The Next Frontier in Energy Storage

June 16, 2021
Our History

2009: Amber Kinetics founded by Dr. Seth Sanders and Ed Chiao

2010: Awarded $3.6M DOE Grant

2012: Amber completes 5 kWh long-duration KESS prototype

2013: Amber completes Series A round

2014: Amber’s 25kWh long-duration KESS operational in Alameda, CA test facility, funded with $1.8M CEC Grant

2015: Amber signs agreement with Elemental Excelerator, based in Honolulu, HI

2016: Amber signs supply agreements with HECO, Emerging Power, and EEI

2016: Amber deploys two KESS units with customers in the Philippines

2016: Amber completes Series B round; awarded second, $2.0M CEC Grant

2017: First commercial supply agreements with multiple global customers

2017: Two-year cooperation agreement with Enel

2018: Hawaii Electric and China Solar + Flywheel projects operational

2020: Flywheel fleet reaches 255,000+ hours of cumulative field of operations globally
First Commercial 4-Hour Discharge Flywheel

- Minimal O&M
- No chemical reaction
- No GHG emissions
- Performs in heat & humidity
- 100% recyclable materials
- No water or active cooling
- No noise
- No fire risk

**MODEL 32**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>8 kW</td>
</tr>
<tr>
<td>Energy</td>
<td>32 kWh</td>
</tr>
<tr>
<td>Duration</td>
<td>4.0 hours</td>
</tr>
<tr>
<td>Cooling</td>
<td>Passive</td>
</tr>
<tr>
<td>Round-trip Efficiency (DC) (includes coasting loss)</td>
<td>&gt;86%</td>
</tr>
<tr>
<td>Cycle Life</td>
<td>11,000 (no daily limitation)</td>
</tr>
<tr>
<td>Design Life</td>
<td>30 years</td>
</tr>
<tr>
<td>Environmental</td>
<td>-20 to 50 C; 100% humidity</td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
</tr>
<tr>
<td>DC Bus Voltage</td>
<td>550-750 Vdc</td>
</tr>
<tr>
<td>Full Power Response Time</td>
<td>&lt; 1 sec</td>
</tr>
<tr>
<td>Average Coasting Loss</td>
<td>&lt; 65 watts</td>
</tr>
</tbody>
</table>
Grid Modernization

THE NEXT FRONTIER IN ENERGY STORAGE

DC to AC Inverter

Aggregated DC Power

AC power to POI

Wind + Solar

Grid

Control and Data

Flywheel Management System

Network

COMPANY CONFIDENTIAL
Daily Cycling with Lithium Ion Batteries

Lithium Ion batteries degrade faster with multiple, daily cycling. This increases overall project cost as the project needs to be oversized to maintain capacity.
CASE STUDY

Only Ruggedized Energy Storage Solution

CHALLENGE

• Harsh weather conditions
• Remote site (a challenge for both installation and maintenance)
• Extremely high altitude

SOLUTION

Amber Kinetics’ highly ruggedized flywheel technology made it the ideal solution to address the challenges surrounding the high altitude and harsh environment.

Successfully commissioned in July 2018, this installation provides energy firming, curtailment capture and power smoothing/ramp rate control seamlessly.
Utility of the Future

Challenge
With the traditional utility model rapidly changing, regulatory drivers, utilities are faced with unpredictable weather patterns, natural disasters, rolling power outages and outdated transmission and distribution networks.

Solution
West Boylston Municipal Lighting Plant (WBMLP) partnered with Amber Kinetics to install a 128kW/512kWh flywheel energy storage system in Massachusetts.

The flywheels are located next to an existing ground mounted solar array at a distributed energy generation facility. The flywheels were designed for energy arbitrage to reduce peak load and increase grid reliability.
In Their Own Words...

“Amber Kinetics’ flywheel demonstrates a consistent operational cost advantage over Li-ion systems in power rating, energy capacity and cycling. M32 presents unique characteristics, making it a suitable product for a wide set of applications.”
In Their Own Words…

“Lower levelized cost of energy storage versus other technologies”

“Full charge and discharge power available at all levels of charge”

“Can be cycled frequently with no impact to performance”

“Significantly longer life”

“Minimal maintenance”
Thank you!