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ENERGY TRANSITION SUMMIT WARSAW 2025

AURORA KEYNOTE:
EMERGING MARKETS FOR RENEWABLE ENERGY INVESTMENT IN CEE

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Introduction

How will emerging challenges, such as curtailment and market saturation, impact renewable projects?

Renewables outlook

What is the outlook for renewables across CEE, and how does it vary across markets?

Challenges & Risks

Key Opportunities

What are the available opportunities for renewables, and how can they facilitate project financing?

Source: Aurora Energy Research

To date, Poland has led RES deployment in CEE, however significant future investment opportunities also exist in Romania, Czechia and Serbia

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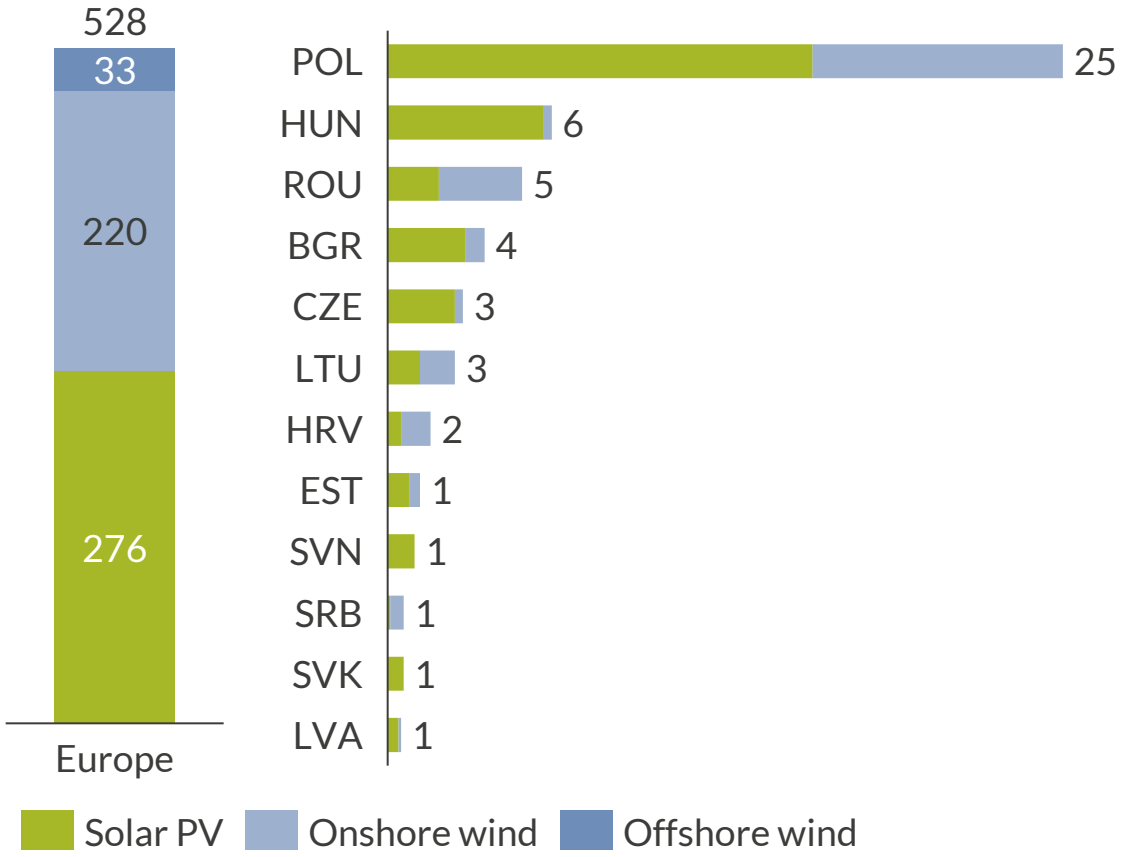
Current installed renewable capacity - GW

Operational renewables capacity in 2023

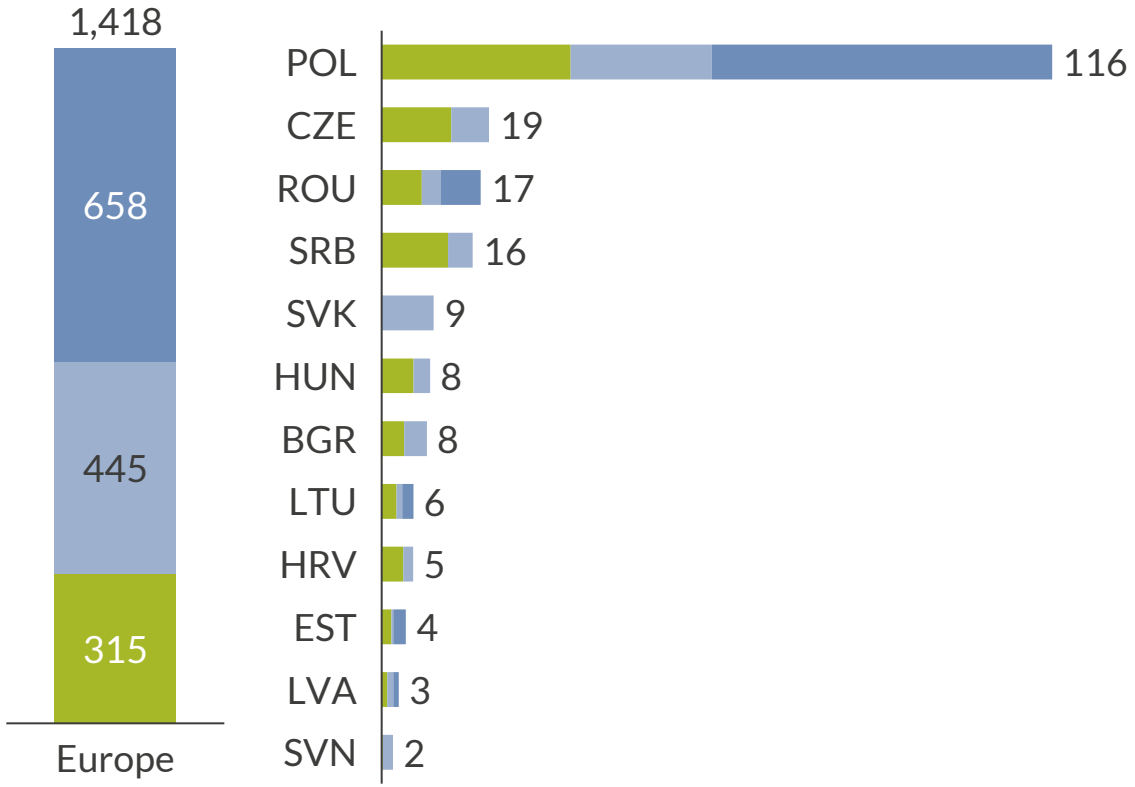
GW



Renewable investment opportunity 2025 – 2050 - €bn

CAPEX investments

€bn (real 2023)



Solar PV | Onshore wind | Offshore wind

Government targets and subsidies are key policy drivers for short term growth, with two-sided CfDs implemented in Poland, Croatia and Romania

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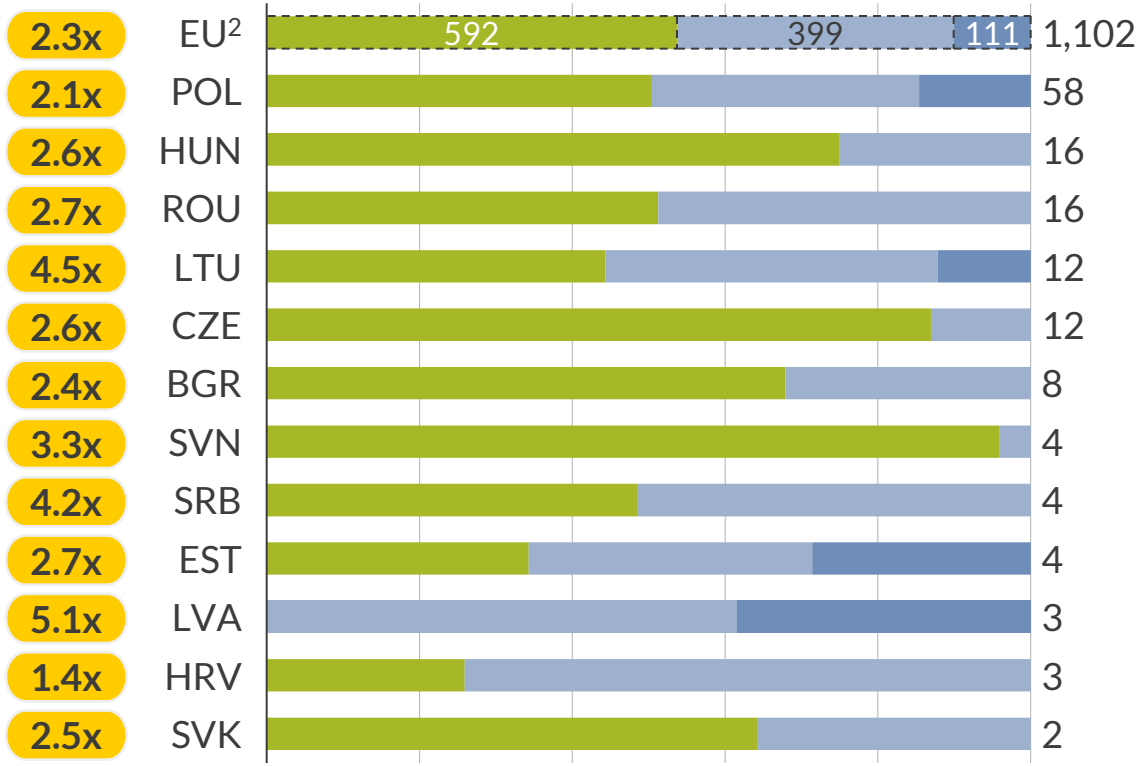
Supply chains | Thermal phase out | **Policy** | Demand | Economics

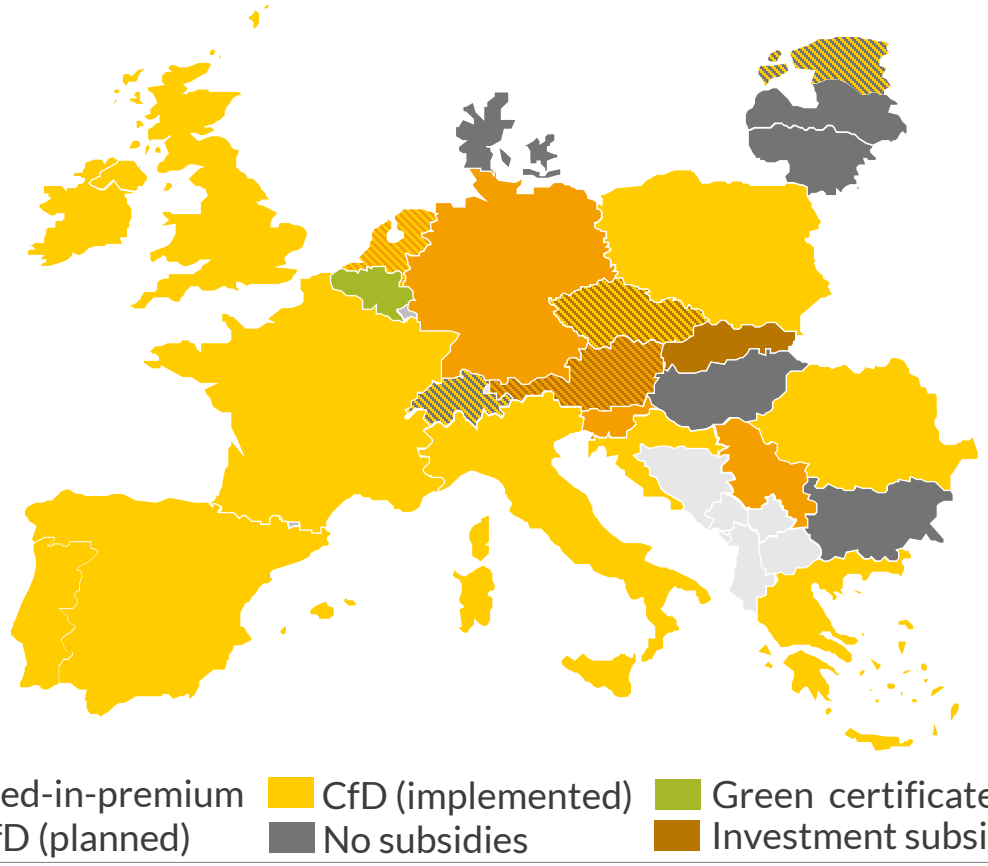
Target RES installed capacity by 2030

GW

X.Xx Targets, relative to 2024 capacity (GW)



Renewables support schemes for standalone utility-scale solar PV and onshore wind assets across Europe



Economic drivers, such as load factors and capture prices, will impact merchant business cases, with highest IRRs in Czechia and Slovakia

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Supply chains | Thermal phase out | Policy | Demand | **Economics**

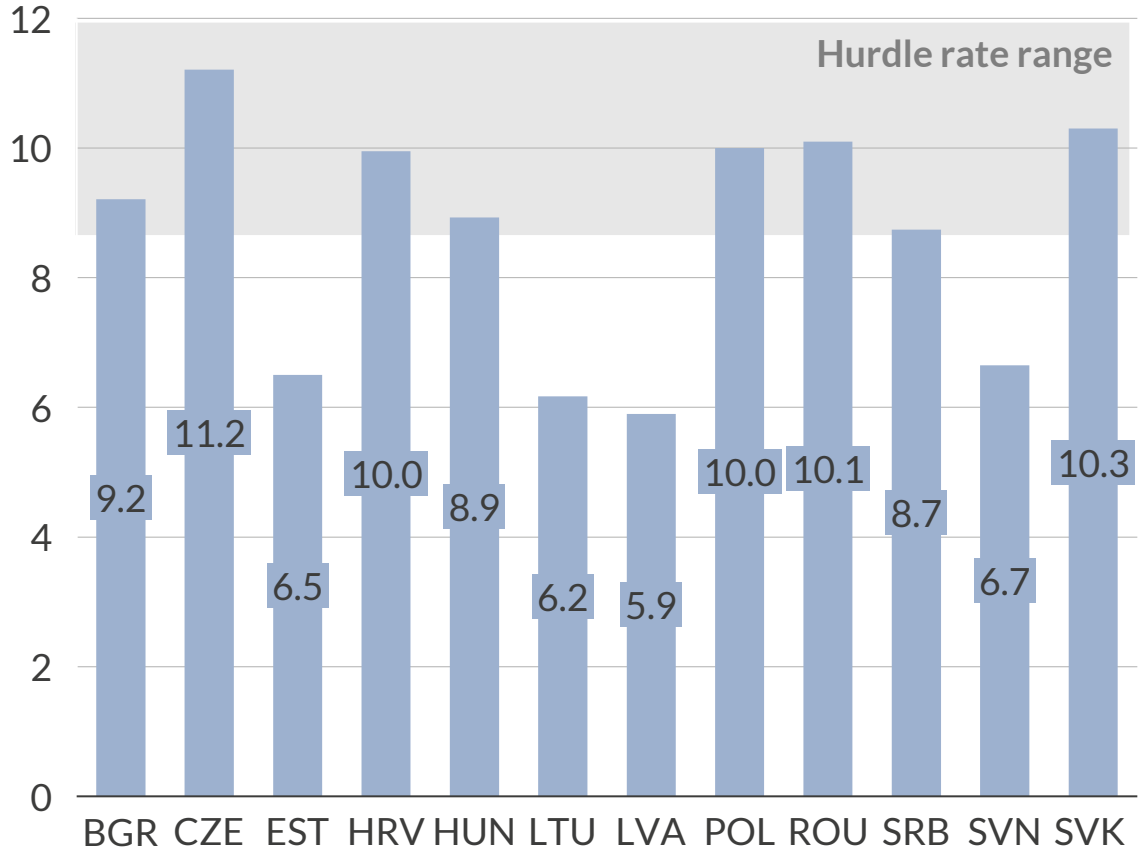
Onshore wind capture prices in 2030

%

		x Load Factor %
27	SVK	108
24	HUN	106
27	HRV	103
21	SVN	101
28	CZE	99
27	ROU	98
27	BGR	98
31	SRB	94
33	POL	81
33	EST	68
33	LTU	65
33	LVA	64

Project IRR, entry year 2028

%, pre-tax, unlevered, real 2023, Central scenario



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Renewable projects are exposed to a variety of market, development and policy risks

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X Deep-dives

Market

Negative prices (A)

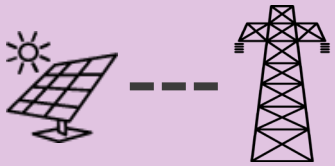
- Increased (subsidised) RES generation and times of low demand cause negative price hours.
- Most regions do not fully shield against these hours.

Market saturation

- Strong RES buildout over Europe leads to higher correlated generation volumes.
- This can lead to reduced capture rates and longer grid queues.

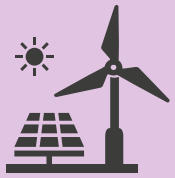
Development

Grid connections



- Long grid queues, sometimes spanning 10+ years, make it difficult to get connected to get projects online.

Supply chains



- Supply chain constraints can increase costs and cause delays in development.
- Permitting can take significantly longer than expected or be refused.

Policy

Grid congestion (B)

- The increasing renewables penetration raises curtailment risks.
- These can occur due to market prices or grid congestion.

Regulation

- Examples include:
  - Market access / reforms
  - Zonal markets
  - Regulatory technology requirements.

Sources: Aurora Energy Research

The magnitude and frequency of negative prices varies across Europe, with Baltics, Romania, Bulgaria and Croatia fully exposed currently

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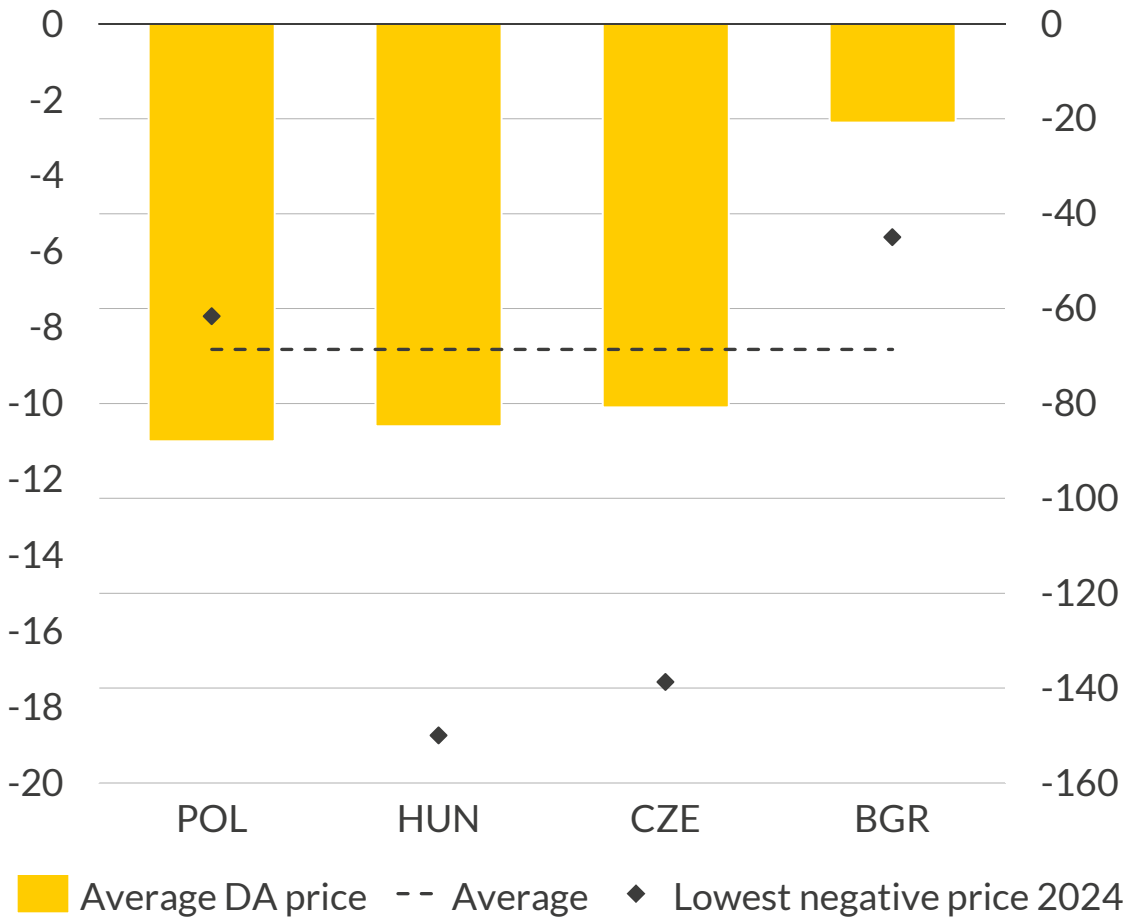
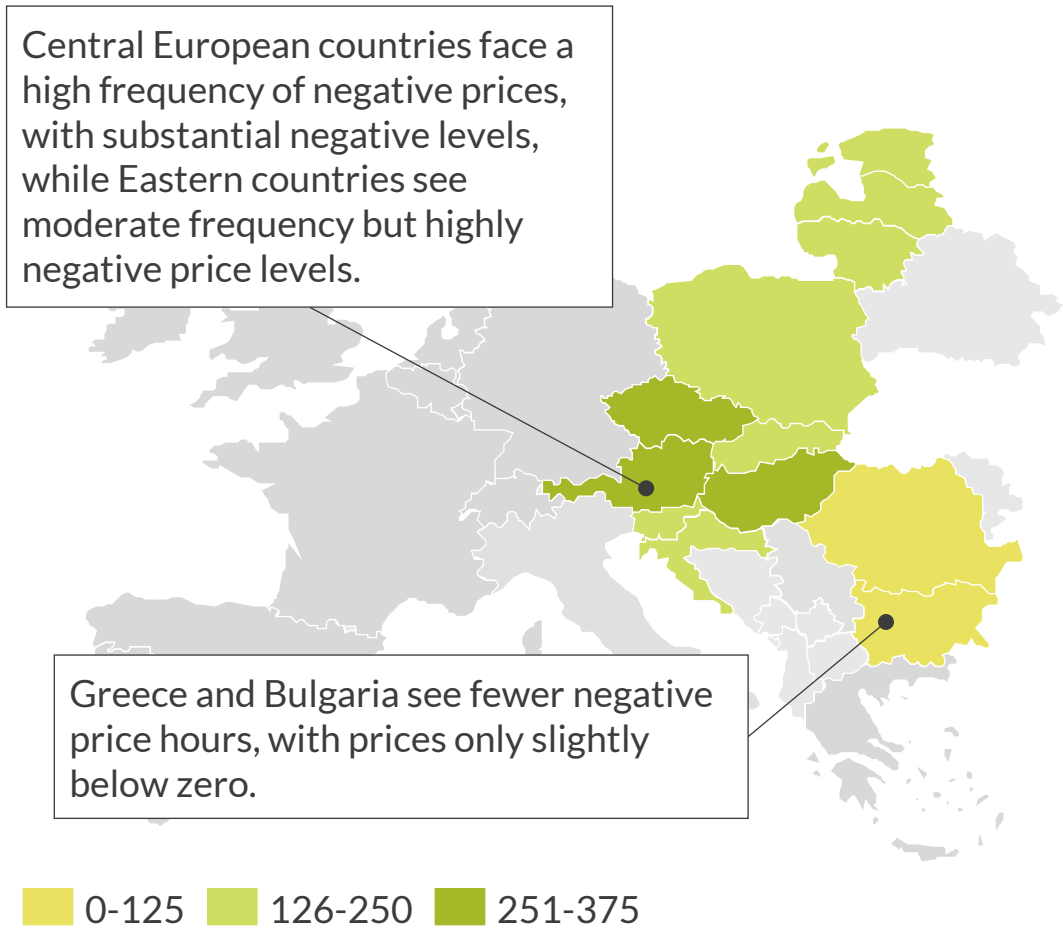
A Negative prices

Average DA[3] price during negative price hours[1,2], €/MWh (nominal)

Lowest negative price[1,2]
€/MWh (nominal)



Number of negative price hours on the Day Ahead market[1,2]
Number of negative price hours



1) 2024 only, according to data from ENTSO-E up to November 2024 2) Italy's current regulation prevents power prices from falling below zero. 3) Day Ahead market.

Source: Aurora Energy Research, ENTSO-E

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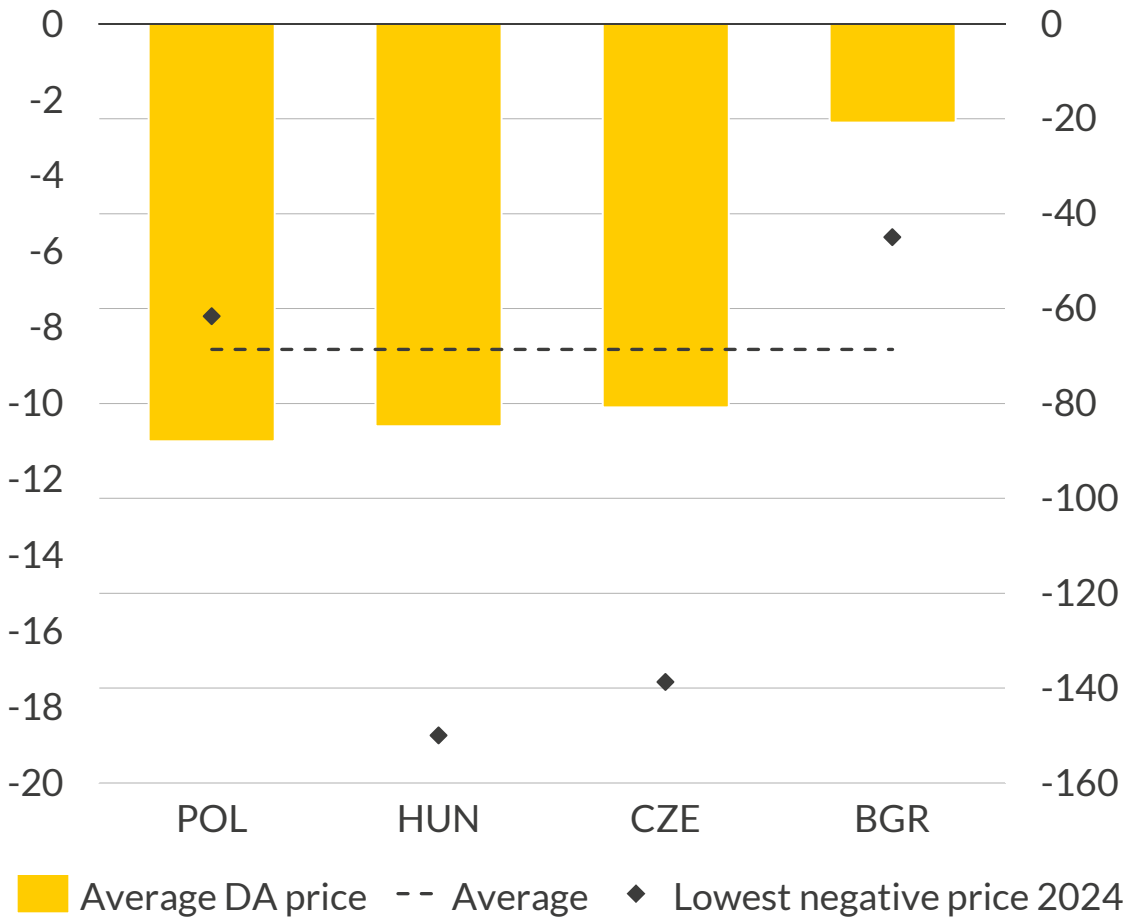

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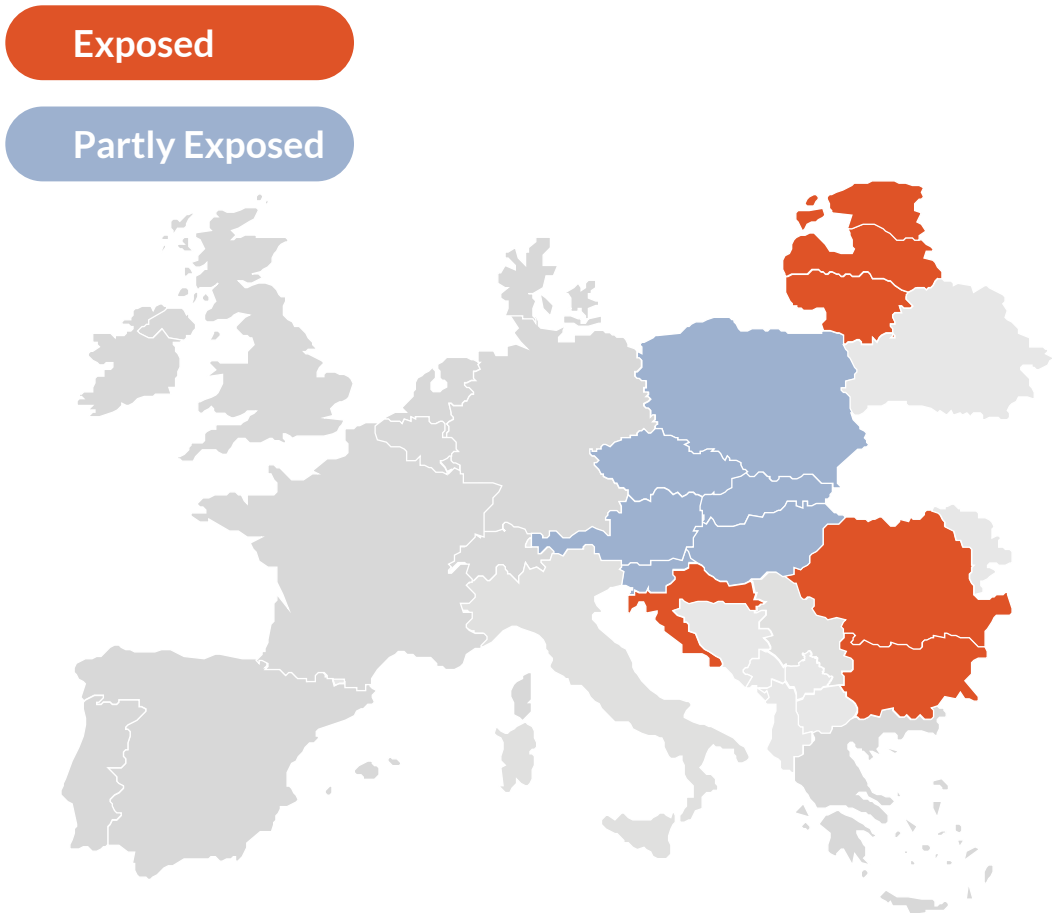

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Source: Aurora Energy Research, ENTSO-E

The increasing renewables penetration raises curtailment risks, which can occur due to market prices or grid congestion

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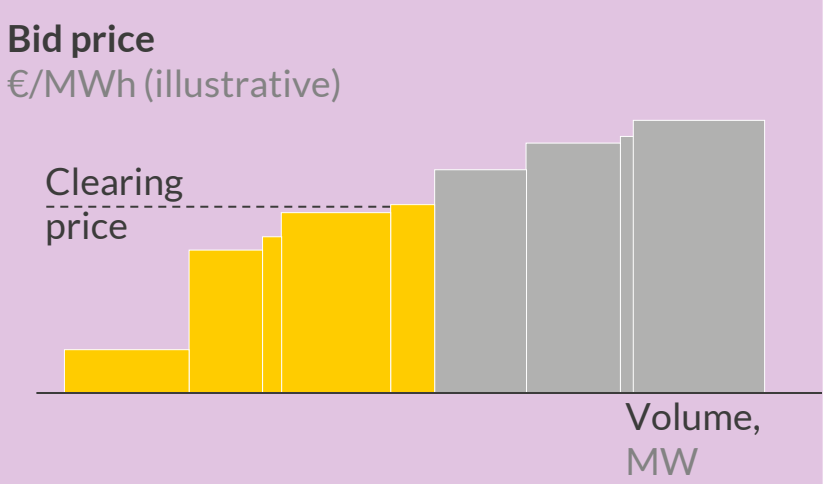
B Grid congestion

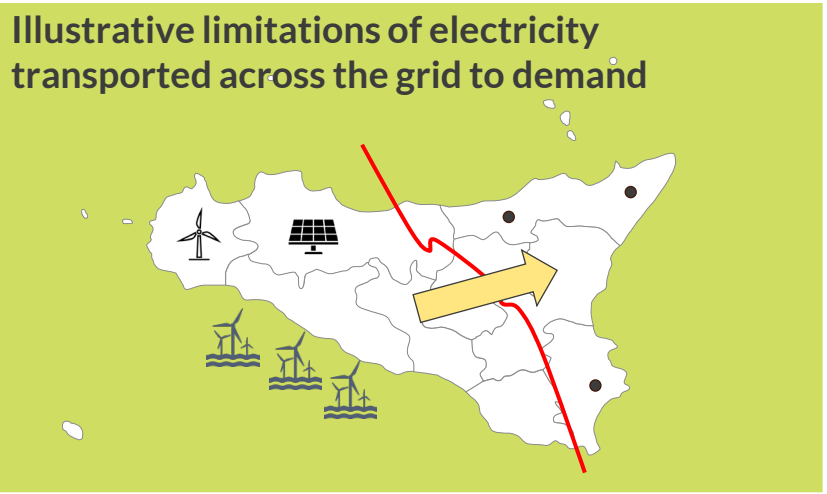
Economic

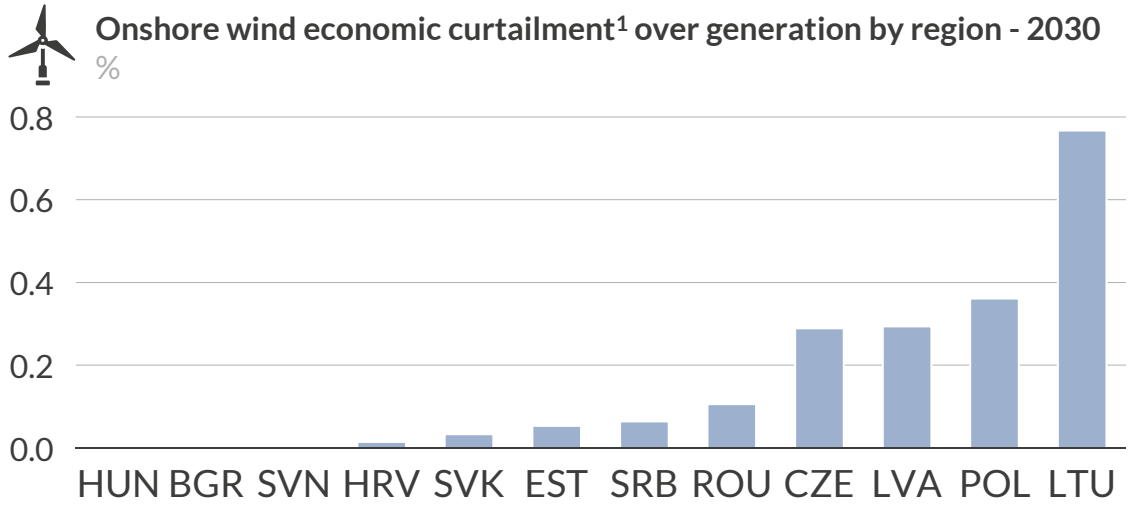
This occurs when the cost of generating electricity exceeds the market price.

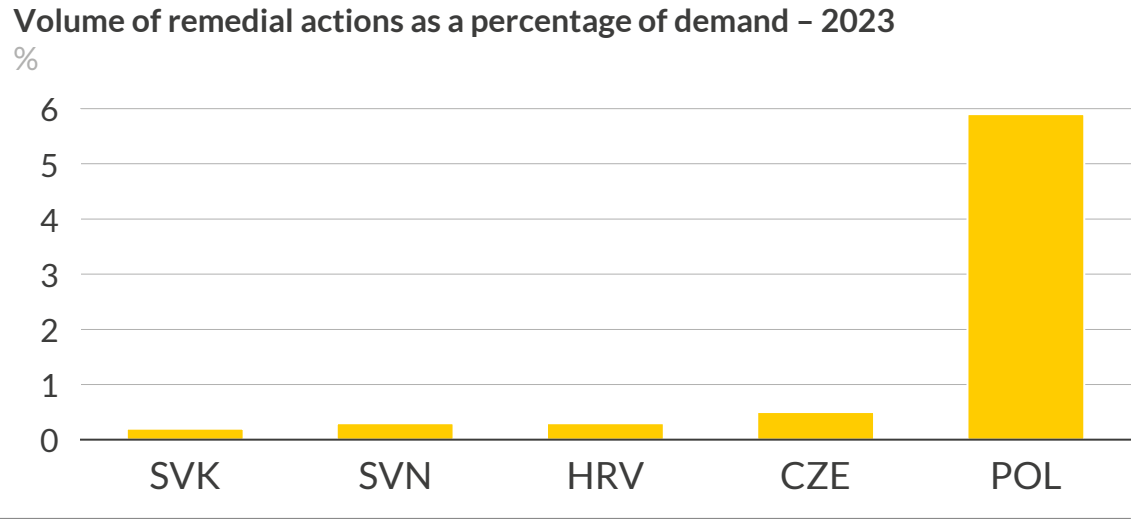


Technical

This occurs when network operators curtail RES to ensure the safe operation of the power system,







Based on Aurora's Oct-24 Central scenarios in model curtailment.

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Source: Aurora Energy Research

Co-location and siting decisions help manage the risks of uncompensated curtailment, but the key mitigations are grid expansion and market reforms

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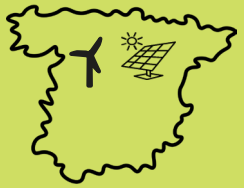
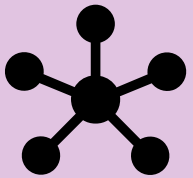
X **Deep-dives**

Portfolio diversification



- Adding assets with different generation profiles.
- Driven by assets' location, technological setup or combining different technologies.

Market Access



- Intermittent RES assets can access more markets than the Day Ahead and the Intraday market
- This offers the ability to diversify revenue streams.

Co-location

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- Co-location enables renewables to shift their generation to less constrained times
- The battery may be able to participate in other ancillary markets

Exchange Hedging

- Using financial instruments, such as futures and options.
- This allows shielding against potential price volatility on electricity markets.

Sources: Aurora Energy Research

Cost savings and additional revenues can help improve the overall project economics of co-located assets compared to standalone

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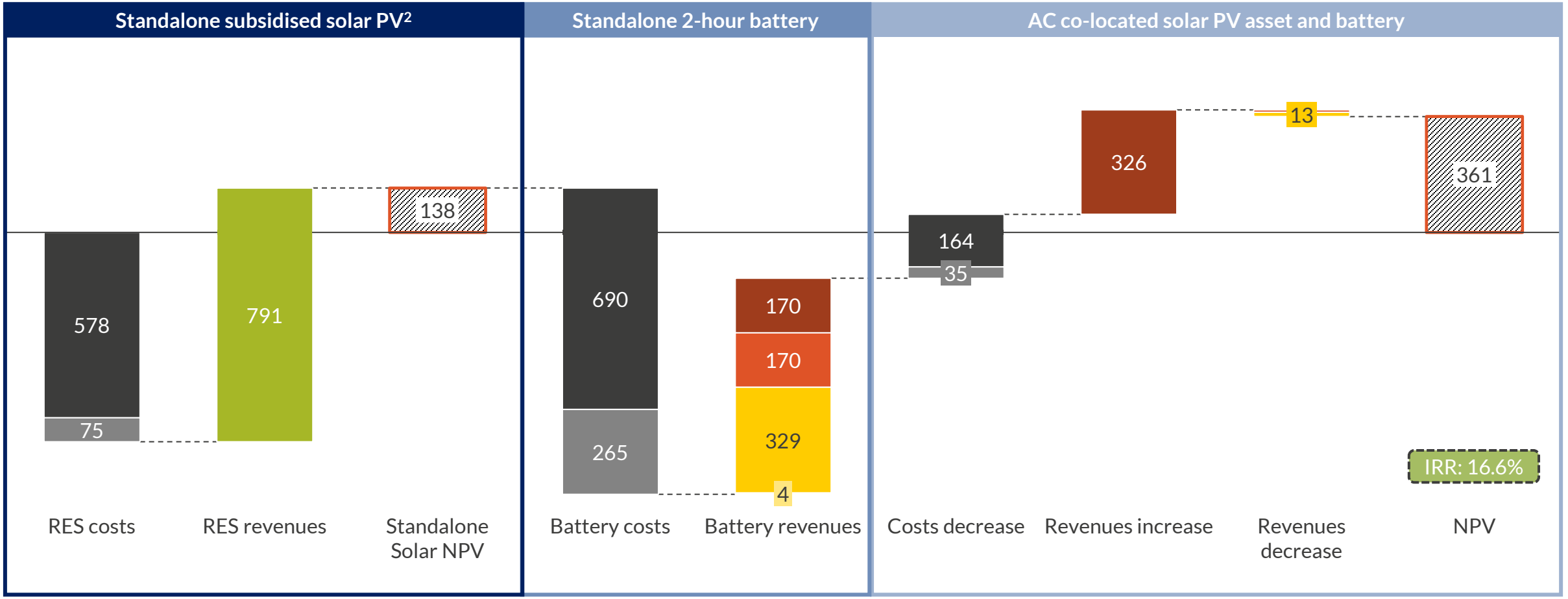
Economics for new-build PV+BESS co-located asset in Hungary - 2h storage duration / 1.5 cycles per day / entry year 2026

Net Present Value[1] €/kW (real 2023)



1) Discount rate of 11%; 2) Assuming standalone assets; 3) Variable grid charges. Fixed grid charges are included in the OPEX; 4) CM = Capacity market; 5) EOL = End-Of-Life.

Source: Aurora Energy Research

Key takeaways

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1 **Growth in Renewables**: Europe's renewable energy capacity has grown to 528GW[1] over the last decade, driven by increasing power demand, strong policy support, elevated commodity prices and the phase-out of thermal power.

2 **Investment Opportunities**: Substantial investment opportunities exist in new renewable energy capacity, with a potential cumulative investment requirement for solar PV and wind of over €1,400 billion in Europe by 2050.

3 **Risks:** Markets are moving away from shielding assets under subsidies from negative market prices. Total remedial actions reached 57.28TWh in 2023, with assets only fully shielded from constraints under a firm grid connection.

4 **Opportunities**: Co-location of RES with BESS can provide cost savings, reduced risk, better grid integration and additional revenue streams.