

The Challenges of the Nuclear Energy in Poland

Introduction

The 1970s brought dynamic development in nuclear weapons research all around the world. Except capabilities of the United States of America (USA) and the Soviet Union, several other countries developed their own nuclear technology. One of them is France, which managed to become independent from the USA by constructing its own base of nuclear assets. In the communist bloc, a good example is Poland, which headed by Edward Gierek between 1976 and 1980, also had a plan to match the world's powers. Although Poland was not as strong as the USA or the Soviet Union, the country had qualified staff from the Military Technical Academy of Warsaw. Later in the 1980s, this project was postponed due to the collapse of communism in Poland. As of 2021, due to a growing demand for electricity and increasing prices of energy, the issue of nuclear power plants is again discussed by politicians. This paper will present the latest developments regarding the establishment of nuclear facilities in Poland and will draw some conclusions regarding challenges regarding the development of this alternative source of energy.

1. The context of the development of nuclear energy in Poland

Poland is the 8th most populated in Europe and one of the most efficient regarding the economic growth in this continent. According to the European Commission, the economic growth of Poland from 2022 is supposed to be approximately 5.5% on a yearly basis (*Komisja Europejska prognozuje Polsce najwyższą inflację w całej UE 2022*). As of 2019, the Polish economy had been growing for 28 years, which is a record high in the EU. These drivers explain the growing demand for electricity in Poland. Some other causes shall be also presented:

- A continuing development of Poland country requires an increase in electricity supply.
- The consumption of energy in Poland is still one of the lowest in the European Union,
- There are also some ecological considerations: Poland must reduce greenhouse gas emissions, especially carbon dioxide, which is produced by its coal units in Poland. Coal still generates about three-quarters of Poland's electricity.
- Fossil fuel resources are depleting in Poland, the operative coal resources will be sufficient maximally till 2050. Furthermore, the costs of obtaining and prices of coal is rising. This is also forcing Poland to import coal from Russia. In the first seven months of 2021, Poland imported approximately 8 million tons of coal from Russia, which represent around 15 percent of the production of coal in Poland in 2020 (*Węgiel z Rosji to nie tylko problem Polski. Kupuje go nawet Ukraina 2021*).
- The utilization of coal is jeopardizing the longevity of Poles and led to a low air quality indicator (Strupczewski 2021: 92).

As of January 2022, there is no major nuclear power plant in Poland, but some are planned to be established in the next 15 years. As of January 2022, the only operational nuclear reactor is the

MARIA Research Reactor in Świerk (30 km south-east of Warsaw), currently managed by the National Atomic Energy Agency (Państwowa Agencja Atomistyki). There are two storages of nuclear fuel from this reactor and radioactive waste are placed in Różan near Ostrołęka (115 km north of Warsaw). The last two facilities are managed by the Radioactive Waste Management Plant based in Świerk. There are also remains of the first Polish nuclear reactor named "EWA" (managed by the agency based in Świerk) which is already decommissioned. However, it may be used in the future as a place for storing nuclear fuel (*EWA i MARIA świadectwem kompetencji polskich naukowców 2015*).

2. The strategy of the Polish government regarding atomic energy

For the reasons mentioned in the first part of the document, Polish authorities issued Program of the Polish Nuclear Energy (*Program Polskiej Energetyki Jądrowej - PPNE*) in 2014 and renewed it in 2020. The primary aim of this project is the construction and commissioning of nuclear power plants in Poland with a total installed capacity of approx. 6 to approx. 9 GWe based on large-scale pressurized water-reactors (PWR). According to this Program, the first block of the Polish nuclear power plant with a capacity of approximately 1-1.6 GW is supposed to be commissioned in 2033 (Strupczewski 2021: 90). The next blocks are to be launched every two or three years. The entire nuclear program provides for the construction of six units with a capacity to 9 GW. The program also underlines that in the perspective of 2045, the optimal amount of nuclear capacity should be approx. 7.7 GWe net, which means the share of nuclear energy in the energy mix of Poland shall be around 27% (*Program Polskiej Energetyki Jądrowej 2020: 27*). A more realistic approach indicates that the construction of the first reactor is scheduled to start in 2026, and the last, sixth, to be launched in 2043. A such time framework is extensive as the planning process is including the entire life cycle of a nuclear power plant, including the choice of technology, through its construction, operation, storage of radioactive waste, and eventual closure of the nuclear reactor.

Polskie Elektrownie Jądrowe (Polish Nuclear Power Plants - PNPP) is a state-owned company that will deal with the construction and operation of public nuclear power plants in Poland. It was officially established in June 2021 and replaced a former Polish company dealing with nuclear energy named PGE EJ1. The Polish State Treasury took over shares which were belonging to several energy companies: PGE SA (70%) and to Enea, KGHM and Tauron (10% each).

From the construction perspective, modern nuclear energy with available technologies in terms of technical, economic and environmental impact in the case of Poland may be offered by companies such as: CNNC / CGN (China, Hualong one reactor), Framatome (France, EPR reactor), KEPCO (South Korea, APR1400 reactor), Rosatom (Russia, VVER reactors) and Westinghouse (USA, AP1000 reactor). Finally, in March 2021, an agreement between the government of Poland and the United States on nuclear power was ratified and includes a plan to transfer technology and

US financial support to the Polish Nuclear Energy Program. Within eighteen months from its entry into force, practically until the end of 2022, a conceptual and executive report is supposed to be presented, containing a description of the initial engineering and organizational works as well as potential sources and arrangements for financing nuclear energy in Poland. The published elements of the contract based seem to exclude a supplier other than American companies. The contract is being implemented by Westinghouse, which opened an office in Krakow in September 2021 (*Westinghouse Global Shared Services Center Opens in Krakow 2021*).

Regarding the localization of the first nuclear energy reactor, this issue is also mentioned in the PPNE (*Program Polskiej Energetyki Jądrowej 2020: 14–15*). 4 places are considered: Bełchatów, Lubiatowo-Kopalino, Pątnów and Żarnowiec (a nuclear facility started to be built in Żarnowiec in 1982, however its construction was cancelled after the Chernobyl disaster in 1986). Finally, the most probably localization of the first the locality of Lubiatowo-Kopalino (Choczewo Commune, Wejherowo County, Pomeranian Province) has been selected as the preferred location for the construction of the first nuclear power plant in Poland as in Poland main shortages of energy supplies applies to the coast. In Poland main shortages of energy supplies applies to the coast. The choice of the preferred location does not mean the final consent to the implementation of the investment in this variant. The location of "Lubiatowo-Kopalino" was indicated on the basis of very detailed environmental and location studies conducted since 2017, unprecedented in Poland, which showed that it meets all environmental requirements for such facilities and is safe for residents (*Lubiatowo-Kopalino. To tutaj ma powstać pierwsza polska elektrownia atomowa 2021*). The previously mentioned company Polskie Elektrownie Jądrowe has also been examining the level of support for nuclear energy among the local community for years. The results of the latest research campaign, carried out in 2021 by the independent research center PBS, showed that 63% of the surveyed residents of the location communes of the analyzed variants (Choczewo, Gniewino, Krokowa) support the decision to build a nuclear power plant in their immediate vicinity (*Powstanie pierwsza elektrownia atomowa w Polsce. Gminę Choczewo czekają wielkie zmiany 2021*).

On the other side, some smaller nuclear reactors named as modular reactors, may be established in Poland. One of them is the Pątnów-Adamów-Konin Power Plant Complex (affiliated with the company named ZEPAK) belonging to Zygmunt Solorz. This Polish Businessman (jointly with Michał Sołowow, another Polish self-made-man) applied in August 2021 to the Polish Energy Operator Polskie Sieci Energetyczne to initiate market and technical consultations on the change of generation sources at the Pątnów Power Plant (230 km south-west of Warsaw) from coal to small modular reactors. Four to six reactors with a total electrical capacity of 1.8 MW are planned to be established. Finally a decision was made to start a joint project and an agreement was signed with SGE to build a nuclear power plant equipped with BWRX-300 reactors, where SGE acts as an investor and technology supplier. In September 2021 authorities of ZEPAK signed an agreement

with the advisory company IP3 Corporation in the field of implementation and development of nuclear energy in Poland. In addition, it was announced that Mrs. Georgette Mosbacher, the former US ambassador to Poland, will join the IP3 authorities regarding nuclear projects in Poland (*Elektrownia atomowa w Polsce. Plan miliardów nabiera rozpędu* 2021).

In the fall of 2022, "the government will have reasons" to make a key decision on the choice of technology in which Polish nuclear power plants will be built.

The strategy at the national level may be blocked by its level of expenditures. The cost of nuclear energy in Poland is immeasurably important. The cost of the PPNE program is in a range between EUR 25-35 billion over 20 years, including the construction of six nuclear reactors with a capacity of 6-9 GW in two or three locations (*Szacunkowy koszt budowy w Polsce bloków jądrowych wyniesie ok. 105 mld zł* 2021).

3. Potential Prospects and Challenges Related to the Development of the Nuclear Programme in Poland

Several conclusions can be drawn on a short and long-term perspective. Climate challenges and increasing pressure to decarbonise are accelerating the energy transition. These are drivers which may force the Polish government to switch its energy mix based on coal energy to a more balanced policy. In the case of Poland, nuclear energy may be the answer to this challenge. If the Polish government believes that nuclear energy is one, it must act both by implementing government projects of key importance for energy security and by supporting smaller private investments, which are not competition with the Treasury State, but can be complementary. One of the main challenges is that the management of PNPP, Tomasz Stępień and Krzysztof Jackowski, are not only associated to the ruling party in Poland entitled *Prawo and Sprawiedliwość* (Law and Justice – L&J) but also are at the head of a company named Gaz System, which is the main operator of liquefied natural gas in Poland. From a managerial perspective, it seems to be difficult to manage such two energy programs on the same time. Secondly if this management board is associated to the previously party, then in the case where L&J would lost elections, then both will be probably removed, and the strategy of nuclear energy will be reviewed. In a such scenario the development of nuclear energy in Poland may be postponed. The PPNE due to its level of expenditures may either reviewed or postponed especially in the context of the COVID-19 Pandemic which induced major states unexpected expenditures. The instability of the political scene in Poland is also jeopardizing the viability of PPNE.

According to ILF Consulting Engineers Polska, "Nuclear energy is an important issue necessary to achieve the goals of the climate neutrality of Poland by 2050. However, the pace of its development will be much slower than assumed by PEP2040 ”.

Some non-mentioned previously companies want also to abandon coal combustion and obtain energy from nuclear reactors. One of them is Ciech, which signed a letter of intent with Synthos Green Energy on cooperation in the use of small and modular micro-reactors technologies. It was also informed that this action is in line with the group's strategy adopted in 2018, assuming, inter alia, reduction of CO₂ emissions by 33% by 2026, the withdrawal of coal as a raw material for energy production by 2033 and achieving climate neutrality of the group (net zero) by 2040.

References:

1. *Elektrownia atomowa w Polsce. Plan miliardów nabiera rozpędu*, <https://www.rp.pl/biznes/art18891261-elektrownia-atomowa-w-polsce-solorz-solowow> (date of access: 11.02.2022).
2. *EWA i MARIA świadectwem kompetencji polskich naukowców*, <https://www.ncbj.gov.pl/aktualnosci/ewa-maria-swiadectwem-kompetencji-polskich-naukowcow> (date of access: 10.02.2022).
3. *Komisja Europejska prognozuje Polsce najwyższą inflację w całej UE*, <https://www.bankier.pl/wiadomosc/Prognozy-Komisji-Europejskiej-dla-Polski-Wzrost-PKB-i-inflacji-8275459.html> (date of access: 12.02.2022).
4. *Lubiatowo-Kopalino. To tutaj ma powstać pierwsza polska elektrownia atomowa*, <https://forsal.pl/biznes/energetyka/artykuly/8320282.elektrownia-atomowa-w-polsce-lubiatowo-kopalino-lokalizacja.html> (date of access: 10.02.2022).
5. *Powstanie pierwsza elektrownia atomowa w Polsce. Gminę Choczewo czekają wielkie zmiany*, <https://www.money.pl/gospodarka/powstanie-pierwsza-elektrownia-atomowa-w-polsce-gmine-choczewo-czekaja-wielkie-zmiany-6718189481921408a.html> (date of access: 10.02.2022).
6. Strupczewski, A. (2021). Energetyka jądrowa koniecznym elementem elektroenergetyki polskiej. *ACADEMIA*-magazyn Polskiej Akademii Nauk, pp. 88–97.
7. *Szacunkowy koszt budowy w Polsce bloków jądrowych wyniesie ok. 105 mld zł* <https://www.bankier.pl/wiadomosc/Szacunkowy-koszt-budowy-w-Polsce-blokow-jadrowych-wyniesie-ok-105-mld-zl-8147376.html> (date of access: 10.02.2022)
8. *Polskie Elektrownie Jądrowe* (Polish Nuclear Power Plants - PNPP) <https://ppej.pl> (date of access: 10.02.2022)

9. *Program Polskiej Energetyki Jądrowej* (The Polish Nuclear Power Program), 2020, <https://www.gov.pl/web/polski-atom/program-polskiej-energetyki-jadrowej> (date of access: 12.02.2022).
10. *Węgiel z Rosji to nie tylko problem Polski. Kupuje go nawet Ukraina*, <https://www.wnp.pl/gornictwo/wegiel-z-rosji-to-nie-tylko-problem-polski-kupuje-go-nawet-ukraina,498810.html> (date of access: 13.02.2022).
11. *Westinghouse Global Shared Services Center Opens in Krakow*, <https://info.westinghousenuclear.com/news/westinghouse-shared-services-center-opens-in-krakow> (date of access: 11.02.2022).