TRANSPORTATION MACROECONOMIC ACCOUNTING MODELS: VISION AND NON-LIGHT DUTY ENERGY AND GREENHOUSE GAS (GHG) EMISSIONS ACCOUNTING TOOL (NEAT)

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PROJECT OVERVIEW

To help research and develop technologies to reduce energy and emissions impacts and evaluate different transportation de-carbonization strategies

Energy use by the U.S. transportation sector has significant impacts on national energy security and emissions. VISION/NEAT have been developed to compare and evaluate fleet impacts of vehicle and fuel technologies by employing consistent, systematic approaches and methodologies.

VISION/NEAT provide estimates of the potential energy use, oil use, and carbon emissions impacts of advanced light-duty vehicles (LDVs), medium-duty vehicles (MDVs), heavy-duty vehicles (HDVs), and freight modes, at the national level. The project includes the following tasks:

- Annually update and calibrate VISION/NEAT models with projections from the Energy Information Administration (EIA) 's Annual Energy Outlook (AEO) reference case and the Department of Transportation's Freight Analysis Framework (FAF)
- Enhance the medium- and heavy-duty (MDHD) modeling capabilities
- Quantify the impact of light-duty vehicle upsizing using VISION

OBJECTIVES

The project aims to **develop and maintain macroeconomic accounting model capabilities** for the Department of Energy and other stakeholders to systematically and consistently evaluate vehicle technologies, freight modes, and fuel pathways so that their impacts on energy and the environment can be compared.

Enhancing MDV and HDV capabilities in response to rising analysis needs in the MD/HDV space. These enhancements reflect emerging trends, such as growth in local and regional shipping relative to long haul, and support future incorporation of emerging technologies, such as shared vehicles, connected and automated commercial vehicles.

We further divided Class 7-8 trucks in VISION to include Vocational (single-unit), Day cab and Sleeper.

Vehicle powertrain types considered in each HDV class

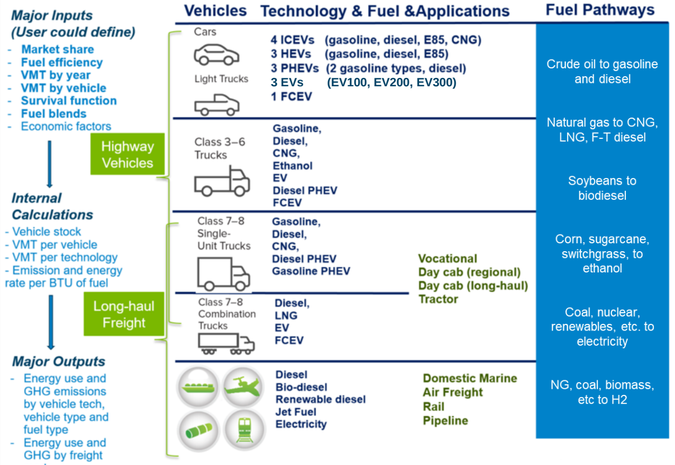
	Class 7-8 Sleeper	Class 7-8 Day	Class 7-8 Vocational
Diesel	✓	✓	✓
Gasoline (incl Flex)	✗	✗	✓
CNG/LNG	✓	✓	✓
HEV (diesel)	✓	✓	✓
HEV (gasoline)	✗	✗	✗
BEV	✓	✓	✓
PHEV (diesel)	✓	✓	✓
PHEV (gasoline)	✗	✗	✓
FCEV	✓	✓	✓

Impact of light-duty vehicle upsizing: Uses EIA's AEO vehicle modeling and modifies the market share of cars and trucks to determine the impacts of changing assumptions related to the vehicle fleet composition. Total fuel consumption, consumer costs, and greenhouse gas emissions are quantified for a wide range of scenarios ranging from 100% cars to 100% trucks.

VISION/NEAT STRUCTURE AND APPROACH

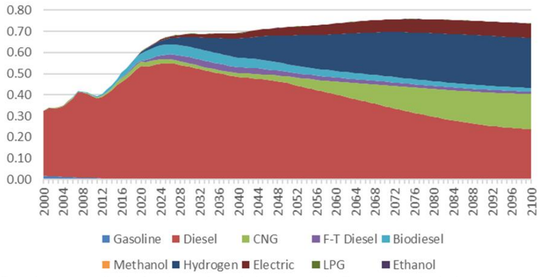
Cover 40 vehicle class and powertrain types, 5 freight modes and all major fuel pathways. Evaluate full-fuel cycle energy consumption and GHG

- Annually updated using energy/emission rates from Argonne's GREET®
- Calibrated to match the energy consumption projected by AEO in the reference case
- Available to public at https://www.anl.gov/es/vision-model
- Argonne has been developing the VISION/NEAT models since 2000 with annual expansions;



Default values are provided in the base case

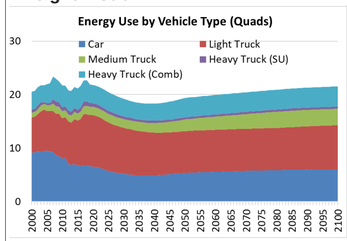
HEAVY-DUTY VEHICLE BASE CASE (AFTER ENHANCEMENT)

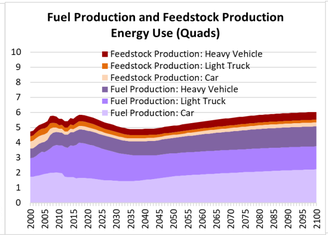


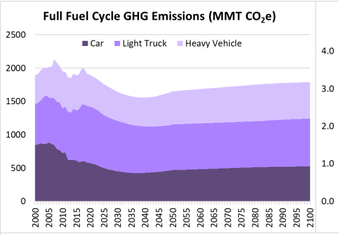
Results are available for day cab and sleeper truck. Energy use includes pump-to-wheel consumption

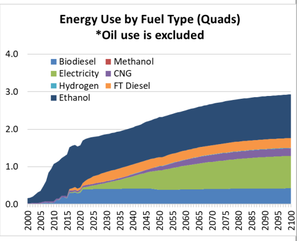
VISION/NEAT 2020 BASE CASE RESULTS

Full-fuel cycle energy use and GHG emissions by fuel type, vehicle type and freight mode







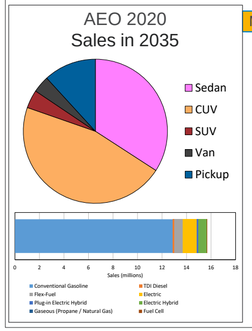


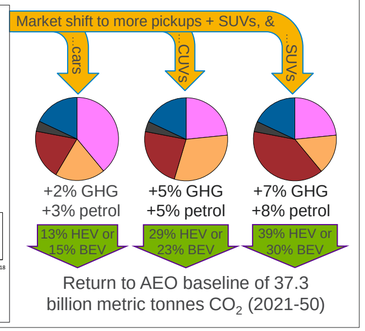
- Users can define their own scenario cases and compare with the base case to see the impacts

IMPACT OF VEHICLE UPSIZING

Key Questions: If we assume a different mix of cars and trucks, by how much might we mis-estimate vehicle emissions and energy use? How can we mitigate an increase in vehicle size?

- EIA's Annual Energy Outlook 2020 has a lower share of light trucks than recent historical trends.
  - Developed 60 different scenarios for LDV based on AEO 2020, changing the mix of cars / crossovers / SUVs / pickups / vans.
- Quantified required share of different technologies needed to mitigate potential increase in vehicle size (in terms of emissions or petroleum consumption)
  - Here, what fraction of sales needs to be EV to offset increases in vehicle size?
    - » Including both fuel consumption and vehicle-cycle emissions
  - Also considered lightweighting, aerodynamic drag reduction, rolling resistance, hybridization (micro-, mild-, and full), and engine downsizing





VISION/NEAT USERS AND APPLICATIONS

- The models were released to the public and are available to download online
- The models are widely used in several DOE/EERE programs and activities to evaluate the impacts of advanced vehicle and mobility technologies
  - VTO Baseline and Scenario analysis
  - SMART Mobility
  - H2@Scale
  - Over 4000 users

VISION: https://www.anl.gov/es/vision-model

NEAT: https://www.anl.gov/es/neat-nonlight-duty-energy-and-ghg-emissions-accounting-tool

SUMMARY

- **Objectives: 1) develop analytical modeling capabilities to compare and evaluate fleet impacts of vehicle and fuel technologies by employing consistent, systematic approaches and methodologies. 2) Use the model to quantify the impacts of LDV upsizing**
- **Outcomes**: publicly available models to provide estimates of the potential energy use, oil use, and carbon emission impacts of highway technologies, and alternative fuels, at the national level.
- **Methods**: Annually updated and calibrated to match with projections from AEO and FAF. Adopts latest energy and emission rates from GREET model. FY20-FY21 focus on summarizing vehicle usage and survival patterns of MD/HDV
- **Results:** 1) release the models on Argonne's websites and support other DOE programs. 2) scenario analysis shows adjusting the sales shares of LDV by size class can change estimates of energy consumption by over 10% comparing to AEO reference case
- **Publications**: 1) User guide and reports to document data and methodologies, 2) Energy And Environmental Tradeoff Associated With Increased Light Duty Vehicle Size (draft report)
- **Future work:** 1) Model annual update and release, 2) quantify the energy impact of truck electrification due to payload penalty

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Any proposed future work is subject to change based on funding levels.

This presentation does not contain any proprietary, confidential, or otherwise restricted information

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