



Overview of the DOE/VTO Vehicle Systems Program

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Vehicle Systems Overview

Using Systems Engineering R&D to Accelerate the Commercialization of Integrated, Highly Efficient Vehicles by Reducing Development Risk, Cost, and Time

**Petroleum Displacement
Energy Security
US Competitiveness
Emissions Reduction**

Integration, Optimization, and Interoperability

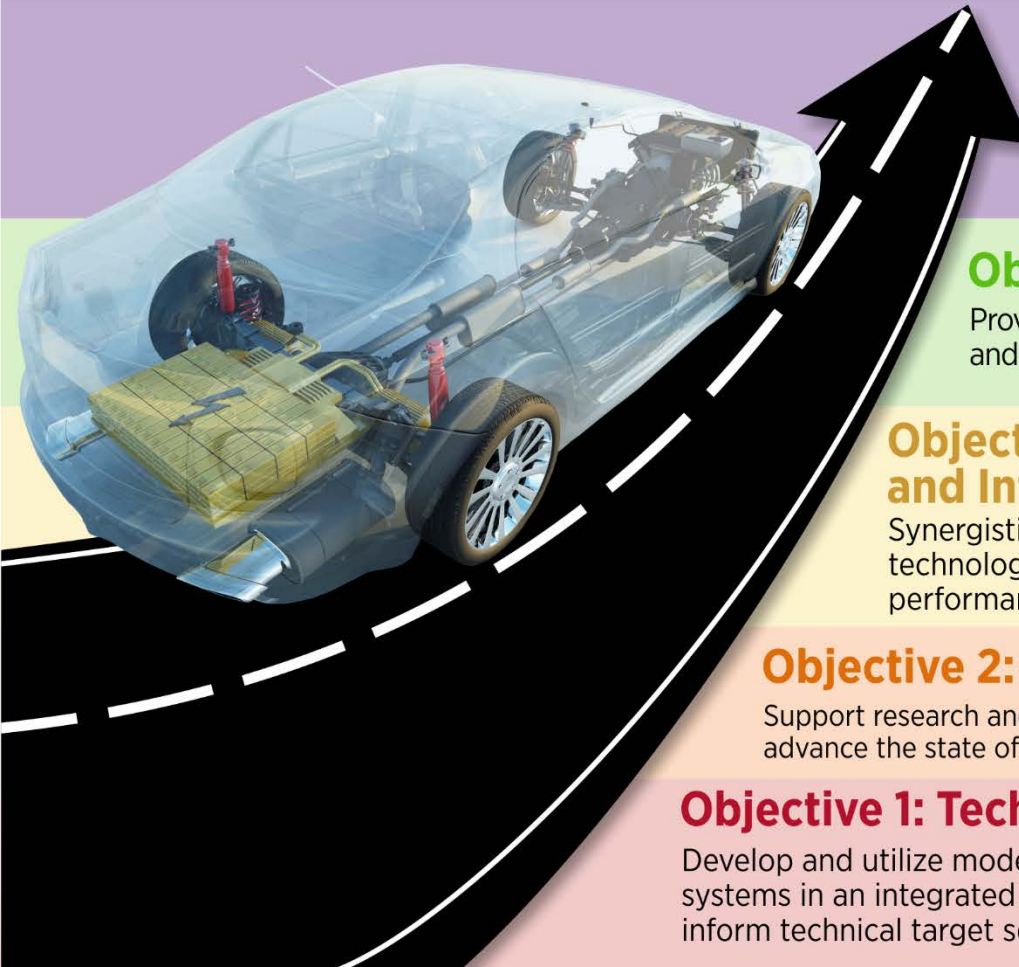
Technical Guidance

Transformational Transportation Systems

Tech-to-Market

Systems R&D

Vehicle Systems Goal and Objectives



Objective 5: Transformational Transportation Systems

Identify and evaluate transformational transportation systems and innovative implementation pathways through modeling, laboratory, and field evaluations

Objective 4: Tech-to-Market

Provide assessment tools and unbiased information to reduce the time and cost of commercializing highly efficient transportation technologies

Objective 3: Integration, Optimization, and Interoperability

Synergistically integrate and optimize system strategies and enabling technologies to maximize vehicle efficiency, interoperability, and performance

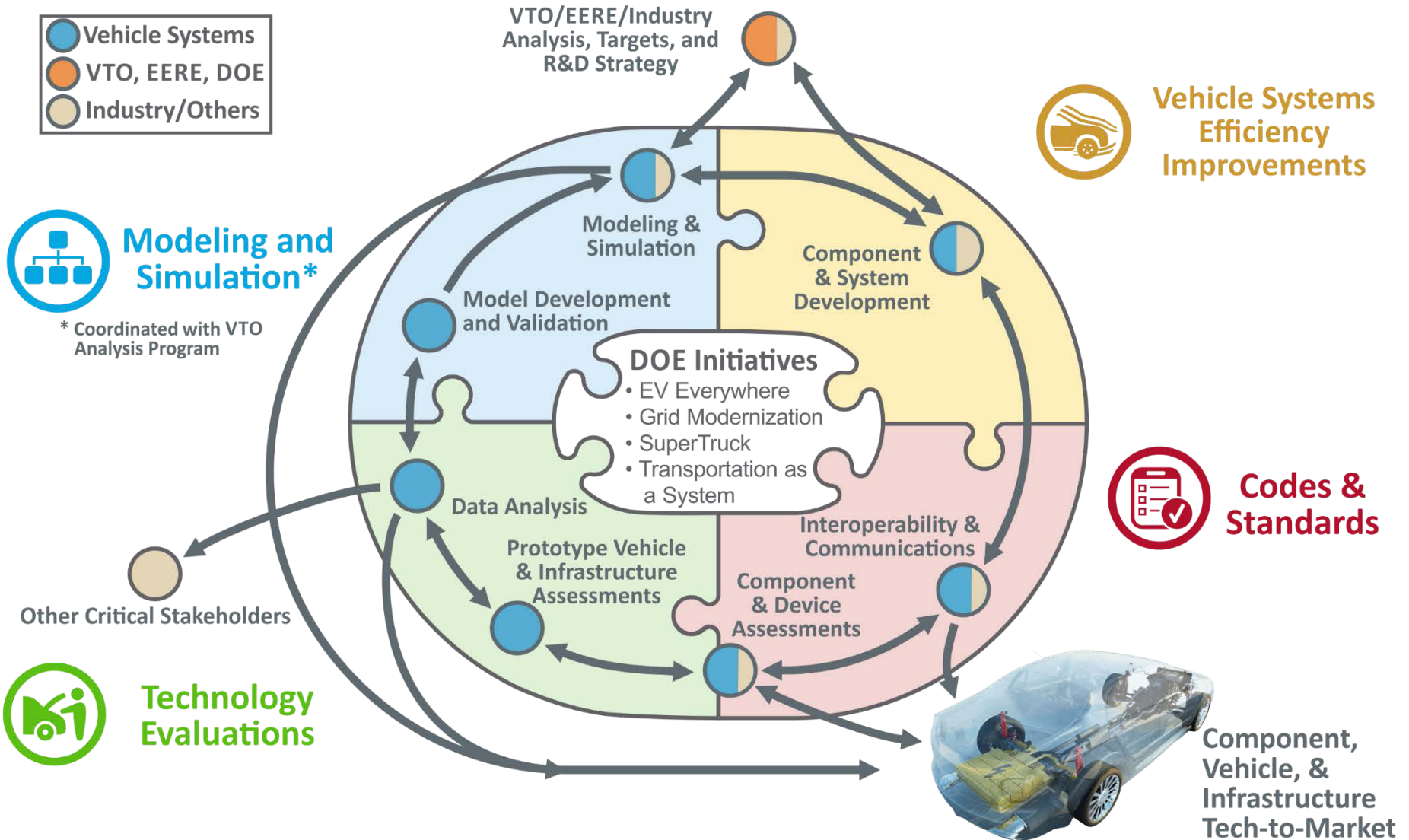
Objective 2: Vehicle Systems R&D

Support research and development of highly efficient vehicle systems technologies to advance the state of the art

Objective 1: Technical Guidance

Develop and utilize modeling, laboratory, and systems tools to assess components and systems in an integrated vehicle context and identify transformational technologies, inform technical target setting, and focus R&D

Vehicle Systems Focus Areas Are Well Integrated



Vehicle Systems Supports the EERE Strategic Plan and its Goal for Sustainable Transportation Technologies



Cost Reduction and Performance Improvement



Develop technologies that enable the cost-effective production of electric-drive vehicles



Technology Validation and Risk Reduction



Demonstrate and evaluate integrated systems for advanced vehicles and alternative fuels



Reducing Market Barriers



Support pioneering deployments of market-ready vehicles and alternative fuels in key early markets



Provide best practices, objective data, and informational materials to potential end-users and investors to promote acceptance of advanced vehicles and alternative fuels



Address alternative fuel infrastructure deployment challenges through analysis and coordination with state- and local-level initiatives



Support the development and harmonization of codes and standards

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Vehicle Systems Answers the Five EERE Core Questions



High Impact

Vehicle Systems identifies, develops, and optimizes transformational technologies to maximize transportation efficiency



Additionality

Vehicle Systems targets critical, underserved gaps and proprietary areas in modeling, testing, evaluation, and optimization to accelerate development and adoption of advanced technologies applicable to public and private stakeholders



Openness

Systems engineering encompasses all facets of technological challenges and incorporates multiple approaches and solution pathways



Enduring U.S. Economic Benefit

Increases OEM/supplier competitiveness and petroleum displacement with validated modeling tools; advanced component research; robust, timely standards; and prototype assessment data



Proper Role of Government

Provides independent, unbiased assessments, analysis, and open data reporting of advanced vehicular technologies which are not available from non-governmental sources. Enables/synergizes industry/government collaboration to address critical needs

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Vehicle Systems Accomplishments



Modeling and Simulation

- Autonomie[®] licensed to more than 175 companies and research organizations worldwide including all major U.S. vehicle OEMs supporting R&D and production. Autonomie used to establish U.S. DRIVE research targets
- Developed big data analytical methodology to estimate fuel savings of “off-cycle” technologies to facilitate deployment of real-world vehicle efficiency solutions
- Developed HVAC system and thermal modeling tools used by light- and heavy-duty vehicle OEMs to design efficient thermal comfort solutions

Vehicle Systems Accomplishments



Codes and Standards

- USDOE and EU EV-Smart Grid Interoperability Centers launched to support harmonization of vehicle, battery, and interoperability standards and test procedures
- Completed the Smart Energy Plaza, integrating EVSE, building systems, and solar to support V2G communications/control studies
- Provided leadership, technical support for procedures / approaches, and device development / validation for 33 EDV interoperability / communication standards



Vehicle Systems Efficiency Improvements

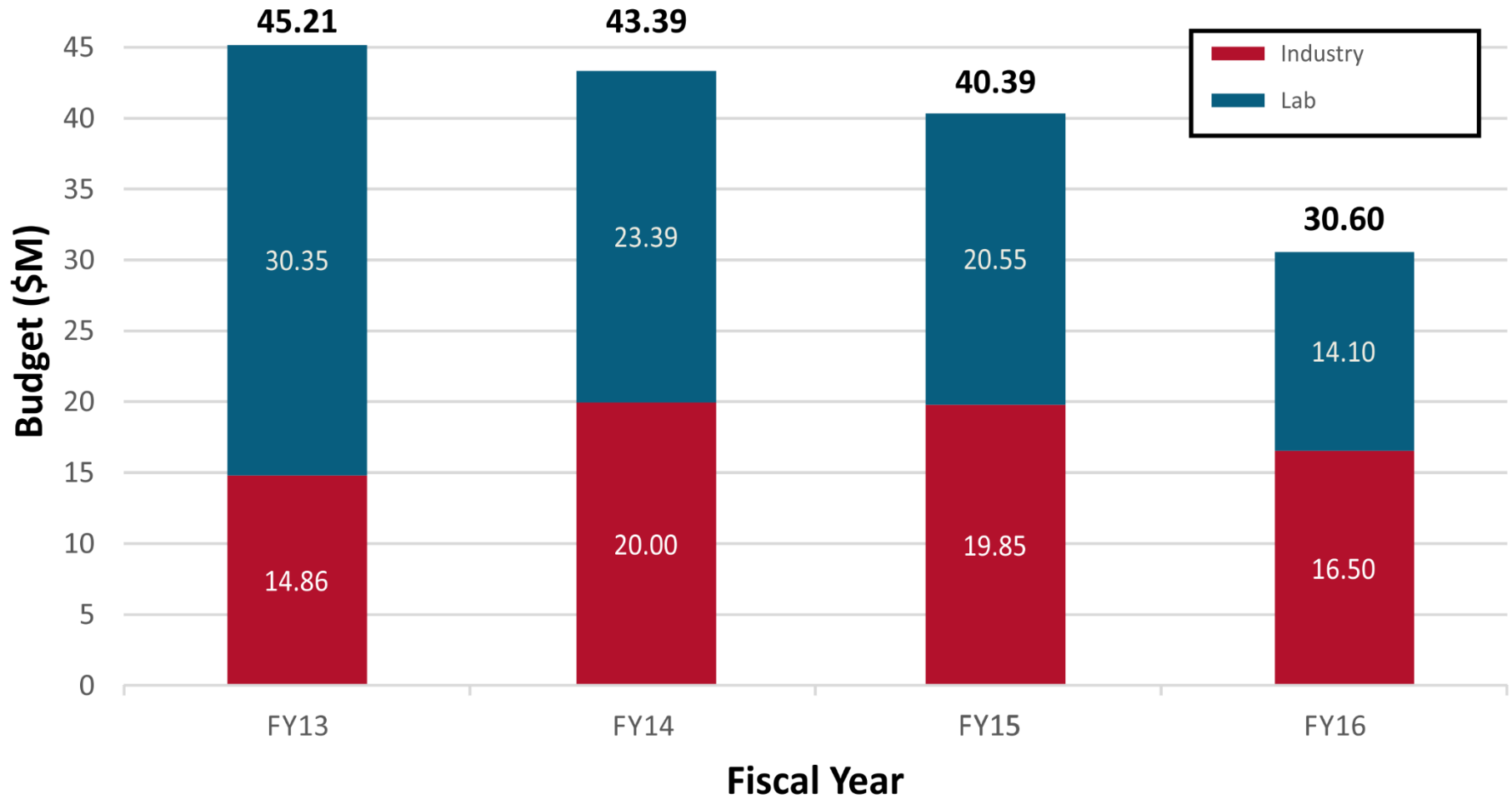
- Designed new body-shape for next generation highly aerodynamic and integrated SuperTruck Class 8 tractor-trailer
- Developed WPT technologies that demonstrated >20KW WPT with 92% end-to-end efficiency meeting ICNIRP requirements
- Demonstrated zonal cabin heating strategy with potential for 28.5% drop in EV HVAC energy use



Technology Evaluations

- Conducted Interoperability testing of AC Level 2 EVSEs / PEVs with SAE
- Quantified real world impact of frequent DCFC showing no significant degradation, thereby enhancing customer perception of EDV usability
- Collected/analyzed data on five multi-year demos of PEVs/infrastructure for dissemination through EV Everywhere Solutions Center
- Developed industry adopted BEV range and fuel economy short cut test for Federal EPA certification

Vehicle Systems Budget Evolution



Vehicle Systems: FY16 Focus and Beyond

- **EV Everywhere:** Through systems and component evaluation/optimization and development of unique thermal control and auxiliary load reduction technologies, support goal to make PEVs as cheap and convenient to own and operate for the average American family as conventional vehicles by 2022
- **Wireless Charging:** 100 KW at >90% efficiency with gap position tolerance
- **Codes and Standards:** high power charging, international coordination, connectivity, communication, and certification
- **Cyber Security:** Vehicle/EVSE/grid interface and CAVs
- **Grid Modernization:** Grid services, impacts on vehicle & components, communications, charge management, and integration of renewables
- **SuperTruck 2:** Support demonstration of a 100% improvement in freight efficiency by 2020 compared to 2009 baseline through hybridization/electrification and reduction in parasitic loads including aerodynamic, HVAC, and rolling resistance losses
- **Transportation as a System:** Identify untapped transportation system level energy efficiency opportunities past the vehicle-level to accelerate sustainable transport

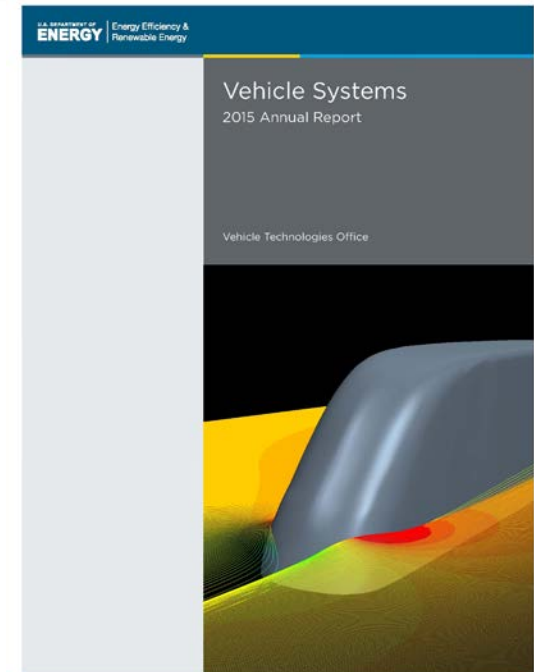
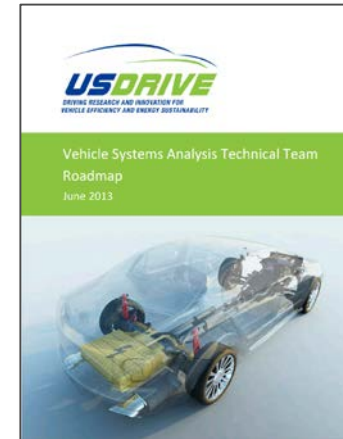
VTO Vehicle Systems R&D Road Maps and Reports

- **U.S. DRIVE Vehicle Systems Analysis Technical Team and Grid Interaction Technical Team R&D Roadmaps**

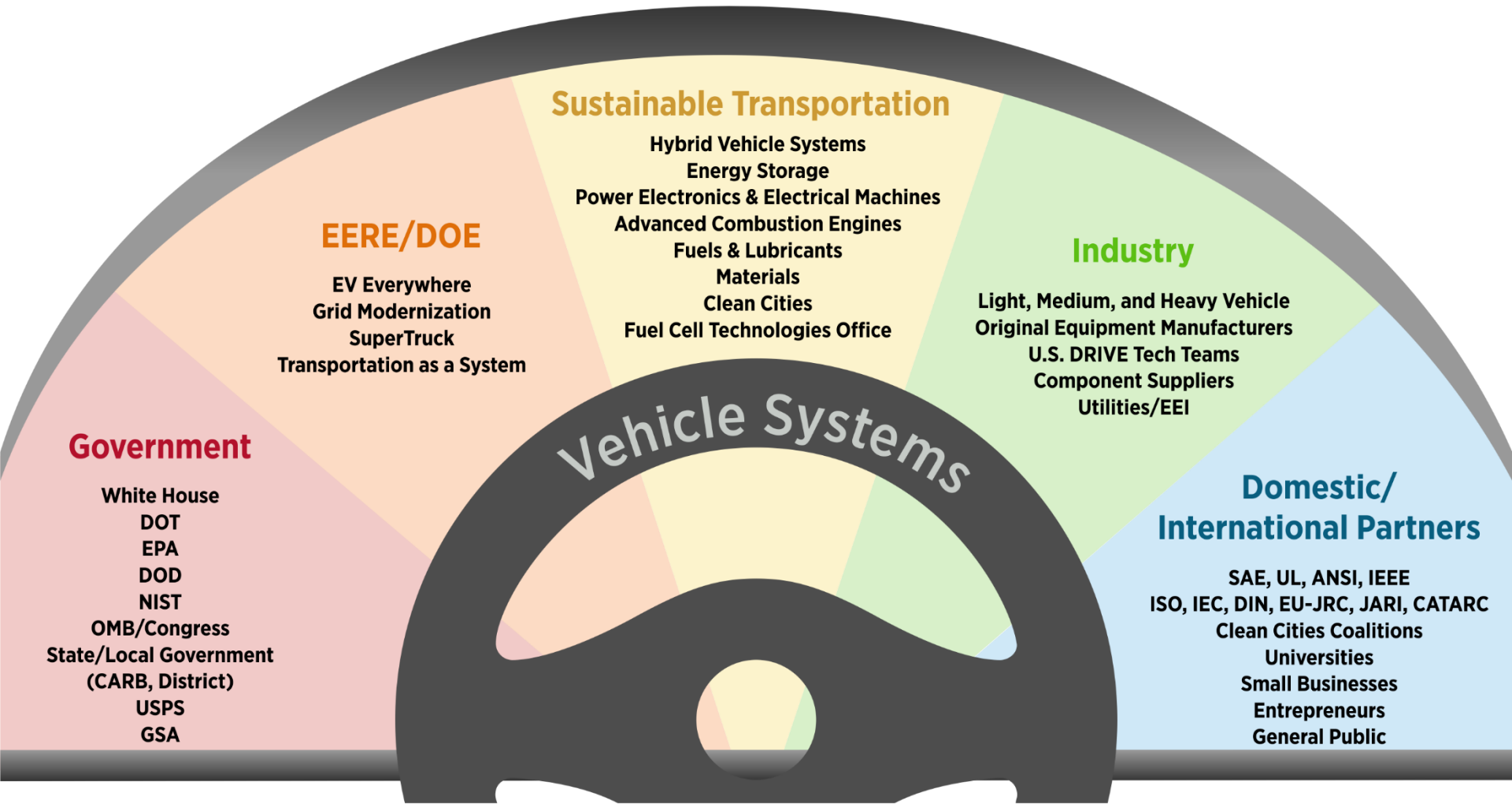
- Describe ongoing/planned R&D efforts by U.S. DRIVE Technical Teams supported by the Vehicle Systems Program.
- http://energy.gov/sites/prod/files/2014/02/f8/vsatt_roadmap_june2013.pdf.
- http://energy.gov/sites/prod/files/2014/02/f8/gitt_roadmap_june2013.pdf.

- **Vehicle System R&D Annual Progress Report for FY2015**

- Describes all Vehicle Systems R&D projects funded by DOE Vehicle Technologies Office (VTO) at a national laboratory or in partnership with industry.
- <http://energy.gov/eere/vehicles/downloads/vehicle-technologies-office-2015-vehicle-systems-annual-progress-report>.



Vehicle Systems Supports Government, Industry, and 3rd Party Partners



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