

Annual Energy Outlook 2021

Planned modeling and data updates in the transportation sector



For

AEO2021 Transportation Working Group

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By

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AEO2021 and COVID-19

- *AEO2021* reflects updated macroeconomic projections from IHS Markit (including vehicle sales)
- Short-term impacts of COVID-19 and its mitigation efforts are reflected in *Short-Term Energy Outlook* (STEO) forecasts
- EIA released an *Annual Energy Outlook Trends and Expectations* report that discusses some of the early impacts of COVID-19 on different energy sectors: https://www.eia.gov/outlooks/aeo/trends_expectations.php

Planned updates to the *Annual Energy Outlook 2021*

The Transportation Sector Demand Module (TDM) consists of four submodules representing a variety of travel modes: Light-Duty Vehicle (LDV), Air Travel, Freight Transport (heavy truck, rail, and marine), and Miscellaneous Energy Demand.

Data and modeling updates are planned for

- Light-duty vehicles
- Public transit modes
- Heavy-duty vehicles (HDV)
- Recreational boats
- Passenger and freight air travel

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Historical data updates

TDM data updates

- Light-duty vehicle stock model
 - Stock data update to 2018 from 2016; data based on vehicle registrations by region, vintage, and fuel type, including car and light truck split based on vehicle data from the U.S. Environmental Protection Agency
 - CAFE technology data update to 2018; technology menu based on results of the *Final Regulatory Impact Analysis*
 - Battery cost and performance update
- Heavy-duty vehicle stock model
 - Stock data update to 2018 from 2016; using vehicle registrations by region, vintage, fleet type, and fuel type
 - Region travel update to 2018, affects scrappage, vehicle miles traveled (VMT) by vintage, and stock fuel economy

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TDM data updates (continued)

- Aviation demand model
 - Update to 2018 from 2016 from federal and private data sources--world sales and stocks, parked aircraft, available seat miles (ASM) traveled, revenue passenger miles (RPM) traveled, cargo revenue ton miles (RTM), fuel use, domestic and international yield, fuel burn rates, load factors, annual capacity per aircraft, and others. Many variables will now be disaggregated by region, body type, and domestic/international.
- Public transit model
 - Update to 2018 from 2016 for transit, intercity, and commuter rail
 - Update to 2018 from 2016 for transit, intercity, and school bus
 - Includes travel demands, fuel use, and efficiency data
- Other updates
 - Update of vehicle miles traveled for light duty vehicles and motorcycles

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Modeling updates

Light-duty vehicle modeling updates

Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule

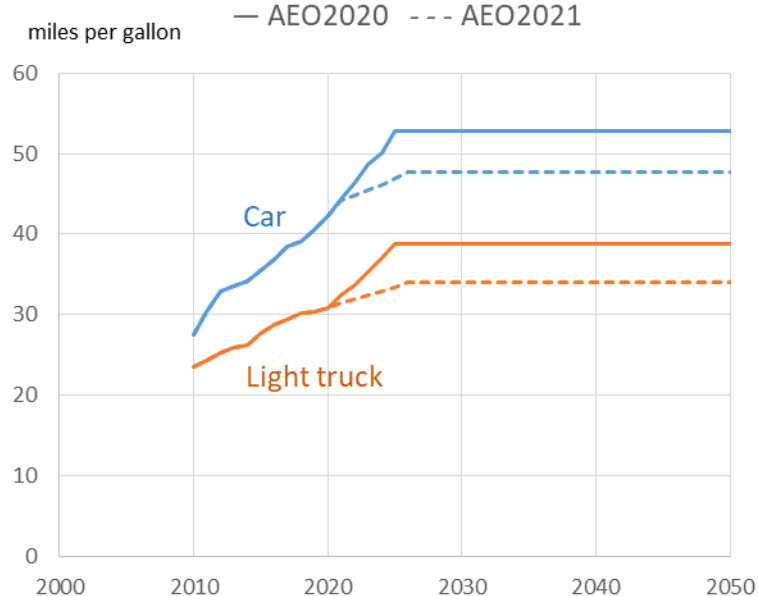
- Update to final CAFE rule (3/2020) -- finalize CAFE and carbon dioxide emissions standards for model years 2021-2026
- ZEV mandate removed (One National Program Rule, 9/2019) -- withdraw California's waiver of preemption under Section 209 of the Clean Air Act

Update estimation to integrate or align tested fuel economy data with on-road fuel economy data

COVID-19 potential impacts

- E.g. travel demand, scrappage, VMT schedules

CAFE fuel economy standards



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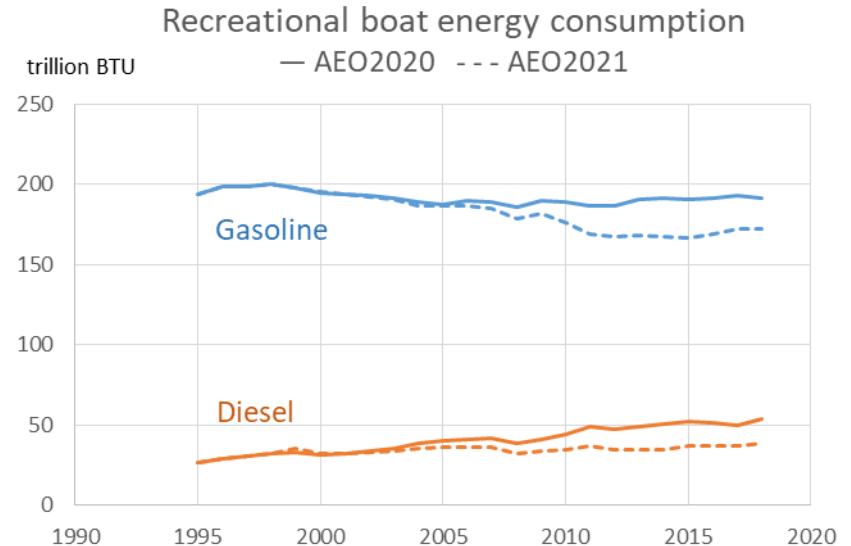
Public transit modeling updates

- Re-estimate coefficients for travel demand (PMT) equations
 - Increased sensitivity of the model by changing macro inputs
- Update transit bus fuel choice to account for projected growth of electric and natural gas buses
- COVID-19 potential impacts
 - Travel demands for public transit modes

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Other modes modeling updates

- Class 2b-8 vehicles: Consider updating freight travel demands by vehicle type (e.g., parcel) in response to COVID-19
- Recreational boats: updated demand projection equation given new historical data
- Other COVID-19 potential impacts



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Aviation modeling updates

- Re-estimate passenger and freight travel demand equations
- Revise fuel efficiency (i.e., fuel burn) methodology and stock model
- COVID-19 potential impacts
 - Revise methodology and model estimation equations for projections of revenue passenger miles and load factors, as well as other demand metrics

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Aviation modeling updates: demand projection equations

- The old model used the following RPM projection specification:

$$RPMT_PC_{wreg=1,di,Year} = CONSTANT_RPM_{wreg=1,di} + \left[\frac{INC00\$NP_{Year}}{INC00\$NP_{BASE_YEAR}} * (1 + SHAPE_{wreg=1,di})^{(Year-BASE_YEAR)} \right]$$

- Revised model specification from ICAO¹:

$$\Delta \ln RPMT_PC_{wreg,di,year} = c + \beta_1 \Delta \ln GDP_PC_{wreg,di,year}$$

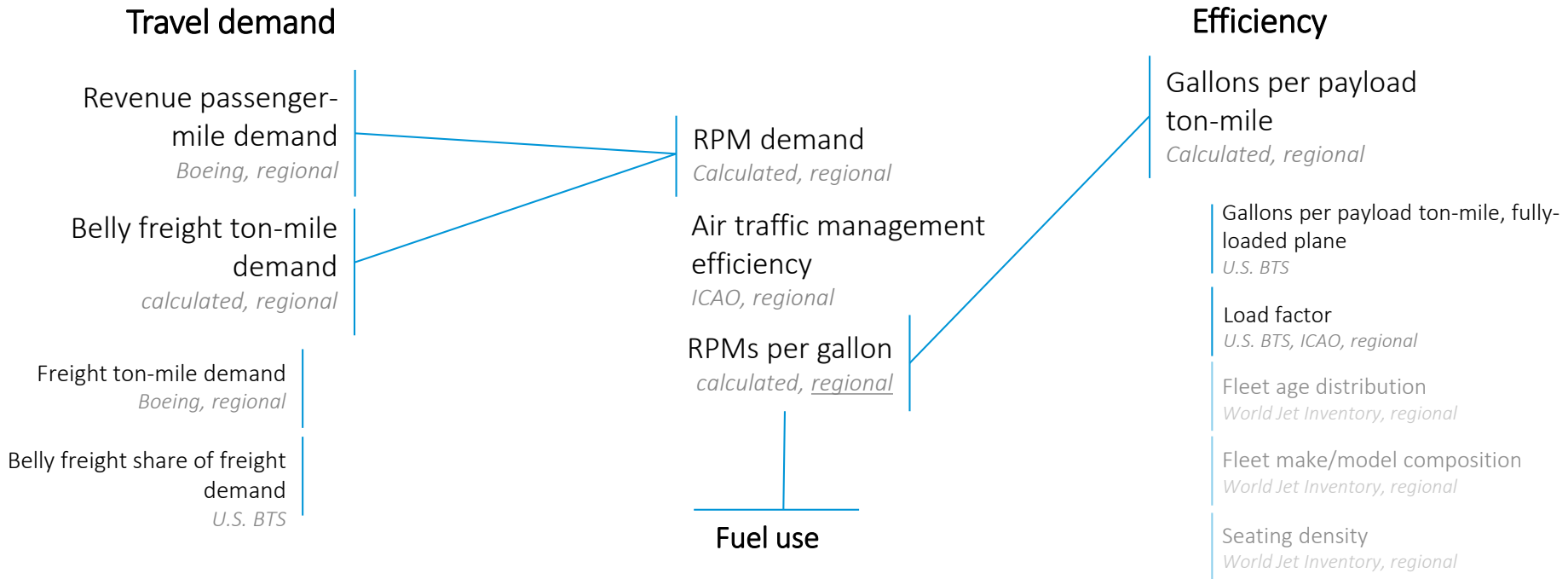
$$\frac{RPM_PC_{year}}{RPM_PC_{year-1}} = e^c \left[\frac{GDP_PC_{year}}{GDP_PC_{year-1}} \right]^{\beta_1}$$

- Additionally, ICAO's RTM specification was implemented in *tranair*:

$$RTM_{year} = c + \beta_1 \ln(GDP_{year})$$

¹ICAO 2019, *Report on the Updated Long-Term Traffic Forecasts*

Aviation modeling updates: fuel burn



Note: all regional variables here also tracked by domestic/international and body type

Aviation modeling updates: global stock model

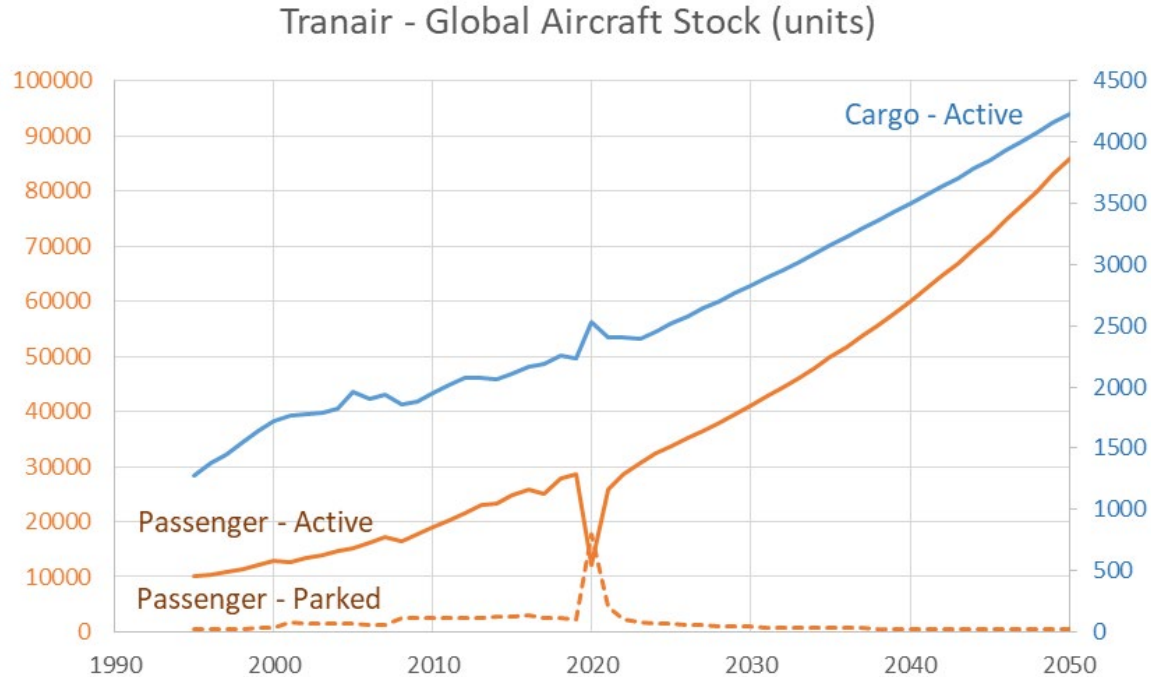
Dedicated freight aircraft

1. If aircraft supply exceeds RTM demand, park aircraft (oldest first).
2. If RTM demand exceeds aircraft supply, four sequential options:
 1. Unpark parked cargo aircraft (newest first)
 2. Convert older parked passenger aircraft (oldest first)
 3. Convert [even] older active passenger aircraft (oldest first)
 4. Purchase new freighters

Passenger aircraft

1. If aircraft supply exceeds RPM demand, park aircraft (oldest first).
2. If RPM demand exceeds aircraft supply, two sequential options:
 1. Un-park parked passenger aircraft (newest first)
 2. Purchase new aircraft

Aviation modeling updates: stock model results



Aviation modeling: potential covid impacts

Metric	Short-term	Details	Mid/Long-term	Details
Revenue passenger miles	▼▼▼	Travel bans; “dread” behavior; telework and videoconferencing	▼	“dread” behavior; telework and videoconferencing;
Load factor	▼▼		-?-	
Available seat miles (RPM capacity)	▼▼	Low load factors lead to smaller ASM hit	▼	“dread” behavior; telework and videoconferencing
Domestic share of passenger demand	▲	Travel bans and other restrictions	-?-	
Cost of air travel	▼▲	Load factor caps; jet fuel price; supply/demand mismatch	▼▲	Additional crew time req’d for pre-screening/cleaning; load factors?
Fuel efficiency	▲	Older planes parked first	▼▲	Un-park planes, or retire and purchase new?
Revenue ton miles [freight]	▼	Belly freight capacity drop	-?-	

Discussion/questions

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