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The *EV Everywhere* Grand Challenge

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- **Outline**
  - ***EV Everywhere* Grand Challenge overview**
  - **R&D Program supporting *EV Everywhere***
  - **Infrastructure supporting *EV Everywhere***

DOE's *EV Everywhere* Grand Challenge

President Obama announced
the EV Everywhere Challenge
on March 7, 2012

EV Everywhere **Goal:**

Enable U.S. companies to produce
plug-in electric vehicles
as affordable and convenient
as today's gas-powered vehicles
by 2022

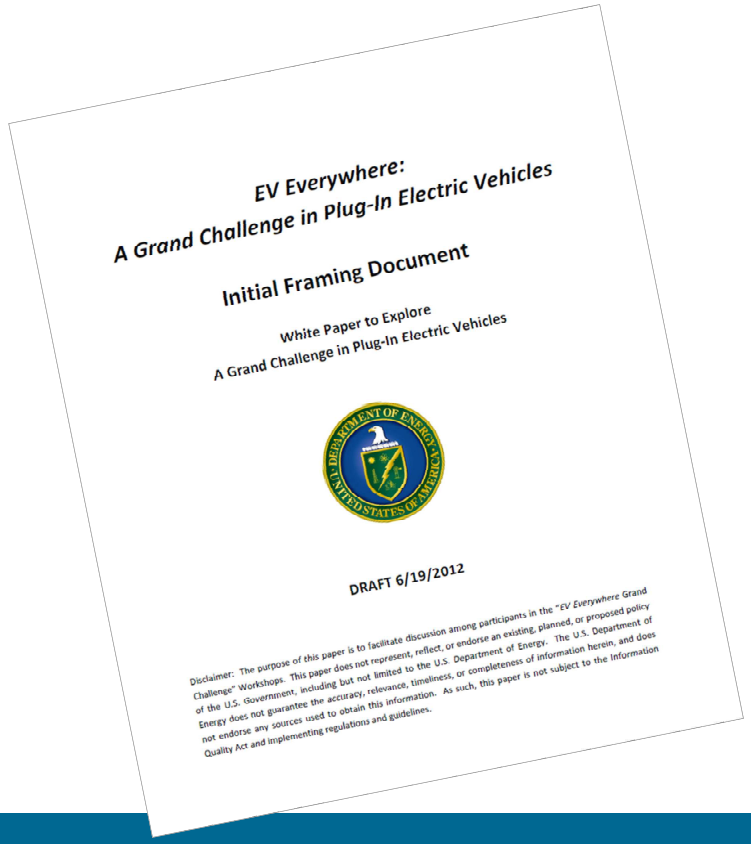
The EV Everywhere Challenge

Initial Parameters:

- Benchmark: 5-passenger vehicle
- Majority of vehicle-miles-traveled powered by electricity under standard drive cycles
- 5-year simple payback vs. equivalent gasoline-powered vehicle
- Any “vehicle range-charging infrastructure” scenario to be considered must credibly allow for the majority of American consumers to be willing to purchase the PEV as a primary vehicle
- No reduction in grid reliability

Three Potential Scenarios

1. **PHEV-40** with limited fast-charge infrastructure,
2. **AEV-100** with significant intra-city and inter-city fast charge infrastructure, and
3. **AEV-300** with significant inter-city fast charge infrastructure



EV Everywhere:
A Grand Challenge in Plug-In Electric Vehicles

Initial Framing Document

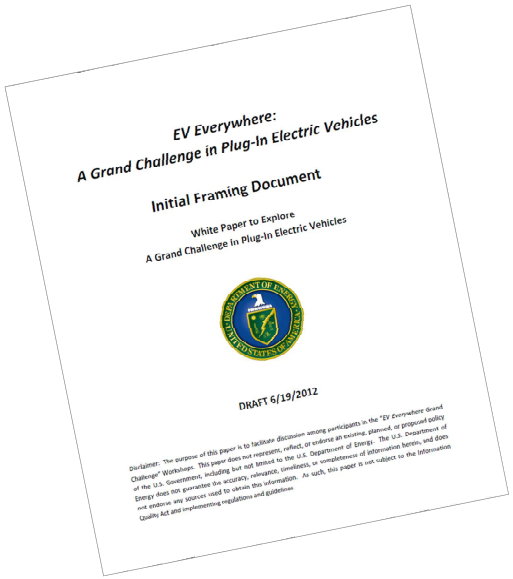
White Paper to Explore
A Grand Challenge in Plug-In Electric Vehicles

DRAFT 6/19/2012

Disclaimer: The purpose of this paper is to facilitate discussion among participants in the "EV Everywhere Grand Challenge" Workshops. This paper does not represent, reflect, or endorse an existing, planned, or proposed policy of the U.S. Government, including but not limited to the U.S. Department of Energy. The U.S. Department of Energy does not guarantee the accuracy, relevance, timeliness, or completeness of information herein, and does not endorse any sources used to obtain this information. As such, this paper is not subject to the Information Quality Act and implementing regulations and guidelines.

Vehicle-level analysis provides a starting point for setting technical targets for these vehicles

Stakeholder Input



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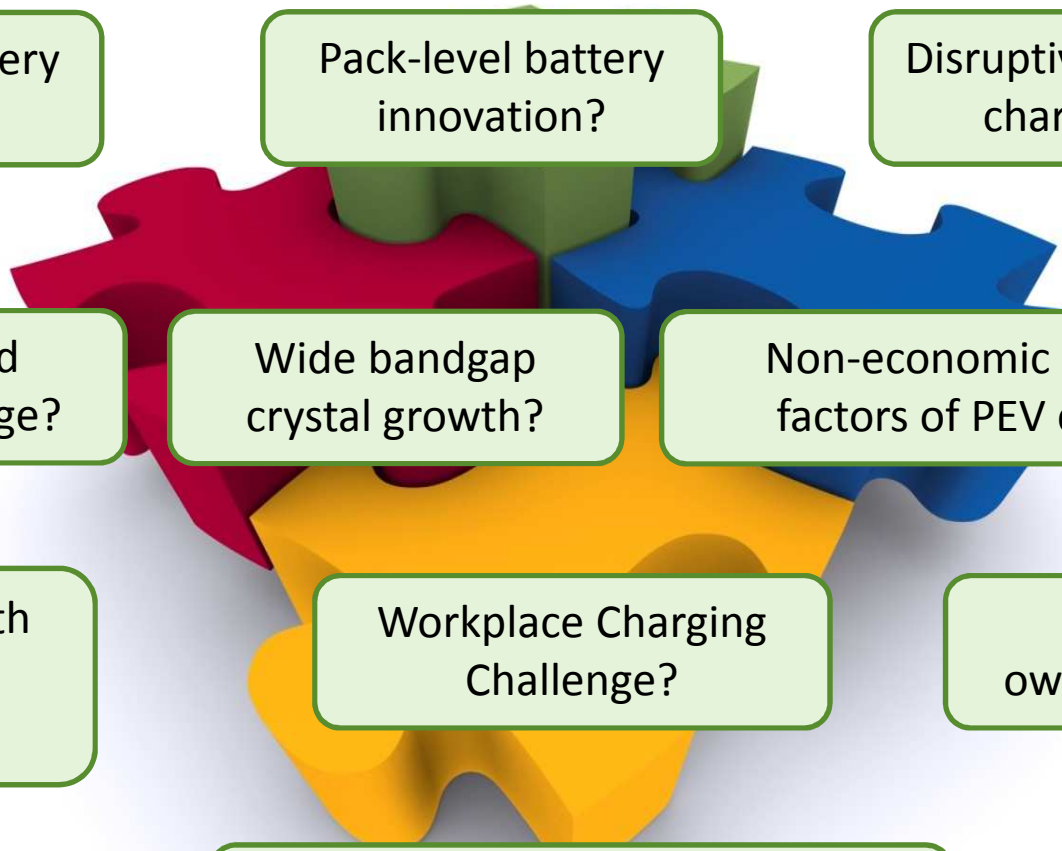
- Five workshops were held to get broad stakeholder input
- Framing document facilitated discussion among participants
- Re-evaluate and refine the existing technical goals for increasing performance and cutting costs

Topic	Date	Location
Kick-Off Framing Workshop	**June 21**	**Detroit**
Electric Drive Components	**July 24**	**Chicago**
Advanced Batteries	**July 26**	**Chicago**
Consumer Behavior and Charging Infrastructure	**July 30**	**Los Angeles**
Lightweight Vehicles and Structures	**Sept 13**	**Washington**

Comments from Workshops

- Themes from workshops:
  - “Majority of vehicle miles electric” vs “Maximize electric miles driven”
  - Payback time of 5 years may be too long for typical consumers
  - Need nationwide standardizations of charging stations, signage, and payment
  - Importance of workplace charging
  - EVs should not just be a replacement product, they need value added components

EV Everywhere Impacts?



Beyond Li-ion battery technology?

Pack-level battery innovation?

Disruptive approaches to fast-charge/battery-swap?

Innovations for grid stability for fast charge?

Wide bandgap crystal growth?

Non-economic drivers/psychological factors of PEV consumer adoption?

New non-rare earth magnet/motor designs?

Workplace Charging Challenge?

New vehicle ownership/usage models?

HOV Access for EV's?

Autonomous vehicle control to enable ultra-lightweight PEV's?

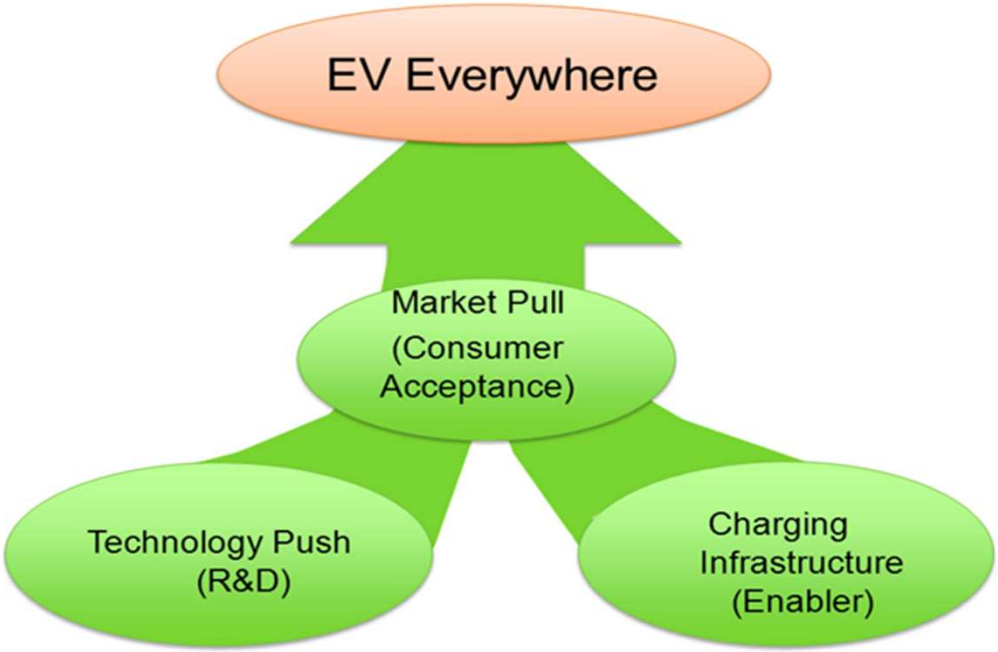
EV Everywhere Technical Targets (2022)

- Vehicle Mass
  - 30% Weight Reduction
- Electric Drive System
  - $8/kW ($30/kW in 2012)
  - 1.4 kW/kg, 4 kW/L, 94% effic.
- Battery
  - $125/kWh ($500/kWh in 2012)
  - 250 Wh/kg, 400 Wh/L, 2 kW/kg

EV Everywhere Blueprint (Jan 2013)

EV Everywhere Research Initiative

- Announced March 2013
- DOE investment of $45 million; industry cost-share required
- R&D proposals requested in 4 technical areas:
  - vehicle lightweighting
  - electric drive systems
  - advanced batteries
  - auxiliary load reduction



EV Everywhere Research Initiative

- Initiated 38 new projects in September 2013
- Vehicle lightweighting – 15 projects
  - cast magnesium, cast aluminum, high-strength steel, joining
- Electric drive systems – 4 projects
  - wide band-gap inverter; high-temperature DC bus capacitors
- Advanced batteries – 13 projects
  - high-energy cells; electrolytes; computer-aided engineering
- Advanced climate control – 2 projects
  - advanced heat pump; phase-change heating

EV Everywhere Deployment Issues

- Workplace Charging
- Interoperability
- Signage
- HOV Lane Access
- Codes & Standards
- Consistent Tax Policy
- Maximizing Federal Fleets

Workplace Charging Challenge

Goal: A tenfold increase in the number of U.S. employers offering workplace charging in five years

Workplace charging availability is a critical part of the deployment strategy for PEVs.

Benefits for the nation

+ Fill infrastructure gap
+ Increase electric-driven miles
+ Increase visibility of PEVs
+ Grow the PEV market

Benefits for the employer

+ Corporate image
+ Corporate sustainability
+ Contribute to LEED certification
+ Attracts/retains employees

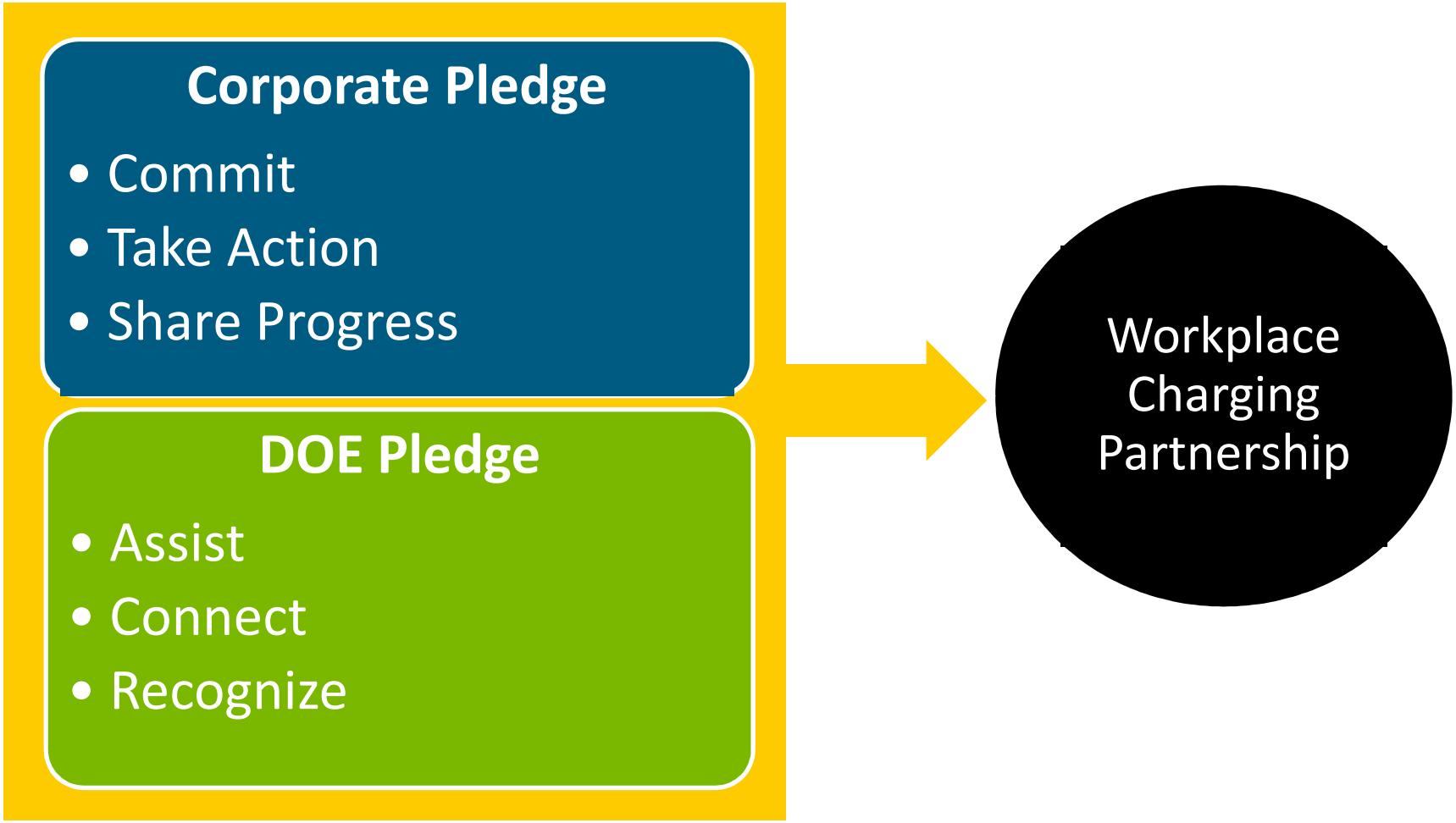
>30 Partners

Raytheon, Duke Energy, DELL, nrg, Hertz, City of Sacramento, Ford, 3M, NISSAN, Google, Lilly, SDGE, verizon, SIEMENS, GE, TESLA, GM, biogen idec, nationalgrid, Coca-Cola, Bentley, OSRAM SYLVANIA, facebook, Bloomberg, SOUTHERN CALIFORNIA EDISON, The Hartford, CHRYSLER, New York Power Authority, AVL

10 Ambassadors

Center for Sustainable Energy California, California Plug-In Electric Vehicle Collaborative, NEXTENERGY, IPI International Parking Institute, Green Parking Council, Electrification Coalition, Rocky Mountain Institute, Plug In America, EDTA Electric Drive Transportation Association, CALSTART

Workplace Charging Partnership



What does “DOE Assistance” really mean?

Helping Employers Overcome Barriers

- Understanding EVSE options
- Permitting requirements and codes
- Working with electrical contractors
- Working with property owner
- Installation costs
- Energy costs
- Management logistics
- Parking priority and availability
- Internal policy development
- Legal liability
- Fairness issues
- ADA compliance

Thank You!

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