



# Sustainable TRANSPORTATION

U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency &  
Renewable Energy

## VTO Analysis Portfolio

**Jacob Ward**

Vehicle Technologies Office

[vehicles.energy.gov](http://vehicles.energy.gov)

Annual Merit Review

May 16, 2013

Project ID: VAN000

# VTO Analysis Mission and Vision

---

## mission

Plan, execute, and communicate technology, societal, economic, and interdisciplinary analyses for VTO, EERE, DOE, and external stakeholders

## vision

Robust transportation energy analysis that speaks for itself

# VTO Analysis Portfolio at a Glance

## Models and Tools:

VISION+



**Macro-econ.  
Accounting**

MA3T, ADOPT, VCM,  
SEDS, TRUCK



**Market Penetration**

GREET



**Emissions and Environmental  
Modeling**

Autonomie, FASTSim  
HTEB



**Vehicle Modeling and Simulation**

TEDB, xEV data,  
SRA database



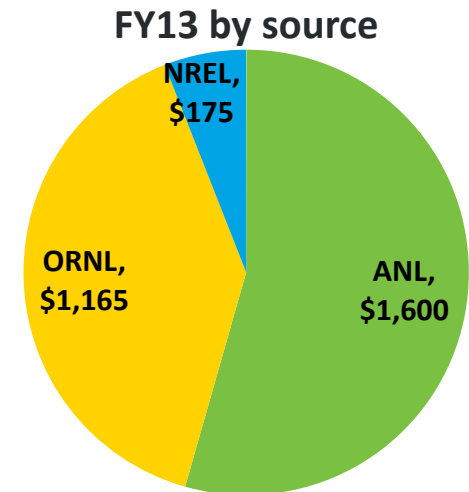
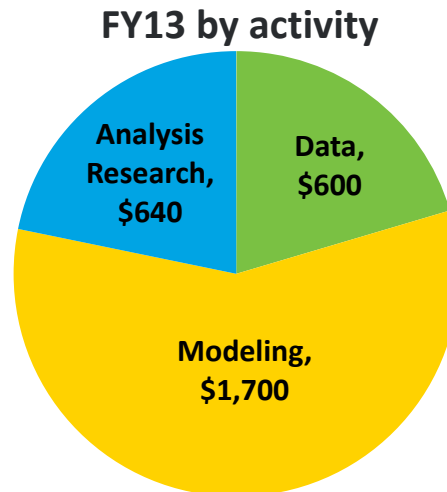
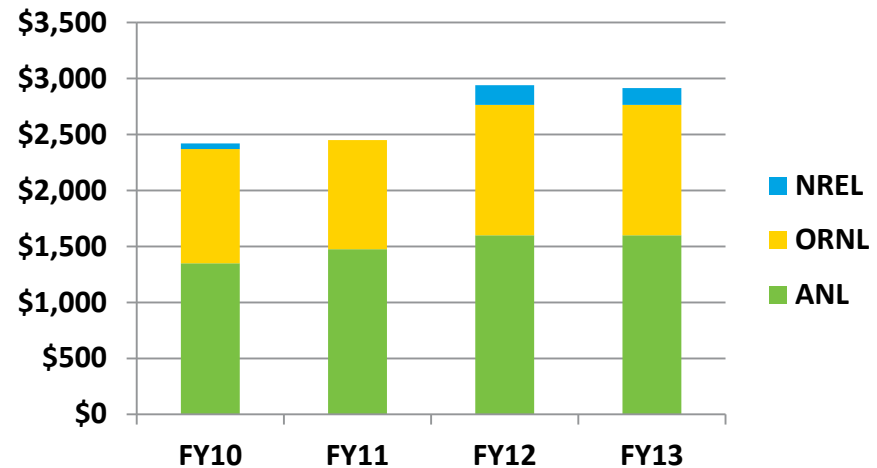
**Technology and Market Data**

**Integrated  
Analysis**

# VTO Analysis Budget

(all numbers in thousands of dollars)

- Budget has been roughly steady around \$3 M for four fiscal years
- The portfolio funds data, modeling, and original analysis
- Laboratory support comes from ANL, ORNL, and NREL





## now

- Published Transportation Energy Data Book, edition 31
- Track and publish xEV sales domestically and abroad
- Develop database to test effects of economic effects on vehicle sales

## next

- Continue updating and disseminating data sources regularly
- Expand market knowledge with third-party data
- Distill and publish robust economic effects affecting and related to vehicle sales



DATA



## now

- Calculate vehicle cost-performance pair meta-data
- Establish VTO inputs for official EERE Low-Carbon Scenario
- Facilitate DOE Levelized Cost of Driving (LCD) official Program Record

## next

- Continue development of user-friendly vehicle characteristics GUI and diagnostic metrics
- Author and publish results and methodology documentation
- Leverage vehicle characteristic meta-data into a family of spin-off publications

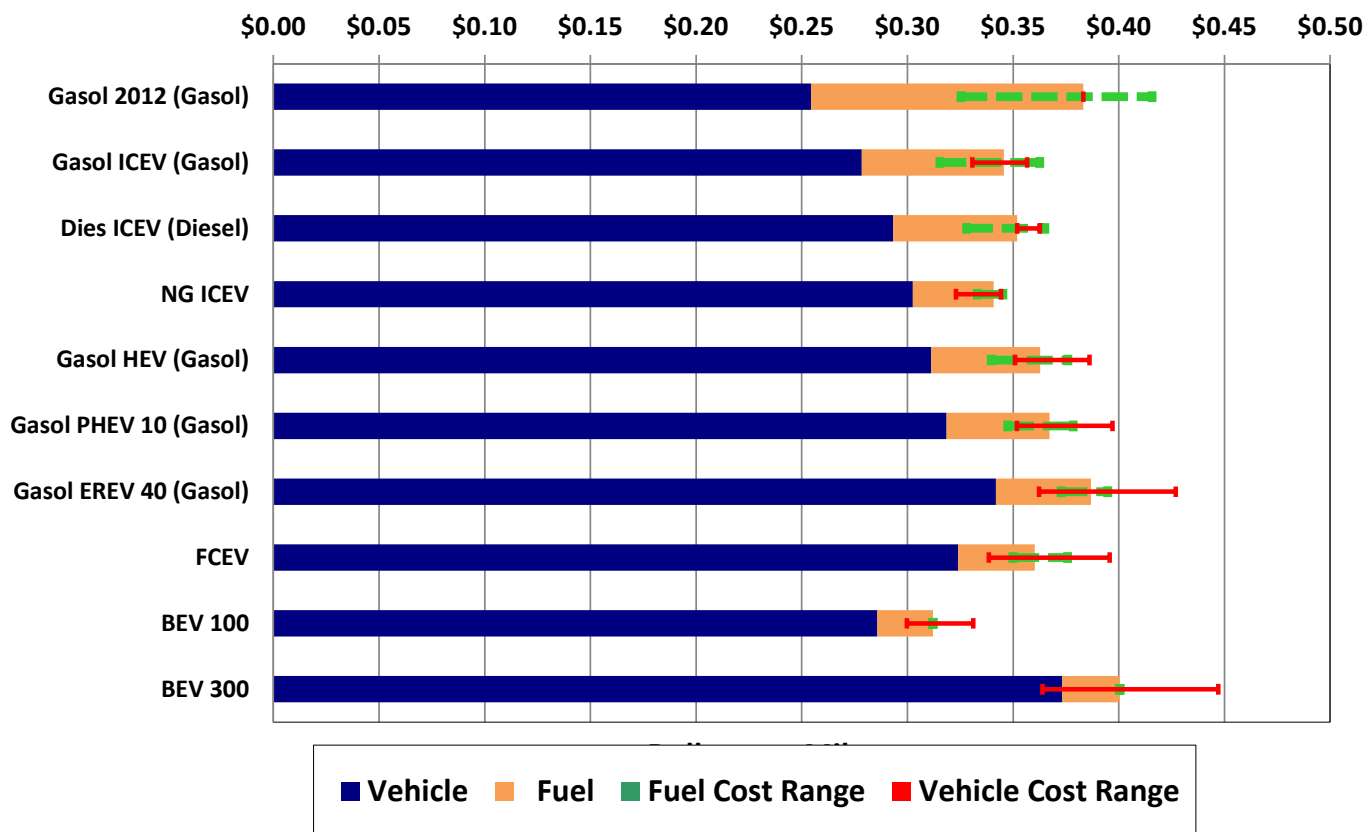
VEHICLE

# Example Results – Levelized Cost of Driving (\$/mi)



## Private View: 5-year ownership period

Vehicle and Fuel Costs per Mile for Midsize Vehicles, 2035  
(Vehicle purchase price estimated as 1.5 x manufacturing cost) (2010\$)



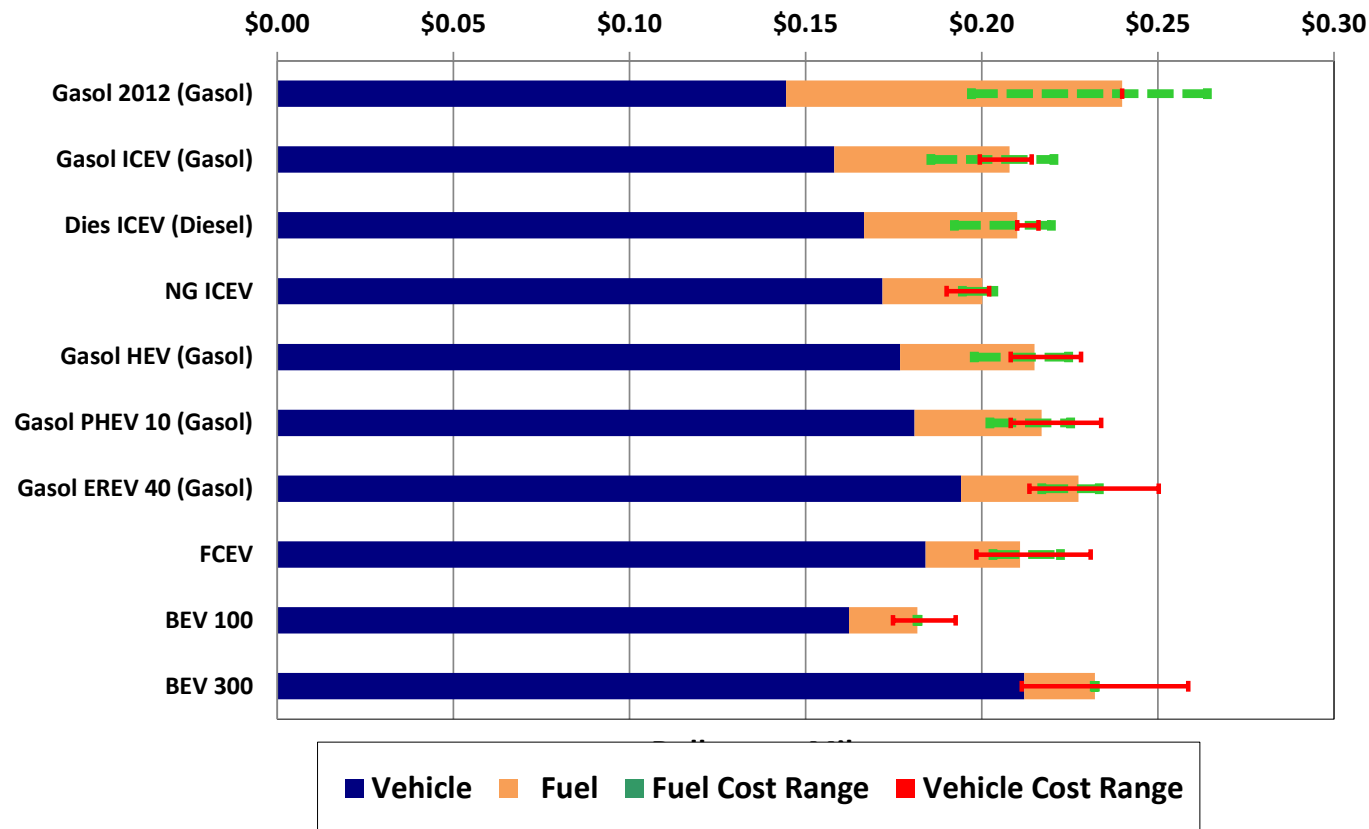
Notes: Average distance driven per car-year derived from USDOT/NHTSA analysis, Resale value at 25% of price, 7% net discount rate for future fuels expenditures, 2035 Results – 5-Year Ownership, 14,000 Miles, (22,500 km) per year (2010 Dollars)

# Example Results – Levelized Cost of Driving (\$/mi)



## Societal View: 15-year vehicle life

Vehicle and Fuel Costs per Mile for Midsize Vehicles, 2035  
(Vehicle purchase price estimated as 1.5 x manufacturing cost) (2010\$)



Notes: Average distance driven per car-year derived from USDOT/NHTSA analysis, Resale value at 25% of price, 7% net discount rate for future fuels expenditures, 2035 Results – 15-Year Ownership, 14,000 Miles, (22,500 km) per year (2010 Dollars)





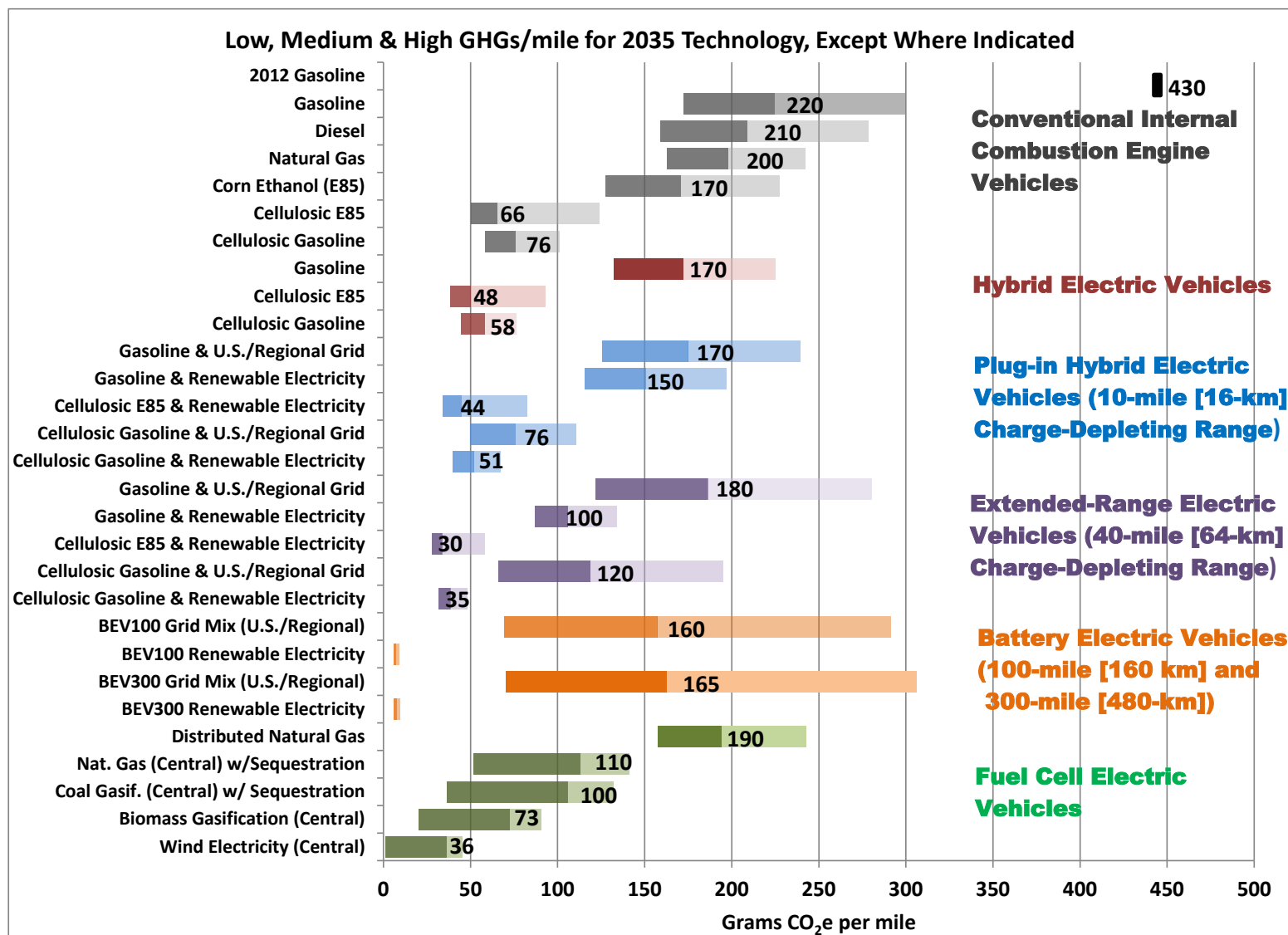
## now

- Provide input to and publish DOE Well-to-Wheel (WTW) official Program Record
- Research and incorporate facility/infrastructure cycle data
- Further develop “GREET.net” user-friendly software platform

## next

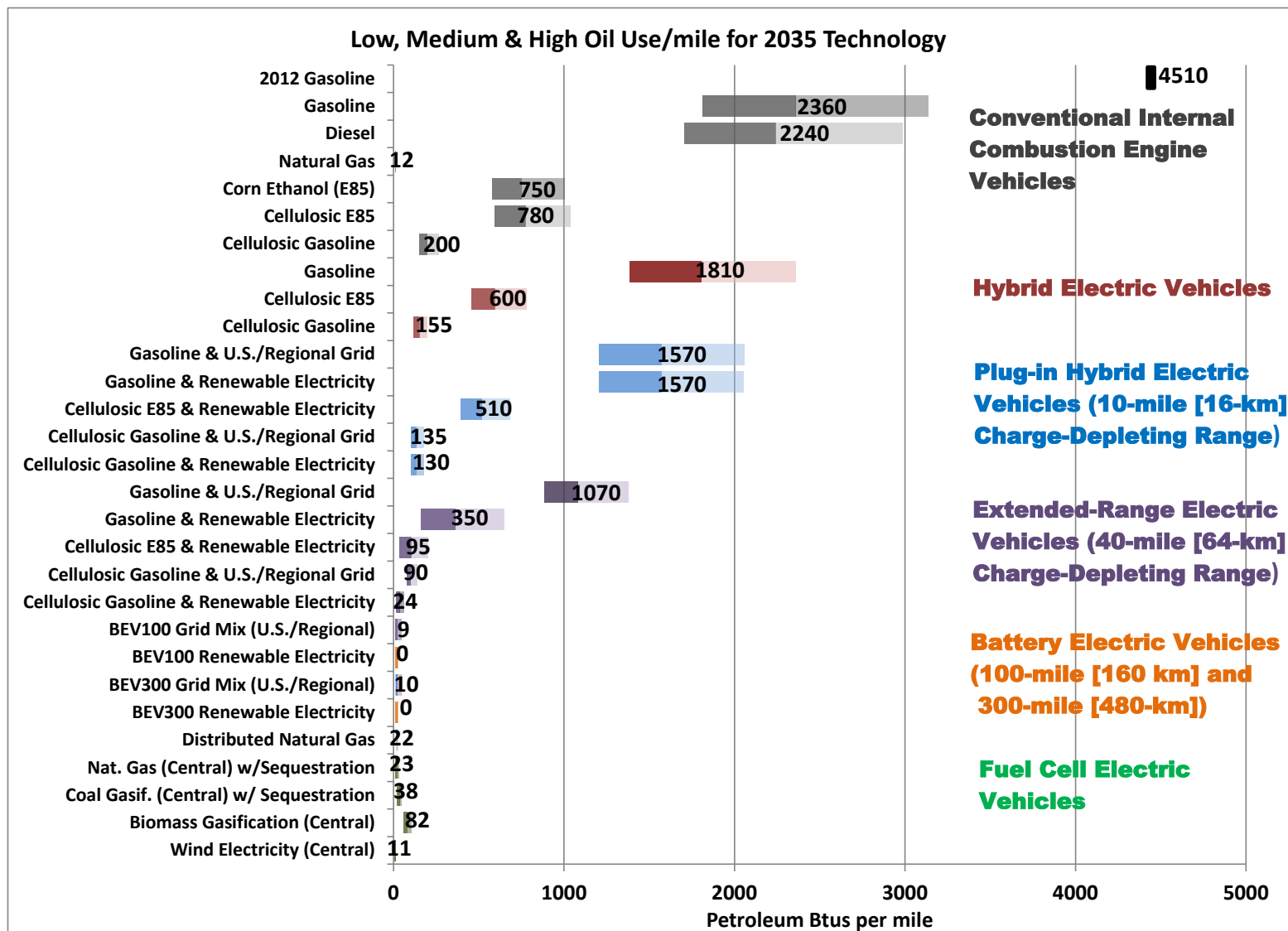
- Continue expansion of GREET.net user-friendly GUI
- Research and refine “back-end” infrastructure and facility data
- Formally begin vehicle-fuel pathway water footprint modeling

# Example Results – Emissions (gCO<sub>2</sub>e/mile)



ECO

# Example Results – Petroleum Use (BTU/mile)



ECO



## now

- Coordinate 4 vehicle choice models (VCMs) for suite operation using common input
- Refine range-anxiety research and incorporate into models
- Estimate market penetration scenario and provide inputs to various analyses

## next

- Cross-validate VCMs via suite operation
- Incorporate 2 additional vehicle choice models for more robust market penetration “triangulation”
- Expand VCM dialogue by engaging with experts beyond the DOE community; compare and refine models accordingly



## now

- Update baseline scenarios to match historical and AEO-projected future data
- Expand tool set to novel analysis modes (e.g., off-highway)
- Design and execute integrated, coherent macroeconomic analysis scenarios examining and estimating VTO technology R&D benefits

## next

- Author and publish benefit metrics and methodology
- Prepare and execute iterative analytical updates as VTO goals, targets, and milestones are updated

# VTO Analysis Portfolio in Summary

Analysis Type: Models:	DATA	VEHICLE	ECO	MARKET	MACRO
TEDB					
xEV sales					
SRA database					
Autonomie					
FASTSim					
HTEB					
GREET					
MA3T					
ADOPT					
VCM					
SEDS					
TRUCK					
VISION					

- The VTO analysis portfolio (left) covers the full analysis space and includes some redundancies
- Some projects (e.g., GPRA, below) span all categories for a truly integrated analyses

GPRA integrated analysis	DATA	VEHICLE	ECO	MARKET	MACRO
<i>expert input</i>					
Autonomie					
HTEB					
GREET					
MA3T					
TRUCK					
VISION					

# VTO Analysis Presentations

Time	Project ID	VAN Category	Principal Investigator	Project Title
9:30	VAN001	MACRO	Tom Stephens, ANL	Analysis of Vehicle Technologies and Reduction of Oil Use and GHG Emissions
10:00	VAN002	ECO	Michael Wang, ANL	WTW Analysis of Vehicle/Fuel Systems and GREET Development

**10:30**

**BREAK**

11:00	VAN003	DATA	Mark Singer, NREL	Consumer Vehicle Technology Data
11:30	VAN004	MARKET	Aaron Brooker, NREL	Analytical Modeling Linking the FASTSim and ADOPT Software Tools
12:00	VAN005	MARKET	Zhenhong Lin, ORNL	Updating and Enhancing the MA3T Vehicle Choice Model

# VTO Analysis Posters

Project ID	Principal Investigator	VAN Category	Project Title
VAN006	Anant Vyas, ANL	MACRO	Development and Update of Models for Long-Term Energy and Emissions Projections
VAN007	Tom Stephens, ANL	MACRO	Government Performance and Results Act (GPRA) Analysis
VAN008	Aymeric Rousseau, ANL	VEHICLE	Support for Government Performance and Results Act (GPRA)
VAN009	Stacy Davis, ORNL	DATA	Vehicle Technologies Data, Markets, and Publications
VAN010	David Greene, ORNL	MACRO	Enhancement of the Oil Security Metric Model (OSMM)





# Sustainable TRANSPORTATION

U.S. DEPARTMENT OF  
**ENERGY** | Energy Efficiency &  
Renewable Energy

Jacob Ward  
Vehicle Technologies Office  
[vehicles.energy.gov](http://vehicles.energy.gov)

