ERAA 2021 – Methodology and results

ESIG Spring Technical Workshop, Tucson, 21 - 24 March 2022

Dr. Ralph Pfeiffer Amprion GmbH, Dortmund, Germany
on behalf of ENTSO-E a.i.s.b.l., Brussels, Belgium

entsoe
Reliable Sustainable Connected

Content

ERAA – European Resource Adequacy Assessment

- Purpose and objectives
- Scenarios and methodology
- Results
- Key takeaways and next steps

Purpose of the European Resource Adequacy Assessment (ERAA)

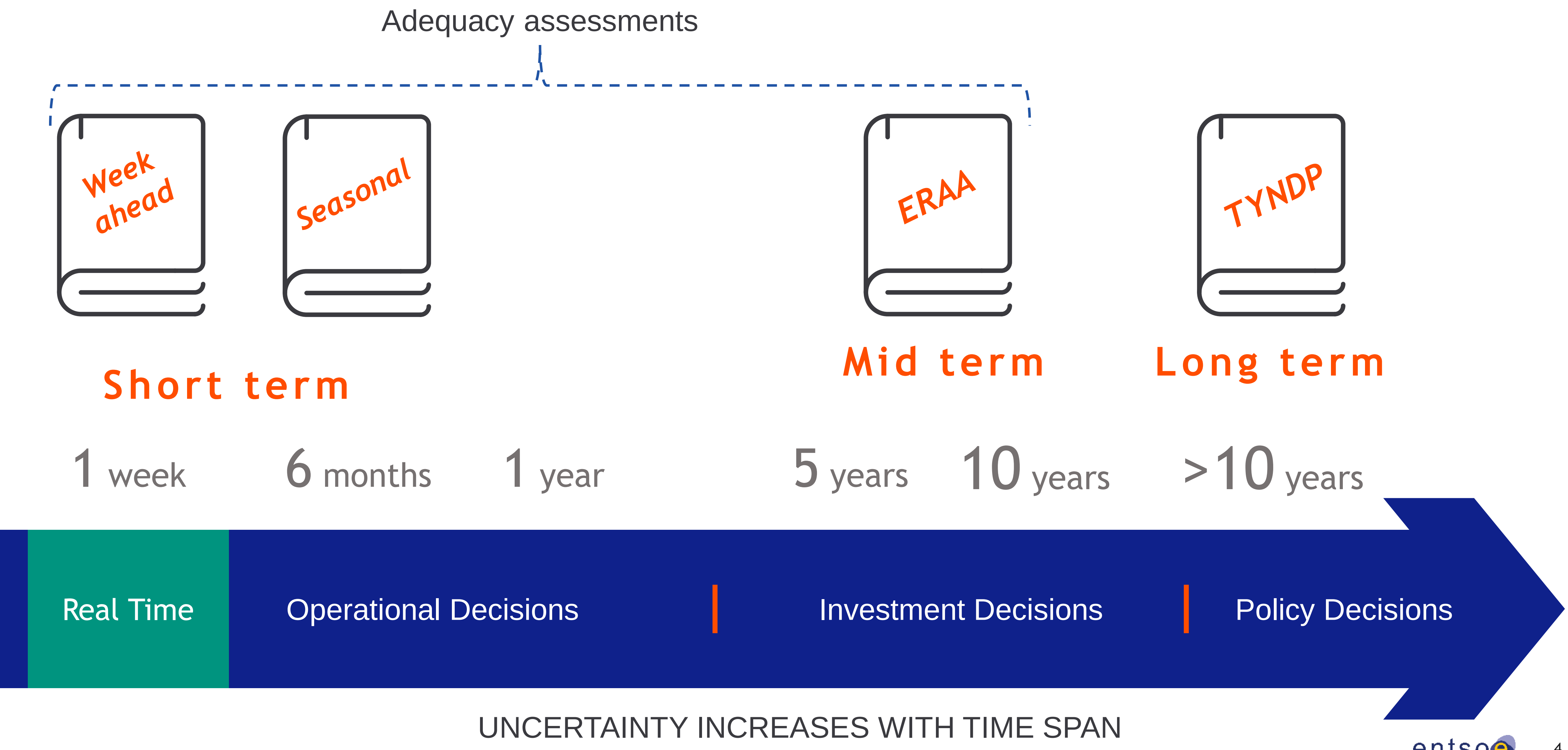
Why?

- **The European electricity supply system is changing at an unprecedented speed** to meet the **EU energy policy** targets of **net-zero CO_2 by 2050**
- The ERAA is driven by **legal mandate, necessity to implement new adequacy assessment methodologies** and **needs of stakeholders** to better understand and prepare to deliver the energy transition.

What?

- **Gradual implementation** until 2024.
- Provision of **an effective tool to understand adequacy** in the coming decade which is pivotal for the energy transition. It contributes to ensuring secure and affordable energy to society.
- Building on this first ERAA learnings, **stakeholder feedback and regulators'/policy makers' review**, the next ERAA 2022 is being initiated.

Dedicated assessments at different timeframes



Understanding adequacy is essential

Identify

- ERAA allows the identification of risks well in advance, as well as a view on how trends will evolve

Understand

- Cutting edge tools give deeper insights into the drivers of system inadequacy

Act

- ERAA enables early targeted action by stakeholders using the substantial toolbox available to mitigate risk

ERAA is not a precise prediction –
it is an early warning tool which enables informed system management decisions

ERAA Scenarios and Methodology

Scenarios

NATIONAL ESTIMATES (2025 AND 2030)

TSO's provide forecasts for capacity based on planned lifetime, new generation estimates and national policy plans.

CENTRAL SCENARIO WITHOUT CAPACITY MECHANISM (2025)

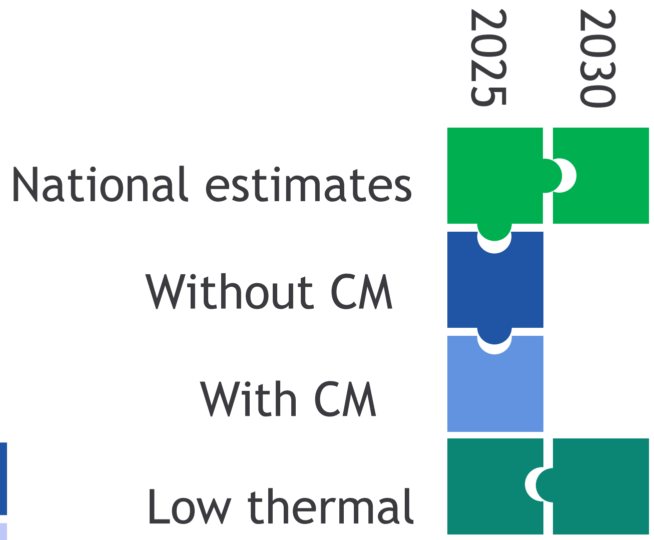
Economic Viability Assessment (EVA) carried out, accounting for forecasted carbon price and market price cap (VOLL)

CENTRAL SCENARIO WITH CAPACITY MECHANISM (2025)

As above, with addition of capacity needed to meet system reliability standards in countries with an approved capacity mechanism.

NATIONAL ESTIMATES WITH LOW THERMAL CAPACITY (2025 AND 2030)

Acts as a stress test: bottom-up estimation of thermal generation phase out through policy measures and economic factors.



7

Economic viability assessment (EVA) of central scenarios

- Market simulation to optimize (i.e. minimize) the total system costs for selected climate years by a closed-loop optimization algorithm

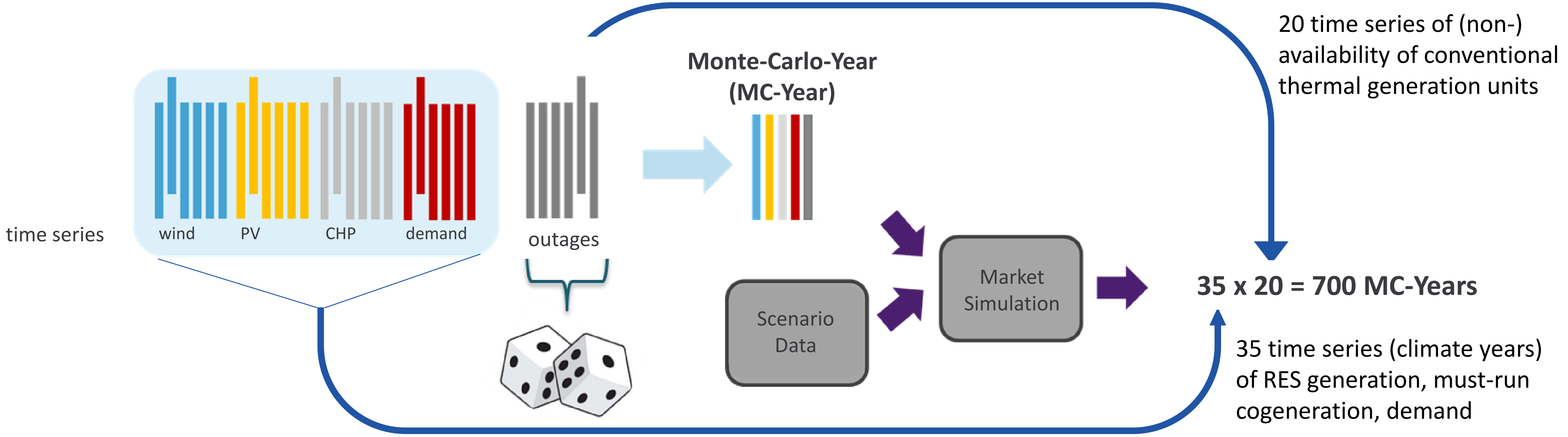
- Total system costs comprise of
  - investment costs of plants and apparatus
  - fixed and variable costs for operation and maintenance of plants and apparatus
  - costs for demand flexibility measures
  - costs of load shedding /social „value“ of loss of load

- Life-cycle considerations by annuity of costs
  - market entry / exit computed endogenously
  - mutual impact / interdependency of different investment options
  - estimation of revenues in an energy-only market (EOM)

Generation Type	Decommissioning Candidate	Expansion Candidate
Nuclear	FALSE	FALSE
Coal	TRUE	FALSE
Lignite	TRUE	FALSE
Gas	TRUE	TRUE
Oil	TRUE	FALSE
DSR	FALSE	TRUE
Renewables	FALSE	FALSE
CHP, Battery	FALSE	FALSE

- Decision variables:
  - decommissioning of generation units, unless provided for otherwise by national legislation/regulation
  - investments in new-built generation (CCGT/OCGT) and demand flexibility

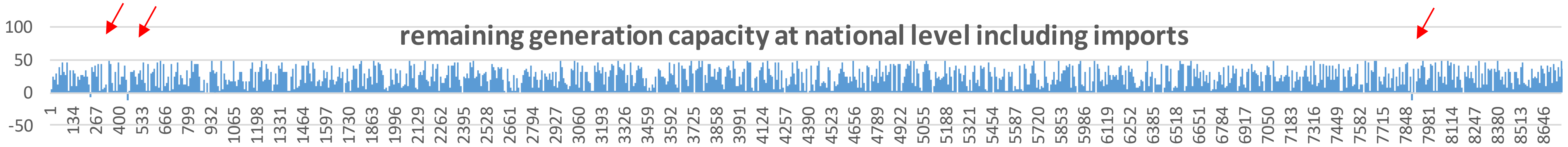
Monte-Carlo-Simulation to create system use cases



- **Monte-Carlo-Simulation** is a stochastic methodology, where a very large number of equitable random experiments forms the basis for further analysis.
- A combination of one climate year (RES feed-in, must-run cogeneration, demand) and one outage drawing is called a Monte-Carlo-Year (MC-Year).

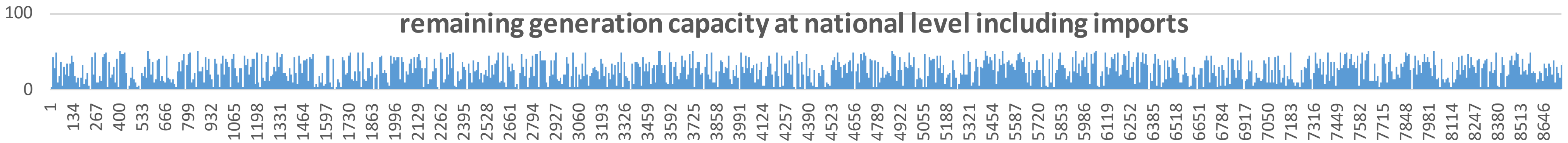
Calculation of Loss of Load Expectation (LoLE)

MC-Y 1



LOLh = 3 hrs/year

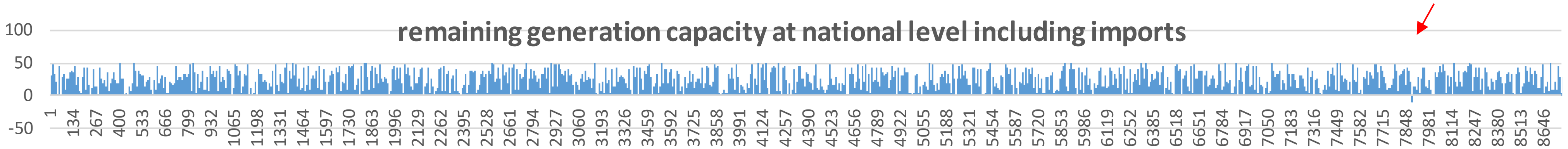
MC-Y 2



LOLh = 0 hrs/year

⋮

MC-Y 700



LOLh = 1 hrs/year

Loss of Load Expectation (LoLE) [hrs/year]:

LoLE is defined as the expected (=average) value of Loss of Load hours of all Monte-Carlo-Years. LoLE represents the expected number of hours per year, where demand cannot be completely matched by the electricity market.

Reliability standard - definition

Reliability Standard (RS):

The reliability standard defines - in terms of LoLE - the equilibrium of willingness of payment and cost of new entry (cost of investment and operation) of generation. In case LoLE > RS, a reduction of LoLE to RS is socio-economically reasonable, because willingness of payment is larger than the accumulated value of lost load.

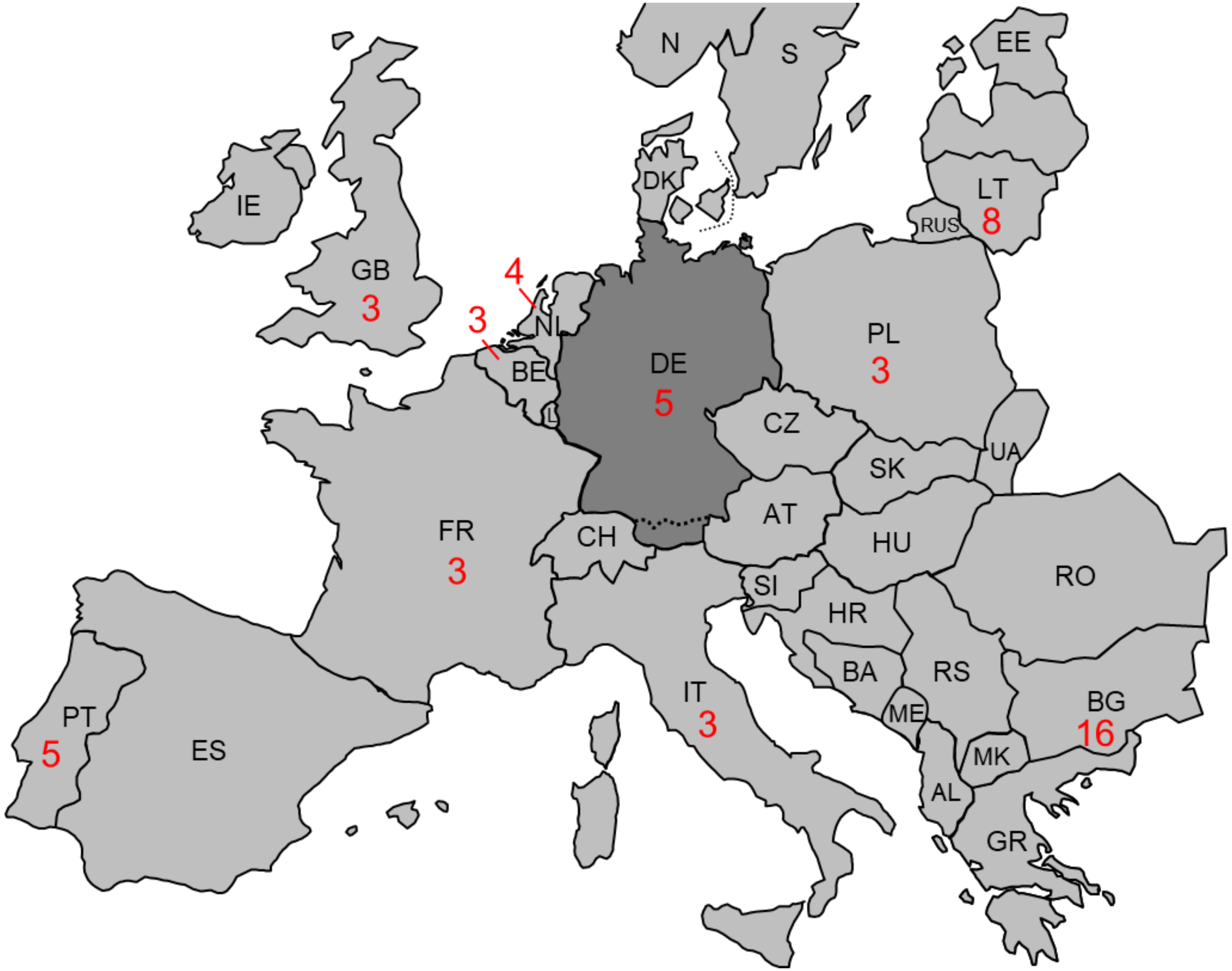
$$RS = LoLE^* = \frac{CoNE}{VoLL}$$

CoNE = Cost of New Entry

VoLL = Value of Lost Load, which customers would be willing to pay to avoid a loss of supply

Example: $$RS = \frac{CoNE}{VoLL} = \frac{50.000\ \frac{\frac{€}{MW}}{a}}{10.000\ \frac{€}{MWh}} = \boldsymbol{5\ \frac{h}{a}}$$

European reliablity standards – some figures

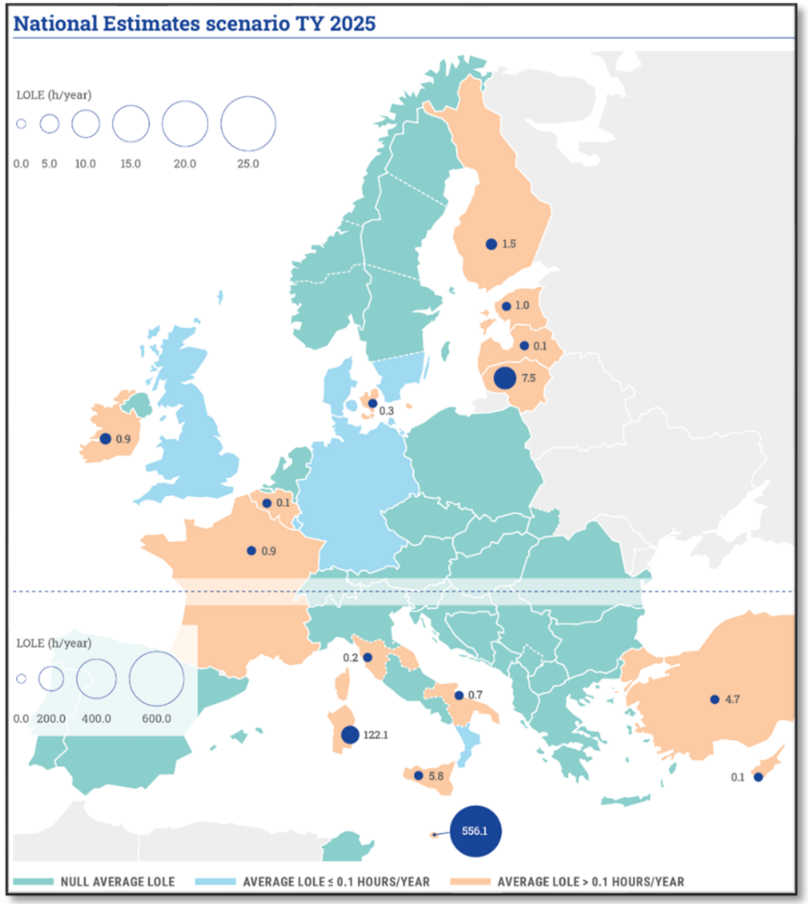


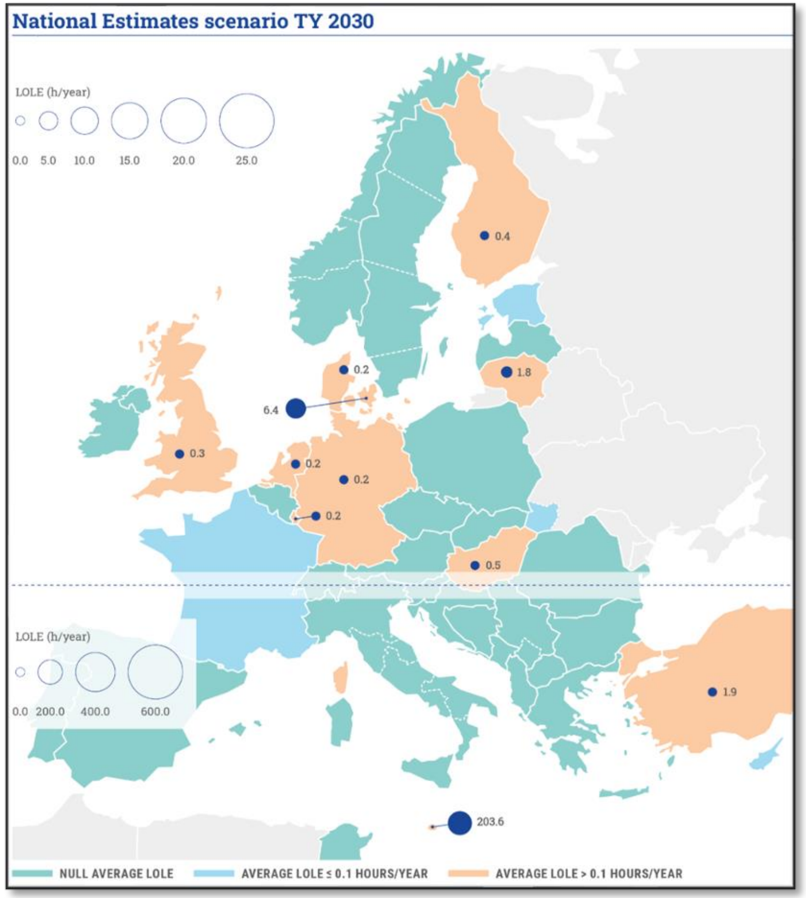
Source: ERAA 2021

All values:
LoLE in [hrs/year]

ERAA 2021 results

National Estimates - Target Years 2025 & 2030

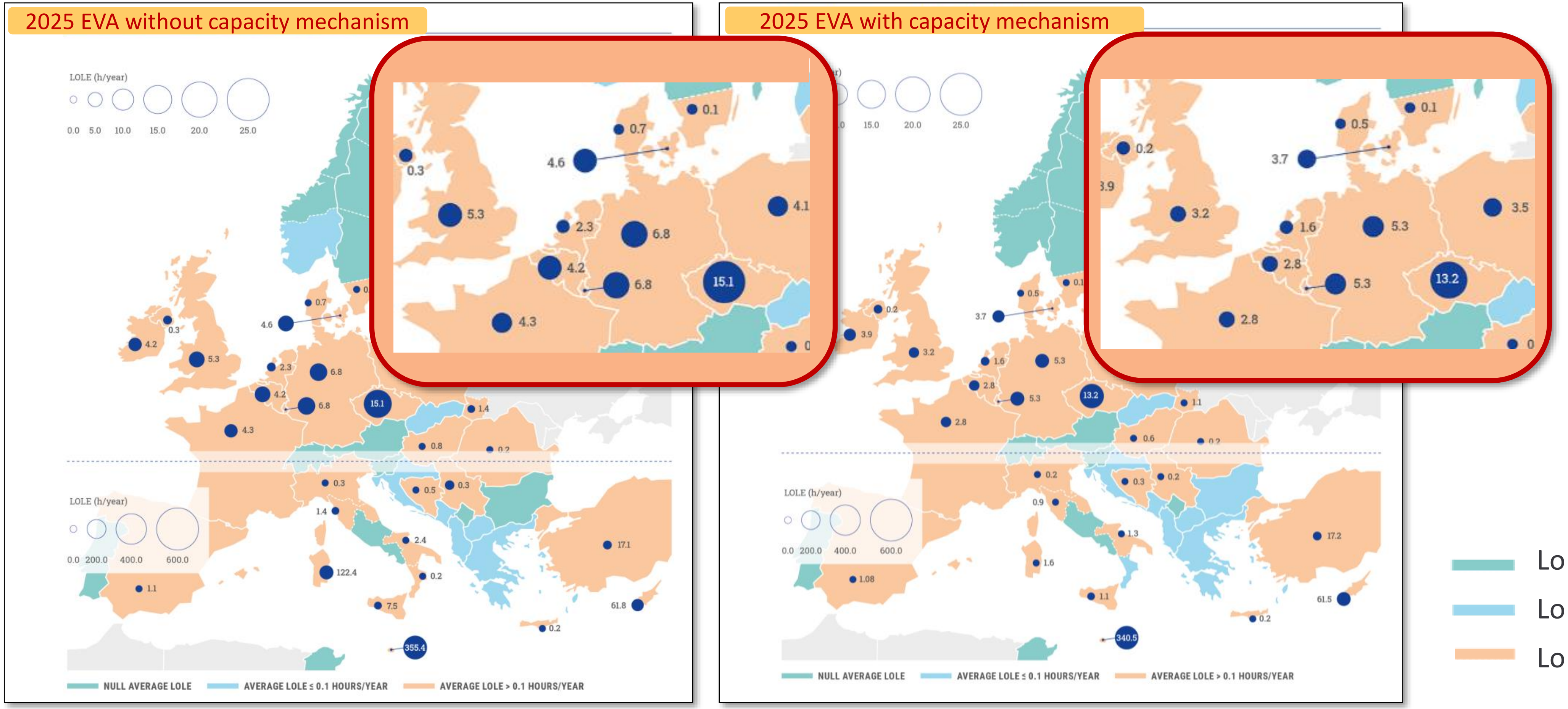




LoLE = 0
LoLE ≤ 0,1 hrs/year
LoLE > 0,1 hrs/year

- **Low adequacy risks in both National Estimates scenarios 2025 and 2030**
- **Impact of 'Fit for 55 Package' not yet considered in ERAA 2021 as Member States need to further specify. This could be significant especially for TY 2030.**

Central scenarios with EVA and capacity mechanisms – Target Year 2025

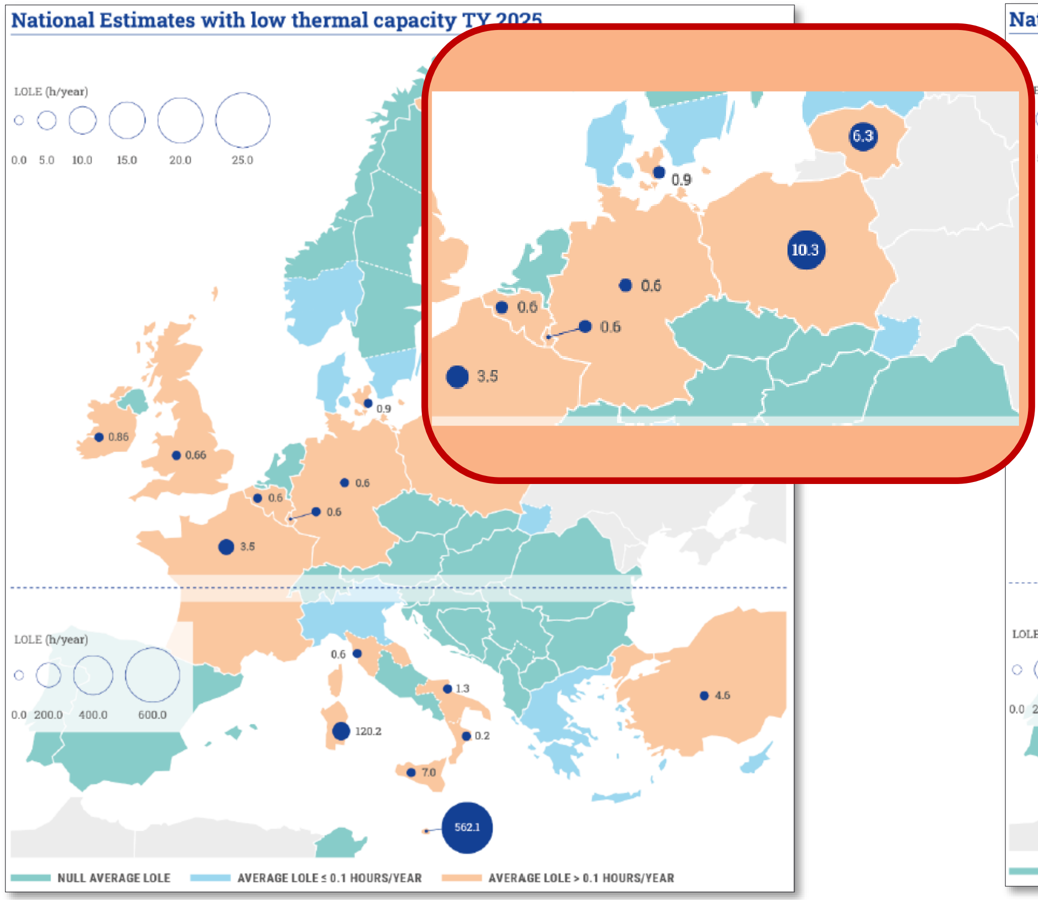


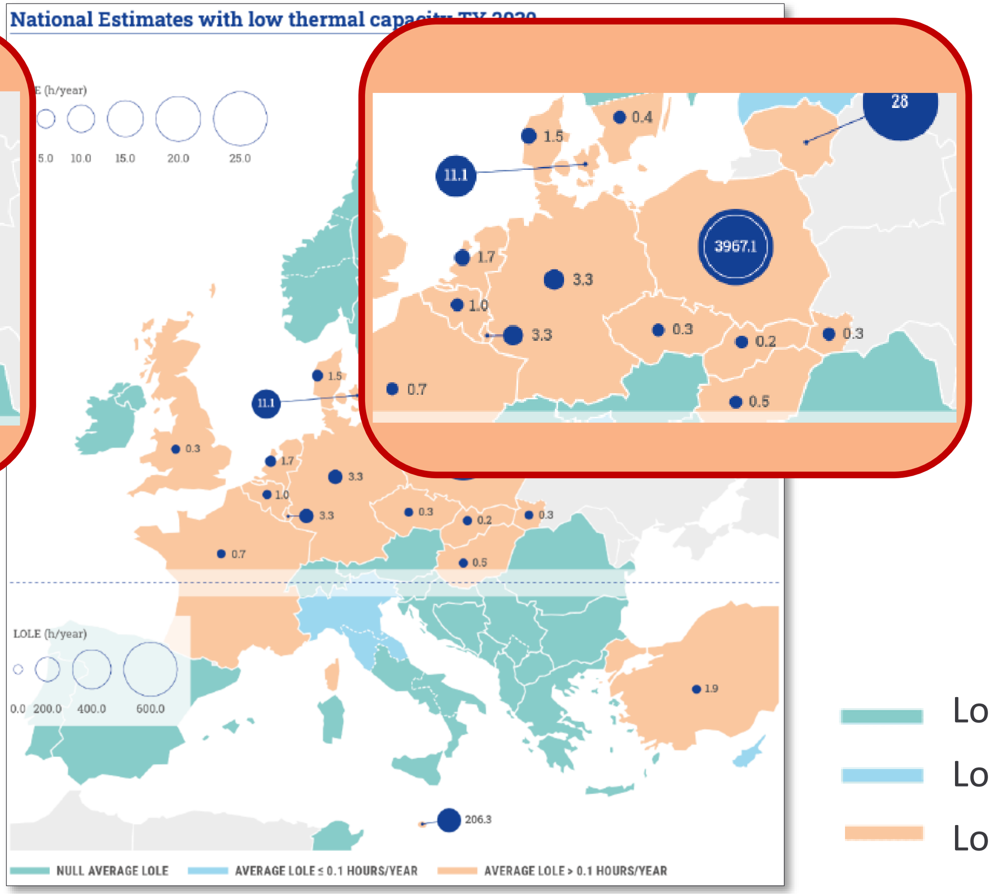
- LoLE = 0
- LoLE ≤ 0,1 hrs/year
- LoLE > 0,1 hrs/year

- **75 GW thermal capacity decommissioned**
- **13 GW commissioned**
- **significant adequacy risks, especially in central-west Europe**

- **4.5 GW additional capacity compared to scenario without capacity mechanisms needed to bring countries closer to their Reliability Standard**

National Estimates Low Thermal - Target Years 2025 & 2030





LoLE = 0

LoLE ≤ 0,1 hrs/year

LoLE > 0,1 hrs/year

- **21.7 GW less thermal capacity**
- **considerable adequacy risks in Poland, Lithuania and France**

- **36 GW less thermal capacity**
- **significant adequacy risks in Poland with impact on neighbouring countries, e.g. Lithuania and Germany**

Key takeaways and next steps

Key takeaways

Cooperation

Sustainable planning, cooperation and targeted measures are key for a secure electricity system.

Risks

In the absence of targeted measures, adequacy risks rise towards 2025.

Coordination

Adequacy issues deeply interlinked; regional coordination is crucial.

Future of ERAA

ERAA 2021 delivers significant learnings for the development of future ERAAs.

ERAA Implementation Roadmap

Stakeholder interaction

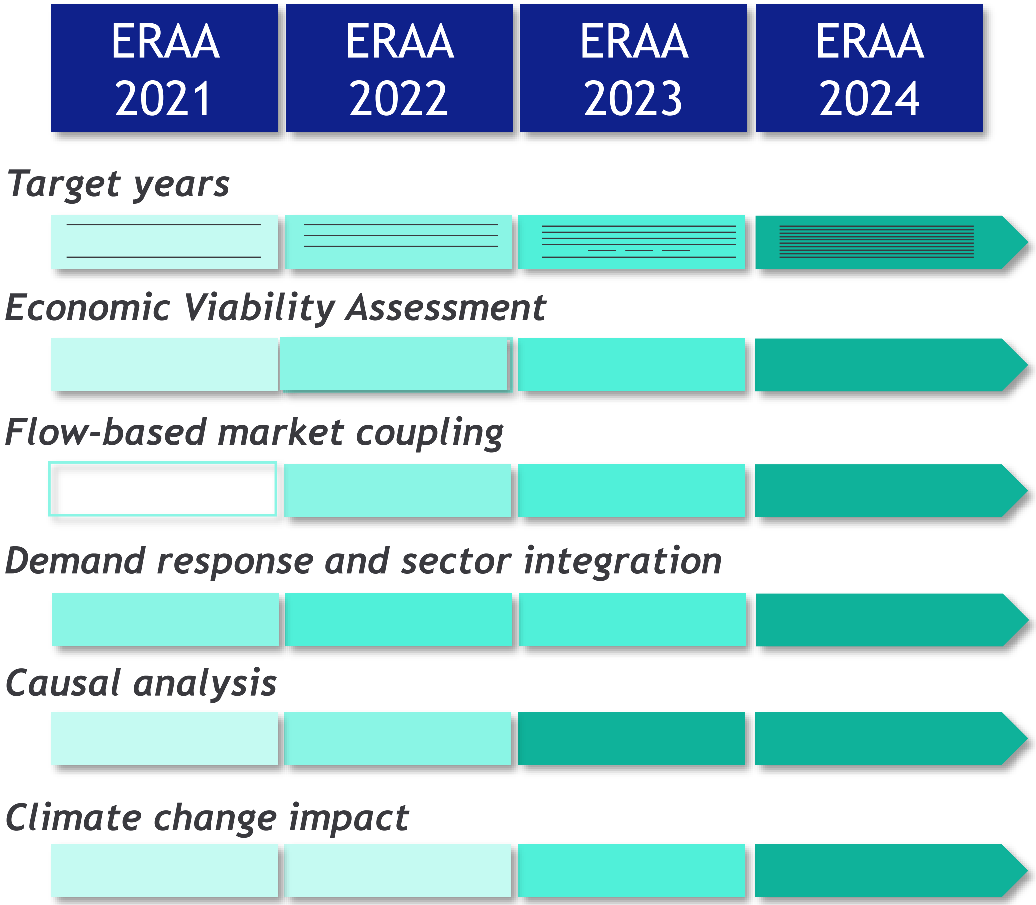
- *ERAA2021 views **feeding** into next ERAA*
- *Consultation on input data*
- *International benchmarking*

Expanded methodology

- *Scenarios heading towards Fit for 55*
- *Enhanced EVA with four target years*
- *Flow-based in central reference scenarios*
- *Role of demand response and electrolysers*

Further proof of concepts

- *EVA for other sources incl. storage and renewables*
- *Improved climate change modelling*



Thank you very much for your attention!

Our values define who we are, what we stand for and how we behave.
We all play a part in bringing them to life.

EXCELLENCE

We deliver to the highest standards. We provide an environment in which people can develop to their full potential.

TRUST

We trust each other, we are transparent and we empower people. We respect diversity.

INTEGRITY

We act in the interest of ENTSO-E

TEAM

We care about people. We work transversal and we support each other. We celebrate success.

FUTURE THINKING

We are a learning organisation. We explore new paths and solutions.

We are ENTSO-E