Flywheel Technology Energy Storage for Grid Services

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Beacon Power Overview

- Public Company – NSDAQ: BCON
- Supplier of fast response frequency regulation using flywheel energy storage:
  - Merchant service provider
  - Seller of turnkey plants
- Operating commercially in ISO-NE since November 2008 (1-3 MW)
- 20 MW merchant plant in NY, complete April, 2011
- Second 20 MW merchant plant to break ground in 2011 in eastern PA
- Pursuing sales of turnkey plants in the US and internationally
1st 20 MW Flywheel Plant – NY

- 200 high-speed, high-energy 25 kWh/100 kW flywheels
- +/- 20MW Regulating range
- Energy storage capacity: 20 MW for 15 minutes
- 4 second full range response
- Provides ~20-40% of regulation for NY State

Highlighted by the White House as being one of the 100 Recovery Act Projects that are Changing America
2nd 20 MW plant -- Pennsylvania

- 20 MW facility in Hazle Township, Pennsylvania
- Identical to Stephentown, New York plant
- Located in PJM where interconnection process has begun
- PJM is a strong supporter of energy storage and Pay-for-Performance pricing
- Expected gross margin -- 80-85%
- Approx. $53 million cost ($16 MM cost reduction vs. Stephentown)
  - $24 million smart grid stimulus grant
  - $5 million PA state grant
Core Technology

Fourth-generation flywheel

- 100kW/ 25kWh
- Proven performance
- 2-3 times more effective than fossil generators
- 20-year design life
- 125,000 equivalent cycles
- Zero energy storage degradation over time
- Strong IP position
Flywheel Product Development

- Gen 1 and Gen 2 addressed telecommunication applications
- Over 1,000,000 hours of operation in the field without mechanical failure
- Only flywheel technology capable of addressing grid-scale applications

2000

Gen 1

2001

Gen 2

2004-05

Gen 3

2007-08

Gen 4

2006/2007

Successful demonstrations in California and New York

2008 - present

Commercial operation and service revenue
Basic 1 MW Plant Building Block

- Transformers and support equipment
- Ten 100 kW / 25 kWh flywheels
- Electronics and controls inside container
What is Frequency Regulation?

Animation available at www.beaconpower.com
Renewables Need more Regulation

Expected increase in Regulation capacity (MW) requirements at 20% and 33% RPS (Spring*)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2012</th>
<th>2020</th>
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</thead>
<tbody>
<tr>
<td>Maximum Regulation Up Requirement (MW)</td>
<td>277</td>
<td>502</td>
<td>1,135</td>
</tr>
<tr>
<td>Maximum Regulation Down Requirement (MW)</td>
<td>-382</td>
<td>-569</td>
<td>-1,097</td>
</tr>
</tbody>
</table>

Requirement increases by 300% with 33% wind

“PJM expects the requirement for regulation to increase from 1,000 MW today to 2,000 MW when we reach 20% wind penetration.”

– Terry Boston, CEO of PJM
Storage Week conference, July 13, 2010

Requirement increases by 60% with 10% wind

Requirement increases by 200% with 20% wind
ACE Correction Example

- 9MW of Flywheels dispatched
- 275 MW total contracted *

3.3% of regulation from Flywheels

- 7.4 MWh managed by flywheels
- 31.1 MWh Total ACE energy dispatched **

23.8% ACE correction from flywheels

Max benefits come from fast first and dispatch at full power

** ACE data provided by NYISO Customer Relations on 3/4/2011
Strong FERC support

✓ FERC issued Order 890 directing ISOs to open regulation markets to non-generation assets

✓ Asset Class – Energy storage-based regulation, separate from generation and demand response

✓ Energy Settlement – Net at wholesale price

✓ Energy Management – Grid operator controls state of charge

✓ Optimized Dispatch – Fastest resources are dispatched first

✓ Pay for Performance – Payment in proportion to regulation effect actually provided, not just the capacity offered
# Future Flywheel Models

<table>
<thead>
<tr>
<th>Power/Energy</th>
<th>Time</th>
<th>C-rate</th>
<th>Primary application</th>
<th>Comment</th>
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<tbody>
<tr>
<td>100kW/25kWh</td>
<td>15 min</td>
<td>4C</td>
<td>• Frequency Regulation</td>
<td>In production</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Micro grid load following</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Ship power</td>
<td></td>
</tr>
<tr>
<td>500kW/12 kWh</td>
<td>+/- 45 sec</td>
<td>50C</td>
<td>• Frequency Response</td>
<td>Current model modified with big motor, half-rim</td>
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<td></td>
<td></td>
<td></td>
<td>• Rail</td>
<td></td>
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<td></td>
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<td></td>
<td>• UPS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Pulse power</td>
<td></td>
</tr>
<tr>
<td>100kW/100kWh</td>
<td>1 hour</td>
<td>1C</td>
<td>• Renewable ramp mitigation</td>
<td>ARPA-E funding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• UPS</td>
<td>85-90% cost reduction / kWh</td>
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<td></td>
<td></td>
<td></td>
<td>• Fast reserve</td>
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<td></td>
<td></td>
<td></td>
<td>• Peak shaving</td>
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Zero-emissions flywheel energy storage ... is a better performing, more cost-effective regulation asset... a much better match for clean renewable energy...