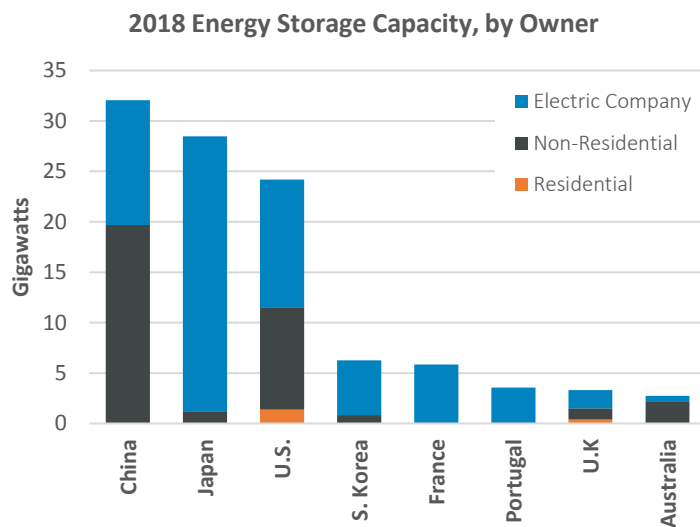




International Energy Storage Trends & Key Issues

December 2019

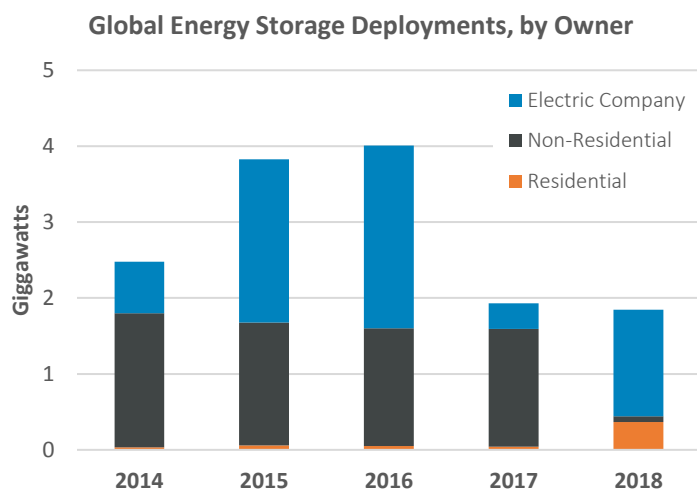
ENERGY STORAGE DEPLOYED TODAY



KEY FACTS

- Energy storage systems, including pumped hydro, batteries, thermal storage, and compressed air systems, can provide several benefits to the global energy grid.
- There are nearly 180 GW of operational energy storage capacity worldwide, more than half of which is owned by electric companies.
- By 2030, around 70 percent of global grid-scale storage deployments will come from ten countries, including China, Japan, the United States, South Korea, and the United Kingdom.

Sources: U.S. Department of Energy Global Energy Storage Database, Navigant Country Forecasts for Utility-Scale Energy Storage



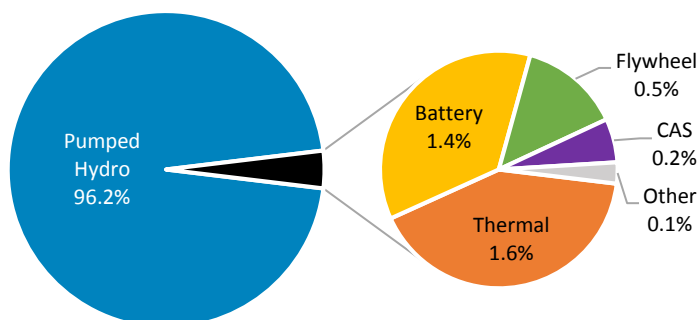
KEY FACTS

- More than half of the global grid-scale deployments in the past five years have come from EEI member companies.¹
- In 2018, more than 1.8 GW of storage came online, with 75 percent of that owned by electric companies. This trend is expected to continue in 2019.
- Over the next six years, grid-scale energy storage deployments are projected to increase thirteenfold to 158 GWh.

¹ EEI members include all U.S. investor-owned electric companies and 74 non-U.S. electric companies operating in more than 90 countries.

Sources: U.S. Department of Energy Global Energy Storage Database, Wood Mackenzie Power & Renewables

2018 Energy Storage Capacity, by Technology



KEY FACTS

- Pumped hydro accounts for 96 percent of all storage deployed worldwide.
- Excluding pumped hydro, batteries and thermal storage make up more than three-fourths of storage deployments.
- In 2019, lithium-ion batteries are expected to account for 65 percent of new grid-scale storage capacity.
- Globally, battery storage is most commonly used for frequency regulation.

Sources: U.S. Department of Energy Global Energy Storage Database, Navigant Country Forecasts for Utility-Scale Energy Storage, IRENA Electricity Storage and Renewables: Costs and Markets to 2030

COUNTRY POLICY HIGHLIGHTS

South Korea

- South Korea's favorable policy measures have made it a leader in storage deployments, with the country accounting for more than one-third of all global capacity installed in 2018.
- Going beyond grid-scale storage, the country also has created a strong commercial and industrial market that has contributed to more than half of all global installed behind-the-meter storage capacity.
- South Korea's most recent Energy Master Plan includes a target for more than 30 percent of generation to come from renewables by 2040, with energy storage systems being key for integrating these renewables.
- As part of the plan, a storage system charged by solar during the day can receive five times the Renewable Energy Certificates for discharging in the evenings, incentivizing renewables to pair with storage to meet peak evening load.
- From 2017-2019, the Korean government also offered a 50 percent rate discount for off-peak charging to encourage storage deployment.
- Public buildings with a contract for more than 1 MW also are required to install storage with a capacity of at least 5% of the contract.

Sources: IEA Energy Storage Tracking, Korea Energy Master Plan

Australia

- Australia has emerged as one of the leading global markets for grid-scale energy storage over the past two years, and it is expected to account for 30 percent of global battery storage demand in 2019.
- Like other countries, Australia's renewable energy targets are driving investment in energy storage. The country aims to reach 33,000 GWh of renewable energy generation by 2020.
- Though there are no formal national policies or standards to regulate storage adoption, many states have been leading the way to encourage storage projects.
- In Victoria, two large-scale battery storage projects have received support from Australia's Renewable Energy Agency and the Victorian government through grants totaling \$50 million (USD 34.32 million).
- In Queensland, the government held reverse auctions for 100 MW of energy storage, with the ten short-listed projects submitting bids to the government-owned electric company.
- Australia also is projected to lead the world's residential battery storage market, with more than 70,000 households expected to install battery energy storage systems in 2019.

Sources: Australian Renewable Energy Agency, Powering Queensland Plan, Bloomberg New Energy Finance

MEMBER TECHNOLOGY SPOTLIGHT

The following is a small sample² of projects from different regions that highlight the variety of solutions energy storage provides to both customers and the energy grid.³

ATCO – SADDLE HILLS, CANADA



In 2016, ATCO energized Western Canada's largest off-grid solar project, located at the Saddle Hills Telecommunication Site in Alberta. The system combines 75 kW of PV capacity with a 250 kWh lithium battery to meet 100 percent of the power needs of the unmanned site. The site is a critical part of ATCO's telecommunications network which was previously powered by propane thermal electric generators. By pairing solar with battery storage, ATCO reduced its carbon emissions while also avoiding expensive distribution line construction.

COMPANHIA ENERGETICA DE MINAS GERAIS – UBERLÂNDIA, BRAZIL



In 2018, Brazil inaugurated the country's first solar photovoltaic (PV) plant with a 1 MW storage system in Uberlândia, in the southeastern state of Minas Gerais. CEMIG and Alsol Energia Renovaveis developed the 300 kWp solar plant to better understand the applications of storage systems with distributed generation. Since 2018, the plant's PV capacity has increased to 400 kWp with 1.58 MWh of storage in lithium iron phosphate batteries. While other renewable generators in Brazil are limited by intermittent energy supply, this plant can store energy throughout the day to sell during peak hours. Thus, energy storage is being used to both integrate renewables and help meet peak demand.

ELECTRICITY SUPPLY BOARD – TURLOUGH HILL POWER STATION, IRELAND



Turlough Hill is Ireland's only pumped storage power station, located 60 km south of Dublin City in the Wicklow Mountains. The station became fully operational in 1974 and can generate up to 292 MW during peak demand periods by releasing water from its upper reservoir (going from standstill to full capacity in just 70 seconds). During periods of lower energy demand, water is pumped back up from the lower reservoir to be ready for future use. Pumped hydro is the oldest and most efficient form of large-scale energy storage. In 2004, Turlough Hill became the Hydro Control Centre for ESB's 10 hydro stations.

² EEI will release more case studies for international member energy storage projects in a forthcoming publication in Q1 2020.

³ Visit [EEI's Energy Storage page](#) to view project examples from our U.S. member companies.

MEMBER TECHNOLOGY SPOTLIGHT (CONTINUED)

STATE GRID CORPORATION OF CHINA – JIANGSU BESS PROJECT, CHINA



Following the decommissioning of three generators totaling 33 MW at the Jianbi power station in 2017, the Jiangsu region faced a significant power shortage. To ensure the security of supply while meeting Jiangsu's 263 Action Plan for ecological and environmental protection, the State Grid Corporation of China (SGCC) began the construction of eight grid-scale energy storage power stations equipped with lithium iron phosphate batteries, totaling 101 MW/202 MWh. By 2018 these systems were operational, providing load shifting, ancillary services, and emergency backup power.

VECTOR – GLEN INNES SUBSTATION, NEW ZEALAND



In 2016, Vector unveiled the first grid-scale Tesla Powerpack battery storage system to be integrated into a public electricity network in the Asia Pacific region. Located at the Glen Innes substation in New Zealand, the system allows Vector to enhance reliability while also deferring a conventional substation upgrade. The battery system has a storage capacity of 1 MW/2.3 MWh, which provides peak shaving and has helped extend the life of the substation, deferring capital expenditure and providing supplementary power to the Glen Innes area.

For more information on international energy storage trends and key issues, contact EEI International Programs at international@eei.org