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DOE Peer Review

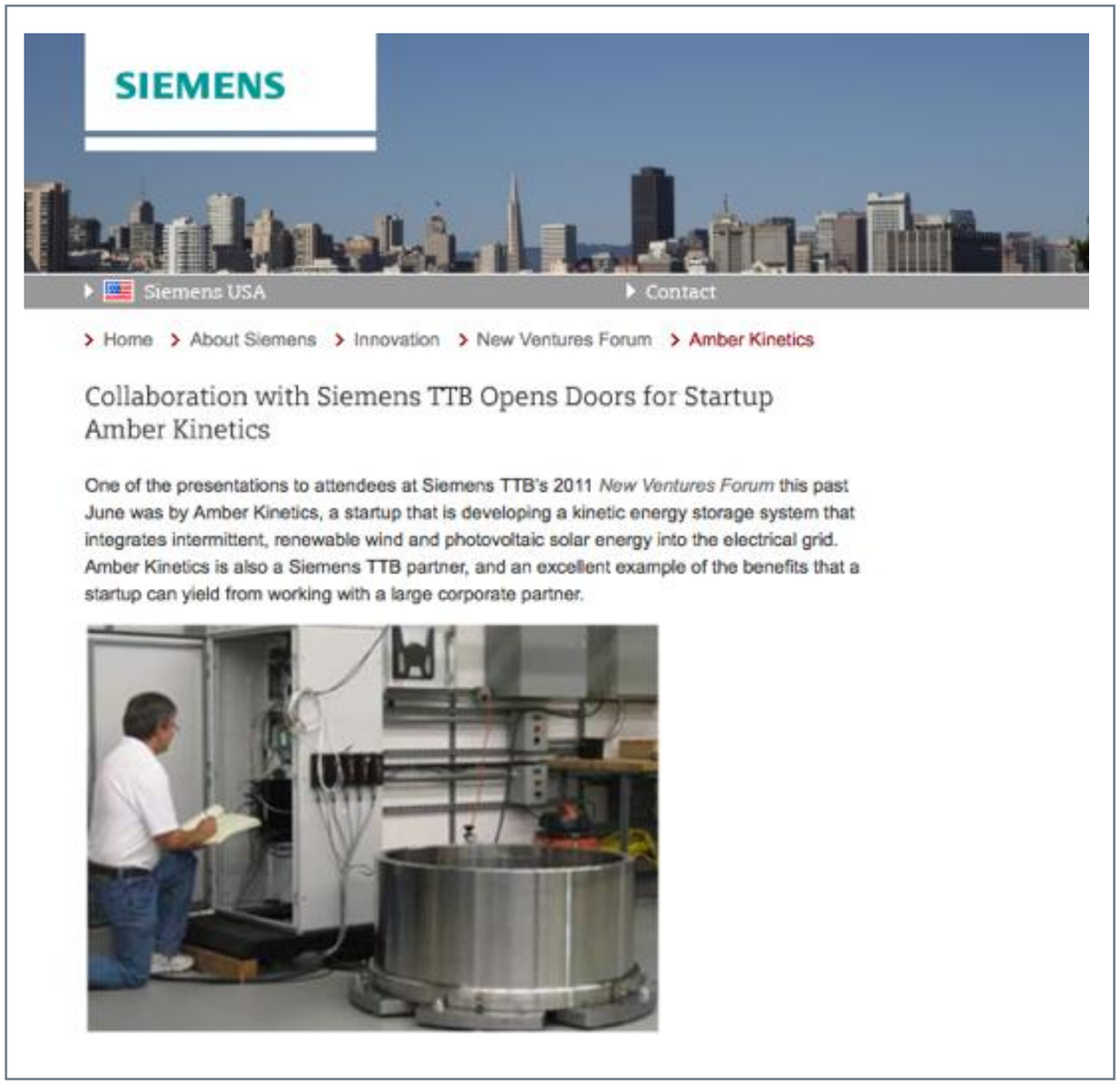
October 20-21, 2011
Ed Chiao, CEO

Amber Kinetics: Our Flywheel History

Stanford University	Start-up launched in 2009, Stanford University Cleantech Entrepreneurship class
Lawrence Livermore National Laboratory	Established a technology licensing & flywheel development partnership with LLNL; Amber Kinetics identified new material & lower-cost rotor designs for commercialization
U.S. Department of Energy	Awarded a Smart Grid Energy Storage Demonstration grant award for flywheels
California Energy Commission	Awarded a matching grant for development & demonstration of flywheel technology

World-class institutions | innovative, deep flywheel technology owned by Amber

Siemens Partnership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Collaboration with Siemens TTB Opens Doors for Startup Amber Kinetics

One of the presentations to attendees at Siemens TTB's 2011 *New Ventures Forum* this past June was by Amber Kinetics, a startup that is developing a kinetic energy storage system that integrates intermittent, renewable wind and photovoltaic solar energy into the electrical grid. Amber Kinetics is also a Siemens TTB partner, and an excellent example of the benefits that a startup can yield from working with a large corporate partner.

Partnership Goals:

2011: Technology Development
2012: Scale & Commercialize
2013: Utility-Scale Demonstrations in CA

Program Schedule

Technology Development

Commercial Product Development

Field Installations

0 months

16 months

32 months

48 months

2010 | 2011 | 2012 | 2013 | 2014

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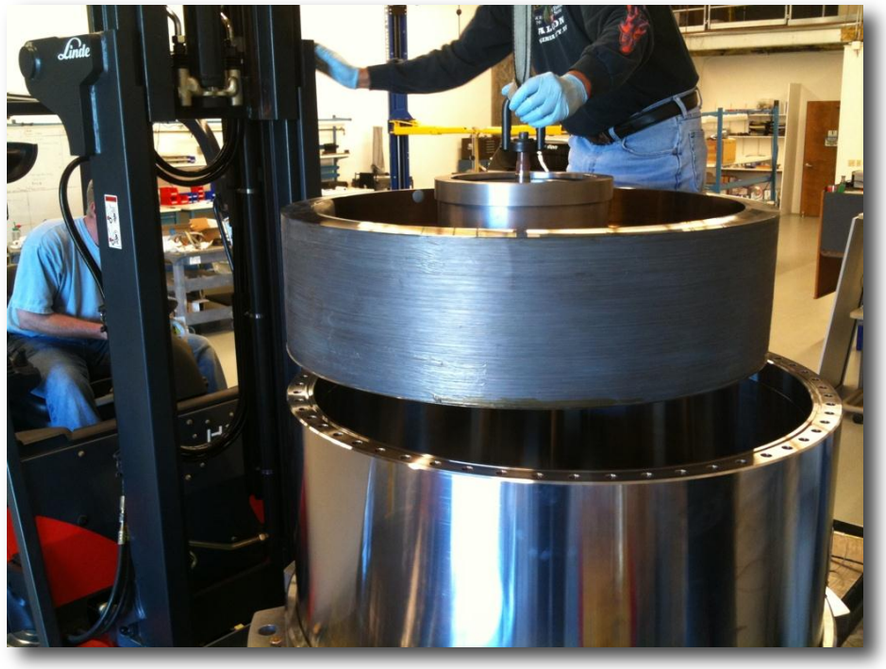
Technology Milestones: Spin Testing

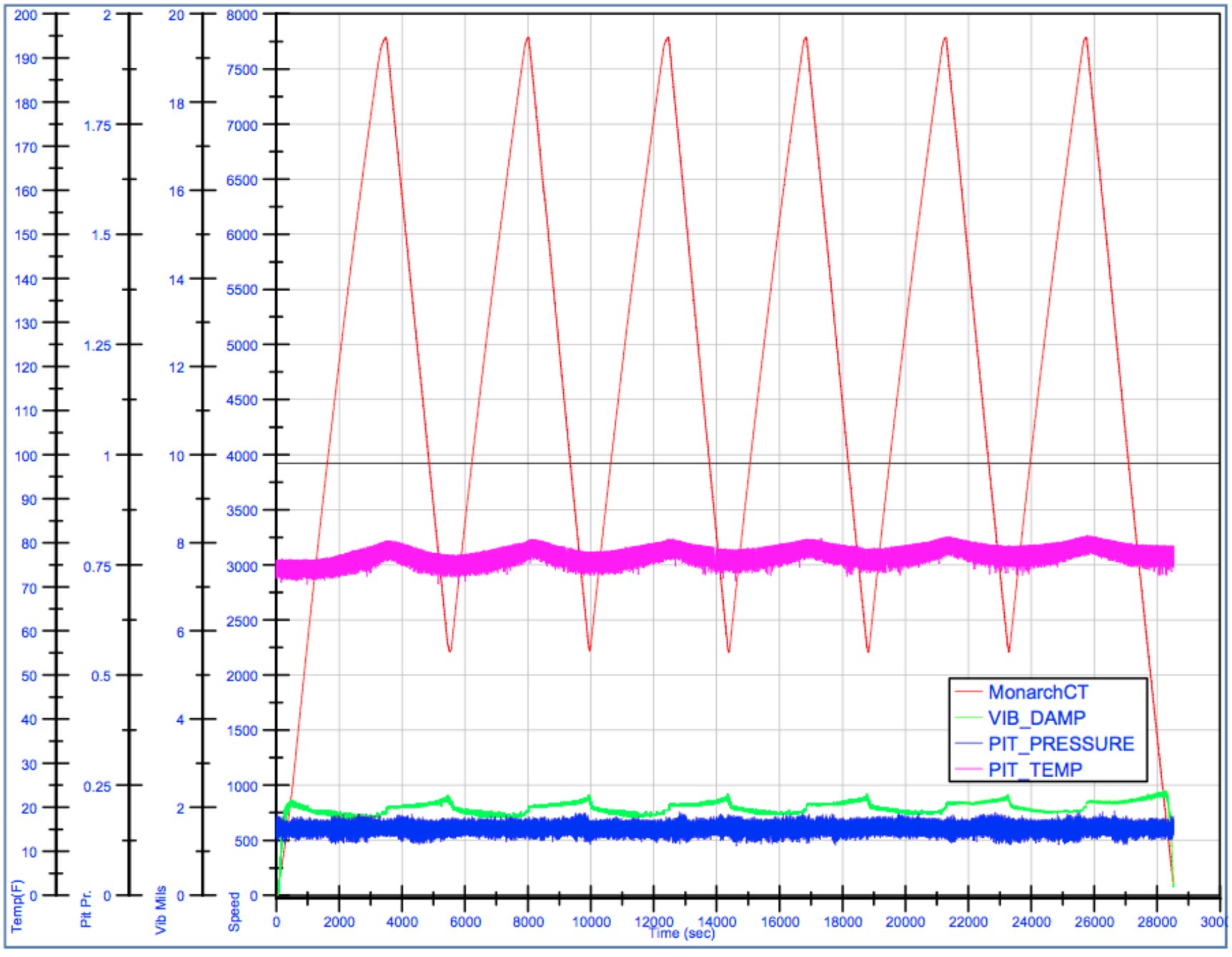


Spin Testing

Reinforced Spin Pit Assembly

Operated to 200% of design speed; no imbalance, run-out growth, or fatigue

Spin Test Cycling Results



- Nearly 400 m/s tip speed

- No run-out growth; excellent balance characteristics

- Low cost material

- Low cost MFG

Technology Milestones: Prototype Flywheel System

Generation One: Prototype 20 kW | 5 kWh Flywheel System

Result: High round-trip efficiency measured, < 1% energy coasting losses

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Next Steps: Generation 2 Flywheel System

Amber Kinetics 500kW | 125kWh
Generation 2 Flywheel
(dimensions: 5 ft W x 12 ft L)

Innovation:

Amber Kinetics flywheel rotors employ low cost, **high-strength steel**

Material is twice as strong as traditional steel

1/20th the cost of carbon fiber & simpler to manufacture

Material is mature; rotor design is **scalable**

Lower balance-of-system costs

Carbon fiber rotors cost 20x more

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Amber Kinetics: Focus on Applications

Lower Cost Steel Flywheel Rotor

+

Economies of Scale (Larger Flywheel System)

< 1/2 Capital Cost ($ / KW)

vs. traditional flywheels

Our Focus: “Seconds to Minutes”

2013: Grid-Scale Demonstration in CA

Amber Kinetics & Siemens Partnering to Co-Develop & Demonstrate Grid-Scale Flywheel Systems

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thank_you

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