Energy Storage: A Clean Capacity Alternative

NCSL Energy Supply Task Force
May 2012, Denver

Praveen Kathpal
praveen.kathpal@aes.com
State policy will impact energy storage adoption

- More options
  - Include energy storage in planning & procurement.

- Cleaner capacity
  - Include storage in clean portfolio standards.

- Accelerated benefits
  - Incentivize contracts with independently-owned storage.
AES operates power facilities in 27 countries.

Our mission is to improve lives by providing safe, reliable and sustainable energy solutions in every market we serve.

27,000 Global workforce
8,452 MW Capacity at AES utility businesses
33,814 MW Capacity at AES generation businesses
$17.2 Billion 2011 Revenue
AES is a diversified power generation & distribution company.

**Generation Portfolio by Fuel Type**
- Natural Gas: 39%
- Coal: 29%
- Renewables: 27%
- Other: 5%

**2012 Proportional Adjusted Gross Margin**: $3.6 Billion
- Utilities: 33%
- Generation: 67%

**Generation**
- 39 Generation businesses
- 36 GW of generating capacity

**Utilities**
- 13 Utilities companies serving 12 million customers
- Operate 8 GW of generating capacity

© 2012 The AES Corporation, All rights reserved.
AES has been serving U.S. utilities with reliability services for over 30 years.

**AES Products**

- Energy
- Clean Energy
- Capacity (R. A.)
- Regulation
- Voltage Support
- Spinning Reserve
- Transmission
- Distribution

**Utility Customers (U.S.)**

- Xcel Energy
- PG&E
- FirstEnergy
- Southern California Edison
- ODEC
- Direct Energy
- Alliant Energy
- Hawaiian Electric Company

© 2012 The AES Corporation, All rights reserved.
Commercial, battery-based storage performing in power markets.

98 MW Laurel Mountain Wind Project with 32 MW BESS Serving PJM Market
Energy storage deployments are providing warehouses and buffers on the grid.

<table>
<thead>
<tr>
<th>Year</th>
<th>Size</th>
<th>Owner</th>
<th>Location</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>27MW</td>
<td>Golden Valley Electric Association</td>
<td>Alaska</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>34MW</td>
<td>Japan Wind Development</td>
<td>Japan</td>
<td>Rokkasho Wind Farm</td>
</tr>
<tr>
<td>2009</td>
<td>12MW</td>
<td>AES</td>
<td>Chile</td>
<td>Los Andes</td>
</tr>
<tr>
<td>2010</td>
<td>8MW</td>
<td>AES</td>
<td>New York</td>
<td>Johnson City</td>
</tr>
<tr>
<td>2011</td>
<td>32MW</td>
<td>AES</td>
<td>West Virginia</td>
<td>Laurel Mountain</td>
</tr>
<tr>
<td>2011</td>
<td>10MW</td>
<td>First Wind</td>
<td>Hawaii</td>
<td>Kaheawa II</td>
</tr>
<tr>
<td>2011</td>
<td>15MW</td>
<td>First Wind</td>
<td>Hawaii</td>
<td>Kahuku</td>
</tr>
<tr>
<td>2011</td>
<td>20MW</td>
<td>AES</td>
<td>Chile</td>
<td>Angamos</td>
</tr>
<tr>
<td>2012</td>
<td>36MW</td>
<td>Duke Energy</td>
<td>Texas</td>
<td>Notrees</td>
</tr>
<tr>
<td>2012</td>
<td>8MW</td>
<td>Southern California Edison</td>
<td>California</td>
<td>Tehachapi</td>
</tr>
<tr>
<td>2012</td>
<td>11MW</td>
<td>Sempra Generation</td>
<td>Hawaii</td>
<td>Auwahi</td>
</tr>
</tbody>
</table>

*Under construction*
More power, less plant: Meet peak demand with existing resources

- Ability to charge at lower off-peak heat rates.
- Support for min. load requirements for other resources.
- No direct emissions from peak demand.
Utility managers face many challenges in making resource decisions.

- Operational flexibility
- Resource adequacy
- Emissions reductions
- Manage off-peak oversupply
- Transmission constraints
- Asset utilization
- Technological adoption
- Regulatory prudence
- Fuel price volatility
- Water rights
- Technology adoption
Energy storage is an alternative to building new peaking power plants.

Figure 1. July 2010 Projection of Need for New Capacity

LIPA eyes world’s biggest battery
400-megawatt proposal would store energy for peak usage

By CLAUDE SOLNIK

As it reviews proposals for up to 2,500 megawatts of electricity, including wind, solar, and power from industrial processes, the Long Island Power Authority (LIPA) is considering a 400-megawatt battery proposal.

Energy storage facility in Johnson City, N.Y.

"I think utility grid storage makes sense. It’s part of the equation we have to look at," said Robert Caruso, former KeySpan chairman and now chairman of the Advanced Energy Research and Development Authority.

"If we need to produce power, we can produce power nearly instantaneously," Caruso said.

Although lithium ion batteries are the most likely candidates, Kathpal said various innovations could allow large-scale projects.

Caruso said the largest generation of batteries is safer, more durable and more efficient than in the past, able to return about 98 percent of the power that’s stored.

"There’s a variety of technologies," Kathpal said. "Massive improvements have been made in battery technology in recent years."

While AES didn’t say how much the project would cost, Kathpal said the company believes “our overall value and not the cost alone” is the reason for moving forward.

AES plans to bring big batteries to Oregon's grid

By Lee van der Voo
Sustainable Business Oregon contributing writer
Energy storage improves reliability and efficiency.

System Reliability
- Capacity to meet peak demand.
- Double the bandwidth.
- Always available.

Energy Efficiency
- Improve utilization and efficiency of existing resources.
- Reduce reliance on peaking plants.

Planning Flexibility
- Rapidly site emissions-free capacity close to load.
- Avoid lengthy transmission siting challenges.
Double the bandwidth of new gas CTs instantaneously with more service hours and less waste.

**50 MW Gas Peaker**
- out of merit generation
- significant standby costs
- standby emissions

**50 MW Storage Unit**
- 0 direct emissions
- low standby costs

**grid service hours**
- Jan
- Dec

**flex range**
- 40 MW
- 100 MW

**minutes to dispatch**

**seconds to dispatch**
Energy storage can improve the utilization of our most efficient conventional generation.

2009 Capacity Factors. Source: EIA.
State policy recommendations to support energy storage adoption

**More options**
- **Include energy storage in planning & procurement.**
  - Utility/regional planning should evaluate storage as resource and transmission alternative.
  - RFPs for capacity should not be prescriptive on technology choices.

**Cleaner capacity**
- **Include storage in clean portfolio standards.**
  - A clean capacity standard would complement RPS rather than continued reliance on building new gas-fired CTs.
  - Existing RPS methodologies (e.g. biomass) can be borrowed to recognize emissions reductions from storage operations.

**Accelerated benefits**
- **Incentivize contracts with independently-owned storage.**
  - Private capital is prepared to invest in storage and provide reliability services to utilities under contract.
  - Allowing IOUs to earn a profit on contracts with storage owner/operators will accelerate customer benefits from storage.
More options: Include energy storage in planning & procurement.

Identification of resource options

Analysis of optimal resource portfolio

Procurement of additional resources

"[W]e believe that the Company’s next IRP would be well served by a discussion of electric storage technologies, and why they may or may not fit into the Company’s resource portfolio. “

(9) "Integrated resource plan" means an analysis describing the mix of generating resources, conservation, energy storage, and efficiency measures that will be used to meet electricity demand, including: (e) An assessment of energy storage systems on the utility and distributed generation scale, including an analysis of energy storage systems as an alternative or adjunct to building nonrenewable generating resources for ancillary services and new transmission or distribution lines for peak loads, and as a complement renewable energy facilities;
Cleaner capacity: Include storage in clean portfolio standards.

Status quo:
- Energy: Promote deployment of clean sources
- Capacity: Build new gas-fired combustion turbines

Clean Capacity Standards would complement existing RPS policies.
Accelerated benefits: Incentivize contracts with independently-owned storage.

Storage owner
- Private investors bear perceived technology risk.

Utility
- Makes PPA payments to storage owner and recovers costs in rates.

Customers
- Receives improved reliability and efficiency in electric service.

O.C.G.A. 46-3A-8:
Authorizes the Commission to determine an “additional sum” in PPA cost recovery (rather than a simple pass-through) to encourage purchases.

Can be adapted to the use of innovative technology resources such as storage.
State legislation on energy storage – enacted and proposed.

<table>
<thead>
<tr>
<th>State</th>
<th>Bill</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>S.607-B (Maziarz) A.3656-A (Cahill) Mar 2011</td>
<td>Removed a regulatory barrier for energy storage by adding batteries to the definition of “alternate energy production facilities”, thereby reducing PSC administration over construction and financing. Signed by governor Mar 25, 2011.</td>
</tr>
<tr>
<td>Texas</td>
<td>SB 943 (Carona) HB 1421 (Anchia) Jun 2011</td>
<td>Allowed energy storage resources to be classified as generation, and thereby owned/operated by a Power Generation Company. Signed by governor Jun 17, 2011. Implemented Nov 10, 2011 by TX PUC under control number 39657.</td>
</tr>
</tbody>
</table>