



# Energy storage as a critical enabler for automotive applications

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Advanced Powertrain Forum

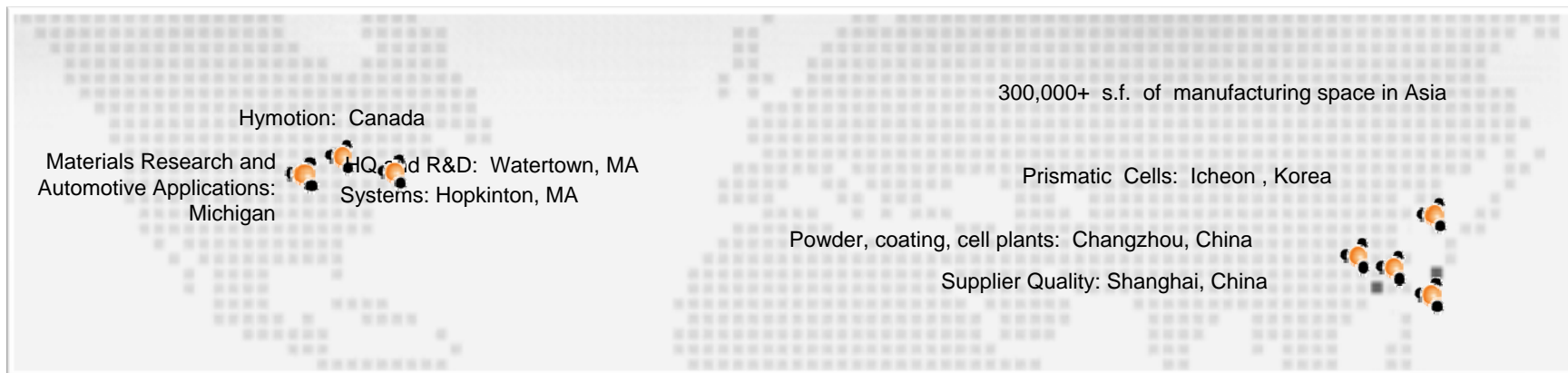
Transcending Turbulence, MBS 2008

August 15, 2008

Traverse City, MI

# About A123

- Developer of Nanophosphate™ high power lithium ion technology
- >1200 employees in multiple locations worldwide
- DOE USABC awards: \$15M for HEV and \$12.5M for PHEV



**Massachusetts  
Institute of  
Technology**

*Cordless  
Power*

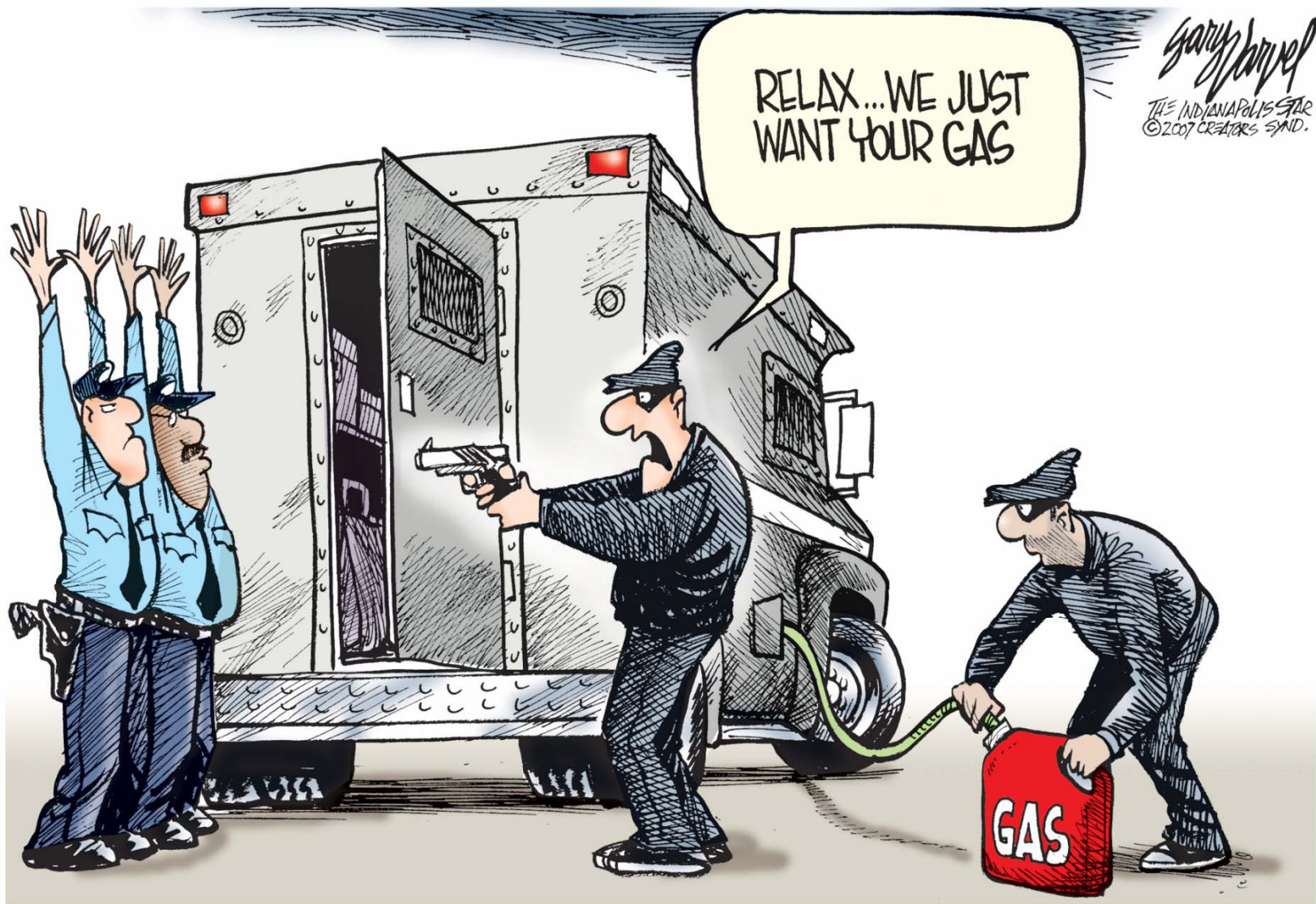


*Grid  
stabilization*



*Transportation*





garvvarvel.com

# The Perfect Storm

- Global warming
- Increased demand, reduced supply
- National Security, Energy independence



**an inconvenient truth**

Two huge industries are transforming  
and a new one is emerging...

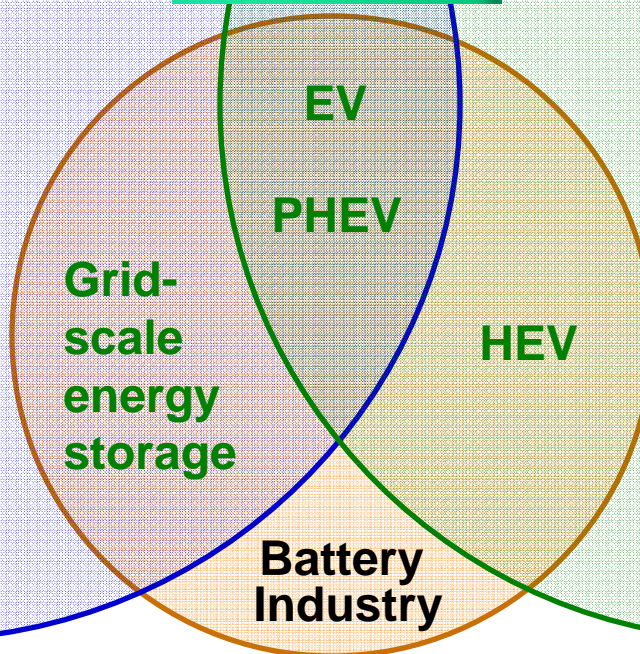


Battery  
Industry

# Energy storage is the interface

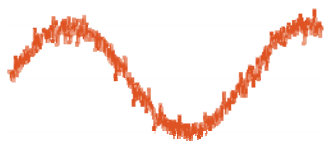
Power Industry

Auto Industry



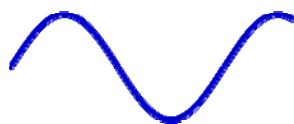
Result: increased demand for energy storage, driving reduced cost.

# “Hybrid” power plant



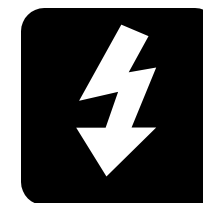
Demand

=



Generation

+



Energy storage

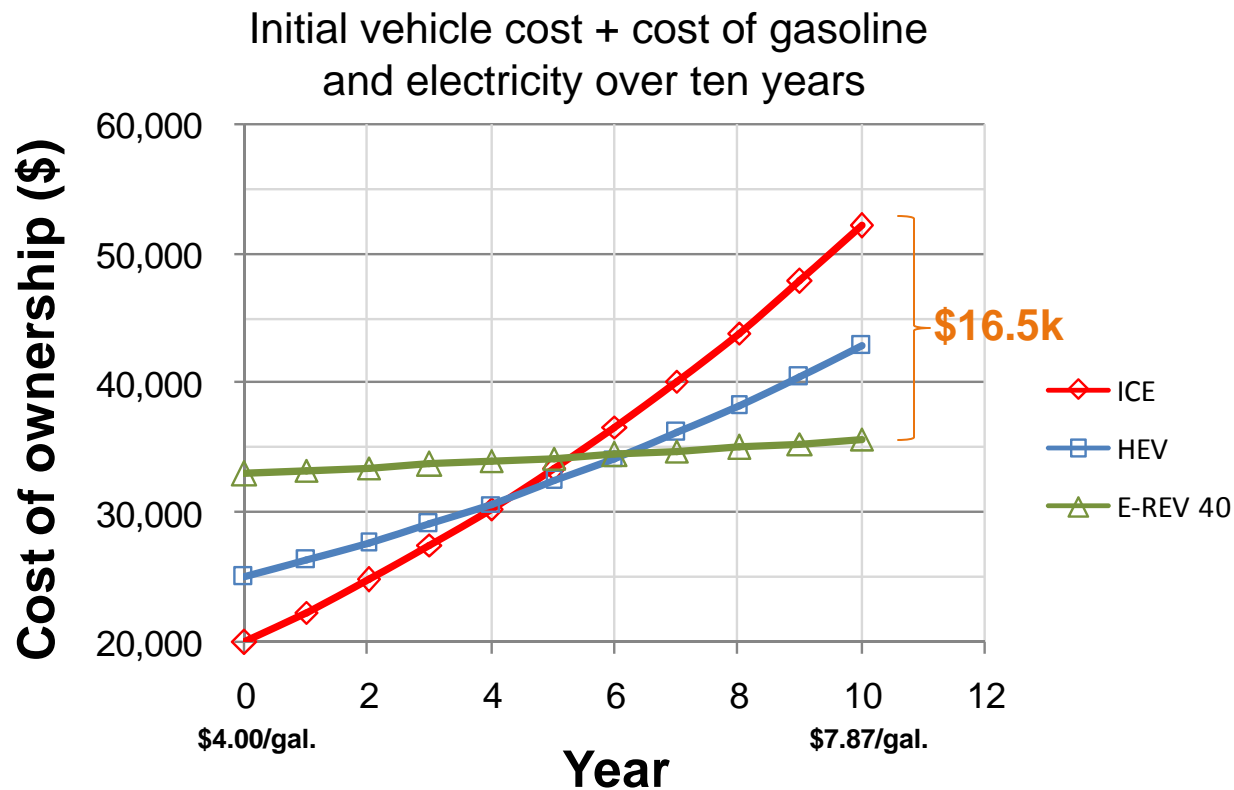
“Hybrid” power plant

Energy storage buffers short-term changes in demand, allowing the power plant to operate more efficiently.

A123 is building multi-MW systems for the power industry.

# Business case for electrification of vehicles

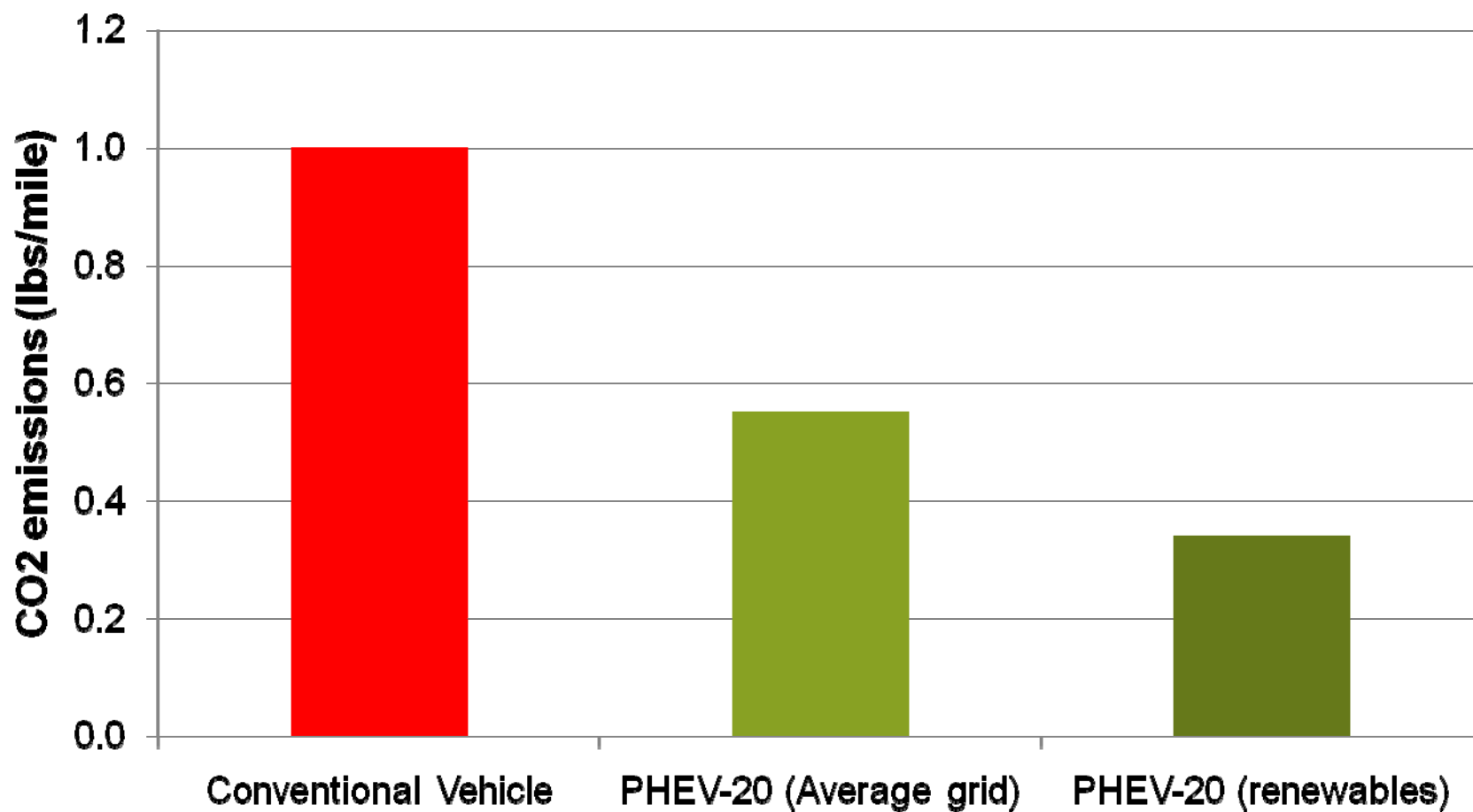
- 15k miles/year, \$4/gallon with 7% yearly increase



Additional economic considerations:

- Tax credits
- Avoiding surcharges
- Cheaper electricity off-peak
- Reduced vehicle maintenance
- Residual battery value

# PHEVs reduce CO<sub>2</sub> emissions

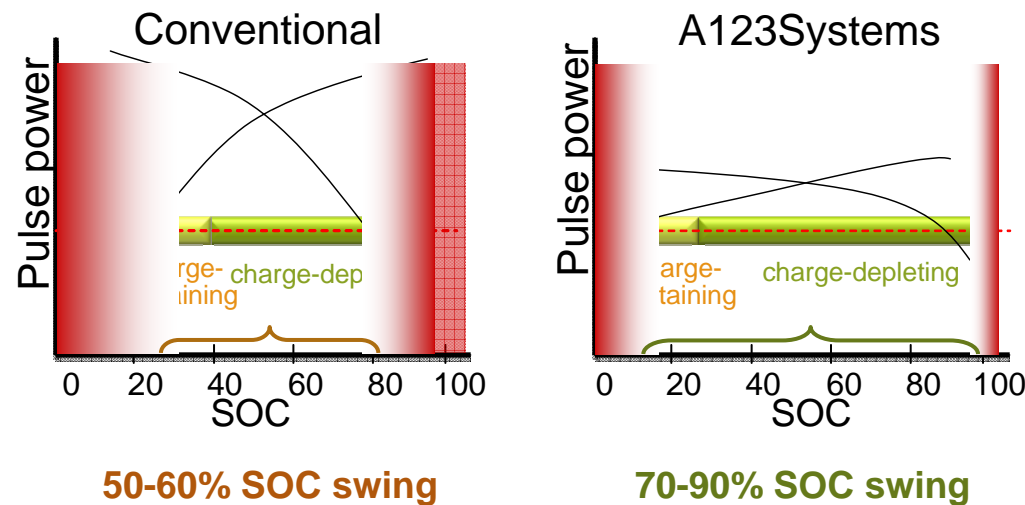


NRDC, July 2007 "The Next Generation of Hybrid Cars: Plug-in Hybrids Can Help Reduce Global Warming and Slash Oil Dependency"

# A123 for PHEV

A123's technology is well-suited for PHEV and extended-range EV applications

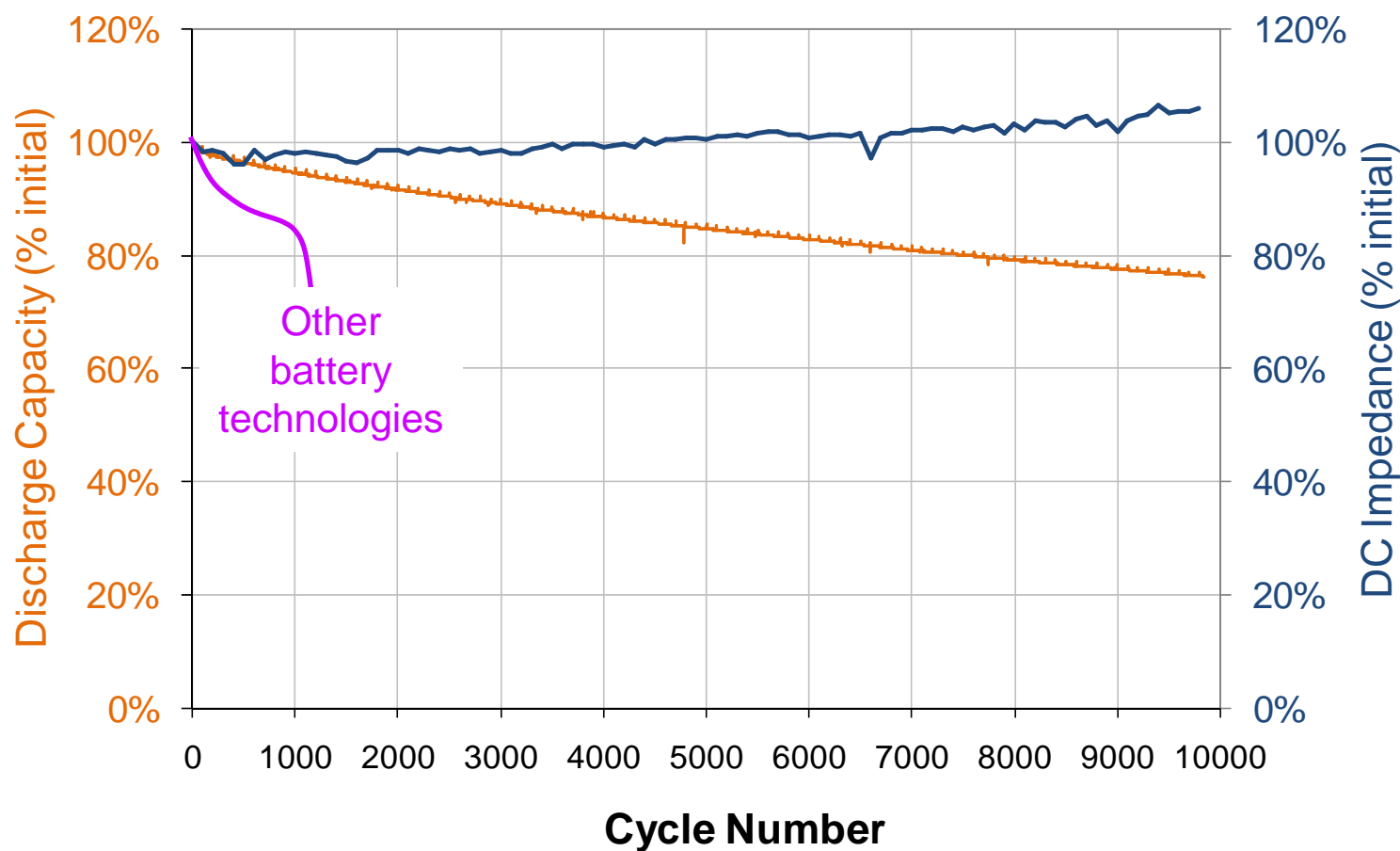
- power. Flat power vs. SOC curve = lower SOC setpoint for HEV operation = higher useable energy
- safety. Superior abuse tolerance allows charging to high SOC = higher useable energy
- life. Excellent deep-discharge cycle life = higher SOC swing = higher useable energy



power. safety. life. = energy.

# Uniform, predictable degradation

Low rate, 100% depth of discharge (DOD) cycling



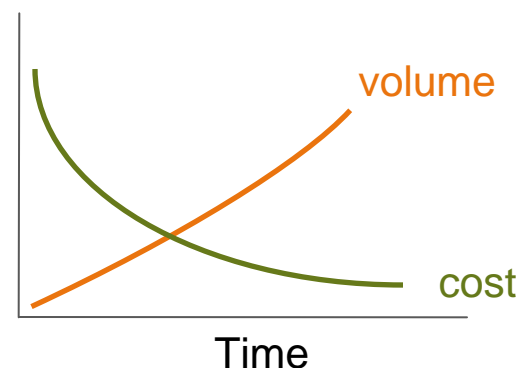
# New business models are emerging

- Predictable degradation, residual battery value at end of life
  - Battery leasing
  - Secondary usage
- EV infrastructure (charging or battery swapping)
- Distributed energy storage



# Looking forward

1. Higher volumes drive manufacturing efficiencies, reducing cost
2. “Smart” cells that use chemistry to eliminate cell management components and reduce cost:
  - Cell balancing
  - Materials stable over wide range of temperature (to reduce cooling load)
  - Prevention of abusive environment (voltage, temp)



# Enabling<sup>+</sup>

A New Era of Sustainable Transportation



[www.a123systems.com](http://www.a123systems.com)