and commitment by the PM, Pakistan is definitely on the right trajectory for meeting its goals for carbon-neutral targets and is consistent with the Paris Agreement and the United Nations 2050 global targets.