Electrochemical Energy Storage for the Grid

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2MW, 0.5 MWh Li-ion battery

Daimler Orion/BAE Systems

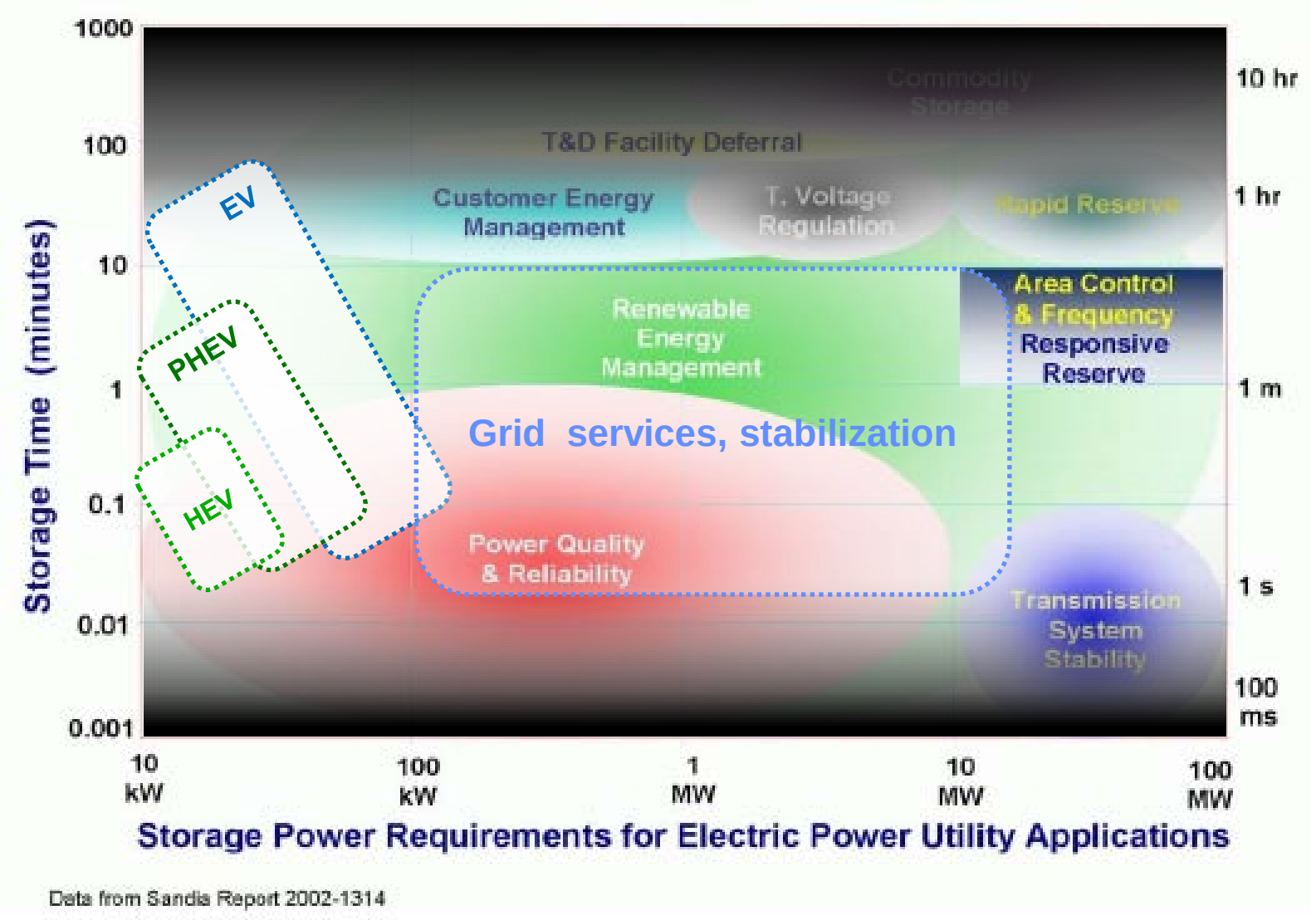

F1


Fisker Karma PHEV

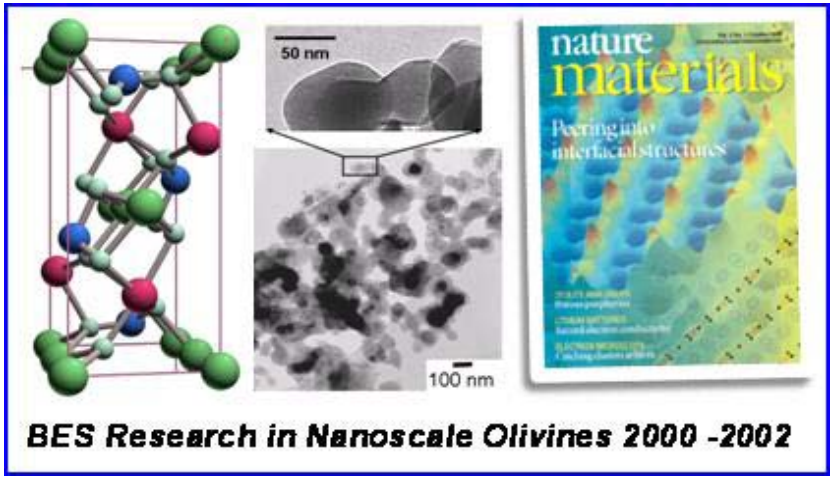

Hymotion PHEV

Ohio State Univ Buckeye Bullet 2.5

Automotive Li-Ion Battery Development is Driving Down Battery Cost, Improving Performance, Enabling Grid Applications



A123 Example: Government-Private Partnership Through Cycle of Innovation and Commercialization



BES Research in Nanoscale Olivines 2000 -2002

USABC Program, 2006
Multiple Vehicles, 2007
ARRA Manufact., 2009

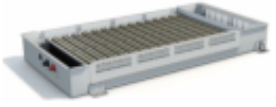
A123's Nanophosphate™ Technology Is Used In Three Core Markets

New Classes of Products Have Been Enabled by Advanced Energy Storage

Transportation

Passenger Hybrids, PHEVs and EVs

Commercial Hybrids, PHEVs and EVs



- Fuel economy
- Reduced emissions
- Energy independence
- Lighter-weight components
- Fuel efficiency

Electric Grid

Smart Grid Stabilization Systems

Network Energy Storage

- Increase grid reliability
- Enable Wind and Solar
- Increase plant efficiency/utilization

Consumer & Industrial

Portable and Mobility

Stationary

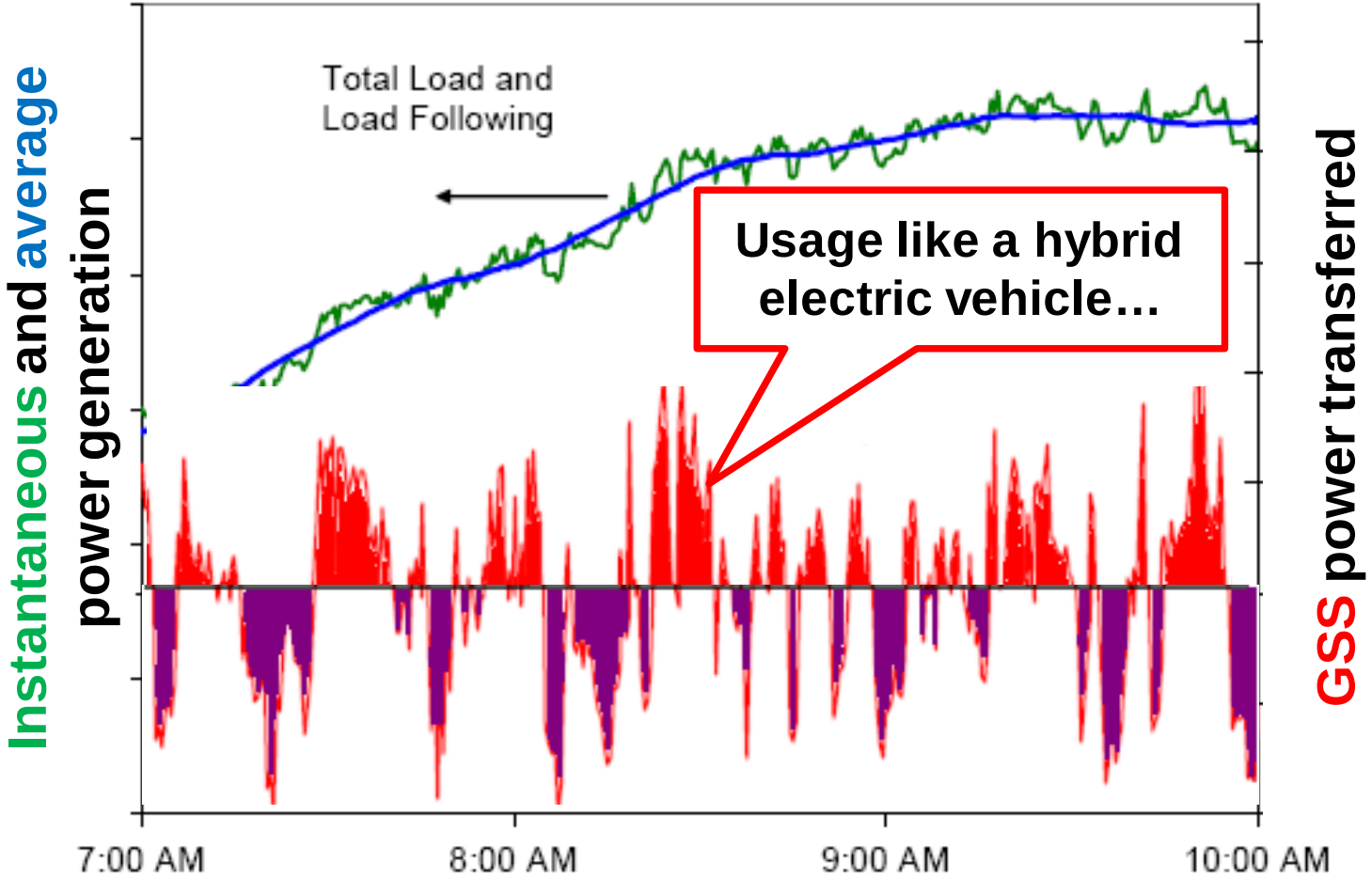
- Improve performance
- Reduce emissions
- Reduce toxic battery chemicals

Drivers

Eight A123 Systems SGSSs™ units providing 16 MW installed on the grid in Chile, performing "spinning reserve" grid stabilization services

Photo courtesy of AES

Frequency Regulation Application: "Hybridizing" Power Plants With Li-Ion Batteries



ISO Regulation Example

The Problem:

- Thermal plants providing regulation operate less efficiently, have increased O&M costs and worse emissions

20MW SGSS ISO Regulation Installation in Westover, NY

The Solution:

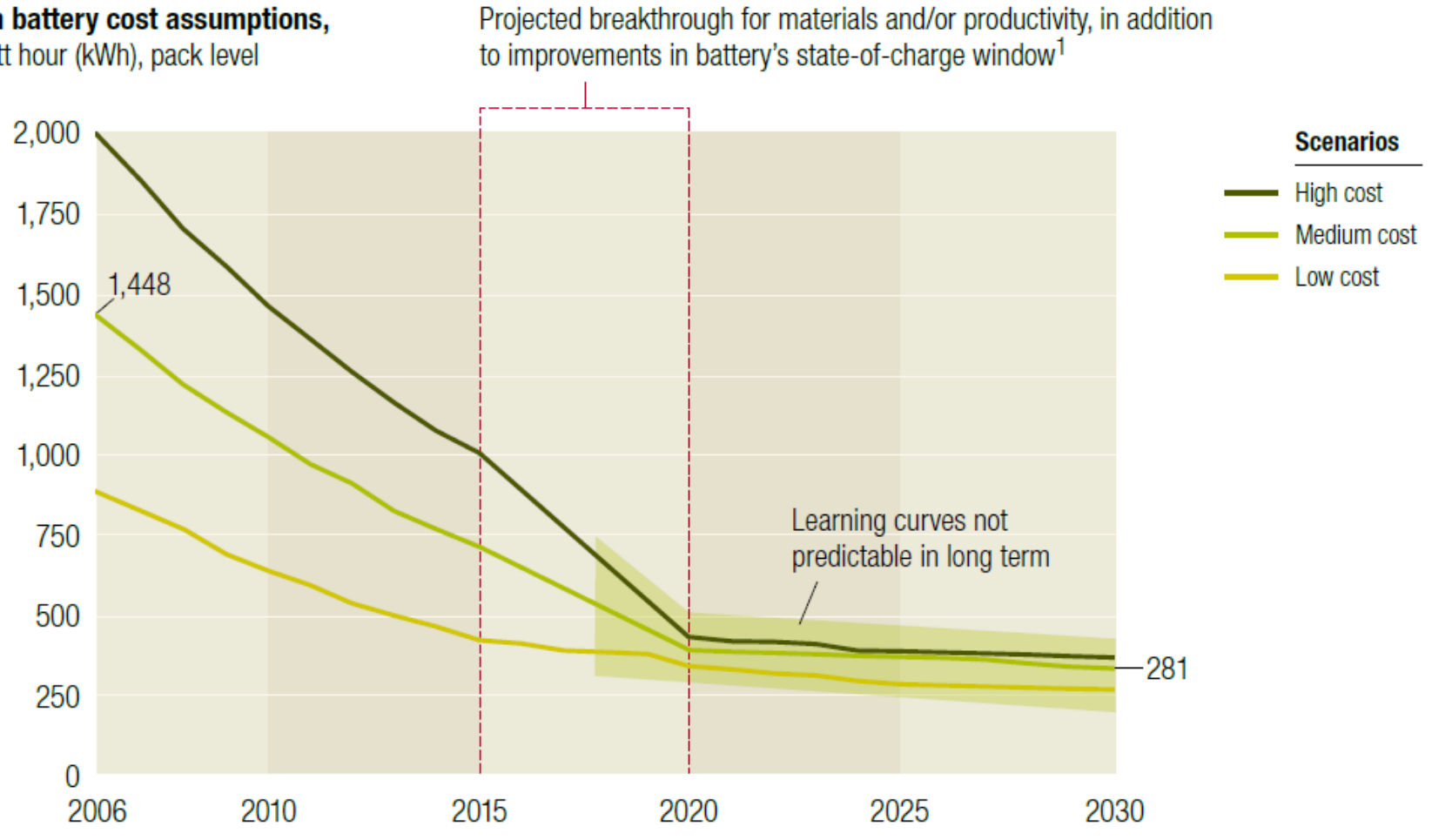
- 20MW **Smart Grid Storage System (SGSS)** in U.S. ISO
- Even with historic low natural gas prices, achieve 3 year payback
- **Improve emissions by >50%**

Wind Firming Example: Tehachapi Storage Project

- Customer: Southern California Edison
- Location: Tehachapi Windfarm
  - California's largest wind resource
  - Wind development potential driving grid infrastructure upgrades and expansion
  - 2nd largest wind park in the world
    - 660MW installed / ~5,000 turbines
- System
  - 8MW – 4 hour (32MW-hour) GBS system
    - World's largest Li-ion battery system when complete
  - Dynamic 4-Quadrant PCS/Grid Interface
  - A123 Prismatic Cells
  - Installation / Operation 2012
  - 13 Targeted Operational Uses – Individually and Stacked

Recent Studies Predict Li-ion Battery Pack Costs Will Reach $330-$400/kWh at Scale

Lithium-ion battery cost assumptions,
$ per kilowatt hour (kWh), pack level



[1] State-of-charge window, is the available capacity in a battery relative to its capacity when full. Conservative applications work within a 65% window, whereas more aggressive applications use 80%; over the next 5 to 10 years, most applications will likely migrate to the higher value.

(McKinsey, 2010)

Future: Pumped Hydroelectric Is Lowest Cost Storage (~$100/kWh), can this be done with electrochemical storage?

- 1872 MW output (21.5 GW total in U.S.)
- 15,000 MWh stored energy
- 2.5 x 1 mile, 842 acres
- Elevated 400 ft above Lake Michigan

The End