

# Unlocking the flexibility of distributed resources in Italy through UVAM and Equigy

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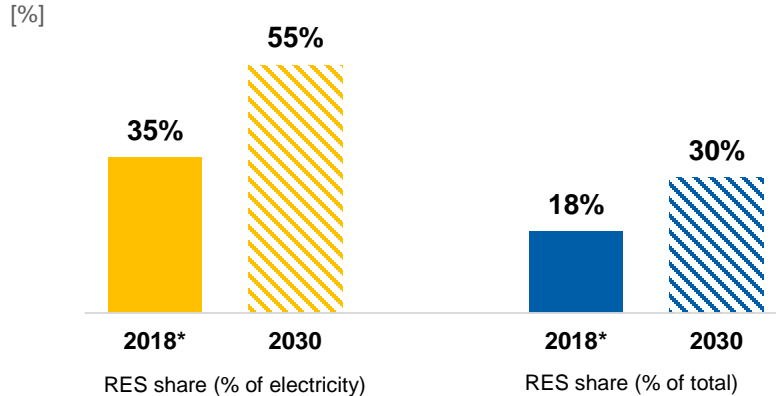
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# Electricity system context

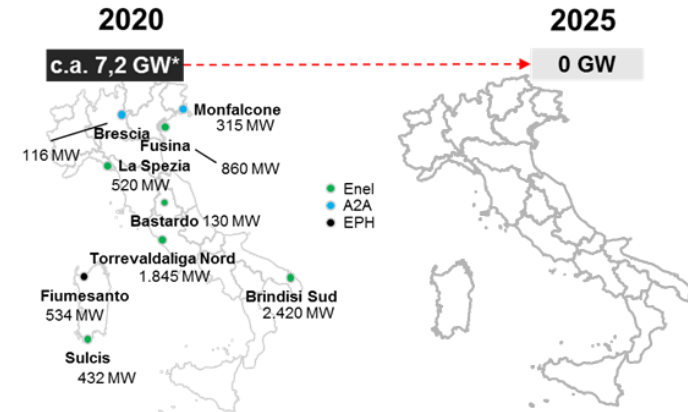
## Italian Energy and Climate Plan (NECP) and future energy scenarios



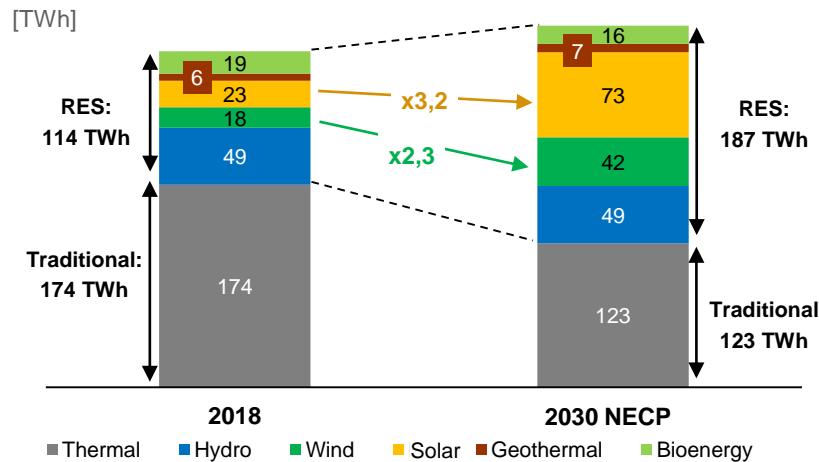
### RES share



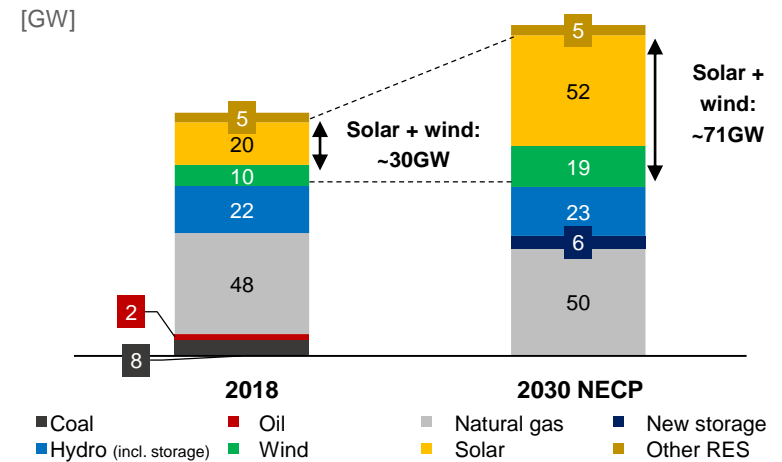
### Coal phase-out by 2025



### Electricity production



### Installed capacity

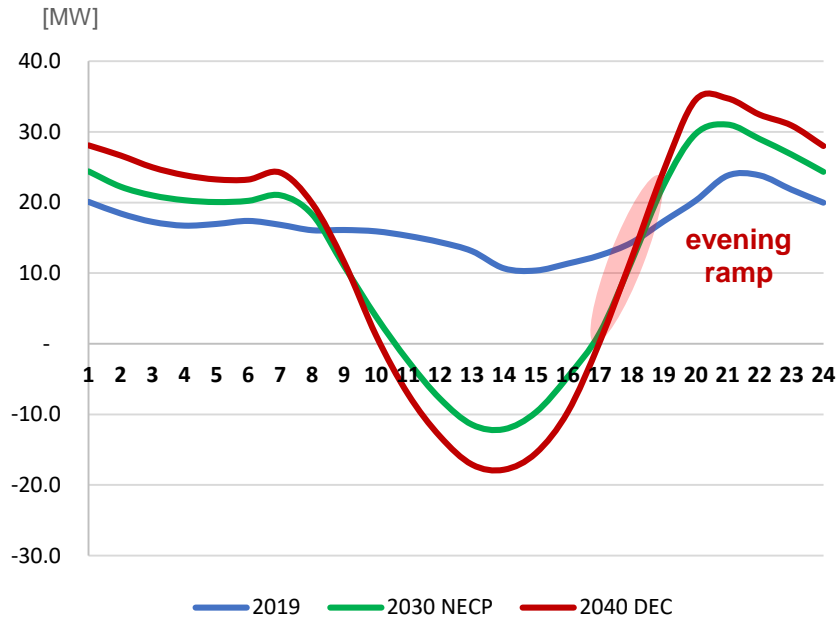


**The NECP targets a complete coal phase-out by 2025 and a significant push towards RES**

# Evolution of electricity system

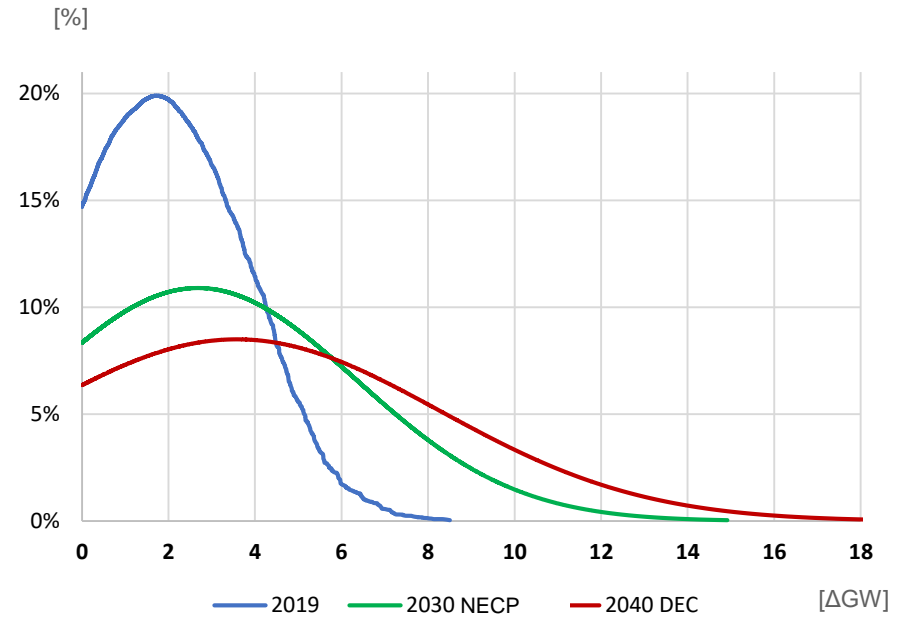
## Growing need for flexibility

Residual load evolution



- **Negative residual load around noon (over-generation)**
- **Increasing steepness on the evening ramp.**

Upward residual load ramp evolution



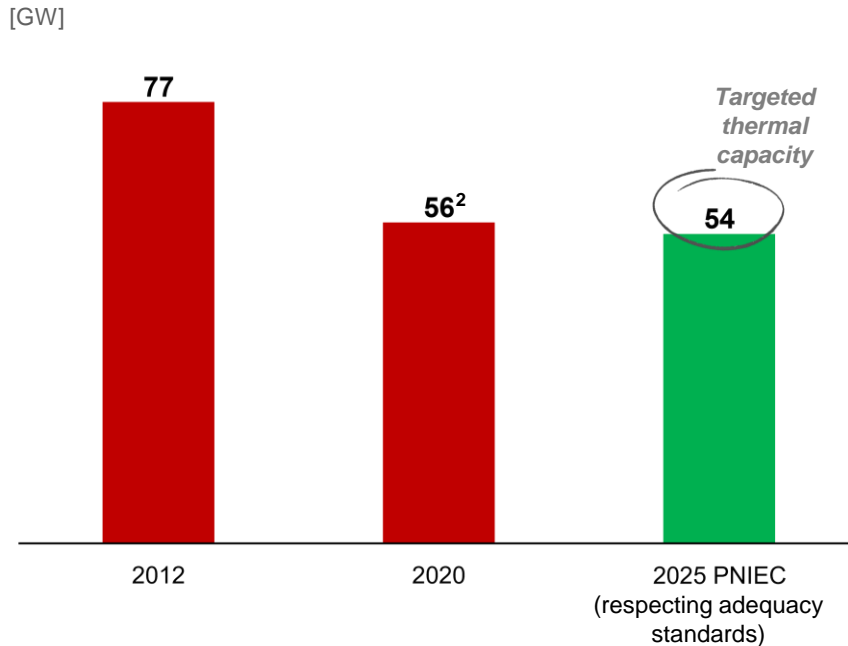
- **Maximum upward residual load ramp shifting from 8 GW/h to 14-15 GW/h.**

**The growing diffusion of variable renewable sources expected will increase the variability of residual load, thus requiring for a larger pool of flexibility resources.**

# Evolution of electricity system

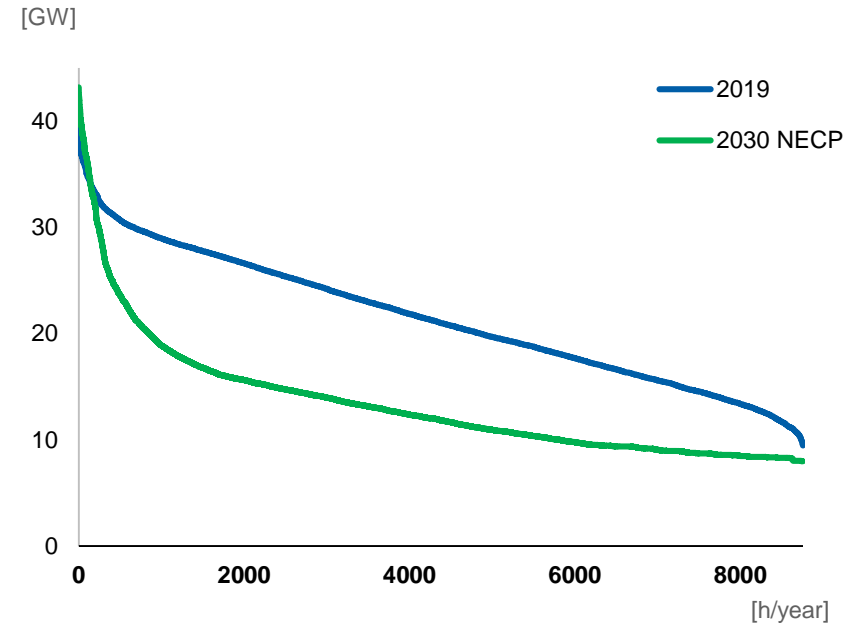
Thermal capacity and generation expected to decrease

Thermal installed capacity<sup>1</sup>



- Further thermal capacity decrease due to coal phase-out by 2025. Nevertheless, **at least at 54 GW** of thermal capacity will be needed to guarantee system adequacy.

Thermal generation duration curve



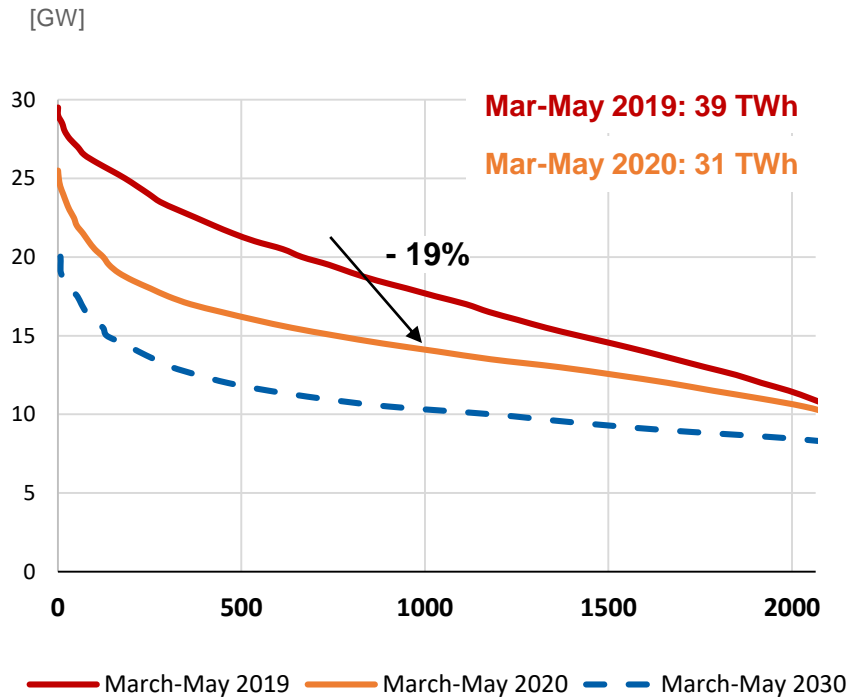
- **Less synchronized thermal power** and therefore **less traditional flexibility service providers**

**The coal phase-out and increasing RES share in power production will lead to a decrease in dispatched thermal power, thus reducing the pool of resources currently providing flexibility to the system.**

# Evolution of electricity system

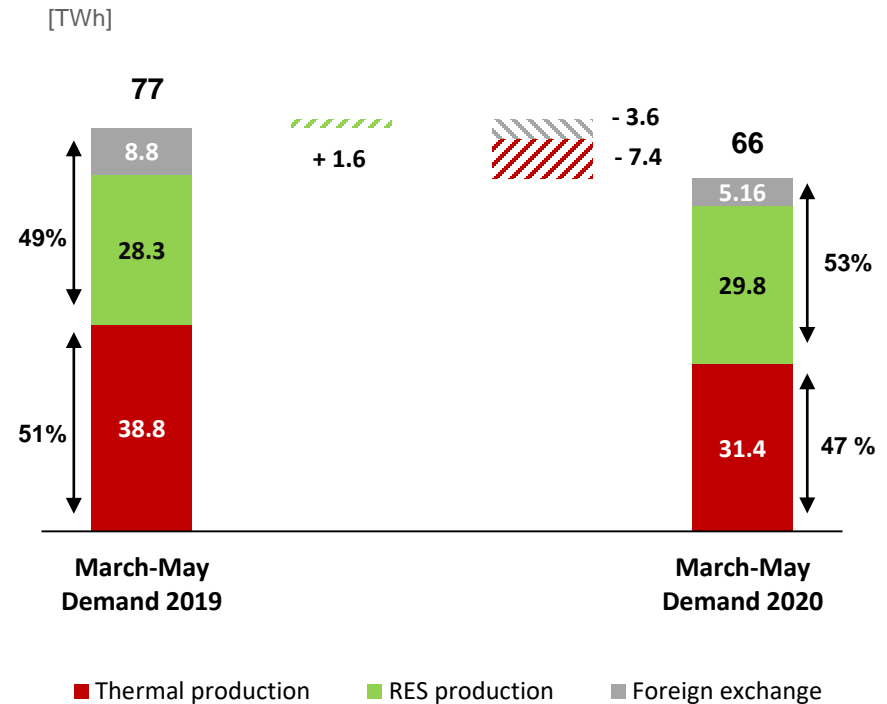
## Thermal generation during Covid-19 crisis

March-May 2020 vs 2019 – Thermal generation



- **Thermal generation decreased by 19%** in the period March-May 2020 vs 2019





March-May 2020 vs 2019 – Generation mix



- **Thermal generation share in total demand diminished by 4 p.p.** in March-May 2020 vs 2019

**During the Covid-19 emergency, the Italian Electricity System experienced a “flash-forward” to 2025, considering the drop in thermal generation caused by the lower demand.**

# Impacts on electricity system management

Cluster	Impacts on electricity system management
<b>Technical characteristics of RES</b> 	<ul style="list-style-type: none"><li>▶ Reduction of <b>system inertia</b></li><li>▶ Reduction of resources for <b>frequency and voltage control</b></li></ul>
<b>Intermittency of RES</b> 	<ul style="list-style-type: none"><li>▶ Reduction of <b>adequacy margin</b></li><li>▶ Growing periods of <b>over-generation</b> during noon hours</li><li>▶ Increasing steepness of <b>residual load evening ramp</b></li></ul>
<b>Location of RES</b> 	<ul style="list-style-type: none"><li>▶ Increasing <b>grid congestions</b> due to geographical distance between RES supply and consumption centers</li><li>▶ Growing <b>system operation challenges</b>, due to the growing of Distributed Generation</li></ul>
<b>Climate change</b> 	<ul style="list-style-type: none"><li>▶ Increasing risk of <b>electricity network disruptions</b></li></ul>

**Changes in the context (the increasing penetration of RES, the continuous decommissioning of conventional thermal capacity and climate change) pose new challenges for TSOs**

## 1 Transmission grid development

- **Strengthening** of North-South **backbone** and **grid reinforcements**
- **Additional cross-border interconnections**
- **Investments** in **voltage regulation assets** and to **increase the system inertia**
- **Strengthen grid resilience**

## 2 Long-term price signals

- **Capacity Market** to deliver long-term price signal to encourage investments in new efficient and flexible thermal generation
- **Auctions** and **Power Purchase Agreements (PPAs)** for RES capacity
- **Long-term contracts through** competitive procurement for new storage capacity, hydroelectric included

## 3 Market evolution

FOCUS

- **Evolution of the structure of the ancillary services market** to cope with new needs (voltage regulation, inertia,...)
- **Participation of new flexibility resources in ancillary services market**, i.e. demand, distributed generation, variable renewable energy sources and storage, including electric vehicle-to grid
- **Progressive integration with EU ancillary services markets**

## 4 Innovation and digitalisation

- **Digitalisation** of the **Transmission Grid** (Assets and processes) and of **electricity system operation**

# Market evolution

## Opening the ancillary services market to new flexibility resources

From traditional resources...

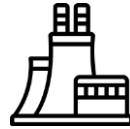


... to a market with a higher degree of complexity



- Relevant qualified units (P>10MVA)

ca. 250 Generation Units



- Relevant qualified units (P>10MVA)

ca. 250 Generation Units



Pilot projects ongoing

- Demand Response
- Distributed Generation
- Non-qualified RES
- Storage (including EVs)

Potentially more than 800k generation units and ca. 40 million consumptions units

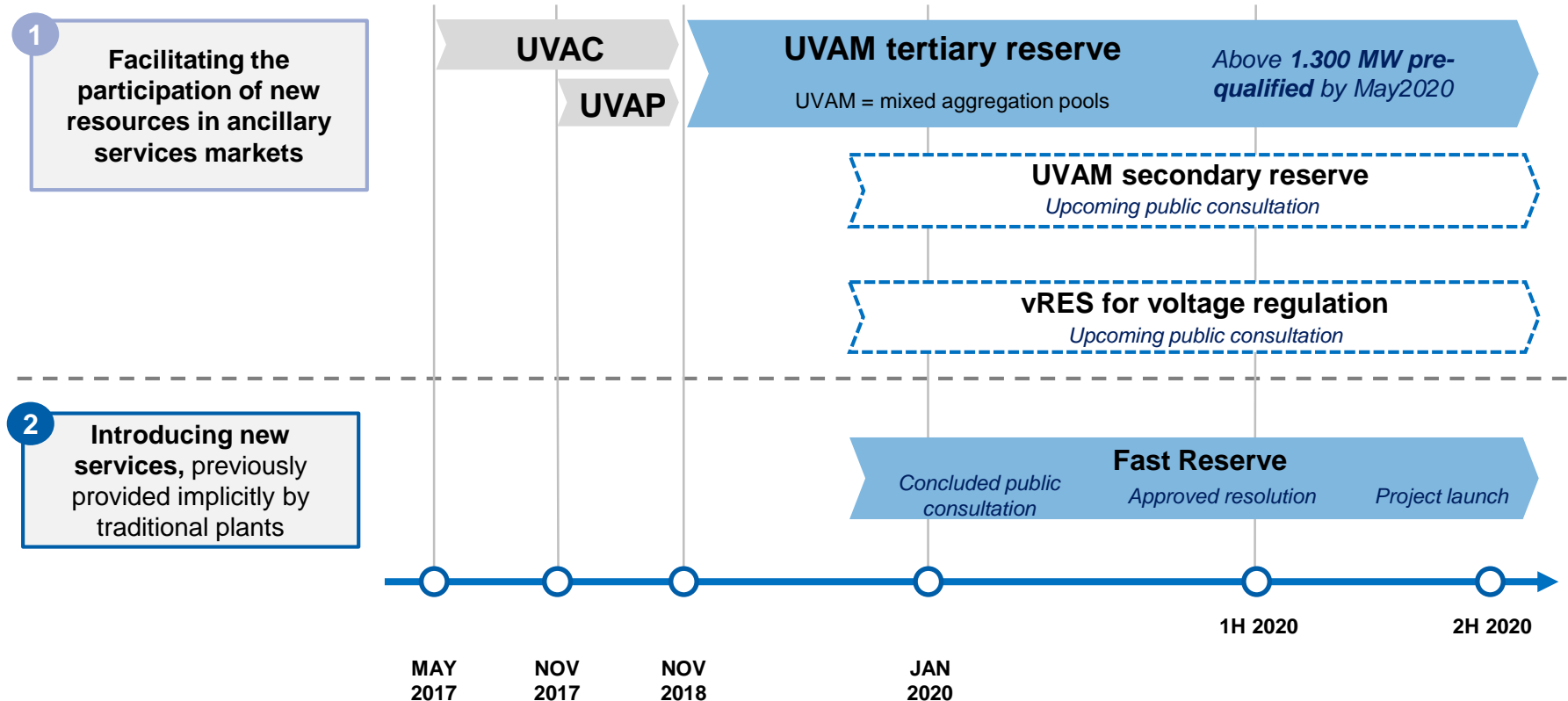
The new context will require a redesign of ancillary services market aimed at increasing the amount of flexibility resources and diversifying their portfolio.

A big challenge will be involving the distributed flexibility resources, including demand response, behind-the-meter storage and electric vehicles.



# Market evolution

## Project roadmap

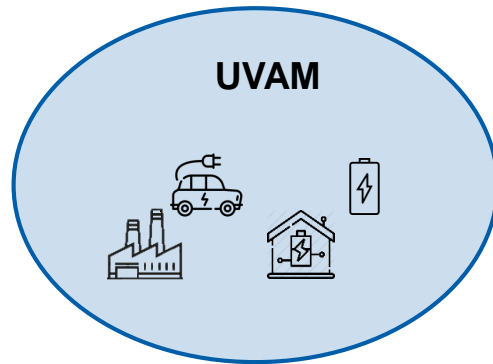


Since 2017, Terna has started various market design initiatives to facilitate the participation of new resources in the ancillary services market and to procure new services explicitly that were previously provided by traditional power plants.



**Objective:** to **increase** and **diversify** the resources available on the ancillary services market ensuring greater **adequacy** and **security**

### Operation mechanism



UVAM are aggregation pools composed of consumption, generation and storage units. They are allowed to participate in the ancillary services market, through a **Balancing Service Provider (BSP)**.

UVAM can provide: **congestion management and tertiary reserve**

### Requirements and remuneration



800 MW

200 MW

Ex-ante contracted capacity receives an availability premium (CAP: 30k€/MW/yr), in exchange for being available for a certain number of hours per day. Their energy offers are subject to a **strike price of 400 €/MWh**.

UVAM without a fixed-term contract have no strike price for energy offers and can freely choose if and when to offer ("free bidding").

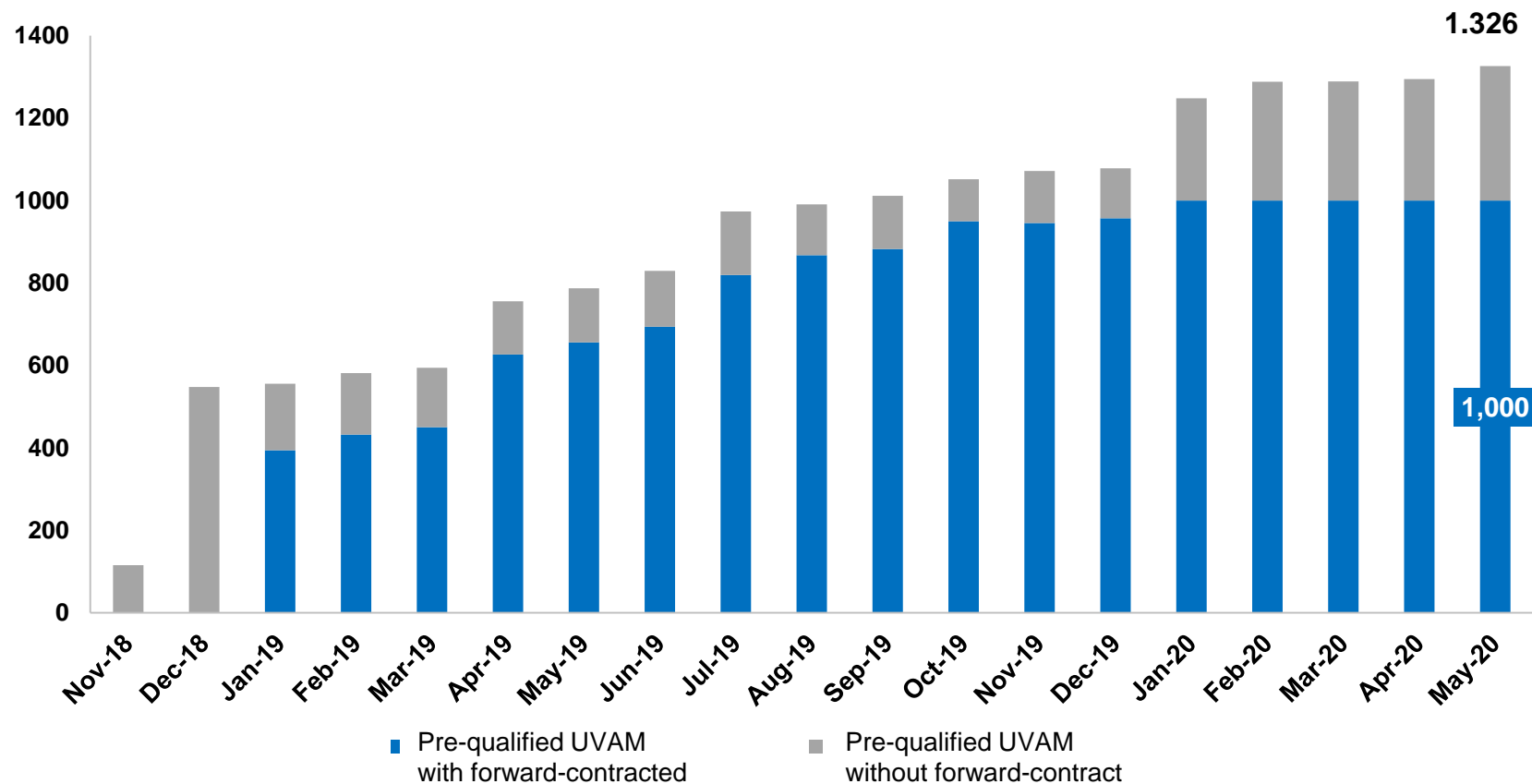
### Participants



- Small-scale production units\* (**UPNR**)
- Consumption units (**UC**)
- **Stand-alone storage systems**, also coupled with UPNR and/or with UC, included Vehicle-to-Grid (**V2G**)
- **Large-scale generation units**, currently not eligible to participate in the MSD

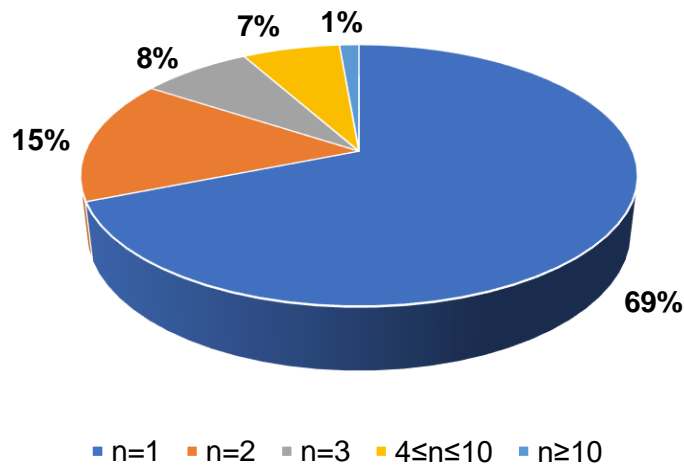
# Market evolution

## Results of monthly UVAM auctions

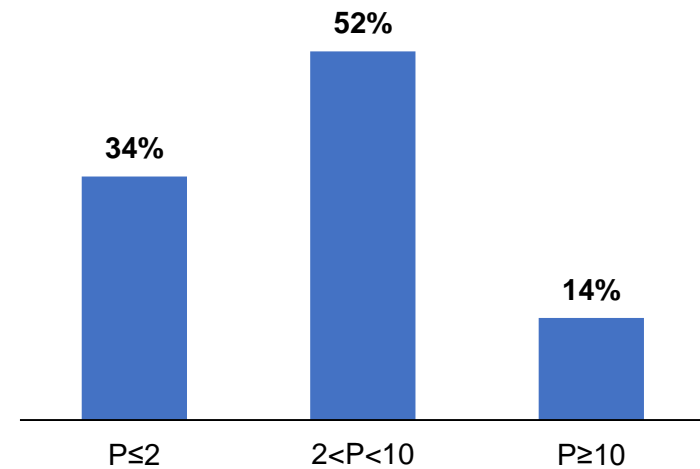


**As of today, more than 1.3 GW of aggregated units are pre-qualified to the ancillary service market. The total forward contracted capacity amounts to 1,000 MW.**

Number of PODs under a single UVAM\*



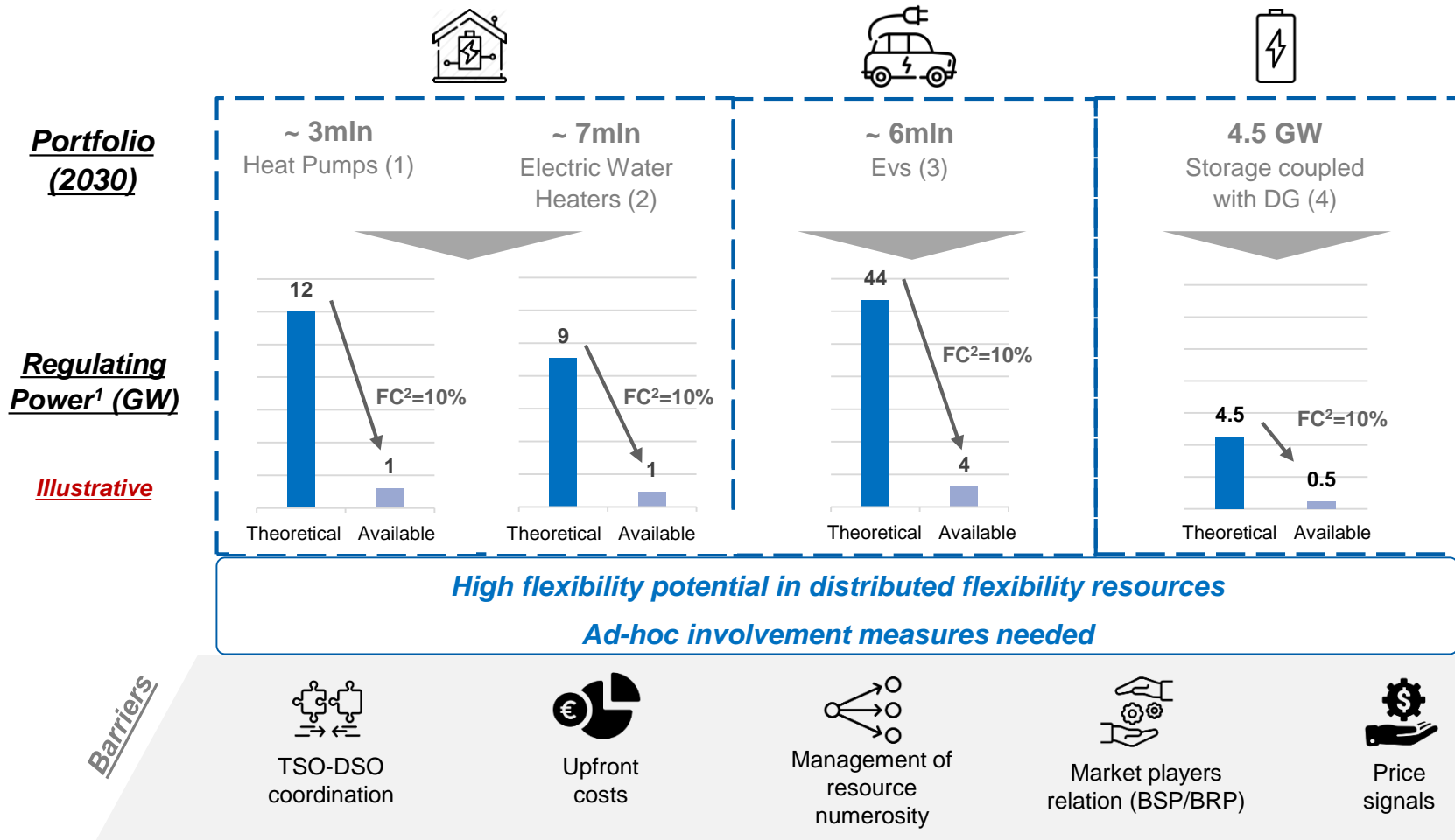
UVAM average pool size (MW)\*



**Most of the UVAM consist of a single POD, mainly related to medium-size industrial or generation plants.**

# Distributed flexibility resources

## Estimated flexibility potential and barriers



**Distributed flexibility resources have a high «technical» potential to provide flexibility. However, at the current stage, there are some barriers to their market participation .**



# EQUIGY

crowd  
balancing  
platform



Blockchain platform that will enable distributed and small-scale resources to offer ancillary services

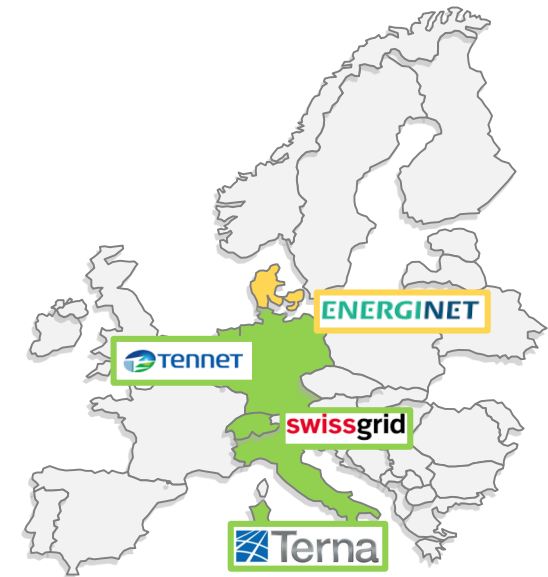
*Blockchain-based*

*Non-exclusive  
& open source*

*European  
Focus*



*Reduction of entry  
barriers for small-scale  
resources*



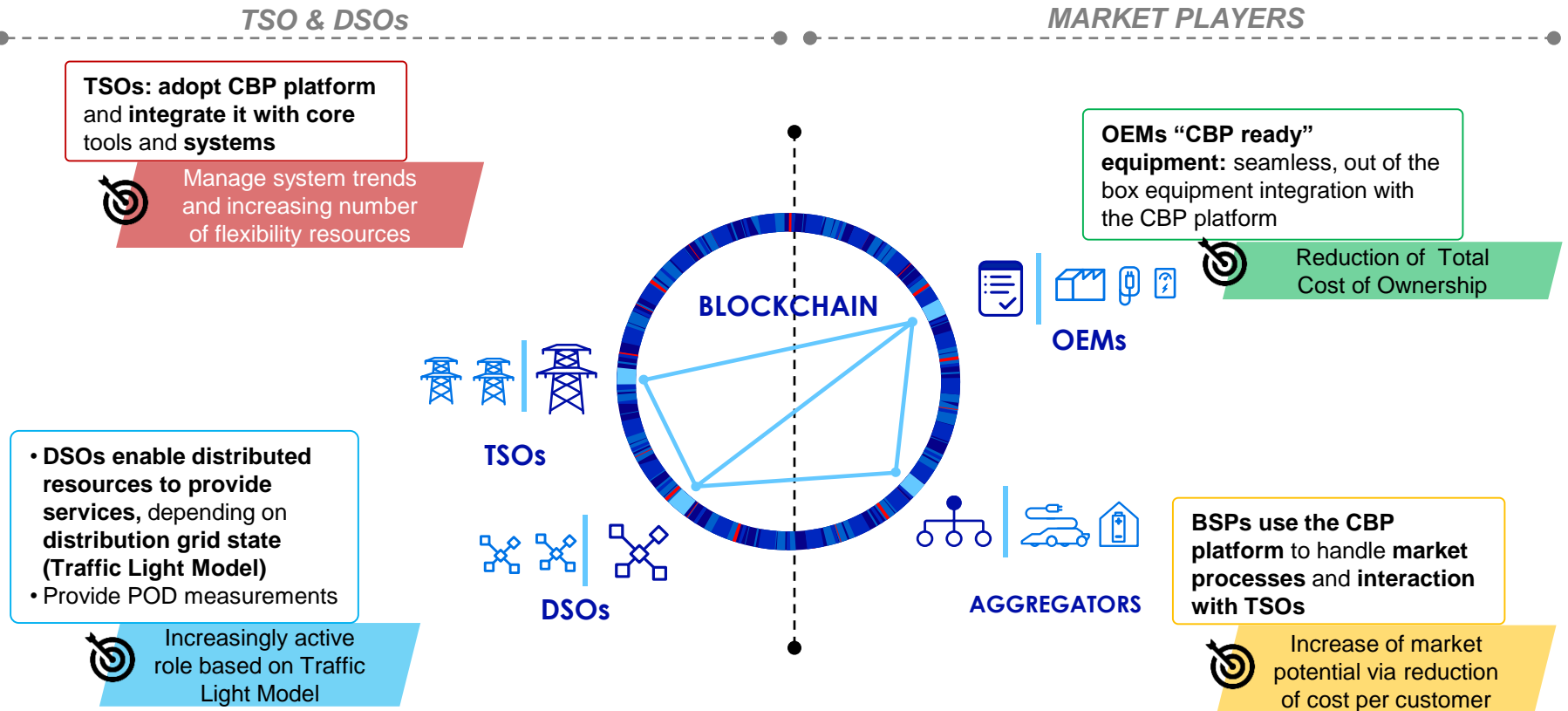
*Founding Fathers*

*Interested partners*

**Equigy is a new blockchain-based platform that will incorporate small and distributed consumer-based resources (EVs, heat pumps, water boilers,...) into the electricity grid-balancing process.**

## Overview: CBP elements

The platform constitutes the **link** between existing ancillary services **markets** and **aggregators** of distributed flexibility. The **Blockchain** technology facilitates the **bidding, activation and settlement processes** associated to the **flexibility transactions** of Virtual Power Plants **guaranteeing quality, security and minimum transaction costs**.



Equigy aims at standardizing processes and protocols to enable a massive participation of distributed flexibility resources. Moreover, it promotes a pan-European cooperation between different stakeholders of the electricity value chain and leverages upon the Blockchain technology