



APE

APPUNTI DI ENERGIA

THE ELECTRICITY STORAGE CAPACITY PROCUREMENT MECHANISM (MACSE)

May 2024

Briefly



MACSE

The Electricity Storage Capacity Procurement Mechanism (in Italian “Meccanismo di Approvvigionamento di Capacità di Stoccaggio Elettrico”: **MACSE**) is a regulatory initiative aimed at fostering the growth of electricity storage capacity in Italy. This growth is crucial to accommodate the increasing presence of non-programmable renewable energy sources in the energy mix. By furnishing clear, **long-term pricing signals**, MACSE seeks to attract investment into the storage systems market. Under MACSE, newly constructed storage facilities will receive compensation through long-term contracts, offering a premium in €/MWh-years. This premium will be determined via competitive auction processes. In exchange, operators of storage facilities involved in MACSE must allocate the corresponding storage capacity for the provision of so-called **time-shifting** products. These products, novel in the market, enable market operators to trade in the market as a virtual storage. Additionally, operators are encouraged to make any unused time-shifting capacity available on the **Ancillary Services Market** (in Italian “Mercato dei Servizi di Dispacciamento”: MSD).

The context



APE MSD

Storage systems participate in the open market through arbitrage activities and, where possible, by providing ancillary services¹. By engaging in these activities, they represent crucial flexibility resources, essential for enabling greater penetration of non-programmable renewable sources, particularly photovoltaic solar, whose production exhibits significant daily cyclicity. However, market risks, long-term uncertainties, and high investment costs may deter potential investors and complicate project financing, thereby slowing down their development. MACSE aims to **overcome** these **uncertainties** by providing a stable compensation through premiums. This measure is highly innovative: it marks the first long-term remuneration through competitive auctions dedicated to storage systems on a global scale, attracting attention even from abroad.



APE Capacity
market

The mechanism fits within the process of the Italian regulatory framework, where other long-term remuneration mechanisms such as the capacity market and auctions for renewable energies (Ministerial Decree FER X) are already in place or planned.



Capacity Market

- Long-term price signals for flexible generation capacity
- Fixed premium based on power (€/MW)
- Containment of price spikes in energy markets through price-caps



MACSE

- Long-term price signals for new storage system
- Fixed premium based on energy (€/MWh)
- Introduction of a new market platform to allocate time-shifting products



FER X (draft)

- Long-term price signals for variable renewable energy plants
- Price through Contract-for-Difference
- Risk redistribution between system and producer

¹In Italy, for electrochemical storage systems, which typically have powers not exceeding a few MW, currently through the UVAM pilot project and permanently from January 1st 2025 through TIDE. Hydropower pumped storage plants, due to their significant size, are already units qualified to provide dispatching services.

The journey



Who is involved



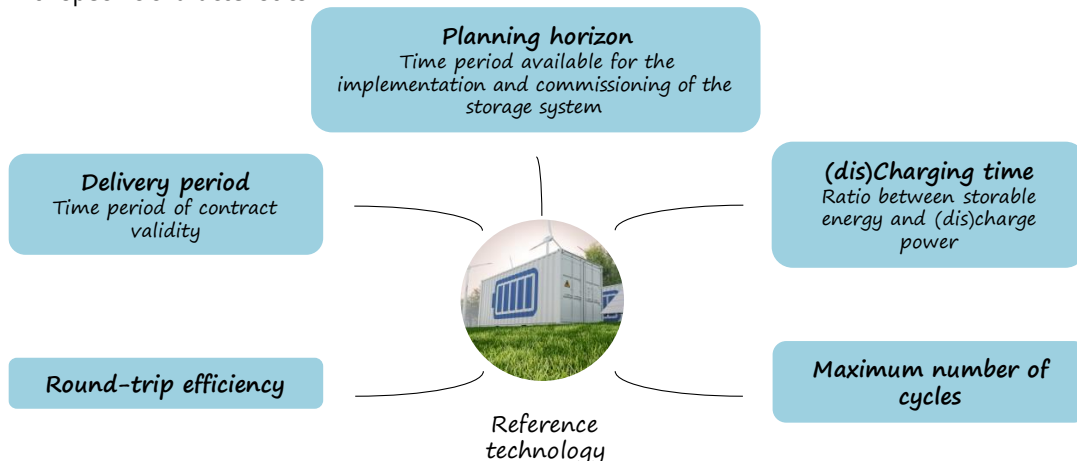
Fast Reserve

The term "hydroelectric concession" refers to the authorization granted for the utilization of water for electricity production, as water resources are considered state-owned assets.

Participation is open to operators holding **authorizations** for the construction and operation of **new storage systems**, who have not previously participated in the capacity market or the Fast Reserve pilot project, and who renounce any other form of incentivization.

For pumped-storage plants, possession of a **hydroelectric concession** is necessary. Projects converting hydroelectric plants into pumped-storage facilities or **enhancing** existing ones are also eligible, provided the increase amounts to **at least 15%** of the maximum energy storable prior to the enhancement. In such cases, only the incremental capacity qualifies for participation in the mechanism.

Following the guidelines of the Italian Regulatory Authority (ARERA) Resolution 247/2023, the Italian Transmission System Operator, Terna, is tasked with compiling and updating a study on **reference technologies** for electricity storage every two years. This document analyzes available electric storage technologies and identifies reference technologies, those deemed feasible and capable of meeting identified electric storage demands. Each reference technology is associated with specific characteristics.



Currently, the **technologies** identified as **reference** in the document presented by Terna for consultation are **lithium-ion batteries** and **pumped storage hydropower** plants. Storage systems utilizing technologies other than those referenced can still participate in auction sessions, provided they meet minimum technical requirements, with a limitation on the maximum assignable supply set at 10% of the total allocation.

Reference technologies

Lithium-ion batteries, Pumped storage hydropower

Other analyzed technologies

CAES, Flywheel, Hydrogen, Electrostatic/magnetic storage, Other electrochemical storage technologies

The auction

Kind of auctions



For each competitive bidding process, multiple auctions will be conducted, each corresponding to a specific group of reference technologies.

The first bidding process will consist of two auctions:

- **Short-term auction:** based on **lithium-ion battery** technology, where contracts with a planning horizon of 2 years and a delivery period of 15 years are awarded.
- **Long-term auction:** based on **pumped-storage hydropower** technology, where contracts with a planning horizon of 6 years and a delivery period of 30 years are awarded.

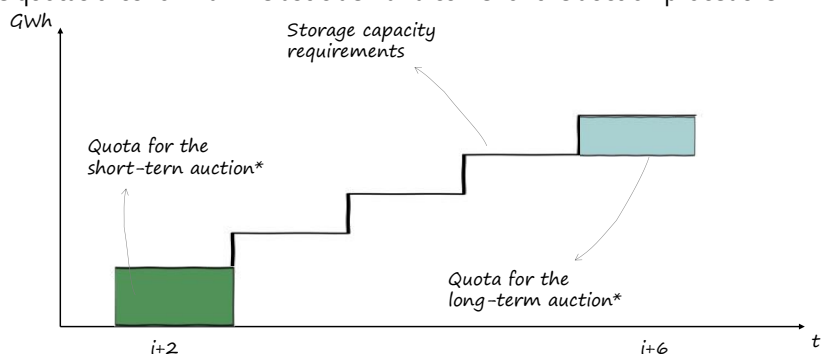
The demand curve



At least 270 days prior to each competitive bidding process, Terna publishes the **storage capacity requirements** and their corresponding temporal progression, identified and approved by the Ministry of the Environment and Energy Security. With a notice of 20 days, the national supply quota and the minimum and maximum quotas for each market Area are then published for each auction within the bidding process.

For the short auction, the quotas will be set at the minimum between the national requirement for the first delivery year and 80% of the capacity qualified for that auction at the national level. For the long auction, the quotas will be set at the minimum between the difference between the requirement for the first delivery year and the requirement defined for the previous year, and 80% of the capacity qualified for that auction at the national level.

These quotas thus form an inelastic demand curve for the auction procedure.



* If greater than 80% of the capacity qualified for the auction

MACSE market Areas are not necessarily matched with electricity bidding zones.

The bids

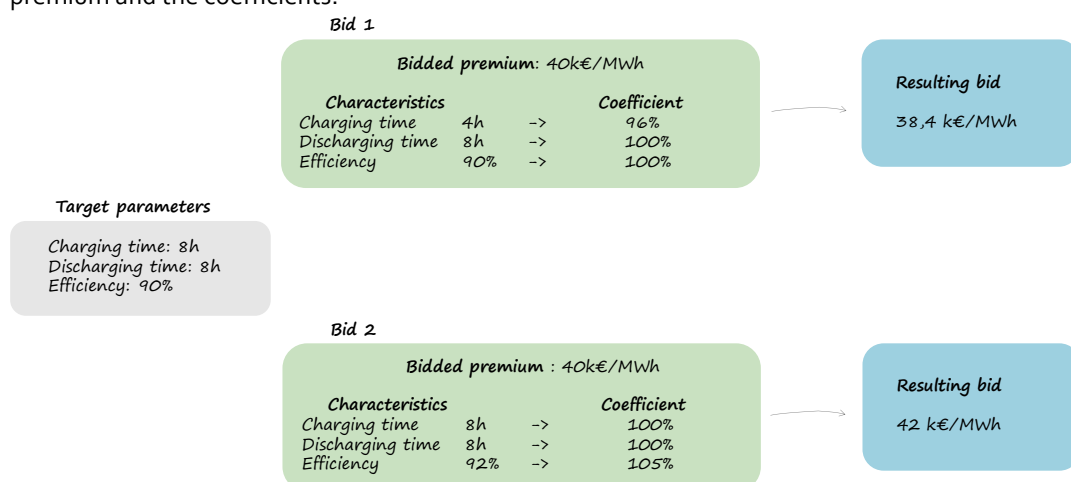


At the time of the auction, participants submit a bid containing the **amount of storable energy** they intend to offer to MACSE (in whole MWh values) and the **premium** requested (in €/MWh-year).

The supply curve

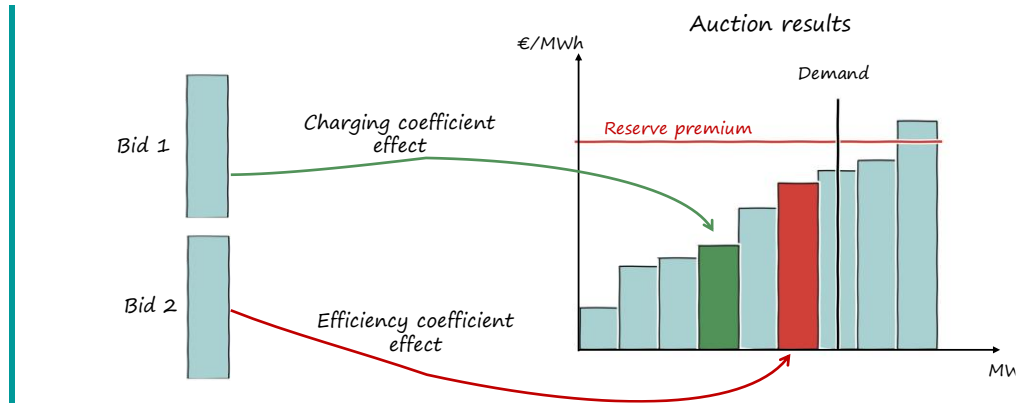


For the construction of the supply curve, the **premiums are multiplied by coefficients** specified in Terna's technical report, which account for potential variations in storage system **performance** compared to target values, particularly regarding storage (dis)charging time and efficiency. This approach enables a competitive advantage for systems with better performance while penalizing those with inferior performance. The resulting premiums are then ranked by **economic merit**. ARERA will define a **reserve premium**, which cannot be exceeded by the product of the offered premium and the coefficients.



In the example's offer 1, the storage system has a shorter charge duration compared to the target. This implies that, for the same amount of storable energy, it can charge twice as fast. The coefficient of 96% positions its offer lower on the supply curve, increasing the likelihood of acceptance.

For offer 2, the storage system exhibits a lower charge-discharge efficiency compared to the target. Consequently, a greater amount of energy will be lost during its utilization. The coefficient of 105% penalizes the offer, placing it higher on the supply curve and reducing its chance of acceptance.



The premium

The winners of the auction are awarded standard supply contracts, granting them the **right** to receive from Terna the **premium** defined during the auction on a **monthly basis**, valued according to the **pay-as-bid** criterion, i.e., equal to the offered amount. Therefore, performance coefficients do not influence the premium obtained. In exchange, the awardees make the **contracted storage capacity available** for the provision of **time-shifting products** and commit to regulated participation in the **Ancillary Services Market**.

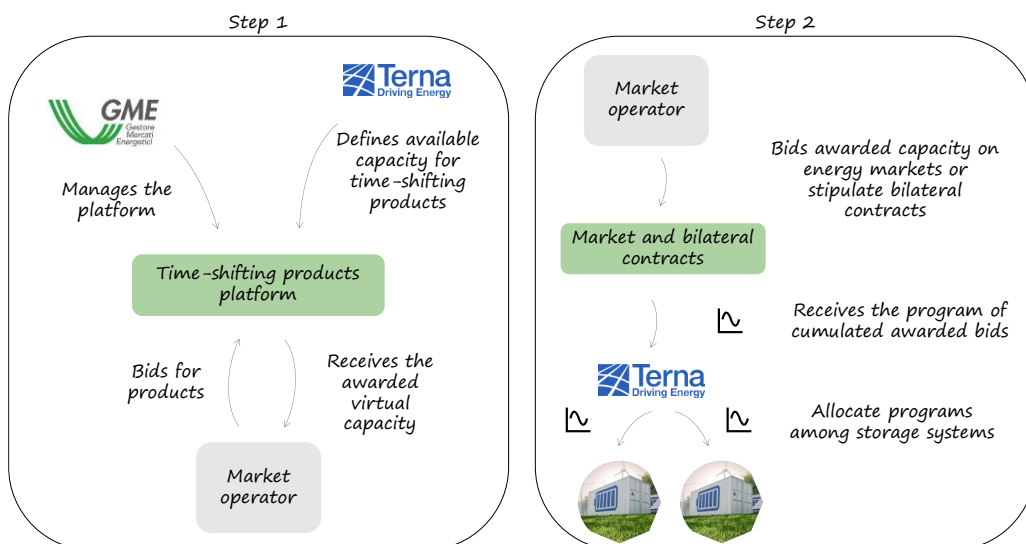
The time-shifting products

Time-shifting products grant holders of equivalent contracts the control over a **virtual storage** system, enabling them to accumulate a share of energy for subsequent reintroduction into the grid.

These products are purchased in a **specific platform** managed by the Italian Energy Market Operator (GME), involving Terna and operators interested in utilizing storage capacity, but not directly the managers of the storage systems themselves, who are simply obligated to make their capacity available.

Specifically:

- GME manages the market platform for purchasing such products
- Terna defines the available capacity for these products
- Market operators purchase time-shifting products and offer the awarded power in energy markets or through bilateral contracts
- Terna allocates the programs resulting from the use of time-shifting products to individual storage systems



During the allocation of programs, Terna will consider the **state of the electrical system** and the **previous utilization** of each storage system, especially if it's characterized by a maximum number of charge-discharge cycles. Moreover, if the market operator exceeds the limits of storable energy, such surpluses will be treated by Terna as imbalances.

Time-shifting contracts are defined by the **bidding zone** they refer to, the **validity period** (which can vary from daily to multi-year), and a set of **technical characteristics** of the virtual storage controlled by market operators (such as the (dis)charge time, round-trip efficiency, and initial state of charge).

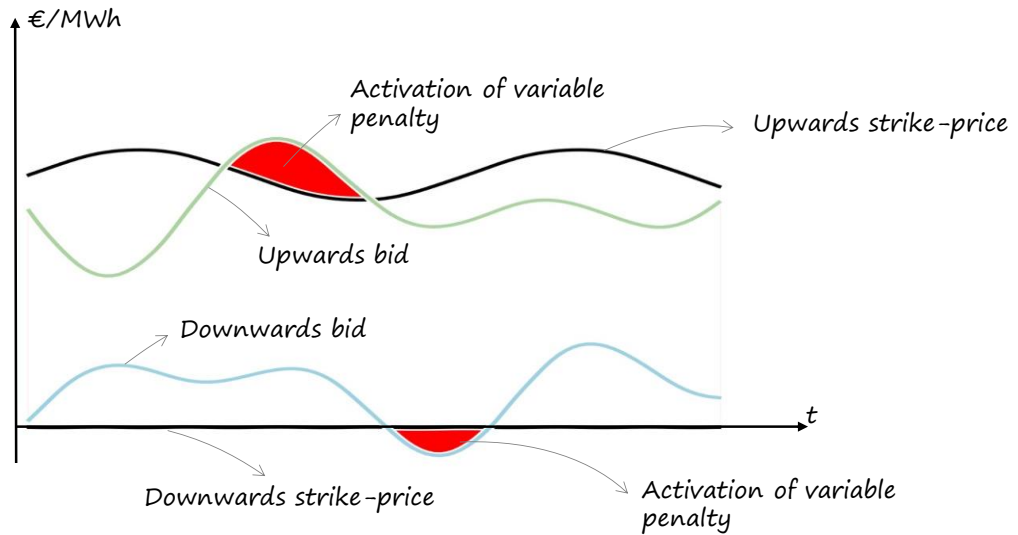
The activity on the ancillary services market

In the design criteria of the mechanism, the primary revenue earned by the storage system operator comes from the fixed premium defined through competitive procedures during the auction. However, to ensure efficient operation of the storage system in providing services to the grid, it will have the option to offer and **retain 20% of the revenues earned in the Ancillary Services Market**. Additionally, these offers must adhere to rules imposed by the regulation to avoid the return of a **variable penalty**, effectively channeling them towards offering the entire available capacity at competitive prices.

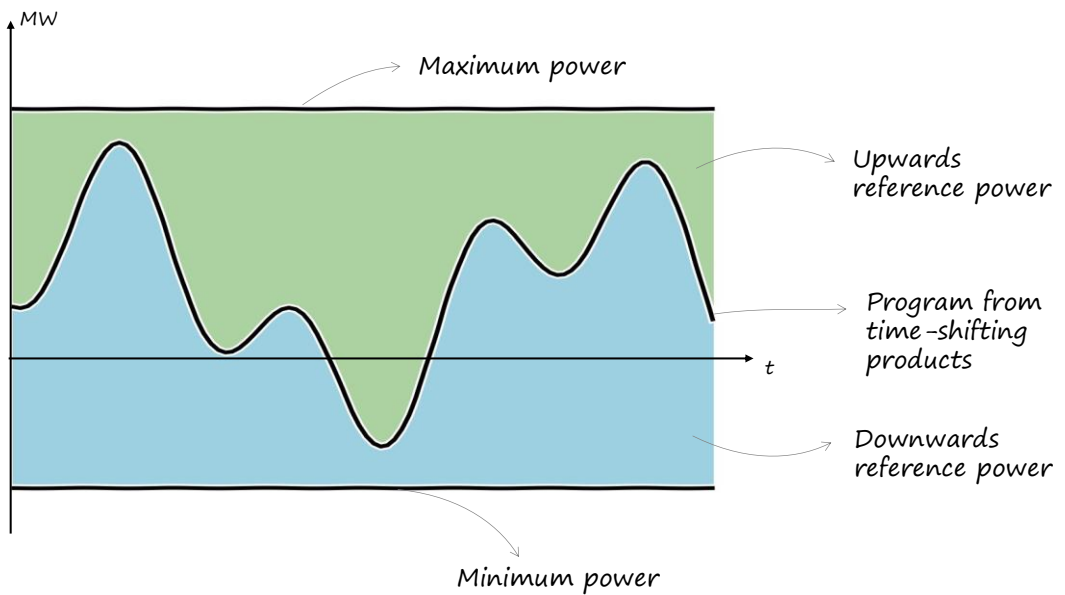
The variable penalty



The market operator is obligated to pay a **variable penalty** if the offered price is higher (lower) than a **strike-price** for upward (downward) balancing bids. The upward strike-price is calculated using the latest methodology approved by ARERA for calculating the strike-price used in the Capacity Market, while the downward strike-price is set at €0/MW.

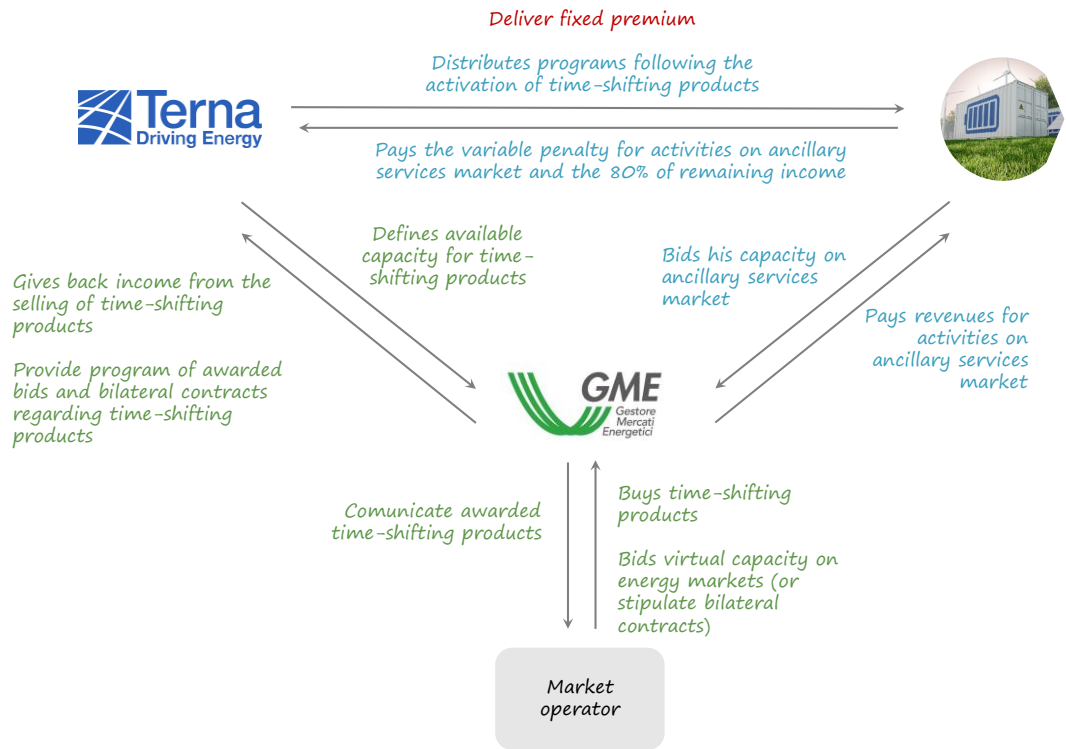


The **reference power** for calculating the variable penalty is determined by the difference between the program output from time-shifting products and the maximum (minimum) power of the storage system.



If the power offered on MSD is lower than the reference power, the remaining quota will be valued using as the reference price the highest (lowest) price among the accepted upward (downward) bids in the ancillary services market in the balancing area.

Sum up



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**For any information,
doubts or clarifications
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