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Energy Storage future in Portugal

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28 may 2026

Energy Storage future in Portugal

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1. The regulatory framework applicable to energy storage in Portugal
2. ERSE's perspective on the role of storage in the integration of renewable energy and in the flexibility of the electricity system
3. Key regulatory and market challenges identified
4. Future prospects for the development of storage within the context of the national electricity system

European vision and strategy (#1/2)

Ambition in the goals of the European Union:

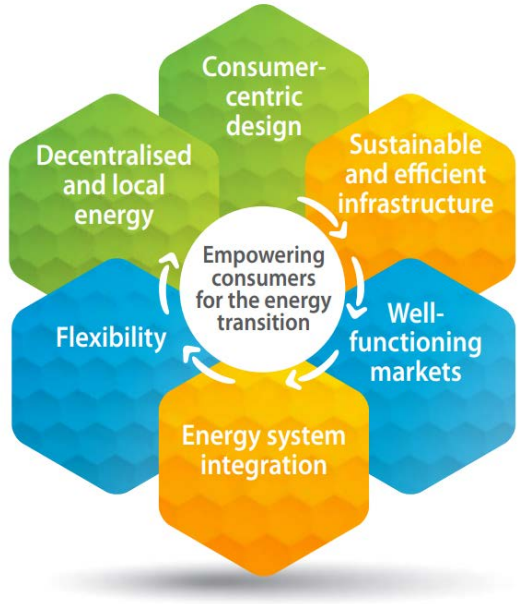
Carbon neutrality by 2050!

Strategy from European Regulators (CEER)

Empowering consumers for the energy transition (2022-2025)

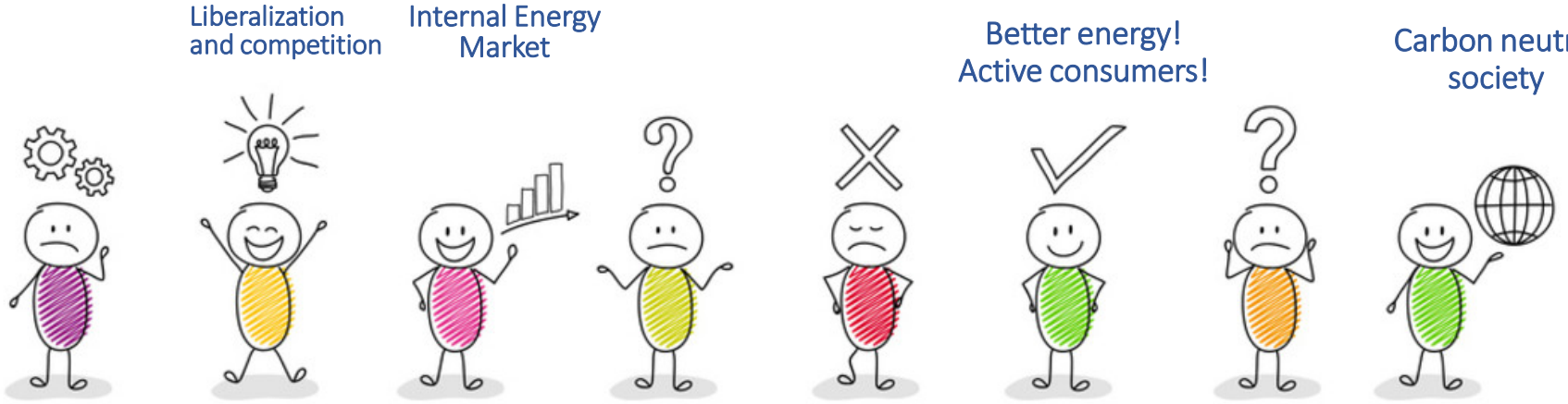
3 fundamental axes for decarbonisation:

- Internal Energy Market (integration of markets at the European dimension)
- Decentralization and local flexibility (Local Economy of Energy)
- Integration of energy vectors (Circular Economy of Energy)



European vision and strategy (#2/2)

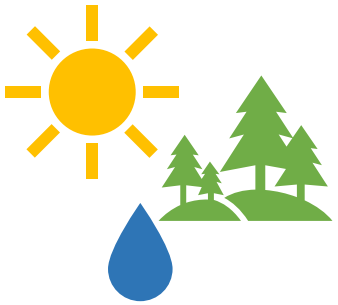
A process that started 30 years ago and is now projected for the next 30 years



The energetic transition/metamorphosis
A transformational process

Storage facilities potential

- Essential for the 2030 renewable energy goals and ensuring the resources adequacy and operational security from the power system



- Absorption of surplus renewable capacity

- Ancillary services provision to the power system

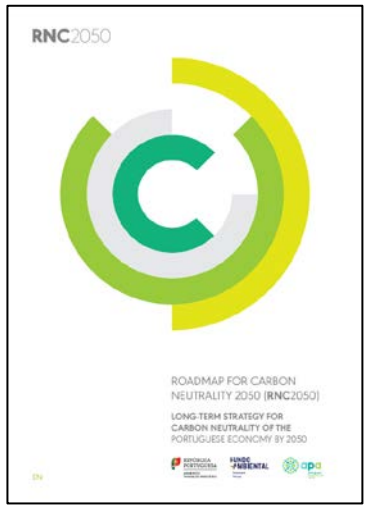
  Grid-connected or behind-the-meter storage facilities, independent (≥1 MW) or aggregated (<1 MW)

  Balancing services, fast response to frequency variation (batteries), voltage control and black start services

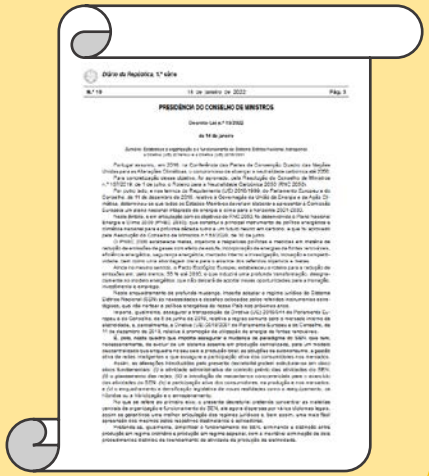
Electric system legal framework in Portugal

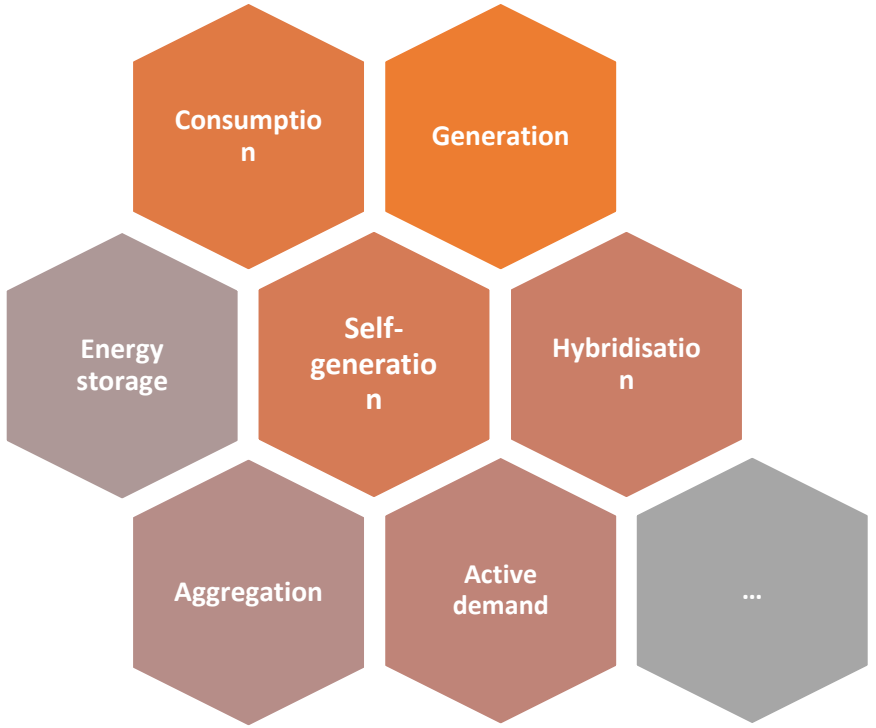
Portuguese Strategies:

PNEC 2030



Decree-law no. 15/2022, 14th January





Storage facilities types by law

A storage facility can have two distinct types (DL 15/2022):

- **Standalone Storage**: when the facility is directly connected to the network without being associated with a power generation facility or a Self-Consumption Production Unit (“UPAC”);

- **Co-located Storage**: when the installation is combined with a power generation facility or a UPAC, both using the same connection point to the network.

Storage Regulatory charges

Regulatory charges to be payed?

(defined by ERSE's Orientação n.º 1/2026)

Storage facility type	Regulatory charges for **Consumption**	Regulatory charges **for Injection**
Standalone Energy storage	**Exemption**	**Exemption** if qualified for ancillary services or with a grid connection capacity up to 10 MVA, or during the commissioning period, plus 3 months. In other cases **no Exemption**.
Co-located Energy Storage (generation facility)	**Exemption** if the energy used to charge the storage is later injected in the network.	**Same** as Standalone storage **above**.
Co-located Energy Storage (consumption facility)	**No Exemption** to the energy used to charge the storage in equal terms to demand.	**Exemption** in cases of selfconsumption or surplus of self-consumption.

Connection to the grid

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- **Portuguese legislation foresees 3 possibilities for network capacity allocation:**

  - **General access** – Allocation of available network capacity upon request from the interested parties (producer or storage), submitted in an electronic platform. Operators shall publish the available network capacity by substation and voltage level.
  - **Agreement** - In cases where there is scarce network capacity, an agreement may be signed between one or more interested parties and the operator, whereby these parties assume the financial costs arising from the construction or reinforcement of the network.
  - **Competitive procedure** - The Government may determine that a tendering procedure shall be carried out for granting network capacity.

Legislative framework

- **Network capacity allocation:**

  - Access to the grid may be granted with restrictions, under the terms regulated by ERSE;
  - **Firm Capacity**: the maximum value of the apparent power that can be assigned to power plants or storage facilities, which the network operator guarantees can be injected throughout the year;
  - **Non-Firm Capacity**: the maximum, non-guaranteed, value of the apparent power that can be allocated to power plants or storage facilities, which may be reduced on the initiative of the network operator, by action on the injection, to ensure the safe operation of the system.

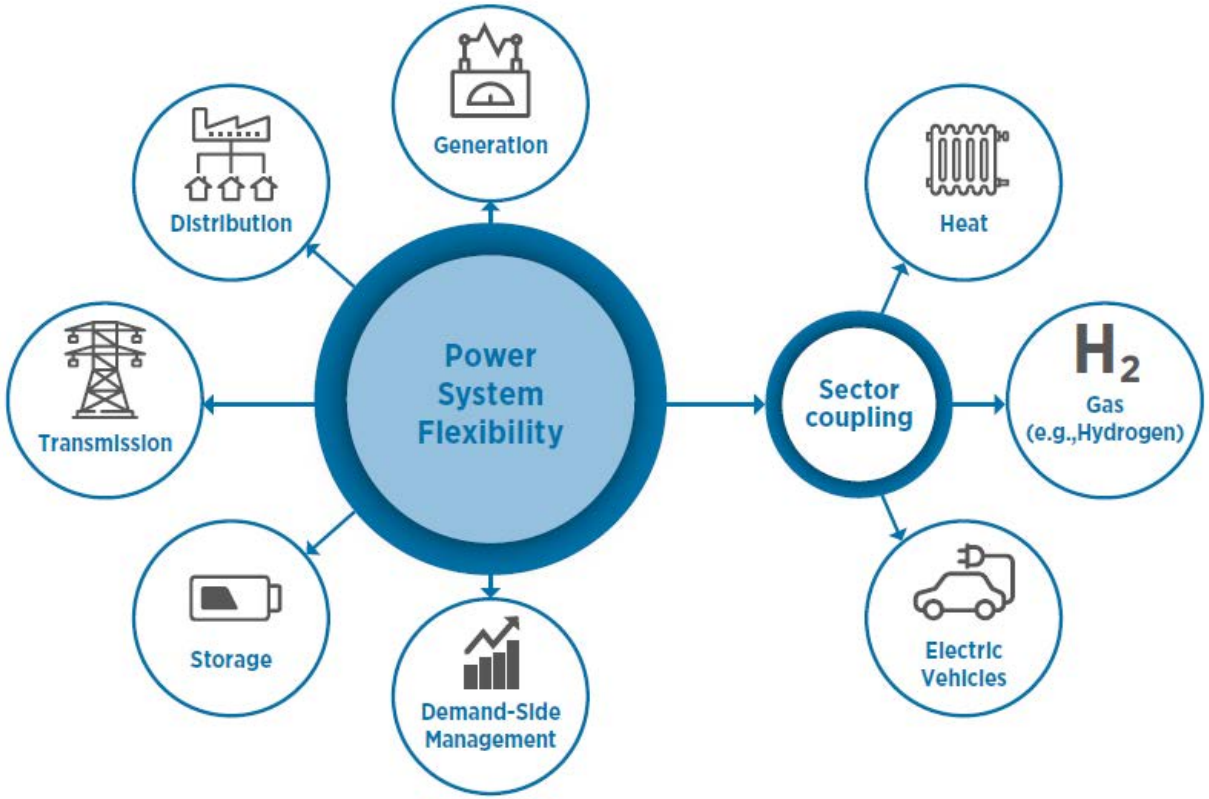
Legislative framework

- **Network capacity allocation:**

  - Directorate-general for Energy (Governmental Body) shall publish the injection capacity that can be allocated with restrictions defined by TSO/DSO, observing the planning standards established in the Network Code;
  - The Network Code determines the methodology for the calculation of reception capacity;
  - The legislative framework establishes the Production License content, which must indicate the maximum power that can be injected in the network without restrictions (firm) and, where applicable, the maximum non-firm injectable power, with identification of associated restrictions.

Flexibility: what and how…

Flexibility can be defined as the ability of the electrical system to respond to fluctuations in supply and demand while maintaining system reliability



Non-dispatchable generation

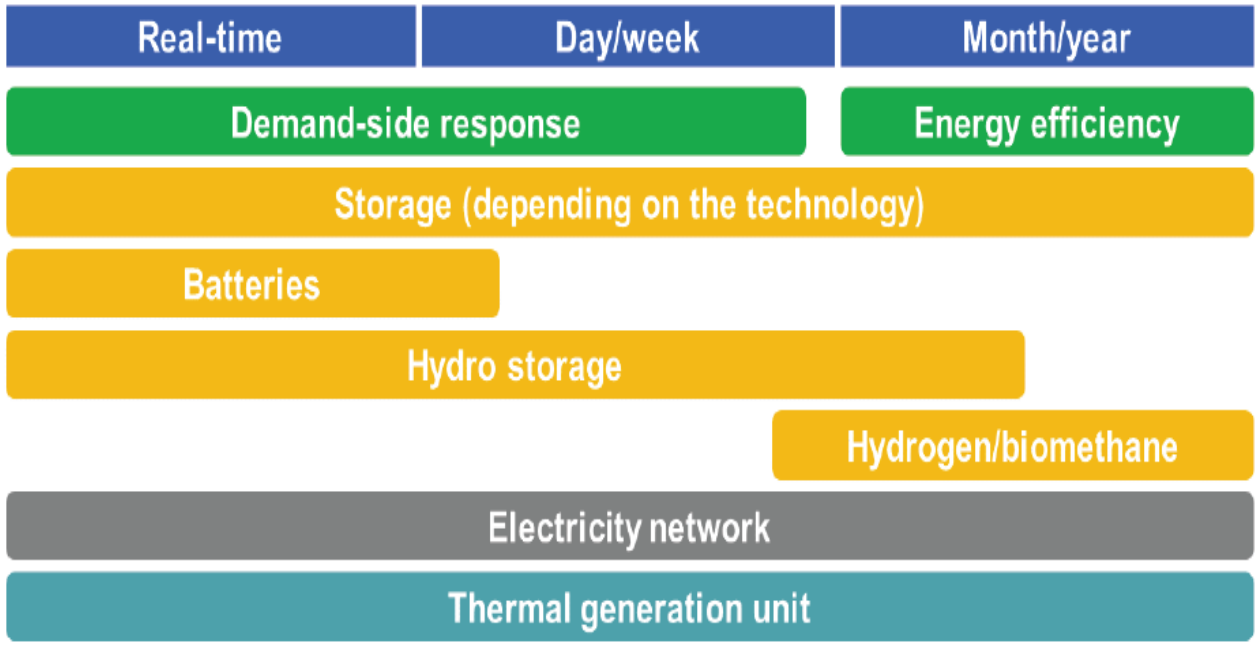
Implication in terms of required resources

Back-up capacity

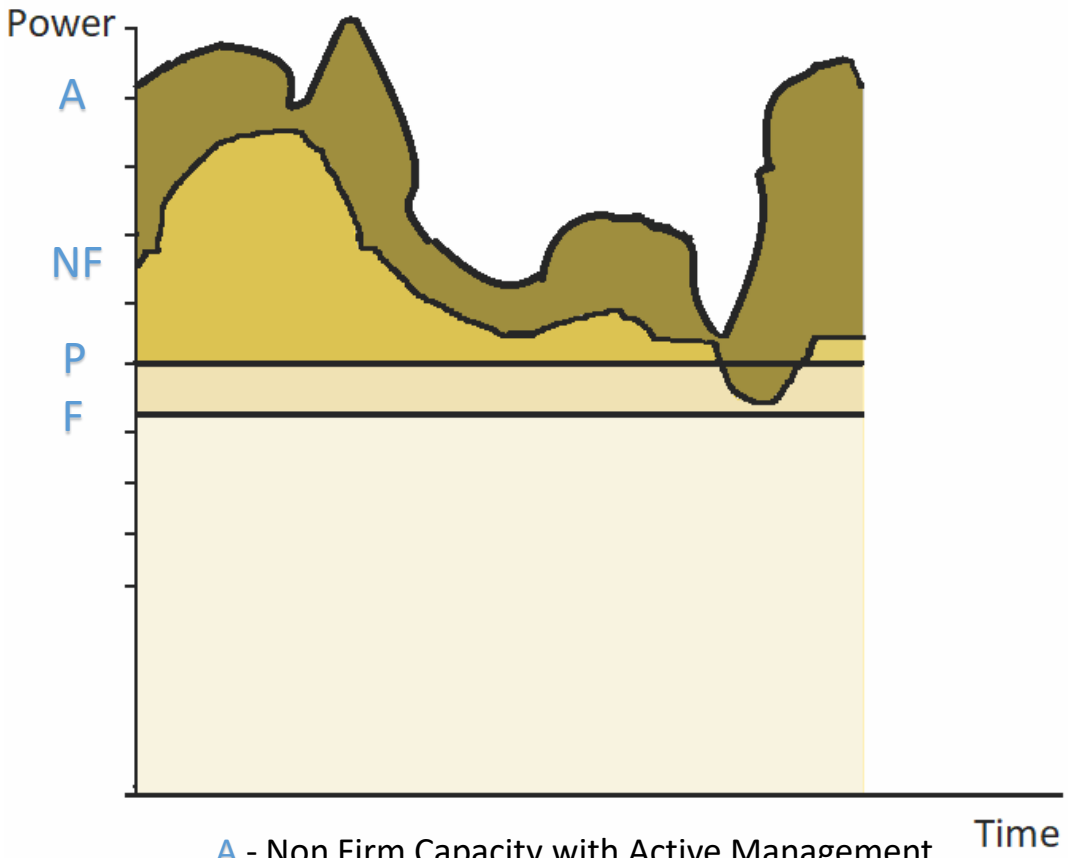
Flexibility resources

Source: Alberto Pototschnig, Pedro Verdelho, ”Market integration of renewable energies”, VIII World Forum on Energy Regulation, Lima, Peru, 21 August 2023

A more flexible electricity system is needed



Source: Adapted from ACER



A - Non Firm Capacity with Active Management

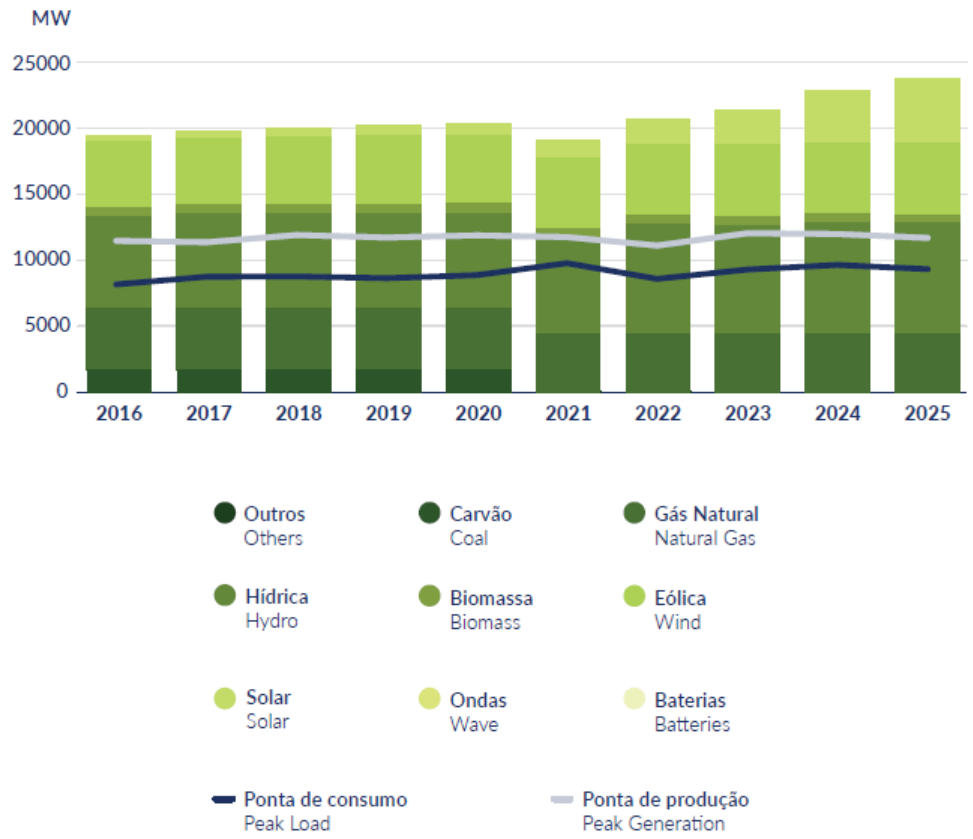
NF – Non-Firm Capacity (probabilistic approach)

P – (100-x)% Firm Capacity (probabilistic approach)

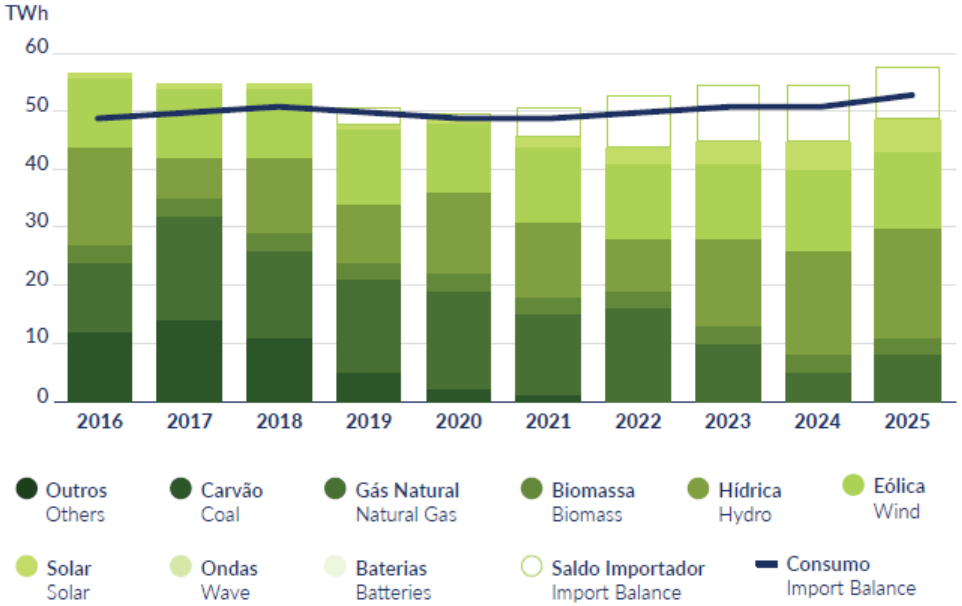
F – 100% Firm Capacity (deterministic approach)

Electricity generation in Portugal – current situation

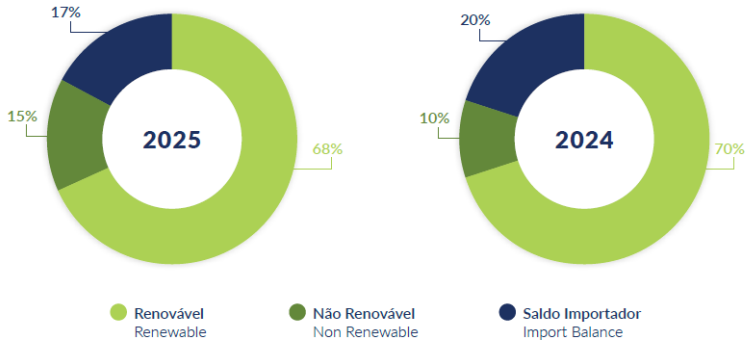
EVOLUÇÃO DA POTÊNCIA INSTALADA E PONTA
INSTALLED CAPACITY AND PEAK EVOLUTION



SATISFAÇÃO DO CONSUMO
SUPPLY



PRODUÇÃO RENOVÁVEL
RENEWABLE GENERATION



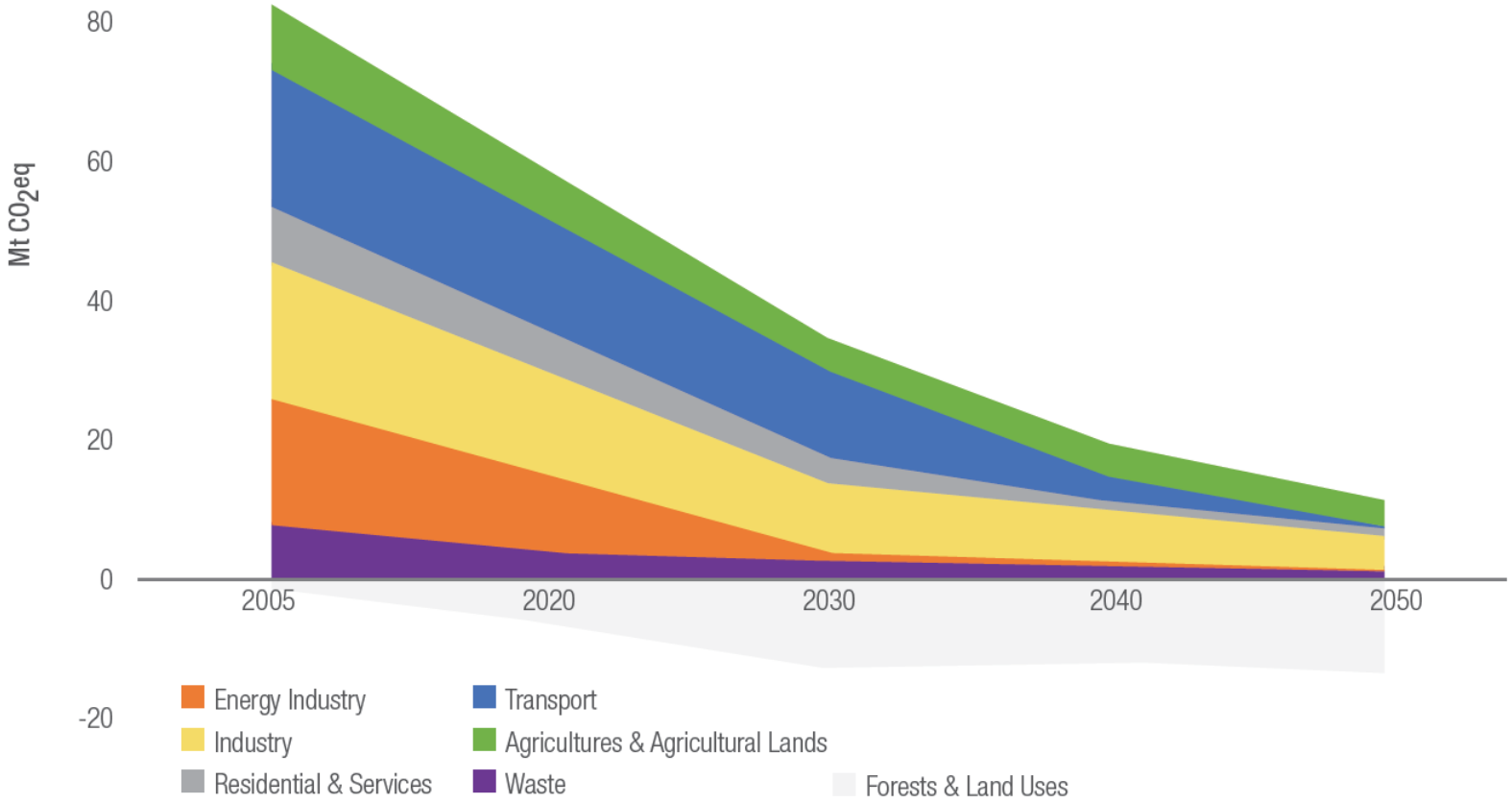
During 2025: 68% renewable generation (27% hydro, 25% wind, 11% PV e 5% biomass)

Source: REN, Dados Técnicos 2025

Towards a Neutral Carbon Society in 2050

Contribution by sectors to the GHG emissions reduction trajectory by 2050 for Portugal

Data from the 2019 Portuguese *Roadmap for Carbon Neutrality 2050*

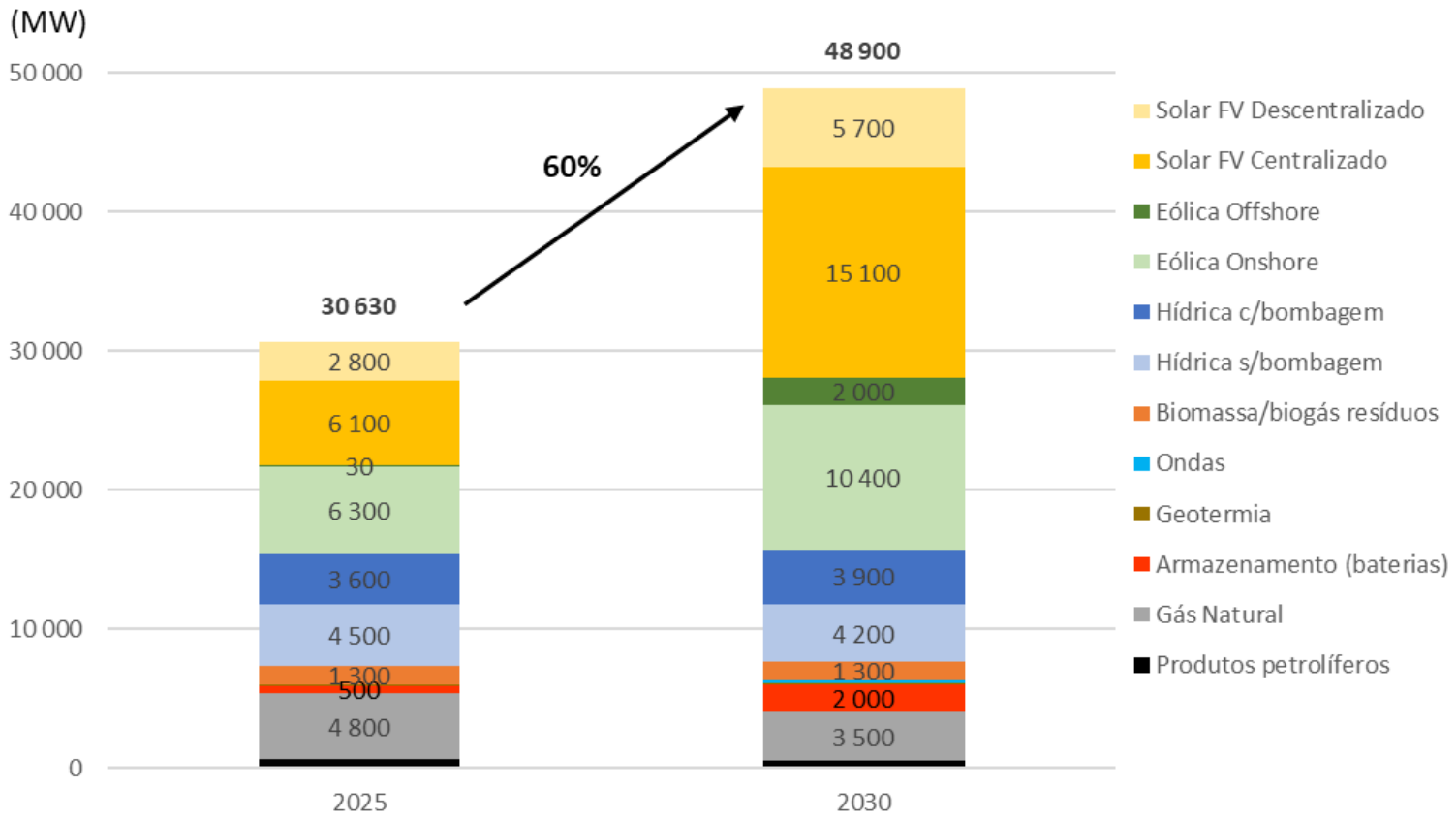


Source: Portuguese Government; *Roadmap for Carbon Neutrality 2050 (RNC 2050), Long-term Strategy for Carbon Neutrality of the Portuguese Economy by 2050*; June 2019; https://descarbonizar2050.apambiente.pt/en/

Portuguese National Energy and Climate Plan

Electric power system
Installed capacity expected evolution

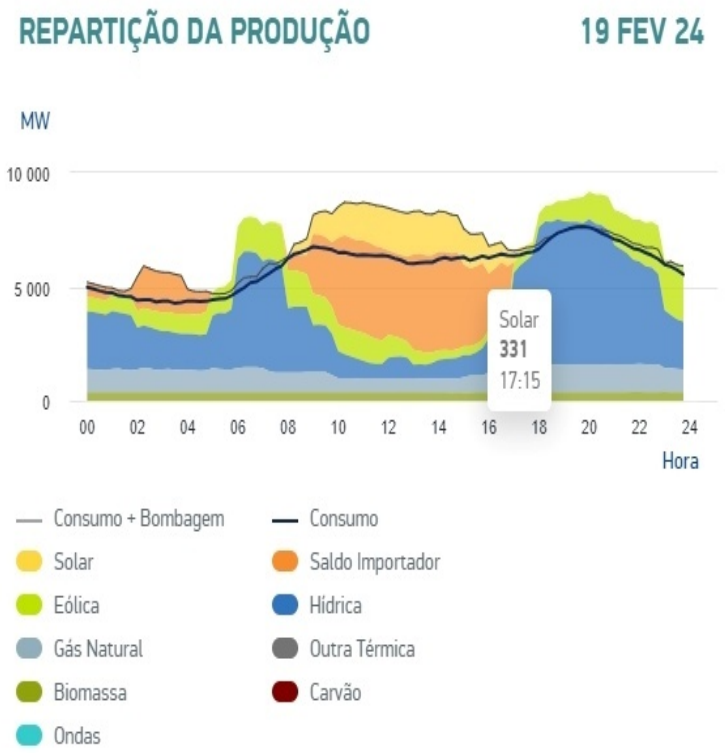
PNEC 2030
PLANO NACIONAL ENERGIA-CLIMA

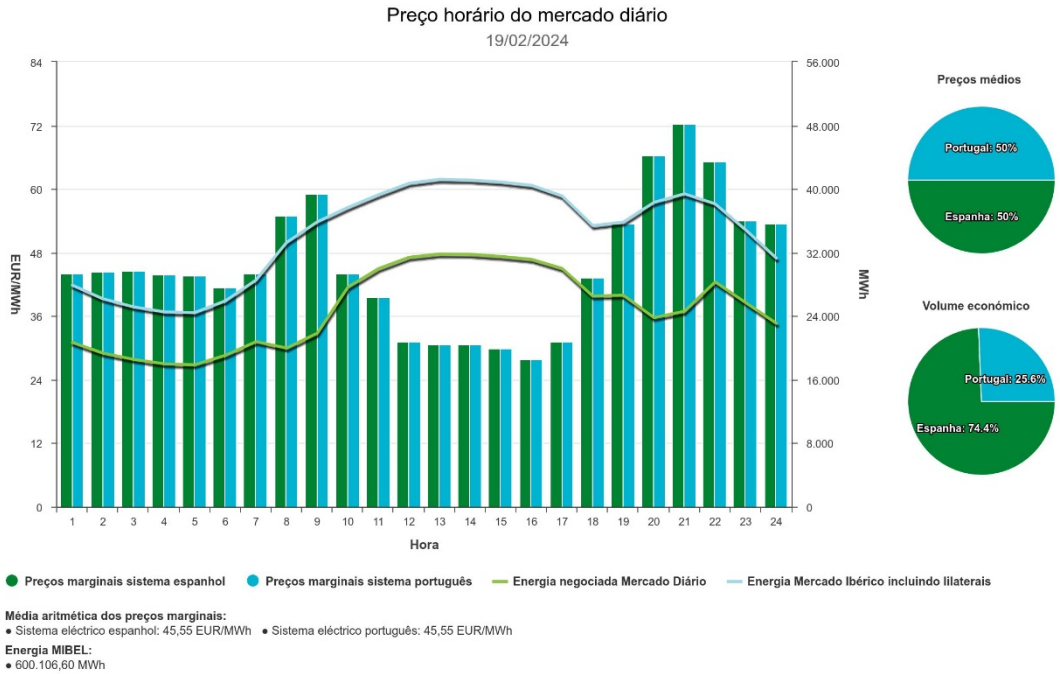


Co-location storage => 41 proj. /631 MW/ 99,75 M€ / Env. Fund Repower EU in 2025

Standalone storage => 30 MW; 750 MVA auction by government in 2026

Flexibility and storage needs



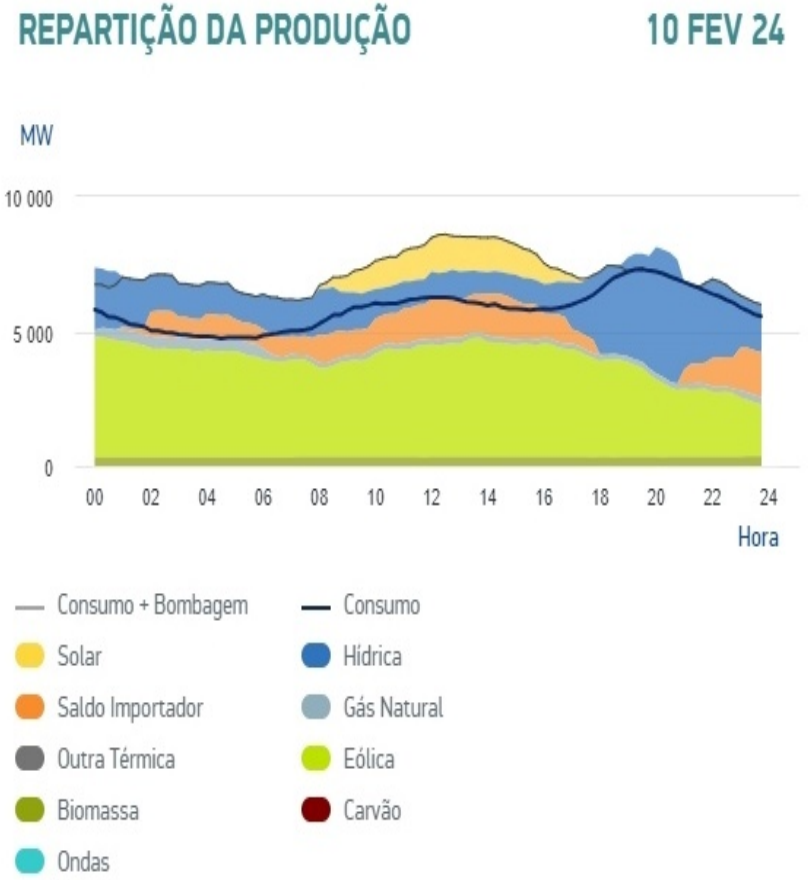


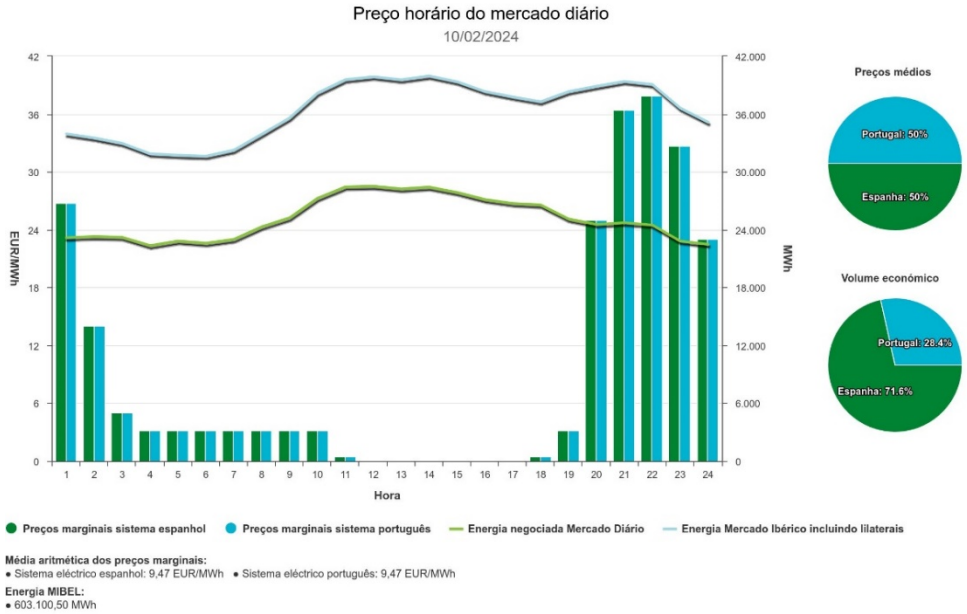
Source: REN, MIBEL

- Pumping during the day absorbs all national solar generation
- Pumping all day long
- Pumping and hydroelectric generation! (3,5 GW at 6:30 am)
- Low wind prevented the need for more storage
- Electricity imports also bring cheaper energy from Spain

Flexibility and storage needs

A windy day with market prices at zero at sunny hours!!





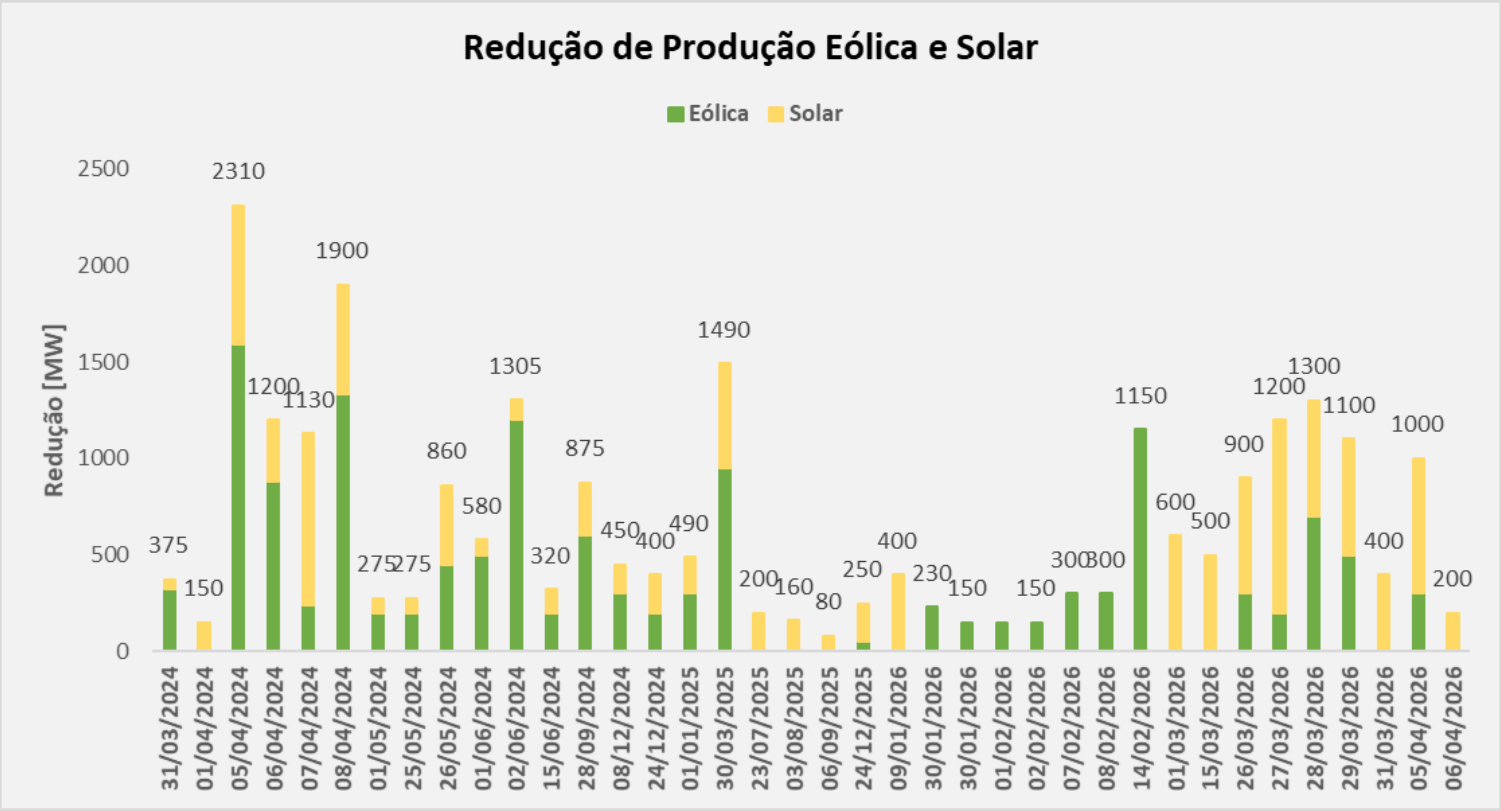
Source: REN, MIBEL

Flexibility needs in Portugal: some examples

Curtailment in Renewable Generation => Flexibility Needs for Renewable Integration

Since Q1 2024, the need to curtail RES increased => Redispatching

Essentially during "sunlight hours" from weekends and holidays, mainly due to low consumption and high solar, wind, and hydro productivity rates



- TSO highlights the need to:
  - Increase the system's storage capacity;
  - Develop flexibility mechanisms – E.g., encourage the participation of RES and storage in balancing and ancillary services markets.

Flexibility needs in Portugal: some examples

Quick power variation (ramp) – Solar energy

15/01/2025

Fonte: REN

15/07/2025

Fonte: REN

- 8h -> 9h => 0 -> 1001 MW

  Increase of ~250 MW every 15 minutes

16h -> 17h => 1122 MW -> 162 MW

Decrease of ~250 MW every 15 minutes.

- 8h -> 9h => 941 MW -> 1813 MW

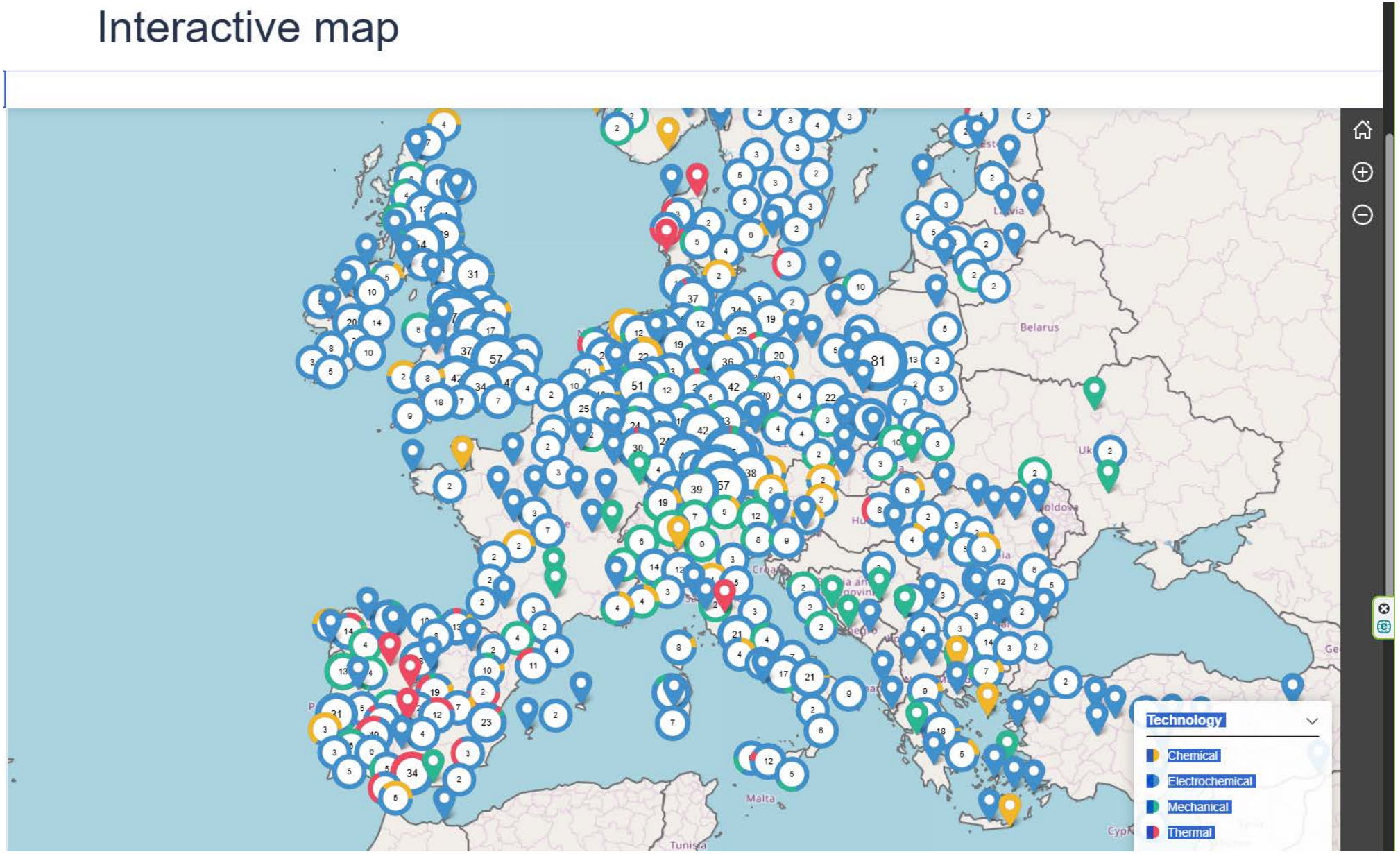
  Increase of ~200 MW every 15 minutes

- 18h -> 19h => 1852 MW -> 952 MW

  Decrease of ~200 MW every 15 minutes.

A flexibility service could be used as a structural solution to this issue.

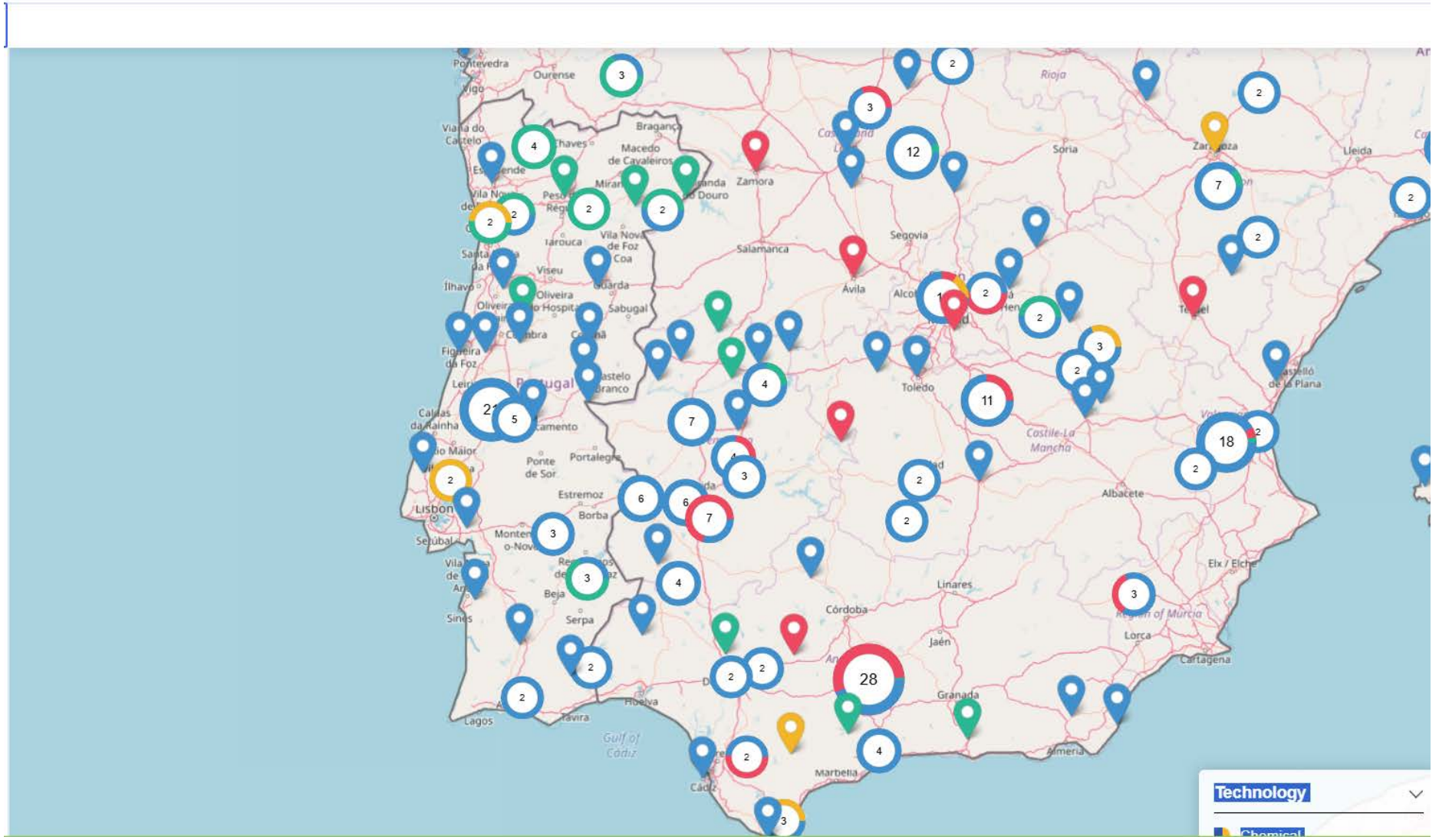
Storage location



Source: JRC

Storage location

Interactive map



Source: JRC

Storage facilities potential

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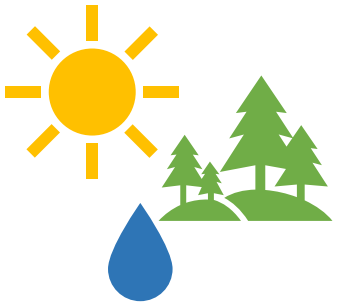


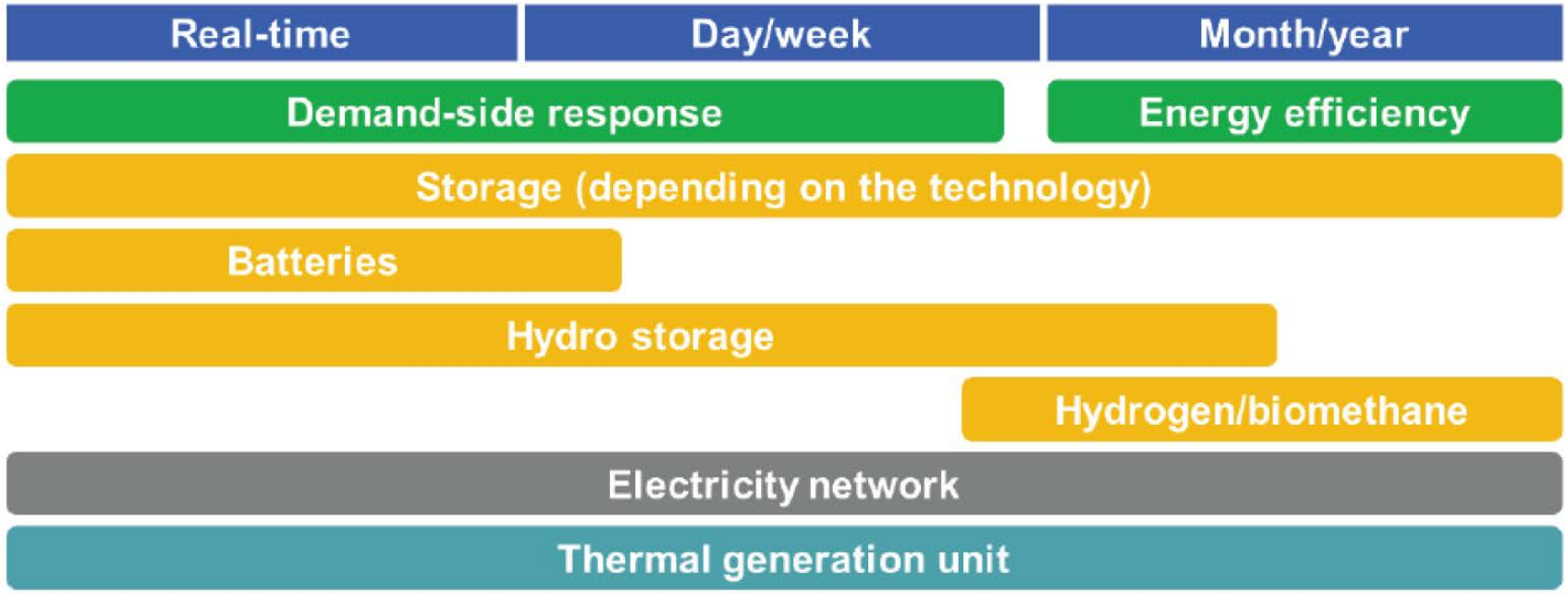
- Absorption of surplus renewable capacity

- Ancillary services provision to the power system

  Grid-connected or behind-the-meter storage facilities, independent (≥1 MW) or aggregated (<1 MW)

  Balancing services, fast response to frequency variation (batteries), voltage control and black start services

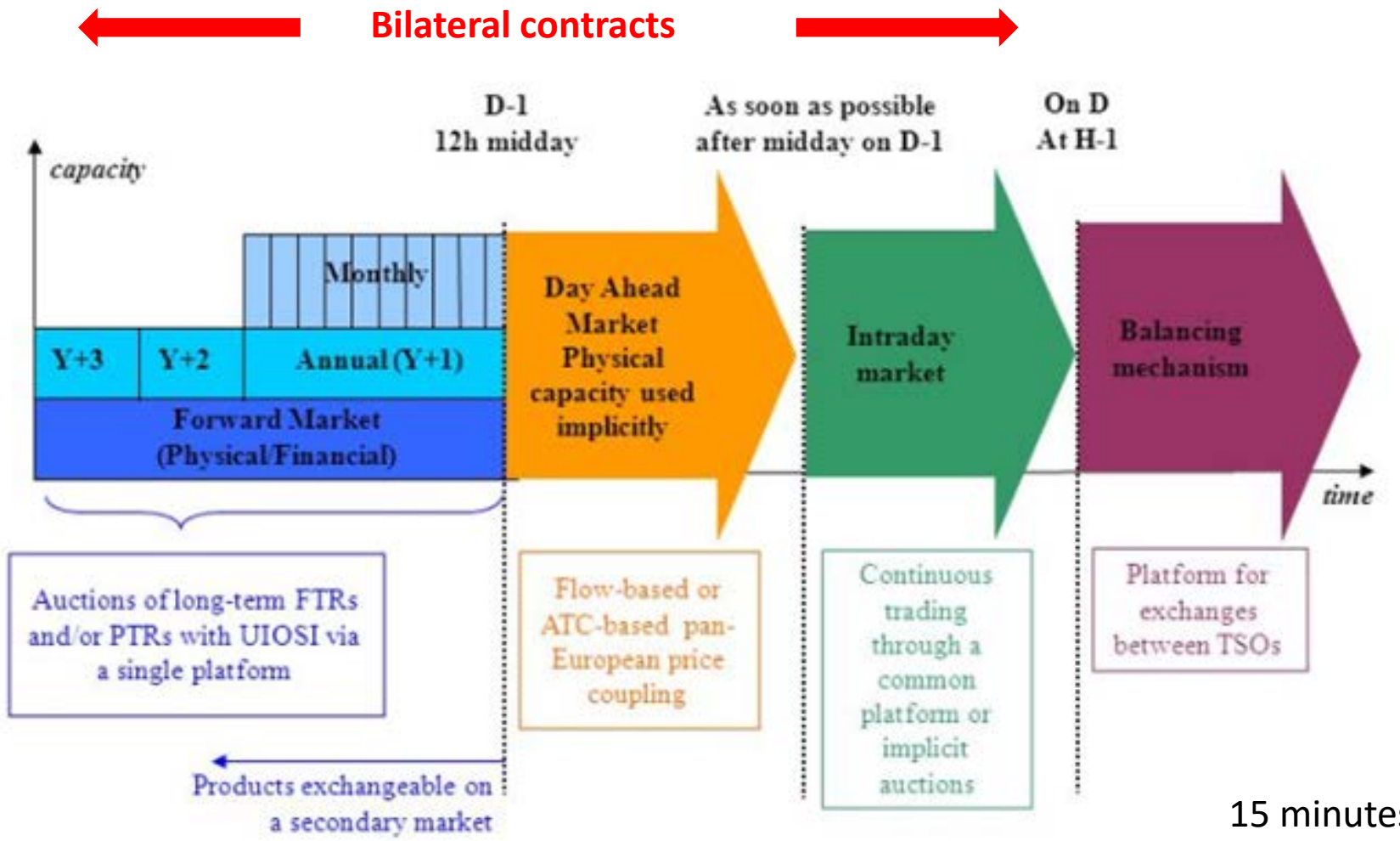
Potential flexibility sources



Source: : ACER

- Hydro storage, batteries and H_2, for renewable energy storage (available in all the time frames)
- Providing balancing services due to its fast response (duration 1 sec-1 min; response time in milliseconds/seconds)
- Fast frequency regulation and synthetic inertia in the future
- Black start service (duration 1h – 4h; response time < 1h)

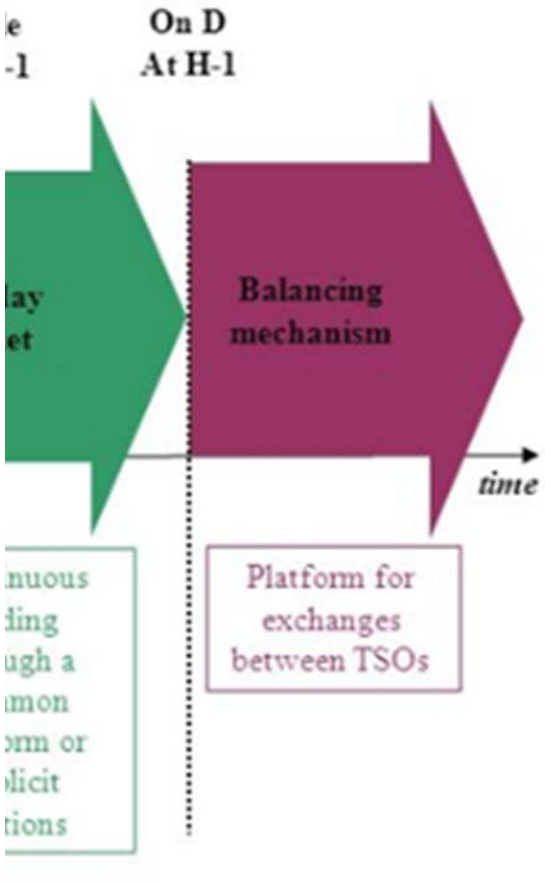
EU-wide Electricity Market

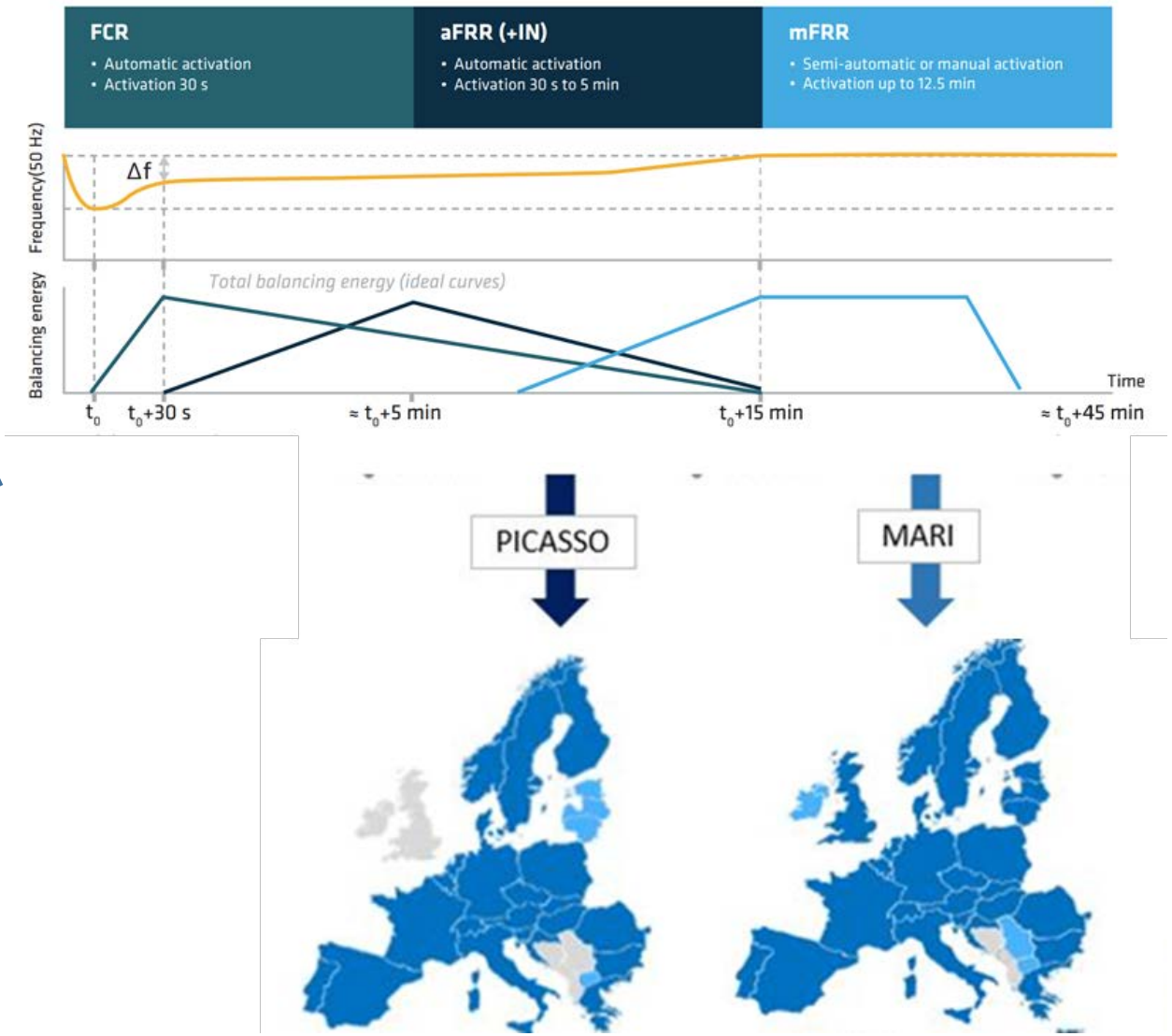


15 minutes granularity already in place

FTR –Financial Transmission Rights
PTR –Physical Transmission Rights
UIOSI –Use It or Sell It

EU-wide Balancing Market

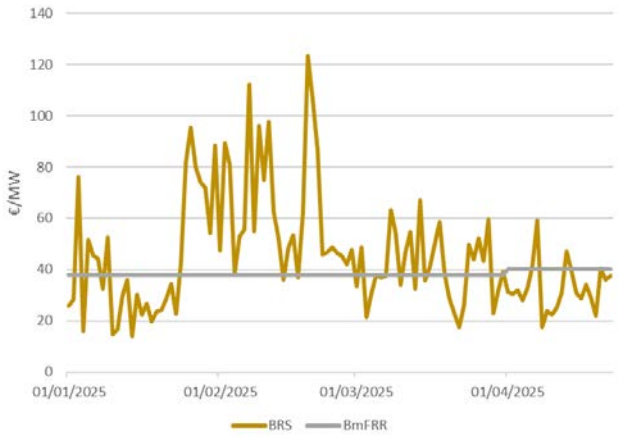




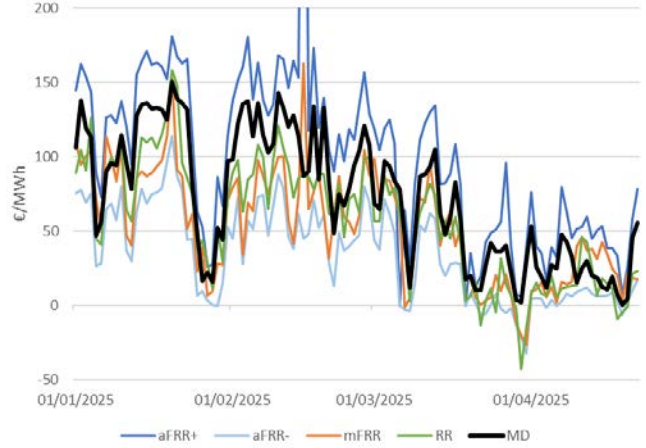
Ancillary services costs

The prices of ancillary services are determined by the respective markets

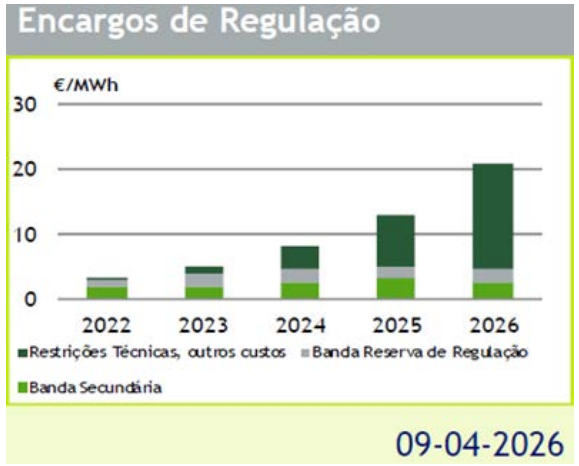
Capacity



Energy



"Ancillary services charges" are supported by suppliers



Deviation to the program

- Deviation to the program surcharges

Networks congestion management

- Congestion surcharges

aFRR capacity and energy provided

- Providers availability for the aFRR (automatic frequency recovery reserve) service

mFRR capacity and energy provided

- Providers availability for the mFRR (manual frequency recovery reserve), capacity service (security of supply)

Flexibility Needs

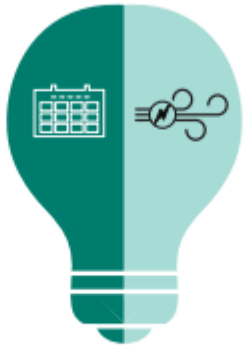
Flexibility needs at European level

Daily, weekly and seasonal flexibility needs

Daily flexibility

Morning and evening demand peaks

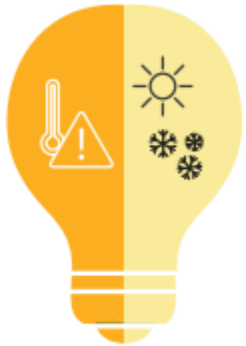
Day-night generation difference



Weekly flexibility

Weekday-weekend demand difference

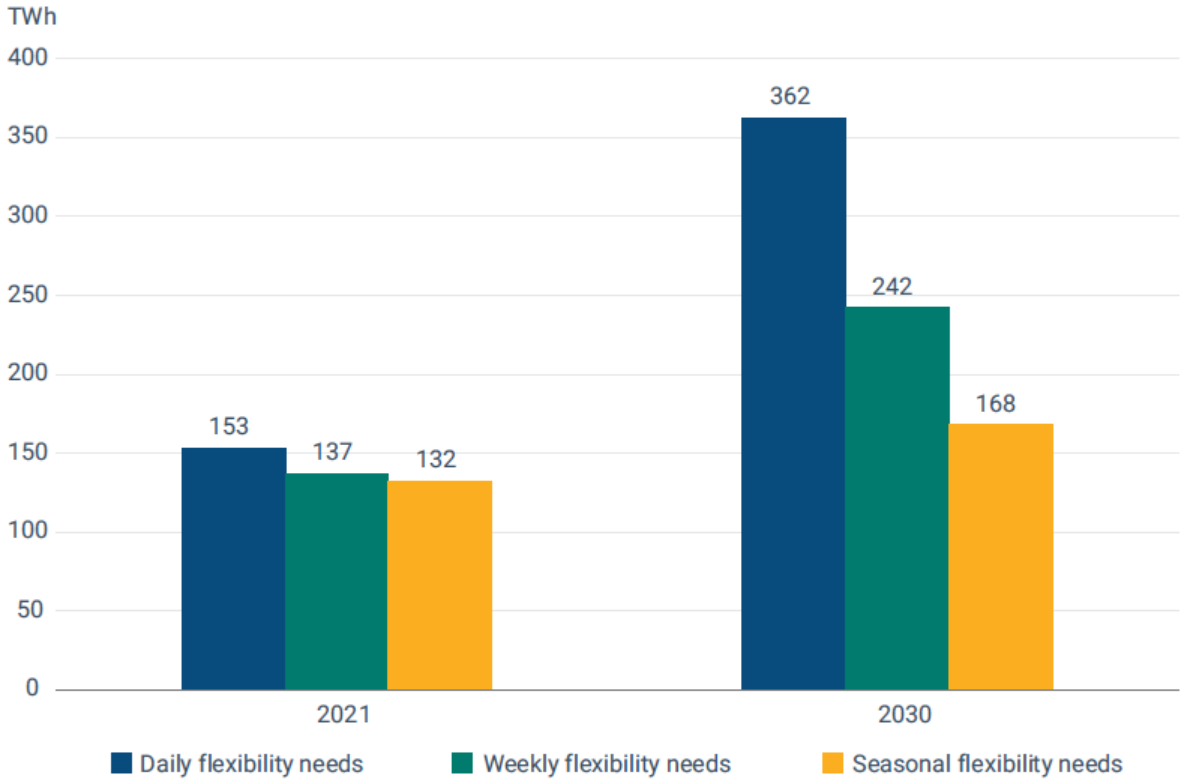
Wind pattern fluctuations



Seasonal flexibility

Heating-cooling periods

Seasonal weather patterns



Source: : ACER, Flexibility solutions to support a decarbonized and secure EU electricity system

Regulation (EU) 2019/943 on the internal market for electricity (recast)

The FNA report will focus on two main types of flexibility needs.:

System flexibility requirements – These requirements are described by 3 indicators: **RES integration, quick power variations (ramps), and short-term needs**

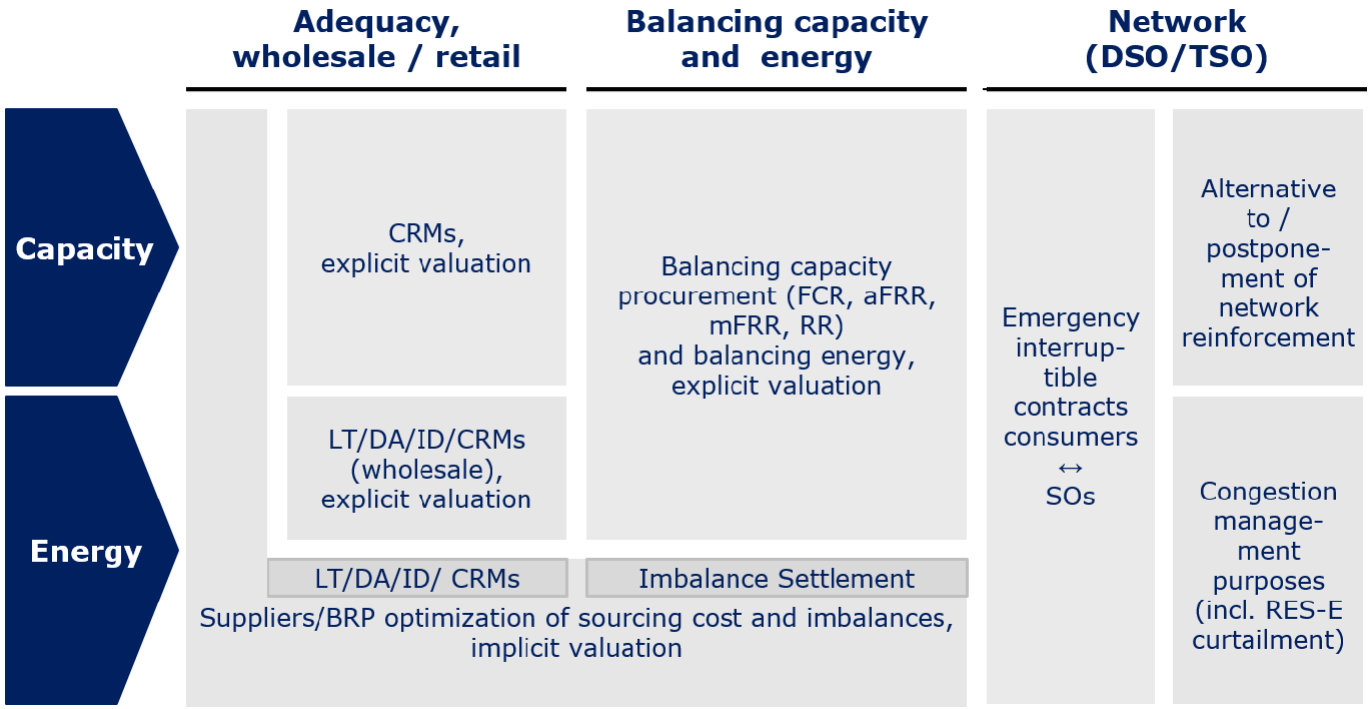
- **Integration of renewables** – the flexibility needed to reduce renewable curtailment (from the perspective of potential "waste" of renewable energy), in order to achieve the targets set in the PNECs (National Energy and Climate Plans).
- **Quick power variations (ramps)** – flexibility needed to cover predicted variations in residual load (consumption minus RES generation), taking into account the technical constraints of available flexible generation units
- **Short-term needs** – flexibility required to cover unexpected variations in consumption, RES generation (forecast errors), or unforeseen unavailability of generation or transmission assets (forced outages)

Network flexibility needs – Reflect the flexibility required to adjust network availability, allowing **avoidance or resolution of congestion or voltage issues.**

- **Flexibility needs at the distribution networks**
- **Flexibility needs at the transmission network**

The FNA Report is expected to be completed by July 25, 2026.

Power system segments where flexibility adds value



Source: "The new retail market design places consumers in the centre", CEER Specialised Training on Wholesale and Retail Market Monitoring, Manuel Sánchez-Jiménez, DG ENER, European Commission, February 2019

Other and new ancillary services are needed

aFRR – automatic Frequency Restoration Reserves
BRP – Balancing Service Provider
CRM – Capacity Remuneration Mecanism
DA – *Day Ahead*
DSO – Distribution System Operator
FCR – Frquency Containment Reserves
ID – Intraday
LT – Long Term
mFRR – Manual Frequency R Reserves
RES-E – Renewable Energy Sources
mFRR – manual Frequency Restoration Reserves
RR – Replacement Reserves
SO – System Operation
TSO – Transmission System Operator

Ancillary services markets

Balancing regulation reserves and network congestion management markets Energy provision

Black start services provision contracting

Balancing regulation reserves markets Capacity provision

Contracting Reactive Energy Management Services

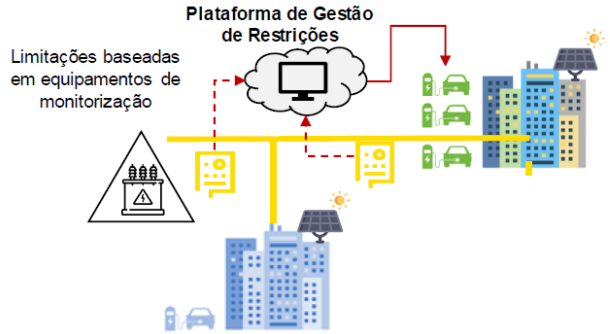
Qualification to provide the service → **Offers on marketplace platforms** → **Activated service provision** → **Service provision remuneration / penalties for non-compliance**

Local flexibility markets

Pilot-projects by the Portuguese main DSO

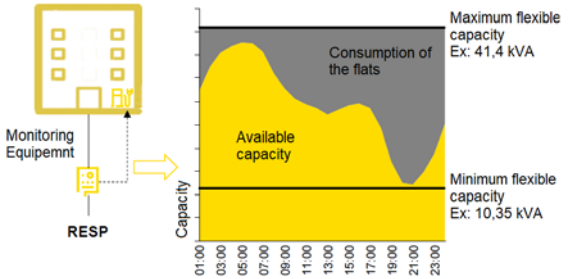
FIRMe – Integrated Flexibility in a Market Regime (pilot-project)

- Fostering local flexibility markets
- Integrating flexibility as a complement to network investment
- Contracting local services providers (consumers, generators, batteries, aggregators)
- Testing the concept of contracting flexibility services and the use of digital platforms
- Developing knowledge for power network operators and other power system stakeholders



FlexC pilot-project

- To be applied to condominiums, aims the development of rules/agreements/contracts for network connection that allow the consumption modulation by the DSO with eventual benefits in access tariffs/network charges and grid connection time



Thank you!

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