



BENEFITS OF ENERGY STORAGE

This factsheet presents an overview of the benefits of energy storage systems, or large stationary batteries installed in residential, commercial, and industrial settings.

KEY TAKEAWAYS



Energy storage can **provide access to on-demand electricity**. When paired with locally generated electricity, including renewable generation sources, energy storage can support **energy independence**.



Energy storage can **reduce the cost of electricity** by both increasing consumption of locally generated electricity as well as supporting time-of-use bill management, supplying electricity when utility prices are high.



Energy storage can reduce the need for backup diesel generators, **improving local air quality during an outage**. Energy storage paired with renewable generation can reduce the emissions impact of local electricity demand without sacrificing grid reliability.



Energy storage **provides resilience to grid outages**, whether the result of local grid conditions, extreme weather events, or utility-initiated shutoffs. Providing uninterrupted access to electricity is especially important for critical infrastructure, such as hospitals and community gathering spaces.



Energy storage paired with local generation sources including renewable generation can serve as a community asset, not only providing energy independence, but **community ownership and wealth creation**.

Energy Access



Traditionally, the electric grid relied on large fossil-fuel powered generators that operate at any time of day, so long as they have enough fuel. Today's electric grid has many more generators that are distributed throughout the grid, and many of them are powered by renewable energy sources like the sun and wind. These generators are known as variable renewable energy resources because their fuel supply is not consistently available, it varies with the time of day, weather, or season. To ensure that electricity demand can always be met, a diverse mix of generators is combined with energy storage to overcome fluctuations in available energy generation.

Electricity travels at the speed of electrons—practically instantaneously. This means that if there are not enough people using electricity at the time at which it is generated, it must be curtailed, meaning that the energy is unused. Energy storage devices, such as residential, commercial, and industrial-scale batteries, store this excess energy for later use, increasing access to renewably generated electricity.

Energy storage can also help bring electricity to places off the grid. At the smaller scale, a portable battery and foldable solar panel are great for camping or keeping devices charged during a small power outage. Scaling up, a remote cabin or community can get most of the power it needs from a rooftop solar array and a small residential battery. At larger scales, batteries can be paired with solar irrigation systems in remote areas or farms where there may not be a nearby power line. These systems not only provide electricity where there previously was no access, they can provide considerable cost savings compared to utility-purchased electricity.

Resilience



Like nearly every critical resource such as food and water, the ability to store electricity brings resilience to the electric grid. Energy storage solutions provide this resilience by supplying access to energy during power outages. In turn, this added resilience helps to keep essential spaces like hospitals and schools running and prevents refrigerated food and medicine from spoiling.

Social Impact



Resilience hubs are community centers, libraries, schools, or other public places that are equipped with energy storage systems designed to boost community resilience. In an outage or emergency, these resilience hubs are a place to safely gather, receive information and updates, coordinate response and relief efforts, charge phones and medical devices, and even distribute supplies and first aid.

Energy storage enables resilience hubs to better serve their communities in times of need.

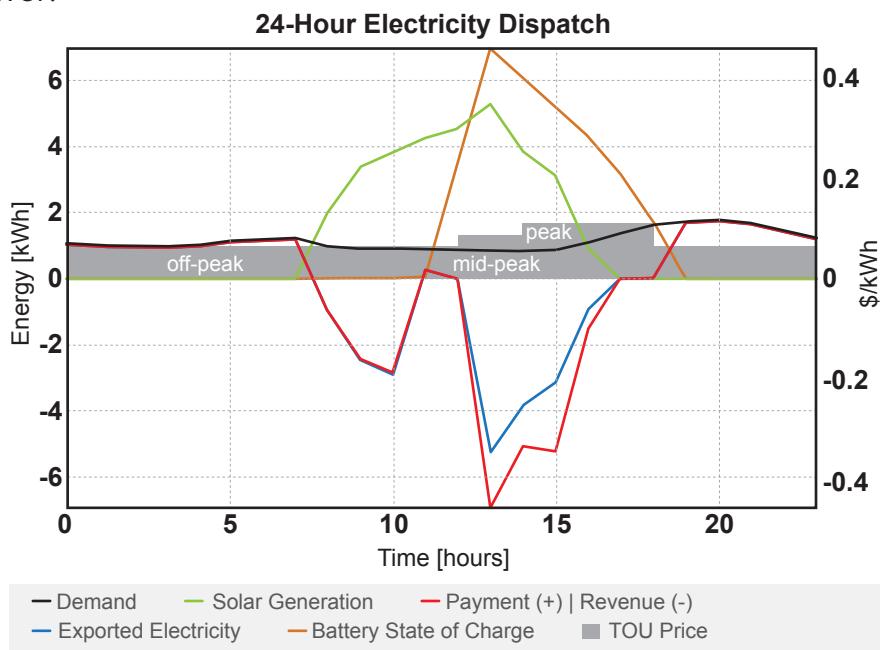


Energy Affordability



Energy storage can also provide cost saving opportunities and increase energy affordability. Many electric utility companies offer or even require their customers to be on time-varying rate tariffs, such as a time-of-use (TOU) rate structure¹. These tariffs are designed to better reflect the real cost of energy throughout the day. On most summer days, electricity is most expensive in the early evening hours as solar generation drops off, A/C use is high, and people return home from work, cook dinner, and play games. These high-demand times are represented by peak prices in electricity, encouraging folks to offset their demand with stored electricity, if able, or to put off doing laundry, running the dishwasher, and especially charging electric vehicles until the demand for electricity is lower.

Energy storage can help replace high-cost utility electricity during peak prices. Electricity that was stored earlier in the day, either generated by rooftop solar or charged from the utility during off-peak pricing, can be used during these high-cost peak times to reduce electric utility bills. Pairing energy storage with rooftop solar is an effective way to reduce electric utility bills, as solar generation can be used to power a house not just during the day, but throughout the night using a battery.



Electricity generated or stored can reduce energy bills when used during peak electricity prices, as shown in this 24-hour electricity dispatch profile from a home with rooftop solar and energy storage.

Environmental Impact



Using energy storage during times of high electric demand can also benefit the environment and improve local air quality. One of the reasons that electricity is more expensive during peak time periods is because the high electricity demand requires utilities to call on the least operationally cost-effective generators on the system. These are often called “peaker plants,” and may require more expensive fuels, operate at lower efficiencies, and emit more pollutants than typical generators. As more peaker plants turn on, local air quality can get worse and can even lead to smog alerts on hot summer days. The need for peaker plants decreases when enough households and businesses reduce their demand by using their batteries during peak hours and when the utility meets the extra demand with their grid-scale energy storage systems.

The benefits of energy storage extend beyond stationary applications. Transportation is one of the main sources of air pollution², and replacing combustion engine vehicles with electric

¹ Commercial and industrial customers with a demand of 1,000 kVA or greater fall under a TOU rate under the Puerto Rico Electric Power Authority (PREPA). Peak hours are 9AM-10PM Weekdays. www.lumaprc.com/current-rates-for-electric-service-in-puerto-rico/

² U.S. Energy Information Administration. “U.S. Energy-Related Carbon Dioxide Emissions, 2024”. May, 2025. Washington, DC. https://www.eia.gov/environment/emissions/carbon/pdf/2024_emissions_report_final.pdf

vehicles can improve local air quality. Communities located close to highways and high-congestion areas typically have worse air quality and higher rates of asthma and other respiratory conditions. Electric vehicles do not produce tailpipe emissions, meaning that even in heavy traffic or when idling, they do not contribute to local air pollution. The regenerative braking systems in EVs also reduce wear and brake dust emissions by 80% compared to traditional brakes³. Transportation emissions can be especially harmful for children's developing lungs and respiratory health, which is why school districts have begun to replace their aging bus fleets with electric school buses. These electric school buses are also less expensive to operate and require far less maintenance, taking up a smaller portion of a school district's budget.



Energy Storage Barriers

While this factsheet has outlined numerous benefits of energy storage, it is important to recognize some of the barriers to adoption. The upfront cost of many energy storage technologies can be burdensome for some project proponents. Depending on the capacity of the battery, the system's physical footprint can also be a limitation. The proposed project's location may not have adequate space that meets siting and safety requirements without increasing the setback distance from property lines or adding fencing or visual screening. Community buy-in and support is also key to a project's success, and local opinions on energy storage vary. Not every proposed project receives support from the community; outreach may be necessary to communicate the project's benefits and risks with those community members. In response to public safety concerns, some local governments have even adopted temporary moratoria on energy storage projects to provide the time necessary to develop or update local zoning ordinances. The Department of Energy and National Laboratories execute technical assistance programs with states, territories, local governments, utilities, and communities that are designed to help these entities understand the benefits and challenges associated with energy storage.

³ EIT Urban Mobility. "Study on Non-Exhaust Emissions in Road Transport". May, 2025.

<https://www.eiturbanmobility.eu/wp-content/uploads/2025/05/41-EIT-Emissions-Report-5a-Digital-1.pdf>