Advancing the Deployment of Electric Vehicles

Patrick Davis, Program Manager,
Vehicle Technologies Program
U.S. Department of Energy
October 2, 2012

- **Research and Development**
- **Deployment & Training**
- **Recovery Act Manufacturing**
- **EV Everywhere**

Electric Drive Vehicle R&D

Organizations

- *ARPA-e*
- *EERE Vehicle Technologies Program*
- *Office of Science*

Technologies

- *Batteries: Li-ion and beyond Li-ion technologies*
- *Power Electronics: wide bandgap devices, capacitors, electrical architectures, packaging, charging*
- *Electric Motors: Non-permanent and PM magnet motors, new magnetic and motor materials*
- *Traction Drive System*
- *Thermal management*
- *Vehicle Systems – HVAC, Wireless Charging*

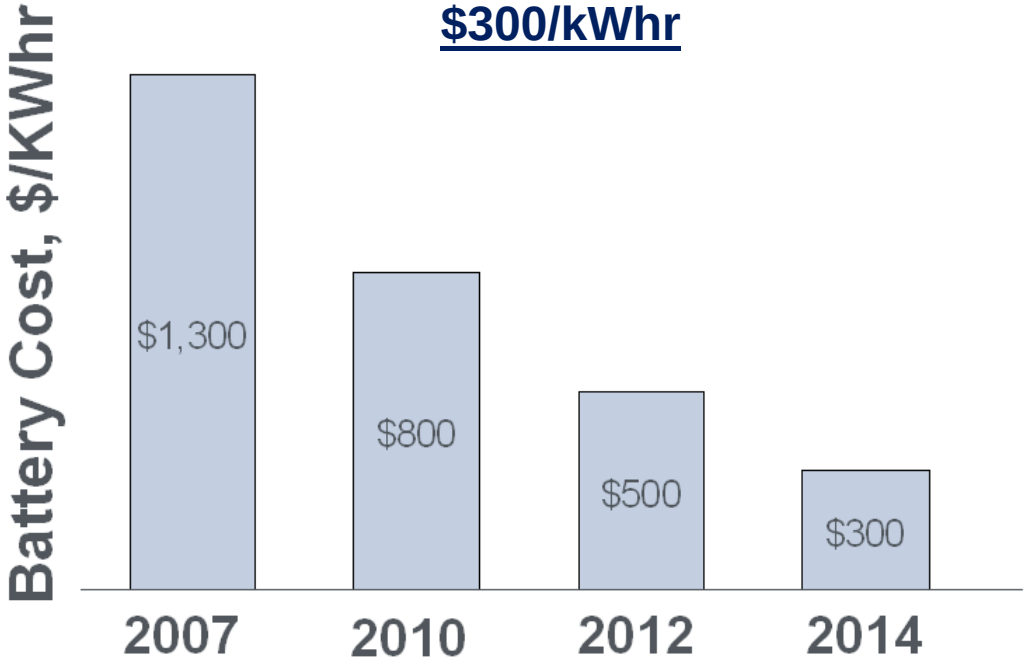
Major Goals

- *By 2020, develop an electric drive system with a cost of $8/kW and efficiency of >94%*
- *Battery goal: Reduce EV battery production cost to $300/kWh by 2015 and $125/kWh by 2022 while also improving abuse tolerance and range*

Approximately Half of the EERE Vehicle Technologies FY12 and FY13 Budgets Support Electric Drive

Battery Costs are Coming Down Quickly

Plug-In Hybrid Battery Cost on Track to Meet 2014 Goal of $300/kWhr



Future Direction

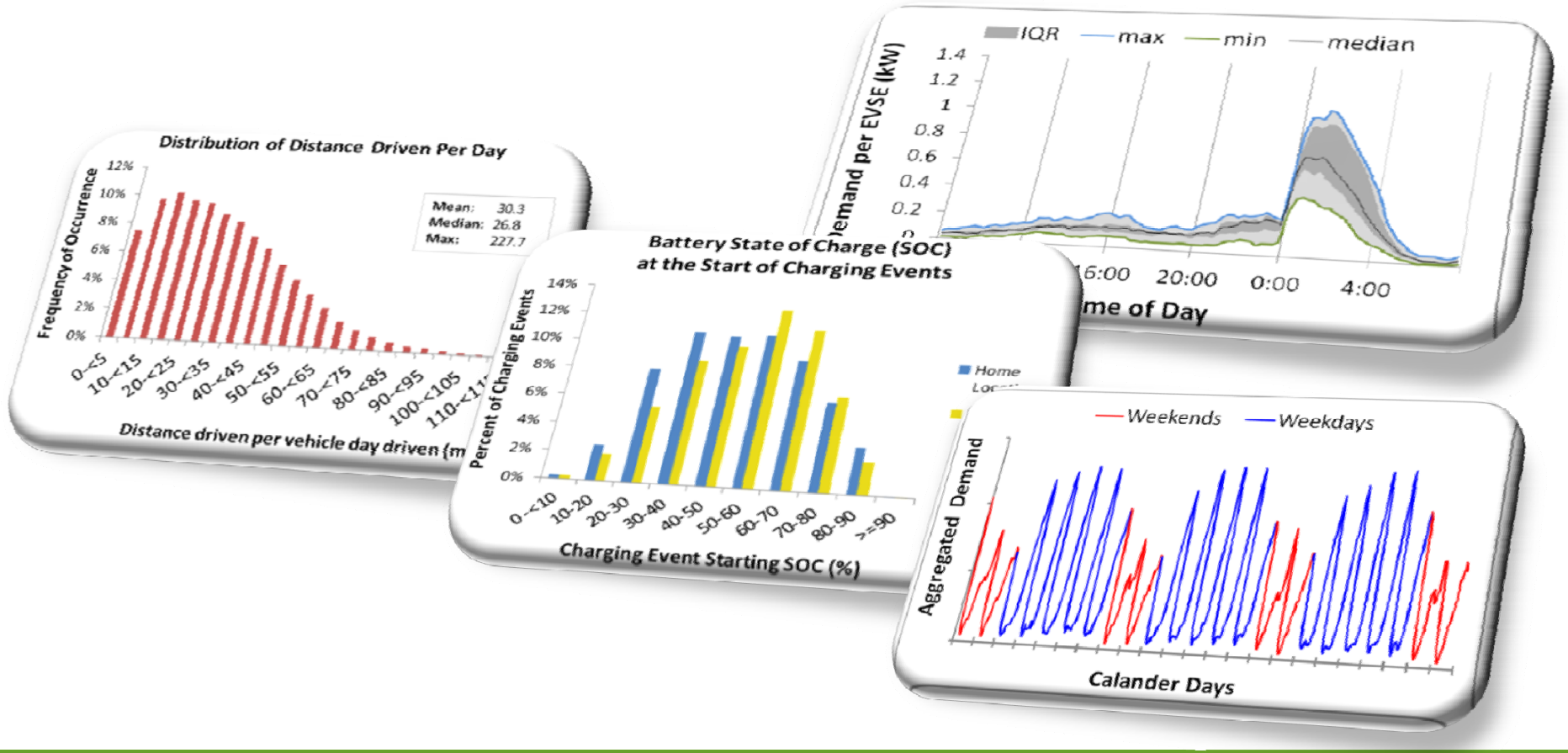
- Cost reduction, durability, safety, and increased specific energy:
  - Innovative development efforts and manufacturing improvements with potential to reach cost goals.
  - Development of high voltage, high capacity cathodes and high voltage electrolytes
  - Develop Silicon Composite & Metal alloy materials and cells
  - Expand focus on beyond-Lithium-ion technology

Also Must Meeting Other Critical Criteria:

- **Cycle life**
- **Calendar Life**
- **Safety and Abuse Tolerance**

The World's Largest Documented Electric Drive Vehicle Demonstration

- Use data on 13,000 vehicles and 20,000 charging locations:
  - 130,000 PHEV/EV test miles and 5,000 charging events documented each day
  - Full details of every charging event and vehicle trip are captured
  - http://avt.inel.gov/index.shtml



Training and Deployment

- 10 Recovery Act projects to educate auto technicians, 1st responders, undergraduate/ graduate students, teachers and the public
- 7 Graduate Automotive Technology Education Centers of Excellence
- 15 university teams participating in EcoCAR 2: Plugging into the Future
- 16 EV/PHEV community readiness projects to develop strategies and overcome market barriers

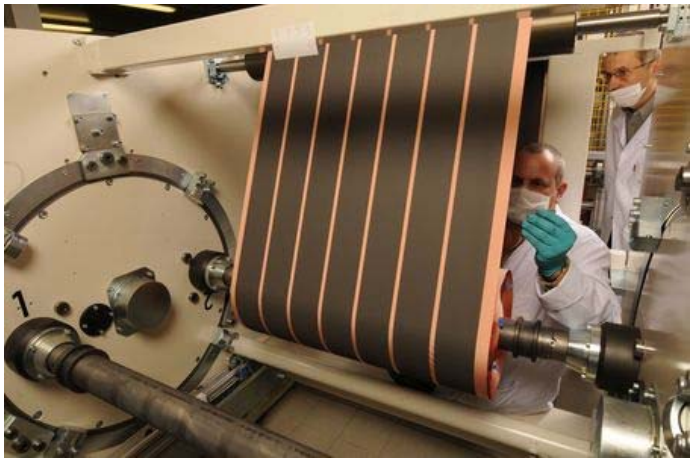
Johnson Controls

Major Lithium Ion battery production

- 175,000 square foot renovated advanced battery facility in Holland, MI, opened August 11, 2011.
- First U.S. facility to produce complete lithium-ion battery cells and systems for hybrid and EVs

Other ARRA Battery Production Projects

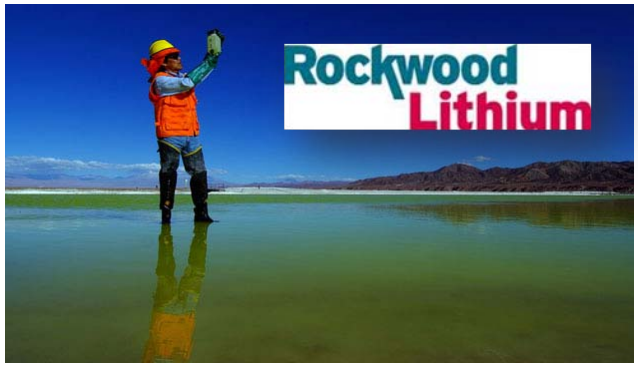
- SAFT – Jacksonville, FL
- Exide – Columbus, GA
- GM – Brownstown, MI
- A123 – Romulus, MI
- EnerDel – Comfort, IN
- East Penn – Lyon Station, PA
- Dow Kokam – Midland, MI
- LGChem – Holland, MI



Chemetall Foote (Rockwood Lithium)

Expanding America's lithium production

- Expansion of lithium production facilities in Silver Peak, NV and Kings Mountain, NC
- Major domestic supplier to the lithium battery industry
- Will significantly increase U.S. capacity to produce lithium, which is mostly imported from South America
- NC facility finished June 2012, NV facility to be completed in 2013



Other Advanced Battery Supplier Manufacturing ARRA Projects

- Celgard – Charlotte, NC; Aiken, SC
- Honeywell – Buffalo, NY; Metropolis, IL
- BASF Catalysts – Elyria, OH
- EnerG2 – Albany, OR
- Novolyte Technologies – Zachary, LA
- FutureFuel – Batesville, AR
- Pyrotek – Sanborn, NY
- H&T Waterbury – Waterbury, CT
- Toda – Battle Creek, MI

Magna E-Car

Electric Drive Component Manufacturing

- 50,000 sq ft new production facility in Grand Blanc Township, MI opened April 2012
- At full production, could assemble full EV drivetrains and support 100,000 vehicles
- Agreement with Ford to supply key components for the Focus EV

Other Electric Drive Component Manufacturing ARRA Projects

- **GM – White Marsh, MD; Wixom, MI**
- **Delphi – Kokomo, IN**
- **Allison Transmission – Indianapolis, IN**
- **Ford – Sterling Heights, MI**
- **Remy – Anderson, IN**
- **UQM – Frederick, CO**

EV Everywhere Grand Challenge

A DOE Clean Energy Grand Challenge with the goal of enabling U.S. companies to produce electric vehicles that are as affordable and convenient for the average American family as today's gas-powered vehicles within the next 10 years (by 2022).

- Midsize sedan, majority of miles driven on electricity,
- < 5 year payback
- Sufficient range and fast charge capability for widespread adoption

- EV-Everywhere Framing Document is available and open for comment.
- Five stakeholder workshops conducted June-September 2012
- Finalization of the Initiative this Fall





fortwo



EV


PLUG-IN
HYBRID







wheego
all electric

Contact Information

Patrick Davis
Program Manager
202-586-8061
patrick.davis@ee.doe.gov

www.vehicles.energy.gov