POLAND

A multitrack strategy revitalizing nuclear energy programs in EU

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NATIONAL CENTRE FOR NUCLEAR RESEARCH ŚWIERK

NUCLEAR ENERGY IN POLAND - HIGHLIGHTS

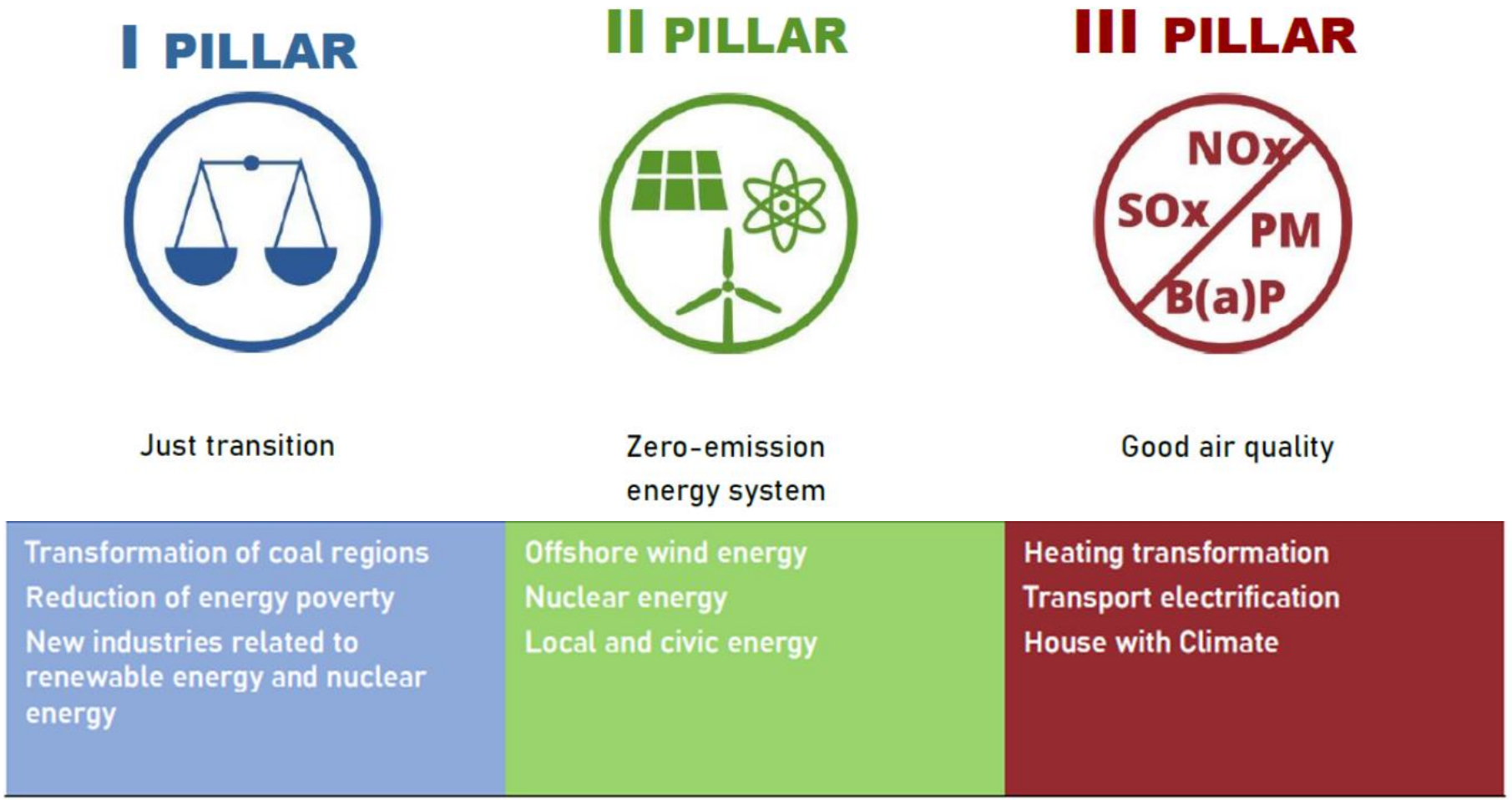
Energy Policy of Poland until 2040 (PEP2040, approved 2021, will be revised)

Polish Nuclear Power Programme (PPEJ, approved 2020, will be revised)

SMR activities in last 2 years

Advanced nuclear technologies (HTGR projects)

Energy Policy of Poland until 2040 (PEP2040) approved by Polish government on February 2nd, 2021



The energy transition is based on three pillars.

After the revision, the fourth pillar will come - energy sovereignty.

Source: PEP2040

Zero-emission strategy for power system (PEP2040)

Provide energy security, ensuring competitiveness of the economy, energy efficiency and reduction of environmental impact.

OFFSHORE WIND

about 8-11 GW to 2040

Investment outlays around 130 bln PLN

NUCLEAR ENERGY

about 6-9 GW

Investment outlays around 150 bln PLN

LOCALIZED AND PROSUMER POWER GENERATION

Increase of prosumers actively take part in Energy market

300 self-sustainable communities and 1 mln prosumers till 2030

Source: PEP2040

The update of the Polish Energy Policy until 2040 will take place at the turn of 2022/2023

The update of the assumptions of PEP 2040 (approved March 29, 2022) concerns geopolitical challenges related to the diversification of gas and oil supplies and the acceleration of all activities aimed at ensuring Poland's energy security. Poland's energy policy until 2040 has been supplemented with the fourth pillar concerning energy sovereignty.

Assumptions:

- Increasing technological diversification and expansion of capacity based on domestic sources.
- Further development of renewable energy sources.
- Improving energy efficiency.
- Further diversify supplies and provide alternatives to hydrocarbons.
- Adaptation of investment decisions in gas generation capacity to the availability of fuel.
- Use of coal units.
- **Implementation of nuclear energy.**
- Grid development and energy storage.
- Negotiations of changes in EU regulations.

Updated Polish Nuclear Power Programme approved by Polish government on October 2nd, 2020

Target

To build 6-9 GWe of installed nuclear power capacity based on large, proven PWR type reactors for electricity generation.

Key elements of nuclear power implementation.

Model (ownership relations):

Project company (51% State Treasury, 49% Strategic co-investor connected with technology supplier). One technology for all NPP's.

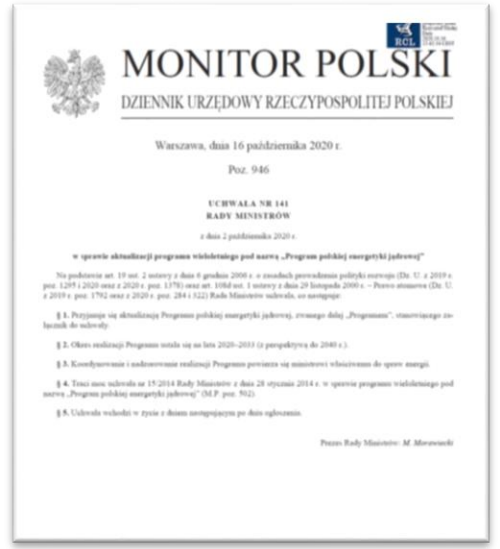
Technology (reason for large PWR's):

The most extensive experience in construction and operation of NPP. No history of important radiological accidents. Common knowledge of PWR technology by Regulators. More options for NPP siting due to smaller emergency zone. Competitive supplier market.

Location: one in North and one in Central Poland

Schedule:

2022 - selection of technology for NPP, obtaining of an environmental and siting decision for NPP1, signing an agreement with the vendor of technology and EPC contractor
2026 – obtaining of a construction permit and start of the construction NPP1, for NPP2 in 2032
2033 – the issuance of an operating license by the Regulator and the commissioning of the first reactor of NPP1
2035 - 2043 every 2 years – the issuance of an operating license and the commissioning of further 2 reactors at NPP1 and 3 reactors at NPP2.


MONITOR POLSKI
DZIENNIK URZĘDOWY RZECZYPOSPOLITEJ POLSKIEJ

Warszawa, dnia 16 października 2020 r.

Poz. 946

UCHWAŁA NR 141
RADY MINISTRÓW

z dnia 2 października 2020 r.

w sprawie aktualizacji programu wieloletniego pod nazwą „Program polskiej energetyki jądrowej"

Source: PPEJ

Assumptions of PEP 2040 for nuclear energy

Nuclear energy will be consistently implemented, mainly based on large reactors (above 1000 MW), which has a low sensitivity to fuel supply interruptions and ensures stable and clean energy supplies.

Parallel to the works on the construction of the first Polish nuclear power plant and the comprehensive implementation of the PNPP, efforts will be continued to implement small modular reactors (SMR) in the long term. The use of this technology to generate process heat may be an alternative to conventional units in industry and heat engineering.

SMR activities in Poland

Last years Poland we have in Poland visible activities of SMR vendor companies. Some of them found potential customers, but the most important barrier for nuclear reactor construction is the Polish law, which forbidden the installation of commercial FOAK. Therefore the biggest chance have companies, having opportunity to build the FOAK somewhere else. Below is the subjective list of such companies:

GE-Hitachi with BWRX-300 (BWR, 300 MWe). Implementation process started in OPG (Canada). GEH started cooperation with the largest Polish private chemical company SYNTHOS. Later to SYNTHOS joined the private utility ZE PAK and biggest Polish company PKN Orlen.

NuScale with VOYGR (PWR, 77 MWe). Implementation process started in Utah (USA). NuScale started cooperation with KGHM (cooper mining) and utility company Tauron.

Ultra Safe Nuclear Company with MMR (HTGR, 15 MWth). Implementation started in Canada and USA. USNC opened division in Poland and cooperate also with SYNTHOS.

Advanced nuclear technologies in Poland – new opportunities for climate change mitigation

Although priority of Poland is to implement nuclear power programme based on large scale reactors we are aware of potential future benefits of HTR. As a result we initiated the scientific project on HTGR's (especially for industrial cogeneration) with the following objectives:

Decreasing dependence on fossil fuel import

HTGR may be an alternative to replace fossil fuels for industrial heat production. With expected growth of CO_2 tax and low discount rate, the cost of the steam from HTGR could be comparable to that from gas, while having more secure availability and more predictable prices.

Decreasing sensitivity of economy to environmental regulations

Industry dependent on fossil fuels might become less competitive in case of stronger environmental regulations (CO_2 tax, emission limits, etc.). HTGR being a zero emission technology is immune to that.

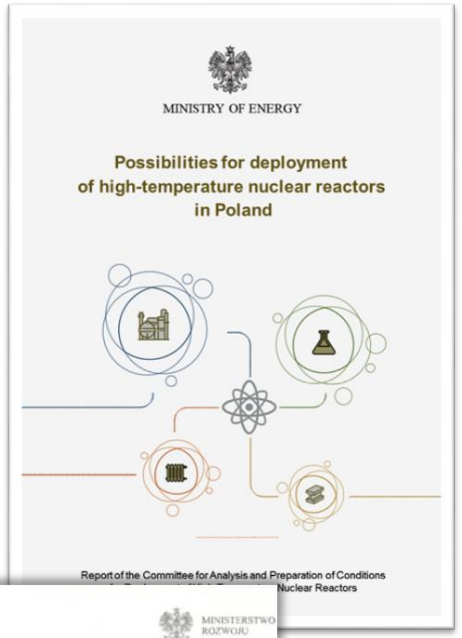
Synergy with multi-GW LWR programme .

Increasing scientific and industrial potential, upgrading the regulatory framework, developing human resources and creating a supply chain, will be beneficial for both HTGR and LWR projects.

Status of nuclear cogeneration activities

Formal basis for HTR technology

- Minister of Energy appointed Committee for deployment of high-temperature nuclear reactors in Poland in July 2016. Report with results of the Committee's works published in January 2018. Minister accepted the report, took note that deployment of HTGR reactors in Poland is desirable and requested Ministry to prepare further steps.
- Strategy for Responsible Development - the governmental program for Polish economic development - adopted in February 2017, contain e.g.: Deployment of HTR for industrial heat production. The project for this action is: Nuclear cogeneration – preparation for construction of the first HTR of 200-350 MWth supplying technological heat for industrial installation.



Status of nuclear cogeneration activities

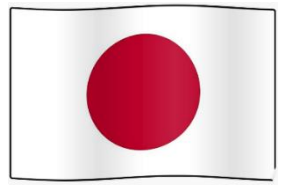
Technical activities

- GEMINI+ (2017 – 2021). The main design options for HTGR fitting the requirements for cogeneration use in Europe.
- The NOMATEN Centre of Excellence has received 7 years (2018-2025) of joint financial support (€37M) from the Foundation for Polish Science (FNP) and the European Commission. NOMATEN focus on the studies and development of novel materials, specifically those designed to work under harsh conditions – radiation, high temperatures and corrosive environments.
- GoHTR (2019-2022). In the frame of national strategy program GOSPOSTRATEG (€4M) joint project of MoE, NCNR and INChT was realized, for preparation of law, organization and technical instruments to deploy the HTR reactors.
- National Centre of Nuclear Research (NCNR) is gaining knowledge on HTGR technology by strengthening collaboration with Japan Atomic Energy Agency (JAEA).

Status of nuclear cogeneration activities

Now

- Action Plan for the Implementation of the Strategic Partnership between the Government of the Republic of Poland and the Government of Japan for the years 2021-2025 seeks cooperation in the field of High Temperature Gas-cooled Reactors (HTGR) between the NCNR and JAEA, as well as other relevant entities towards possible deployment of industrial HTGR's.



- We start the NCBJ - MEiN Programme – HTGR Basic Design a first phase of EUHTER (EUropean High Temperature Experimental Reactor) program (design and construction of small experimental HTGR, being also the technology demonstrator). Financing will be based on national resources.
  - The contract determines that the conditions for the construction of a high-temperature research reactor in Poland will be created within three years and that the conceptual design and further most of the basic design of such a device will be prepared. The reactor will be a prismatic type HTGR using TRISO fuel producing approximately 30-40 MWth at an outlet temperature of 750 ^{o}C.
  - Time: 1.06.2021 – 1.06.2024.
  - Value: approximately €14M

- GEMINI 4.0 (2022 – 2025). New Euratom project as a continuation of GEMINI+.

Thank you for your attention

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