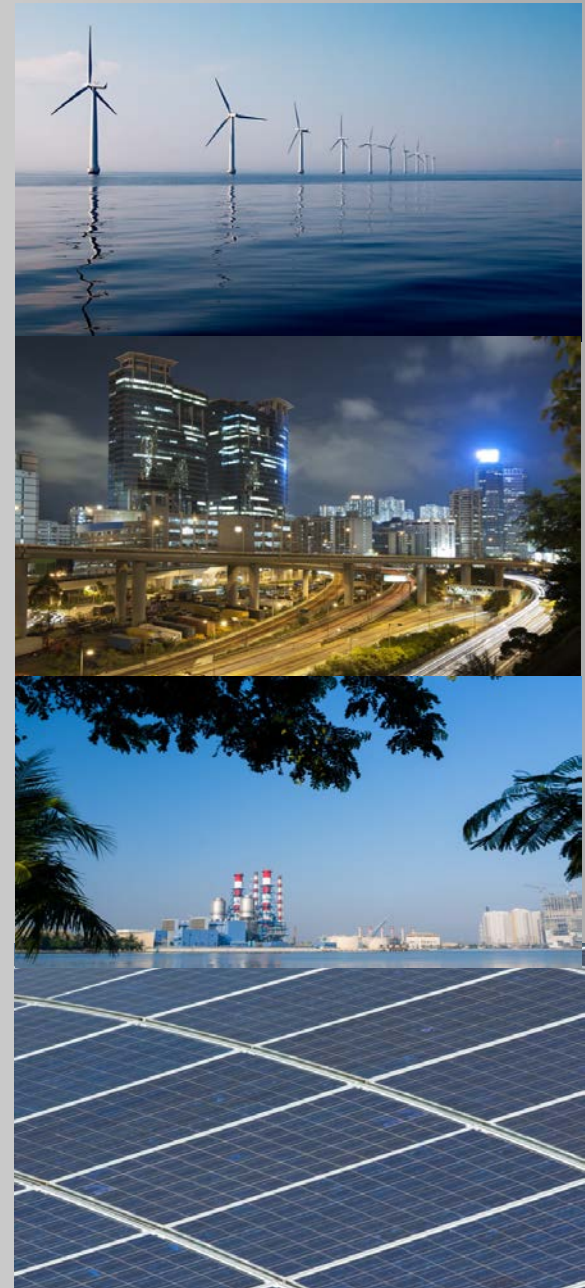




Analyzing Transportation Policies using the National Energy Modeling System (NEMS)

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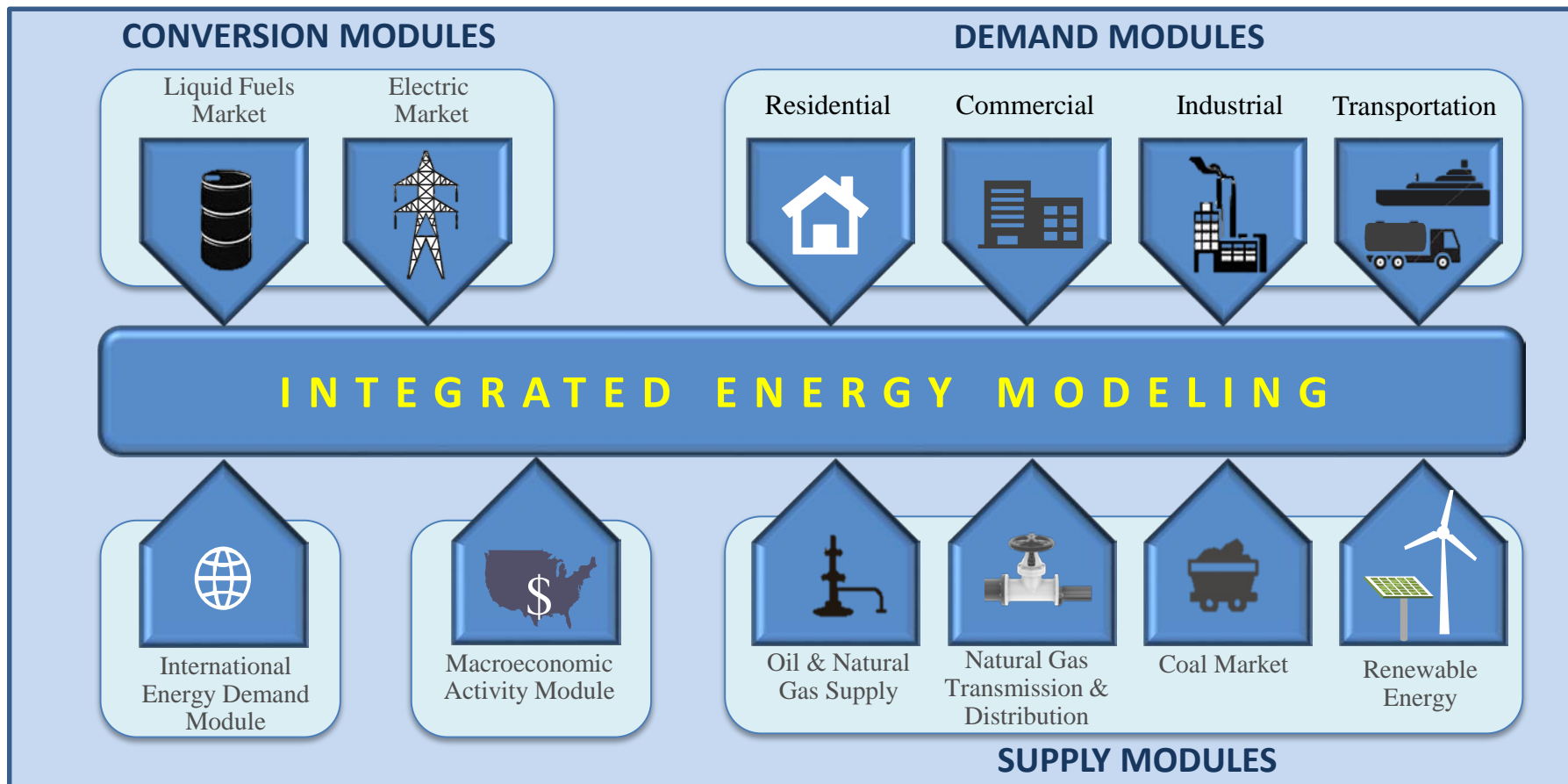
Outline

- Overview of NEMS
- Transportation Model Overview
- Regional Representation
- Light-Duty Vehicles
- Freight Trucks
- Transit
- Key Policies
- Key Assumptions and Inputs
- Key NEMS Outputs

Overview of NEMS

- The National Energy Modeling System (NEMS) is an integrated energy model that includes energy supply and production by fuel type, energy consumption by end-use sector, and energy conversion (electricity production & refining)
- NEMS was developed by the Energy Information Administration (EIA) – an independent agency within DOE
 - Used by EIA for its Annual Energy Outlook projections, as well as Congressional and other agency requests
 - Also used extensively outside of EIA (NGOs, private sector, etc.)
- Provides annual results through 2050 with significant detail by fuel and sector
- Modular structure allows each sector to be represented by methodology and data that fit it best

NEMS Schematic

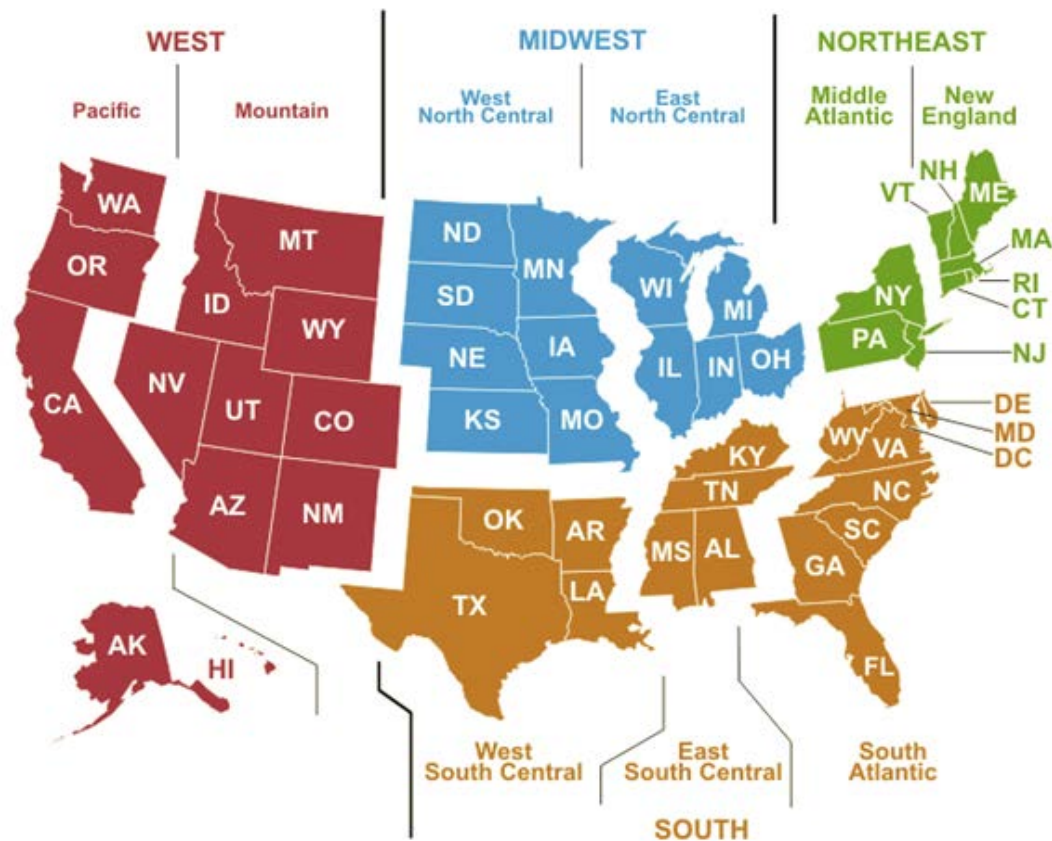


Transportation Model Overview

- Energy use is modeled by transportation mode: light-duty vehicles, freight, aviation, bus, rail, etc.
- Transportation model uses a variety of inputs from other modules within NEMS to determine vehicle shares, fuel consumption, VMT, etc.
 - GDP; sales of new cars and trucks; disposable income; population; industrial output; fuel prices
- Calculates transportation energy demand by fuel and feeds it back to the overall NEMS system
- Greatest detail for light-duty vehicles (LDVs) and freight trucks

Regional Representation

- NEMS models the transportation sector at a regional level using the 9 Census divisions
- OnLocation will modify NEMS to split the South Atlantic into 2 regions: states that are participating in TCI (DE, MD, VA, DC) and all other states in the region



Transportation Categories

- Light-Duty Vehicles (LDVs) for personal use and fleets
 - Cars in 6 EPA size classes; Light trucks in 6 EPA size classes
- Freight Transport
 - Truck (light-, medium-heavy- and heavy-duty classes)
 - Rail Freight
 - Marine (domestic and international)
- Aviation
- Other Transport
 - Bus (commuter, intercity, and school buses)
 - Passenger Rail (commuter, intercity, and transit)
 - Recreational Boats
 - Military

Light-Duty Vehicles

- Significant technology detail for LDVs
 - Includes conventional/gasoline vehicles, hybrid and plug-in hybrid electric vehicles, CNG & LPG, fuel cell, and dedicated electric
- Market shares for vehicle types are calculated based on consumer preferences, vehicle costs, cost of driving, acceleration, range, etc.
- Model estimates new LDV fuel economy, price, horsepower, weight and range
 - Fuel economy is primarily driven by standards
- Vehicle Miles Traveled (VMT) is calculated based on the cost of driving (fuel & mpg), disposable income per capita, employment rate, number of vehicles per driver
- NEMS tracks the vehicle stock by technology and vintage and accounts for sales, retirements and transfers each year

Freight Trucks

- Truck sales are shared from the macroeconomic model forecast sales into subclasses for fuel economy classification purposes and two fleet types
- New truck fuel efficiency depends on the market penetration of specific fuel-saving technologies
 - Each of these have a variety of characteristics such as date of introduction, capital cost, fuel economy improvement, rate of base penetration, minimum and maximum penetration, and engineering notes
 - Technologies enter the market depending upon when they become available, and on the level of fuel prices
- Nine fuel options are represented: diesel, gasoline, CNG/LNG, LPG, Electric, PHEV diesel, PHEV gasoline, fuel cells
- Truck VMT is based on the growth in value of industrial output in 12 sectors and is shared to size classes, vintages, fuel type, and fleet type
- Total fuel consumption is calculated based on VMT and fuel economy

Key Policies NEMS Can Address

- Regional Transportation CO₂ Caps: CO₂ caps on highway gasoline and diesel fuel
 - Level of the emissions cap
 - Allowance banking
 - Cost containment
- Incentives for more efficient and/or alternative fuel vehicles (rebates, tax incentives, etc.) including both LDVs and freight trucks
- Impact of policies on VMT
 - NEMS has a limited ability to model detailed investment policies that would reduce VMT
 - OnLocation will work with Cambridge Systematics to incorporate their analyses into NEMS
- Policies to increase transit

Key Assumptions and Inputs

- The analysis will be based on EIA's *Annual Energy Outlook 2018*, but assumptions in AEO 2018 can be changed
 - User assumptions can generally be changed easily (e.g., battery costs for EVs)
 - Inputs to the transportation model from other parts of NEMS (e.g., fuel prices) can be changed but some are more challenging than others
- Gasoline and diesel prices (calculated by NEMS based on world oil prices, U.S. oil production, refinery costs and inputs, demand)
- Battery costs for EVs as well as the balance of electric vehicle costs (non-battery costs)
- Baseline regional VMT growth
- Existing federal and state policies such as fuel economy standards for LDVs and commercial trucks, tax incentives for EVs, ZEV mandates, etc.
 - AEO 2018 includes existing federal policies at the time the projection was finalized.

Key NEMS Outputs

- CO₂ emissions by region and sector (including power sector CO₂ emissions)
- Price of CO₂ allowances and total revenue generated
- Annual energy consumption by fuel type, transportation mode, and region
 - Includes biofuels such as corn ethanol, cellulosic ethanol, biodiesel, biobutanol, and others
- Sales and stocks of LDVs by type (conventional gasoline, hybrids, PHEV, EV, etc)
- Fuel economy
- LDV and freight truck VMT