Highview Power

Solution
Liquid Air Energy Storage

Company Role
Designer, developer, licensor

Deployment Philosophy
Use proven equipment, suppliers & EPC

Contracting
Build Own Transfer – PPA – Turnkey & wrap

Facilities
5.5 MW built
200 MW under development
How Liquid Air Energy Storage works

1. Charge
2. Store
3. Discharge

Hot Recycle

Cold Recycle

Additional hot and cold thermal recycling increases efficiency
Modular deployment

50 MW
400 MWh
2.5 acres
Cost dynamics favorable to long duration

- Power
  - 10MW
  - 100MW
  - 1GW

- Duration
  - 2h
  - 4h
  - 12h
  - 24h

- Costs
  - $1,000 / kW
  - $50 / kWh
  - $600 / kW
Key characteristics

- Low cost for long duration
- No degradation
- Low standing losses
- Fast response capability
- Synchronous generation
- Safe and environmentally friendly

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed energy cost</td>
<td>$50 / kWh</td>
</tr>
<tr>
<td>Installed power cost</td>
<td>$1,000 / kW at 50 MW</td>
</tr>
<tr>
<td>Usable energy degradation</td>
<td>None</td>
</tr>
<tr>
<td>Roundtrip efficiency</td>
<td>60%</td>
</tr>
<tr>
<td>Standing losses</td>
<td>0.1% per day</td>
</tr>
<tr>
<td>Min. response time</td>
<td>&lt; 1 minute</td>
</tr>
<tr>
<td>Synchronous services</td>
<td>Inertia and VARs</td>
</tr>
<tr>
<td>Chemical hazard</td>
<td>None</td>
</tr>
<tr>
<td>Fire hazard</td>
<td>Low</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Low</td>
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</tbody>
</table>
Some value cases

California
High energy price spread due to solar and anti-fossil environment.

Revenue mix (%)
- Energy: 38%
- Regulation: 31%
- Spinning Reserve: 20%
- Capacity: 11%

Texas
High penetration of variable renewables. No capacity market.

Revenue mix (%)
- Energy: 79%
- Regulation: 16%
- Spinning Reserve: 5%

ISO-NE
Moderate renewables and still using gas.

Revenue mix (%)
- Energy: 32%
- Regulation: 27%
- Spinning Reserve: 19%
- Capacity: 22%

NYISO
Peaker replacement initiative. Highly constrained grid.

Revenue mix (%)
- Energy: 53%
- Regulation: 26%
- Spinning Reserve: 19%
- Capacity: 2%
## Economic sensitivities

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Economic Sensitivity</th>
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<tbody>
<tr>
<td></td>
<td>CA case</td>
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<tr>
<td>Capital cost</td>
<td>★★★☆☆</td>
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<tr>
<td>Degradation</td>
<td>★★☆☆☆</td>
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<td>Roundtrip efficiency</td>
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Thank you!

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