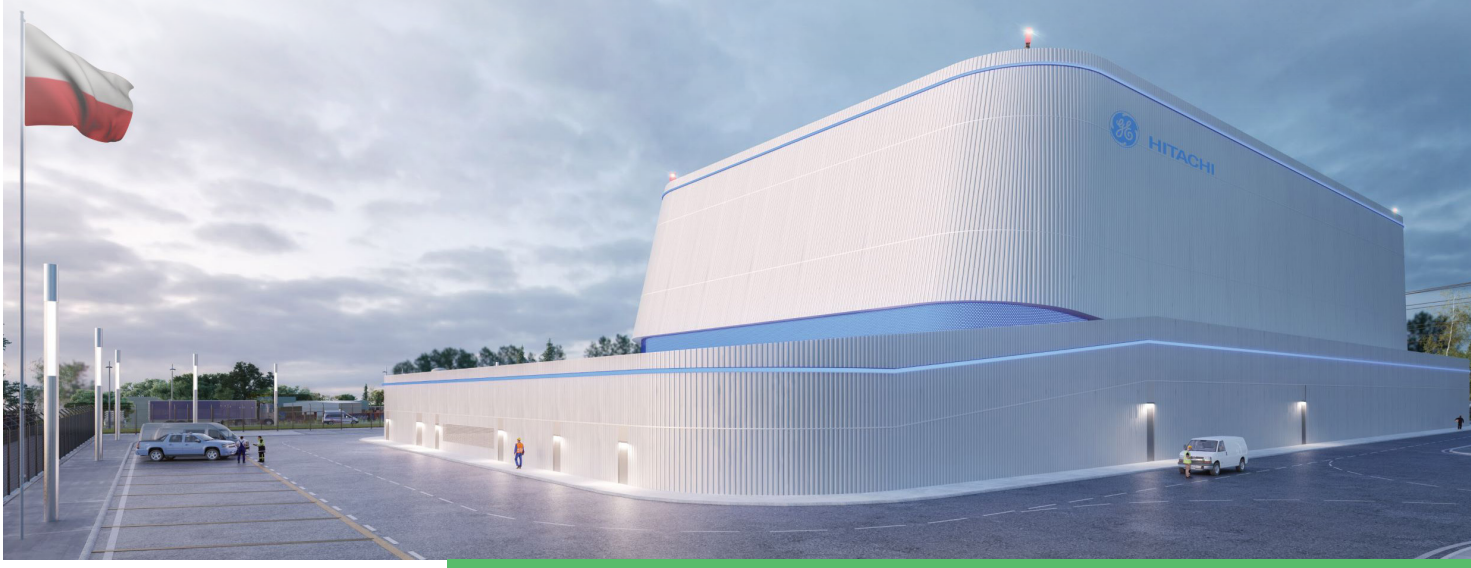
OSGE | ORLEN SYNTHOS GREEN ENERGY

HITACHI

BWRX-300

TRANSFORMING ENERGY, INDUSTRY AND HEATING IN POLAND



Why do we need nuclear power?

Polish households and industry need stable, zero-emission and cost-attractive sources of electricity and heat to gradually replace or complement traditional energy fuels. Electricity and heat production from small reactors will be cheaper than from coal or natural gas.

What are small modular reactors (SMRs)?

Small modular reactors (SMRs) have a power capacity of up to 300MWe per unit.

SMRs can generate both electricity and heat for households and industry. They differ from large reactors not only in power capacity, but also in their production process. Serial production allows costs to be reduced, and producing the reactors in modules allows very accurate quality control, easy transport of the modules and assembly on site.

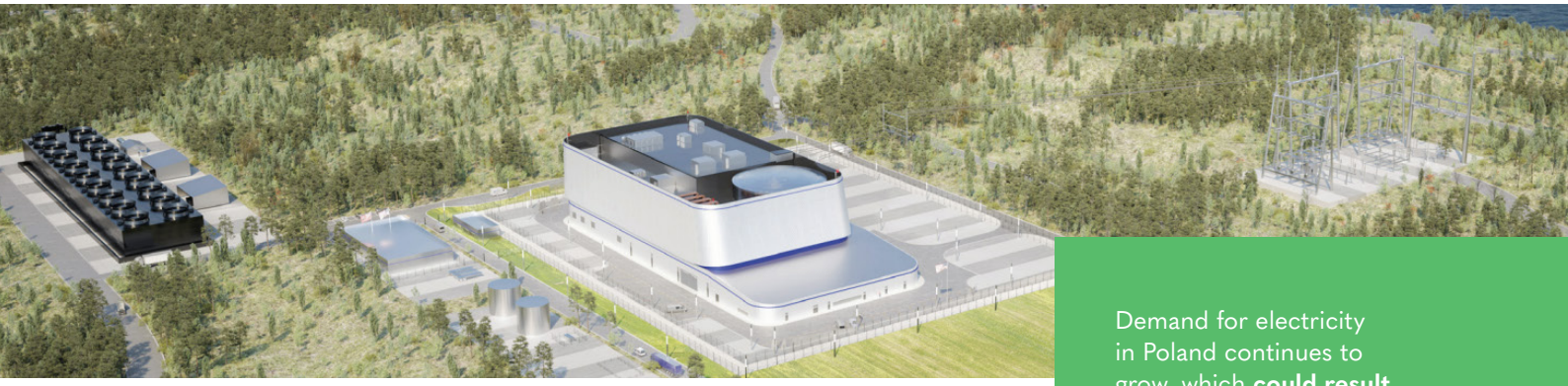
Many countries around the world are investing in small reactor technology, including the United States, the United Kingdom, France, China, the Czech Republic, Estonia, Lithuania, Finland, Romania and Poland. In the coming decades, up to several hundred coal-fired power plants could be replaced by nuclear units, including small modular reactors, across Europe and the United States.

What will small modular reactors give us?

Cheaper electricity and heating for industry and individual consumers compared to coal- and gas-fired installations.

Better quality of life: ZERO harmful emissions into the atmosphere.

Security of electricity and heat supply and predictable prices for 60-90 years, the lifetime of the reactor.



OVER 60 YEARS,
A SINGLE BWRX-300 WILL ELIMINATE:

176M tonnes of CO_2 emissions*	**65M** tonnes of coal burned	**1.7M** km of rail transport of coal
0.32M tonnes of SO_x emissions*	**0.28M** tonnes of NO_x emissions*	**0.75M** tonnes of dust emissions*

* source: UNECE Carbon Neutrality in the UNECE Region, 2022

Demand for electricity in Poland continues to grow, which **could result in a 14 gigawatts** of generating capacity gap by 2040.

This could lead to an increase in Poland's dependency on energy imports and/or regular power outages.

The construction of dozens of 300MWe small modular reactors will help **avert a potential energy crisis**.

Safety based on the rights of nature

- A safety system based on gravity and natural circulation of the coolant allows the reactor to cool itself for up to 7 days. In the event of any malfunction, the reactor shuts down automatically, without any intervention, and does not need electricity to self-cool.
- The reactor is located below ground level in a special steel and concrete containment, guaranteeing full isolation from groundwater.
- Spent nuclear fuel and other radioactive waste will be stored safely in special facilities prepared in accordance with international standards.

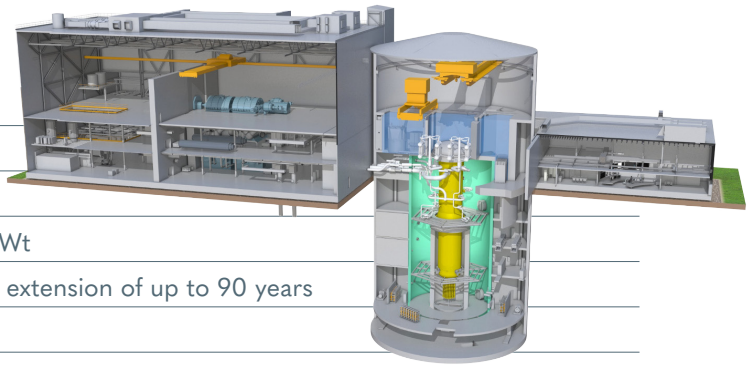
Around the world, nuclear power plants have been operating near cities for decades without failure with power capacities of up to several thousand megawatts:

- **Canada:** 15 km from centre of Toronto;
- **Czech Republic:** 30 km from České Budějovice;
- **Poland:** 5 km from Otwock situated near Warsaw (National Centre for Nuclear Research).

BWRX-300 reactor designed by GE Hitachi

- Designed by the US-Japanese company GE Hitachi Nuclear Energy, the BWRX-300 is the only SMR design based on existing technology that can replace decommissioned coal-fired units and guarantee stable baseload electricity production.
- The BWRX-300 design is based on boiling water reactor (BWR) technology, which has passed the test of time. BWR reactors have been operating safely for over sixty years. To date, 67 BWR reactors are in operation worldwide.
- By 2028, the first BWRX-300 reactor will be built in Canada. Poland's first reactor will be based on the Canadian experience, allowing for a more efficient investment based on proven technology. BWRX-300 reactors will also be built by other companies in North America (Canada, United States) and Europe (Sweden, Czech Republic).
- SMRs require a relatively small space, as compared to traditional large reactors. The entire plant with the BWRX-300 reactor will only require an area of 260 x 332 m, with the nuclear island located inside a building which will be roughly the size of a football pitch.
- In contrast to traditional large reactors, power plants and CHPs with small reactors do not require large volumes of water to run or cool, so they will not tax local water management systems.
- The reactor power output is flexible and can be adjusted allowing easy cooperation with the renewable energy sources, which has a high variability of power generation caused by weather.
- BWRX-300 reactors will be located below ground level, therefore the required safety zones are small, not exceeding the boundaries of the power plant or CHP plant site. The area of an old coal-fired power plant will usually be sufficient.
- Small modular reactors are an ideal source of electricity and heat for industry, including glassworks and steel mills, cement and paper producers.
- SMRs can also be a source of heat for district heating systems. More than 16 million Poles are connected to district heating systems. Warsaw has the largest district heating system in the EU.
- Small modular reactors will make optimal use of existing transmission grids, after coal power plants are shut down in the coming decades. Since it has capacity similar to current coal-fired units and can be built on the same amount of land, the BWRX-300 will significantly reduce the scale and cost of grid modernization.

BWRX-300 specification



Supplier: GE-Hitachi Nuclear Energy (USA)

Reactor type: boiling water (BWR)

Gross/net power: electric 300/280MWe, thermal 870MWt

Projected time of operation: 60 years with an expected extension of up to 90 years

Capacity factor: 95%

Construction time: 24-36 months

The plant site is approximately 8.6 hectares, which is about 10% of the terrain required for a large traditional nuclear power plant, and slightly less than the area required for a coal-fired unit with similar power capacity

Capable of load following: possible power change down to 50% – 0.50% power/minute

Ideal for electricity generation and industrial applications, including hydrogen production and district heating

Design-to-cost approach. Significant capital cost reduction per MW

The evolutionary design – it is a 10th generation of boiling water reactors (BWRs) designed by GE and GE Hitachi

World-class safety

Evolutionary design – BWRX-300 uses proven and licensed elements

OSGE | ORLEN SYNTHOS GREEN ENERGY

ORLEN Synthos Green Energy (OSGE) is a company established by ORLEN S.A. and Synthos Green Energy S.A. The company plays a leading role in the deployment of modular nuclear reactors in Poland, aiming to contribute to the effective decarbonisation of the power generation, heating and industrial sectors.
OSGE's mission is to build a fleet of BWRX-300 reactors designed by US-Japanese company GE-Hitachi Nuclear Energy, which will become an important part of the country's energy mix, providing households and industry with stable zero-carbon electricity.

Orlen Synthos Green Energy

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