Issue Brief: Energy Storage

Energy storage is considered the "holy grail" of energy because it allows for stockpiling unused power for when consumers need it the most. Currently, the U.S. electricity grid only has enough cumulative storage capacity to provide power for around 20 minutes – or a mere 10 seconds if only battery storage is considered. The development of additional energy storage capacity will prove crucial in creating a grid that is more reliable, resilient, and flexible, ensuring a smooth transition to the increased use of renewable energy resources.

Benefits of energy storage

RELIABILITY, RESILIENCE, AND FLEXIBILITY

Energy storage technologies allow electricity that would otherwise be lost to be stored for later use. Energy storage can accommodate energy needs during outages or weather-related events, thus providing the grid with greater reliability and resilience. An estimated $150 billion is lost to power outages in the United States every year.

The greater the energy storage capacity, the greater flexibility of the grid to accommodate varying demand: excess electricity can be stored during periods of low demand and consumed during periods of peak demand – in later minutes, hours, days, or seasons. This flexibility also helps consumers avoid higher electricity rates that characterize peak demand periods.

A KEY PARTNER TO RENEWABLE ENERGY TECHNOLOGIES

Storage technologies are fuel neutral and can work in coordination with any form of power generation that feeds into the grid: solar, wind, hydro, nuclear, gas, or coal. They are especially valuable to fully take advantage of the electricity created by renewable energy technologies such as wind and solar, where fuel sources are intermittent and peak output does not usually align with peak demand times. Storage systems can capture electricity generated by renewable energy technologies during periods of low demand, which might otherwise be wasted. They also help reduce emissions from traditional energy generation sources, as they allow them to ramp up more gradually when they are activated to meet peak consumer demand. Energy storage facilities can also play an important supportive role for the growing fleet of electric vehicles, which will require a reliable charging station infrastructure.

ECONOMIC GROWTH

Energy storage is a rapidly growing sector of the economy that is driving major investments and job creation. According to the Energy Storage Association up to 35 GW in new energy storage capacity can be developed in the U.S. by 2025, which could generate around $4 billion in annual operation cost savings. Over 70,000 people are currently employed in the U.S. energy storage sector and could grow up to 167,000 by 2025 if 35 GW of additional storage capacity are brought online.

Current technology

Energy can be stored directly with different types of batteries, or through kinetic energy storage.

- **Kinetic energy storage. Pumped storage hydropower** is the primary kinetic storage technology with over 16.5 GW of installed capacity, equivalent to 94 percent of the current energy storage capacity in the US. Pumped storage facilities store water in a reservoir to be released through a turbine into a reservoir at a lower elevation to generate electricity when power is needed. In the U.S., 40 existing pumped storage projects provide over 22,000 MW of storage, with the largest projects in Virginia, Michigan and California. There are also 60 pumped storage projects with a capacity of 51,310 MW awaiting licensing in permitting from the Federal Energy Regulatory Commission (FERC). As a proven technology, pumped storage has been shown to be cost effective, highly efficient, and operationally flexible. Other kinetic storage technologies include compressed air storage, which can be released through a turbine to generate power, and thermal storage, whereby certain materials are cooled or heated, and this energy is used at a later time. Flywheels, which consist in a cylinder rotating in a vacuum, also store kinetic energy which can be released when the cylinder is slowed down.

- **Battery storage.** Most grid-scale battery storage devices are lithium-ion based. Other technologies include flow batteries, where negative and positive ions are stored in liquid electrolytes housed in separate tanks, and energy is captured as the electrolytes are pumped through electrodes; or traditional lead-acid batteries. A grid supported by more storage resources would also be more responsive to Electric Vehicle (EV) charging needs during peak demand periods. Grid scale storage can also reduce the amount of new transmission required to support many states' gradually increasing renewable energy goals.

- **Hydrogen fuel cells.** Another storage technology in early stages of development is the conversion of excess electricity from sources such as wind and solar to produce hydrogen, which can later be used by fuel cells to convert the hydrogen back to electricity to power vehicles, or feed back into the grid.

CRES Forum Policy Recommendations

- **Establish a stand-alone energy storage tax credit.** The Internal Revenue Service currently allows for an Investment Tax Credit (ITC) for energy storage when it is installed in conjunction with a solar energy system – under certain circumstances. CRES supports modifying the existing ITC to clarify that stand-alone energy storage technologies will qualify. This "all of the above" clarification will ensure that storage attached to any energy source will be eligible for the tax credit, helping to spur demand for innovation and advance storage technologies.

  Simply adding energy storage to the list and allowing storage projects to be eligible for the credit, regardless of what type of energy flows into them, would create certainty for investors and favor innovation and research of energy storage technologies, as well as the development of large-scale energy storage projects.

- **Invest in pumped storage hydropower.** According to the U.S. Department of Energy, up to an additional 35.5 GW in electricity generating capacity can be achieved by 2050 with the construction of new pumped storage facilities. Developing additional pumped storage facilities, particularly in areas with recently increased wind and solar capacity, would significantly improve grid reliability while reducing the need for construction of additional fossil-fuel generation.

- **Increase investment in the installation of new energy storage capacity, as well as the research and development of energy storage technologies.** ESA stipulates that reaching an additional 35 GW of energy storage capacity by 2025 will require $48.7 billion of investment. According to the International Renewable Energy Agency, over 80 percent of the world's electricity could come from renewable energy sources by 2050, and energy storage will be a crucial component of this transition. Investment in utility-scale energy storage projects will help ensure that the United States remains a global leader in the energy sector.

- **Scaling Energy Storage is a Climate Action Enabler. CRES specifically supports programs at the DOE** such as the Energy Storage Grand Challenge, which brings together world-class researchers from national labs and private sector innovators to develop state of the art technologies needed to integrate more clean energy resources into the grid. The program also supports U.S.-based manufacturing and supply chains for this technology. Another valuable DOE program is the Grid Storage Launchpad, slated to be built at Pacific Northwest National Laboratory, which will supercharge and better target applications for grid-scale storage research and development.