



## OFFICE OF PUBLIC PARTICIPATION

FEDERAL ENERGY REGULATORY COMMISSION

# ANCILLARY SERVICES

Ancillary services help keep the grid stable and resilient by maintaining frequency (so electricity flows consistently), reducing voltage fluctuations (so equipment works properly), and helping to prevent power outages. They also respond quickly to sudden changes - like when a power plant unexpectedly goes offline - by making backup power available immediately. Many power companies and other electricity providers also sell ancillary services. To manage these services and ensure they are available when needed, there are national standards and market systems in place.

The North American Electric Reliability Corporation (NERC) sets mandatory reliability standards that are reviewed and approved by the Federal Energy Regulatory Commission. Grid operators, such as Regional Transmission Organizations and Independent System Operators (collectively, RTO/ISOs), determine the minimum amount of each ancillary service needed to meet these NERC reliability standards.

To acquire these ancillary services, grid operators may use specialized markets, or non-market mechanisms that rely on contracts, ownership, and operational rules. Energy markets are where power companies bid to sell electricity and customers bid to buy it to meet daily demand. Ancillary services markets work differently - grid operators procure backup power and flexibility to handle unexpected changes in electricity supply and demand. These ancillary services fall into five main categories.

## ANCILLARY SERVICES CATEGORIES

**Voltage Support:** maintains energy voltage within safe, operational limits, so equipment runs properly.

**Frequency Regulation:** maintains the electrical current at a steady speed (60 cycles per second) by responding within seconds to balance electricity generation with demand.

**Reactive power:** energy that supports the movement of electricity through power lines over long distances. While it does not power lights and appliances directly ("real power"), reactive power maintains the conditions needed to transport electricity safely and efficiently. As more electricity flows on a line, more reactive power is needed. Power plants can provide reactive power and are compensated for this service.

**Black Start Capability:** a power plant or other power supply resource that has the capability to start and restore power to an energy grid without relying on external electricity, which can be essential after a major grid event such as a blackout.

**Operating Reserves:** backup power which can quickly replace lost power generation due to unexpected events. There are three types of these reserves:

- *spinning reserves* are provided by an already-online generator with spare capacity and capable of increasing output within a specified time frame (for example, 10 minutes);
- *non-spinning reserves* include backup power sources that are not currently online but can be started and connected to the grid relatively quickly (typically 10 minutes). This includes power plants and demand-side resources (like programs that reduce customer electricity use during peak times); and
- *supplemental reserves* include backup power that takes longer to become available than spinning or non-spinning reserves and is not necessarily connected to the grid.

These five types of ancillary services come from many different types of power providers, competing or participating in specialized markets.

# ANCILLARY SERVICES MARKETS IN RTO/ISOs

Power providers and sellers sell their ancillary services in the different RTO/ISO ancillary services markets. These markets provide financial compensation to those that can provide these services, often on short notice.<sup>1</sup>

## HOW THE MARKETS OPERATE

First, an RTO/ISO identifies its reliability needs (frequency regulation, reserves, etc.). Then, energy resources bid at auction on the ancillary services they can provide. Winning bids are typically determined by the least cost to the consumer, consistent with reliable operation. Those committing to provide the service must perform if they are called upon, with penalties for non-performance.

## PARTICIPANTS

While coal, gas, and hydropower providers have long been participants in the ancillary services markets, additional requirements have created opportunities for new participants:

- Grid-scale batteries can provide frequency regulation due to rapid response, high levels of accuracy, and no fuel costs.
- Distributed energy resources (units that generate electricity or store energy near the point of consumption) can often provide reserves, frequency regulation, and voltage support.
- Demand response providers that can reduce energy demand during critical periods may offer that service as reserves in RTO/ISO markets.
- Wind and solar generators equipped with technology that helps regulate electricity flow, especially when paired with storage, may also provide reserves or frequency regulation.

## Pricing and Revenue

Ancillary service prices are based on system scarcity and operational need, not the cost of energy. When an energy grid is well-supplied, prices are low. During times of variability such as extreme weather events or sudden spikes in demand, prices rise. Ancillary services providers may be paid **ancillary revenue** (for agreeing to be on standby), **performance revenue** (for actual response, and determined by accuracy and speed), and/or **opportunity cost compensation** (if a provider could have earned more in other energy markets). Different regions have different market rules and methods for determining how ancillary services providers are compensated.



<sup>1</sup> Additional resources: Check out the FERC Energy Primer which provides background on ancillary services and many other topics at <https://www.ferc.gov/media/energy-primer-handbook-energy-market-basics>.



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