Global Symposium on Connected Vehicles and Infrastructure – Energy & Mobility

Reuben Sarkar - Deputy Assistant Secretary for Transportation
Office of Energy Efficiency and Renewable Energy (EERE)
Department of Energy (DOE)
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U.S. Energy and Petroleum Use

36% of all U.S. energy use is from petroleum

70% of U.S. petroleum goes to transportation

50% of U.S. petroleum comes from imported oil

0.007% electricity used for transportation
Office of Energy Efficiency and Renewable Energy

**Technology Offices**

- **Vehicles**
- **Bioenergy**
- **Hydrogen and Fuel Cells**

**Major Administration Goals**

- Efficiency Improvement
- Fuel Diversification
- Domestic & Renewable
- Reduced GHG

- Reduce GHG emissions in the range of 17% by 2020 *
- Reduce net oil imports by 50% by 2020 *
- Achieve CAFE Standards 54.5 mpg by 2025

*U.S. DEPARTMENT OF ENERGY  Energy Efficiency & Renewable Energy*
FY 2015 EERE Budget Request - $2.317B

- Vehicles, $359M
- Bioenergy, $253M
- Fuel Cells, $93M
- Advanced Manufacturing, $305M
- Buildings, $212M
- Weatherization & Intergovernmental, $305M
- Corporate Support, $238M
- Solar, $282.3M
- Wind, $115M
- Geothermal, $61.5M
- Water, $62.5M
- FEMP, $36M
- Corporate Support, $238M

Sustainable Transportation, $705M

Energy Saving Homes, Buildings, & Manufacturing, $858M

Renewable Electricity Generation, $521M
Current RDD&D Focus

• EERE is DOE’s primary applied research office
• Research, Development, Demonstration, and Deployment
  – Vehicle Electrification
  – Materials Lightweighting
  – Advanced Combustion
  – Drop-in Biofuels
  – Fuel Cell Technology
  – Hydrogen Infrastructure
  – Community Partner Projects
  – Grid Systems Integration
Connected Vehicles and Infrastructure

- Autonomy
- Safety & Collision Avoidance
- Multimodal Transportation
- V2X
- Data as a Service

- EERE foundational work
  - FY14-16
- Potential “Big Idea” FY16+
  - Multi office, lab, agency initiative
Key Energy-Related Needs for Connected Mobility

• Co-optimization of safety, efficiency (logistical and energy), productivity
  – Safety and energy first

• Interoperability across connected V2X systems

• Design for crashworthiness impact on vehicle efficiency
  – Safer operation (vs. safer design) enabling lighter vehicles

• Potential enabler for enhanced ROI and adoption of alternatively fueled vehicles

• Law of unintended consequences – rebound effect
  – Macro effect of lowering cost to travel on fuel consumption
<table>
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<tr>
<th>Synergies Between Connected Mobility &amp; Energy</th>
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<tr>
<td><strong>Autonomy</strong></td>
</tr>
<tr>
<td>• Efficient driving</td>
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<tr>
<td>• Platooning</td>
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<tr>
<td>• Assisted parking</td>
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<td><strong>Safety &amp; Collision Avoidance</strong></td>
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<td>• Reduced idling</td>
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<td>• Significant light weighting</td>
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<td>• Enhanced aerodynamics</td>
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<td><strong>Multimodal Transportation</strong></td>
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<td>• Lowest carbon trip planning</td>
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<td>• Automated carpooling</td>
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<td><strong>V2X</strong></td>
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<tr>
<td>• Vehicle-to-Vehicle (V2V)</td>
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<td>• Traffic signal management (V2I)</td>
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<tr>
<td>• Grid system integration (V2G)</td>
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<td><strong>Data as a Service</strong></td>
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<tr>
<td>• Big data analytics</td>
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<td>• Efficient routing</td>
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<td>• Optimizing corridor efficiency</td>
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R&D Efforts at the Nexus of Energy and Mobility

• Conduct foundational studies on potential gains FY14-15
  – Quantifying synergistic gains from safety initiatives
  – Impact of fuel efficiency algorithms
  – Comparative studies to safety algorithms
  – Potential for lightweighting and improved aerodynamics

• Deeper research based on identified areas of opportunity
  – Advanced vehicle design (Trajectory to 2050)
  – Novel diagnostics, controls, and sensor development
DOE is Leveraging a Series of Integrated Tools from Individual Vehicles to Large Scale Simulation to Quantify the Fuel Benefits of Automated & Connected Vehicles

- Independent Vehicle
- Small Network of CAVs and ITS “Virtual Testing Ground”
- Entire Urban Area
- Transportation Systems
- Energy Model
At the Fleet Level, Multiple Tools are Being Integrated to Quantify the Fuel Savings Over Corridors or Cities

Transportation Simulation

*Define network, control & demand*

Vehicle Energy Consumption

*Vehicle speed/grade profiles extraction/generation*

Energy consumption of the transportation network from corridor (~100,000 vehicles) to entire cities (>10M vehicles)
Lessons from Sustainable Transportation Initiatives

- Tackle the infrastructure challenge upfront
- Get to critical mass – focus on first market adoption
- Develop consistent long-term policy
- Have an exit plan and business model sans subsidies
- Consider human factors and consumer behaviors
- Think like an investor starting at the R&D stage
- Be a shepherd in the valley of death
Economic and New Business Opportunities

- The opportunities are diverse and significant
- Business model innovation is as important as technology
Areas for Collaboration

• DOT/DOE discussions are a next planned step
• Engage with UMTRI, RITA, NHTSA, ITS America, Non-Profits
• DOE looking for the right layers in which to participate
  – Hardware, software, physical & data infrastructure(s), cyber security
• Opportunities for collaborations
  – Diagnostics, controls, and sensor development
  – Systems modeling
  – Vehicle testing
  – Deployment
  – Data collection and analysis
• Coordinate across boundaries to make best use of $’s
Questions?

Sustainable TRANSPORTATION

Reuben Sarkar
Reuben.Sarkar@ee.doe.gov