



Global Market Forecast: Comparing Storage Around the World

Energy Storage Digital Series

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Global Market Forecasts

Utility Scale Energy Storage

Large Scale Energy Storage on the Transmission & Distribution Grid

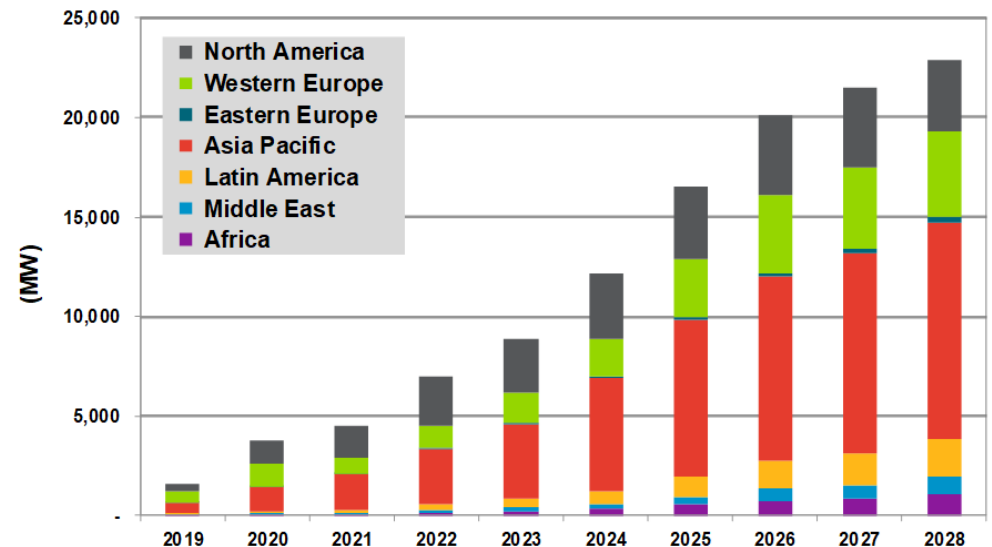
Currently the utility scale energy storage market (front-of-the-meter) is the largest segment of the global market

New project activity remains concentrated in a small number of countries

NOTE: These forecasts were developed in late 2019, we are currently developing new forecasts for 2020 and beyond, accounting for COVID-19 disruptions

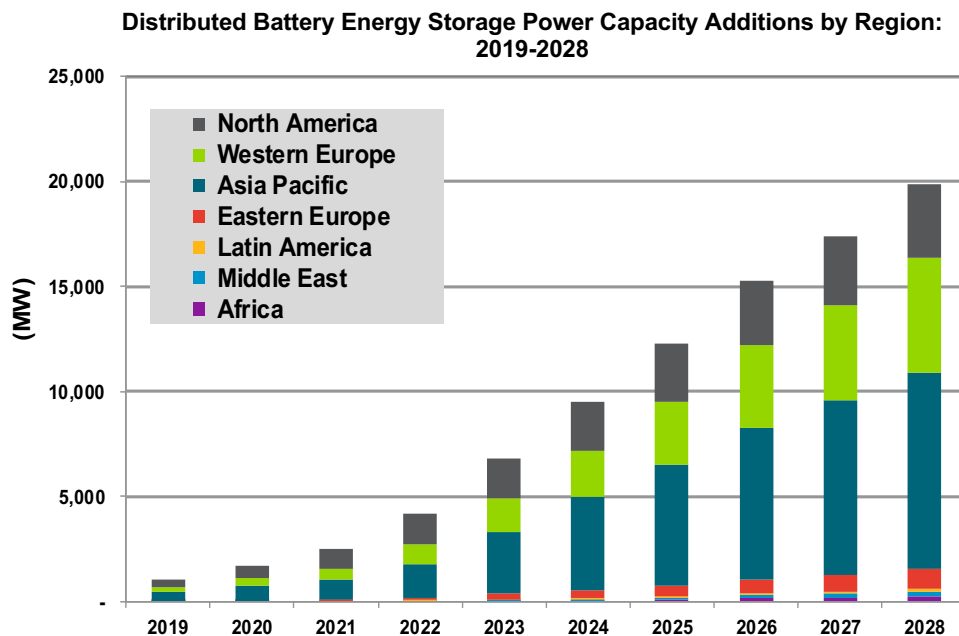
- We expect a decrease in 2020 of approximately 10-20%. Many projects will be delayed and shift to 2021/2022. Overall we do not expect a major decrease in the 10-year forecast

Utility Scale Energy Storage Power Capacity Additions by Region: 2019-2028



Distributed Energy Storage

Behind-the-Meter Commercial & Industrial, Residential, Remote/Off-Grid



The distributed energy storage market is not expected to grow as rapidly as the utility scale segment in the near-term

Economics for BTM energy storage projects for C&I and residential customers remain challenging in most of the world, further cost reductions and rate structure changes will be required before growth accelerates

The leading markets for BTM energy storage are concentrated in Western Europe, North America, and East Asia/Australia

Key Policies & Market Drivers

The growth of renewable energy is the single biggest driver of new storage development

- Energy storage provides many services on the power grid, yet mitigating the negative effects of variable renewable generation are the most impactful and the largest markets
- Growth in solar and wind generation challenge grid operations by reducing both stability and economic efficiency
- The leading energy storage use-cases are designed to facilitate growing penetrations of renewable energy

Key Supporting Policies in Each Region

North America

State-level targets for energy storage development are key drivers in North America by requiring utilities to procure energy storage. Currently 7 states have storage targets which total ~12,000 MW of new capacity by 2030.

Federal government Investment Tax Credit provides a 30% subsidy for energy storage co-located with solar PV generation

Europe

Europe's utility scale energy storage market is led by grid stability projects providing frequency response and other ancillary services. Grid operator procurements in the UK and Ireland have driven recent growth.

Residential energy storage is a major market in Europe, driven by policies reducing feed-in-tariff compensation, and subsidies in Germany and Italy

Asia Pacific

Australia is a leading market for utility scale storage, the country's ambitious renewable energy targets combined with constrained T&D networks require energy storage for effective integration.

South Korea has been a leading market for C&I energy storage in the region, driven by incentives for buildings to reduce peak energy demand

Rest of the World

Growth in Latin America will be driven by regulatory reforms to increase competition in energy markets, notably in Mexico and Chile. Caribbean countries are also supporting energy storage development to increase resiliency.

Storage Technology Price Forecasts

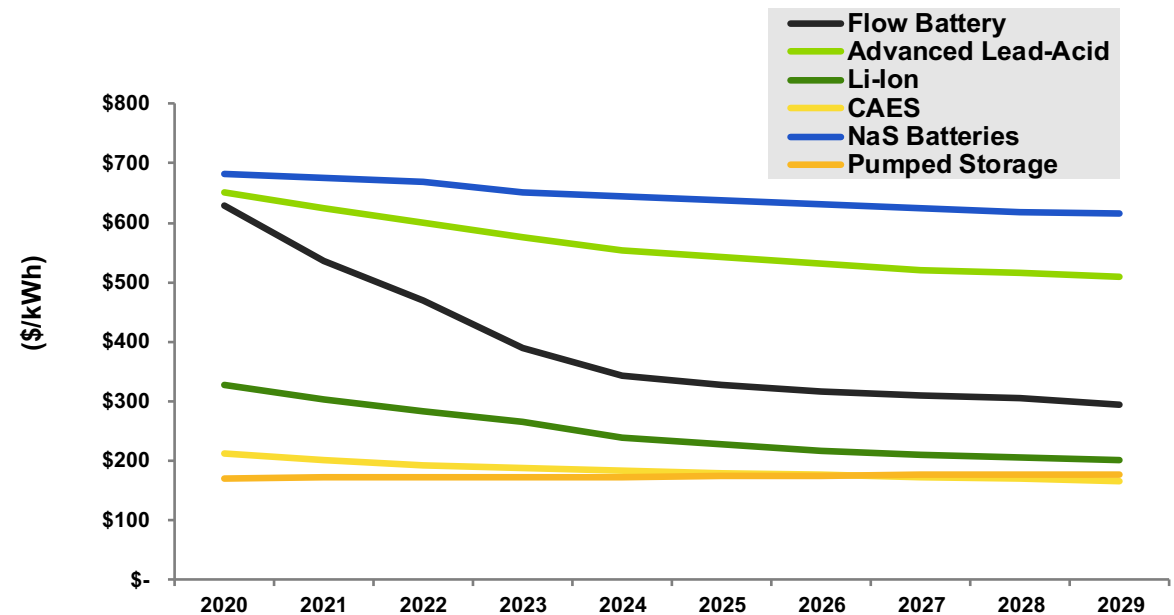
Average Installed Costs for Utility Scale Technologies

Lithium Ion batteries have become the leading choice for new energy storage projects. Other technologies are competitive on upfront costs, but face challenges limiting their deployments

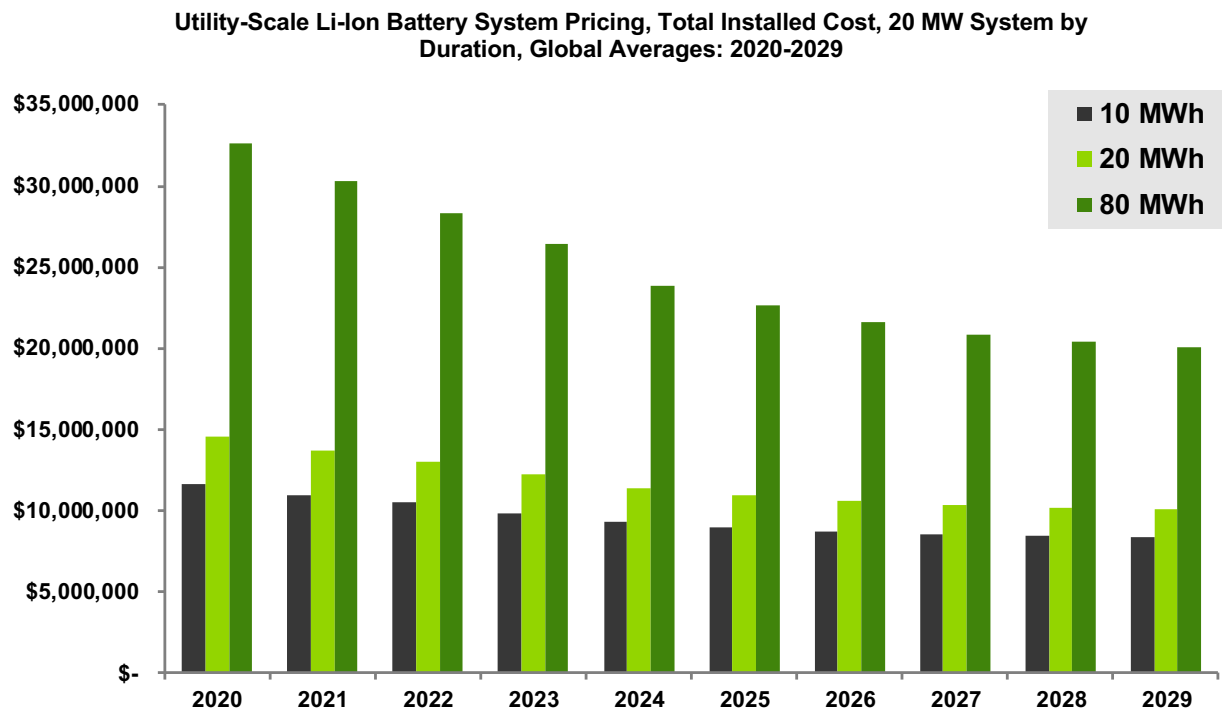
This chart compares technologies providing bulk energy storage in terms of upfront installed costs. One key assumption is discharge duration:

- **Flow Batteries:** 4 hours
- **Advanced Lead-Acid:** 4 hours
- **Lithium Ion:** 4 hours
- **CAES:** 8 hours
- **NaS Battery:** 6 hours
- **Pumped Storage:** 10 hours

Utility-Scale Energy Storage CAPEX Assumptions by Technology for Energy Services, Global Averages: 2020-2029



Lithium Ion Project Costs



The duration of an energy storage project is a key consideration determining costs

Project size and duration differences result in a wide array of reported prices

This chart shows global average prices for fully installed Li-ion grid storage systems based on duration for a 20 MW project

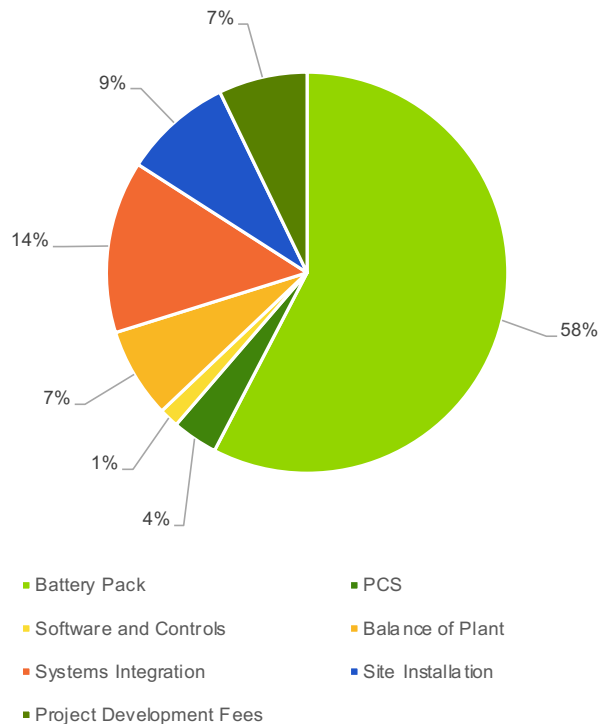
Lithium Ion Project Costs by Component

These charts illustrate the breakdown of a utility scale Li-ion energy storage project by component

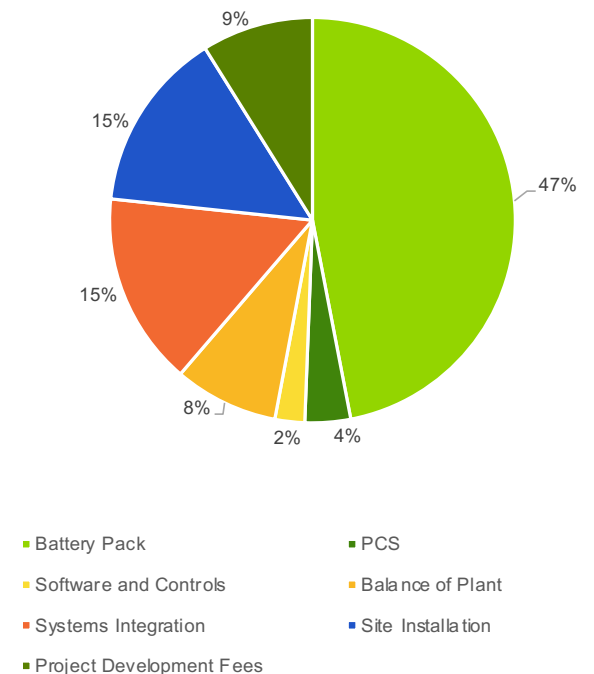
This sample project is a standard 4-hour duration of 20 MW / 80 MWh capacity

The battery pack is expected to see the greatest decrease in price over the coming 10 years. By 2029, site installation and system integration account for 30% of project cost

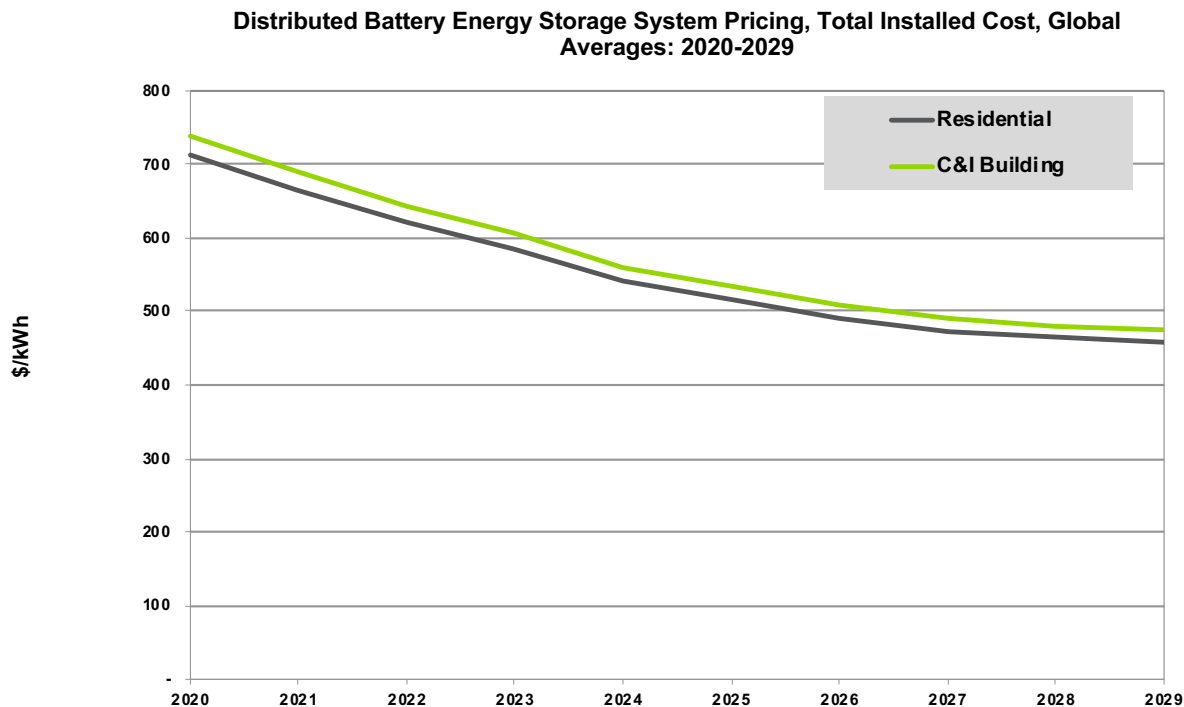
Total Installed CAPEX by Component:
2020



Total Installed CAPEX by Component:
2029



Distributed Energy Storage Pricing



On a per kWh basis energy storage for C&I and residential buildings is more expensive than utility scale due to their smaller size

Li-ion batteries account for the majority of the residential and C&I markets. Both are expected to see price decreases over the coming decade

C&I systems are slightly higher in cost due to less standardization in products and installation

Notable New Projects Around the World

Four Categories of Projects Are Driving Growth Globally

Solar-plus-Storage

Co-located solar-plus-storage projects account for many of the largest systems globally. These projects provide dispatchable solar generation and are leading applications in the United States, Australia, and other markets

Peak Generation Capacity

Storage projects designed to replace fossil fuel peaking plants. Many are built to serve urban areas where new fossil fuel plants are prohibited due to air quality restrictions, or lack of available land

Grid Stability & Ancillary Services

Frequency regulation balances the fluctuations between electricity generation and electrical load, manages variability in the grid's frequency, and maintains the frequency on transmission lines within safe ranges.

EV Charging Integration

Storage reduces the cost to build and operate new EV charging stations by limiting the need for new electrical infrastructure and reducing peak demand charges

Notable New Solar-plus-Storage Projects



Source: AES Corp.

- South Australia is a hotbed of new solar-plus-storage projects.
 - EPS Energy is a leading developer, its projects include the Bungama Solar Farm with 280 MW PV and 140 MW / 260 MWh ESS and a 500 MW PV array with 250 MW / 1,000 MWh ESS in Robertstown
- Utilities in the southwestern United States are procuring massive solar-plus-storage projects. In 2019 NV Energy announced the development of three large solar-plus-storage projects including the country's largest, the Gemini plant with 690 MW solar PV and 380 MW / 1,520 MWh ESS

Notable New Peak Generation Capacity Projects

- In June 2018 Pacific Gas & Electric in California announced the largest procurement of energy storage for peaking capacity services. The Moss Landing projects total 568 MW of capacity, including a single project at 300 MW / 1,200 MWh
- In October 2019 New York utility regulators approved a 316 MW energy storage plant for peaking capacity in New York City, with an 8-hour duration for 2,528 MWh capacity. The project will be built at an existing fossil fuel plant site (pictured to the right)
- This month utility Southern California Edison announced a 770 MW energy storage procurement for peaking capacity services, with 7 separate projects awarded contracts



Source: LS Power

Notable New Grid Stability & Ancillary Services Projects



Source: Kokam

- The UK and Ireland are among the leading markets for energy storage providing grid stability and ancillary services. National Grid in the UK procured 200 MW of ESS projects for its enhanced frequency response (EFR) service in 2017-2018
- In October 2019 a similar program was announced in Ireland, with contracts awarded for 110 MW of energy storage capacity in 3 projects
 - These contracts are critical to stimulating growth in the country's market
 - Last month Solar Media reported the pipeline of battery storage projects in Ireland has reached 2.5 GW

Notable New EV Charging Integration Projects

- Energy storage to support EV charging stations has become a rapidly growing application for both utility scale and BTM energy storage where EV adoption has accelerated, particularly in Europe
- In April 2020 battery system provider Tesvolt announced it will provide a 2 MWh ESS to a large EV charging station in the Germany. The system will be integrated with onsite solar PV and wind generation to reduce the station's costs while increasing the speed at which vehicles can charge



Source: Tesla

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