Today:

• What’s new in VTO
• Priorities and Initiatives
• Hot Off the Press!
Vehicle Technologies Office Federal Staff

Deputy Director
David Howell (Acting)

Director
Christy Cooper (Acting)

Hybrid Electric Systems
Program Manager
David Howell

Materials Technology
Program Manager
Felix Wu

Fuel Technologies and
Deployment
Program Manager
Stephen Goguen

Advanced
Combustion
Engines
Program Manager
Gurpreet Singh

Operations Supervisor
Christy Cooper

Analysis
Jacob Ward
Rachael Nealer

Communications and
Education
Connie Bezanson

Budget
Cindy McMullen

Office Administration
Bernadette Jackson

Technology Managers
Battery R&D
Brian Cunningham
Tien Duong
Peter Faguy
Vacant (posting closed 6/3)

Power Electronics and
Electric Motors
Susan Rogers
Steven Boyd

Vehicle Systems
Lee Slezak
David Anderson

Workplace Charging
Sarah Olexsak*
Nick Bleich

Technology Managers
Lightweight Materials
Carol Schutte
William Joost
Sarah Ollila

Propulsion Materials
Jerry Gibbs

Technology Managers
Kevin Stork
Michael Weismiller

Deployment Managers
Vehicle Technologies
Deployment
Dennis Smith
Linda Bluestein
Shannon Shea
Mark Smith

Legislative and
Rulemaking
Dana O’Hara

Project Officers at the National Energy Technology Laboratory

*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

### 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

### 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

### Outreach, Deployment, and Analysis
- Deployment – Clean Cities
- EPAct rulemaking
- Student competitions
- Analysis
## Vehicle Technologies Budget ($K)

<table>
<thead>
<tr>
<th>Subprogram/Key Activity</th>
<th>FY 2016 Enacted</th>
<th>FY 2017 Request</th>
<th>Cross-Cutting Initiatives</th>
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</thead>
<tbody>
<tr>
<td><strong>Vehicle Technologies</strong></td>
<td>$310,000</td>
<td>$468,500</td>
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<tr>
<td>Batteries &amp; Electric Drive Technologies</td>
<td>$141,100</td>
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<tr>
<td>Battery Technology R&amp;D*</td>
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<td>$130,000</td>
<td>EV Everywhere, CEMI</td>
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<td>Electric Drive Technologies R&amp;D*</td>
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<td>$90,000</td>
<td>EV Everywhere, Grid</td>
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<td>Modernization, SuperTruck II</td>
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<tr>
<td>Advanced Combustion Engine R&amp;D</td>
<td>$37,141</td>
<td>$74,800</td>
<td>SuperTruck II, Co-Optima</td>
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<td>Materials Technology</td>
<td>$26,959</td>
<td>$82,700</td>
<td>Advanced Materials, EV</td>
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<td>Lightweight Materials Technology</td>
<td>$21,636</td>
<td>$71,500</td>
<td>Everywhere, SuperTruck II</td>
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<td>Propulsion Materials Technology</td>
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<td>$11,200</td>
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<td>Fuel and Lubricant Technologies</td>
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<td>$20,500</td>
<td>Co-Optima</td>
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<tr>
<td>Outreach, Deployment, and Analysis</td>
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<td>$31,500</td>
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<td><strong>Vehicle Technologies Deployment</strong></td>
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<td><strong>Advanced Vehicle Competitions</strong></td>
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<td>Legislative and Rulemaking</td>
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<tr>
<td>Analysis</td>
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<tr>
<td>NREL Site-Wide Facility Support</td>
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</table>

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.
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
Major Interagency Collaborations

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

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

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

• Department of Interior
  o 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
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

Cumulative U.S. Plug-In Vehicle Sales

- Volt and LEAF release (Dec 2010)
- 440,000+ PEVs on U.S. roads (Apr 2016)
EV Everywhere and Market Acceleration

- Research & Development
- Grid Modernization
- Electrification Benefits Awareness
- EV Everywhere UP
- Workplace Charging Challenge
- State Engagement

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

ORNL 3D printed power module design
Goal: Increase the number of employers offering charging by 10x by 2018

~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-pez-charging-work
Join the Challenge!

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

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!

For drivers of ELECTRIC VEHICLES, it adds up.

electricity + car = POWER

For drivers of ELECTRIC VEHICLES, it adds up.

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.
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
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...
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/
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
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