

# Segurança do Abastecimento e Estabilidade do Sistema Elétrico: desafios e soluções

July 2026



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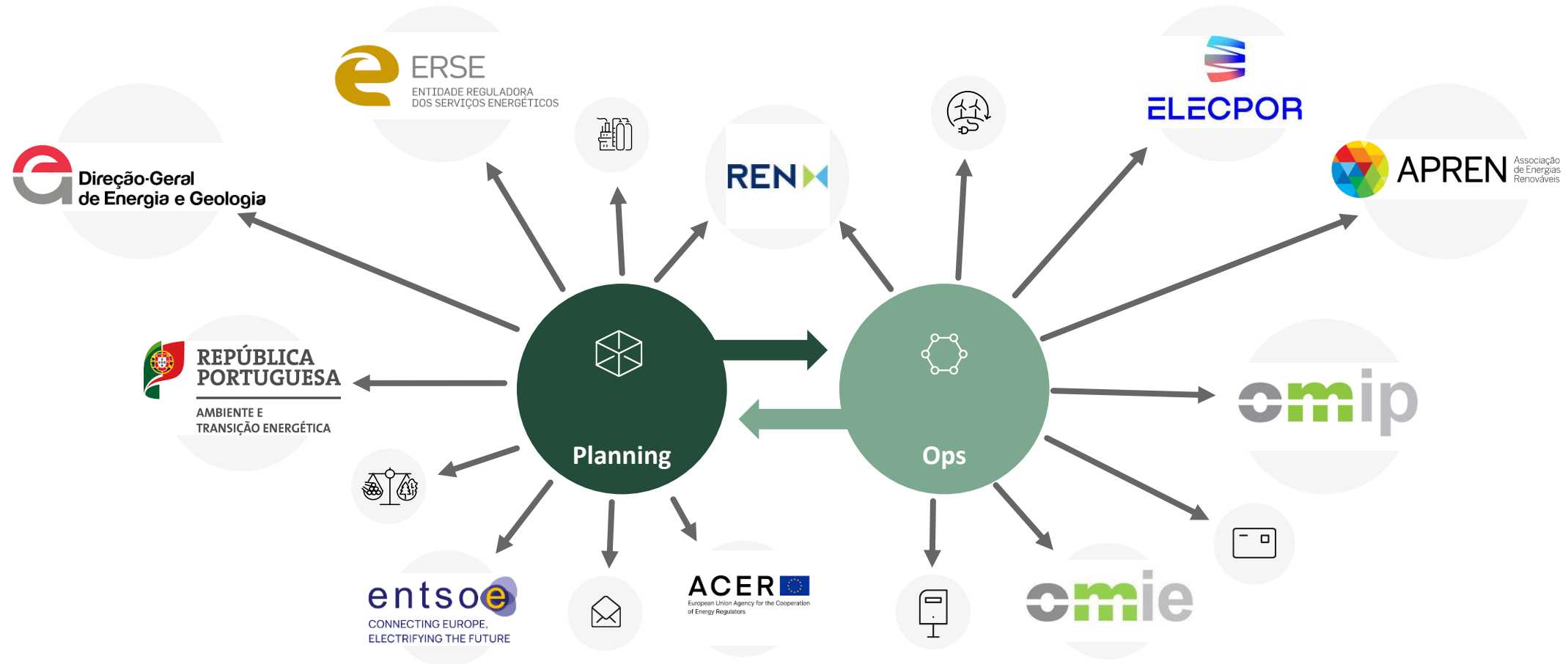
# Agenda

## — Introduction

- Long-term planning: security of supply
- Long-term planning: ERAA vs. RMSA
- Operation of the Portuguese system

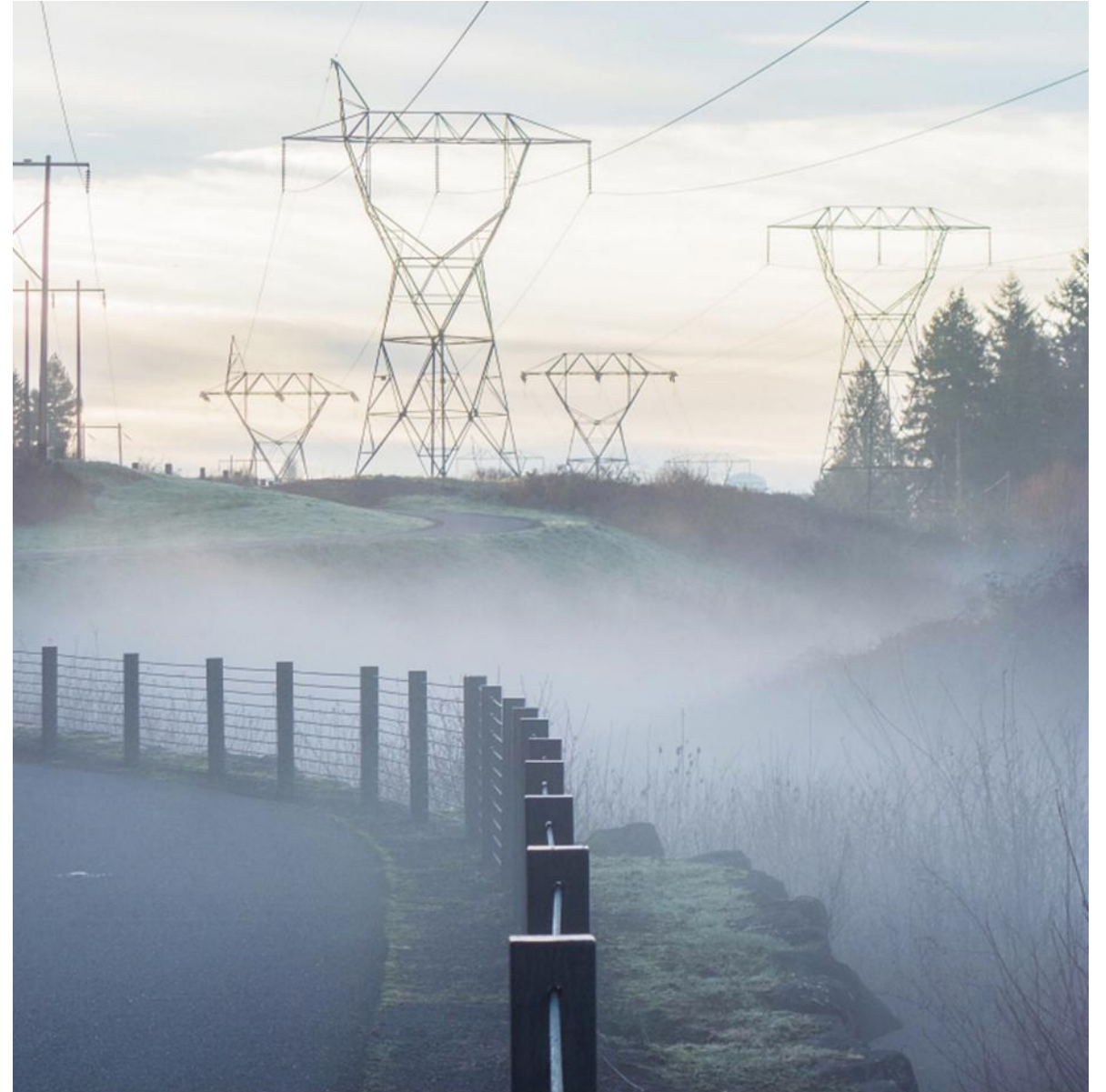


# Two layers needed to understand the operation of the Portuguese system: planning and operations



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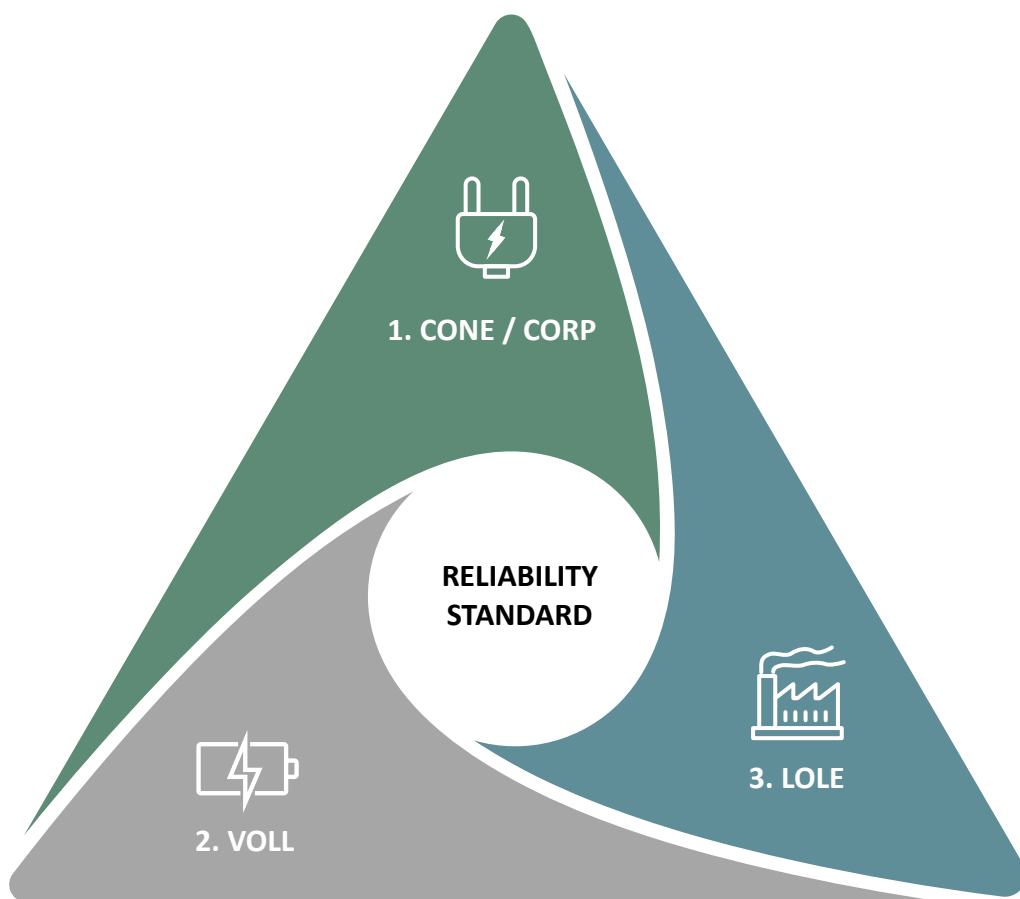


Security of Supply in Europe has been assured through capacity mechanisms



***Ability of an electricity system to guarantee the supply of electricity to customers with a clearly established level of performance, as determined by the member states concerned***

# Reliability Standard balances capacity costs, load shedding costs and acceptable risk



## 1. Cost Of New Entry/Cost Of Renewal or Prolongation (CONE/CORP)

*What is the cost of building new power plants or renewing or prolonging existing ones to increase the security of the system?*

Annualized cost for commissioning and retaining new generation capacity or for keeping an existing generator in operation or prolonging its lifetime.

## 2. Value Of Lost Load (VOLL)

*What is the cost of every MWh of demand not served?*

Maximum monetary value that consumers are willing to pay to avoid an outage.

## 3. Loss Of Load Expectation (LOLE)

*How many hours can demand remain non-served to be more economical than build/renew/prolong power plants?*

# 01.

Criteria to calculate CONE/CORP

## Reference technologies and CONE/CORP are defined following ACER guidelines

### 01.

Selection of reference technologies and estimation of their potential

### 02.

Definition of technical characteristics based on reference technologies

### 03.

Estimation of capital and fixed costs for each technology

### 04.

Estimation of the Weighted Average Cost of Capital (WACC)

### 05.

Calculation of CONE/CORP (fixed and variable)

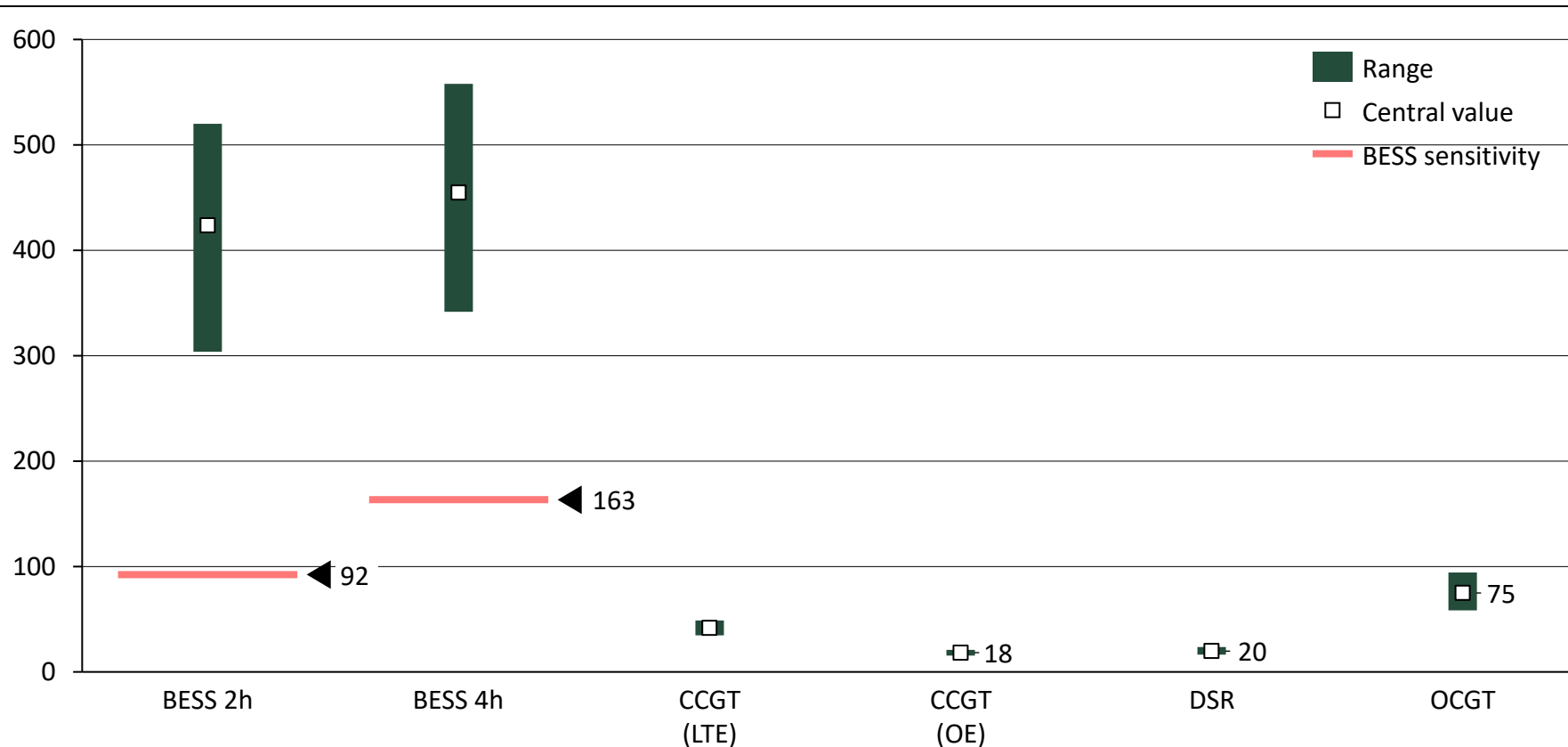
### 06.

Transparency, reliability and objectivity

Note: criteria summarized by AFRY from the methodology to calculate CONE/CORP, VOLL and RS by ACER (ACER Decision 23/2020).

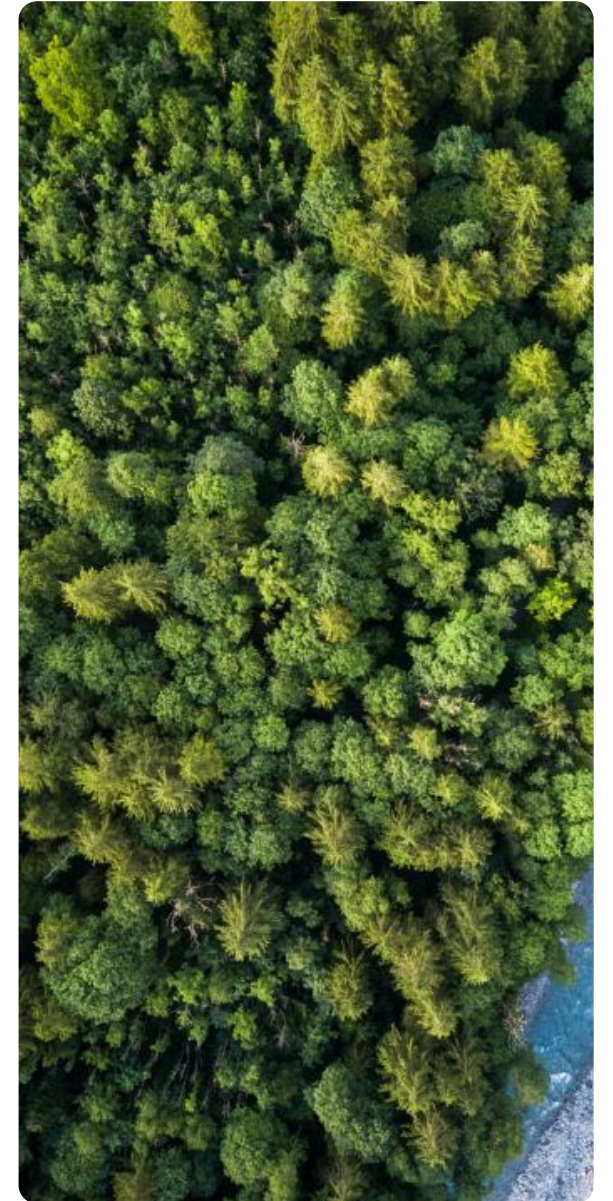
According to the analysis undertaken, CCGTs and DSR are the technologies with lowest CONE/CORP

CONE (€/kW-year, real 2025 money)<sup>1</sup>



Notes: 1) CONE for offshore wind, onshore wind and solar PV not shown in the chart as values are higher than €1,000/kW.

Sources: Damodaran, ECB, ERSE and AFRY.



AFRY has followed ACER's guidelines in order to calculate VOLL by surveying Portuguese consumers alongside QMETRICS

## 01.

Customer segmentation: households, tertiary, public services, industry and transport

## 02.

Definition of VOLL parameters: duration, period of occurrence and pre-notification of loss of load events

## 03.

Statistically representative surveys

## 04.

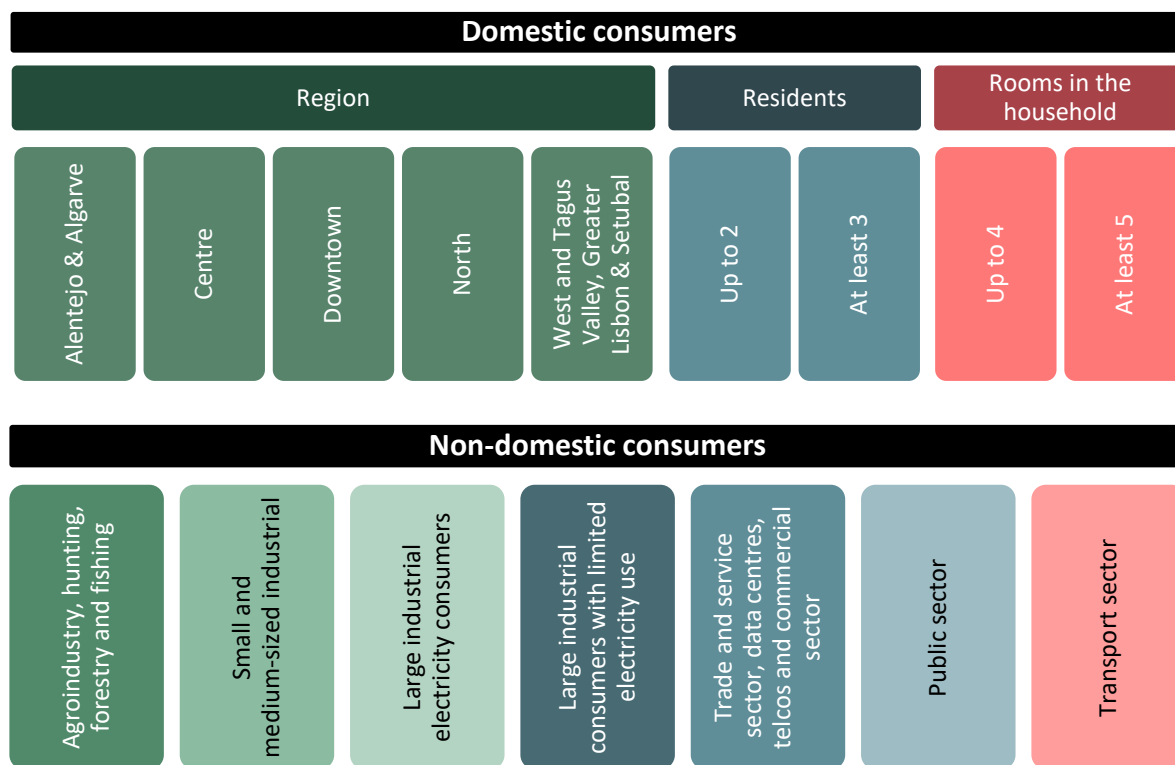
Single VOLL calculation through weighting of the different consumers

## 05.

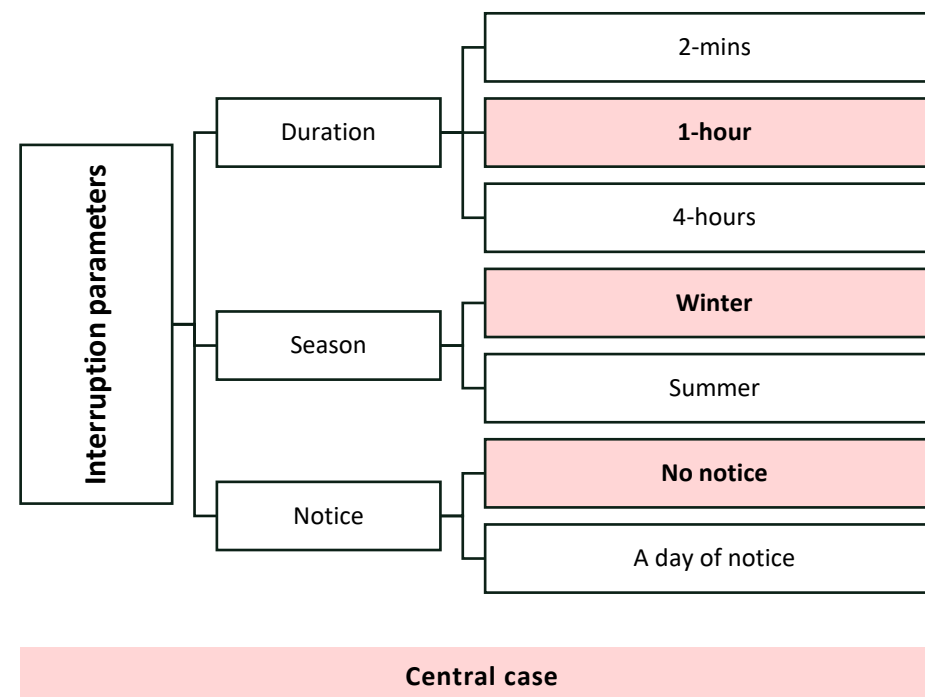
Transparency, reliability and objectivity

The consumer segmentation developed allows us to group consumers with similar behaviors and their response to electricity interruption scenarios

### Survey segmentation

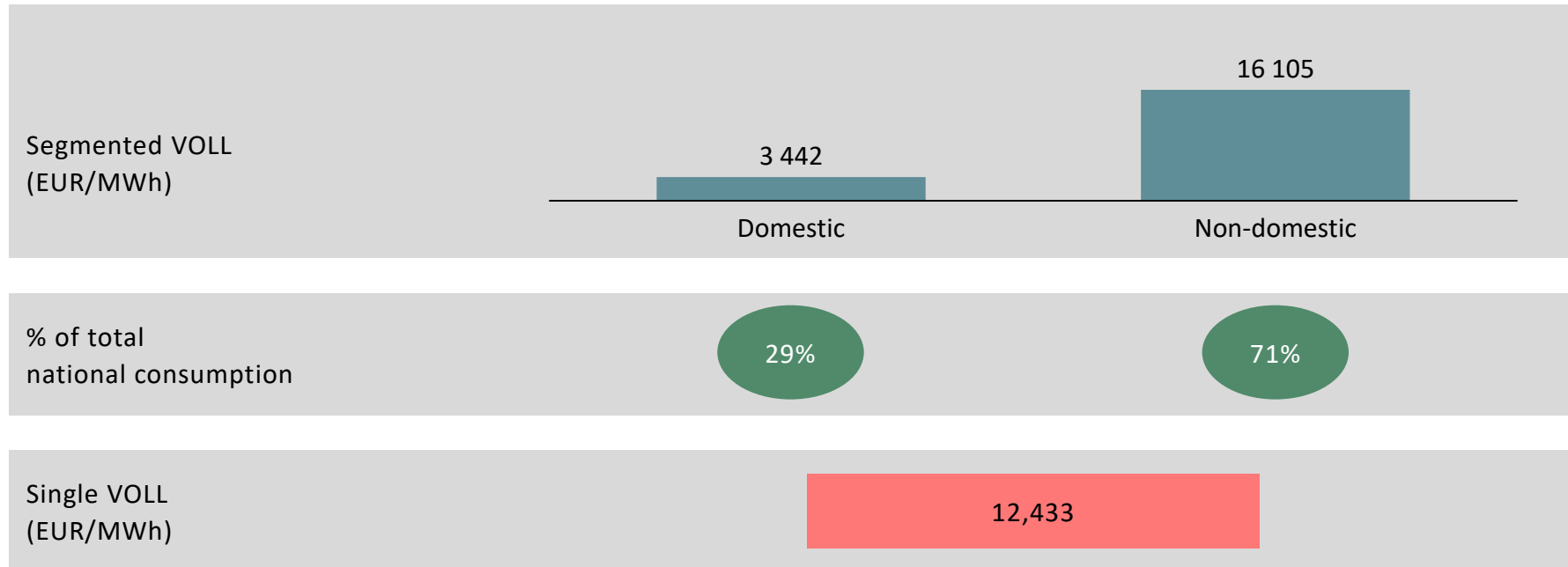


### Electricity interruption scenarios



AFRY has calculated a single VOLL of €12,433/MWh for Portugal, largely driven by the non-domestic segments

#### VOLL calculation



Source: AFRY.



## Reliability Standard is calculated from LOLE following ACER methodology

**01.**

Calculation of LOLE for every reference technology

**02.**

Verification of the validity of the LOLE

**03.**

Calculation of the RS considering the LOLE and the potential for each technology

AFRY has concluded that the RS in Portugal is 1.46 h/year, set by the extension of the operation of the current CCGT fleet

### Methodology

$$\text{LOLE}_{\text{Reference Technology}} = \frac{\text{CONE/CORP}_{\text{Fixed}}}{\text{VOLL}}$$

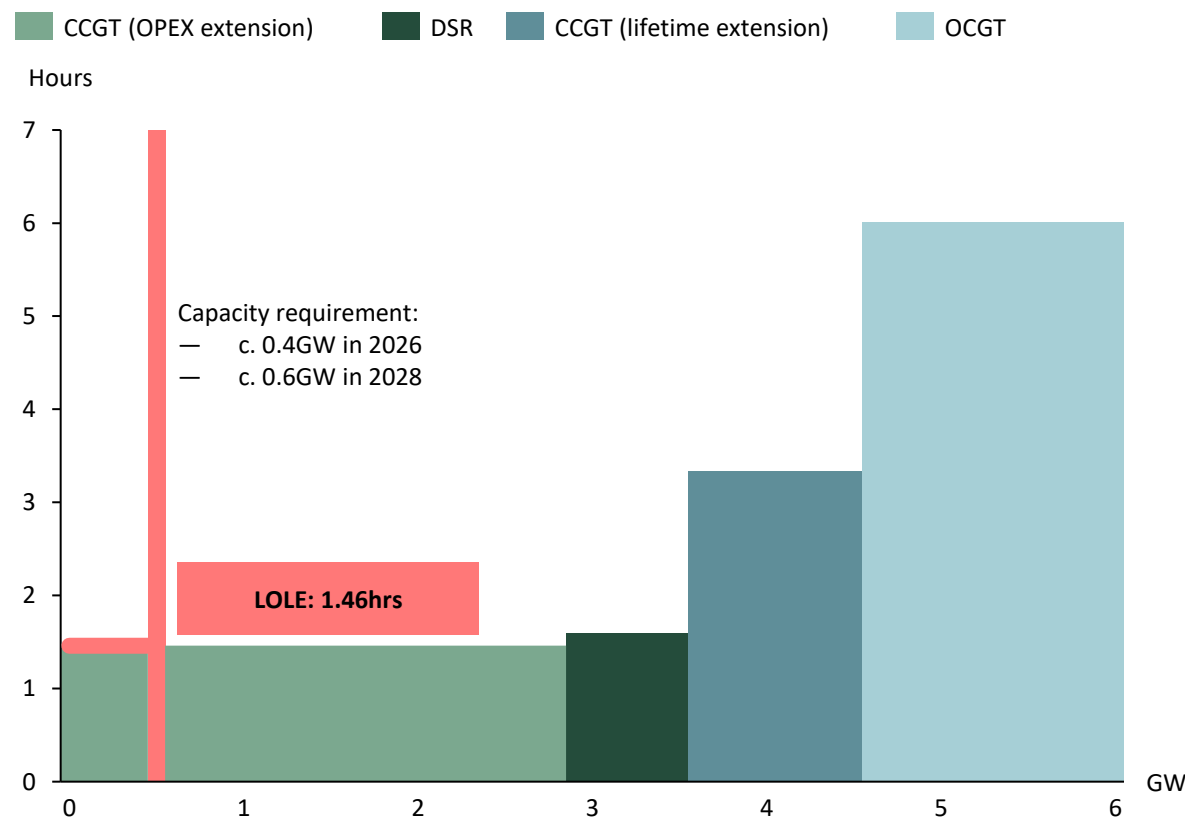
- **Minimum capacity required** to reach the RS according to ACER must be less than (or equal to) the maximum hourly energy not supplied EENS observed in the ERAA or, where applicable, in the regional or national coverage study (i.e., RMSA<sup>2</sup> for Portugal).

| Year | LOLE (h) | EENS (MWh) | Minimum capacity required to reach RS (MW) |
|------|----------|------------|--------------------------------------------|
| 2026 | 0.13     | 9.68       | 446                                        |
| 2028 | 0.12     | 10.36      | 557                                        |
| 2030 | 0        | 0          | 0                                          |
| 2035 | 0        | 0          | 0                                          |

Notes: 1) Expected Energy Not Supplied; and 2) Relatório de Monitorização da Segurança de Abastecimento.

Sources: ERAA 2024 (<https://www.entsoe.eu/eraa/2024/>) and AFRY.

### RS calculation for 2026 and 2028



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# ERAA 2025 and RMSA 2025 lead to different conclusions using the same methodology, resulting from differing assumptions

| LOLE for Portugal (h/year) | Standard | ERAA 2025 | RMSA 2025 <sup>1</sup> |
|----------------------------|----------|-----------|------------------------|
| 2026                       | 1.46     | 0.8       | 1.7                    |
| 2030                       |          | 0.0       | 8.3                    |
| 2035                       |          | 0.1       | 68.3                   |
| Verdict vs standard        |          | Adequate  | Breached               |

WHY THE DIFFERENCE

Same system and methodology, opposite verdict: RMSA considers a capacity mix and demand more aligned to expectations<sup>2</sup> while ERAA assumes a political view

Notes: 1) “Complementar” trajectory selected, using the European methodology; and 2) potential assumptions for 2026.  
Sources: ERAA 2025 (ENTSO-E) and RMSA 2025 (DGEG).

# ERAA 2025 and RMSA 2025 lead to different conclusions using the same methodology, resulting from differing assumptions

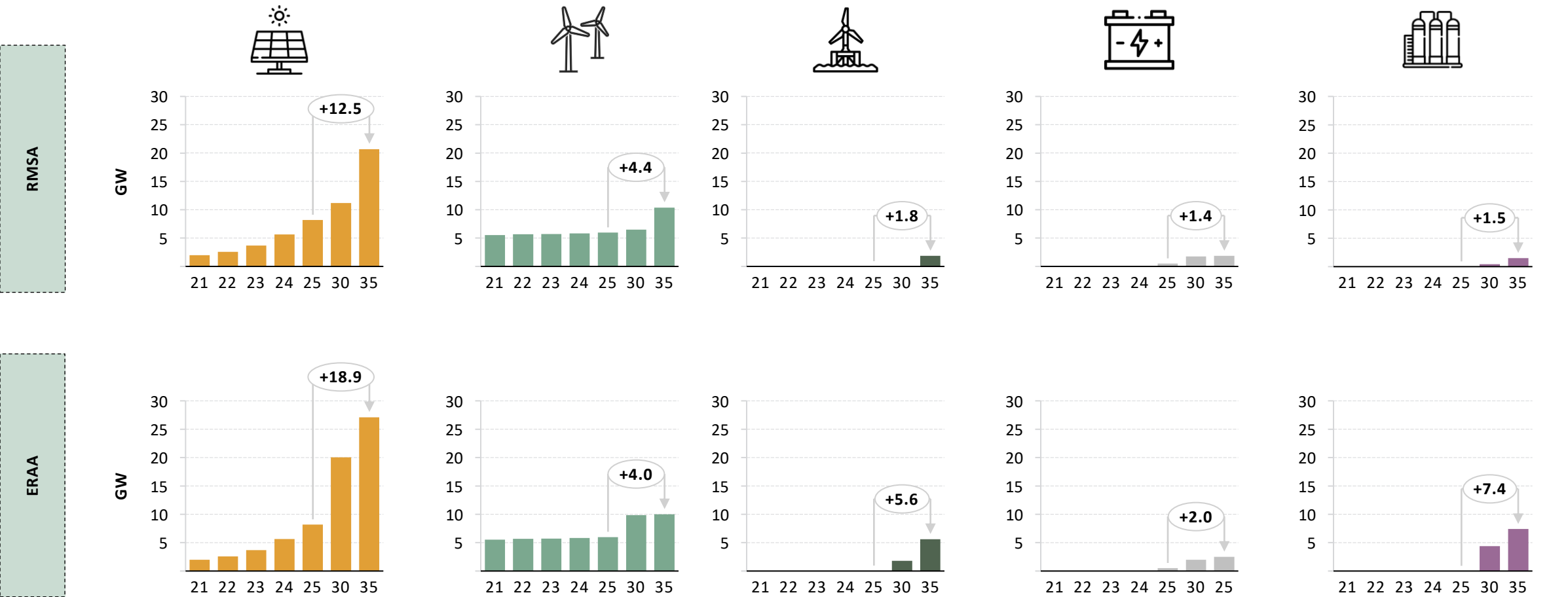
| Assumption                        | ERAA (ENTSO-E)                                                       | RMSA 2025 <sup>1</sup> (DGEG)                                                 |
|-----------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Methodology & scope               | EU adequacy methodology; pan-European modelling                      | EU methodology, with a lower number of weather scenarios                      |
| Interconnection with Spain        | Full cross-zonal capacity available in all scenarios                 | Conservative scenarios credit only ~10% of Spain interconnection (SoS stress) |
| Demand scenarios                  | EU-harmonised common reference scenarios                             | More realistic view according to latest available information                 |
| Generation capacity & retirements | TSO data + economic viability; ERAA 2025 adds investor risk aversion | More realistic view according to latest available information                 |

THE SWING FACTOR

Same system and methodology, opposite verdict: RMSA considers a capacity mix and demand more aligned to expectations<sup>2</sup> while ERAA assumes a political view

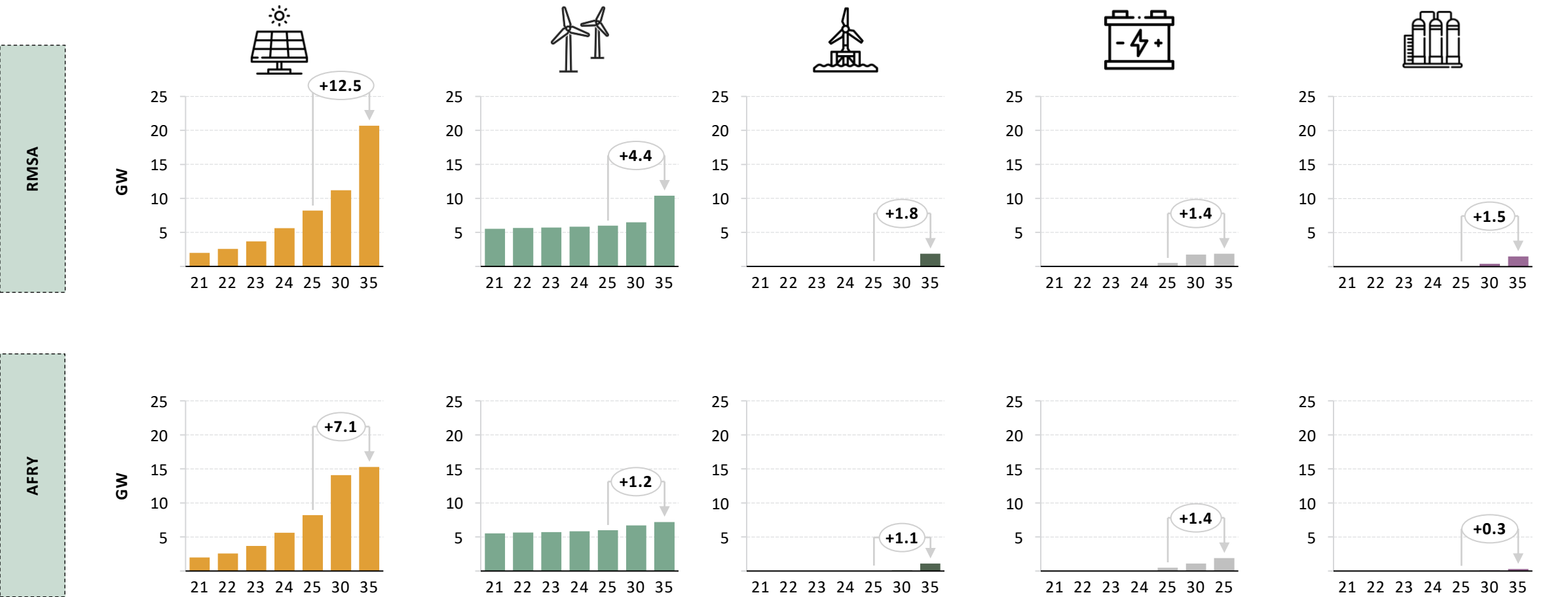
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Sources: RMSA 2025 and AFRY.

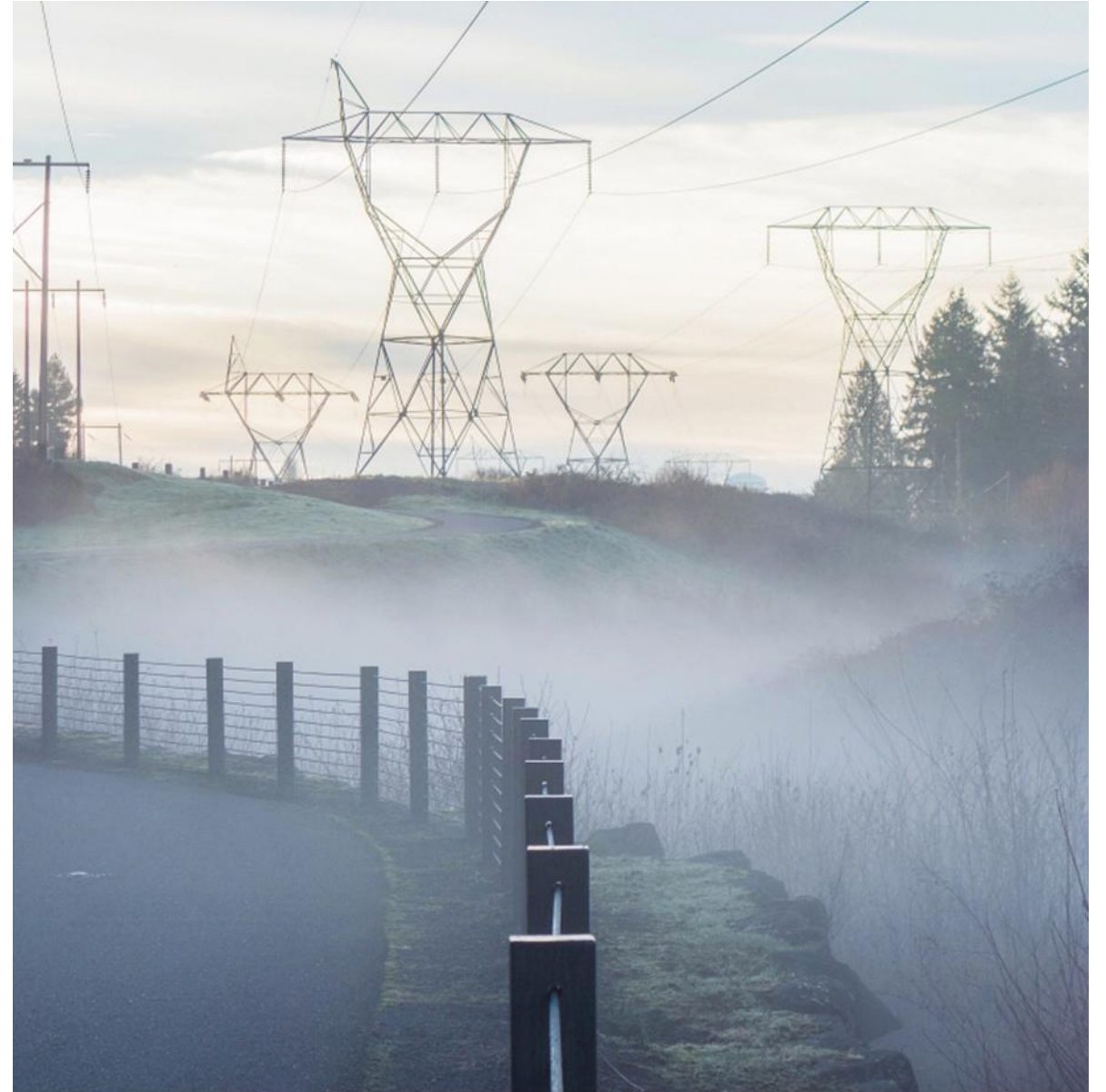
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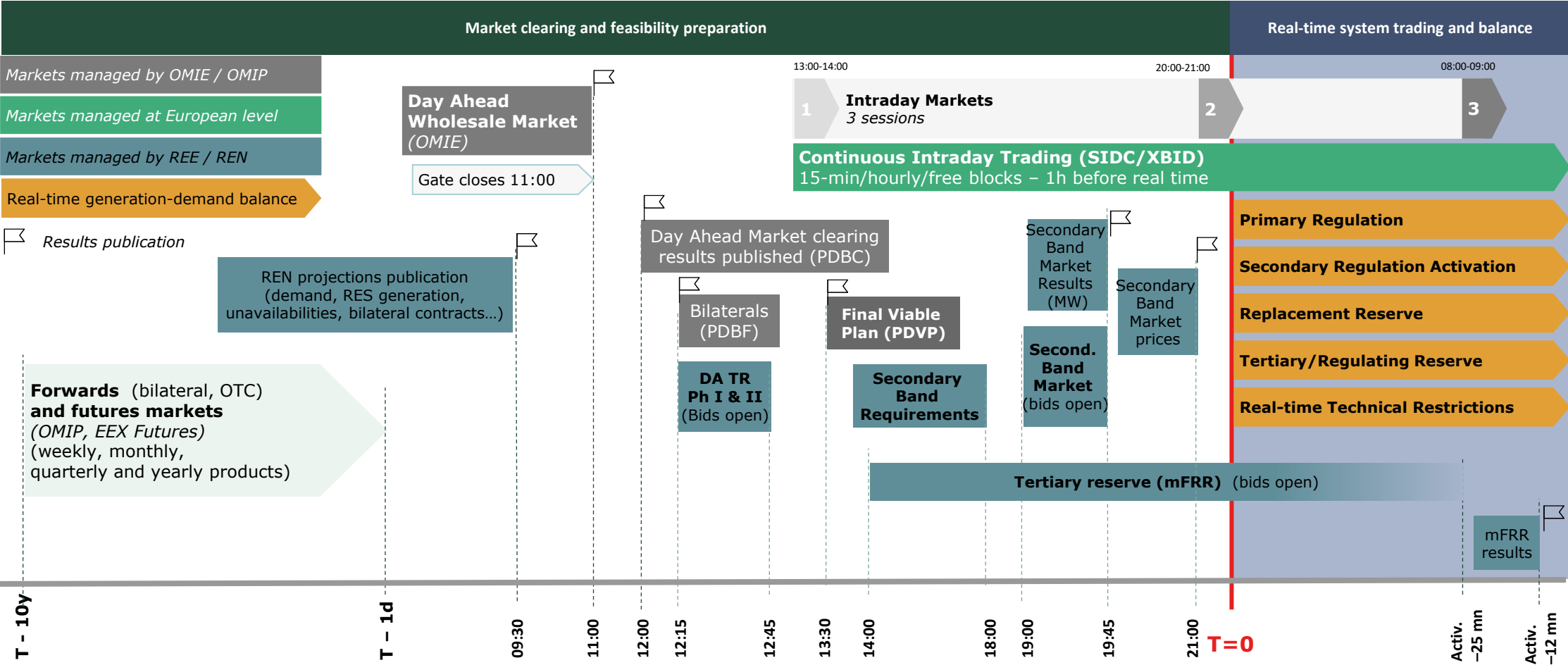
Sources: RMSA 2025 and AFRY.

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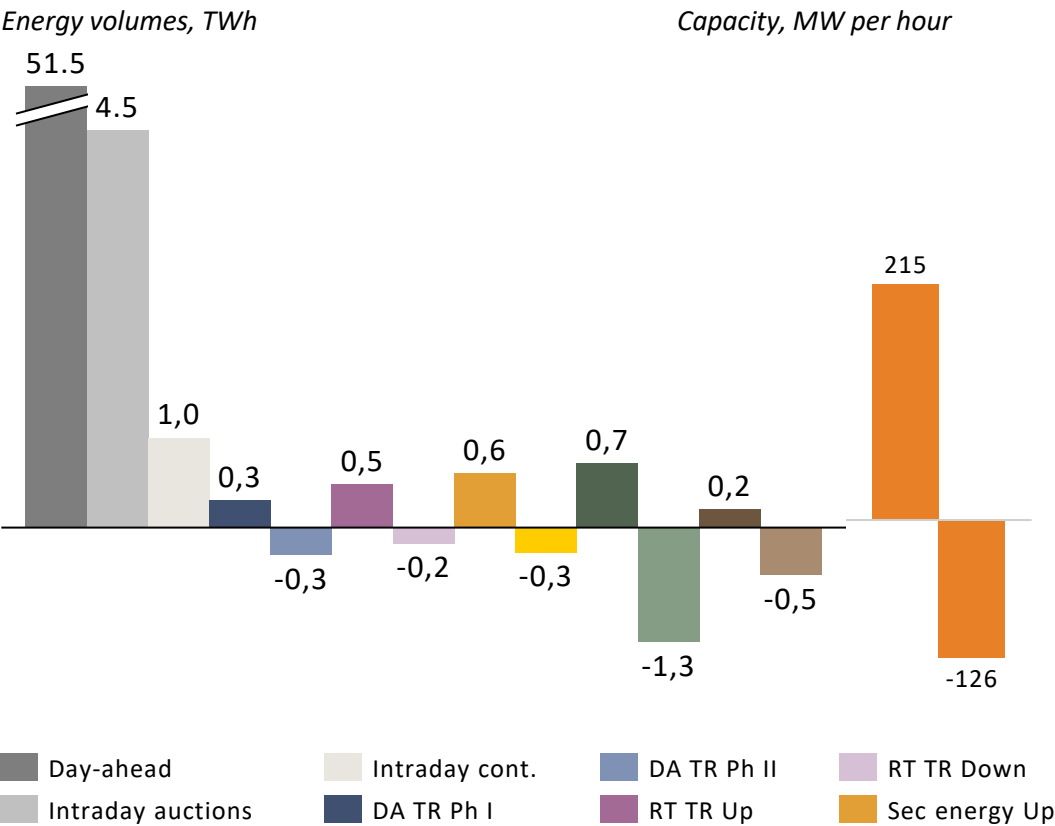
In Iberia, power is traded at a variety of timescales - balancing process is the final phase to manage energy at real-time scale



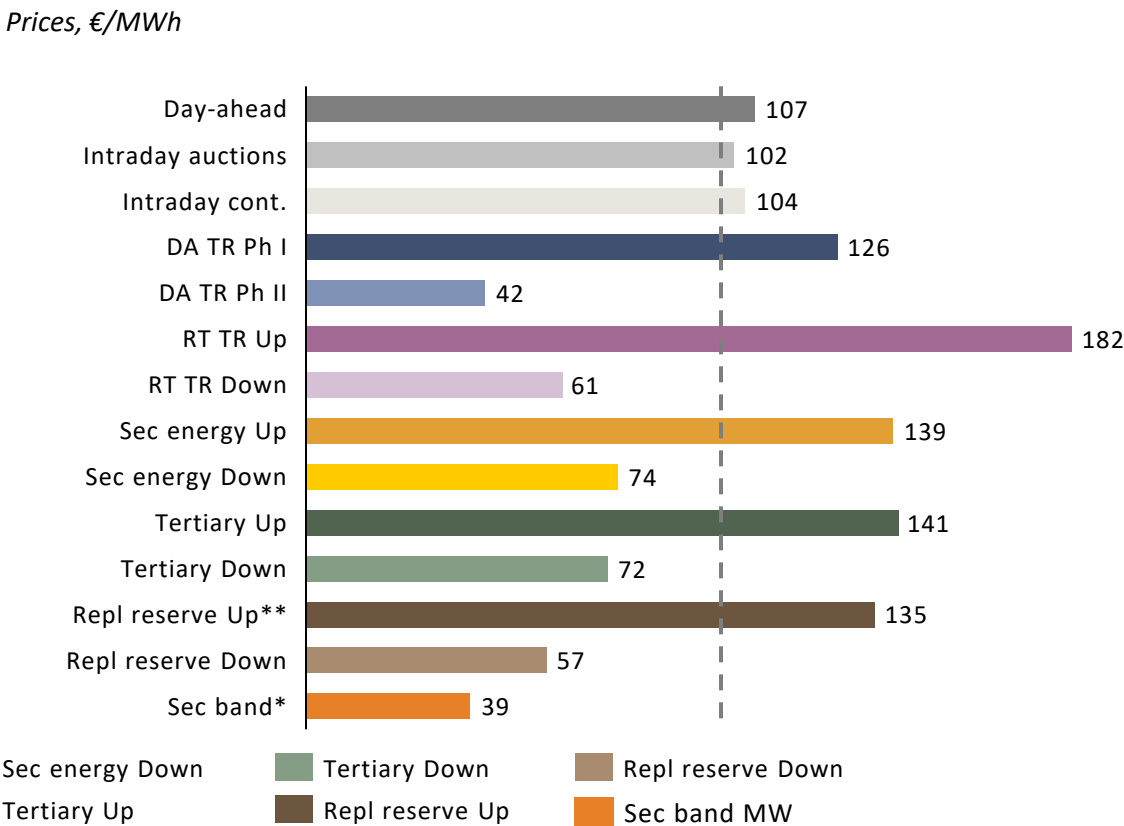
Sources: REN, OMIE | SDAC: Single Day-Ahead Coupling; SIDC/XBID: Single Intraday Coupling; OMIE: Iberian Market Operator; REE: Spanish TSO.

The majority of the energy traded takes place at the day-ahead market, although ancillary services are of critical importance for the operation of the system

Average volumes per market, 2022-2024



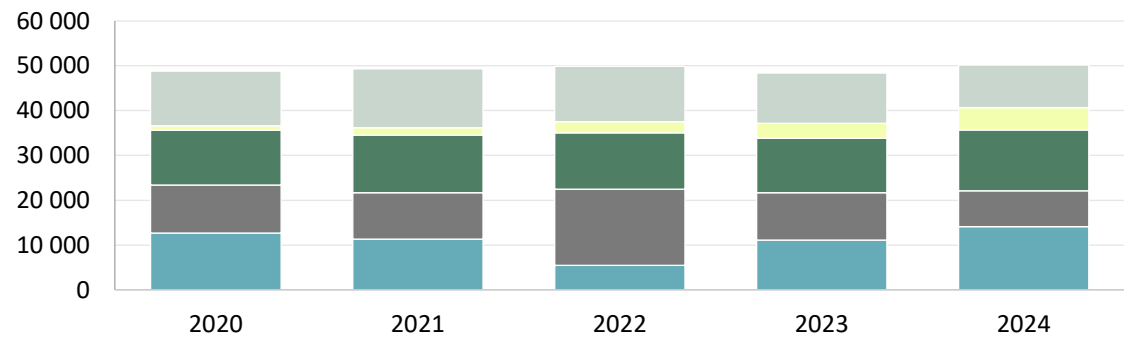
Average market prices, 2022-2024



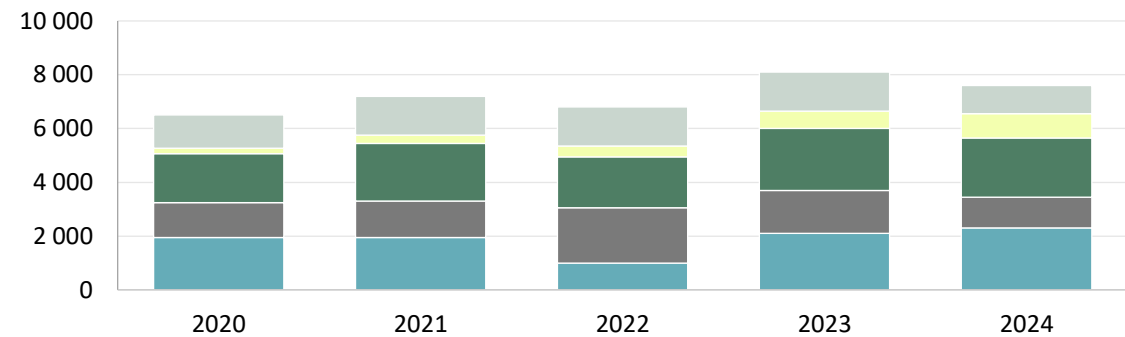
Note: \*Secondary band prices are in €/MW. \*\* Replacement Reserve is discontinued as of December 2025.  
Source: REN

# Dispatchable hydro and thermal are the main drivers of ancillary services solution and an important contributor to energy markets

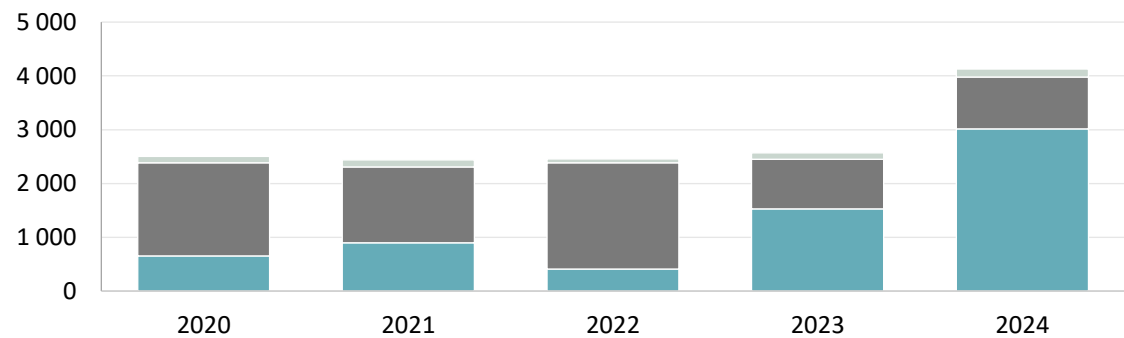
Day-ahead market – energy traded (GWh)



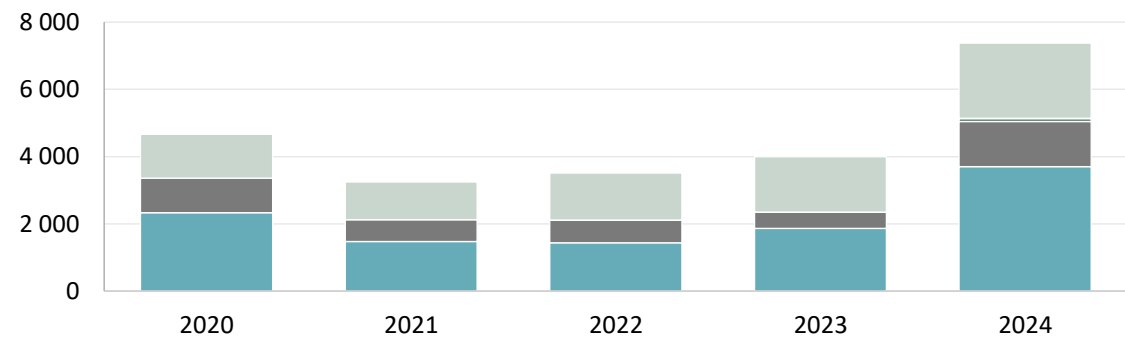
Intraday market – energy traded (GWh)



Secondary reserve band – contracted (MW)



Other ancillary services – mobilised energy (GWh)



Hydro Thermal (gas/CCGT) Wind Solar PV

Other (imports, cogen, storage)

Sources: OMIE, REN, ERSE and ENTSO-E.



CONTACT INFORMATION

## AFRY Management Consulting



**IGNACIO COBO**

Senior Principal

[ignacio.cobo@afry.com](mailto:ignacio.cobo@afry.com)

+34 611 481 021

