Independent Statistics and Analysis
U.S. Energy Information Administration

May 30, 2024

MEMORANDUM FOR: Angelina LaRose
Assistant Administrator for Energy Analysis

FROM: Jim Diefenderfer
Director, Office of Long-Term Energy Modeling

SUBJECT: Summary of AEO2025 Transportation Working Group held on Wednesday, May 22, 2024

This memorandum summarizes our presentation and discussion at the *Annual Energy Outlook 2025* (AEO2025) Transportation Working Group meeting. The Transportation Working Group presentation summarized AEO2023 Reference case transportation projections. It also highlighted the planned historical transportation data and modeling updates for the Transportation Demand Module (TDM) for the AEO2025 Reference case, as configured in our National Energy Modeling System (NEMS). After the presentation, meeting participants commented on additional model and data topics. The presentation for this meeting is available in a separate document on our website.

Model updates (AEO2025)

We presented an overview of planned data and model updates for AEO2025 by mode, including but not limited to:

- Light-duty vehicle (LDV) model updates
  - New consumer powertrain choice model, Inflation Reduction Act (IRA) Clean Vehicle Credit (CVC), National Highway Traffic Safety (NHTSA) Corporate Average Fuel Economy (CAFE) standards, zero-emission vehicle (ZEV) credit update
- Freight truck model updates
  - NHTSA CAFE Phase 3 standards, IRA Section 45W Commercial Vehicle Credit, California Advanced Clean Truck (ACT) rule
- LDV and freight truck data updates
  - Sales and stocks, annual vehicle miles traveled per vehicle, scrappage, battery prices
- Air data updates
  - Sales, stock, revenue passenger miles, and freight ton miles
- Public transit data updates
  - Passenger bus and passenger rail travel demand and energy consumption
- Military data updates
  - Distillate and jet fuel energy consumption

Discussion

During the discussion, participants primarily asked about model structure, electric vehicles, batteries, and policy.

Model structure discussion

An attendee asked whether we include rail in the transportation module. We confirmed that both freight and passenger rail are included in the transportation module. We explained that we are making historical updates to freight rail with information from the U.S. Department of Transportation's Freight Analysis Framework and historical updates to passenger rail from the National Transit Database.

An attendee asked how we define manufacturer groups in our module. We explained that our module includes 11 manufacturer groups, which are further split into 5 car groups and 6 light-truck groups. Manufacturers are grouped based on their approach to meeting emissions and efficiency standards and on vehicle attributes and pricing. Domestic, European, Japanese, and Korean manufacturers are separated. We emphasized that an important modeling update is that we are separating *both* luxury and exotic vehicles out from mass-market vehicles, whereas in the past, only exotic vehicles were separated out. We base the separations on price by size class; for example, a large SUV has a higher price threshold to reach the luxury classification than a sedan does. We also pointed out that we have always separated exotics in our module due to compliance behavior. Exotic manufacturers typically prioritize vehicle performance over emissions and fuel economy compliance. Instead, they account for expected penalties when setting their vehicle prices. Another attendee asked which manufacturer group Tesla would fit into in our module. We responded that, at current prices, Tesla models would fit into the luxury category. We noted that we are looking out for announcements of future lower-price Tesla models, which could fall below the luxury price threshold.

An attendee asked what our new heavy-duty payback curves are based on (Slide 18), and what is behind reducing potential adopters at the 1–3-year payback period and subsequently increasing adopters at the 3–7-year payback period (Slide 19). We explained that we base the curves on S&P/Polk vehicle registration and Vehicle Inventory and Use Survey (VIUS) data, from which we derived average length of ownership. The data source for the original curve—an American Trucking Associations (ATA) survey—did not have significant detail on methodology, so we cannot specifically draw out the difference between adoption rates between the old and new curves. However, we assume that heavy-duty-vehicle buyers need their vehicles to pay back in less than half of their expected ownership period. Because trucks are revenue-generating assets, a heavy-duty payback calculation is fundamentally different from that of an LDV: Truck drivers who generally owns their trucks for seven years, for example, would not be willing to switch to a powertrain that takes seven years to break even.

An attendee asked if we will model infrastructure for hydrogen vehicle refueling. We answered that hydrogen prices will be available to us from the Hydrogen Market Module (HMM), so hydrogen infrastructure will be represented in the module, but it will be built out in the HMM rather than directly in the TDM.

Electric vehicles discussion

A participant asked if we will include charging infrastructure in our consumer choice model. We responded that we are working on building a projection of charging infrastructure. We will include the effect of policy incentives on infrastructure growth while also incorporating a feedback mechanism with

growth in on-road electric vehicle (EV) stocks. So, for example, if battery-electric vehicle (BEV) adoption slows down, infrastructure buildout will also slow down. Another participant asked us to discuss endogenous adoption of charging infrastructure in more detail. We responded that although still in development, we expect it to be a relatively aggregate-level projection of average fuel availability, rather than a projection of specific charging sites. We also noted that LDV and heavy-duty chargers are different, so although some may be sited together, we don't assume that to be true throughout the charging network. Slides 10 and 11 of our presentation provide information on charging-related module updates.

A participant asked if we shared preliminary AEO2025 results on EV market share. We clarified that we did not share AEO2025 results in our presentation because those results are not ready.

A participant asked if we would incorporate electric school and transit bus sales in addition to fuel consumption. We confirmed that we do model buses, but we do not have a stock flow model that accounts for sales, on-road stocks, and scrappage. We plan to update the module with recently announced U.S. Environmental Protection Agency (EPA) funding for electric school buses.

A participant asked why BEV adoption flattens in our module over time, given that recharging a BEV is less expensive than refueling an internal-combustion engine (ICE) vehicle and that the availability of fast chargers and the speed of battery recharging are both improving dramatically, which should overcome a significant deterrent to BEV adoption. We responded that the relative cheapness of refueling a BEV versus ICE vehicle depends on many factors, including the type of vehicle, the cost of electricity, and parallel improvements in ICE efficiency over the projection period. In other words, the participant's assessment of the future included several assumptions that would require a discussion beyond the brief allotted Q&A period. We noted that we would be interested in a more detailed discussion on this topic in the future and invited the participant to follow up with us.

Batteries discussion

An attendee noted that although battery costs continue to decline in our module, EV market share eventually plateaus. The participant asked whether that trend is due to a battery-cost floor, and if so, what data determine the cost floor. We confirmed that EV market share levels out partially because the decline in battery cost levels out. We explained that we do not have an explicit floor in our module; rather, the materials cost stage of our two-stage learning rate provides a *moving* floor, or minimum threshold, for total battery costs. Slide 14 of our presentation explains our learning rate calculation and shows a chart of our battery cost projection compared with projections from other organizations. The attendee noted that the battery cost study on Slide 14 is based on 2016–2017 cobalt prices and asked whether we perform sensitivity analyses on our battery cost assumptions. We confirmed that we have run sensitivity analyses in NEMS using different battery prices and emphasized that EV adoption is very sensitive to significant changes in battery prices.

An attendee asked if our vehicle scrappage modeling considers end-of-life battery recycling as BEVs cycle out of the on-road fleet. We responded that we do not currently have a battery recycling model in place.

Policy discussion

A participant asked whether we will incorporate California's Advanced Clean Cars (ACC) II regulations in the module for AEO2025. We thanked the participant for pointing out that we did not mention these

regulations in our presentation and noted that we would add it to Slide 25 after the discussion. We confirmed that if ACC II receives a waiver from the EPA, and if we have sufficient time to incorporate it in the model, it will be represented in AEO2025.

A participant asked whether leased LDVs can access the IRA Section 45W Commercial Clean Vehicle Credit in our consumer choice model. We answered no; LDVs do not have access to the 45W credit in our module at this time. We explained that this omission is due to uncertainty regarding whether and how manufacturers will pass the credits on to consumers. Another attendee asked how we will characterize critical mineral supply chain effects of the 2021 Infrastructure Investment and Jobs Act (IIJA) and the IRA. We explained that although we do not have an explicit critical minerals pricing forecast in NEMS, we will review battery manufacturer plans for critical minerals mining and production and assess how much battery production could comply with Section 30D of the IRA. We also emphasized again that we do not include the IRA Section 45W Commercial Clean Vehicle Credit at this time.

Finally, a participant asked us to elaborate on implementing the manufacturer response to the EPA's Phase III greenhouse gas performance standards in our module and noted that those standards do not include explicit requirements for BEV adoption. We explained that EPA's No Action projection in the regulation assumes a certain level of BEV adoption—growing from 26% of new vehicle sales in 2027 to 35% in 2032. BEV adoption in our module will fall within the range of that level as a lower bound regulatory requirement.

Attendees

Guests (Webex/phone)	*Affiliation*
Michael Hartrick	Alliance for Automotive Innovation
David Gohlke	Argonne National Laboratory
Alyssa Leibold	Bureau of Labor Statistics
Elena Giyenko	California Energy Commission
Nicholas Chase	Congressional Budget Office
Chris Harto	Consumer Reports
Katherine Baird	U.S. Department of Transportation
Christina Beck	U.S. Department of Energy
Noel Crisostomo	U.S. Department of Energy
Colin Cunliff	U.S. Department of Energy
Jason Frost	U.S. Department of Energy
Eric Goode	U.S. Department of Energy
Gavriella Keyles	U.S. Department of Energy
Gavriella Keyles	U.S. Department of Energy
Jennifer Li	U.S. Department of Energy
Jun Shepard	U.S. Department of Energy
John Wimer	U.S. Department of Energy
Thomas Timbario	Energetics
Daniel Bizer-Cox	U.S. Environmental Protection Agency
Tiffany Mo	U.S. Environmental Protection Agency
Chris Ramig	U.S. Environmental Protection Agency
Michael Shelby	U.S. Environmental Protection Agency
Lester Wyborny	U.S. Environmental Protection Agency
Wyatt Thompson	Food and Agricultural Policy Research Institute, University of Missouri
Matthew Ives	GTI Energy
Ansh Nasta	GTI Energy
Bart Sowa	GTI Energy
Derek Wissmiller	GTI Energy
Kingsley Asare	Hitachi Energy
John Meyer	Leidos
Steve O'Malley	Leidos
Wesley Cole	National Renewable Energy Laboratory
Arthur Yip	National Renewable Energy Laboratory
Samaneh Babaee	OnLocation
Hao Deng	OnLocation
Frances Wood	OnLocation
Jillian DiMedio	Oregon Department of Energy
Stacy Davis	Oak Ridge National Laboratory
Hannah Kolus	Rhodium Group
Robert Hershey	Robert L. Hershey, P.E.
Joshua Junge	Sargent & Lundy

David Degidio	SJ Fuel South
Liam Watts	Tenaska
Fazal Malakhail	University of Missouri
J Whistance	University of Missouri
John Ryter	U.S. Geological Survey
David Pace	Volpe Center, U.S. Department of Transportation
Don H Pickrell	Volpe Center, U.S. Department of Transportation
David Daniels	Swedish National Road and Transport Research Institute
Alex Sun	Wood Mackenzie
Philip Jennings	WSP USA

EIA staff attendees (Webex/phone)

Monica Abboud
Michael Dwyer
John Maples
Tess Prendergast
Jeff Bennett
Erin Boedecker
Michael Cole
Joe DeCarolis
Jim Diefenderfer
Rosalie Dubbohlke
Kathryn Dyl
Mindi Farber-DeAnda
Mala Kline
Angelina LaRose
Kevin Nakolan
Boon Teck Ong
Kendyl Partridge
Mark Schipper
Elizabeth Sendich
Sauleh Siddiqui
Nicholas Skarzynski
Courtney Sourmehi
Claire Su
Manussawee Sukunta
Josh Whitlinger