Examining Future Global Transportation Energy Demand



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By John Maples

Outline

Model overview

- Passenger travel
- Freight travel
- Energy consumption for 16 regions:
 - USA, Canada, Mexico/Chile, OECD Europe, Japan, S. Korea, Australia/New Zealand
 - Russia, Non-OECD Europe/Eurasia, China, India, Non-OECD Asia, Middle East, Africa, Brazil, Other South/Central
- IEO2016 Reference case transportation projections
- Preliminary scenario results



Travel demand **Exogenous** determinants Passenger Gompertz curve miles traveled Population. (PMT) loait shares income, Gompertz curve f(income, cost-ofemployment travel) Light-Duty Fuel prices, Vehicle stocks Implicit Vehicle price (?) vehicle price, 2 Transit demand Wheeler policies (D1) Exog Comm. Survival Curves LDV PMT stock shares 🔪 by vehicle type VMT_Constraint Anticipated average miles/vehicle Personal Commercial Provisional Vehicle Stock Provisional Provisional Provisional Vehicle Stock Avg mi/veh by Unmet PMT Load factor — LDV VMT 2W PMT Transit PMT Vehicle Type (if any) Personal Commercial f(ownership **\(\)**(?) Vehicle Sales Vehicle Sales or time) Policy logit shares Interventions, Congestion, Private Sales by Comm Sales by Realized **Final Unmet** Realized Realized **Fuel Prices** Technology Type **Technology** Type Transit PMT PMT (if any) 2W PMT (D2) LDV VMT Stock average Stock Accounting by on-road fuel New vehicle fuel Other Model economy by Vehicle and Techn Type economy **Fuel Shares** fuel type **On-Road** Other Mode Stock by vehicle **Degradation Factor** miles/vehicle VMT shares Fuel and fuel type LDV Fuel Other Mode by vintage by 🛪 by fuel type Economies Consumption Fuel vehicle type PHEV by Fuel Type Consumption elec/gas split By Fuel Type Efficiency and fuel share Fuel consumption

Passenger travel flow diagram



Model overview

- International Maritime Freight Module methodology
 - Seaborne vessels involved in international trade
- Intraregional Freight Module methodology
 - On-road, rail, and waterborne freight taking place within national/regional borders
- Air Module methodology
 - By aircraft type (regional, narrow-body, and wide body) for passenger and freight movements
 - Regional and international travel



Non-OECD surpasses OECD around 2020 and world transportation energy consumption reaches 155 quadrillion Btu by 2040



IEO2016 Reference Case



Variation between publications, world transportation energy consumption in 2040

Energy consumption quadrillion Btu





World transportation energy consumption by fuel dominated by liquid fuels but natural gas begins to gain market share

Energy consumption quadrillion Btu



IEO2016 Reference case



Diesel accounts for the largest increase in transportation fuel consumption between 2012-2040

Change in energy consumption quadrillion Btu



IEO2016 Reference case



Scenarios



Low and high liquid scenario assumptions

- Scenarios begin in 2021
- Proportionally adjusted LDV ownership growth rates
- Adjusted region specific consumer preference coefficients for LDV purchase by fuel and technology type and rate of change allowed
- Assumed changes in new LDV vehicle prices to reflect either technology cost adjustment or subsidy adjustment
 - Removed commercial LDV subsidies for alternative fuel vehicles in the high liquids scenario
- Fuel economy standards unchanged in low liquid case, held constant at 2020 levels in the high liquids case
- Adjusted fuel efficiency for rail and marine, load factors for trucks and willingness to fuel switch for all freight modes



Larger potential for upside and downside energy consumption in non-OECD countries than OECD countries

Energy consumption quadrillion Btu



IEO2016 Reference Case, low liquids scenario, and high liquids scenario

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Motor gasoline most effected fuel in low and high liquid scenarios in non-OECD countries

Change in energy consumption quadrillion Btu



Low liquids scenario and high liquids scenario

No light-duty vehicle diesel in EU scenario

- Assumes consumer preference or policy dramatically changes diesel LDV demand in EU
- Does not assume any particular fuel/technology will replace diesel
- Assumes no feedback from refiners or macro



Motor gasoline replaces diesel and alternative fuels in no diesel in EU scenario

New LDV sales percent market share



IEO2016 Reference case and no diesel in EU scenario

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Motor gasoline and diesel LDV become more efficient to meet CO2 standards if consumers no longer choose to purchase diesel vehicles

MPG gasoline equivalent



IEO2016 Reference case and no diesel in EU scenario

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Total combined diesel and motor gasoline LDV fuel consumption lower in no diesel in EU scenario than in Reference case in 2040 Transportation fuel consumption trillion Btu



IEO2016 Reference case and no diesel in EU scenario

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China slowdown scenario

- New macro parameters used in the reference case
- GDP and industrial output growth slowed down in China slowdown scenario
- No additional changes made in the transportation model



Chinese GDP 15% lower in 2040 in China slowdown scenario



New macro Reference case and China slowdown scenario

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All LDV transportation fuels, except NG, decrease in China slowdown scenario

Transportation fuel consumption trillion Btu



New macro Reference case and China slowdown scenario

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Chinese freight travel 15% lower in 2040 in China slowdown scenario

Freight travel demand billion ton-miles



New macro Reference case and China slowdown scenario

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John Maples

| phone: 202-586-1757 | email: j<u>ohn.maples@eia.gov</u>

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