

USCAR Ethanol Volume Scenarios for 95 RON High Octane Fuel

May 2018

Background and Assumptions

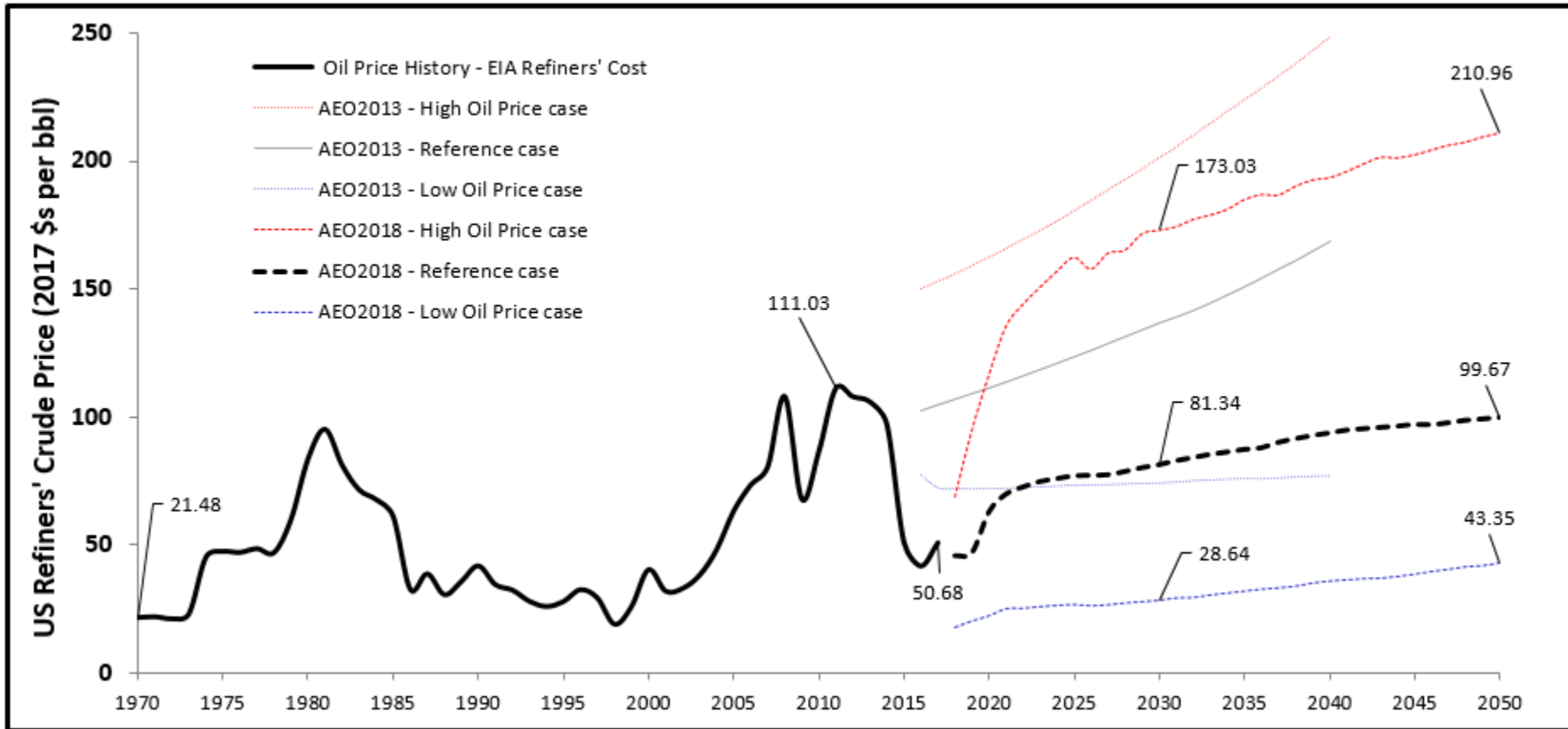
Background

- A model was constructed within the USCAR Fuels Working Group to quantify US ethanol use in gasoline, under various scenarios, as regular gasoline transitions to 95 RON high octane fuel (HOF) from CY22 (vehicle MY23)
- Model scenarios are based on EIA Annual Energy Outlook 2018 oil price cases and data sets, a pace of fuel pool transition derived from Argonne National Lab's VISION model, and assumptions around US gasoline grades, market shares, and ethanol volume percentages

Model Assumptions

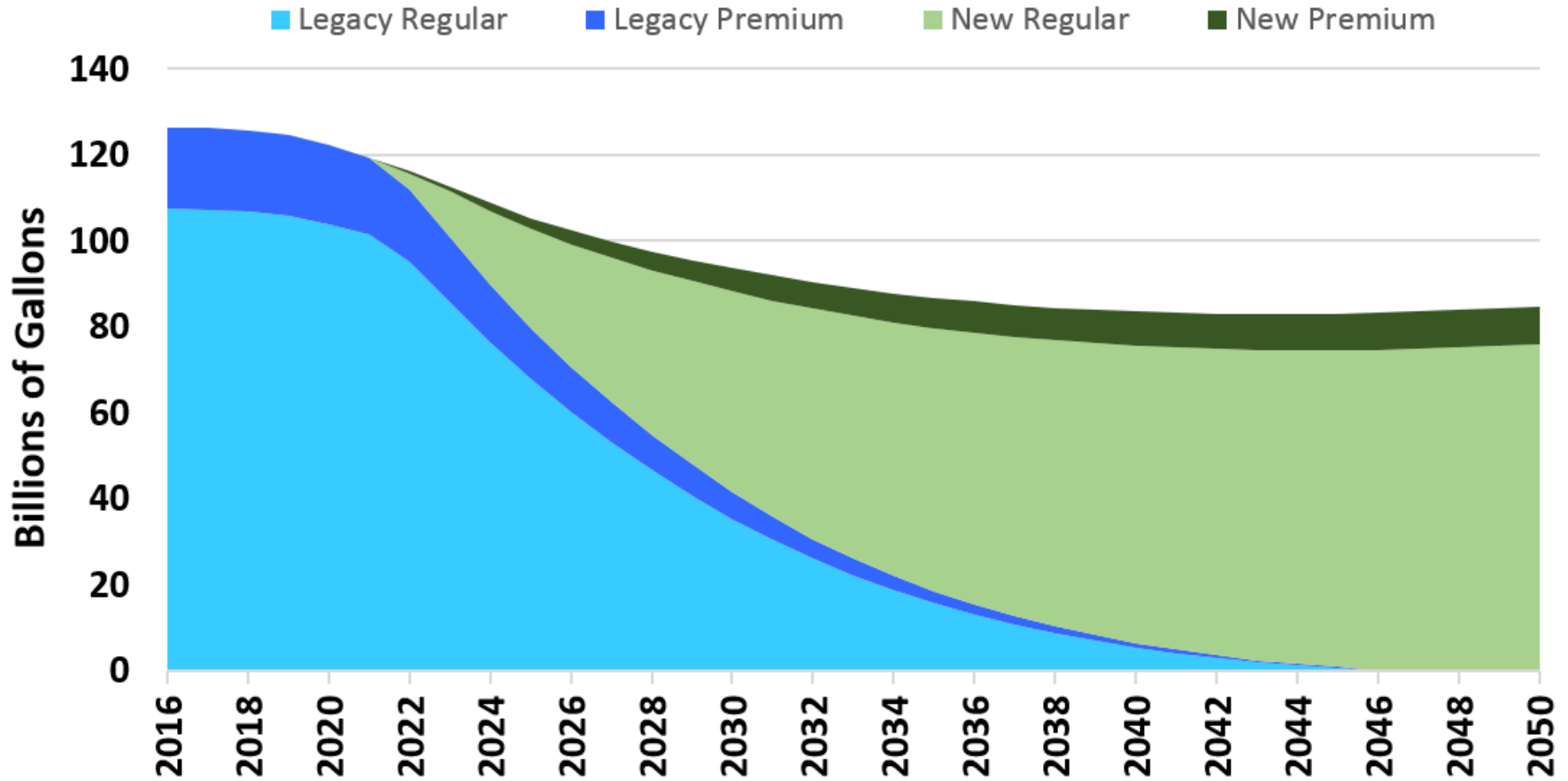
- Legacy fuel remains at E10 (ethanol volume set to 10.1% to calibrate with 2017 actual ethanol use, including blender pump / E85 volumes, of 14.5 B gallons)
- E85 volumes from EIA are not modeled explicitly. Assumed that these volumes will largely be absorbed into 95 RON HOF for octane value
- Exceptions not made for California – assumed CA will follow rest of country in any shift toward E15 or higher (understanding work is required to enable this)
- 98 RON new premium grade is included in the model, but ethanol blend volume of this grade follows 95 RON HOF in current scenarios
- Non-light duty vehicle gasoline is assumed to follow light duty in octane and ethanol blend volume (for Ref case for 2017, 88% of US gasoline is used by light duty vehicles)
- EIA oil price projections are illustrated on the following slide

EIA Oil Price Projections



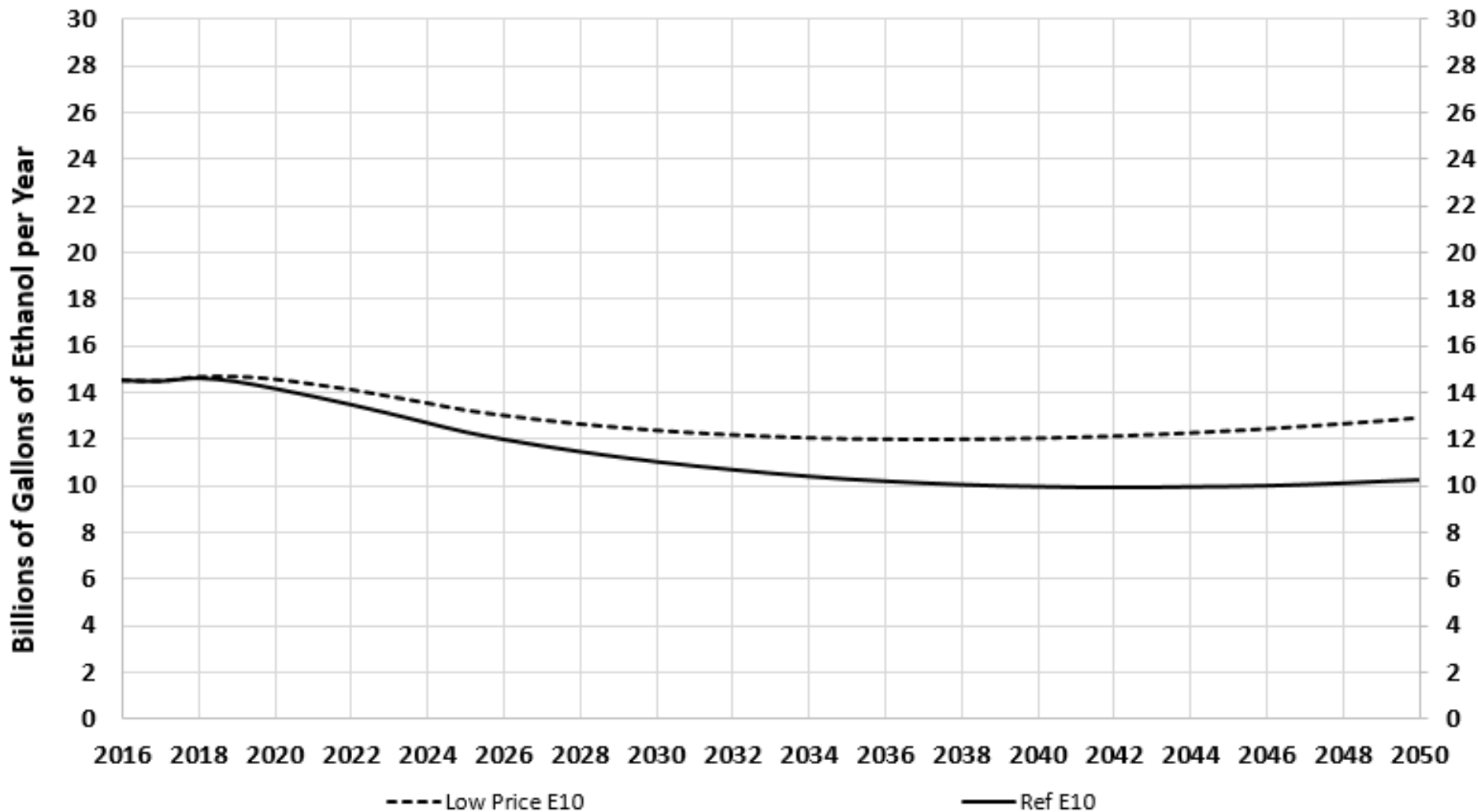
- The three oil price cases modeled (High Oil Price, Reference, and Low Oil Price) cover a broad range and comprehend most probable futures
- 2013 projections included for comparison. EIA's oil price projections have trended downward over time as new oil resources, particularly those unlocked by new U.S. production technologies, have moved into the market
- A sustained High Oil Price case is deemed unlikely. Therefore, this case has been excluded from the following analysis

Reference Case: US Light Duty Gasoline Pool Projection



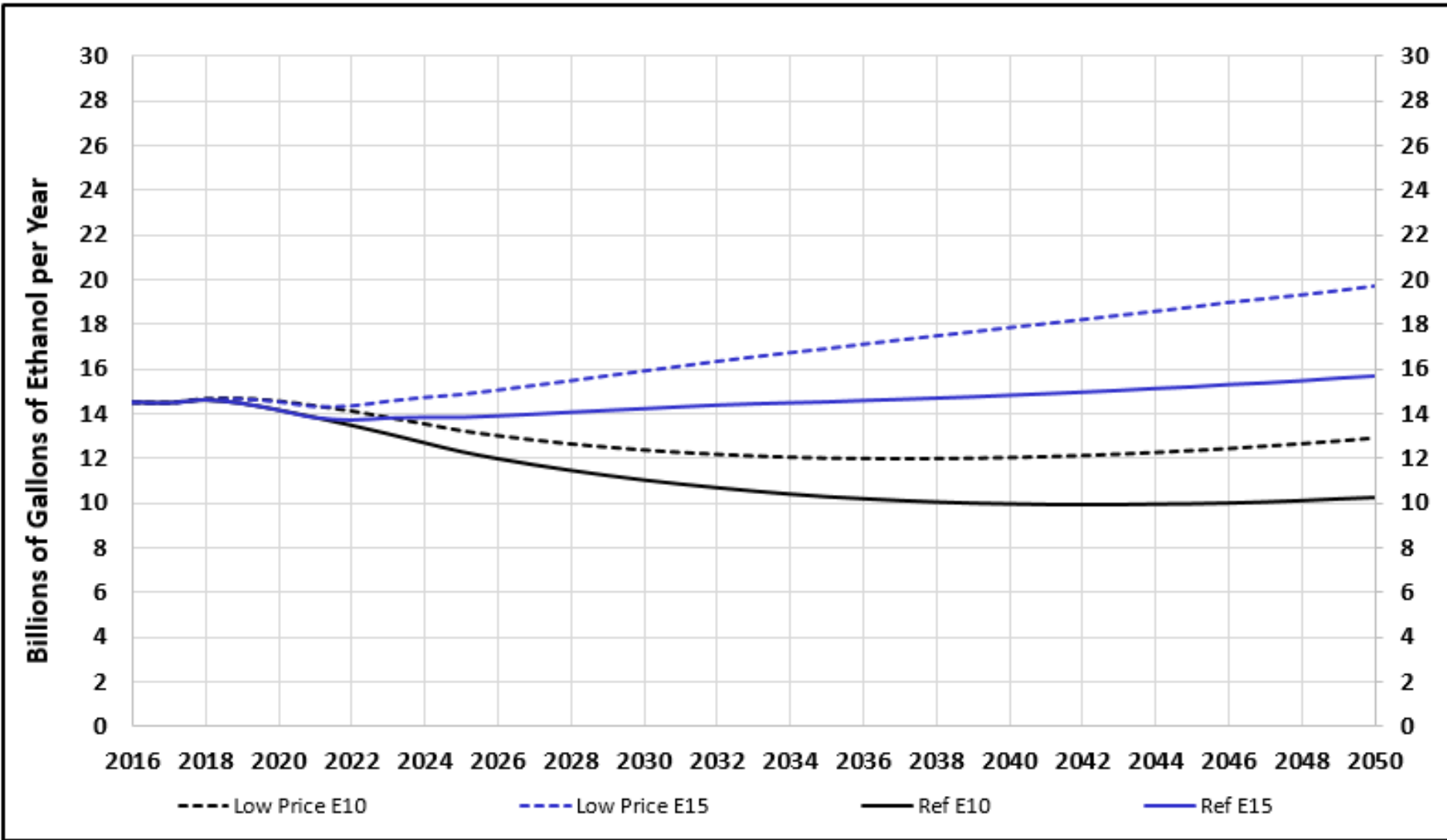
- The overall fuel pool shrinks as efficiency gains more than offset growth in miles traveled
- The fuel pool transition outpaces the fleet transition, as new vehicles are driven more miles each year than older vehicles
- Assuming a transition start date of 2022, half of U.S. fuel will be high octane in 7 years (2029), and 80% will be high octane in 13 years (2035)

Ethanol Volume Projections for E10 HOF Case



- At E10 blend levels, ethanol volumes decline to a range of 10~12B gallons/year over the two EIA oil price cases modeled

Ethanol Volume Projections for E10 and E15 HOF Cases



- Assuming blend levels land between E10 and E15 as demand for octane grows, ethanol volumes might be expected to hold at 14-16 billion gallons per year, even as the broader fuel pool shrinks by 20-30%

Data Sources

Fuel Volumes

US fuel volumes over time were taken from EIA's Annual Energy Outlook 2018 Reference, Low Oil Price, and High Oil Price cases. Key tables used were

Table 2 - Energy Consumption by Sector and Source

Table 37 - Transportation Sector Energy Use by Fuel Type Within Mode

<https://www.eia.gov/outlooks/aeo/>

Fuel Pool Transition Rate

US light duty vehicle fuel pool transition rates were based on Argonne National Laboratory's VISION model, which provides projections of sales volumes, new vehicle fuel economy, vehicle miles traveled by age, and rate of attrition of older vehicles out of the national fleet

<https://www.anl.gov/energy-systems/project/vision-model>

Fuel Energy to Volume Conversions

Values used in converting EIA's energy units (Btu's) to physical gallons of fuel were taken from Argonne National Laboratory's GREET model

<https://greet.es.anl.gov/>