

Nuclear Poland?

The second approach after 20 years

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Poland's plan for reorganization of its energy mix is to construct several nuclear reactors (2 NPPs with number of units depending on reactor type) of total capacity 6000 MW. It is assumed that energy from NPPs will provide up to 19% of the electricity production in Poland after 2035. Currently there is no nuclear power plant in operation. The previous nuclear programme was canceled in 1990. Almost 20 years later Polish government has undertaken second attempt to construct first NPP by adoption of The Polish Nuclear Power Program in January 2014. Since that moment were started intensive preparations to implement many legal regulations related to future nuclear industry in Poland e.g. Atomic Law amendment. In the same year the Owner's Engineer was chosen by the main investor PGE S.A. Following "nuclear" a lot of Polish Universities launched studies connected with the subject to ensure employees for deployment and sustaining of nuclear technologies in Poland. This paper describes the rationale staying behind the government decision, present situation of Polish energy market and current work status.

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BACKGROUND AND POLISH MIX

In January 2009 Polish government decided to launch the nuclear power programme. This is the second attempt to build a NPP – the previous programme in 1980's was canceled in 1990. In January 2014 the Council of Ministers adopted The Polish Nuclear Power Programme. This strategic governmental document envisages commissioning of 2 NPPs (a total of 4-8 units, depending on reactor type) between 2024 and 2035. The main investor will be PGE PolskaGrupaEnergetyczna S.A., the largest power utility in Poland.

In November 2011 PGE selected three possible NPP sites for further investigation: Choczewo, Żarnowiec (the latter one was the NPP construction site in 1980's) and Gąski. This third site was suspended after negative result of local referendum. Both currently investigated sites are generally coastal sites, however "Żarnowiec" is located ca. 8 km from sea shore, next to the lake. In 2014 PGE nominated AmecFoster Wheeler as the Owner's Engineer.

17 Polish Universities have launched studies connected with the subject of nuclear energy. Three research institutes: Institute of Nuclear Chemistry and Technology (Warsaw), Institute of Nuclear Physics - Polish Academy of Science (Cracow) and National Nuclear Research Center (Otwock-Świerk near Warsaw) with research reactor - MARIA,

are scientific and research facilities. All of these institutions are intended to provide the basis for education of qualified staff for the future NPP.

Polish energy mix is dominated by hard coal and lignite. There is no nuclear power. Renewable Energy Sources contribute at 10.4% (Table 1).

Nuclear power is recognized by the government as a tool for diversification of the energy mix.

ELECTRICITY GRID AND POWER PLANTS AGE

There was one serious blackout in Szczecin city (Western Pomerania region, North-Western Poland) in 2008. It lasted ca. 24 hours and caused a direct losses of EUR 15.3 million (in

2014 prices). The blackout risk is increasing with every year because of growing electricity demand (more than 2% per year), despite serious energy efficiency efforts made by public and private sector supported by EU funds (Figure 1).

Most power units need urgent replacement, which is very challenging in present electricity market conditions. Most of current conventional generation capacity (ca. 20 GW) will be gradually shut down by 2035. This results in serious power shortage risk just after 2025. The estimated cost of a hypothetical blackout covering all territory of Poland and lasting for 1 month is EUR 32.4 billion (in 2014 prices).

Source	Production (TWh)	Share (%)
Hard Coal	81.568	49.6
Lignite	56.150	34.1
Natural gas	5.247	3.2
Other (oil, non-organic waste etc.)	3.968	2.4
Hydro (pumped storage)	0.558	0.3
RES, including:	17.066	10.4
- Biomass and biogas	8.622	5.2
- Hydro	2.439	1.5
- Wind	6.004	3.7
- PV	0.001	0.0
TOTAL	164.557	100.0

Source: Polish Energy Market Agency 2014

Table 1. Polish energy mix in 2013.

DRIVERS FOR BEING A NUCLEAR "NEWCOMER"

The growth of energy demand is response to industrialization and urbanization that led to a high primary energy consumption. More than 80% of Polish energy production comes from combustion of fossil fuels but these energy sources are gradually depleted. Most of the Polish power units are over 35 years and need replacement. To ensure energy security and to reduce dependence of fossil fuels, Polish government decided to build 2 NPPs.

Next reason why Poland is motivated to go to nuclear is EU climate policy, which requires lowering emissions of CO₂, fly ash and mercury. Hard coal and lignite energy sector causes very high external costs including the negative impacts on water, toxic coal waste, air pollution, and the long-term damage to ecosystems and human health.

Economic competitiveness of nuclear power in the long term and lack of reasonable alternatives make nuclear power a necessity for Poland.

POLAND CURRENT TIMELINE AND FRAME FOR THE FIRST NUCLEAR UNIT IN POLAND

Polish Nuclear Power Programme stipulates the year 2024 as the year of commissioning of first unit of the first NPP. The government will probably decide to change organization of the project and move this date to 2029. There are many reasons for this delay but the most important are the electricity market distortions and lack of EU-wide policy for nuclear industry, especially lack of standardized economical support mechanisms for NPPs which cannot anyway compete with highly subsidized renewables. The Hinkley Point C case is rather an exception than a common rule for support.

PGE EJ 1 is responsible for preparation and execution of the first Polish nuclear power plant project. At the moment Company conducts several major projects related among others to financing model. PGE EJ 1 runs analysis of possible structure and most adequate support mechanisms for the NPP build and operations.

In 2015, PGE PolskaGrupaEnergetyczna sold 10% of the shares in its subsidiary PGE EJ 1 to each of its three business partners: the metallurgy group KGHM PolskaMiedź and the power utilities: TAURON PolskaEnergia S.A. and ENEA S.A.

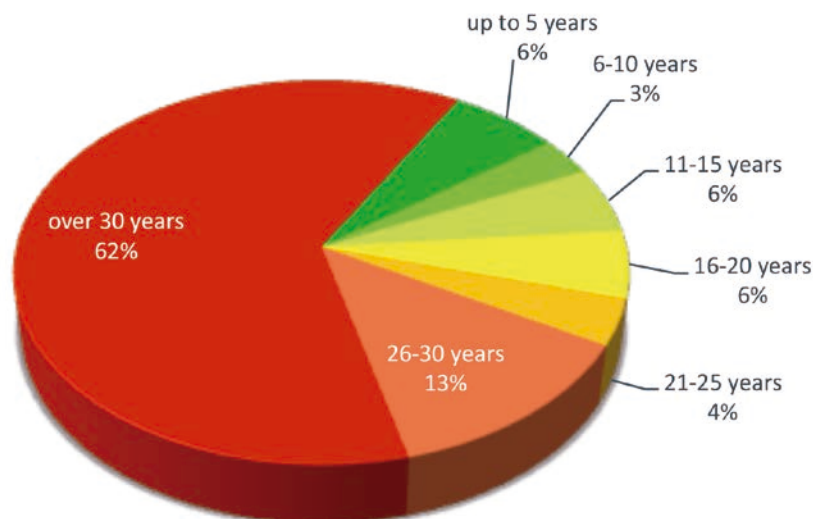


Figure 1. Age Structure of the Existing Power Plants in Poland (sorted by boiler's age). Source: Polish Energy Market Agency 2014.

Under the cooperation agreement signed, the partners will jointly finance operations in the initial phase of the project, proportionately to their shareholdings, over the next 3 years.

In the end of 2015 PGE EJ 1 will launch the integrated proceedings. The concept of this proceedings embraces all key elements and services related to the nuclear project: nuclear reactor technology, EPC services, fuel supply, O&M services support in the first years of NPP operations, capital engagement by a potential strategic partner or business partners as well as debt financing from ECAs and commercial banking institutions.

WORKFORCE AND EDUCATION

Construction of the first NPP in Poland will generate approximately 1 500 – 2 000 permanent jobs as well as an equivalent number of additional jobs to provide services necessary to support the nuclear plant. It is expected that construction of the plant will last about 6 years. Operation of the NPP will require approximately 800 – 1000 permanent employees.

However, the development of nuclear energy in Poland will also create a demand for skilled labor in a wide range of other economic fields. That is why one of the challenges for the academic sector is to prepare appropriate specialists for the new type of energy generation in Poland. Polish universities have started to develop new specializations and departments not only in nuclear engineering, but also in various other

fields, such as energy law, environmental protection and management.

In 2013, PGE EJ 1 launched its academic cooperation programme entitled "Atom dla Nauki" ("Atom for Science"). The key aim of the programme is to promote nuclear-related projects among students and university professors, to promote young scientists and develop resources for the implementation of nuclear power in Poland.

NUCLEAR FUEL CYCLE

At present there is no operating uranium mine in Poland (the last mine was closed in 1963). Polish uranium deposits are low grade deposits and difficult to access (are buried more than 800 m underground on "Natura 2000" areas). Uranium mining and processing in Poland are still uneconomical at current uranium prices in the international market. All front-end of nuclear fuel will be imported, however the government is considering the idea of a network of a joint front-end center together with V4 countries (Poland, Czech Republic, Hungary, Slovakia), or a construction of some front-end facilities purely for Polish NPPs if the nuclear program will be extended to more than 2 NPPs after 2035.

Spent nuclear fuel will not be reprocessed and will be initially stored and subsequently put to underground disposal site. However, reprocessing cannot be excluded in the future, if the market conditions and technology development make it competitive against open-cycle (once-thru). The government is planning

a construction of deep geological disposal site around 2060 for nuclear (high and intermediate level) and also toxic waste. Today spent nuclear fuel from research reactors is being sent to Russia in the framework of IAEA-US-Russia's GTRI programme.

NUCLEAR DEPLOYMENT FRAME IN POLAND

The company, in collaboration with the Owner's Engineer (AMEC Foster Wheeler), has been working on revising the assumptions and possible optimization of the project overall schedule involving, among others:

- developing new approaches and the timing of location and environmental studies. Recognizing the vital importance of location and environmental studies for further steps in the process of building the nuclear power plant, PGE EJ 1 decided on the termination of the contract with WorleyParsons, the company responsible for carrying out this part of the project. The reason for this decision was the fact that WorleyParsons was not fulfilling its contractual obligations which resulted in the un-

timely execution of the work specified in the agreement. PGE EJ 1 intends to complete the project in a modified organisational formula. The plan is to rely on the experience of the PGE Capital Group and the nuclear experience of an industry consultant. Companies within the PGE Group will take over the activities related to the management and coordination of site characterization, applications and reports, as well as the acquisition of key licenses and permits. Currently, site characterization works are conducted in the Pomeranian voivodeship on three sites simultaneously: "Choczewo" and "Lubiatowo-Kopalino" (Choczewo commune) and "Żarnowiec" (Gniewino and Krokowa communes). Site characterization is to confirm the suitability of the given, potential site for hosting an NPP from both the environmental and nuclear safety perspective. In August Company submitted an application to the General Directorate for Environmental Protection for issuing an Environmental Decision and an application for the definition of the scope of the Environmental State-

ment (including the PIS - Project Information Sheet).

- the elaboration of the legal formula, approaches and stages of the Integrated Proceedings. The concept of integrated proceedings embraces all key elements and services related to the nuclear project: nuclear reactor technology, EPC services, fuel supply, O&M services support in the first years of NPP operations, capital engagement by a potential strategic partner or business partners, as well as debt financing from ECAs and commercial banking institutions. The proceedings will be launched at the end of 2015.
- developing the funding concept of the project. Because of the scale of the project, it cannot be financed by PGE alone. That is why at present, PGE EJ 1 is conducting analyses of the possible structure and the financing options, such as State support, debt financing by ECAs and commercial banks, capital involvement of the partners, as well as analyses of potential support mechanisms for the NPP build and operations. ■