



# U.S. ENERGY STORAGE: 2019 Year in Review



Energy  
Storage  
Association

DELIVERING MORE PROJECTS AT LOWER COST THAN EVER BEFORE PURSUED BY NEW BUYERS AND EXPANDED APPLICATIONS.

THE ESA  
VISION

**35**  
GIGAWATTS

OF NEW ENERGY STORAGE  
INSTALLED BY 2025

**\$4**  
BILLION

IN OPERATIONAL  
GRID SAVINGS

**167+**  
THOUSAND

NEW JOBS  
CREATED

**3.67** MILLION METRIC TONS OF CO<sub>2</sub>,  
EQUIVALENT **REDUCED**

Moving the U.S. toward a disruption-proof grid.

# MARKET GROWTH

2019 INSTALLATIONS

**523**  
MEGAWATTS

**1,113**  
MEGAWATT-HOURS

**\$712**  
MILLION

Cumulatively, **24 GW of total energy storage is now installed**, including pumped hydropower, on the U.S. electric grid. Of that total, **1.6 GW is non-hydropower and more than 1.3 GW are batteries installed on the U.S. electric grid.**

**2019 showed balanced growth among industry segments.**

**251 MW** of Front of the Meter (FTM) deployments | **272 MW** Behind the Meter (BTM) deployments

**Behind the meter deployments showed balanced growth between residential and non-residential deployments:**

**Total deployments:** 68% growth over 2018 | Residential: 66% growth | Non-residential: 71% growth

**Costs to install energy storage systems continued to fall across industry segments in 2019:**

BTM residential system costs **declined by about 5%** during the year

FTM system costs **declined by 7% - 10%** during the year

**80 GW** FTM pipeline proposed to regulators

*All deployment and pipeline numbers from Wood Mackenzie/ESA U.S. Energy Storage Monitor report.*

# NOTABLE 2019 PROJECTS

**Kauai Island Utility Cooperative (KIUC)** completed the largest storage plus solar facility in the world with **AES/Fluence** at the turn of the year, with 28 megawatts (MW) of solar and 100 megawatt-hours (MWh) of storage, enabling KIUC to operate with all renewable electricity during certain parts of the day.

**Hawaiian Electrical Company (HECO)** contracted the second largest storage aggregation in history, with seven contracts for 262 MW of solar and 1,048 MWh of storage on three islands with partners including **Clearway Energy and AES**. This nearly doubled the current U.S. installed capacity for storage, according to Wood Mackenzie. HECO then asked for 900 MW additional storage and renewables contracts, of which more than 240 MW are storage. | *HECO's contracts were record-low prices for the state, at 8¢/kWh dropping the state's prices for solar plus storage from 2016 to 2019 by 42%.*

**Nevada Energy** contracted 590 MW of solar and 950 MW of storage from three third-party owned projects with **Cypress Creek Renewables** and **NextEra Energy Resources**, nearly six times what it procured from storage in 2018.



**Arizona Public Service** announced 850 MW of energy storage with 300 MW of third-party owned storage systems and utility-owned storage systems to pair with existing solar farms from partners, including **Invengery** and **AES**. An additional 550 MW of storage is planned to be procured in its upcoming IRP.

**Florida Power & Light** proposed a 409 MW/900 MWh storage development to shift solar power use into the evening and replace older gas plants.

**Oklahoma Western Farmers Electric Cooperative** contracted with **NextEra Energy Resources** for the largest hybrid solar, wind, and storage facility in the U.S., with 250 MW each of solar and wind, and 200 MW/800 MWh of storage.

**Southern California Edison** contracted for 195 MW of storage, including a single 100 MW-sized project, with partners including **Able Grid, E.ON/RWE, Enel North America**, and **Strata Solar**.

**California municipal utility Glendale Water & Power** announced 75 MW/300 MWh of battery storage, 12.8 MW of residential solar plus storage, and other resources to forego a new gas peaking power plant.



## Five Largest U.S. Projects Installed in 2019

Project Name	MWh Capacity	MW Capacity	Location
<b>Pacific Missile Range Facility - Barking Sands Solar-plus-Storage</b>	70	14	Hawaii
<b>Tesla Nantucket BESS</b>	48	6	Massachusetts
<b>10 MW Stand Alone SRP</b>	40	10	Arizona
<b>Montauk Energy Storage System</b>	40	5	New York
<b>Energport PJM BESS 1 &amp; 2</b>	36	36	Illinois/ West Virginia

Portland General Electric contracted with NextEra Energy Resources to build 300 MW wind, 50 MW solar and 30 MW/120 MWh storage to supply near-baseload power.

California's East Bay Community Energy, Peninsula Clean Energy, Silicon Valley Clean Energy and Silicon Valley Power jointly sought 32.7 MW of customer-sited storage to support resource adequacy and customer resilience.

Utilities announced all-source RFPs in Indiana, Hawaii, Alabama, Arkansas, and Tennessee.

Georgia regulators approved 80 MW of storage in Georgia Power's 2019 IRP.

Sunrun won the first residential storage capacity contracts in New England ISO.

In Vermont, Green Mountain Power's network of residential storage helped to keep 1,100 customers powered during an October storm-related outage.

Also in Vermont, Highview Power Storage, Inc. and Encore Renewable Energy announced they would site a utility-scale long duration liquid air energy storage system, a first in the United States.

New York Public Service Commission approved the largest storage project in NY's history, a 316 MW energy storage project at Ravenswood Generating Station in Queens owned by LS Power, to be partially operating by 2021.

The Los Angeles Department of Water and Power approved a solar plus storage project with 400 MW of solar and 300 MW/1200 MWh of storage with partner 8minute.

El Paso Electric announced a storage plus solar project with NextEra Energy Resources and a storage plus natural gas project with Ørsted that would add 100 MW of battery storage to the grid by 2023.

Duke Energy pledged to spend \$500 million to install battery systems throughout the Carolinas over the next 15 years, which will increase battery storage in the region almost twentyfold.

GE Renewable Energy announced plans for two hybrid storage plus gas turbine systems, one in the Los Angeles Basin and one in upstate New York.

# ACCELERATING MARKETS IN 2019

**ESA secured broad, bipartisan support for a stand-alone storage federal investment tax credit and a dozen other federal support bills in 2019. ESA also drove state policies such as implementation of state energy storage deployment targets, cost-benefit studies, and new, innovative state programs and regulatory reforms.**

## FEDERAL LEGISLATIVE

2019 saw twelve bipartisan and bicameral bills introduced to support energy storage, including:

- A federal **Investment Tax Credit** for stand-alone storage gained strong bipartisan, bicameral support in the final stages of a federal spending bill, backed by a broad coalition of supportive industries and power sector stakeholders. Ultimately it was not included in the 2019 bill, but remains on the short list for “new” energy tax provisions and is included in several other energy tax bills. Sponsors plan to revive the push for clean energy tax breaks in 2020.
- Senate and House committees each approved amended versions of the **Better Energy Storage Technology (BEST) Act**, which would enshrine energy storage RD&D and project demonstrations among the highest priority for federal energy technology innovation investments at \$1.4 billion over five years.
- House infrastructure packages such as the **LIFT Act** that propose funding energy storage for resilience.
- Ten additional bipartisan, bicameral bills were introduced in support of energy storage.

## FEDERAL AND REGIONAL REGULATORY

- The Federal Energy Regulatory Commission (FERC) re-affirmed its landmark **Order 841** with a robust defense of competition and rebuffing challenges to its decision to require distributed energy resource (DER) energy storage have access to wholesale markets. Opposing parties file a petition with the D.C. Circuit Court to litigate the directive as a violation of the Federal Power Act. ESA intervened in support of FERC.
- All six regional transmission organizations (RTOs) and independent system operators (ISOs) filed **Order 841 compliance plans**, and ESA requested changes to four of them. FERC approved PJM and Southwest Power Pool (SPP) 841 implementation rules with important caveats. In rulings on each of the plans FERC agreed with ESA in ordering numerous changes—most notably opening a new proceeding to determine whether **PJM’s capacity qualification standard** for energy storage is appropriate.
- FERC also re-affirmed **Order 845**, backing its original directives that transmission owners and RTOs/ISOs need to update rules to better facilitate storage retrofits to existing generators. RTOs/ISOs filed compliance plans allowing new **surplus interconnection service** designed for storage.

- FERC included discussions of **storage-as-transmission** in its inquiry and subsequent technical conference on ways to improve the capabilities and resilience of the transmission system.
- **California Independent System Operator (CAISO)** and **Midcontinent Independent System Operator (MISO)** initiated stakeholder processes to update their rules for **storage-plus-generation “hybrid”** resource interconnection and market participation.
- Texas grid operator **ERCOT** established a **Battery Energy Storage Task Force**.
- The U.S. Trade Representative (USTR) **imposed tariffs** on lithium-ion batteries, inverters, and other storage system components imported from China, creating uncertainty for the U.S. storage industry. ESA filed a request with the USTR seeking exclusion of energy storage system components from Sec. 301 tariffs on Chinese imports.

### STATE LEGISLATIVE

- **New York** authorized \$350 million in new incentives, and utilities solicited 350 MW of bulk storage to help deploy Governor Andrew Cuomo’s target of 3 GW by 2030.
- **Maryland** signed into law the Energy Storage Pilot Project Act to test regulatory ownership and deployment models for energy storage to identify savings and reliability benefits for ratepayers.
- **Minnesota** passed the Omnibus Jobs and Energy Bill, incorporating storage into utility planning and funding the Energy Storage Cost-Benefit Analysis Study for statewide deployment.
- **Maine** passed a storage study bill with the final report from the Storage Study Commission recommending a suite of policies including a 100 MW energy storage goal.

### STATE REGULATORY

- **California** regulators proposed reallocating \$613 million of Self-Generation Incentive Program funds to prioritize fire zones, low income, medical needs and frequent outage zones.
- **Massachusetts** proposed the first-in-the-nation Clean Peak Standard to support its 1,000 MWh by 2025 energy storage target.
- **Georgia** regulators approved a 2019 integrated resource plan (IRP) for Georgia Power that calls for 80 MW of energy storage, and the state opened a Center of Innovation in Energy Technology with the goal to make the state the regional leader on battery storage production, R&D, and delivery jobs.
- **Nevada** regulators proposed new regulations with a 1,000 MW energy storage target in NV Energy’s IRP process.

### MARKET ADOPTION IN 2019...

- All told, **10 utilities** filed IRPs with energy storage investments. At least **four utilities** issued all-source Requests for Proposals in which storage can bid.
- Community **aggregators, municipal utilities, and co-ops** increasingly solicited storage resources, paralleled by state initiatives for disadvantaged communities, as in California.
- Fast-charging **electric vehicle facilities began adding stationary storage** for grid benefits, for increased charging capability and providing grid benefits.

# CONNECTING MEMBERS IN 2019



**A year of increased member services and benefits to serve ESA's 14% growth in membership—particularly municipal utilities, end-users, and transportation stakeholders—and 17% growth in ESA Leadership Circle members.**



The **2019 ESA Policy Forum** hosted in February in Washington, DC brought together more than 200 energy thought leaders and industry leaders to hear Senator Martin Heinrich (D-NM), FERC Chairman Neil Chatterjee, and other national and state policymakers



**The 2019 ESA Energy Storage Annual Conference & Expo**, held in April in Phoenix, Arizona, featured keynotes from industry leaders and major utilities, as well as a panel of solar, wind, investor owned utility and EV industry association executives to discuss the integration of energy storage into energy markets. It remains the only national conference for the industry by the industry, attracting more than 1,000 procurement decision-makers and approximately 2,000 participants.

At the conference, 36 storage industry leaders signed a pledge to prioritize safety in ESA's official launch of the **Energy Storage Industry Corporate Responsibility Initiative (CRI)**. By the end of 2019, almost 60 industry leaders have signed the ESA pledge and contributed to dozens of safety meetings, resulting in four new ESA educational resources. ESA and its members have worked for years towards the 2019 release of the NFPA 855 and UL 9540A energy storage standards and test methods.



**ESA Storage Exchange—Powered by EPRI**, held in October in Bellevue, Washington, featured a keynote by DOE Assistant Secretary Daniel Simmons and in-depth technical poster sessions that shared real-world experiences of successful integration and deployment practices in an engaging exchange of technical expertise and peer-to-peer ideas.

## LEADERSHIP CIRCLE ACTIVITIES

ESA connected its most active members involved at the Leadership Circle level with federal and state officials throughout the year to provide direct input from the industry on priorities and needs from government. With its Leadership Circle members, ESA facilitated two VIP roundtables, a multi-agency meeting of federal administrative officials, and approximately 25 meetings of ESA members with members of Congress on Capitol Hill.

## POLICY WORKING GROUPS

ESA members drive state and federal positions through subject-specific Policy Working Groups. In 2019, the Working Groups focused on Multiple-Use Storage, enabling storage to ensure compensation for multiple services in one or more domains, and Storage-as-Transmission. In 2020, Working Groups will focus on state storage deployment target design; long-term federal incentive framework for storage; and dual-use storage-as-transmission.

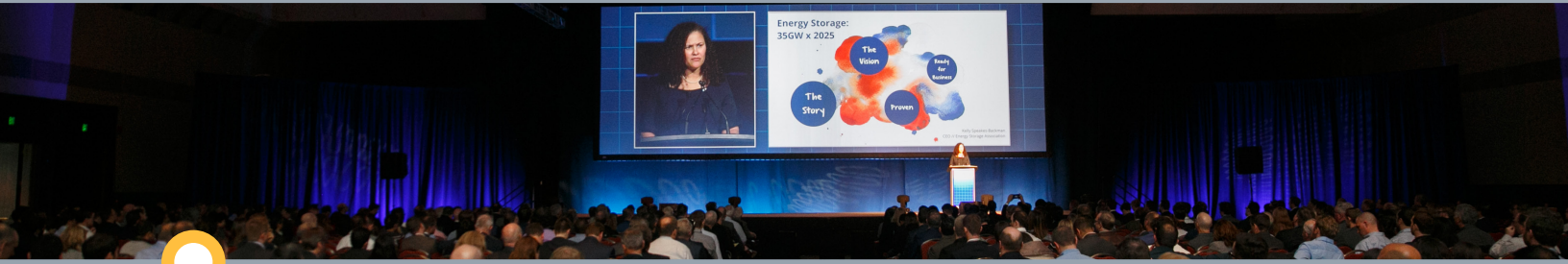
# EDUCATING STAKEHOLDERS IN 2019



**ESA is the central source on energy storage in all its forms—keeping members apprised of the latest in policy, technology and markets.**

- In partnership with Wood Mackenzie Power & Renewables, ESA issued four **U.S. Energy Storage Monitor quarterly reports and webinars**.
- ESA published five new **white paper resources**, including:
  - Emergency Response Plan template
  - Operational Risk Management in the U.S. Energy Storage Industry: Lithium-Ion Fire and Thermal Event Safety
  - U.S. Energy Storage Operational Safety Guidelines
  - Capacity Value of Energy Storage in PJM
  - Enabling Versatility: Allowing Hybrid Resources to Deliver Full Value
- ESA held **25 educational webinars** attracting 1,600 unique participants, including Storage 101 and storage*PLUS* series on how storage improves existing energy resources.
- ESA held an **integrated Resource Planning Seminar** for intensive training in resource planning.
- ESA made **new policy recommendations** on hybrid storage-plus-generation resources, proposed regulatory frameworks on storage-as-transmission and multiple-use storage; and more.
- ESA fielded more than **625 public and member assistance calls/emails** each month.
- ESA published **24 newsletters and blogs** highlighting RFPs and business opportunities in 2019.

# ESA—YOUR VOICE OF ENERGY STORAGE TO ACCELERATE MARKETS, CONNECT MEMBERS AND EDUCATE STAKEHOLDERS



**ESA is the central hub for storage policy, business deal making and educational events, delivered by the nation’s definitive source for energy information and premier advocate for energy storage.**

**New initiatives** in regional wholesale market research, Integrated Resource Portfolio planning, communications support, a national projects database, the role of storage in transportation, storage financing, and the Corporate Responsibility Initiative on safety practices, recycling and supply chain practices.

**Entire value chain coverage**, including manufacturers (storage and renewable energy systems, technology vendors, software providers, and storage supply chain manufacturers); implementers, (developers/IPP, integrators); services (finance, legal, analysis, and others); system operators (public and private utilities, independent system operators); public agencies, non- profits, and academics; end users; and transportation.

- 190 members: 14% increase in total membership in 2019;
- Growing participation of investor owned, municipal and cooperative electric utility members.

**ESA leadership represents a full diversity of value:**

- Half of 2019-2020 Board of Directors are Leadership Circle members, gaining the fastest insights on regional and state market opportunities;
- Half of Board are women executives;
- ESA’s Leadership Circle has increased 15% since EOY 2018, representing the full spectrum of the storage value chain;
- A Technical Advisory Council to guides ESA research, and provide input from national leaders in electricity and transportation analysis.

**Increased policy engagement**, including activities in **23 states**, the RTOs, and all major Federal venues in 2019:

- More than 60 speaking events, including providing public testimony at federal, RTO, or state legislatures;
- Nearly 50 filings, testimonies and letters of support at the state and federal regulatory levels;
- Tracked 32 bills in eighteen states on behalf of members;
- Meetings with approximately 40 Congressional offices and committees, including Senate & House leadership and key committees.

**Broad member services include:**

- Corporate Responsibility Initiative and emergency preparedness resources and peer networks;
- Communications Council of Members and Thought Leadership Program for peer information-sharing and member media promotion;
- Crisis communications and media toolkits;
- Technical Advisory Council-supported research programs; and
- Policy Partner and Sponsorship Partner opportunities for ESA member promotion; member-to-member introductions, careers portal, and more.

---

**Ninety-two interviews in 2019** with international, national, and local media about energy storage, with 116 media mentions on websites that reported a total of 455 million unique web visitors per month.

---

# COMING UP IN 2020

- **The ESA Energy Storage Annual Conference & Expo**, hosted August 26-28, 2020 at the David L. Lawrence Convention Center in Pittsburgh, Pennsylvania, is the one energy storage event led by the industry's premier voice. Attendees will be able to meet the experts, learn insights, and do deals.
- **Energy Storage Policy Seminar** series for new employees of ESA members.
- **New initiatives** in fire safety regulations; codes and standards; communications support; national projects database; and the Corporate Responsibility Initiative covering recycling and reuse, and supply chain practices.
- **Deeper and broader reach** into more segments of the value chain, including software and grid support providers, transportation, consumer segments, and other expanding demands for energy storage.
- **Members-only updates** on Wood Mackenzie's Energy Storage Monitor and the CES Storage IQ and continuing a diverse set of webinars on timely issues and broader topics important to the storage industry, which are open to nonmembers as well as members.
- **2020 advocacy priorities:**
  - Federal: Secure immediate relief from COVID-related economic stress on our members and the energy storage industry, including a storage ITC with direct pay or cash option; enact BEST Act to elevate public RD&D investment in storage; secure tariff exclusion for grid energy storage equipment.
  - Wholesale markets: Defend FERC Order 841 and continue to expand market rules on stand-alone and hybrid storage.
  - States: Advance deployment targets, behind-the-meter utility programs, and resource planning reform.



**2019 Cleanie Awardee  
for Woman of the Year,  
Kelly Speakes-Backman,  
CEO, U.S. Energy Storage  
Trade Association**

## ESA Vision

The U.S. Energy Storage Association is the leading national voice that advocates and advances the energy storage industry to realize its 35 GW by 2025 goal, resulting in a better world through a more resilient, efficient, sustainable, and affordable electricity grid.

## ESA Mission

ESA's mission is to accelerate the widespread use of competitive and reliable energy storage systems in North America. To achieve this mission, ESA will educate stakeholders, advocate for public policies, accelerate market growth, and deliver direct member value.

**ESA: Moving the U.S. toward a disruption-proof grid.**



[www.energystorage.org](http://www.energystorage.org)