Energy Storage Technology Advancement Partnership (ESTAP) Webinar:

State of the U.S. Energy Storage Industry: 2016 Year in Review

January 27, 2017

Hosted by Todd Olinsky-Paul
ESTAP Project Director
Clean Energy States Alliance
Housekeeping

All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded.

You will find a recording of this webinar, as well as all previous CESA webcasts, archived on the CESA website at www.cesa.org/webinars
State & Federal Energy Storage Technology Advancement Partnership (ESTAP)

Todd Olinsky-Paul
Project Director
Clean Energy States Alliance (CESA)
Thank You:

Dr. Imre Gyuk
U.S. Department of Energy,
Office of Electricity Delivery and
Energy Reliability

Dan Borneo
Sandia National Laboratories
ESTAP is a project of CESA

Clean Energy States Alliance (CESA) is a non-profit organization providing a forum for states to work together to implement effective clean energy policies & programs:

State & Federal Energy Storage Technology Advancement Partnership (ESTAP) is conducted under contract with Sandia National Laboratories, with funding from US DOE.

ESTAP Key Activities:

1. Disseminate information to stakeholders
   - ESTAP listserv >3,000 members
   - Webinars, conferences, information updates, surveys.

2. Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment

3. Support state energy storage efforts with technical, policy and program assistance

ESTAP Project Locations:

- Oregon: Energy Storage RFP
- New Mexico: Energy Storage Task Force
- New York: $40 Million Microgrids Initiative
- New Jersey: $10 million, 4-year energy storage solicitation
- Vermont: 4 MW energy storage microgrid & Airport Microgrid
- Maryland: $40 Million Resilient Power/Microgrids Solicitation; $10 Million energy storage demonstration program
- Connecticut: $45 Million, 3-year Microgrids Initiative
- Pennsylvania Battery Demonstration Project
- Hawaii: 6MW storage on Molokai Island and 2MW storage in Honolulu
- Kodiak Island Wind/Hydro/Battery & Cordova Hydro/flywheel projects
- Northeastern States Post-Sandy Critical Infrastructure Resiliency Project
- New York $40 Million Resilient Power/Microgrids Solicitation; $10 Million energy storage demonstration program
- Massachusetts: $40 Million Resilient Power/Microgrids Solicitation; $10 Million energy storage demonstration program
- Connecticut: $45 Million, 3-year Microgrids Initiative
- Pennsylvania Battery Demonstration Project
- Maryland Game Changer Awards: Solar/EV/Battery & Resiliency Through Microgrids Task Force
ESTAP

Project Director: Todd Olinsky-Paul
Contact: Todd Olinsky-Paul, Todd@cleanenergy.org

The Energy Storage Technology Advancement Partnership (ESTAP) is a federal-state funding and information sharing project, managed by CESA, that aims to accelerate the deployment of electrical energy storage technologies in the U.S.

The project’s objective is to accelerate the pace of deployment of energy storage technologies in the United States through the creation of technical assistance and co-funding partnerships between states and the U.S. Department of Energy.

ESTAP conducts two key activities:

1) Disseminate information to stakeholders through:

   - The ESTAP listserv (>2,000 members)
   - Webinars, conferences, information updates, and gatherings.

NEW RESOURCES

October 14, 2015
Resilience for Free: How Solar+Storage Could Protect Multifamily Affordable Housing from Power Outages at Little or No Net Cost
By Clean Energy Group

September 30, 2015
Webinar Slides: Energy Storage Market Updates, 9.30.15

UPCOMING EVENTS

December 16, 2015

LATEST NEWS

November 30, 2015
Massachusetts Takes the Lead on Resilient Energy Storage
Panelists

**Brett Simon**, Analyst, Energy Storage, GTM Research

**Dan Finn-Foley**, Senior Analyst, Energy Storage, GTM Research

**Todd Olinsky-Paul**, Project Director, Clean Energy States Alliance (Moderator)

Prepared For:

Brett Simon - Analyst, Energy Storage
Daniel Finn-Foley – Senior Analyst, Energy Storage

January 2017
About Greentech Media

News/Online
Greentech Media delivers business-to-business news, analysis and events at the forefront of the global energy transformation. Our coverage area extends across the clean energy industry with a focus on solar power and the electric utility market’s evolution. Greentech Media’s industry-leading coverage is provided by a team of analysts from our market intelligence arm, GTM Research, as well as our world-class journalists and global network of expert contributors.

Research
GTM Research is the market analysis and consulting arm of Greentech Media. GTM Research is comprised of analysts covering solar, grid edge, and energy storage markets. Our analysts combine diverse backgrounds in energy, environmental, emerging technology, information technology and strategic consulting sectors. This diverse team provides critical and timely market analysis in the form of research reports, consulting, and data subscription services.

Event
Greentech Media and GTM Research experts come together to produce all of Greentech Media’s industry conferences throughout the year. These summits provide a platform for our latest market intelligence and draw together the industry influencers from organizations across the value chain.
State of the U.S. Energy Storage Industry: 2016 Year in Review

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1. Deployment Trends

Front of the Meter

Behind the Meter

Total

Source: GTM Research

State of the U.S. Energy Storage Industry: 2016 Year in Review

Front of the Meter

Behind the Meter

Total

Q3 U.S. Energy Storage Deployments (MWh)

Q3 2013 Q3 2014 Q3 2015 Q3 2016

Source: GTM Research

Source: GTM Research

Source: GTM Research
California and PJM (Excl. NJ) Account for 81 Percent of Deployments Since Q1 2013

<table>
<thead>
<tr>
<th>Rank</th>
<th>Residential</th>
<th>Non-Residential</th>
<th>Utility</th>
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<tbody>
<tr>
<td>1</td>
<td>All Others*</td>
<td>California</td>
<td>PJM (excl. NJ)</td>
</tr>
<tr>
<td>2</td>
<td>California</td>
<td>All Others*</td>
<td>All Others*</td>
</tr>
<tr>
<td>3</td>
<td>Hawaii</td>
<td>PJM (excl. NJ)</td>
<td>California</td>
</tr>
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Source: GTM Research

*GTM Research is currently monitoring eight individual markets. Complete coverage of all markets is available in the full report.
Lithium-Ion Technology Continues the Trend of More Than 90% Share for the Eighth Consecutive Quarter

**Source:** GTM Research

**Note:** “Other” includes flywheel and unidentified energy storage technologies
2. Market Drivers and Developments
2016 Experienced Significant M&A Activity

Source: GTM Research / ESA U.S. Energy Storage Monitor
Behind-the-Meter Policy and Market Developments, Q4 2016

California
- SCE announced winners of the second round of the PRP program. AB 1637 doubled the SGIP budget. AB 2861 created rules for expedited grid interconnection dispute resolution. AB 2868 added an additional 500 MW to the Calif. energy storage mandate, with up to 125 MW of the total from behind-the-meter storage. CPUC required PG&E to procure additional contracts under DRAM. SoCalGas filed an SGIP advice letter regarding new programs rules on behalf of PG&E, SCE and CSE.

Washington
- Washington Department of Commerce announced funding winners under Clean Energy Fund 2.

New York
- New York City announced an energy storage target of 100 MWh by 2020. New York State Department of Public Service issued a Value of DER Straw Proposal.

Massachusetts
- MA DOER issued the State of Charge study in collaboration with independent consultants; also proposed adding provisions to the MA Solar Initiative to incentivize pairing solar PV and energy storage. Budget approved for ACES storage RFP with publication expected in November 2016.

New Jersey
- NJ Board of Public Utilities issued a draft for the Town Center Distributed Energy Resource Microgrid Feasibility Study Incentive Program, with up to $200,000 available for microgrid feasibility studies.

Nevada
- PUCN issued two orders soliciting comments for the state’s Energy Storage Initiative.

Source: GTM Research
New York City implemented the first city-wide energy storage mandate in the country, a 100 MWh target by 2025 to capture what the report calculates as more than $2.2 billion in potential value for ratepayers.

Massachusetts

The Massachusetts DOER has until the end of the year to decide whether to implement an energy storage mandate following the passage of H 4568. A study team that’s part of the Energy Storage Initiative published the State of Charge report, recommending a 600 MW storage target by 2025 to capture what the report calculates as more than $2.2 billion in potential value for ratepayers.

Federal

FERC held a technical conference on November 9 to examine the role of storage as a grid asset and obtain a baseline understanding of transmission and distribution grid applications. On November 17, it issued a notice for proposed rulemaking (NOPR) to open up wholesale markets for energy storage and aggregation.

Oregon

The Public Utility Commission of Oregon submitted UM 1751 in August, requesting comments on draft guidelines in response to HB 2193’s 5 MWh energy storage mandate.

California

FERC approves CAISO tariff revisions further recognizing energy storage. California State Legislature passes AB 33, directing the CPUC to examine energy storage for renewable integration, and AB 2868, potentially increasing the energy storage mandate by 500 MW. SCE and SDG&E move forward with Aliso Canyon energy storage procurements, with several going on-line in Q4 2016 and others scheduled for Q1 2017 totaling 84.5 MW.

Massachusetts

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SCE and SDG&E Have Contracted 84.5 Megawatts of Energy Storage As Part of Aliso Canyon Procurement

CA County Map Source: California Elections Website http://www.sos.ca.gov/elections/map/
Source: GTM Research

GTM Research Based on SCE and SDG&E announcements and procurement websites

Aliso Canyon Expedited Energy Storage Procurement Totals 84.5 Megawatts

SCE Aliso Canyon Awarded Procurements
1. Western Grid Santa Paula, 5 MW/20 MWh
   On-line target Q1 2017
2. AltaGas-Greensmith Pomona, 20 MW/80 MWh
   On-line target Q4 2016
3. Tesla Ontario, 20 MW/80 MWh
   On-line target Q4 2016
4. Powin Energy Irvine, 2 MW/8 MWh
   On-line target Q1 2017

SDG&E Aliso Canyon Awarded Procurements
1. AES Escondido 30 MW/120 MWh
   On-line target Q1 2017
2. AES El Cajon 7.5 MW/30 MWh
   On-line target Q1 2017

<table>
<thead>
<tr>
<th>SCE Procurement</th>
<th>SDG&amp;E Procurement</th>
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<tbody>
<tr>
<td>47 MW/4-hr. duration</td>
<td>37.5 MW/4-hr. duration</td>
</tr>
<tr>
<td>Multiple RFP winners</td>
<td>Single awardee</td>
</tr>
<tr>
<td>On-line 2016/2017</td>
<td>On-line 2017</td>
</tr>
<tr>
<td>New procurements</td>
<td>Procurements expedited</td>
</tr>
<tr>
<td>ordered from CPUC</td>
<td>from ongoing LCR program</td>
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Electric storage resources must be eligible to provide all capacity, energy and ancillary services that they are technically capable of providing in the organized wholesale electric markets.

The bidding parameters incorporated in the participation model must reflect and account for the physical and operational characteristics of electric storage resources.

Electric storage resources can be dispatched and can set the wholesale market clearing price as both a wholesale seller and a wholesale buyer consistent with existing rules that govern when a resource can set the wholesale price.

The minimum size requirement for electric storage resources to participate in the organized wholesale electric markets must not exceed 100 kW.

The sale of energy from the organized wholesale electric markets to an electric storage resource that the resource then resells back to those markets must be at the wholesale LMP.

Source: FERC Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, Dockets AD16-20 and AD16-23
3. Outlook
U.S. Energy Storage Annual Deployments Will Exceed 2 GW by 2021

Source: GTM Research

State of the U.S. Energy Storage Industry: 2016 Year in Review
Energy Storage Will Be a $2.8 Billion Market in the U.S. by 2021

Source: GTM Research

State of the U.S. Energy Storage Industry: 2016 Year in Review
Thank you!

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Interested in other GTM Research products and services? Please visit www.gtmresearch.com or contact sales@greentechmedia.com

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ESTAP Website: bit.ly/CESA-ESTAP
ESTAP Listserv: bit.ly/EnergyStorageList