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Executive Summary: Nuclear Energy as One Option for Decarbonising Poland's District Heating Systems

*An English-language summary of the original report **"Ciepło z atomu? Rola energii jądrowej w dekarbonizacji ciepłownictwa systemowego w Polsce"**, which assesses whether nuclear technologies could contribute to the decarbonisation of selected district heating systems in Poland.*

Scale of the challenge

Poland's district heating sector needs a competitive decarbonisation pathway that leverages a broad range of clean technologies. In 2025, licensed district heating companies operated 50.95 GW of installed capacity and 23,000 km of heat networks, while coal-based fuels accounted for 52.8% of all fuels used for heat generation, compared with as much as 81.7% in 2002.

Polish nuclear context

Poland is currently preparing its first large-scale nuclear power plant, with the first unit planned to enter commercial operation in 2036. In parallel, the government is advancing preparations for a second large-scale nuclear power plant and developing a national, non-legally binding roadmap for the deployment of small modular reactors (SMRs). The roadmap is intended to provide guidance for the development and implementation of potential SMR projects.

Potential role of nuclear energy

Nuclear energy could become one decarbonisation option for selected large and medium-sized district heating systems. Its deployment is most likely to be justified where heat demand is sufficiently high and predictable, heat transmission costs can be low, and long-term offtake arrangements can support the recovery of high fixed costs. Nuclear heat is not a universal solution. Each prospective project should be assessed against locally available low-carbon alternatives, including other heat-generation technologies, thermal energy storage, and measures to reduce heat demand.

Potential benefits

Nuclear energy can provide low-carbon heat independently of weather conditions and reduce exposure to fossil-fuel prices and carbon costs. Combined heat and power operation can also enable reactor capacity to be used for electricity generation outside the heating season. A heat-only reactor configuration may be technically simpler and require lower capital expenditure than a cogeneration unit. The extent to which these benefits can be realised will nevertheless depend on capacity utilisation, the cost of capital, and the availability and structure of financing.

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Technical configurations

Assessments should distinguish between three principal options: cogeneration from a large nuclear power plant, a cogeneration SMR, and a heat-only SMR. Heat supply from a large nuclear plant could leverage a nuclear power project that is already planned for electricity generation.

Still, it would require a suitable location, heat-transmission infrastructure, and steam extraction embedded in the turbine design. A cogeneration SMR provides an additional electricity revenue stream, but entails greater technical complexity and higher capital expenditure, while heat extraction may reduce electricity output. A heat-only SMR is more exposed to seasonal utilisation, the risk of oversizing, and dependence on a single revenue stream. None of these setups should therefore be treated as inherently preferable.

Deployment barriers

Deploying nuclear energy for district heating faces several barriers. For SMRs specifically, these include the lack of commercially operating units and ongoing uncertainty about costs and delivery schedules. More broadly, nuclear heat projects may face lengthy licensing procedures, seasonal heat demand, and social acceptance challenges. Municipal utilities and local governments have limited capacity to absorb the investment and project-development risks associated with such projects.

Project development costs

Nuclear heat projects involve substantial pre-investment and development costs, including engineering, licensing, and project preparation. For SMRs, these costs may represent a larger share of total investment if they do not decrease proportionately with project size. These costs should therefore be evaluated on a project-by-project basis, as Poland's district heating systems are local and may require public support for feasibility studies and early-stage development.

Recommended actions

If nuclear heat is deemed as a potentially feasible option for decarbonising district heating in Poland, the government should initially co-finance site-specific feasibility and techno-economic studies to assess where deployment is technically and economically justified. Technology and location decisions should be made only after financial viability has been established. The aim should be to assemble a portfolio of credible projects that can advance to detailed engineering, licensing, and financing stages, rather than selecting preferred technologies or cities prior to completing the necessary assessments. Concurrently, the transposition of the Directive (EU) 2023/1791 on energy efficiency should ensure that district heating and cooling systems remain eligible to qualify as efficient based on greenhouse gas emissions per unit of heat delivered.