

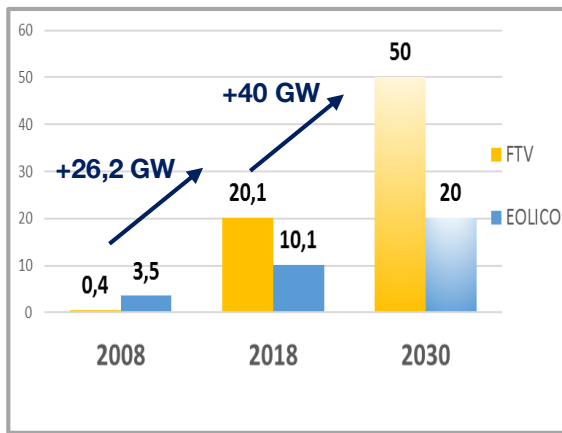
Regulatory challenges and market developments

4th AIEE Energy Symposium

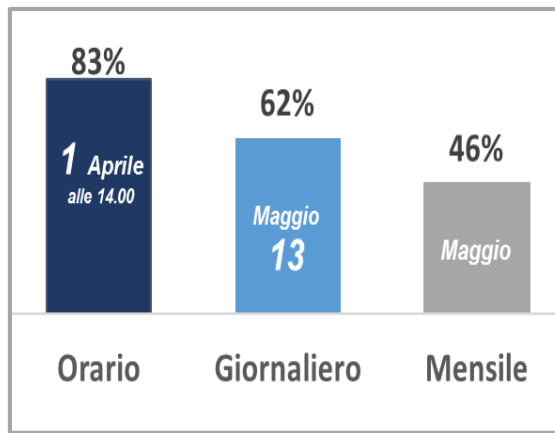
Rome, 11th December 2019

RES growth and thermal power plants decommissioning

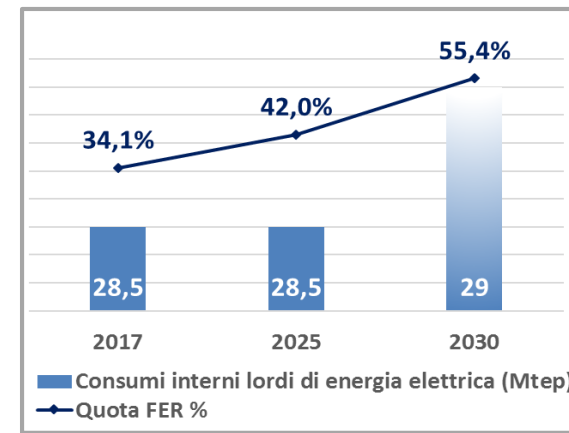
Installed Wind and PV capacity (GW)



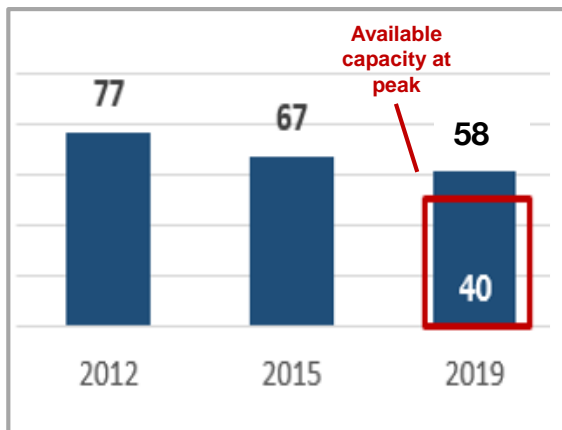
Demand covered by RES* (%)



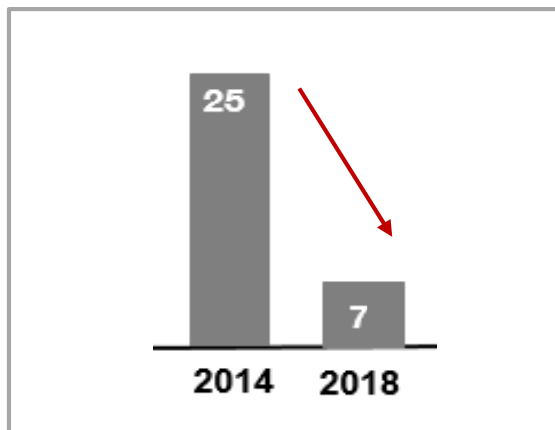
RES penetration in the electricity sector (PNEC)



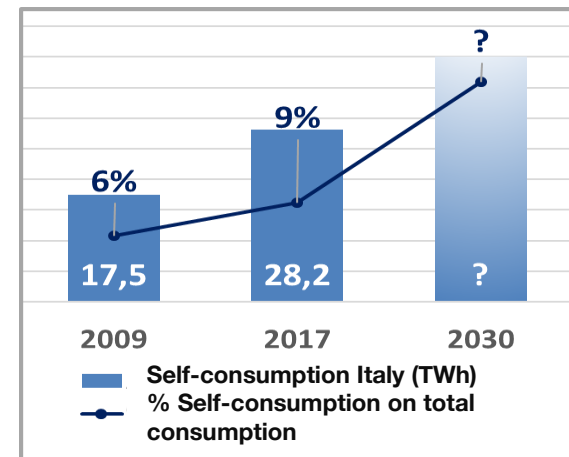
Phase out of thermoelectric capacity (GW)



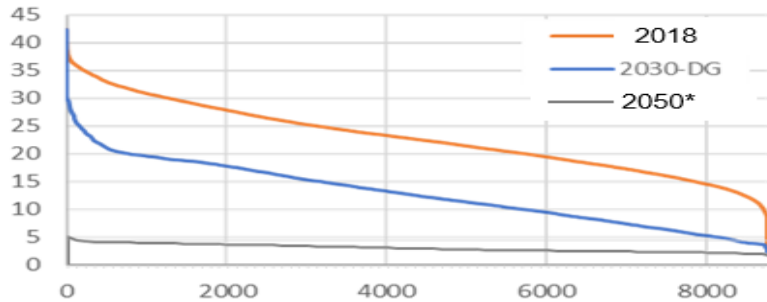
Reserve margins (GW)



Self-consumption (TWh)



Duration curve: Dispatching capacity of thermoelectric plants, historical and forecast data* (GW)



In the future, installed thermoelectric capacity and average dispatched capacity are expected to decrease, with **impacts on both security** (real-time system management) **and adequacy** (medium/long-term planning)

System trends

Progressive decommissioning of thermoelectric capacity

Non-programmable RES increase (still insufficient in terms of adequacy)

Change in residual demand curve

Expected phase-out of coal power plants by 2025

Absence of long-term signals to allow the renewal of the generation fleet

Main impacts

Reduction of control power and reserve margins / adequacy risks (Critical situations July '15, January '17, August '17)

Increased congestions due to lack of homogeneity of RES at the geographical level (overgeneration)

Increased steepness of the loading ramp due to non-programmable production volatility

Reduced system inertia

Increased needs of resources for control services (f, V and Pcc)

Increased resource handling on MSD

(some) main impacts

Reduction of control power and reserve margins / adequacy risks (Critical situations July '15, January '17, August '17)

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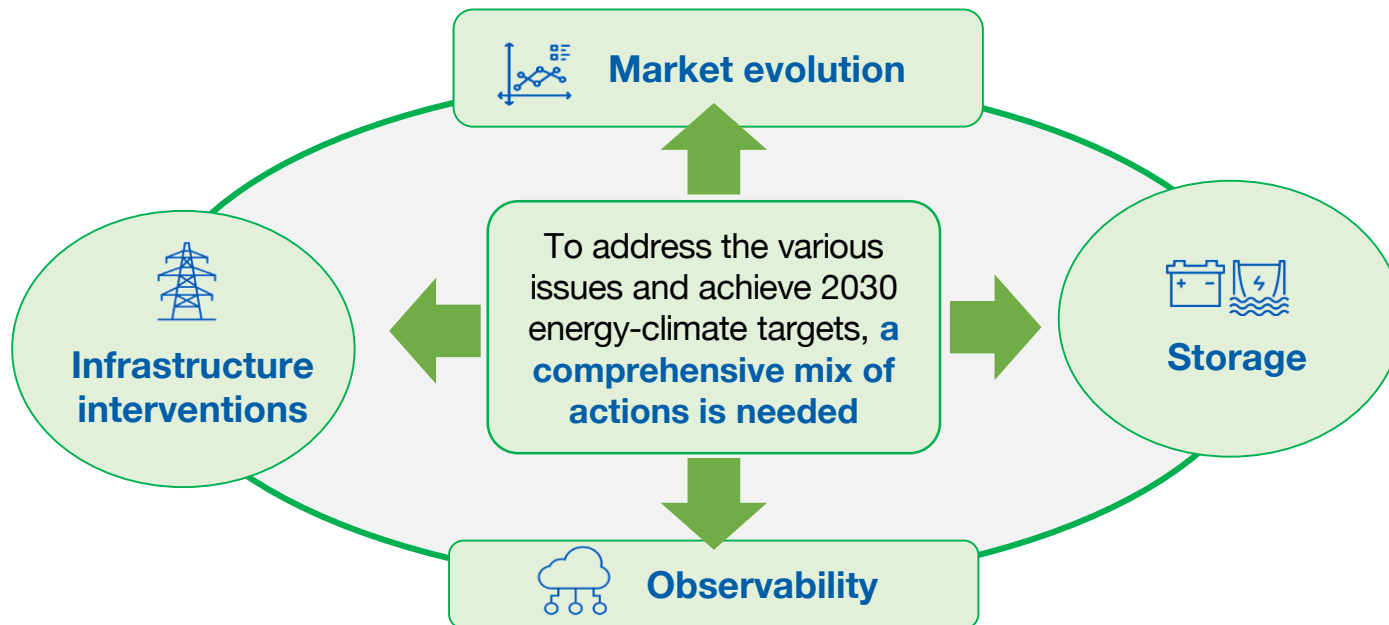
Reduced system inertia

(some) key actions

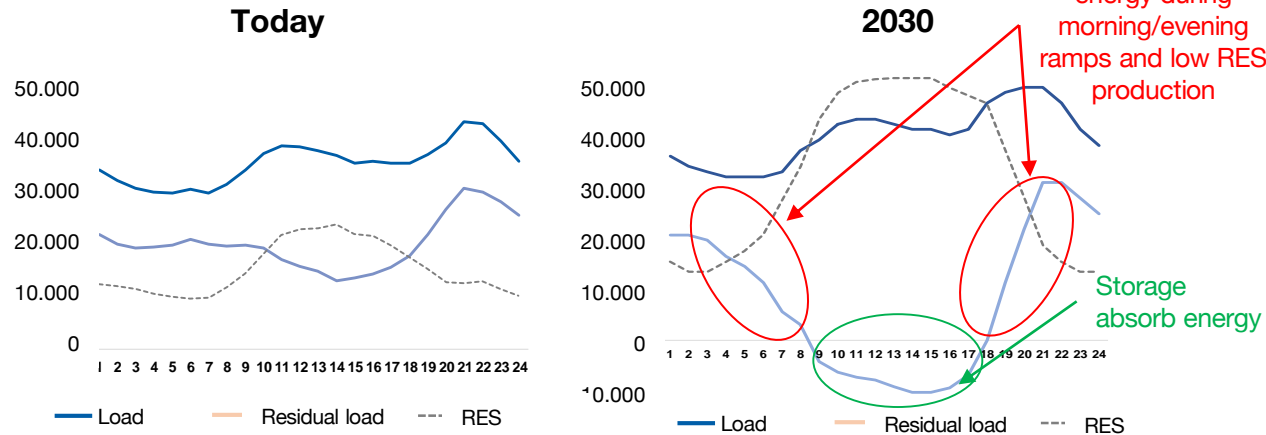
Long term price signals (Capacity market)

Innovative market framework to promote investments in storage systems

Introduction of fast response ancillary services (e.g. Fast Reserve)



Residual load curve with RES growth



By 2030 additional storage capacity will be needed in order to:

- **Reduce grid congestions** and hours with excess wind/solar infeed (**overgeneration**);
- **Cover peak demand** during high demand and low wind/solar contribution;
- **Provide regulation services (f-V regulation)** with fast activation times and high precision, **increase short circuit power and system inertia**

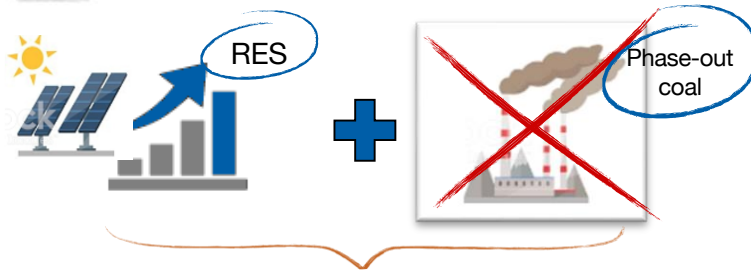
Market framework

- **Need of long-term contracts (e.g. 20 years)** for storage with **remuneration on capacity [€/MW-year]**
- Two possible remuneration models under study: **semi-regulated/fully-regulated**
- **Offer obligations** in the **ancillary services market (MSD-MB)** and minimum energy requirements
- Pilot project for at least 1 GW of new storage capacity by 2025



**NEW STORAGE
CAPACITY NEEDS TO
2030**

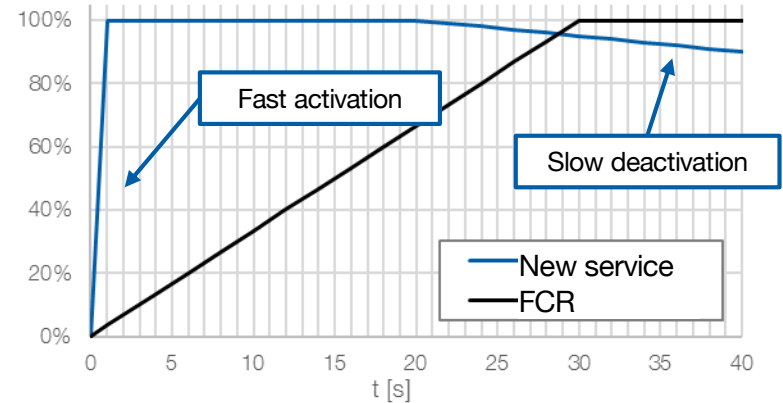
Terna deems necessary **6 GW** of **new storage capacity** in Italy centre, south and in the islands (higher RES penetration and lower storage capacity) to reduce overgeneration and ensure system security



Need of a fast response service to **improve system dynamics** in the transient phase

- **Target:** introduce a new fast frequency regulation service (**activation time < 1s**)
- **Resources:** production, storage, consumption units complying with technical requirements, also in aggregated form with size: **5-25 MW**
- **Procurement:** long-term **contracts (3-4 year)**. multi-round **pay-as-bid** auction [€/MW/year]. Delivery from 2022
- **Requested availability:** **1000 h/year**. The specific hours will be indicated by Terna closer to real time (D-2).

Activation curve: Fast reserve vs primary reserve



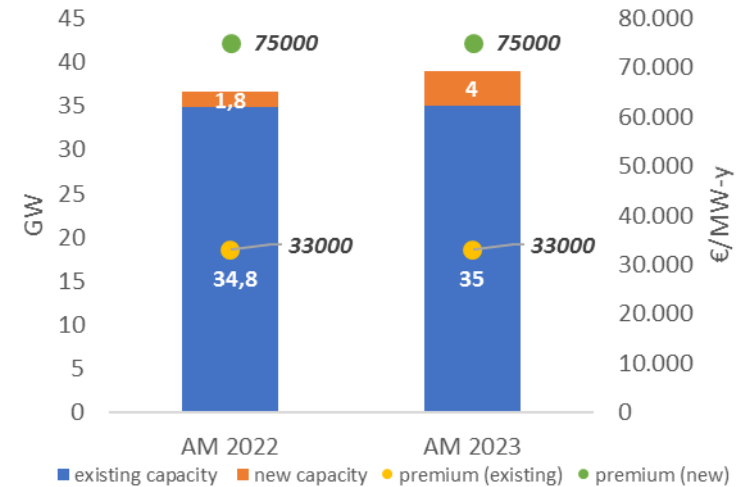
Feature	Technical requirement
Activation time	<1 s
Duration	30 s (linear deramping 20%/min until full deactivation after 5 minutes)
Activation mode	<ul style="list-style-type: none"> • <u>Local</u>: bidirectional and proportional to frequency error (over and under-frequency conditions) when $\Delta f > \text{deadband}$ • <u>Remote control</u>– UPDM (based on the defense plan)
Monitoring system	PMU interfaced with Terna control system



Service **not in substitution** of primary frequency regulation (FCR) but in coordination with that to help **frequency dynamic stability**

First auctions with D.Y. 2022-2023

- The first auctions of the Italian capacity market took place in November 2019 for delivery in **2022 and 2023**
- **5.8 GW** of new capacity have been procured overall
- Fundamental step for reaching **coal phase-out targets**
- **Strong price signals coherent with expected capacity shortage**



Capacity market: next steps

- The capacity market is a **structural element of a market design fit for the energy transition** to **ensure capacity adequacy** also in presence of high RES penetration
- **Next step: undertake actions to ensure full compliance with the Clean Energy Package (CEP), such as:**

- **Introduce CO₂ emission limits (✓)**
- Provide an **implementation plan** to the DG Energy for **alternative market measures*** to solve adequacy issues
- Use common **methodologies to define CONE, VOLL, reliability standards**
- **European Resource Adequacy Assessment (ERAA)** to justify the need of capacity mechanisms
- Sign agreements with neighbouring TSOs to enable **direct cross-border participation** to capacity mechanism

