VAN920:
Vehicle Technologies Office Analysis Overview

Jacob Ward, Technology Manager, U.S. DOE/VTO

2 Jun 2020

An "Overview of this Overview" Presentation
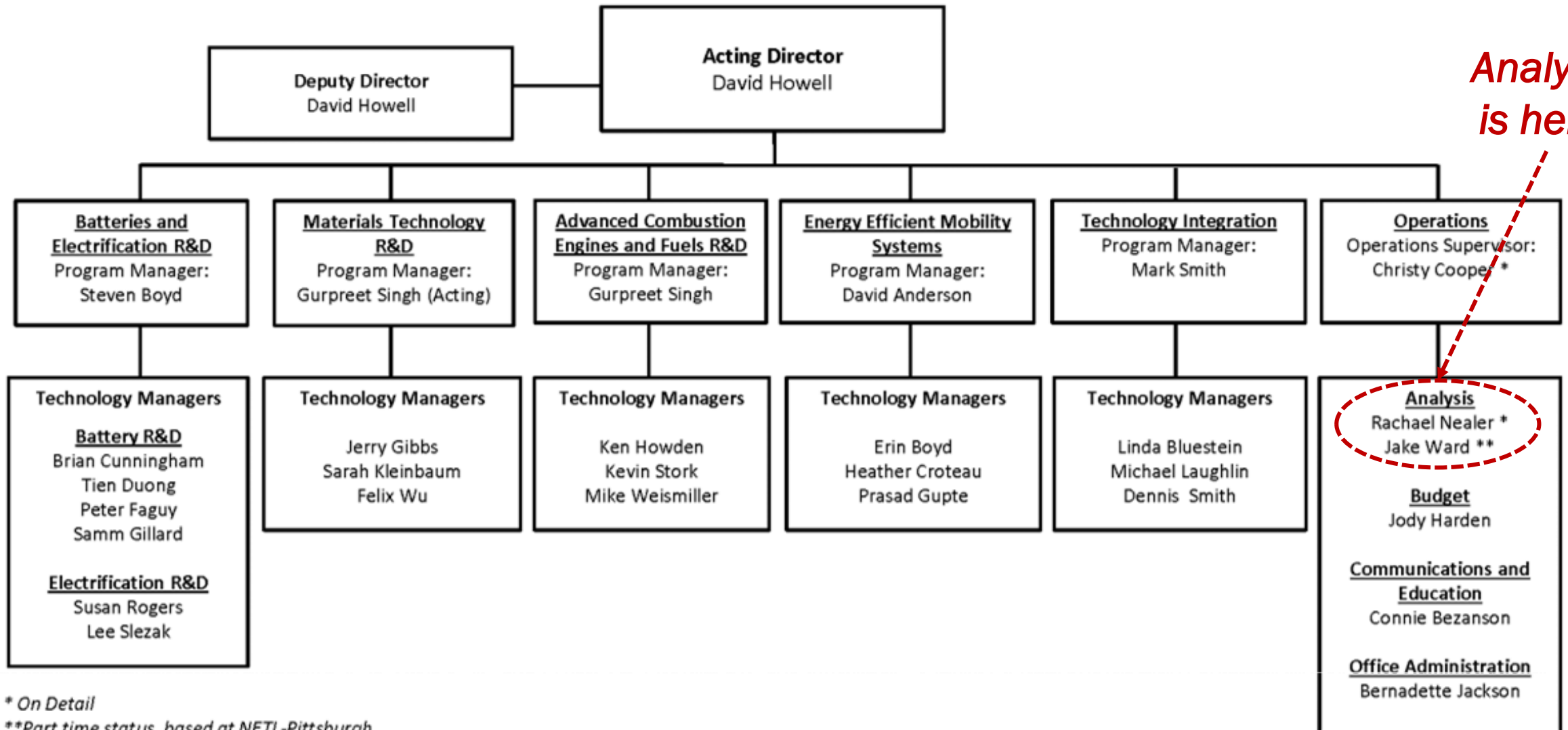
- **Analysis Team Personnel**

- **Strategic Visioning**

- **Analysis Program Projects Previews/Summaries**
  - *A contextual framework, then portfolio specifics:*

	Presentation(s)	Poster(s)
– Data	VAN016, 032	
– Modeling and Simulation	VAN018, 023	
– Powertrain Choice & Infrastructure Use		VAN019, 021, 034
– Energy and Emissions Modeling	VAN017	
– Integrated Analysis	VAN018, 033	VAN028, 035, 036, 037

- **2020 AMR Posters and Presentations Schedule**

Vehicle Technologies Office Federal Staff

Acting Director
David Howell

Deputy Director
David Howell

Batteries and Electrification R&D
Program Manager:
Steven Boyd

Materials Technology R&D
Program Manager:
Gurpreet Singh (Acting)

Advanced Combustion Engines and Fuels R&D
Program Manager:
Gurpreet Singh

Energy Efficient Mobility Systems
Program Manager:
David Anderson

Technology Integration
Program Manager:
Mark Smith

Operations
Operations Supervisor:
Christy Cooper *

Technology Managers

Battery R&D
Brian Cunningham
Tien Duong
Peter Faguy
Samm Gillard

Electrification R&D
Susan Rogers
Lee Slezak

Technology Managers

Jerry Gibbs
Sarah Kleinbaum
Felix Wu

Technology Managers

Ken Howden
Kevin Stork
Mike Weismiller

Technology Managers

Erin Boyd
Heather Croteau
Prasad Gupte

Technology Managers

Linda Bluestein
Michael Laughlin
Dennis Smith

Analysis
Rachael Nealer *
Jake Ward **

Budget
Jody Harden

Communications and Education
Connie Bezanson

Office Administration
Bernadette Jackson

Analysis is here.

* On Detail
**Part time status, based at NETL-Pittsburgh

Analysis Team Personnel (~FY20)

Madhur Boloor,
AAAS Fellow

Kate McMahon,
*recent alumna
(former ORISE
Fellow)*

Rachael Nealer,
Technology Manager*

Jacob Ward,
Technology Manager

on detail as Chief of Staff, Deputy Assistant Secretary for Transportation

Strategic Visioning: Mission

New for soon-to-be-updated VTO Multi-Year Program Plan (MYPP):

VTO Analysis Vision Statement

- "Develop and manage a portfolio of data-driven, advanced transportation technology analysis to answer critical questions and create insights about energy use and other relevant metrics."
  - Build and sustain comprehensive core capabilities and expertise to anticipate and respond to immediate office analysis needs and identify longer-term strategic opportunities (i.e., program target-setting).
  - Cultivate bidirectional support for and feedback from EERE leadership, VTO programs, our research community, and other stakeholders.

Strategic Visioning: Goals

VTO Analysis Strategic Goals
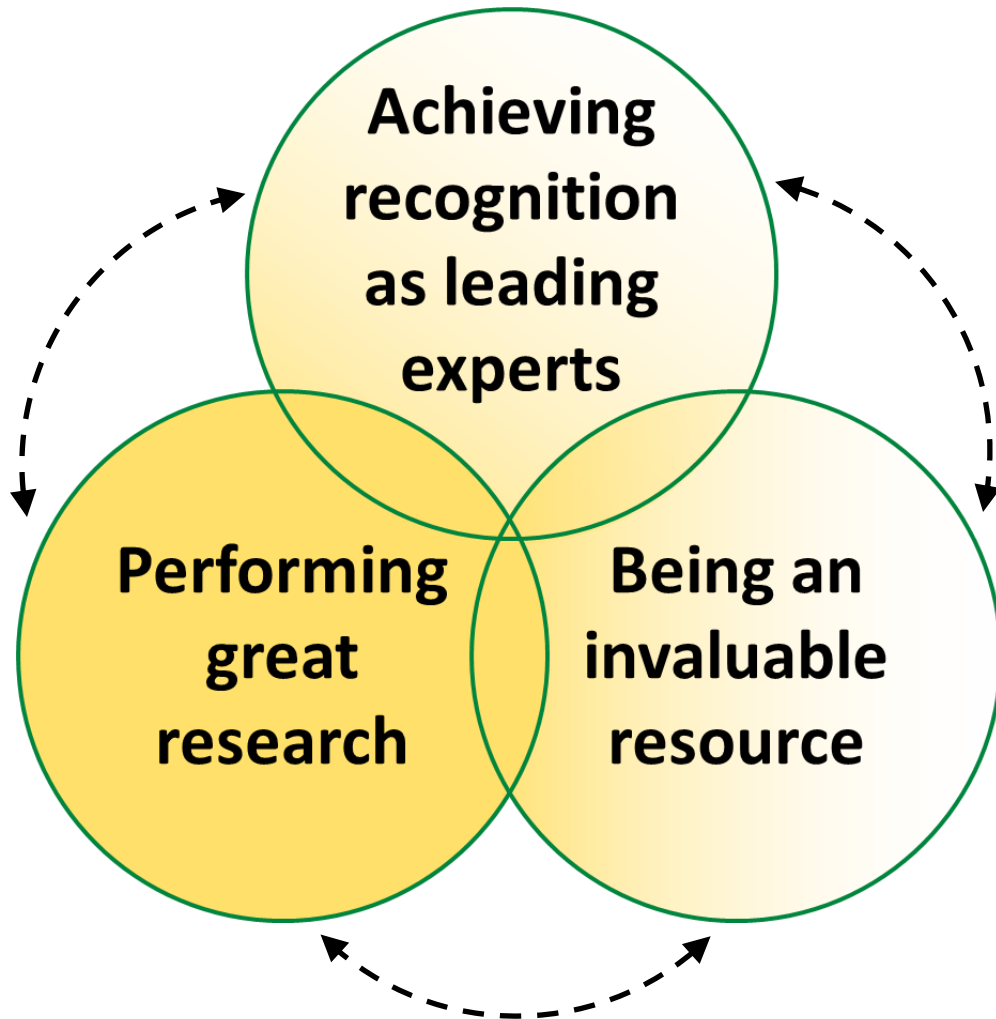
- **Performing great research**
  - Core capabilities making demonstrable contributions
  - Agility, flexibility, responsiveness
  - Anticipating the cutting edge
- **Being an invaluable resource**
  - Transportation energy insight clearinghouse
  - Community cultivation
- **Achieving recognition as experts**
  - Efficient stewardship
  - Mobilizing knowledge (proactively and responsively)

VTO Analysis Overview

(1) Collect, synthesize, and make public **DATA** and insights

(2) Use data to build, maintain, and expand robust **MODELING** capabilities

(3) Apply models for impactful **ANALYSIS** to answer priority research questions

Integrated Analysis

Models and tools developed, maintained, or used by VTO Analysis:

Layer	Tools
Application/ Accounting	VISION, NEAT
Energy and Emissions Modeling	GREET
Powertrain Choice and Infrastructure Utilization	ADOPT, ParaChoice, TEEM/MA^{3}T, EVI-pro
Vehicle Modeling and Simulation	Autonomie, FASTSim
Technology and Market Data	TEDB, FOTW EV sales
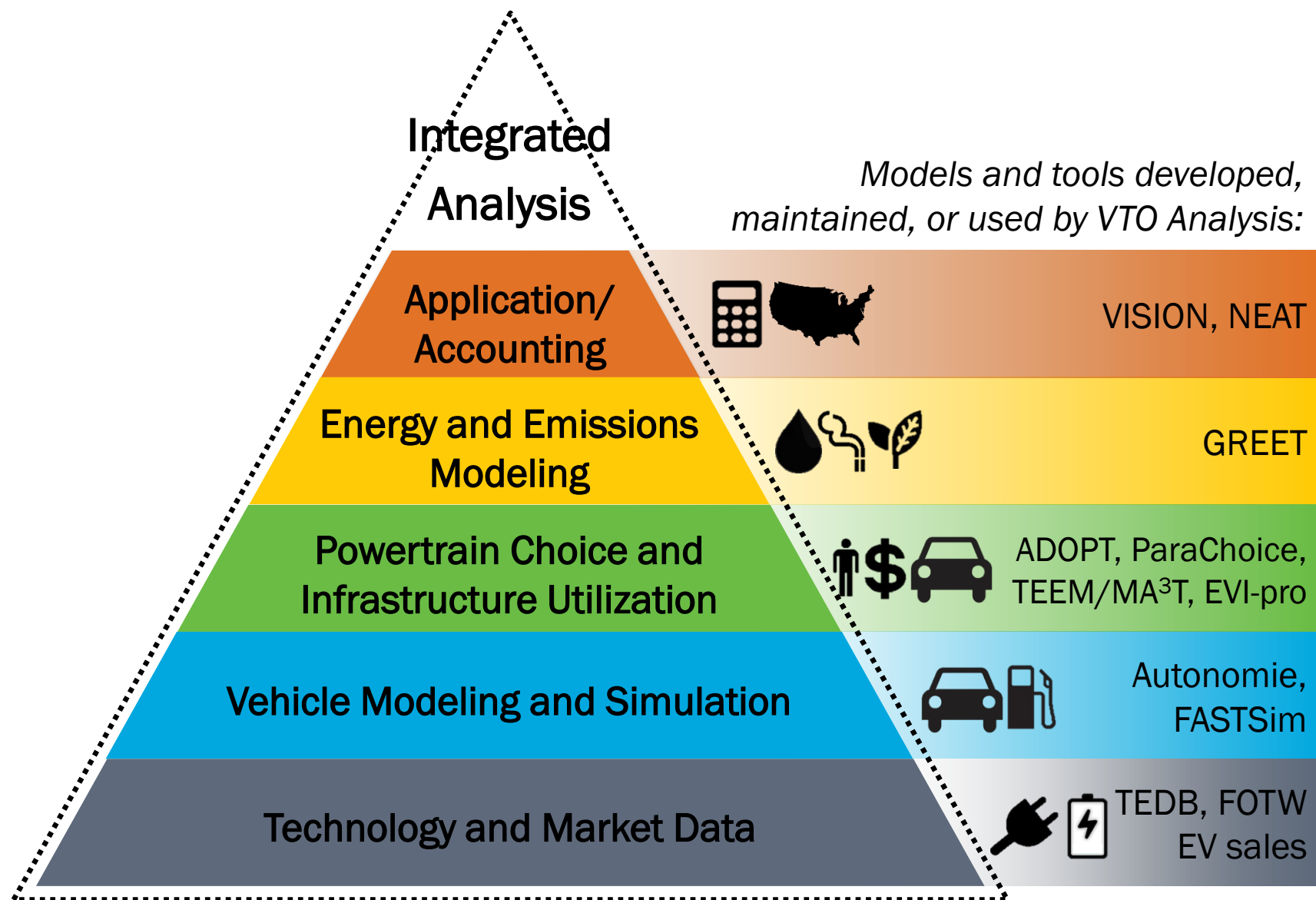
Transportation Energy Data Book (TEDB)

- TEDB contains **226 tables and 70 figures** from ~50 different sources

- **Two new updates each calendar year** (January ed. 38, April ed. 38.1, August ed. 38.2)

- Edition 38 features a **new chapter** on "Transit and Other Shared Mobility"

- **3,230 Google scholar citations**

https://tedb.ornl.gov
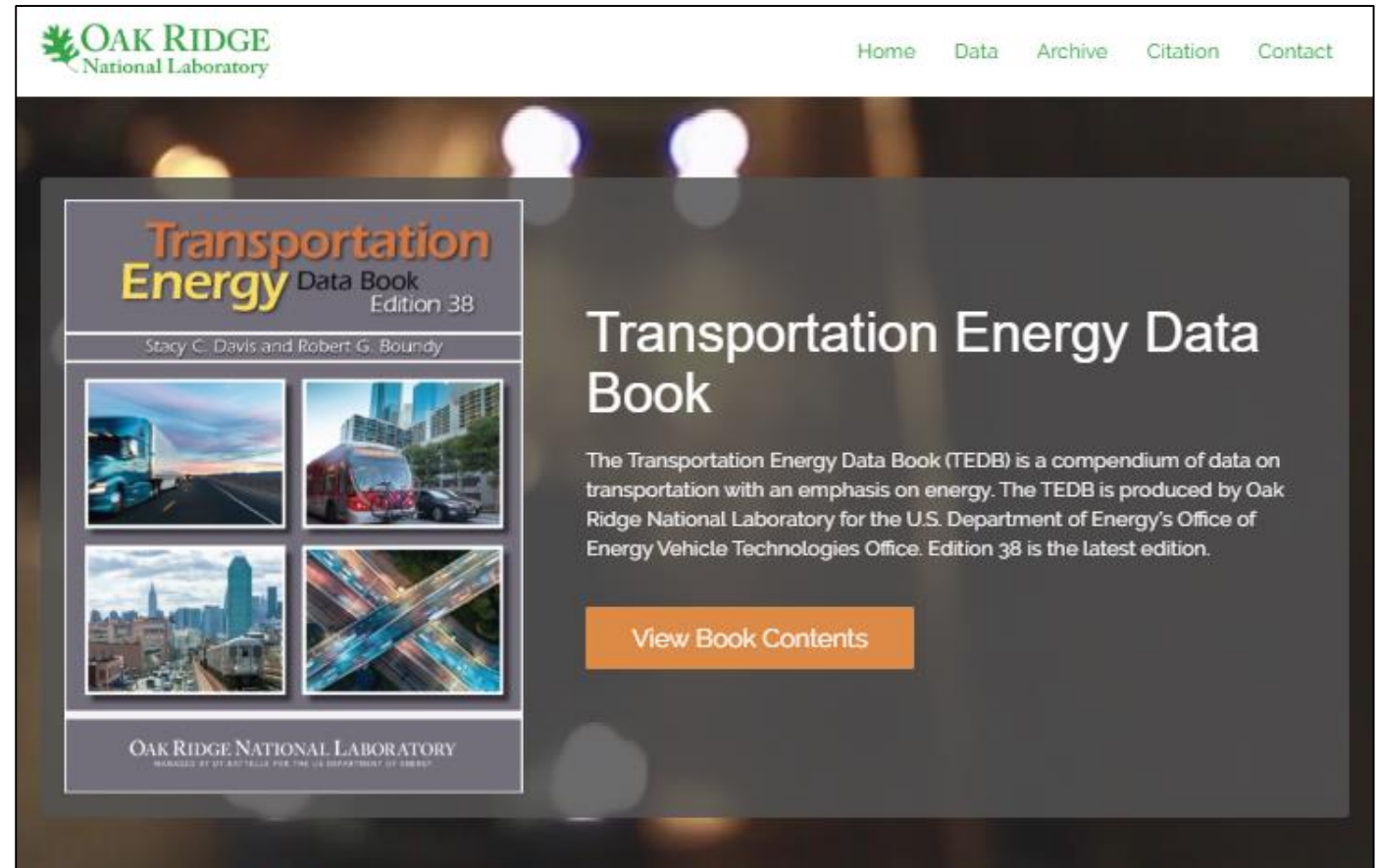
Figure from VAN016 (Davis et al., 2020)

Fact of the Week (FOTW)

- **FOTW** combines a graphic, explanatory text, source, and Excel file

- Recent topics have included:
  - regional gasoline prices
  - automotive battery cell composition,
  - fuel economy trends by transmission type
  - fuel economy mythbusting, and
  - light-duty vehicle production locations

- \>25,000 weekly subscribers, and \>220,000 pageviews—35% for VTO site—in 2019

- *E-mail davissc@ornl.gov to subscribe*
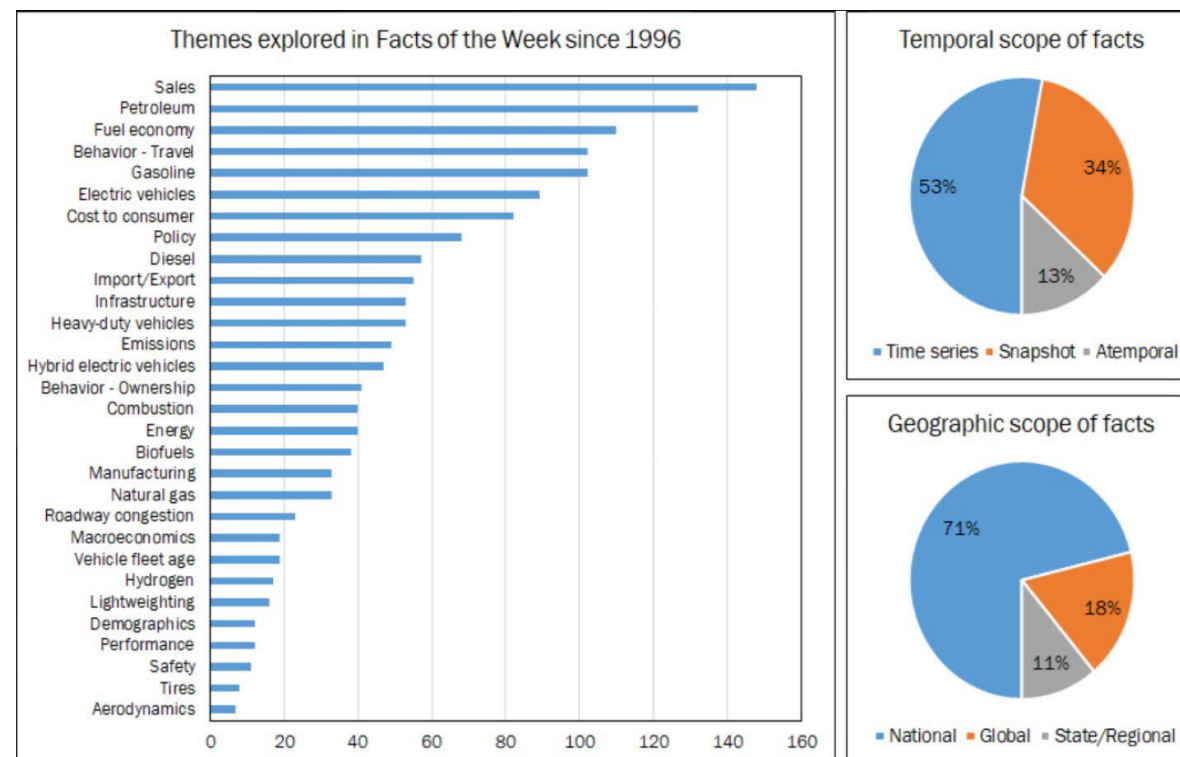
Figure from VAN016 (Davis et al., 2020)

Tracking EV and New Mobility Technology

- Technology tracking addresses **new and emerging knowledge gaps for new and emerging technologies.**
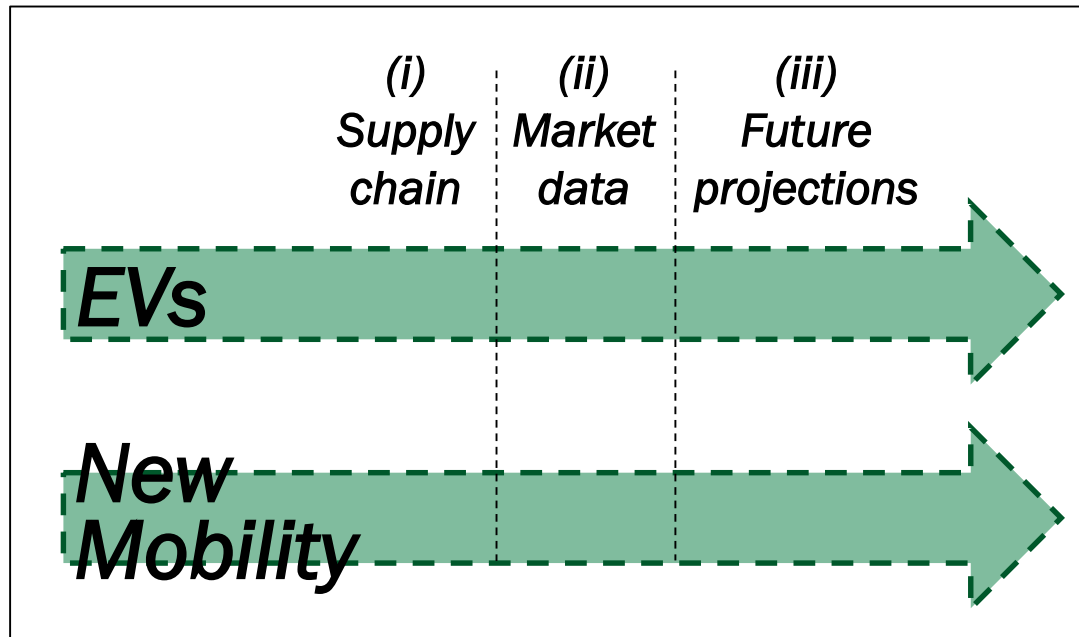
- **Electric drive sales data** convey market by nameplate and geography, as well as infrastructure and future projections.
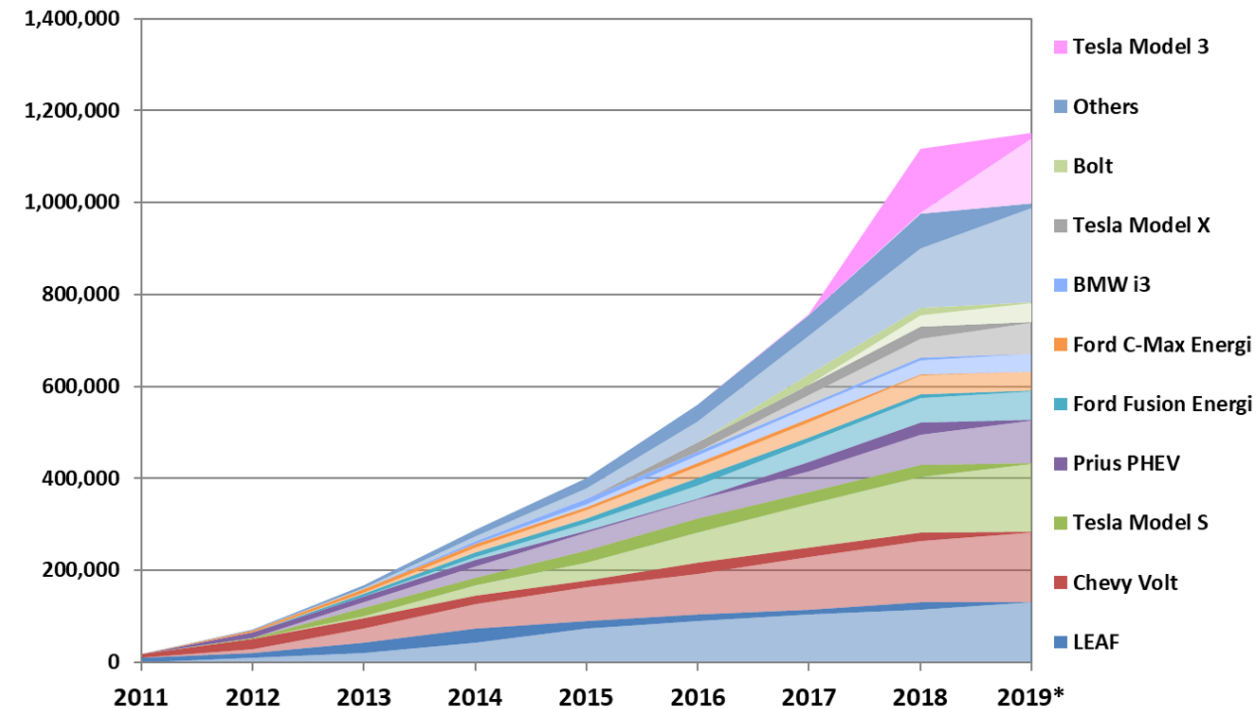

Figure from VAN032 (Zhou et al., 2020)

Modeling and Simulation

- ANL's *Autonomie* software quantifies the impact of VTO-supported component technologies.

- FY20 work focuses on implementation of newly improved process and interface with NREL analysis team:
  - *E.g., preliminary estimated **fuel consumption and MSRP reductions for a PHEV50 shown at right.***
  - *Expanded evaluation of light-, medium-, and heavy-duty vehicles is ongoing.*

- Also in FY20: completion of machine learning for technology and MSRP analysis
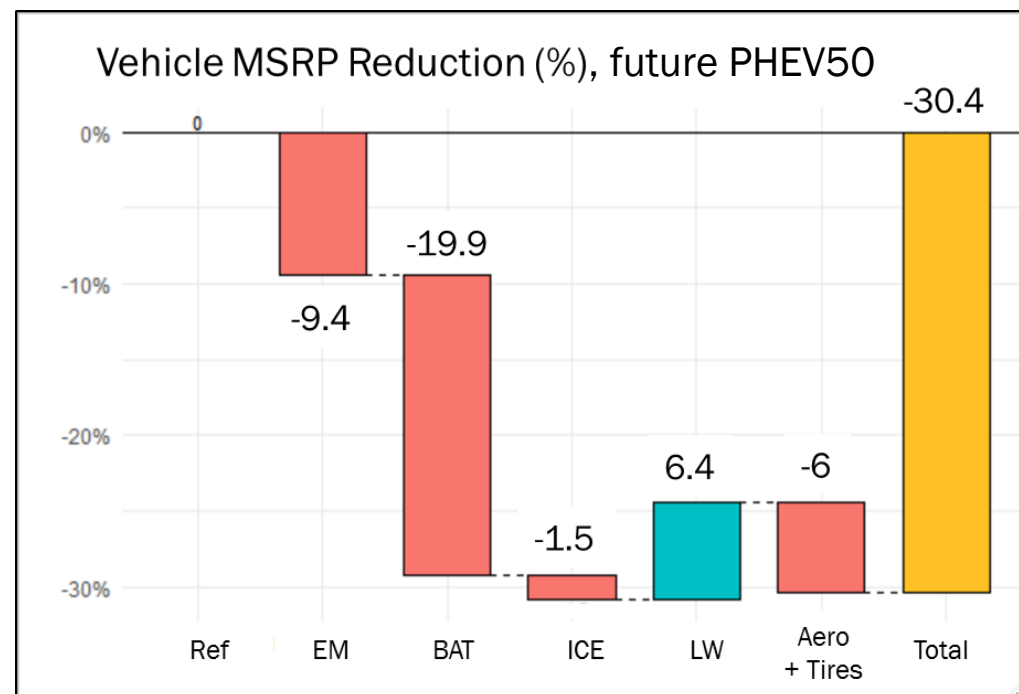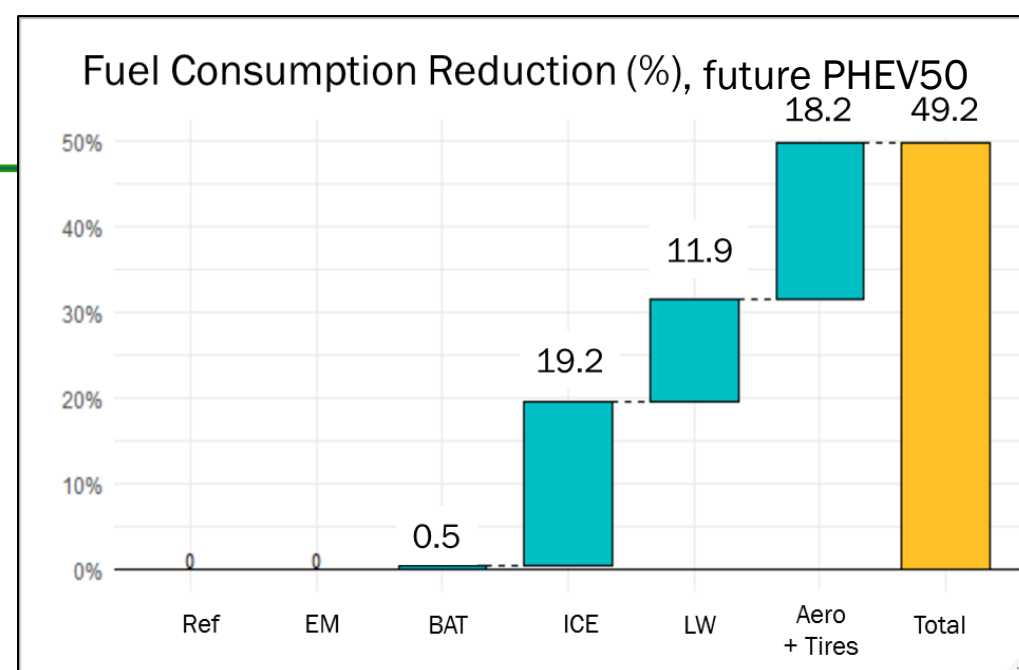
*Figures from VAN023 (Vijayagopal et al., 2020)*

Fuel Consumption Reduction (%), future PHEV50

Vehicle MSRP Reduction (%), future PHEV50

Powertrain Choice (ADOPT, ParaChoice, TEEM/MA3T)

Vehicle and driver characteristics and statistics → Consumer "utility" (in $) of vehicle characteristics → Market penetration scenario

- **Vehicle**
  - MSRP
  - Efficiency
  - Performance
- **Driver**
  - Housing
  - Driver intensity
- **Geography**
  - [Sub-]Urban?
  - Census region
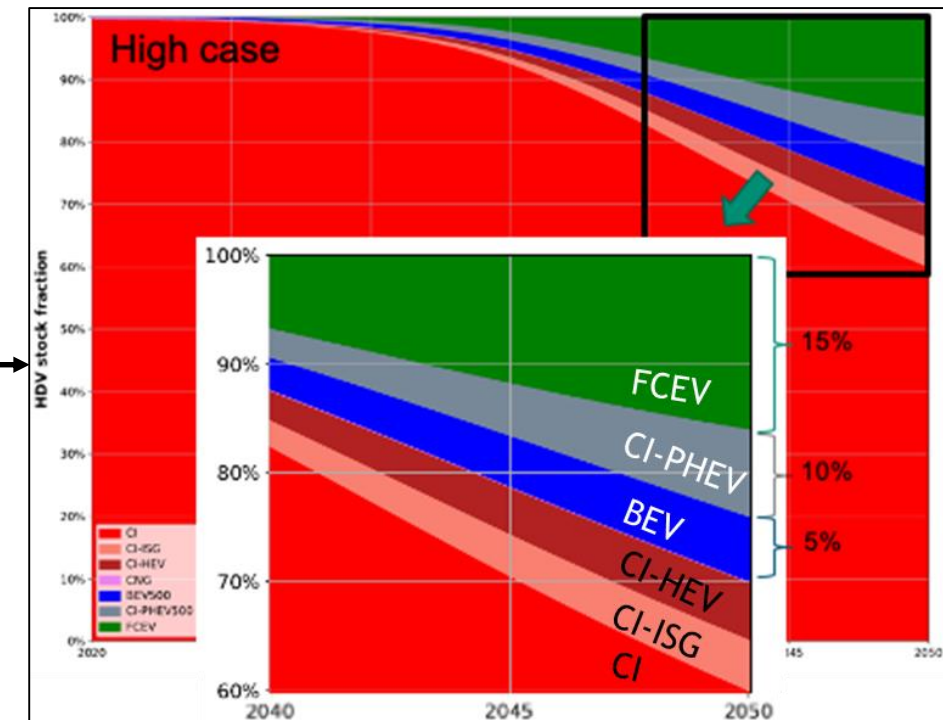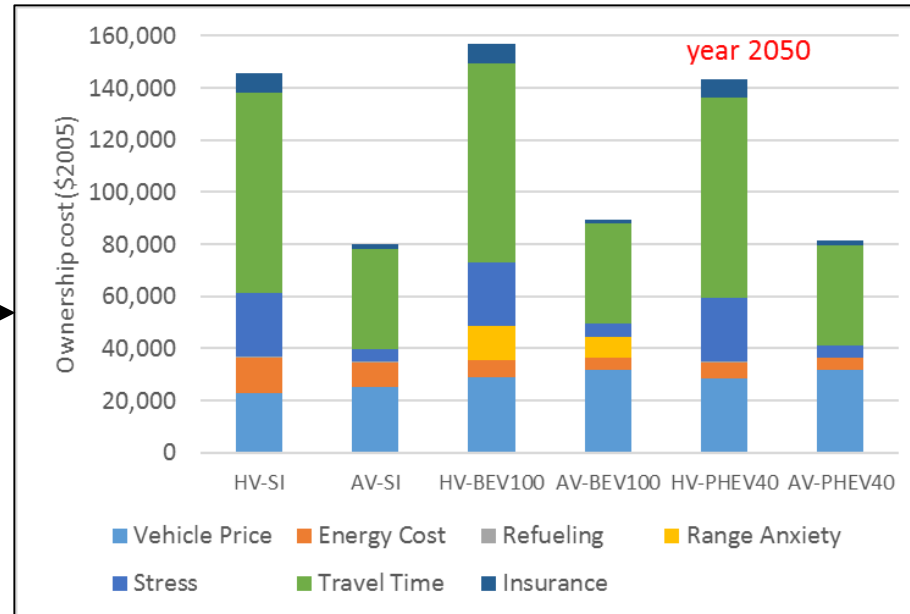
Figures from VAN019 (Proctor et al., 2020) and VAN021 (Lin et al., 2020)
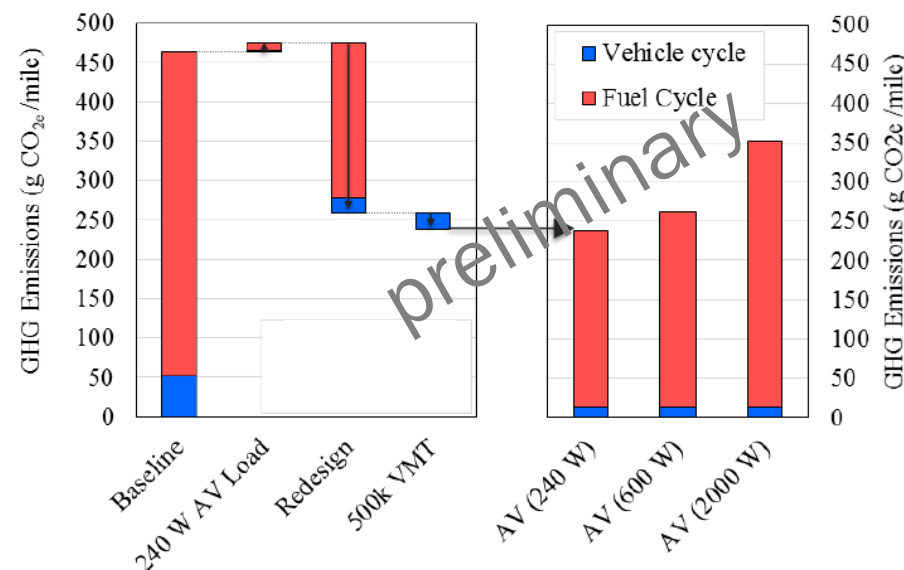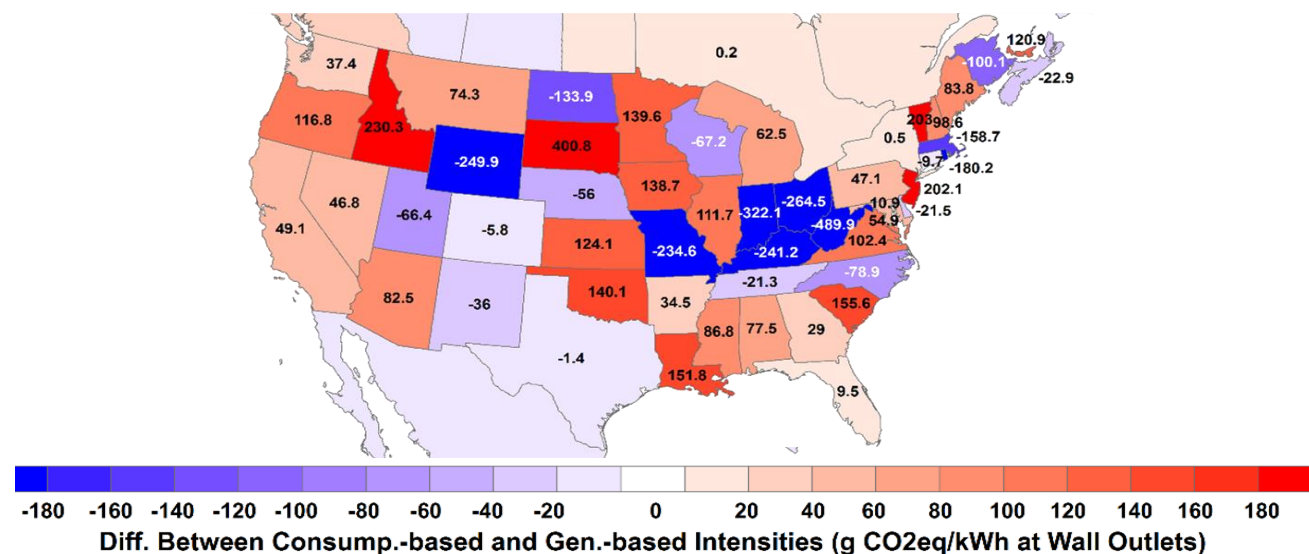
Energy and Emissions Modeling (GREET™)

FY20 updates:

- Emissions coefficients updated based on **regional consumption-based electricity mixes**

- **Material flow analysis** for steel and aluminum

FY20 applications:

- **LDV CAV analysis** *(at right)* examines sensing/computing load, vehicle redesign, and additional VMT

- **Generation- vs. consumption**-based electricity emission intensities, virtual flows, and regional emissions implications
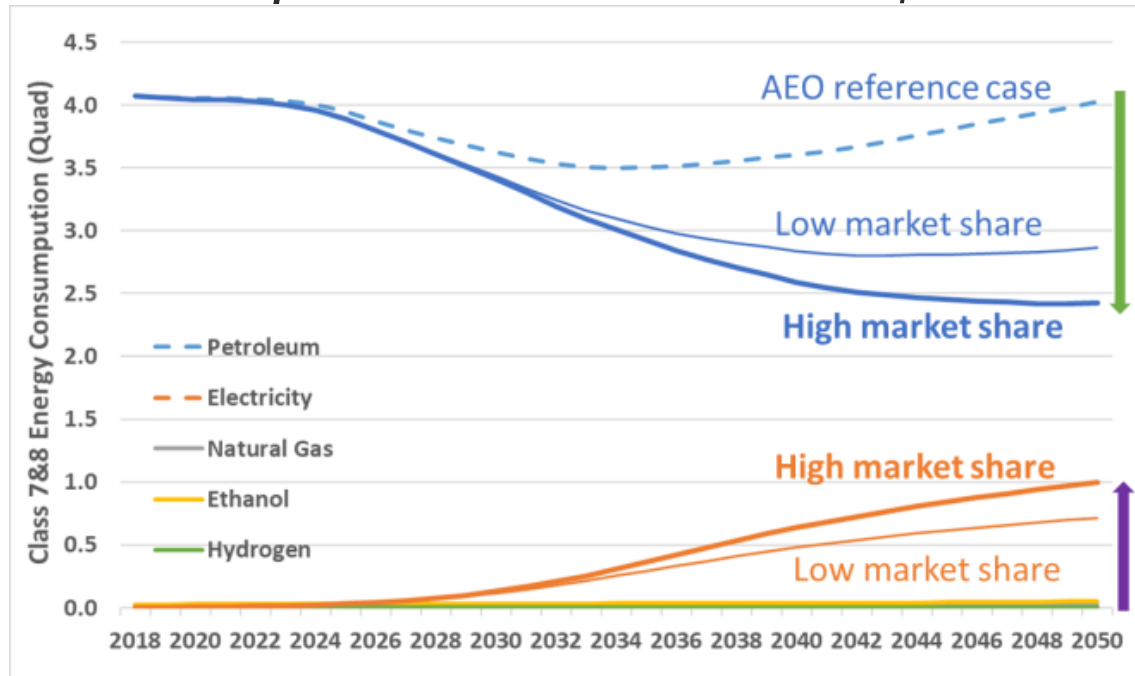
Figures from VAN017 (Wang et al., 2020)

Diff. Between Consump.-based and Gen.-based Intensities (g CO2eq/kWh at Wall Outlets)
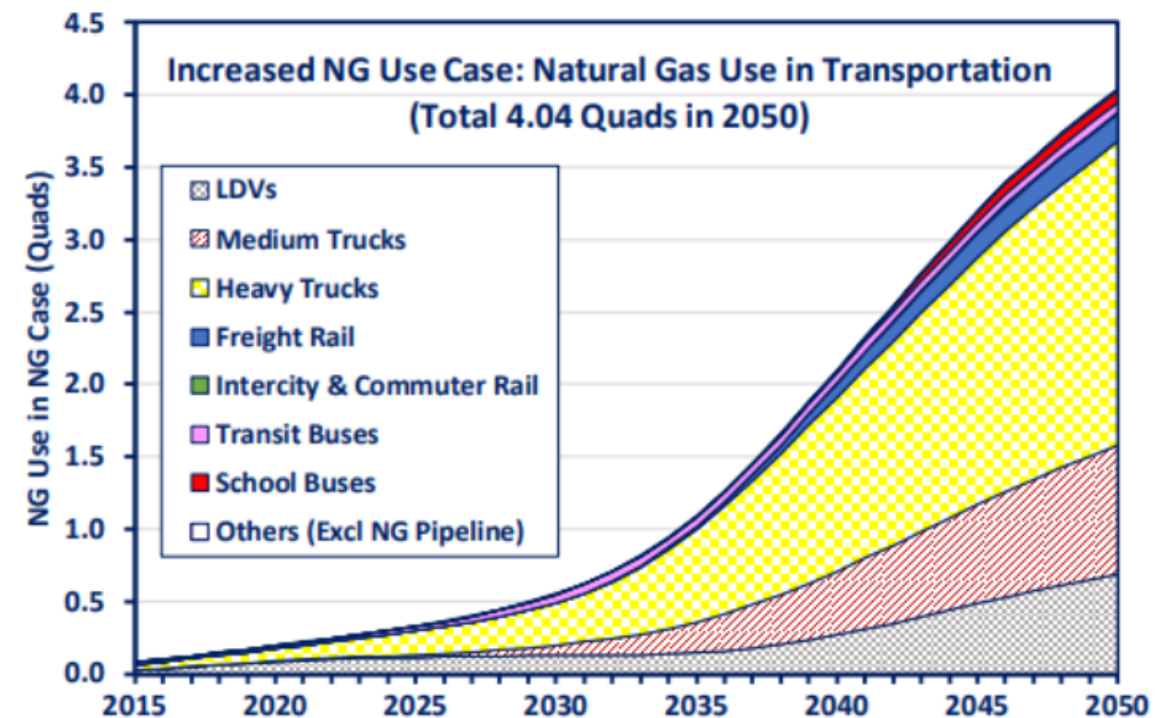
National Transportation Energy Accounting (VISION/NEAT)

- VISION/NEAT estimates **future (through the year 2100) energy use and carbon emissions** as a function of fleet and efficiency input assumptions (from today)

Example 1: HDV electrification impacts
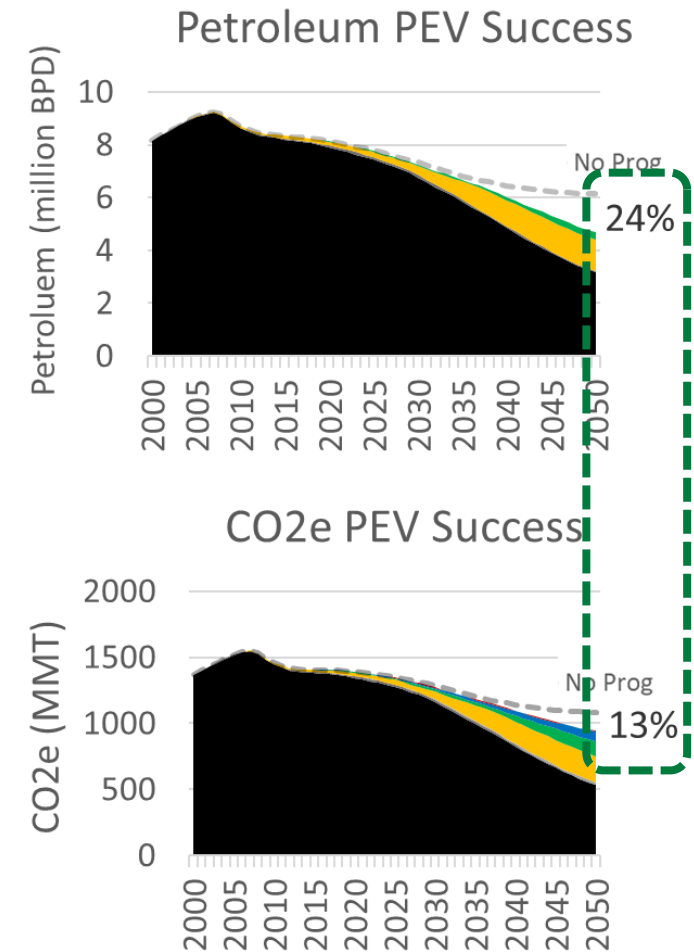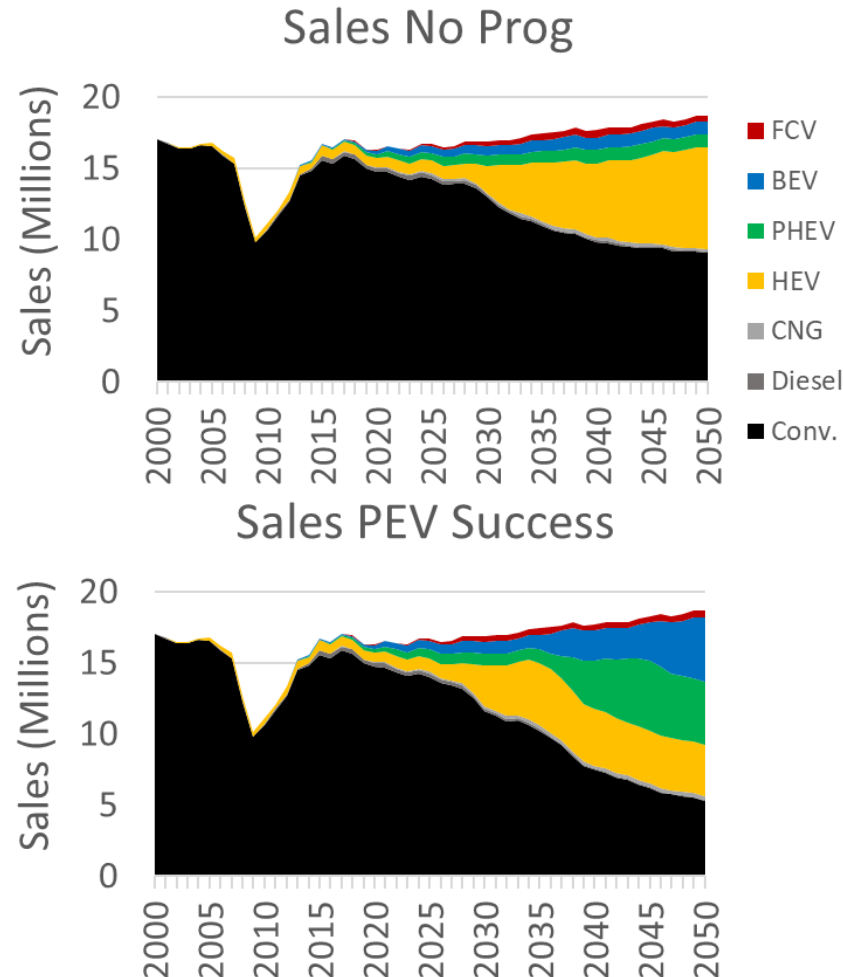

Example 2: natural gas in transportation

Figures from VAN033 (Zhou et al., 2019; Zhou et al., 2020)

- **Objective**: estimate potential future benefits attributable to VTO (national-level reductions in petroleum use, consumer costs, and emissions)

- **Approach**: compare two scenarios, with and without Approach successful deployment of VTO technologies

Figures from VAN018 (Brooker et al., 2020)

Advanced technology changes vehicle fleet mix… → *…and value of national-level benefits.*

Sales No Prog

Sales PEV Success

Petroleum PEV Success

CO2e PEV Success

Analysis Summit

- Proposals and selections are a complement to conventional VTO Lab Call
- Aligned with the Analysis philosophy of "agility, flexibility, responsiveness"

| Project	Performer(s)
Develop a techno-economic tool for calculating the **levelized cost of fast charging battery electric medium- and heavy-duty vehicles**	ANL
Automated Vehicle Sensing and Processing: Current and Emerging Hardware, Research, and Opportunities	ANL
Studying the energy and environmental tradeoff associated with increased **light duty vehicle size**	ANL
Electrified Aviation	ANL
Off-Road Vehicle Energy Saving Potential	ANL
Exploring **Transit and TNC Interactions** Using Disaggregate Spatiotemporal Ridership Data	ANL
Utilizing Location History Data to Develop **Travel Demand Prediction Models**	NREL

Today's VAN Presentations

Time*	Project #	Title and Presenter
3:00p	VAN920	**Vehicle Technologies Office Analysis Overview** (Jacob Ward, DOE/VTO)
3:30p	VAN016	**Transportation Data Program** (Stacy Davis, ORNL)
4:00p	VAN017	**VTO Analysis Modeling Program** (Michael Wang, ANL)
4:30p		*[AMR break]*
5:00p	VAN023	**Assessing Energy and Cost Impact of Advance Vehicle Technologies** (Ram Vijayagopal, ANL)
5:30p	VAN018	**Light-Duty Vehicle Choice Modeling and Benefits Analysis** (Aaron Brooker, NREL)
6:00p	VAN032	**Tracking the Evolution of Electric Vehicles and New Mobility Technology** (Joann Zhou, ANL)
6:15p	VAN033	**Transportation Macroeconomic Accounting Models: VISION and NEAT** (Joann Zhou, ANL)

*all times EDT

"Tonight's" VAN Posters (now virtual, but still available online):

Project #	Title and Presenter
VAN019	**ParaChoice Model** (Camron Proctor, SNL)
VAN021	**Transportation Energy Evolution Modeling (TEEM) Program** (Zhenhong Lin, ORNL)
VAN028	**EV-Grid Analysis Modeling** (Fan Tong, LBNL)
VAN034	**Medium- and Heavy-Duty Vehicle Choice Modeling and Applied Analysis** (Alicia Birky, NREL)
VAN035	**Assessing Vehicle Technologies Benefits in a Transportation Energy Ecosystem** (Vincent Freyermuth, ANL)
VAN036	**Distributions of Real-World Vehicle Travel** (David Gohlke, ANL)
VAN037	**Vehicle MSRP Estimation using Machine Learning** (Ayman Moawad, ANL)
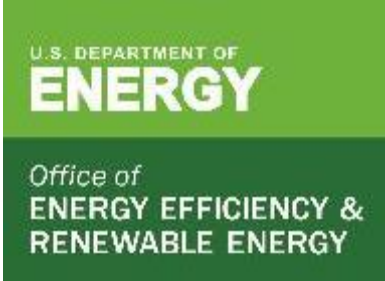
Thank You.

Jacob Ward, Analysis Technology Manager, U.S. DOE/VTO

jacob.ward@ee.doe.gov

202 430 2229