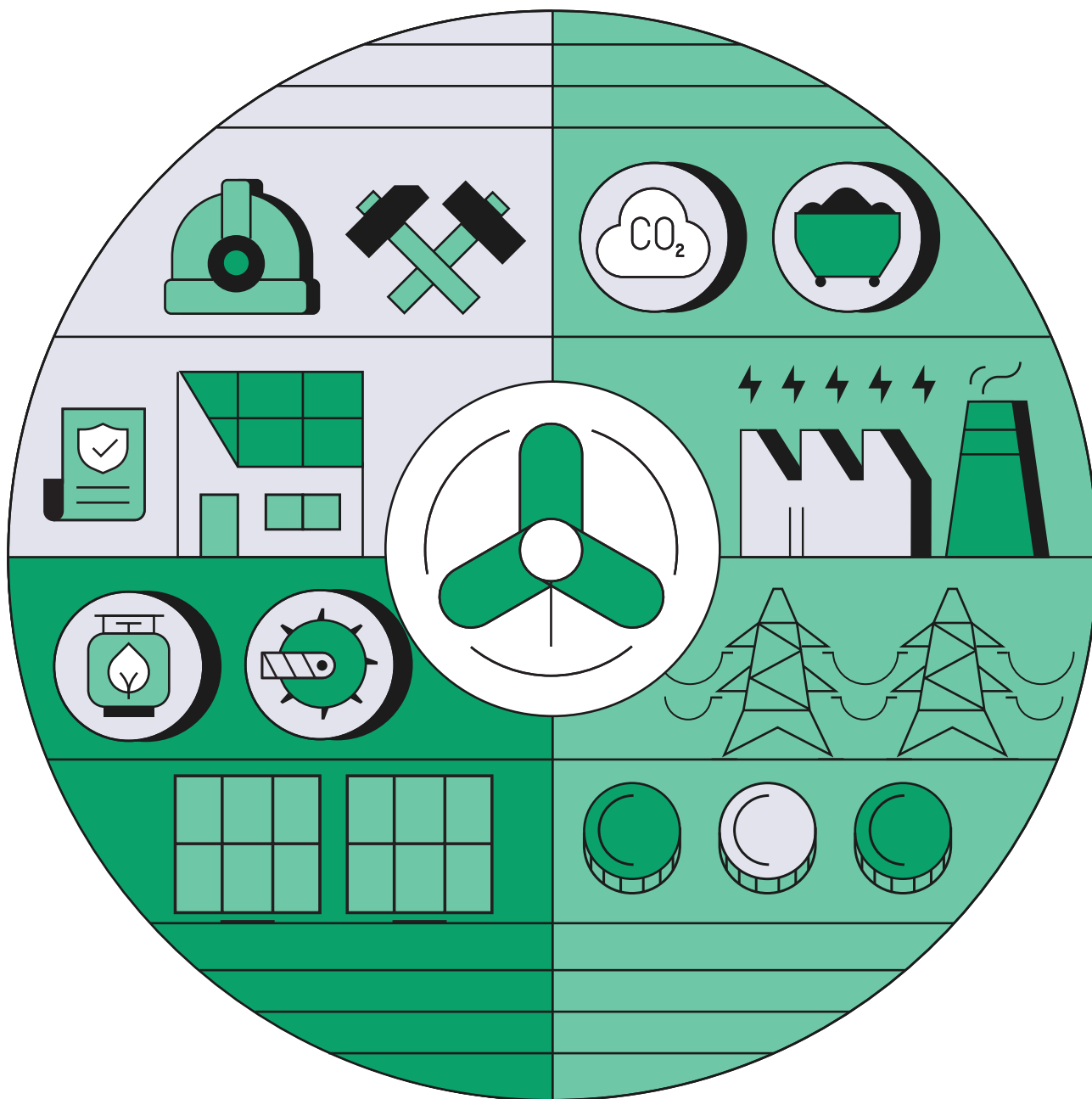


Baseload power

Modelling the costs of low flexibility
of the Polish power system

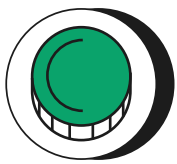


Key findings and numbers



80–85%

The achievable instantaneous share of wind and solar energy in the Polish electricity mix that would minimise the loss of clean energy in the 2030 perspective. Currently, due to technical constraints, the instantaneous penetration of the Polish power system by those energy sources can reach maximally 55-60% – any surplus of renewable energy is wasted.



**1.1–1.3
billion EUR**

Costs of the clean energy curtailment and the coal and gas power plants' overproduction resulting from the low flexibility of the Polish power system in the 2030 baseline scenario. This scenario assumes the deployment of renewable energy sources (RES) in line with the new government scenario proposal made public in June 2023.



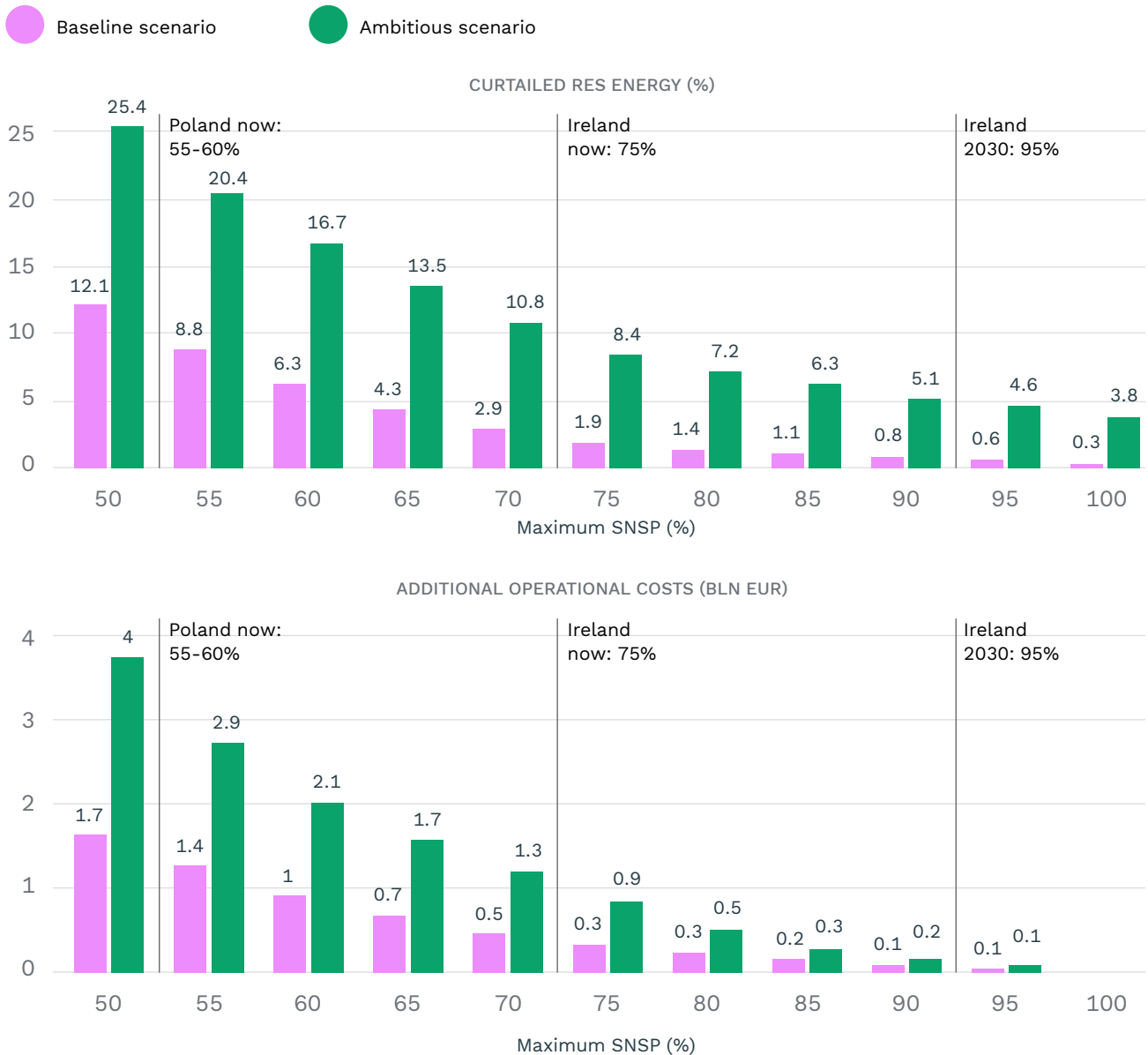
**2.1–3
billion EUR**

Financial losses in 2030 due to the low flexibility of the Polish power system in the ambitious RES scenario. The higher the installed RES capacity, the higher the costs resulting from the insufficient system's flexibility.

- On two sunny Sundays in April 2023, the transmission system operator ordered a curtailment of PV generation, even though almost 8 GW of conventional (mainly coal-fired) capacity was still online.
- Using new functionalities of the PyPSA-PL model, we analyse the factors that may cause conventional power plants to 'overproduce'.
- Our analysis indicates that the main reason for the continuous operation of coal-fired power plants is the need to ensure system stability. Currently, conventional units are responsible for providing power reserves and other ancillary services.
- In the future, the Polish power system will not have to rely on fossil fuel-based power plants for stable operation. Other types of electricity generators and storage units can also provide ancillary services. However, this requires adequate technical preparations and regulatory changes. As a result, the Polish power system will be able to absorb more renewable energy, and the Polish economy will benefit from savings on coal and gas purchases.

INCREASING THE TECHNICALLY FEASIBLE MAXIMUM PENETRATION OF THE POLISH POWER SYSTEM BY NON-SYNCHRONOUS SOURCES MEANS LESS RES CURTAILMENT AND MORE SAVINGS ON OPERATIONAL COSTS

Curtailed RES energy and additional operational costs of electricity generation in 2030 resulting from less than 100% technically feasible penetration of the power system by non-synchronous sources in the power system



Source: InStrat's own analysis based on PyPSA-PL modelling. • Operational costs include fuel costs, CO₂ emission fees, and other variable costs of electricity production, as well as electricity import expenditures net export revenues. • **Additional operational costs** are the difference in the operational costs between a less-than-100%-maximum-SNSP variant and the unconstrained variant. The operational costs without constraint on the maximum SNSP are EUR 11 billion for the baseline scenario and EUR 8.6 billion for the ambitious scenario. • **SNSP** (System Non-Synchronous Penetration) is the share of total instantaneous electricity generation coming from non-synchronous sources (PV, wind, batteries, DC interconnectors).



Full publication in Polish can be found [under this link](#).