European Resource Adequacy Assessment 2025 Results

15 January 2026

entsoe

Reliable Sustainable Connected

Agenda and practical matter

1	**Welcome and introduction**	**Patricia Labra**, Chair of System Development Committee (Red Eléctrica)
2	**Context of ERAA**	**Ralph Pfeiffer**, Convenor of Steering Group ERAA 2025 (Amprion)
3	**Methodological improvements**	**Daniel Huertas**, vice-convenor of Steering Group ERAA 2025 (Elia)
4	**Results**	**Łukasz Jeżyński**, member of Steering Group ERAA 2025 (PSE)
5	**Takeaways and Next Steps**	**Ralph Pfeiffer**, Convenor of Steering Group ERAA 2025 (Amprion)
6	**Q&A**	**Lukas Galdikas**, Project Manager (ENTSO-E)

Questions welcome on Sli.do

#6551927

Webinar is recorded and will be published on ENTSO-E website.

#6551927

Welcome and Introduction

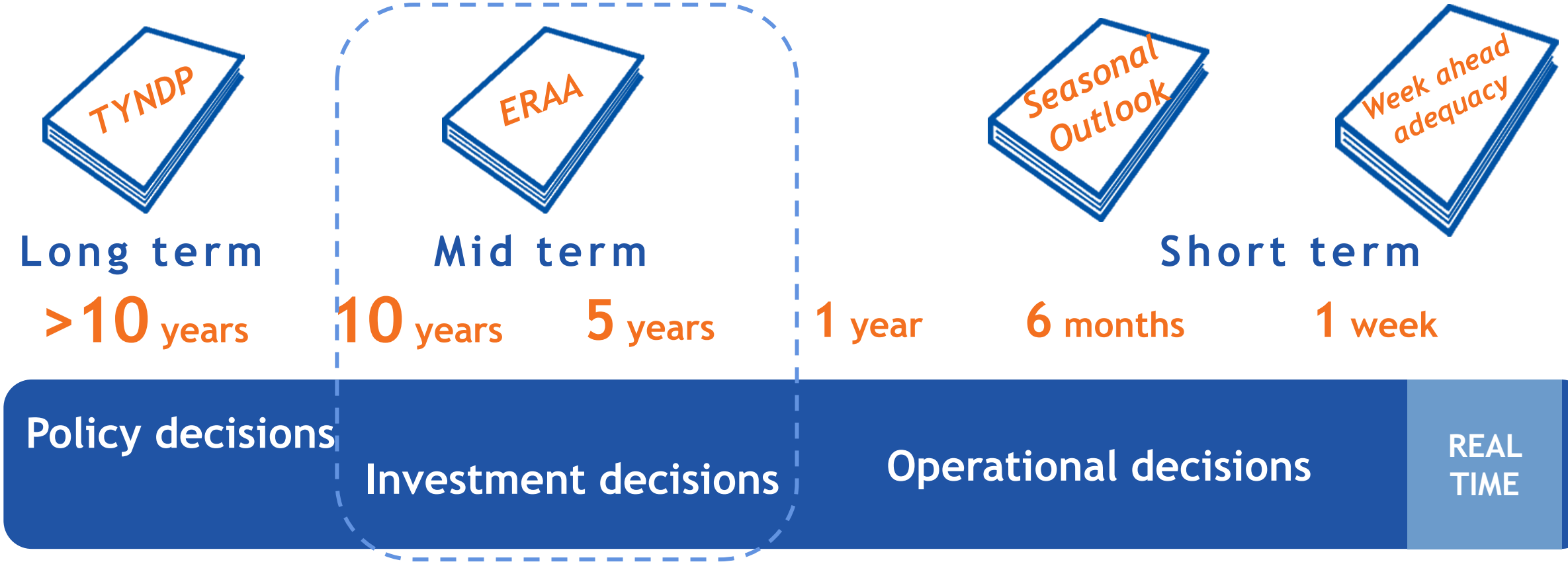
Patricia Labra (Red Eléctrica)

Chair of System Development Committee

entsoe

Reliable Sustainable Connected

Different risks are addressed within different timeframes



#6551927

Context

Ralph Pfeiffer (Amprion)

Convenor of ERAA 2025 Steering Group

entsoe

Reliable Sustainable Connected

Role of the ERAA

Assess adequacy risks of the European power system in medium term / coming decade

With focus on Target Years 2028, 2030, 2033, 2035

Inform decision makers and stakeholders

Reference for Member States to introduce capacity mechanisms

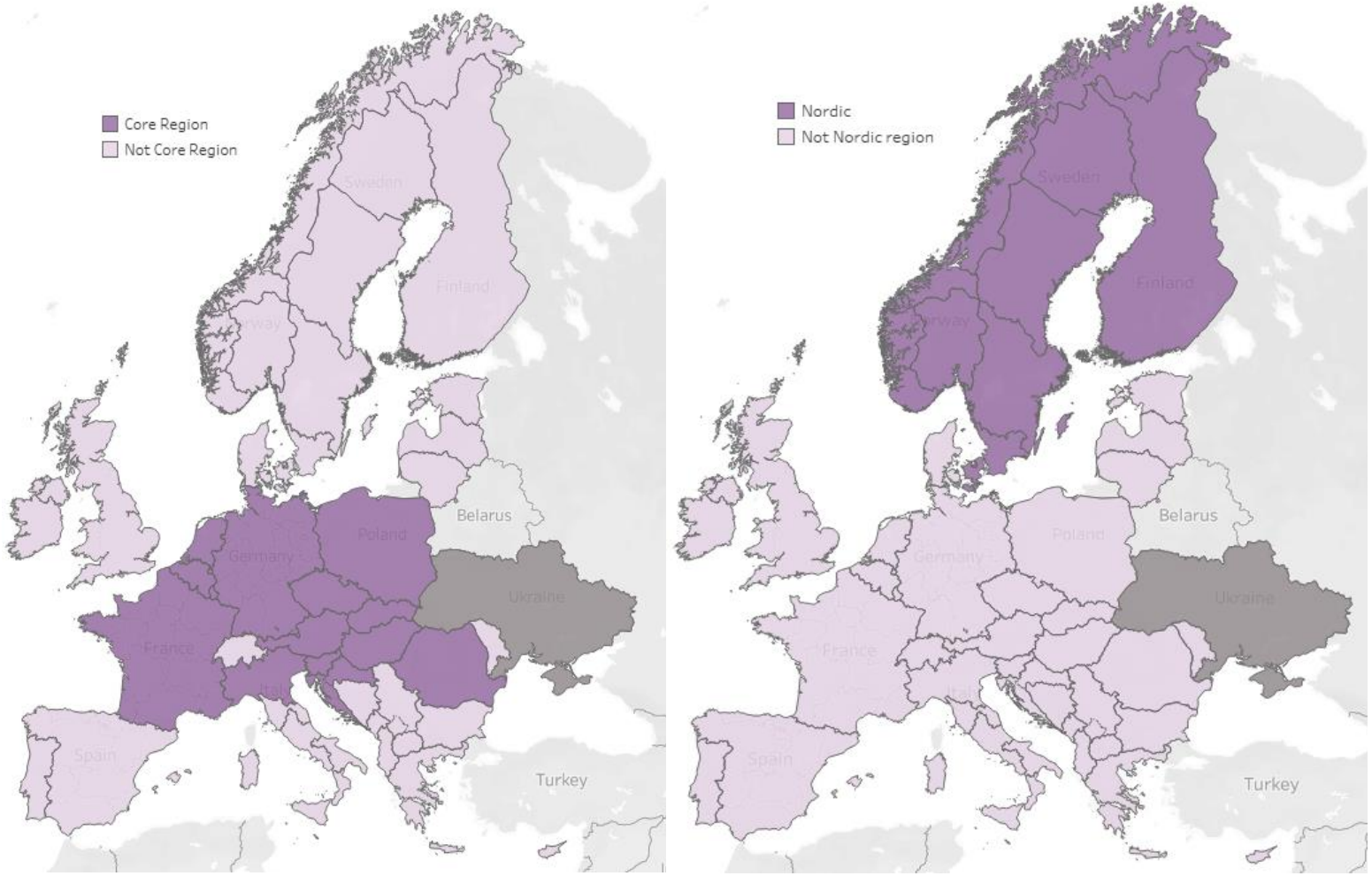
Strengthen Europe's energy transition

Transparent data, complementing other planning studies

#6551927

The interconnected European power system modelled in ERAA 2025

ERAA 2025 geographical scope



Core (left) and Nordic (right) flow-based market coupling region

#6551927

The framework of ERAA 2025

PEMMDB

Net Generation Capacities

Market Coupling

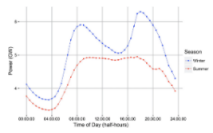
Net Transfer Capacities Flow-Based

PECD

Capacity Factors

Hydro Database

Temperature profiles



Demand

Native demand forecasts

National Trends (NECPs) & Central Assumptions

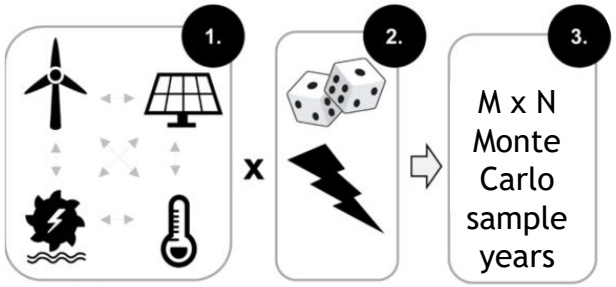
Economic Viability Assessment (EVA)

- Stochastic overall costs minimization
- Iterative revenue-based apporach

Central Reference Scenario

Include EVA entry/exit of market capacity

ED Model: Monte Carlo Simulation



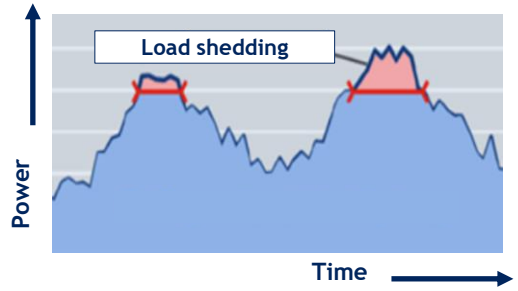
N years of independent climate data

M random draws for unplanned outages

Adequacy Metrics

$$EENS = \frac{1}{M \times N} \sum_j ENS_j$$

$$LOLE = \frac{1}{M \times N} \sum_j LLD_j$$



LOLE = Loss Of Load Expectation [hrs/year]:

average number of hours in which the demand exceeds the generation and import capacity in a market area.

EENS = Expected Energy Not Served [GWh/year]:

average energy not supplied when the demand exceeds the generation and import capacity in a market area.

Focus of development: Investor risk aversion modelling

ERAA 2024

ERAA 2024 showed high gas expansion (>70 GW in 2035) driven by rare scarcity hours with price spikes.

Feedback

Requests from **several stakeholders** to improve EVA to reflect investor behaviour more appropriately.

Survey outcome: risk aversion parameters **beyond hurdle premiums** are usual practice.

Objectives of Risk Aversion

Refined modelling of risk and uncertainty in investment decisions within the EVA framework

Measures

Measure 1: enhanced estimation of hurdle premiums for new gas investments.

Measure 2: Revenue Cap to limit scarcity revenues.

Two risk aversion approaches were implemented to represent uncertainty

- Approach 1: with the enhanced hurdle premium only
- Approach 2: with the enhanced hurdle premium combined with a revenue cap

#6551927

Methodological improvements

Daniel Huertas (Elia)

Vice-convenor of Steering Group ERAA 2025

entsoe

Reliable Sustainable Connected

Continuous improvement

ERAA 2025 focuses on improvements in the Economic Viability Assessment (EVA) maintaining robustness of ERAA framework and ensuring timely delivery.

- Weather Scenario selection improvements
- Risk aversion enhancements with presentation of future uncertainty
- Scarcity events analysis
- Robust EVA (cost-based)
- Alternative EVA testing (revenue-based)

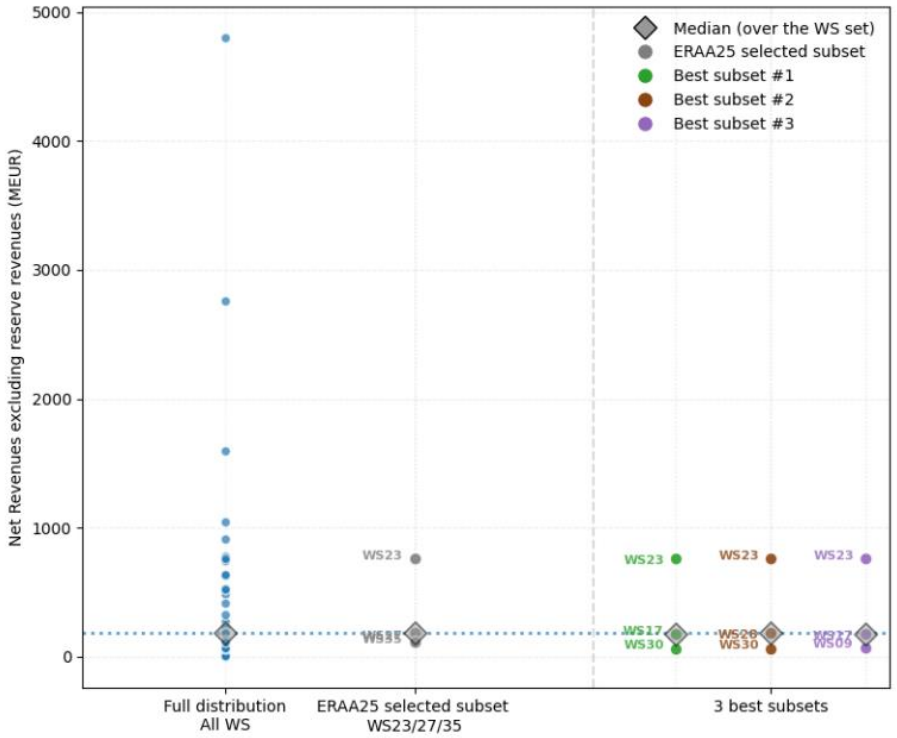
Weather scenario selection

Improvements in ERAA 2025:

ERAA 2024	ERAA 2025
Pre-EVA ED results	Post-EVA ED results
TY 2030 only	All TYs
A single FO sample	All FO samples

Representativity analysis

Weather Scenario selection is reasonably aligned with the full set and with the new theoretical best-fitting subsets.



Weather scenario representativity analysis

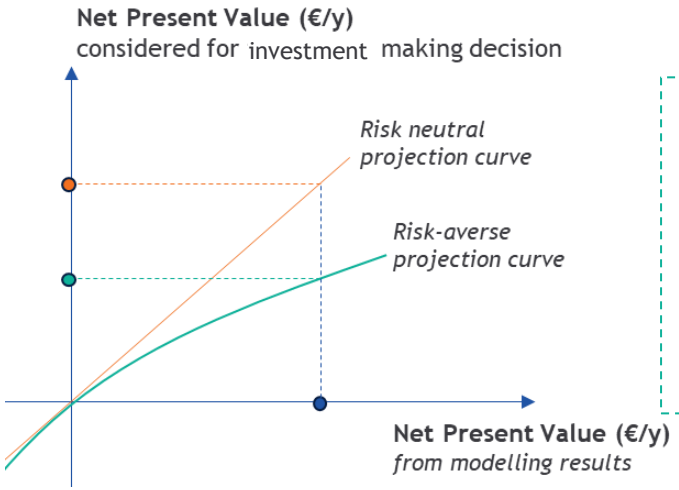
risk aversion modelling with the enhanced hurdle premium combined with a revenue cap

Investor risk aversion modelling – update in ERAA 2025

(update of hurdle premiums)

1 CARA-Based Risk Premiums

Concept:
A utility-based approach using the Constant Absolute Risk Aversion (CARA) function is implemented. It tailors hurdle rates for different technologies like OCGT and CCGT.



Risk-averse projection curve is defined by risk aversion coefficient. ERAA 2025 used 0.0075 (moderate risk aversion).

Expansion tech.	ERAA 2024 hurdle P.	ERAA 2025 hurdle P.
Gas OCGT New	6 %	9,9%
Gas CCGT New	4,5%	6,9%

2 EVA Revenue Cap Adjustment

Concept:
Analyse available price probability density function to define appropriate reliable price spike expectations from the perspective of rational investors.

ERAA 2024 analysis

Price Interval	Cumulative %
0 – 50	23.515%
50 – 100	60.754%
100 – 150	95.903%
150 – 200	99.402%
200 – 250	99.520%
250 – 300	99.576%
300 – 350	99.609%
350 – 400	99.633%
400 – 450	99.656%
450 – 500	99.678%
500 – 550	99.725%
550 – 600	99.794%
600 – 650	99.801%
650 – 700	99.807%
700 – 750	99.813%

Price Interval	Cumulative %
750 – 800	99.818%
800 – 850	99.823%
850 – 900	99.827%
900 – 950	99.832%
950 – 1000	99.851%
1000 – 1050	99.855%
1050 – 1100	99.859%
1100 – 1150	99.862%
1150 – 1200	99.864%
1200 – 1250	99.866%
1250 – 1300	99.869%
1300 – 1350	99.870%
1350 – 1400	99.872%
1400 – 1450	99.879%
1450 – 1500	99.881%

Cap €/MWh	2028	2030	2033	2035
DA Market Cap evo.	5500	6500	7000	7500
EVA Revenue cap	1000	1200	1300	1400

Scarcity event analysis

Simultaneous scarcity events

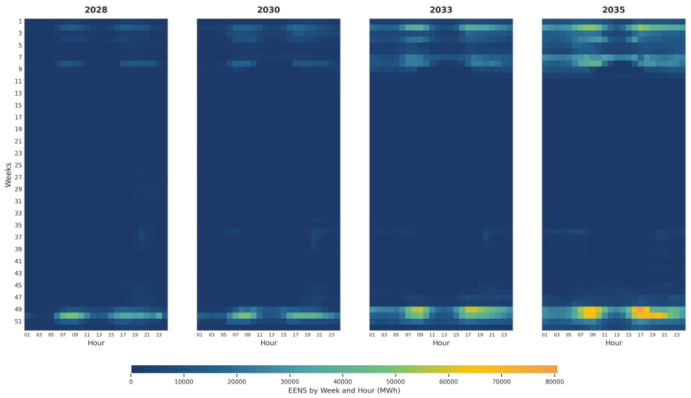
Concept:
Simultaneous scarcity refers to the joint occurrence of ENS across multiple study zones, where the probability of scarcity in one system is influenced by the scarcity in another.

Simultaneous scarcity events in the Baltics

Scarcity temporal distribution

Concept:
A temporal ENS distribution analysis is conducted to more precisely characterise the timing of scarcity events throughout the year.

Analysis includes:
- Weekly/monthly risk analysis
- Daily risk profile analysis

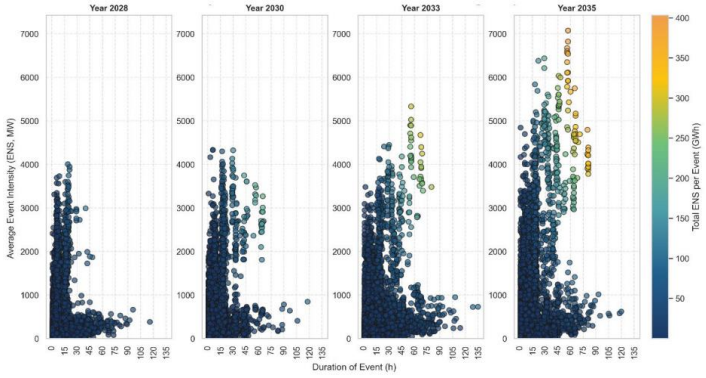


Scarcity temporal distribution over weeks in year and hour

Individual scarcity events distribution

Concept:
The individual scarcity events distribution shows every shortage event that occurs in the simulations.

Analysis includes:
- Native demand percentiles during scarcity
- Share of imports during scarcity
- Intensity and duration analysis



Scarcity even analysis on intensity and duration

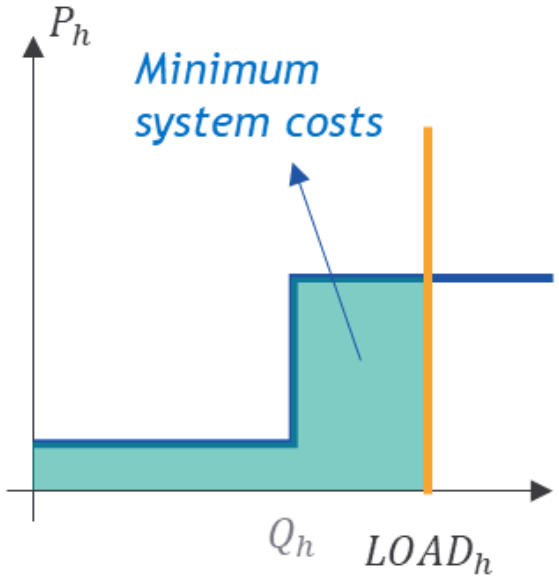
Economic Viability Assessment approaches -

Cost minimization approach

Operational since ERAA 2021

The installed capacity in power system is optimized to minimize the costs overall system considering:

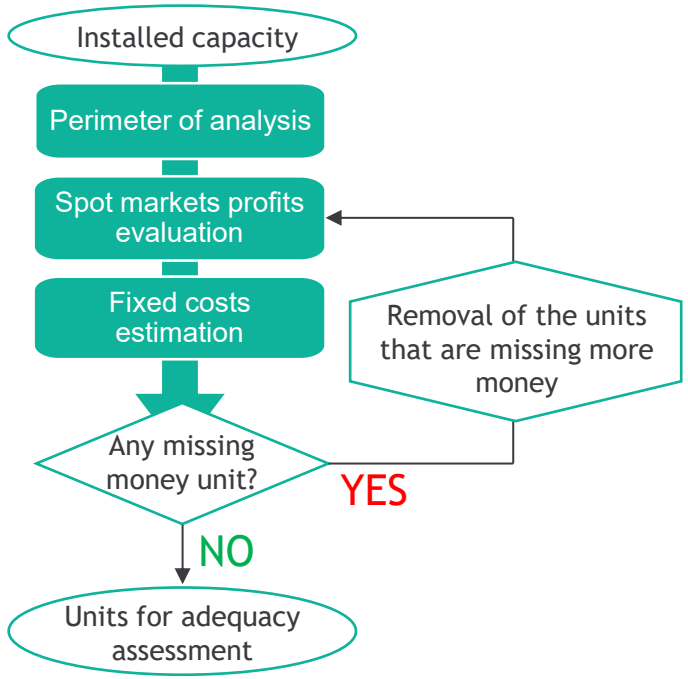
- Dispatch costs
- Capacity costs (e.g. expansion)
- Load shedding costs



Revenue-based approach

Development stream since ERAA 2024

Units' revenues are compared to their costs in an iterative process to identify the ones that are unprofitable (missing money)



Towards higher Economic Dispatch and Economic Viability Assessment consistency

Single complex stochastic model with numerical stability challenges and required substantial power system representation simplifications compared with complete Economic Dispatch model.

Sophisticated heuristic modelling enabling use of detailed Economic Dispatch model and reducing complexity of fundamental EVA model.

#6551927

Results

Łukasz Jeżyński (PSE)

Member of Steering Group ERAA 2025

entsoe

Reliable Sustainable Connected

Economic Viability Assessment

Different investment strategies may lead to a wide range of expected capacity resources. In 2035, the power supply fleet capacity varies ~21 GW due to the uncertainty on investment strategies.

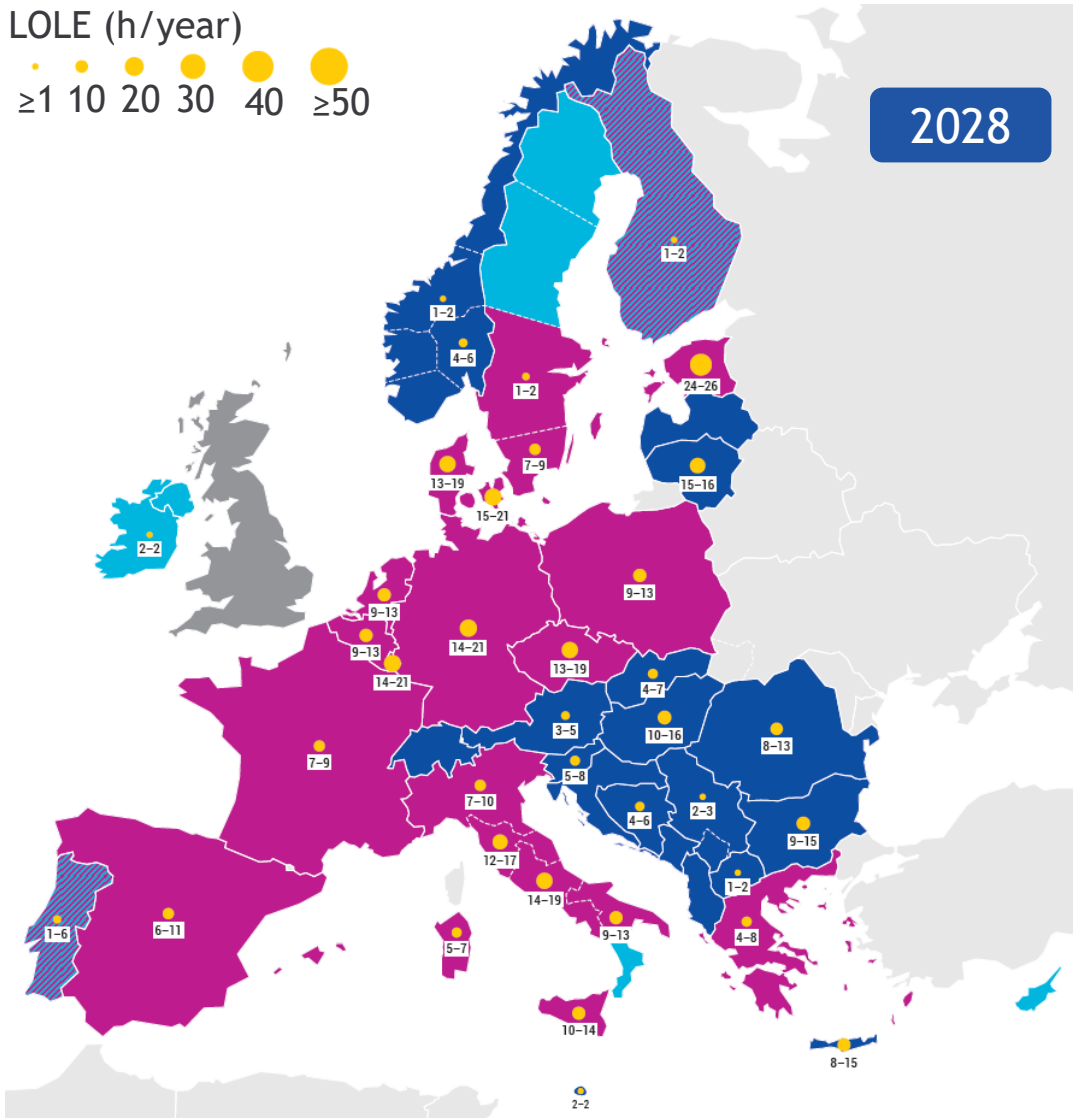
- Monitoring needed that investments will be realised.
- Monitoring needed for existing power plants to confirm decommissioning does not to exceed the anticipated levels.

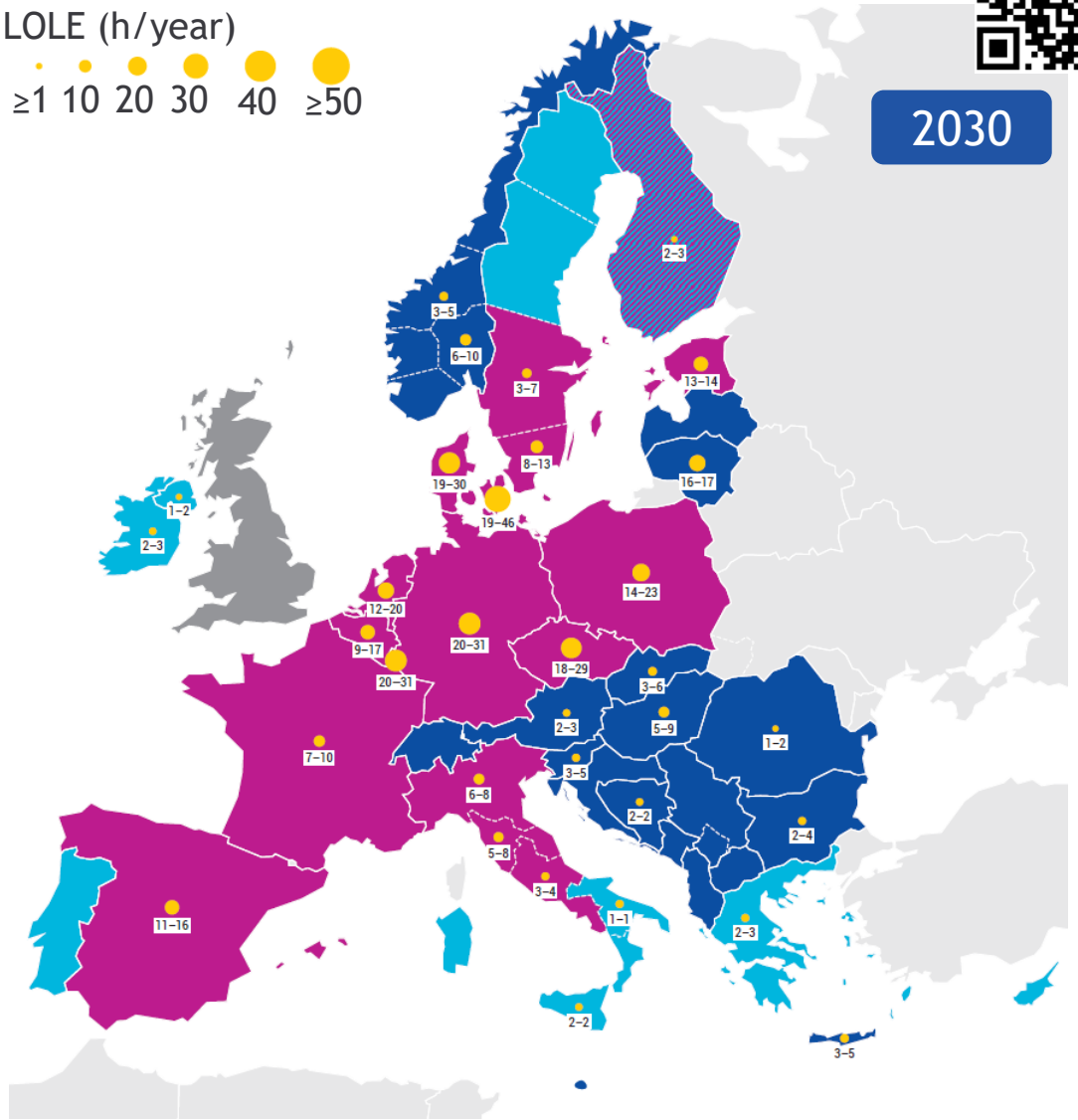
Note: for each target year results are reported as difference with respect to initial (pre-EVA) capacity submitted by TSOs.

European Resource Adequacy Assessment 2025 public webinar (ENTSO-E, 2026-01-15)

#6551927

Adequacy results

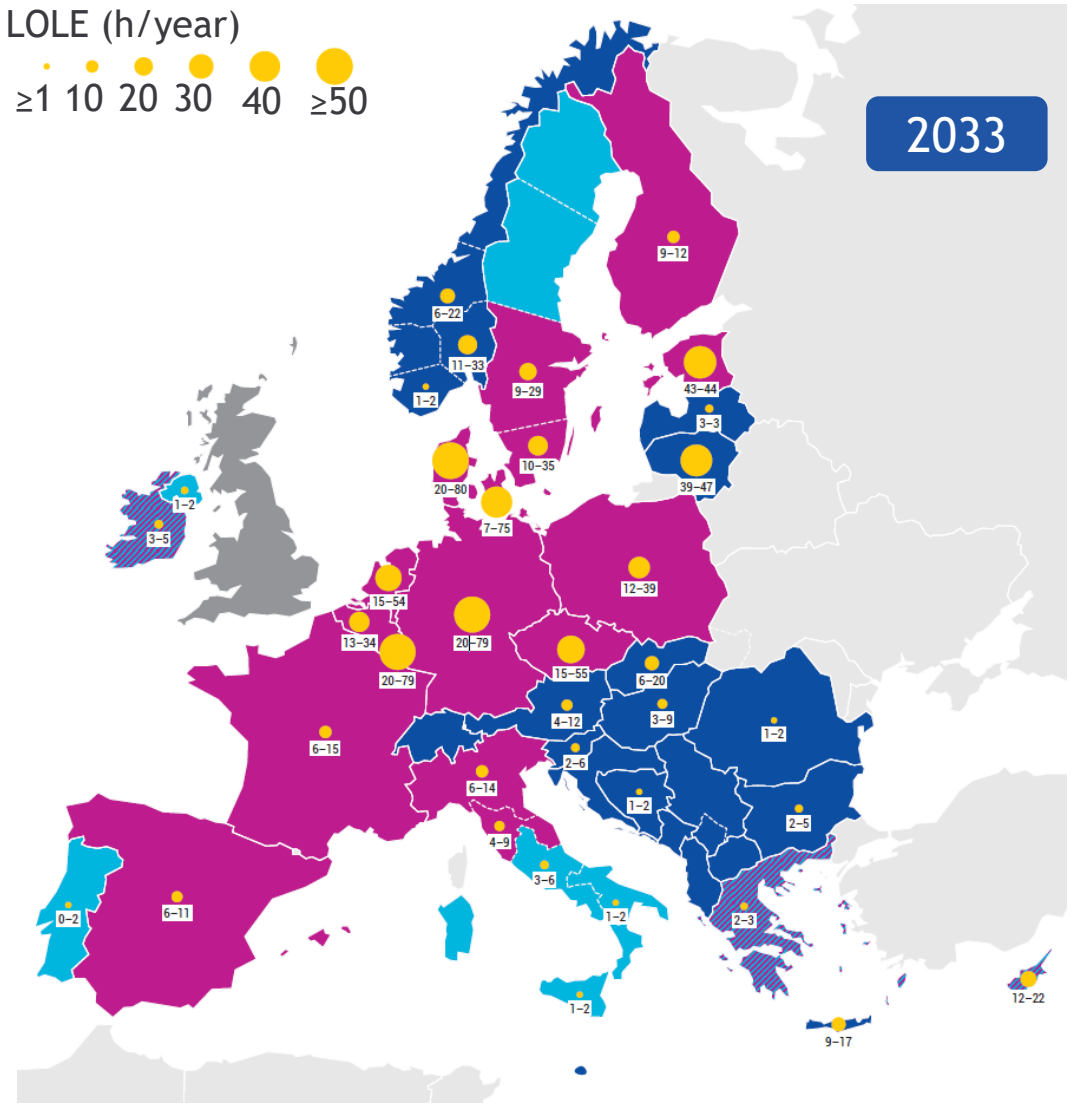


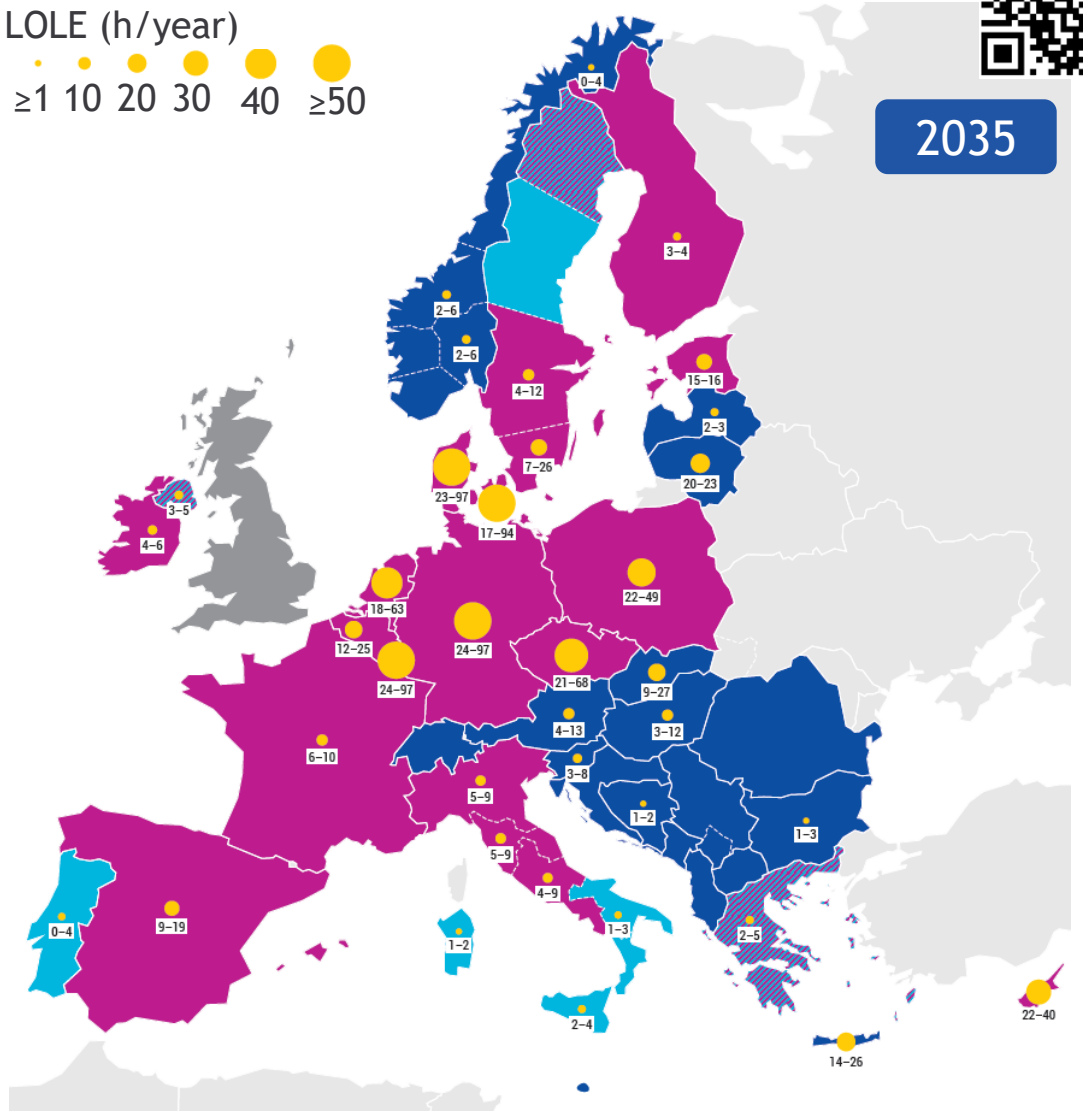


- Within available Reliability Standard
- Exceeds available Reliability Standard
- Reliability Standard within range of risk
- Reliability Standard does not exist
- Results not published

#6551927

Adequacy results





- Within available Reliability Standard
- Exceeds available Reliability Standard
- Reliability Standard within range of risk
- Reliability Standard does not exist
- Results not published

#6551927

Key Takeaways and Next Steps

Ralph Pfeiffer (Amprion)

Convenor of ERAA 2025 Steering Group

entsoe

Reliable Sustainable Connected

Key takeaways of ERAA 2025

Additional supporting mechanisms must be promoted where necessary to enable the transition while maintaining system security.

Revenues from the energy-only market are insufficient to sustain parts of the existing thermal fleet, with notable decommissioning risks already in the short and mid term. To avoid adequacy risks and maintain security of supply, **targeted interventions and long-term market mechanisms are needed**, as reliance on rare scarcity price spikes does not provide sufficiently reliable price signals for risk-averse investors.

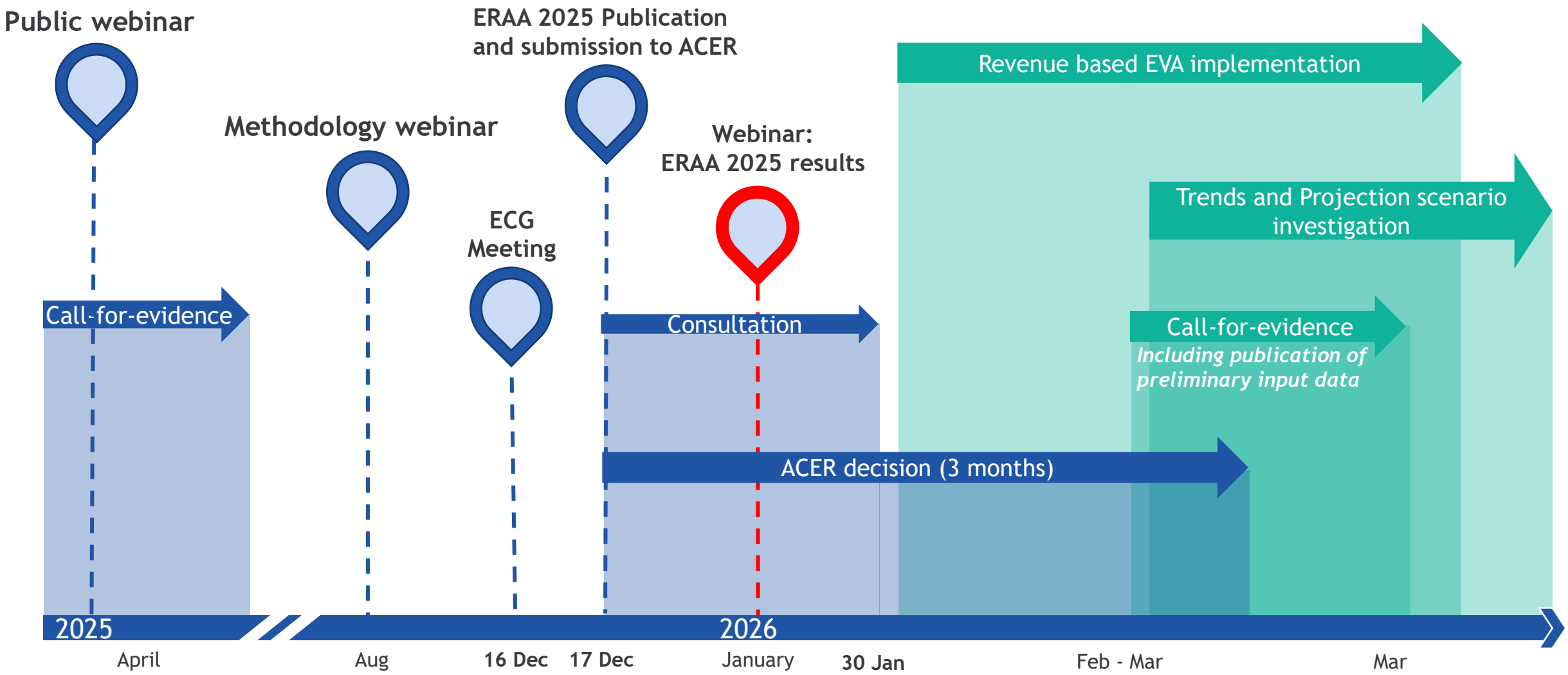
RES expansion will not be sufficient to fully compensate for the decline in dispatchable thermal generation and the significant increase in electrification by 2035. **Close monitoring of both new investments and decommissioning trends is therefore required to prevent further deterioration of resource adequacy**.

ERAA 2025 underlines the importance of scaling up storage, demand-side response and other flexible resources, alongside the development of cross-border electricity transmission networks to enable renewable electricity to flow where it is most needed. These measures are essential to safeguard security of supply in a system with rising RES shares and tighter capacity margins.

ERAA 2025 identifies widespread adequacy risks across Europe, while NRAAs offer a more detailed view of national specificities and local sensitivities. **ERAA and NRAAs are complementary to each other**. Together they support the identification of resource adequacy concerns and the design of appropriate measures, including capacity mechanisms and other supporting interventions.

Stakeholder Engagement and next steps

ERAA 2025 | ERAA 2026



#6551927

Public consultation – share your feedback on the ERAA 2025

Why your views matter

- ENTSO-E relies on the contributions of stakeholders to develop the ERAA.
- ENTSO-E has continuously engaged with stakeholders during the development of this 2025 assessment.
- ENTSO-E now organizes a public consultation of stakeholders to gather feedback on the ERAA 2025 report and further the improvement of the ERAA.

Public Consultation Open

Closing date: 13 February 2026

Consultation page

https://consultations.entsoe.eu/system-development/european-resource-adequacy-assessment-2025-report/consult_view/

Q&A

Lukas Galdikas

ERAA 2025 Project Manager (ENTSO-E)

entsoe

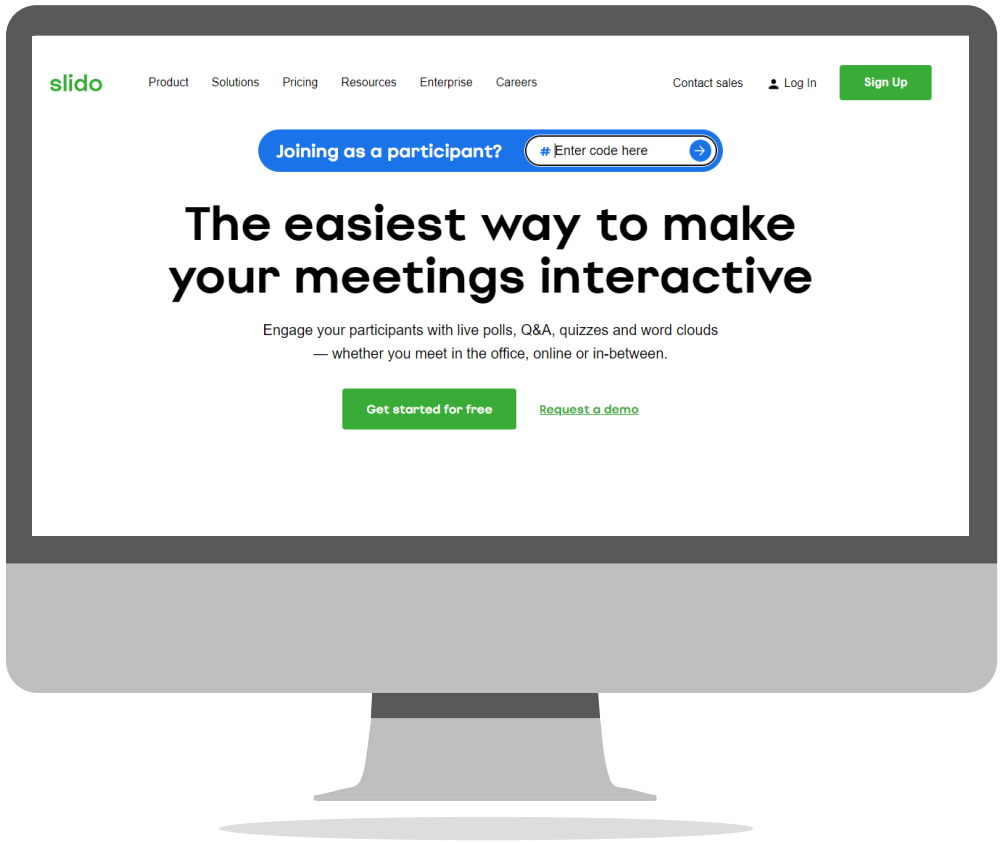
Reliable Sustainable Connected

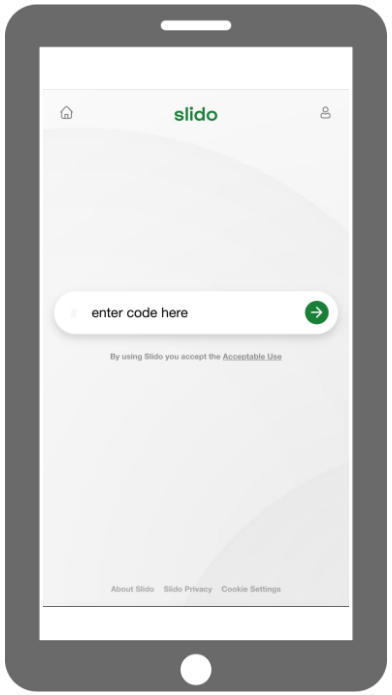
Share your questions on Slido

Go to www.sli.do and enter **#6551927**

OR

Scan the QR code with your phone





Public consultation – share your feedback

ERAA 2025 Results
Public Consultation

Closing date: 13 February 2026

Consultation page

https://consultations.entsoe.eu/system-development/european-resource-adequacy-assessment-2025-report/consult_view/

Thank you for your participation

contact: info@entsoe.eu