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

VTO Analysis Portfolio

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VTO Analysis Goals, Objectives, and Strategy

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

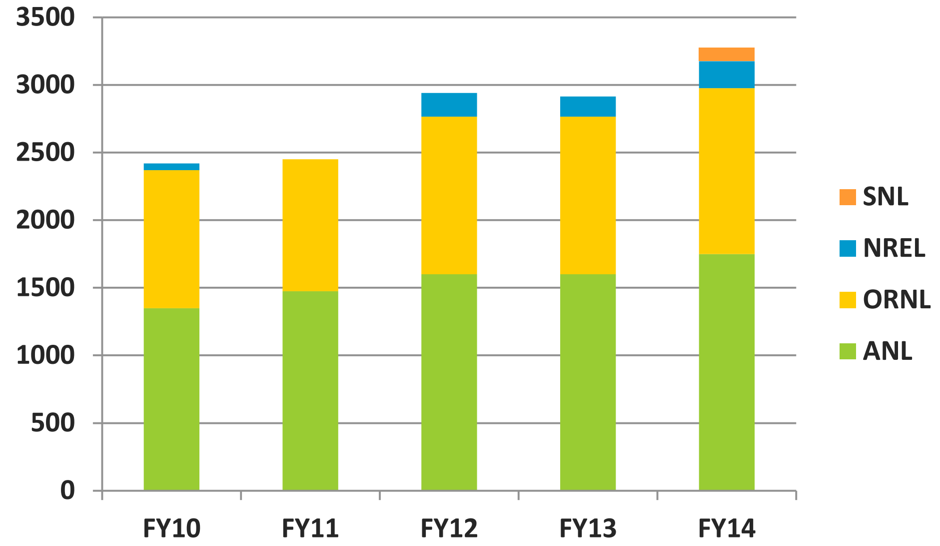
objective Robust transportation energy analysis that speaks for itself

strategy Support a strong foundational of data, build relevant analytical models, and execute insightful integrated analyses

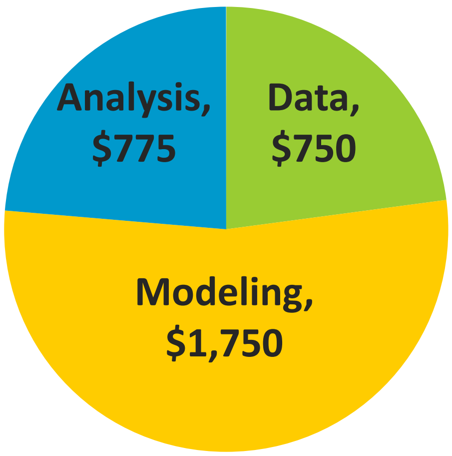
VTO Analysis Budget

(all numbers in thousands of dollars)

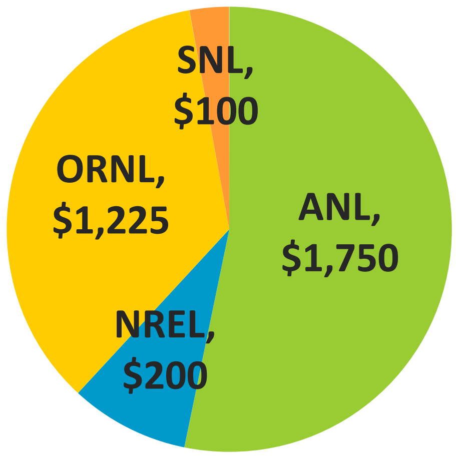
- Budget has been roughly steady around $3 M for five fiscal years
- The portfolio funds data, modeling, and original analysis
- Laboratory support comes from ANL, ORNL, NREL, and SNL



FY14 by activity



FY14 by source



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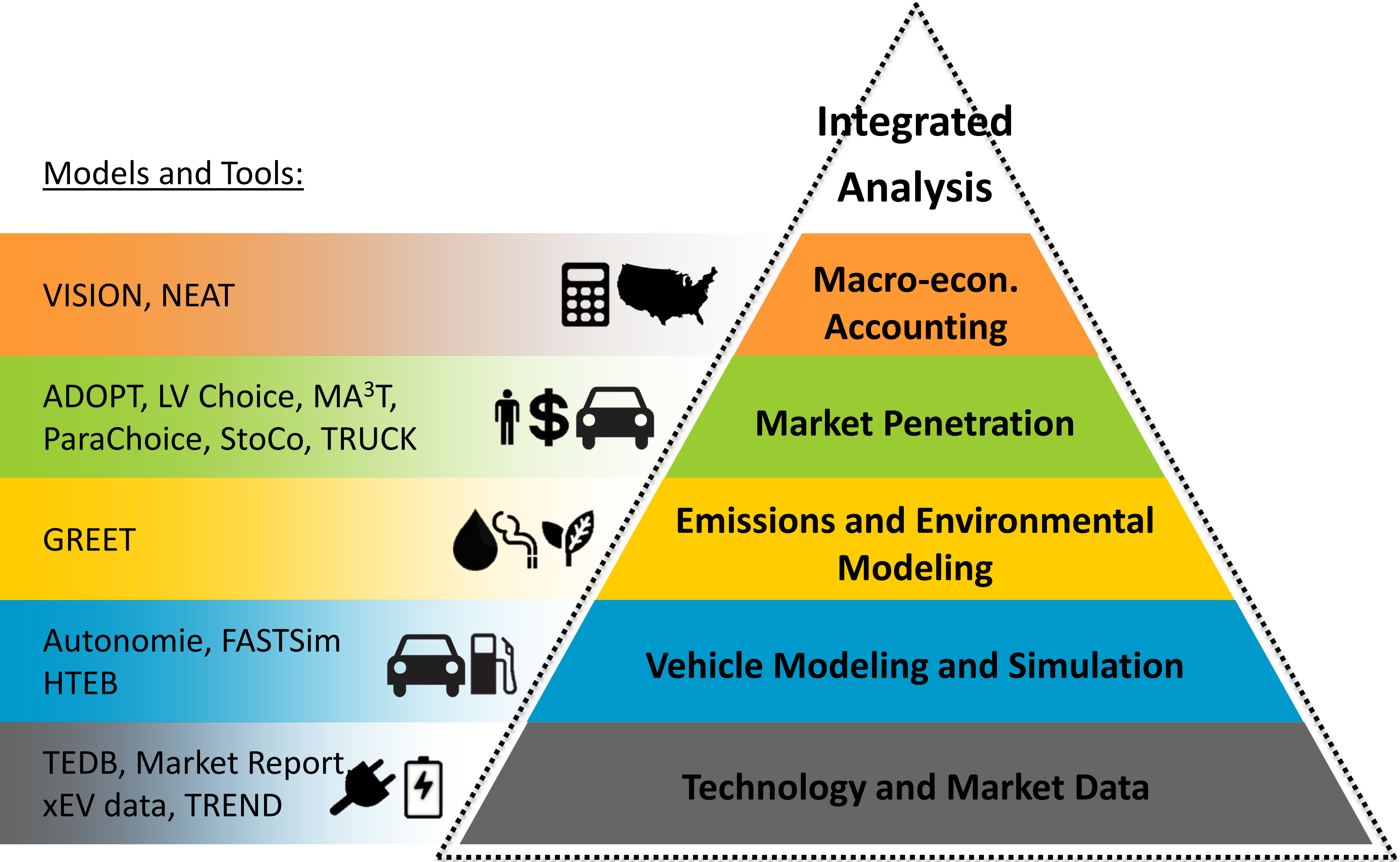
VTO Analysis Portfolio at a Glance



Technology and Market Data

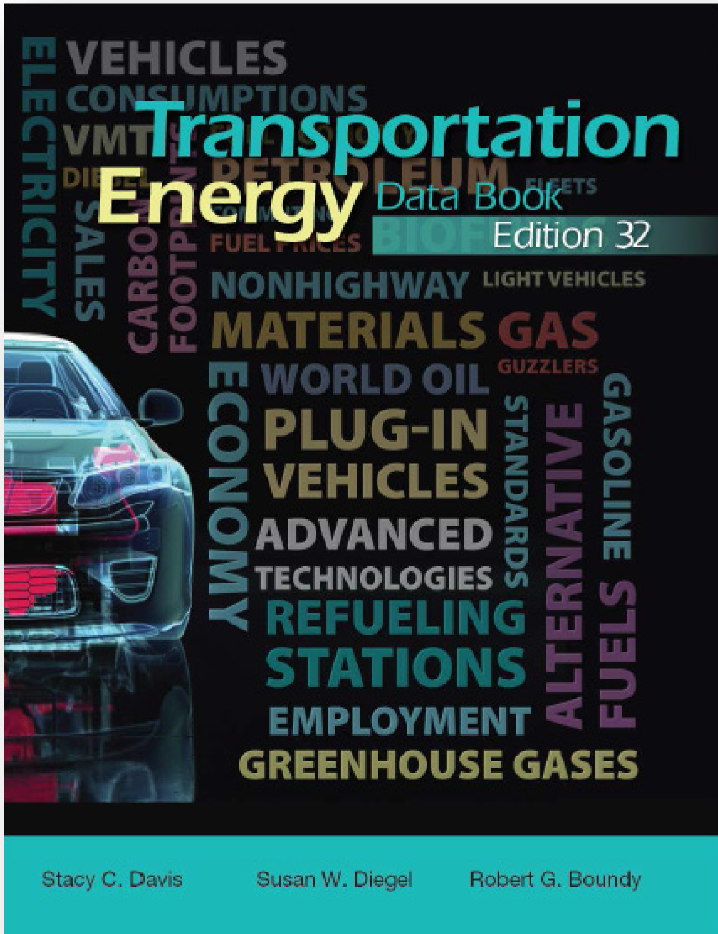
2013

- Published Transportation Energy Data Book, edition 32
- Track and publish P/H/EV sales domestically and abroad
- Develop database to test effects of economic effects on vehicle sales

future work

- 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

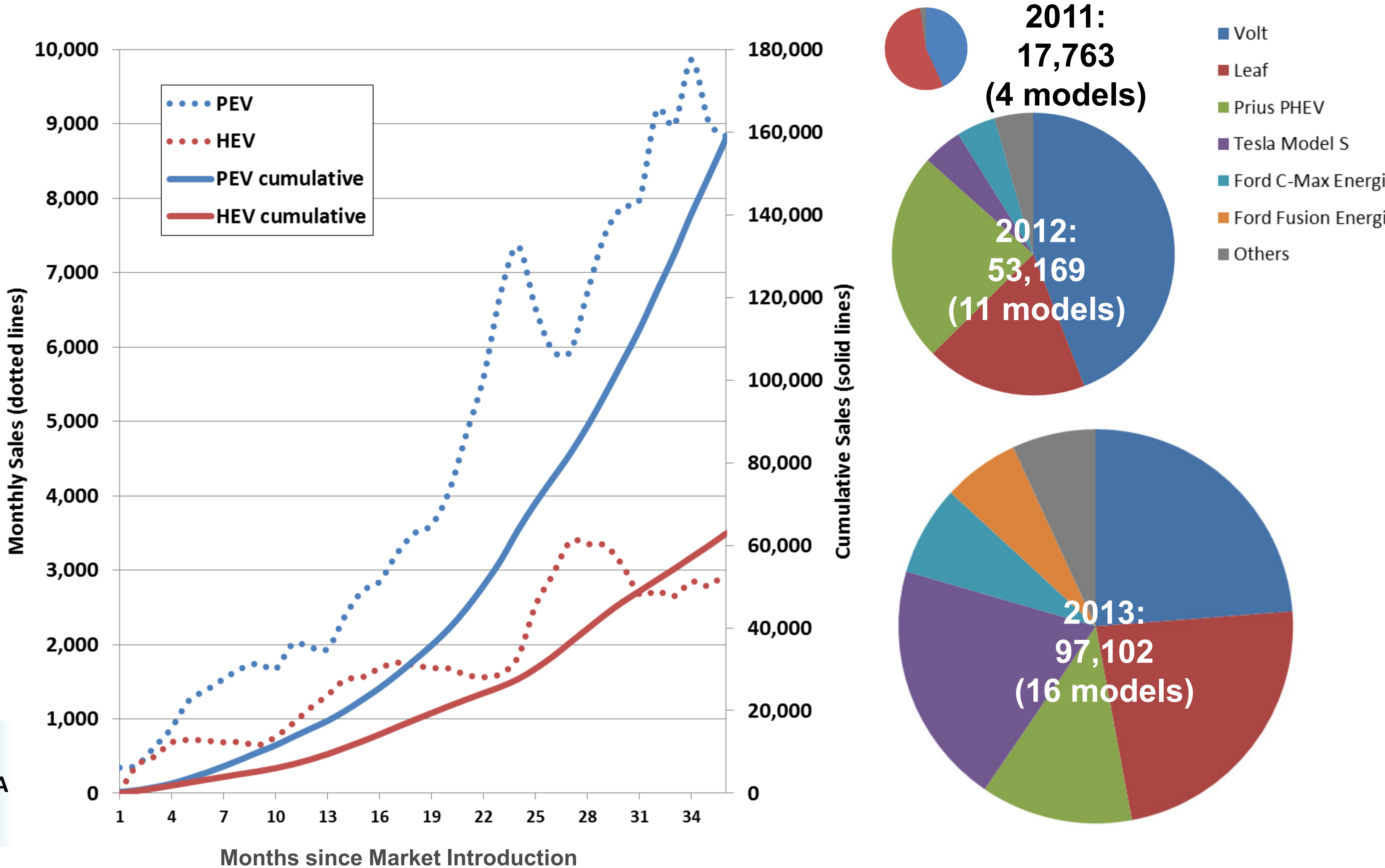


Website address:
http://cta.ornl.gov/data/

Website address:
http://cta.ornl.gov/vtmarketreport/

DATA

P/H/EV data show sales are increasing



DATA

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2013

- 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

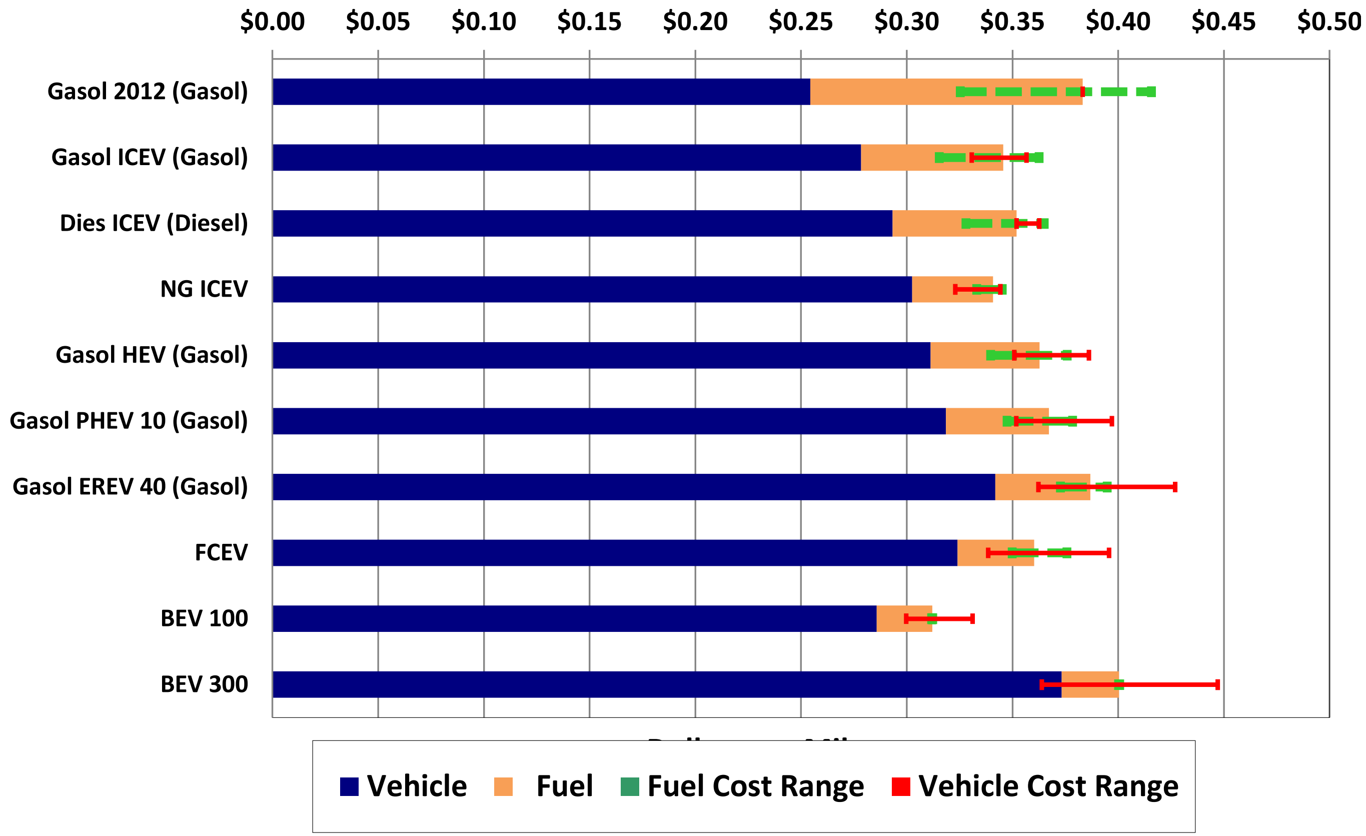
future work

- 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

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$)

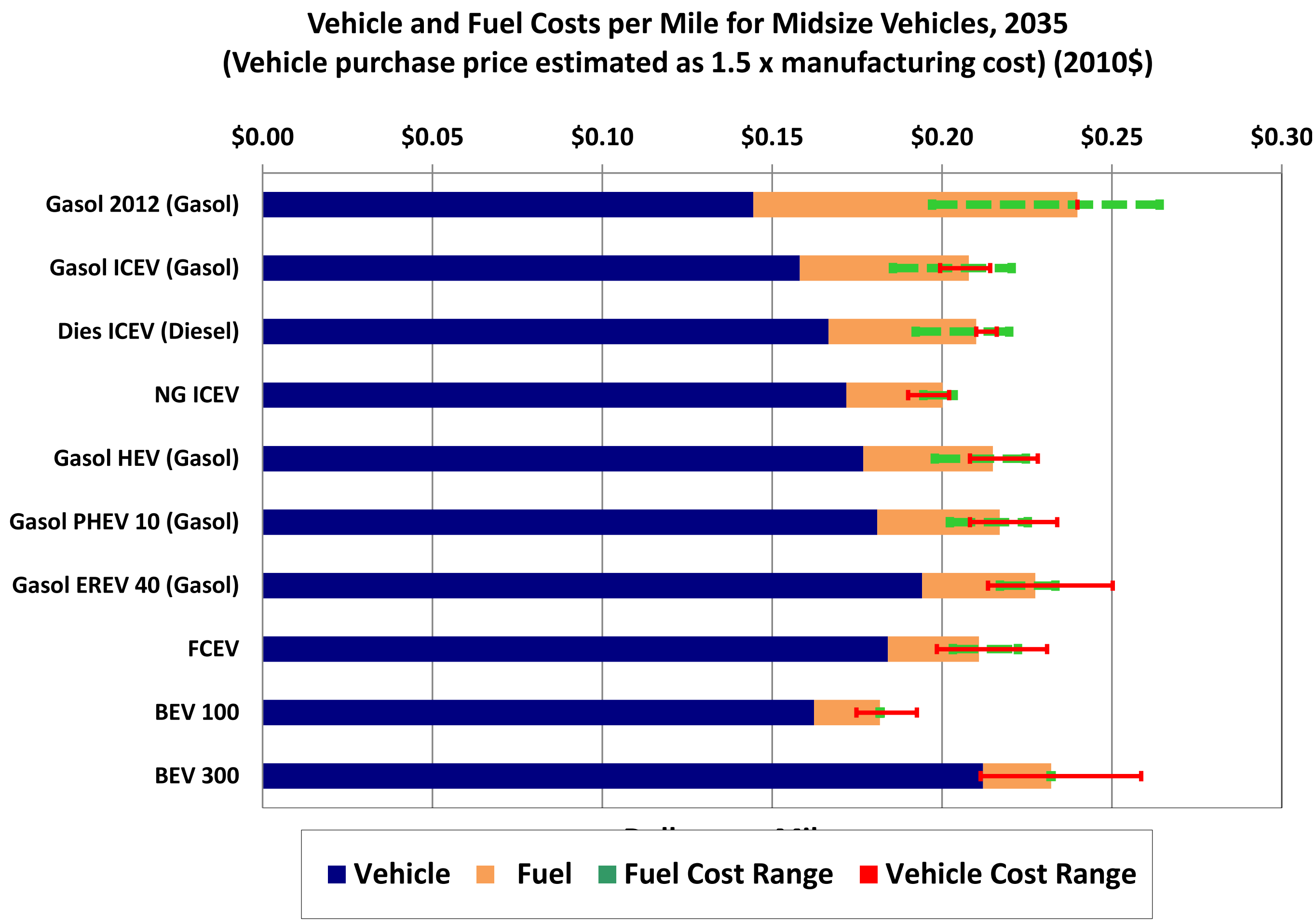


VEHICLE

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

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ECO

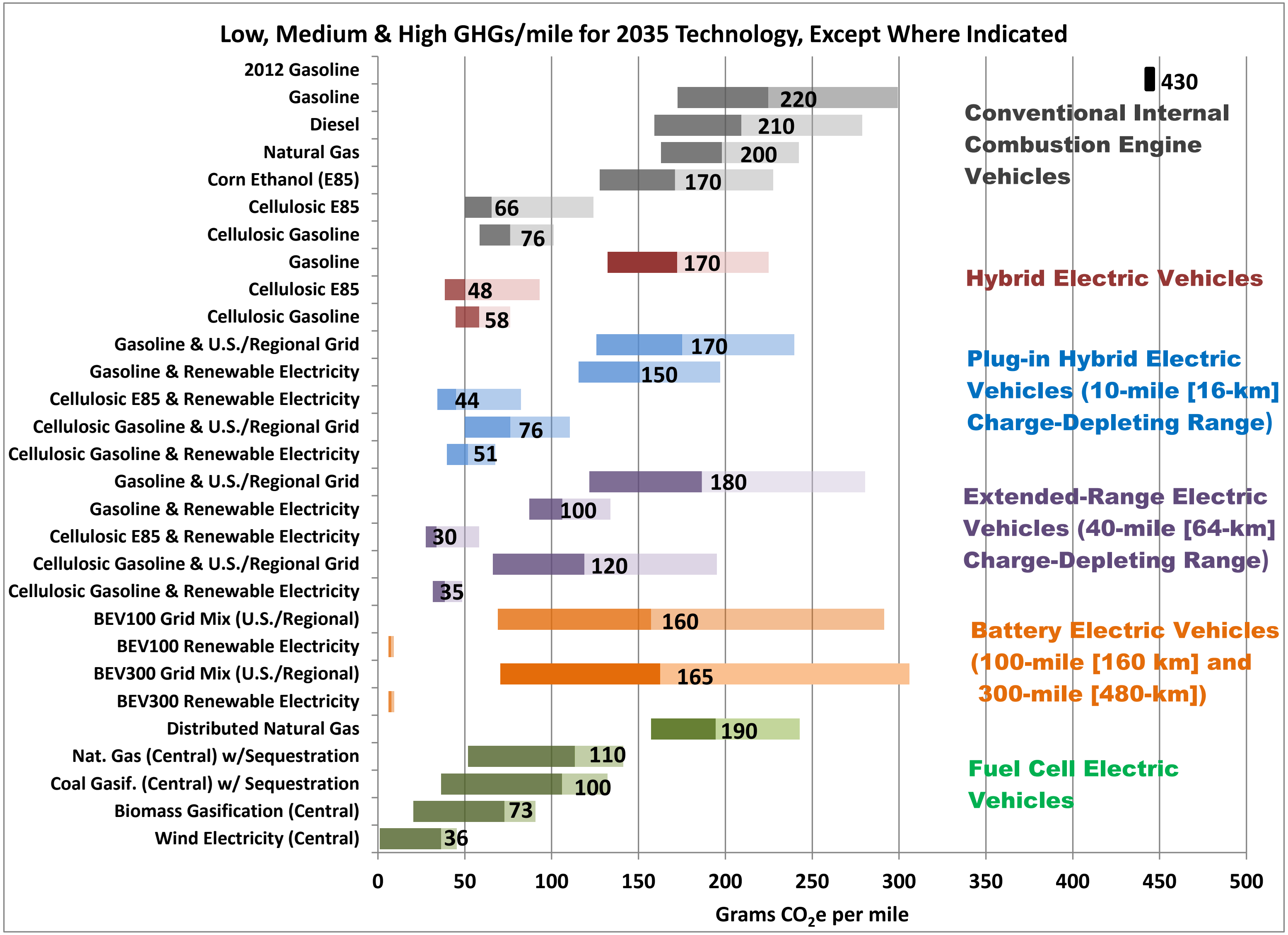
2013

- 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

future work

- 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_2e/mile)



ECO

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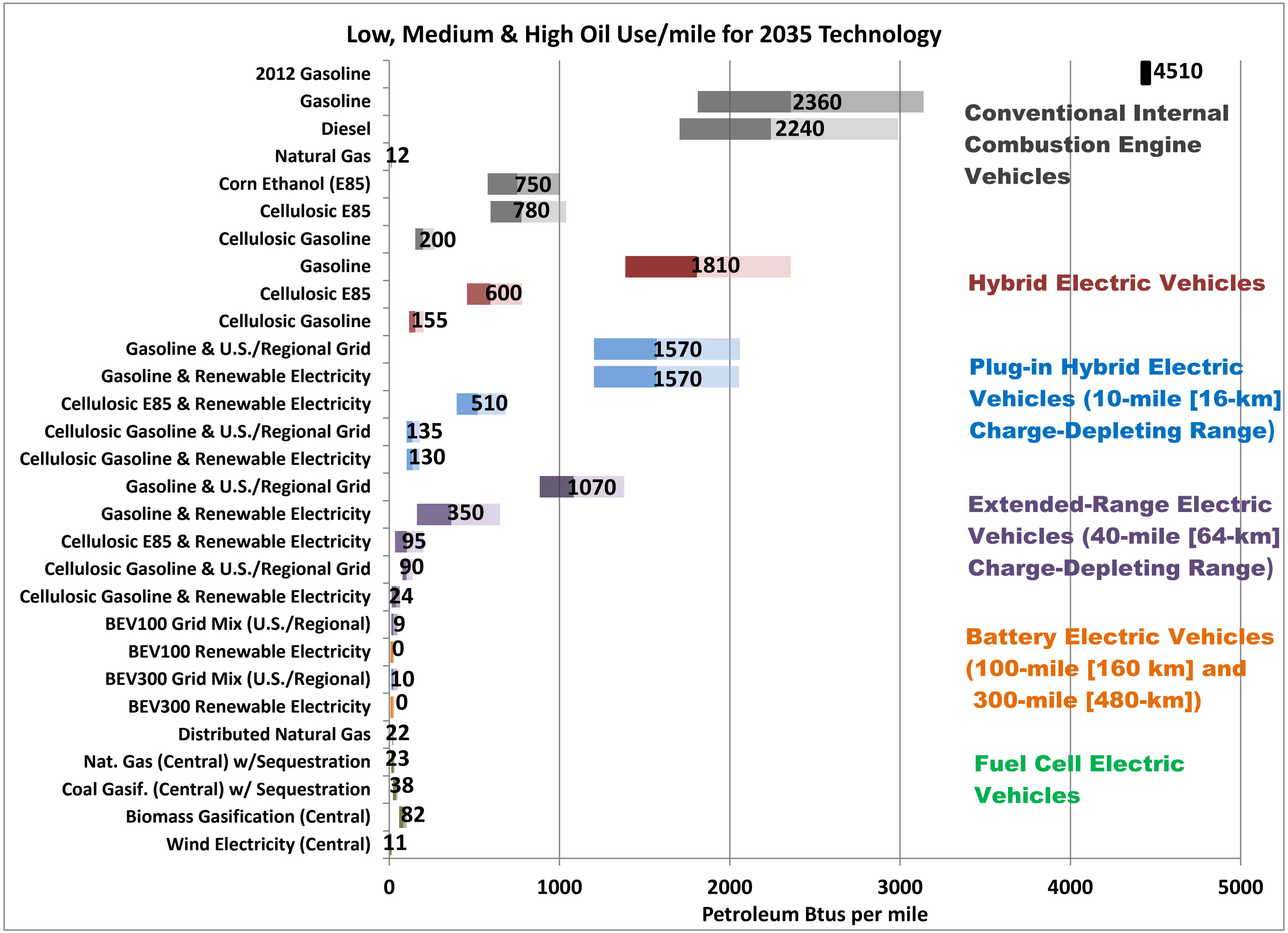
Example Results – Petroleum Use (BTU/mile)



ECO

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MARKET

2013

- Coordinate 6 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

future work

- Cross-validate VCMs via suite operation
- Expand VCM dialogue by engaging with experts beyond the DOE community, both nationally and internationally; compare and refine models accordingly

Motivation for understanding consumer choice

Three important contextual caveats:

1. DOE's Energy Information Administration (EIA) is the *only* part of DOE responsible for future energy projections (through the Annual Energy Outlook, AEO)
2. Neither VTO nor EERE are in the business of market projection.
3. VTO-supported market/consumer choice analysis models are tools for understanding how VTO R&D investment and complementary Federal policies can further VTO goals (reducing petroleum consumption, abating GHG emissions, and bolstering energy security)

MARKET

Primary use: VTO R&D portfolio benefits analysis

- VTO R&D lowers technology cost and improves performance
- Translating technology progress to national benefits requires market understanding

Secondary use: Federal policy analysis

- Federal policies (subsidies, infrastructure investment) complement technology progress
- Interactions require market understanding

Ad hoc use: scenario analysis

- Full transportation transition scenarios require some investment (in technology and policy)
- Market understanding provides insight into such transitions

Models are *generally* similar at a high level

MARKET

	ADOPT	LAVE-Trans	LV Choice	MA^3T	ParaChoice	StoCo
Authoring institution:	NREL	ORNL	TA Engineering	ORNL	Sandia	ANL
Origin:	NREL LDRD	CA ZEV NRC	Simplified version of EIA's NEMS	Legacy development from TAFV, HyTrans, etc.	Sandia LDRD	EERE uncertainty analysis
Inputs from:	Autonomie (vehicle) GREET (emissions) EIA (fuel)					
Standard outputs:	market share energy use GHG emissions					

…but each model offers unique analytical capabilities

MARKET

	ADOPT	LAVE-Trans	LV Choice	MA^3T	ParaChoice	StoCo
Unique outputs:		• transition uncertainty analysis			• parametric trade-space output	• results with uncertainty distributions
Unique methods:	• competes all LDVs (over 1000 trims) • “clones” successful models • consumers at ZIP code level	• benefit-cost calculation for energy transition • “back-casting” for desired transition	• explicit consideratio n of size classes • intentional mimicry of NEMS	• 1458 consumer segments	• Monte Carlo analysis	• stochastic simulation
VTO uses:	• ZIP code-level analysis	• transition policy analysis	• NEMS “light” simulation	• PHEV and market segmentatio n	• parametric analysis	• uncertainty analysis
Notable third-party users:		• NRC “Transitions ” Study	• NPC Study			

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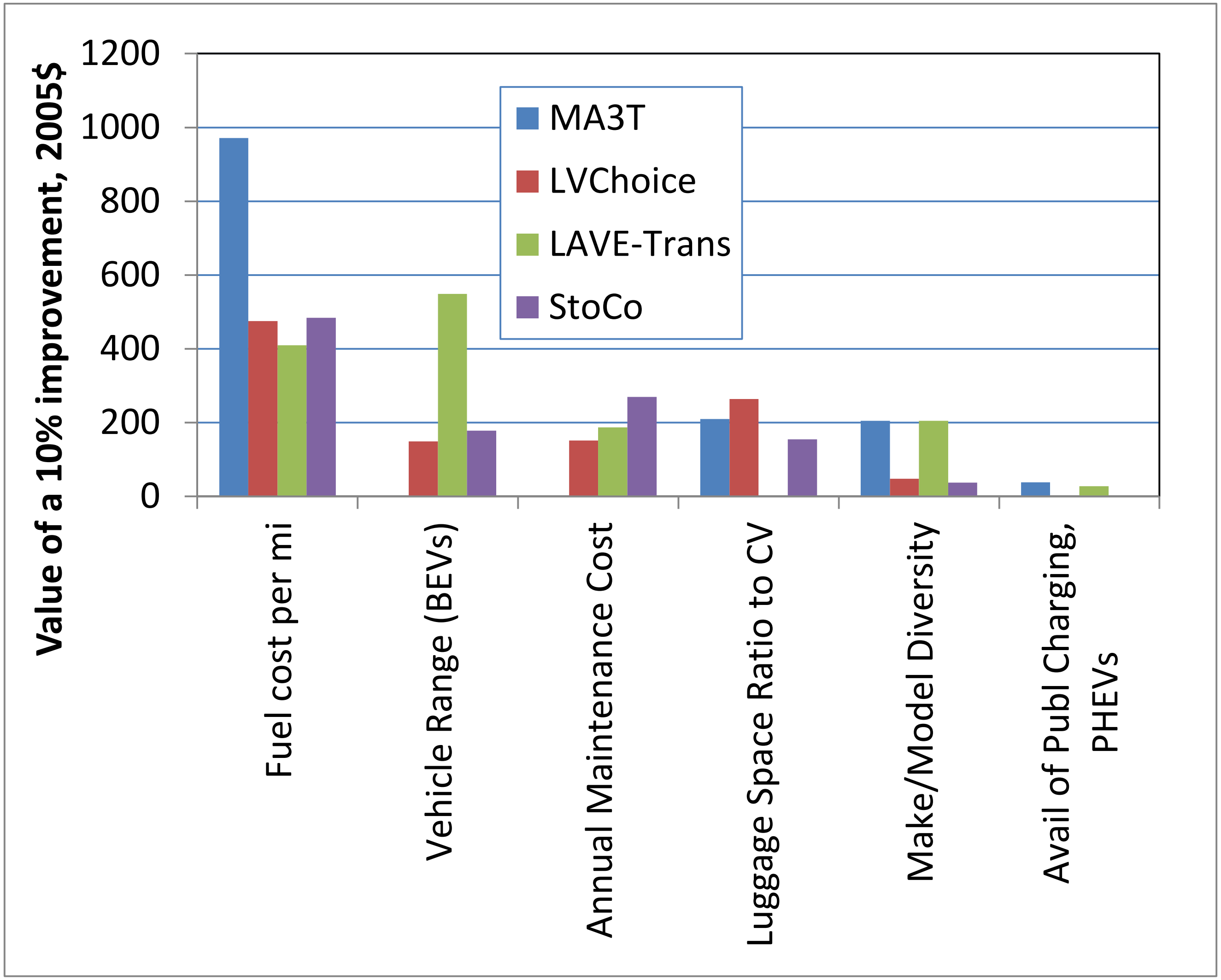
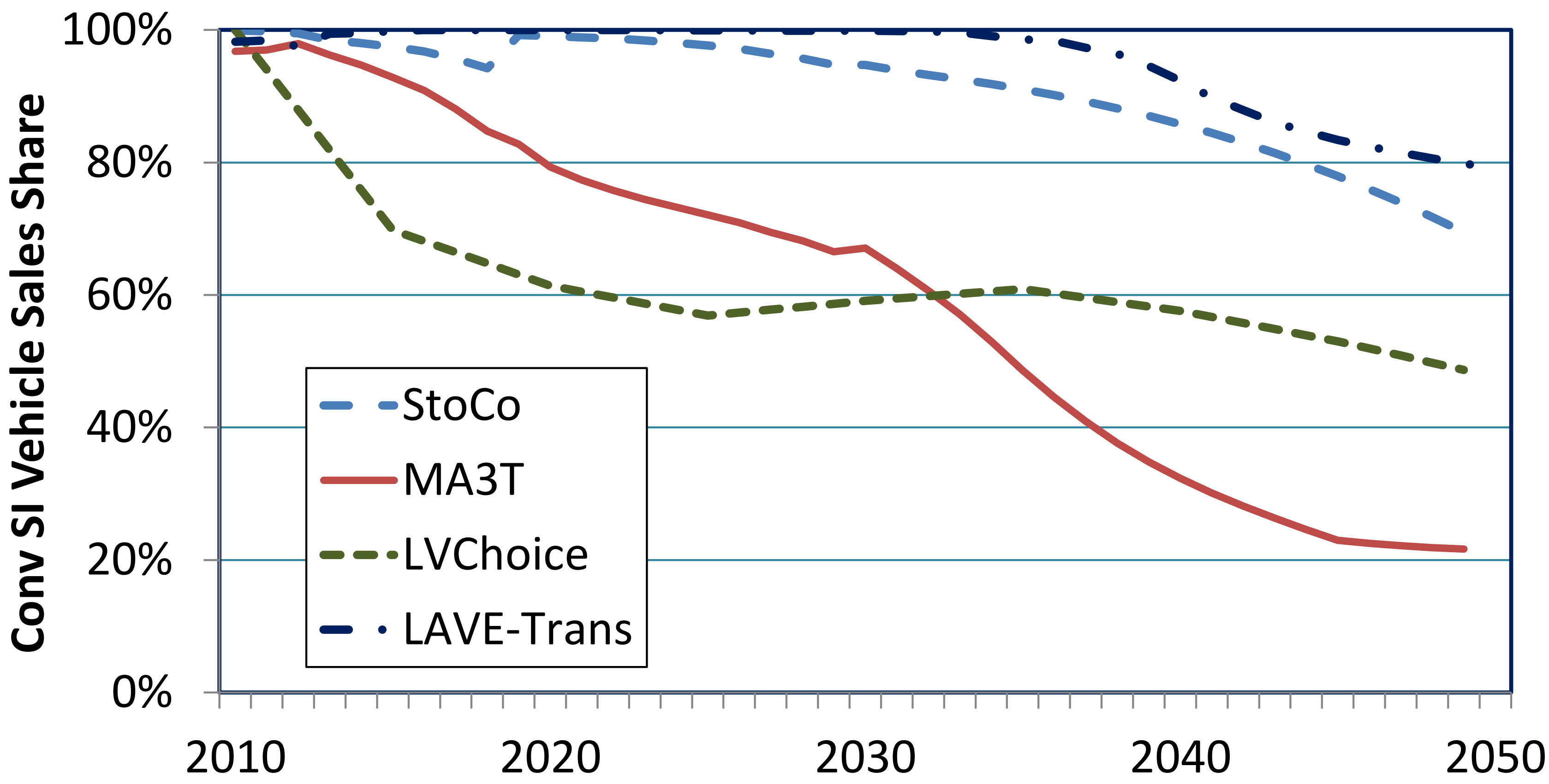
Choice models consider inputs differently…

MARKET



…and choice models produce different results.

MARKET



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Macroeconomic Accounting

MACRO

2013

- 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

future work

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

BaSce/GPRA quantifies VTO benefits

MACRO

TABLE 12 Vehicle Technologies Program Benefits Metrics[a]

Impact	Metric	Year		
		2020	2030	2050
Energy security	Oil savings, cumulative (billion bbl)	1.0	7.7	31.1
	Oil savings, annual (million bpd)	0.9	2.4	3.5
	New vehicle mpg improvement (percent)[a]			
	LDVs	53	75	82
	HTs	25	39	43
	On-road mpg improvement (percent)			
	LDVs	9	44	87
	HTs	12	27	36
Environmental	CO_2 emissions reduction,[b] cumulative (million t $CO_{2\,eq}$)	450	3,500	14,000
	GHG emissions reduction, annual (million t $CO_{2\,eq}$/yr)			
	LDVs	85	259	350
	HTs	64	142	235
	Total	149	401	585
Economic	Primary energy savings,[b] cumulative (quads)	7	53	218
	Primary energy savings, annual (quads/yr)	2.2	6.2	9.0

[a] Improvement relative to baseline (No Program) fleet in the same year.

[b] "Reductions" and "savings" are calculated as the difference between the results from the baseline (No Program) case (i.e., in which there is no future DOE funding for this technology) and the results from the Target case (i.e., in which requested DOE funding for this technology is received and the program is successful). All cumulative metrics are based on results beginning in 2015.

http://www.transportation.anl.gov/pdfs/G/955.PDF

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., BaSce/GPRA, below) span all categories for a truly integrated analysis

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

VTO Analysis (VAN) Presentations

Time	Project ID	VAN Category	Principal Investigator	Project Title
1:45	VAN009	DATA	Stacy Davis, ORNL	Transportation Energy Data Book, Market Report, and Fact of the Week
2:15	VAN011	DATA	Joann Zhou, ANL	E-drive Vehicle Sales Analyses
2:45	VAN008	VEHICLE	Aymeric Rousseau, ANL	Evaluation of VTO Benefits Using Large Scale Simulation
3:15	VAN012	MARKET	Alicia Birky, TA Engineering	Modeling for Market Analysis: HTEB, TRUCK, and LV-Choice
3:45			*Break*	
4:15	VAN006	MACRO	Joann Zhou, ANL	Development and Update of Long-Term Energy and GHG Emission Macroeconomic Accounting Tool
4:45	VAN010	MACRO	Changzheng Liu, ORNL	Reassessing the Outlook of US Oil Dependence Using Oil Security Metrics Model (OSMM)
5:15	VAN013	MARKET	Changzheng Liu, ORNL	Transportation Energy Transition Modeling and Analysis: the LAVE-Trans Model

VTO Analysis (VAN) Posters

Project ID	Principal Investigator	VAN Category	Project Title
VAN003	Mark Singer, NREL	DATA	Consumer Vehicle Technology Data
VAN002	Michael Wang, ANL	ECO	GREET Life Cycle Analysis
VAN004	Aaron Brooker, NREL	MARKET	Unified Modeling, Simulation, and Market Implications: FASTSim and ADOPT
VAN005	Zhenhong Lin, ORNL	MARKET	Consumer-Segmented Vehicle Choice Modeling: the MA3T Model
VAN014	Dawn Manley, SNL	MARKET	Parametric Vehicle Choice Modeling: ParaChoice
VAN001	Tom Stephens, ANL	MACRO	VTO Baseline and Scenario (BaSce) Activities
VAN015	Michael Nicholas, UC-Davis	MACRO	PEV Consumer Behavior in Practice (PCBIP)

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Annual Merit Review

June 16-20, 2014