

The Societal Cost of Prioritising Nuclear Power Over Renewable Energy in Finland

At the COP28, 25 countries, including Finland, declared their intention to triple global nuclear energy capacity by 2050. This expansion includes plans for small modular reactors (SMRs), intended for electricity generation and combined heat and power production for the case of Finland.

The analysis of nuclear power expansion scenarios in the Finnish energy system¹ reveals that prioritising nuclear power over renewables leads to significantly higher costs and financial risks. Nuclear scenarios show 71–84% higher annualised system cost vs renewables-based system in 2050. The system cost difference represents about 2.3% of the national gross domestic product in 2050. The levelised cost of electricity in nuclear scenarios is 99–115% higher compared to the cost-optimal reference scenario by 2050 and the levelised cost of final energy is 72–84% higher.

In the reference scenario, which simulates a free cost optimisation with a zero emissions target, new nuclear power capacities are not installed, indicating that new nuclear power plants are not part of a cost-optimal system.

PROBLEM

Nuclear tripling scenarios possess more risks compared to a renewables-based system. Associated risks include cost, long lead times, and uranium supply uncertainties.

SMR technologies are not yet commercially available. The analysis assumed they will be by 2035, with decreasing costs, but SMRs remain significantly more expensive than the RE system, even with subsidised financing (5% cost of capital). New electricity generation projects are needed immediately, while reliance on nuclear power in long-term planning may leave the country facing an energy deficit if SMRs are not commercialised or the construction of conventional nuclear power plants is delayed, as seen in past projects.

The high costs and centralised infrastructure of nuclear power raise concerns about distributive justice, as these costs may burden low-income households, exacerbating existing inequalities. In addition, the centralised nature of nuclear power limits

¹Who will foot the bill? The opportunity cost of prioritising nuclear power over renewable energy for the case of Finland.
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opportunities for broad stakeholder involvement, raising concerns about procedural justice in energy decision-making. Expanding nuclear power risks locking society into a centralised and inflexible energy system, potentially hindering the development of more innovative and cost-effective alternatives.

SOLUTION

1. Policy should outline the overarching goal of establishing a low-cost, fully defossilised, resilient, and just energy system, while allowing market forces to determine the precise energy mix. This approach will naturally phase out uncompetitive options and safeguard the competitiveness of Finland's energy-intensive industries.
2. When policymakers and energy consumers prioritise investments in renewable energy sources and sector coupling technologies (such as power-to-X), remarkable savings can be achieved in fossil-free energy system investments. The reference scenario achieves necessary system flexibility through higher electric heater capacities, higher electrolyser capacity, and more hydrogen storage capacity compared to nuclear scenarios.
3. Fast-track permitting process for grid expansion, flexible grid connection procedure for renewable projects and a regularly updated national grid expansion plan are essential to roll out renewables quickly across the country.
4. Policies should advance a more equitable, inclusive, and adaptable energy system by embracing decentralised renewables, which promote broader participation and distributional justice. Wind power and solar PV support decentralised innovation and participation, allowing diverse stakeholders, including local communities, to contribute and benefit from the system.

POLICY BRIEF, 11/2025:

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