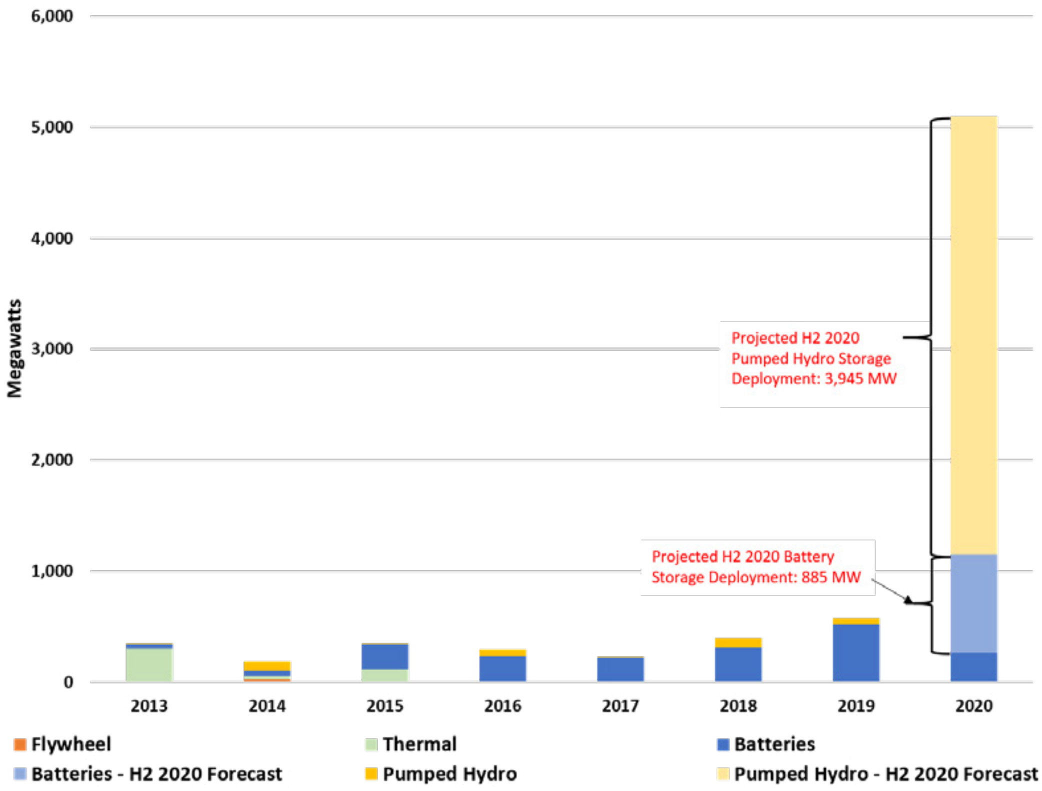
Energy Storage and Microgrid Trends & Key Issues

October 2020

ELECTRIC COMPANIES LEADING THE WAY ON ENERGY STORAGE

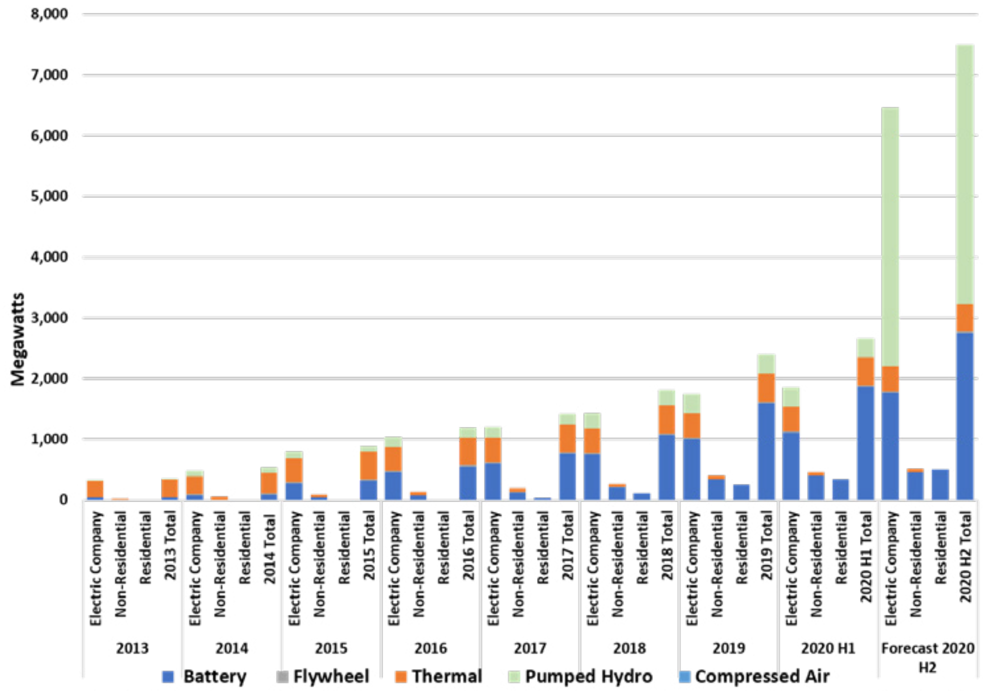
Energy Storage Capacity Additions by Technology, *(2013-2020)*



Sources: Wood Mackenzie Power & Renewables/ESA U.S. Energy Storage Monitor 2020; Dept of Energy's Energy Storage Database, 2020; ABB Database 2020.

- In the first half of 2020, energy storage deployment totaled 266 MW, and electric companies deployed more than 111 MW of that, approximately 42 percent of the total. Electric companies more than quadrupled their deployment quarter-on-quarter, from 21.5 MW in Q1 to 90 MW in Q2.
- 4.8 GW of energy storage capacity is scheduled to come online in the second half of 2020—9 times more than all energy storage capacity deployed in 2019 and 80 percent more than the total capacity deployed since 2013.
- As of June 2020, electric companies own, operate, or utilize 23.7 GW or 96.4 percent of all energy storage. In 2020, electric companies are expected to account for 92.6 percent of the year's energy storage capacity additions, or 4.6 GW.

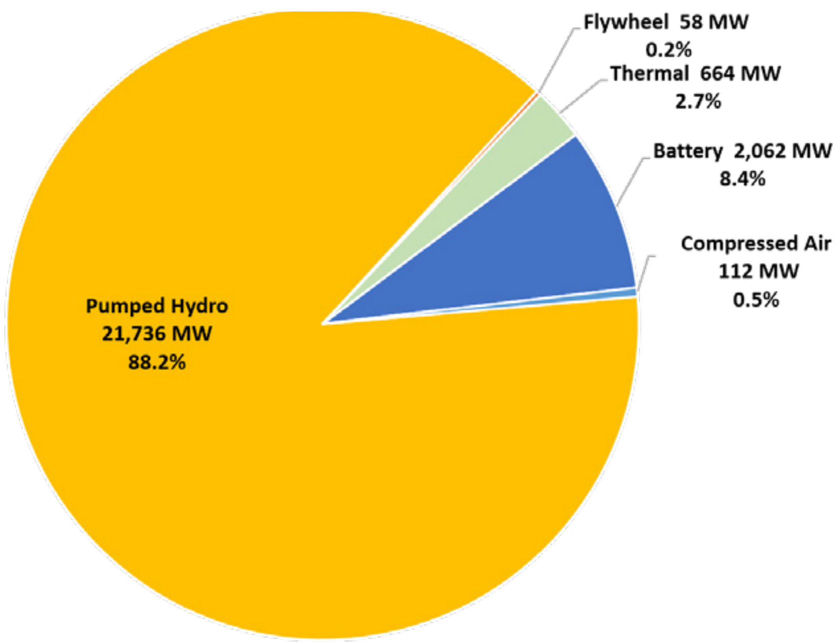
Cumulative Energy Storage Capacity Additions by Segment and Technology, *(2013-2020)*



Sources: Wood Mackenzie Power & Renewables/ESA U.S. Energy Storage Monitor 2020; Dept of Energy's Energy Storage Database, 2020; ABB Database 2020.

- Total energy storage capacity is expected to increase 20 percent in 2020, from 24.6 GW to 29.5 GW.
- Total non-pumped hydro storage capacity is projected to grow 163 percent from 2013 to the end of 2020, from 892 MW to 2.35 GW. Annual non-pumped hydro capacity is expected to grow 229 percent, from 350 MW to 1.15 GW, over the same period.

Total Installed Energy Storage Capacity by Technology, *24,632 MW*



Data includes Q2 2020 deployments.
Sources: Wood Mackenzie Power & Renewables/ESA U.S. Energy Storage Monitor 2020; Dept of Energy's Energy Storage Database, 2020; ABB Database 2020.

- Pumped hydro comprises the majority of installed energy storage capacity, at 21.7 GW or 88 percent of total capacity.
- Battery energy storage continues to be the fastest-growing energy storage technology, increasing 936 percent from 199 MW in 2012 to 2,062 MW in H1 2020. Lithium-ion chemistries dominate battery installations, with 1,832 MW deployed to date while 60 MW are attributable to other battery chemistries.

FEDERAL POLICY UPDATES

EEI RESPONSE TO DEPARTMENT OF ENERGY'S REQUEST FOR INFORMATION REGARDING ENERGY STORAGE GRAND CHALLENGE ROADMAP

On August 31, EEI submitted its response to the Department of Energy's (DOE) Request for Information (RFI) regarding the Energy Storage Grand Challenge Roadmap. EEI's considerations and recommendations for DOE included:

1. DOE should fund large-scale fire testing of operational battery energy storage systems;
2. It is important to recognize that energy storage can provide multiple value streams;
3. Electric companies should be able to own, operate, and procure energy storage, and can best optimize energy storage;
4. Existing asset classification rules—traditional generation, transmission, and distribution definitions—may not account for all attributes of energy storage technologies;
5. Electric companies should be allowed to determine where on the energy grid and when energy storage can be safely and reliably integrated;
6. DOE should support long-duration, seasonal storage research, development, and deployment through pilots and demonstrations and support long-duration storage providers;
7. DOE should support domestic critical minerals production and product end-of-life considerations;
8. DOE should defer to the Federal Energy Regulatory Commission (FERC) on wholesale market participation questions;
9. DOE should employ a flexible approach in considering resilience with respect to energy storage policy issues;
10. Electric companies should be directly involved in vehicle-to-grid battery storage;
11. DOE should consider emerging energy storage supply chain issues specific to security, including:
    i. The need to balance transparency, protection of sensitive information, and the ability to share security information in a timely manner to help distribution system owners protect their systems;
    ii. The commitment of the electric power industry to developing the security, mitigation, and response strategies needed to ensure energy grid security and resilience together with industry and government partners.

EEI SUBMITTED COMMENTS TO FERC FOLLOWING ITS TECHNICAL CONFERENCE ON HYBRID RESOURCES

On July 23, FERC held a technical conference on hybrid resources – those consisting of a generation resource paired with energy storage. EEI submitted post-conference comments to FERC on September 24, highlighting that there are regional differences in hybrid resource penetration, and regulatory flexibility is necessary to accommodate these regional differences. The RTOs/ISOs already are working with their stakeholders on hybrid resource integration issues, and the Commission should allow these discussions to continue and not take a generic action at this time.

MEMBER TECHNOLOGY SPOTLIGHT

The following demonstration projects highlight the variety of solutions energy storage provides to customers as well as to the energy grid.

AMEREN ILLINOIS – CYBERSECURITY MICROGRID, CHAMPAIGN

Ameren's Technology Applications Center (TAC) hosts a microgrid powered by an integrated mix of distributed energy resources, including a 250 kW/500kWh battery energy storage system, wind, solar, and natural gas. The energy generated by the microgrid can be delivered directly to local customers, routed to the central energy grid, or stored in the microgrid's battery. The use of energy storage allows the microgrid to take advantage of renewable energy generation by charging when it is available via the wind turbines and the solar array, and allowing the battery to serve as generation when needed, lessening the need for natural gas. The battery also operates as a voltage source during islanding conditions of the TAC and microgrid loads. This feature enables the wind turbine and solar array to operate while separated from the energy grid, and this allows the company to test the operational parameters of the individual distributed energy resources.

AMERICAN ELECTRIC POWER – SODIUM SULFUR (NAS) BATTERY ENERGY STORAGE SYSTEMS

American Electric Power (AEP) pioneered NaS battery use, installing its first demonstration unit in Gahanna, Ohio in 2002 after testing at its Columbus, Ohio Dolan Technology Center. This was followed by installation of a 1.2 MW stationary NaS battery near Charleston, West Virginia in 2006. In 2008, Churubusco was part of a 2 MW trifecta of installations that went up in Balls Gap, West Virginia, as well as in Bluffton, Ohio. The batteries at Churubusco provide AEP with greater flexibility in managing the energy grid. More specifically, the battery systems provide load leveling, defer capital upgrades, alleviate transformer load during summer peaks, and offer seven hours of emergency backup power to several hundred customers during electricity outages. AEP uses an in-house SCADA system and custom software that creates a feedback loop to control all of its batteries. The NaS battery systems also have the potential to be used for electric energy time shift and spinning reserve capacity, though these are not the primary purposes of the batteries.

SOUTHERN CALIFORNIA EDISON – TEHACHAPI WIND ENERGY STORAGE PROJECT

The Tehachapi Wind Energy Storage Project is an 8 MW, 32 MWh lithium-ion battery storage system housed adjacent to Southern California Edison's (SCE) Monolith Substation. The project was strategically located in the Tehachapi Wind Resource Area to test the integration of the area's 4,500 MW of wind capacity. The $50 million Tehachapi storage project was co-funded by SCE and DOE. The project started as a pilot to test multiple operational functions, including integration of large-scale variable wind generation, voltage support and frequency regulation, diminishing congestion, deferring transmission investment, providing an energy time shift, and increasing reserves. Additionally, SCE demonstrated the lithium-ion battery's ability to provide nearly instantaneous maximum capacity for renewables ramping to minimize the need for traditional back-up generation.

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