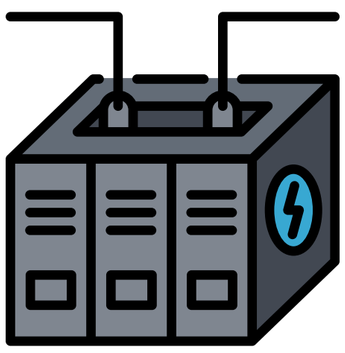
Energy Storage Systems

What Is It?

Energy Storage Systems (ESS) consume energy, store it, and release it into the electric grid when it is needed. There are multiple ESS types with different limitations, with Battery Energy Storage Systems (BESS) having the most market penetration.



Why is it important?

ESS can help keep electricity supply stable by collecting excess energy when demand is low and supplying it again when demand is high. ESS can help counteract intermittency issues from renewable energy sources or provide power for emergencies and unexpected events.

What Does It Cost?

The cost of ESS is dependent on the technology utilized. Lithium Ion batteries have had the most investment due to their widespread use in daily life, costing at least $250 per kWh at the utility scale.

Space

ESS facilities grow with the capacity of the facility and depend on the technology utilized. An ESS plant can range in size from a house to a football field. Battery systems can be contained within modular and self-contained shipping containers, that can be stacked to save space.

Point		Counterpoint
• By storing excess energy, ESS stabilizes the grid and prevents outages.	⟷	○ The installation of large-scale ESS requires significant upfront investment in infrastructure and maintenence.
• BESS can be integrated into any existing facility or plant, and is often built alongside renewables.	⟷	○ BESS has fire risks (like other batteries) due to energy being a stored via a chemical reaction.
• Investments in ESS technology research are continuously driving down costs.	⟷	○ ESS costs are not yet affordable for all entities to purchase solely for an economic return on investment.
• ESS stores energy that may be otherwise lost due to temporary overproduction.	⟷	○ ESS, like any battery, has energy losses regardless of the storage technology utilized.
• Lithium ion technology utilized in BESS is also commonplace in cellphones and laptops.	⟷	○ The safety features and requirements in a BESS unit are still being finalized by local fire departments nationally.

How Does It Work?

1. Excess energy is generated by the electric grid and consumed by the ESS units. This occurs during off-peak times when energy prices are lower or excess supply is available.

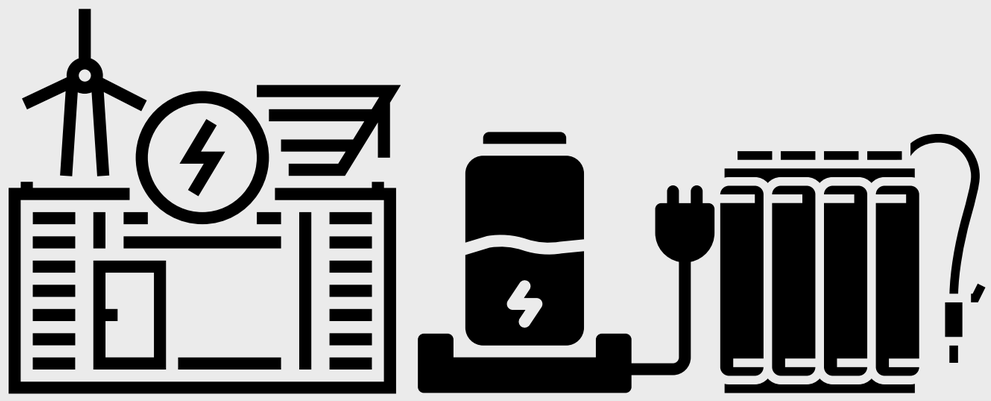
2. The storage mechanism is dependent upon the storage technology utilized. Electricity is generally stored as chemical or potential energy.

3. The stored energy remains available until needed. Real-time monitoring systems track energy levels and state of charge to ensure the ESS is ready for discharge when demand arises. Depending on the technology, energy can be stored for hours, days, or even months.

4. When sensors monitoring the grid detect increased demand or instability in the electricity supply, the ESS system is activated. This is usually autonomous.

5. The stored energy is converted back to usable electricity and discharged into the grid or directly to consumers.

6. The ESS system stabilizes the power supply, managing demand peaks and improving grid reliability. When demand goes down again, systems can recharge or reset to repeat the process again when needed.



Did You Know?

Flywheel Energy Storage Systems store energy by spinning a rotor (flywheel) at high speeds in a vacuum to maintain kinetic energy, which can be converted back to electricity when needed. They are ideal for applications requiring short bursts of energy, and are extremely efficient.

What's Next?

Advancements in technology, integration with smart grids, and cost reductions are making ESS more effective and helping improve grid resilient. As the share of solar and wind energy grows, the need for ESS technology to counteract intermittency will expand proportionally.