



SAFT



Battery energy storage systems (BESS):

a flexible and reliable resource for ancillary grid services

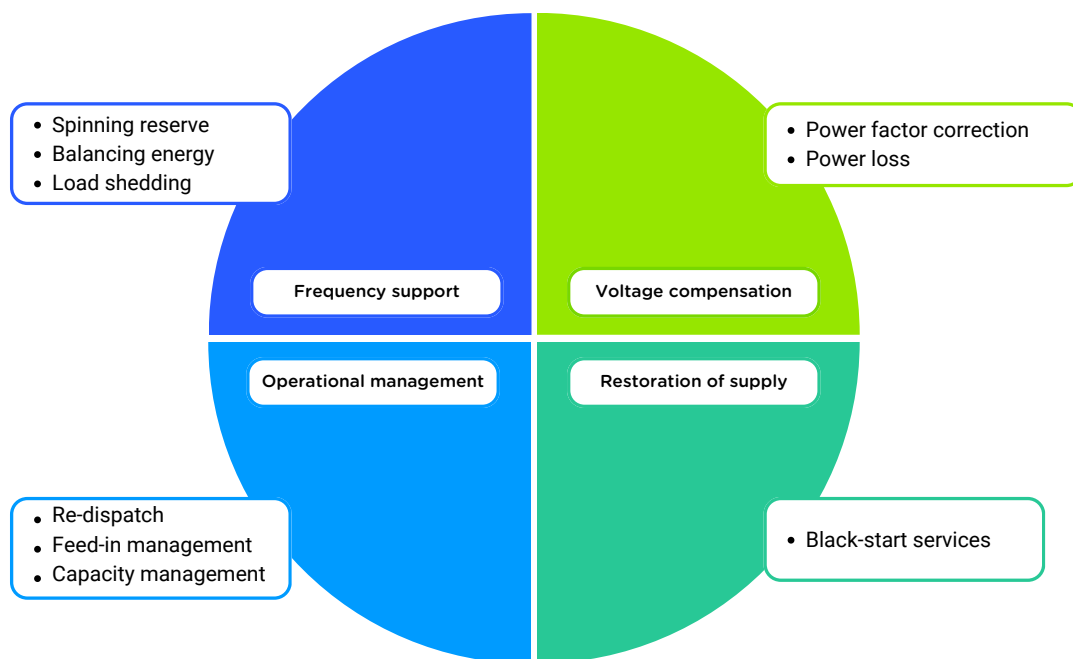


TotalEnergies

BESS Solution: a unique resource for all ancillary services supporting the energy transition of electric grids

Frequency regulation and voltage support are well established ancillary services used by TSO's* and DNO's* as a lifeline to ensure voltage and frequency stability of the power systems. The contribution and competitiveness of batteries to these ancillary services is well understood and BESS have reached significant shares on frequency regulation markets in several countries. However, the ever-increasing penetration of variable renewable sources (wind, solar) brings new challenges to grid operators. State-of-the-art BESS offers technically sound solutions to address various problems in a single solution. Therefore, they offer an economically practical and environmentally friendly substitute to a variety of, usually CAPEX intensive conventional solutions.

* TSO: Transmission System Operator
DNO: Distribution Network Operator



Frequency support services: In addition to the existing services, new types of services from frequency based on **Inertia support** will be often called upon now and in the future due to reducing system inertia on account of more renewables connecting to the grid. They include:

- Spinning reserve (**inertial support**)
- Balancing energy (**primary / secondary/ tertiary frequency supports**)
- Sheddable loads (**frequency-based load sheds**)

Voltage compensation services: Voltage support now will be needed at equal measures in distribution and in transmission networks for different applications. In distribution to absorb the VAR to keep statutory voltage levels of the network, and in transmission for the losses during transit of power voltage compensation is needed. BESS can supply both compensations avoiding the need for CAPEX intensive solutions They include:

- Power factor correction
- Power loss

Operational Management services: With increase in penetration of renewables resulting in **curtailment of generation** and **congestion of the network**. Operational management services address the **3C's** (Congestion, Curtailment and Capacity reserve). They include:

- Re-dispatch (**capacity management** services including **energy-shifting, & congestion**)
- Feed-in **management** (stability management services including **curtailment avoidance**)
- Available capacities and capacity mechanisms (**subscription** services)

Restoration of supply: During black start of a particular network in the grid, batteries can replace expensive fossil-fuelled backup resources.

They consist mainly of:

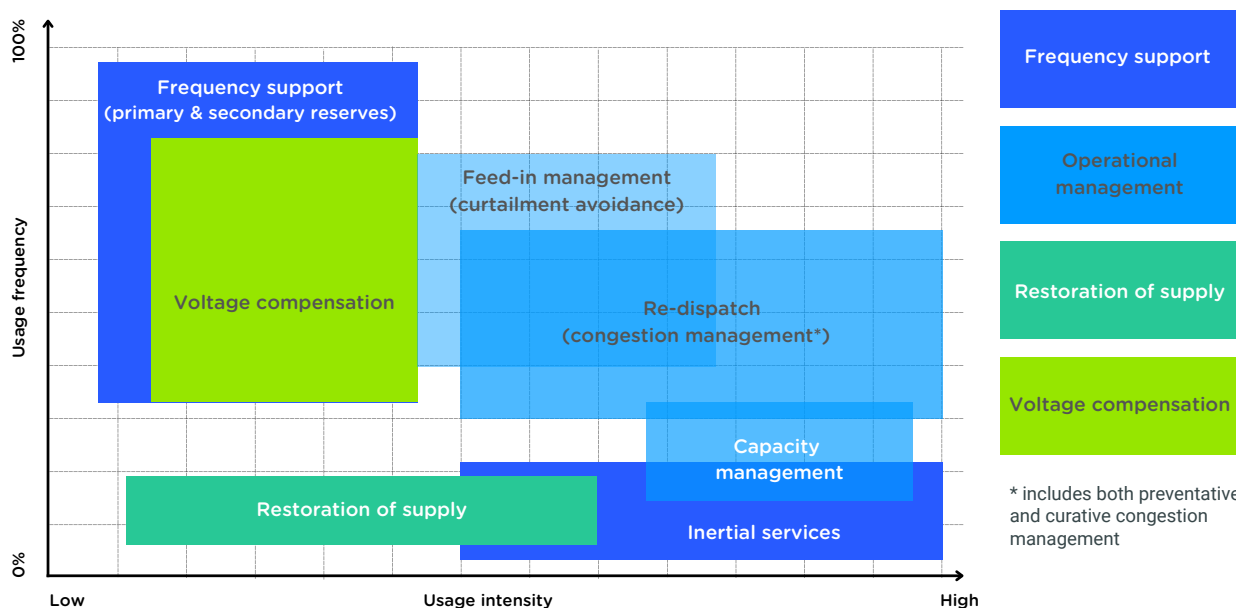
- Black start services

Key benefits of BESS solution as a Grid ancillary service resource:

- **Deferral of CAPEX:** By reducing CAPEX intensive infrastructure expenditures on re-inforcement and stability, such as (1) re-conductoring of existing lines, (2) investments in new lines and (3) reducing the dependence on other inertial supports.
- **Increased Grid Resilience due to value stacking of services:** Optimized use of BESS for “multiple ancillary services” from a single resource by utilising battery capacities (power & energy) and proper tuning of the BESS controllers.
- **Faster return on investments (ROI) & Maximization of revenue:** Due to the nature of their construction, BESS require less installation and commissioning time, therefore, having a shorter gestation period to bring returns on investment to the grid operators.
- **Increased renewable connections:** By reducing the re-inforcement strategies on CAPEX intensive solutions, more renewables will be integrated to the grid than waiting in the connection queues.

BESS applications mapped according to the usage intensity and usage frequency:

In line with Saft’s segmentation of Grid Ancillary services, various applications that the batteries can support according to their usage intensity and usage frequency are shown below. Applications on the grid side as well as on the developer side share the same needs based on battery characteristics. This helps both the developers and the grid side customers to optimally plan the battery resource for value-stacking of the services.



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