Annual Merit Review and Peer Evaluation Meeting

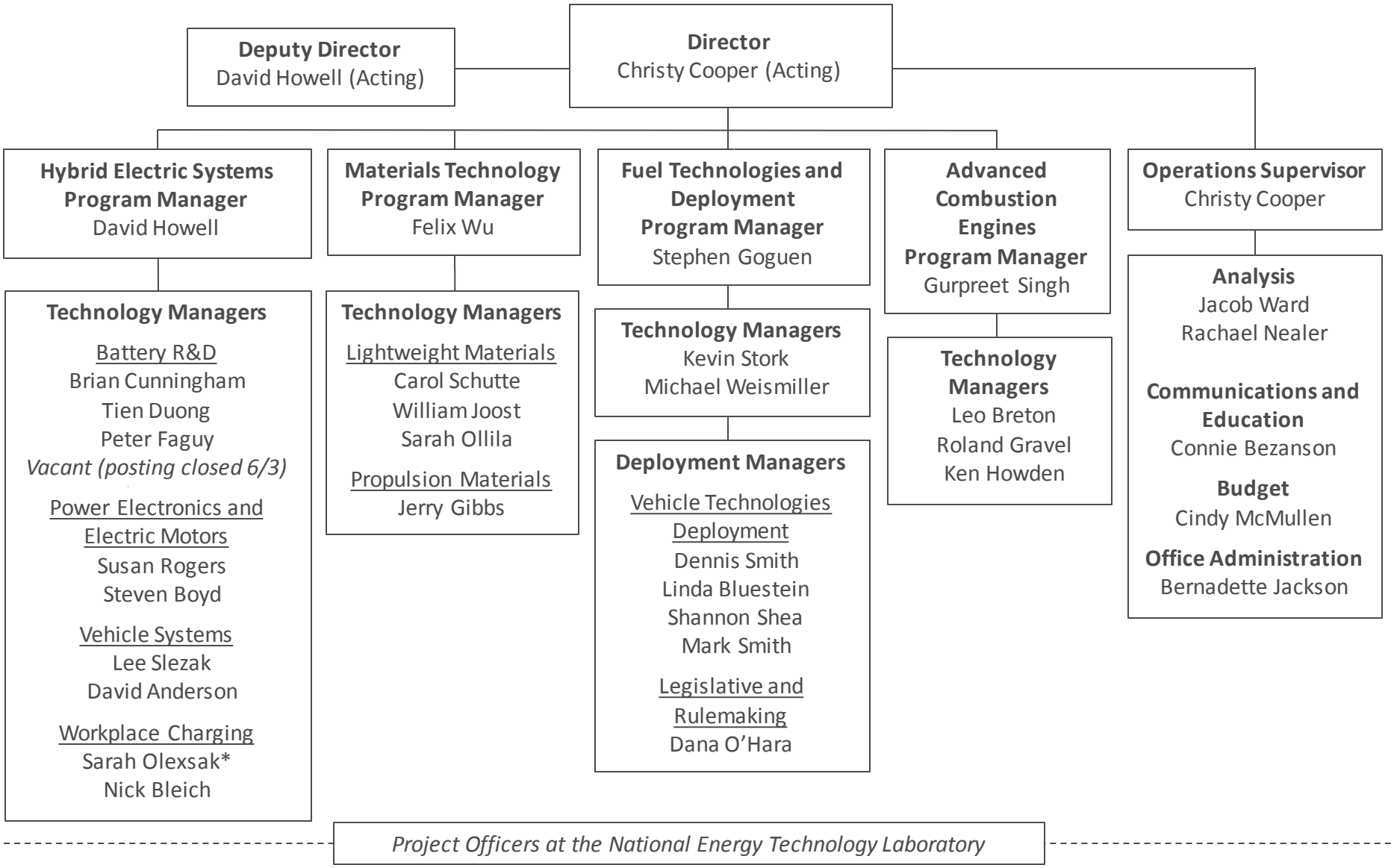
June 6, 2016

Christy Cooper
Acting Director
Vehicle Technologies Office

Today:

- What's new in VTO
- Priorities and Initiatives
- Hot Off the Press!

Vehicle Technologies Office Federal Staff



*On detail to WH Council on Environmental Quality

New VTO Staff

Felix Wu
Program Manager, Materials

Sarah Ollila
Technology Manager, Materials

Mike Weismiller
Technology Manager,
Fuel and Lubricant Technologies

Nick Bleich
Presidential Management Fellow
Workplace Charging Challenge

Dave Gohlke
AAAS Fellow, Analysis

Rachael Nealer
Technology Manager, Analysis

Sustainable Transportation Drivers

2/3 of total U.S. petroleum usage is for transportation

On-road vehicles account for **85%** of transportation petroleum usage

Transportation is the **2nd** most expensive spending category after housing

Transportation accounts for **~1/3** of U.S. carbon pollution

Vehicle Technologies Portfolio

Advanced Technologies for Clean, High Efficiency Vehicles

Batteries and Electric Drive

- Advanced batteries
- Advanced electric drive technologies

Vehicle Systems

- Grid integration
- Validation
- Aerodynamics, rolling resistance, and accessory loads
- Modeling
- Codes and standards
- Connected and autonomous vehicles

Materials Technology

- Lightweight low cost structural composites
- Lightweight metals improved properties, processing, cost
- Predictive tools
- Multimaterial enabling: joining, corrosion
- Materials enabling higher efficiency propulsion systems

Advanced Combustion Engines

- Combustion R&D (low temperature combustion, lean-burn, direct injection)
- Emission controls and aftertreatment
- Light- and heavy-duty engine efficiency

Fuels and Lubricants

- Drop-in biofuels
- Clean/efficient combustion fuel characteristics
- Improve use of natural gas in vehicles
- Advanced lubricants

Outreach, Deployment, and Analysis

- Deployment – Clean Cities
- EPAct rulemaking
- Student competitions
- Analysis

Vehicle Technologies Budget ($K)

Subprogram/Key Activity	FY 2016 Enacted	FY 2017 Request	Cross-Cutting Initiatives
Vehicle Technologies	**$310,000**	**$468,500**	
Batteries & Electric Drive Technologies	$141,100	-	
Battery Technology R&D*	-	$130,000	*EV Everywhere, CEMI*
Electric Drive Technologies R&D*	-	$39,000	*EV Everywhere*
Vehicle Systems	$30,600	$90,000	*EV Everywhere, Grid Modernization, SuperTruck II*
Advanced Combustion Engine R&D	$37,141	$74,800	*SuperTruck II, Co-Optima*
Materials Technology	$26,959	$82,700	
Lightweight Materials Technology	*$21,636*	*$71,500*	*Advanced Materials, EV Everywhere, SuperTruck II*
Propulsion Materials Technology	*$5,323*	*$11,200*	*SuperTruck II*
Fuel and Lubricant Technologies	$22,500	$20,500	*Co-Optima*
Outreach, Deployment, and Analysis	$48,400	$31,500	
Vehicle Technologies Deployment	*$34,000*	*$23,000*	
Advanced Vehicle Competitions	*$2,500*	*$2,500*	
Legislative and Rulemaking	*$1,500*	*$1,500*	
Analysis	*$10,400*	*$4,500*	
NREL Site-Wide Facility Support	$3,300	-	

FY17 House Mark for Vehicle Technologies: $268M; FY17 Senate Mark for Vehicle Technologies: $308M

* Battery Technology R&D and Electric Drive Technologies R&D proposed as separate subprograms in FY 2017 Request.

Industry Partnerships: U.S. DRIVE

Recent Highlights:

- ✓ **Completed Cradle-to-Grave Analysis:** Cross-cutting, consensus-based study of full lifecycle petroleum/GHG reduction potential of multiple pathways **(published June 1!)**
- ✓ **2015 Highlights of Technical Accomplishments Report**

Look Ahead:

New 2025 Partnership research targets (June 2016)

http://energy.gov/eere/vehicles/vehicle-technologies-office-us-drive

Industry Partnerships: 21st Century Truck

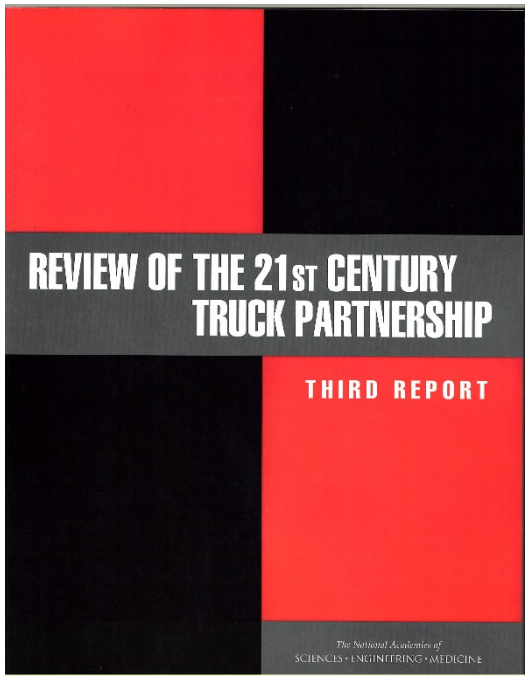
Recent Highlights:

- ✓ Completed third NAS review of 21CTP – with favorable results
- ✓ Expanded scope of hybrid team to encompass advanced adaptive transmission and axle technologies
- ✓ Held first joint meeting of 21CTP (manufacturers) and National Clean Fleets Partnership (user community)

Look Ahead:

Working on extensive revisions to 21CTP roadmap

21st CENTURY TRUCK PARTNERSHIP



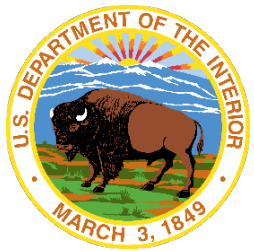
Major Interagency Collaborations

- **Department of Defense**
  - **Advanced Vehicle Powertrain Technology Alliance**
  - Collaboration, coordination, and co-funded projects; do more together than either could do separately

- **Department of Transportation**
  - Longstanding coordination across RDD&D portfolio
  - **NEW: MOU formalizes collaboration on innovative smart transportation systems and alternative fuel technologies**

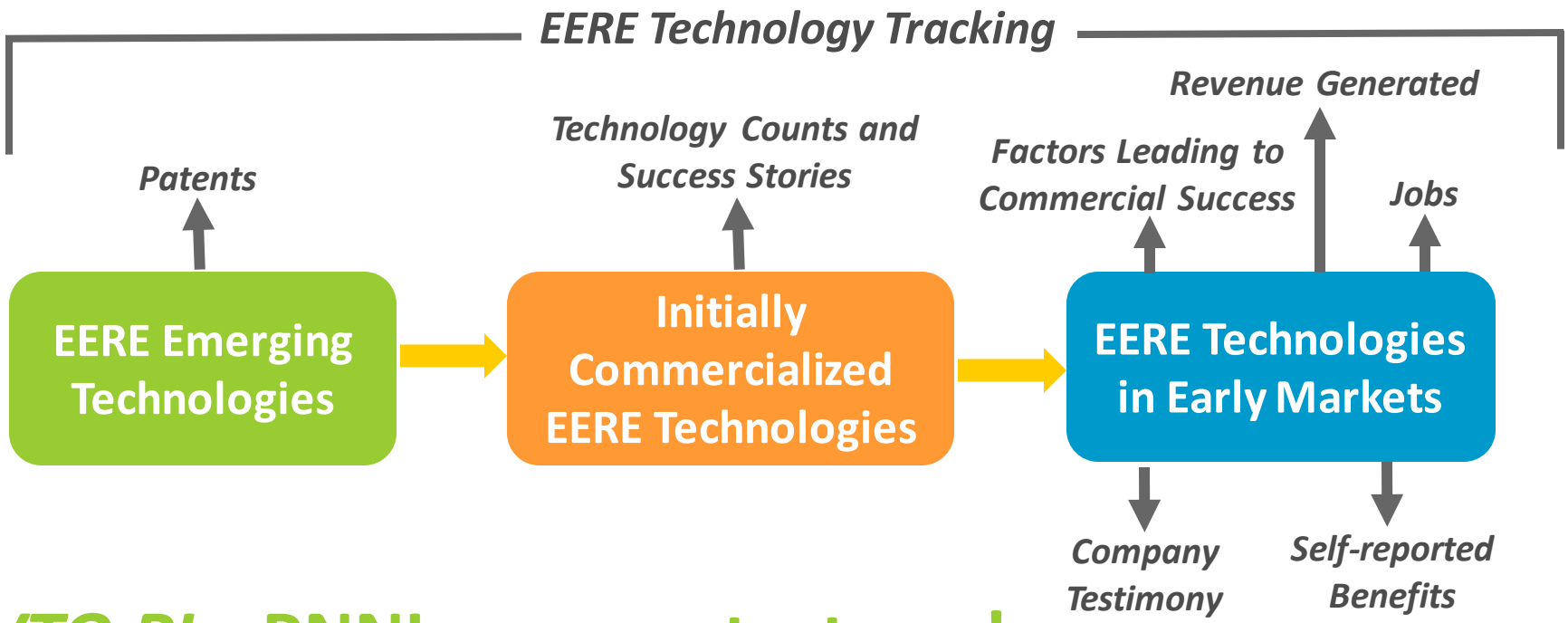
- **Environmental Protection Agency**
  - Longstanding coordination across RDD&D portfolio
  - Jointly sponsorship of **www.fueleconomy.gov** and **Green Racing**

- **Department of Interior**
  - Competitively-selected projects to showcase clean, alternative fuel technologies in **highly-visible demonstrations** at National Parks



Measuring Progress: EERE Technology Tracking Activity

- New this year; led by PNNL
- "Technology" is defined as a process, technique, design, widget, machine, tool, material, or software that…
  - was funded, at least in part, by an EERE program
  - has resulted in domestic manufacturing, sales, or deployment



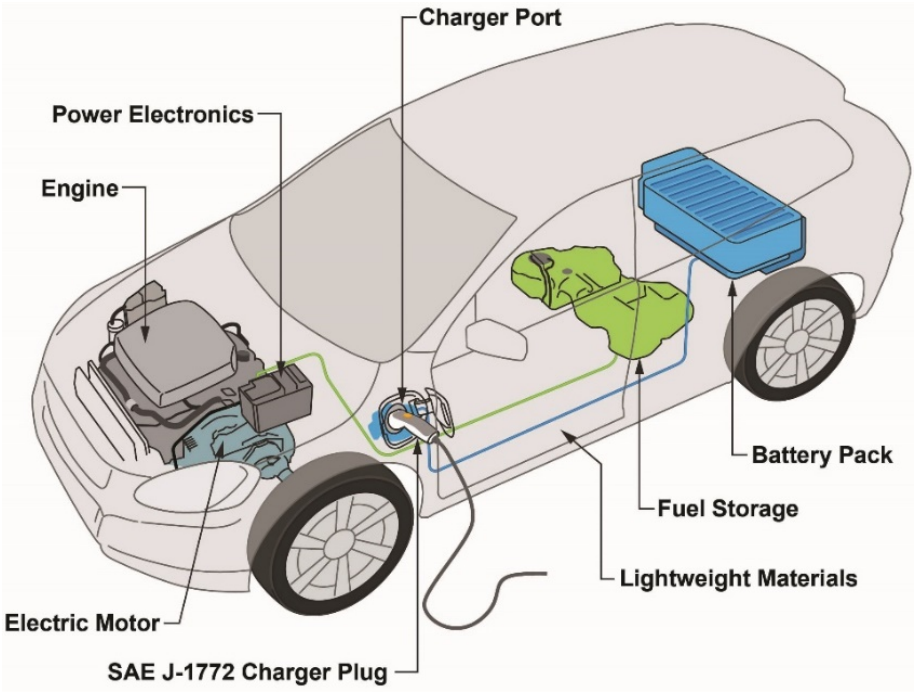
***VTO PIs:* PNNL may contact you!**

Priorities and Initiatives

EV Everywhere Grand Challenge

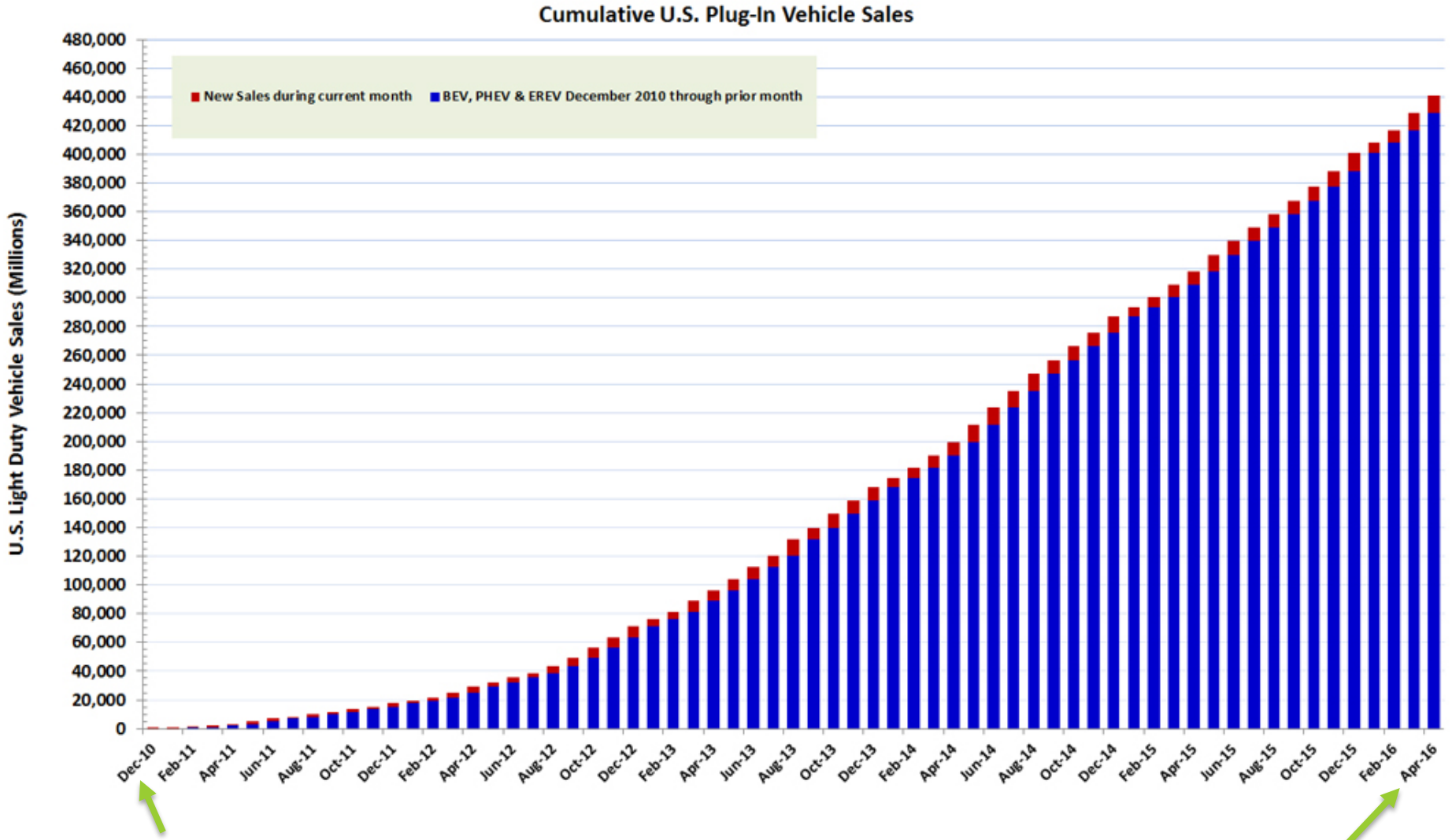
Goal:

Enable plug-in electric vehicles to be as affordable and convenient for the American family as conventional gasoline-powered vehicles by 2022



energy.gov/eveverywhere

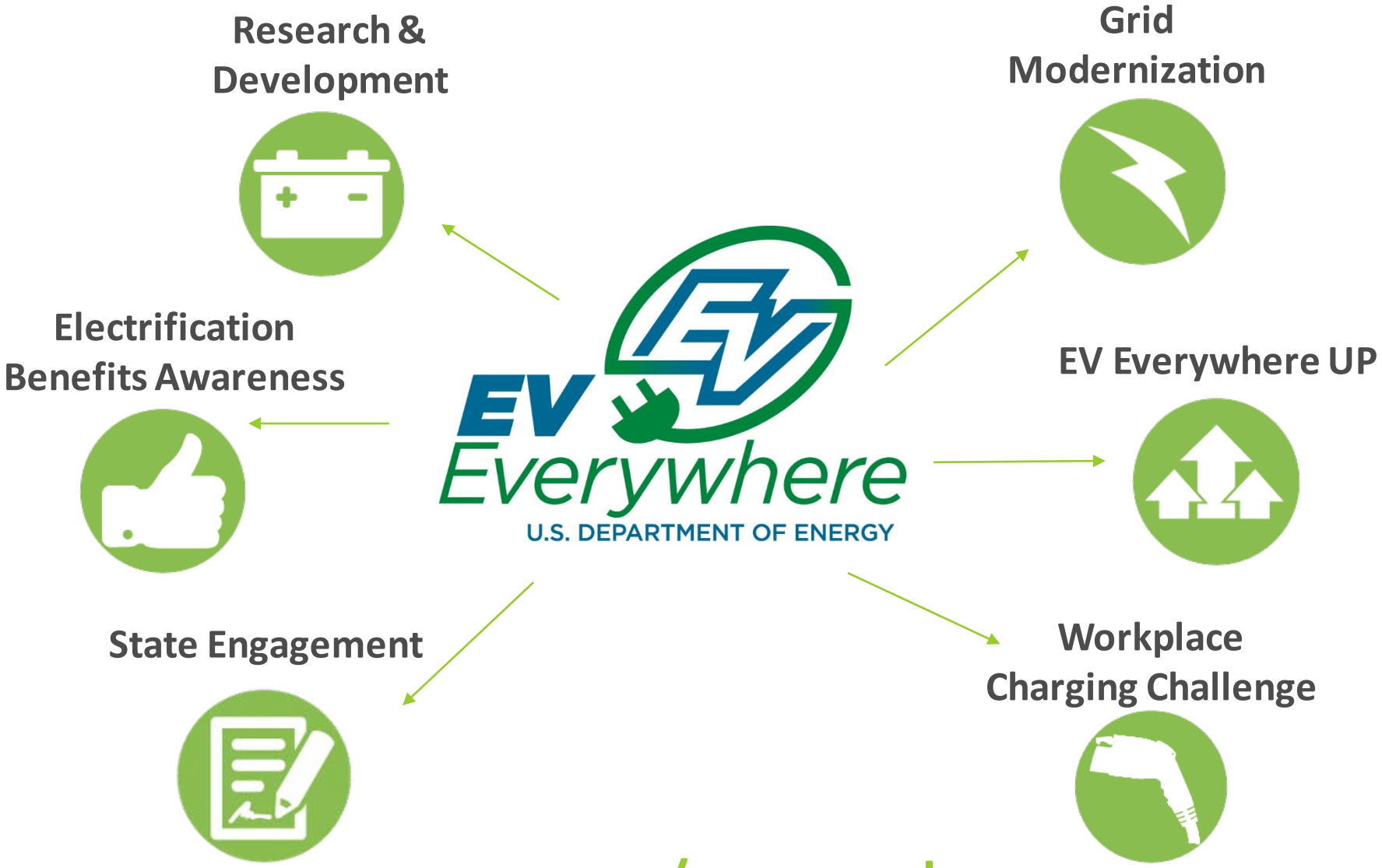
Plug-in Electric Vehicle Market Growth



Volt and LEAF release (Dec 2010)

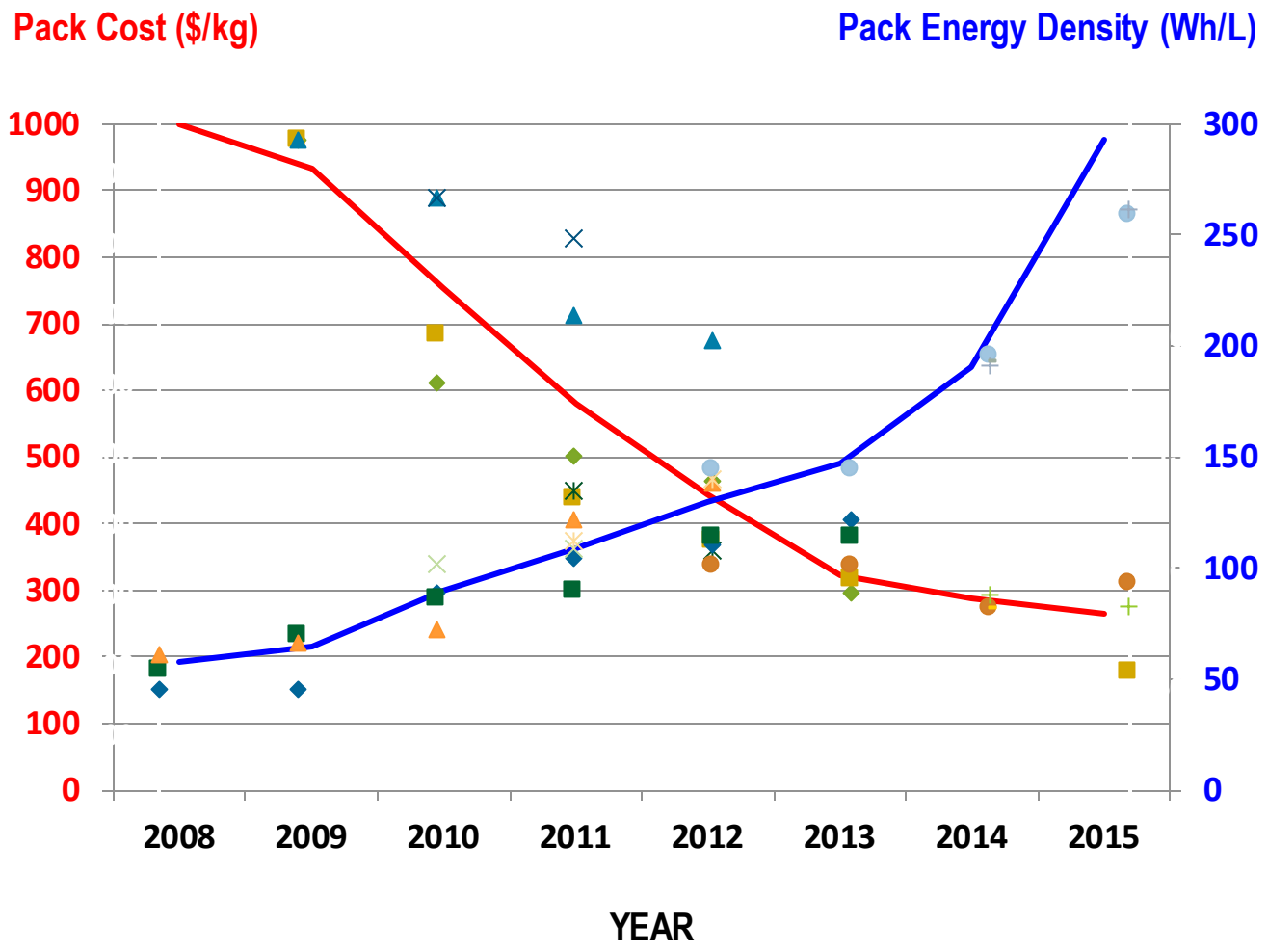
440,000+ PEVs on U.S. roads (Apr 2016)

EV Everywhere and Market Acceleration



energy.gov/eveverywhere

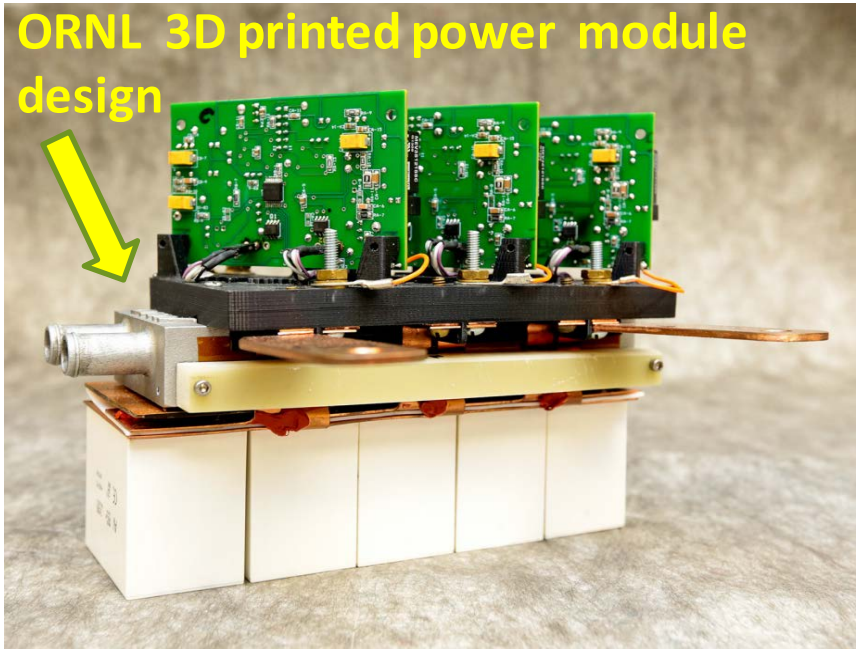
R&D Highlights: Batteries



VTO R&D has lowered the cost of batteries to **$268/kWh;**

~70% reduction since 2008

R&D Highlights: Electric Drive/Systems



Worlds' First 3D Printed Inverter

- Innovative cooling technique for high and low temperature components
- Design approach possible only with 3D printing techniques

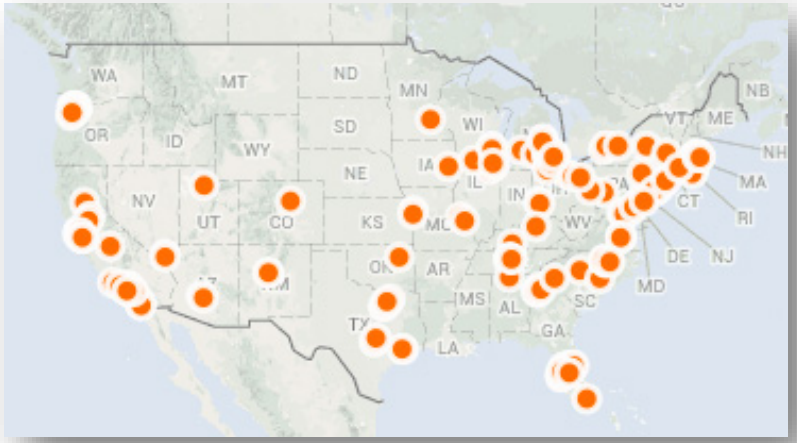
Wireless Charging System Demonstration

>90% grid-to-battery efficiency while in-motion wireless charging system achieves charge-sustaining energy transfer

Workplace Charging Challenge

Goal: Increase the number of employers offering charging by 10x by 2018

Workplace Charging Challenge
U.S. DEPARTMENT OF ENERGY



~300 Partner employers committing to provide EVSE for employees

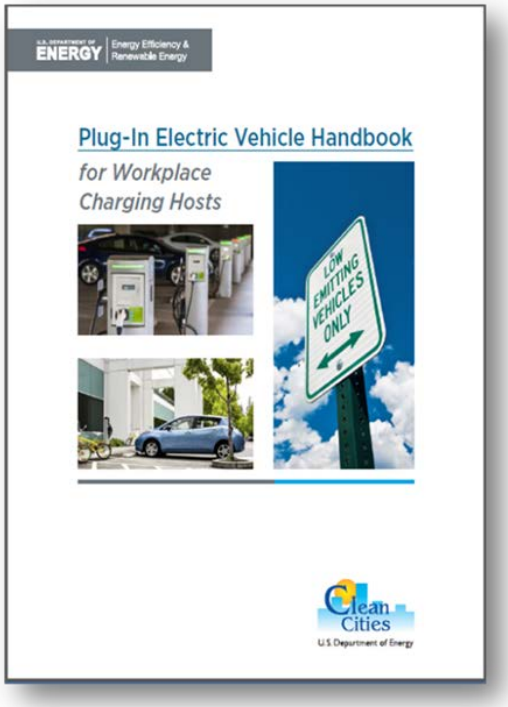
5,500+ EVSE installed or planned for installation

18 Ambassadors promoting and supporting workplace charging

Resources:

http://energy.gov/eere/vehicles/workplace-charging-challenge-install-and-manage-pev-charging-work

Join the Challenge!



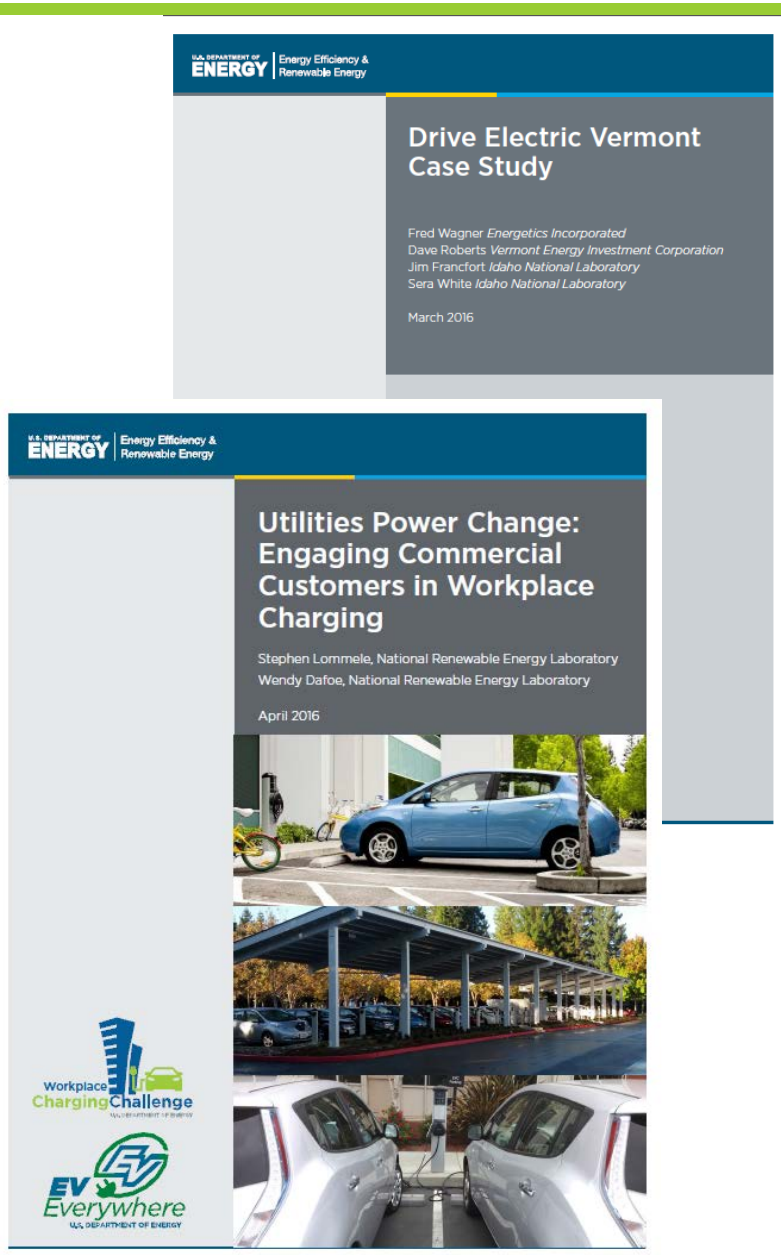
- EV 101
- Employer Resources
- Employee Outreach Toolkit
- Case Studies
- Webinars
- Workshops
- Quarterly Newsletters
- One-on-One Technical Assistance

Take the Pledge

Join the Challenge

For more information or to join the Workplace Charging Challenge, contact Nicholas.Bleich@ee.doe.gov

EV Everywhere *Solution Center*



Find:

- Drive Electric Vermont Case Study
- Workplace Charging Utility Case Studies
- National Economic Value Assessment
- Consumer Behavioral Analysis
- Infrastructure Analysis
- Fleet Gap Analysis
- …and more!

energy.gov/eveverywhere

Awareness Campaign: Best.Drive.EVer – Go Electric!

TAGLINE LOCKUP

Best. Drive. EVer.

For drivers of **ELECTRIC VEHICLES**, it adds up.

COLOR PALETTE

FONT
GOTHAM
abcdefghijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789(!@#$%^&.,?:;)

CAMPAIGN FLEXIBILITY
Campaign design and content easily translate to:

PRINT AD
POSTER
FLYER
BILLBOARD
TRANSIT AD
WEB BANNER AD
SOCIAL MEDIA POST

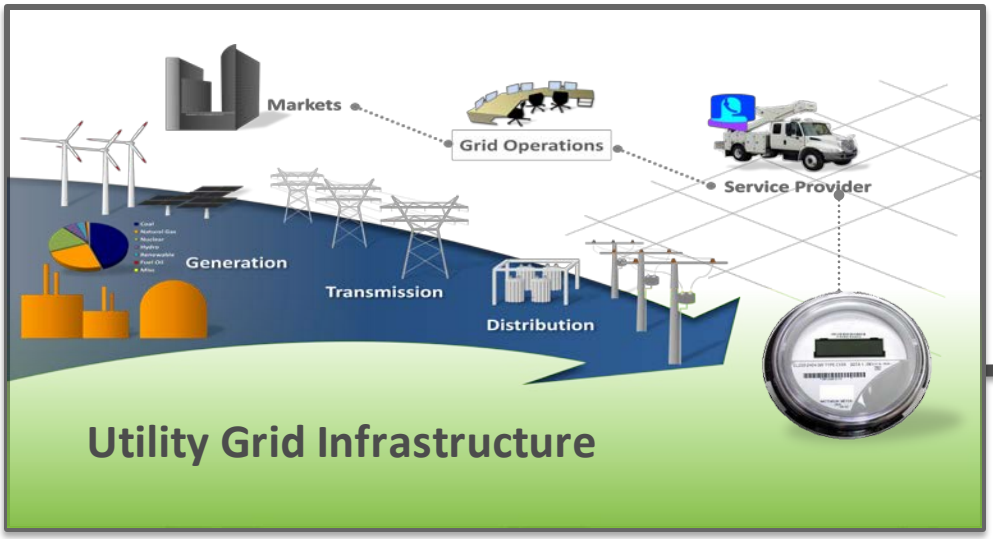
Contact: Robert.Graham@ee.doe.gov

Grid Modernization

Mitigating adverse effects of EV deployment and **leveraging existing synergy** between EVs and the grid, building energy management systems, distributed renewables, and other smart grid assets

Smart Building Systems

Distributed Renewables



Intelligent Charging & Grid Services

Transportation as a System (TaaS)

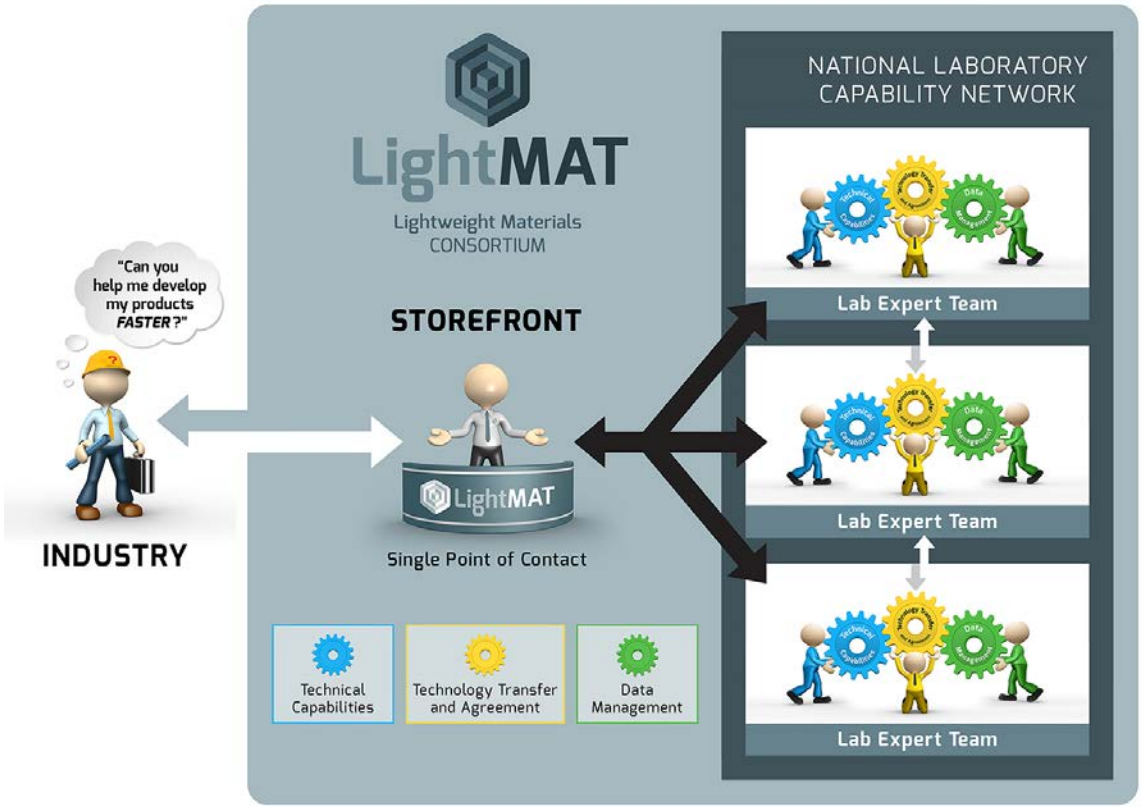
- Radically reshaping the nation's transportation energy footprint by **exploring untapped system-level efficiencies**
- Combines expertise of national labs, industry, and federal, state and local efforts

U.S. DEPARTMENT OF ENERGY
SMARTMOBILITY
Systems and Modeling for Accelerated Research in Transportation

Energy Materials Network: LightMat

Facilitating connections between industry and the National Labs by:

- Building a network of **unique National Lab resources**
- Providing a **single point of contact** and concierge
- Managing materials **data and tools**
- **Streamlining** the agreements process



http://LightMAT.org

Co-Optimization of Fuels and Engines ("Co-Optima")

- Joint VTO/BETO effort; nine-lab consortium with industry board
- **Focus:** Develop new fuels and engines that have better performance; can be produced affordably, sustainably, and at scale; and reduce GHG emissions
- **Goal:** Reduce per-vehicle petroleum consumption by 30% vs. 2030 base case
  - **Additional 7-15%** reduction in engine fuel consumption
  - **20% reduction** in fuel well-to-tank emissions
  - GHG emissions reduction of the light-duty vehicle fleet by **9-14%** relative to business-as-usual within 10 years of market introduction

SuperTruck II

Will demonstrate Class 8 truck that:

- Achieves **>100% freight efficiency improvement** (2009 baseline)
- Achieves **>55% engine brake thermal efficiency**
- **Cost effectiveness** emphasis: 18-36 month payback period
- Comparable **performance**

Technologies expected:

- Engine efficiency, emission control, waste heat recovery
- Advanced transmission & hybridization
- Auxiliary power unit to reduce idling
- Improved aerodynamics
- Tire rolling resistance
- Lightweight materials
- Others…

VT Deployment: Tools, Resources and Technical Assistance

AFDC: ***20,000+*** *entries in Station Locator;* ***17*** *other interactive tools; nearly* ***200*** *case studies*

FuelEconomy.gov: *Find-a-Car tool has* ***30+ years*** *of vehicle data;* ***300M users***

Clean Cities: Leveraging Local Networks

~100 coalitions with **1000s** of stakeholders in nearly **every major city** in the country

Look Ahead: Leveraging boots-on-the-ground **expertise** to build out **Transportation as a System** and **smart mobility** efforts

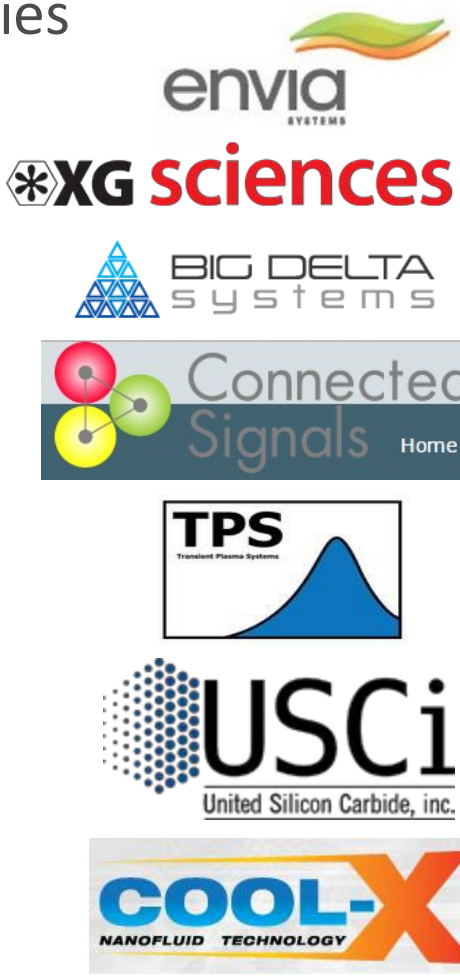
Hot off the Press!

Hot Off the Press: Small Business Vouchers Pilot

Supports EERE's **Lab Impact Initiative** to increase and **enhance lab-private sector relationships**, and increase and **streamline access** to national lab capabilities

- Cuts across all EERE R&D programs
- VTO SBV pilot funding: $2.45M
- Lead Labs: ORNL, LBNL; multiple others participating
- 3 Rounds this year
  - Round 1: Complete
  - Round 2: Selection process ongoing
  - Round 3: Coming soon

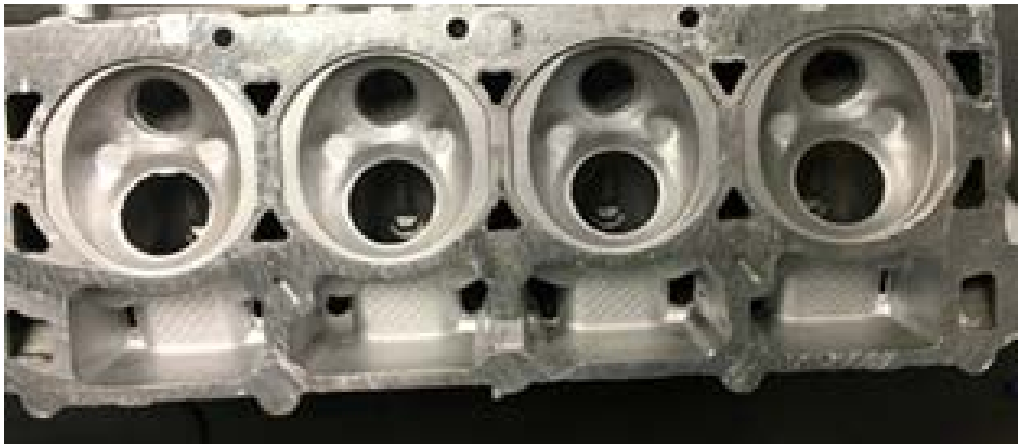
https://www.sbv.org/



Hot Off the Press: R&D Highlight

Enabling Next-Generation Engines

Developed low-cost, high-performance aluminum alloy with a 25% increase in strength at temperatures up to 300°C



- Low-cost, easy-casting, high-performance Al alloy to enable next-generation high-efficiency automotive engines with **rapid tech-to-market transition potential**
- FCA/ORNL collaboration – **leveraged multiple capabilities unique to lab** (e.g., high performance computing, Spallation Neutron Source)
- **Significantly accelerated development time**

Hot Off the Press: EcoCAR 3 Year 2

Focus:

- Hands-on vehicle work
- Dynamic events: vehicle safety tech inspections, on-road safety, energy consumption
- Technical, project management, communications presentations

Competition Results:

1. The Ohio State University
2. Virginia Tech
3. Embry Riddle

16,000+ Students

have participated in the DOE Advanced Vehicle Technology Competition Series!

Hot Off the Press: Sustainable Transportation Summit

Sustainable TRANSPORTATION

Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

July 11-12
Washington, D.C.

http://energy.gov/eere/2016-sustainable-transportation-summit

July 11, noon-6pm

- Deep Decarbonization in the U.S. Transportation Sector
- Consumer Adoption of New Vehicle Technologies
- Net-Zero Carbon Fuels
- The Future of Mobility

July 12, 8am-noon

- Track 1: EV Everywhere EV Market Acceleration
- Track 2: Workplace Charging Challenge
- Track 3: Clean Cities & Smart Mobility
- Track 4: Co-Optima
- Track 5. Hydrogen Fuels and Infrastructure
- Track 6. Synthetic Biology Foundry

**Federal and Lab attendance must be coordinated through BETO, FCTO, and VTO*

Thank You

Christy Cooper
Acting Director
christy.cooper@ee.doe.gov

www.vehicles.energy.gov