Clean Fuels Forecast Methodology – 2019 Forecast

This document outlines the methodology used to construct the Clean Fuels forecast for the 2019 administration year. Oregon Revised Statutes (2017) Chapter 750, Section 163[1] authorizes the Office of Economic Analysis (OEA), with substantial assistance from the Department of Environmental Quality (DEQ), to produce annually a forecast regarding deficits and credits owing to fossil and alternative fuel consumption, as well as the availability of fossil and alternative fuels in Oregon. In particular, the forecast is to determine whether the available supply of low-carbon alternative fuels (ethanol, electricity, biodiesel, renewable diesel, natural gas, and propane) will be sufficient to generate the credits needed to meet the scheduled applicable low carbon fuel standards for the compliance period. The forecast report is required to include an assessment of banked deficits and credits at the beginning of the compliance period. The forecast is to be published no later than 90 days prior to the onset of the compliance period.

This methodology was constructed by the consulting firm ICF for use by DEQ to produce the 2018 Clean Fuels forecast. Furthermore, the methodology was used by OEA Economic Analysis to produce the 2019 forecast. Beginning in early 2019, OEA will institute a technical advisory committee to review and update the methodology to incorporate additional data sources, make use of OEA's technical expertise regarding statistical modelling and econometric techniques, and address issues raised during the development of the 2019 forecast.

The document adheres to the following outline:

A. Data Sources
B. Consumption forecasts
    a. Gasoline and diesel
    b. Alternative fuels
C. Supply forecasts
D. Estimation of Deficits and Credits
    a. Fossil Fuels
    b. Alternative Fuels

A. Data Sources

The forecast uses available public and program data to develop the estimates of low-carbon fuels available to Oregon and estimated consumption of fossil and alternative fuels in Oregon. The sources of this data include:

- Oregon Clean Fuels Program (CFP) Online System[2]
- Fuel Pathway Codes (carbon intensity values) approved in Oregon and California
- Oregon Department of Transportation's (ODOT) Revenue Forecast
- Oregon DMV vehicle registration data
- Annual Energy Outlook from the US Energy Information Administration

[1] https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/HB2017/Enrolled

[2] https://www.oregon.gov/deq/aq/programs/Pages/Clean-Fuels-Data.aspx

- Trade associations (Renewable Fuels Association and the National Biodiesel Board) on their members' production capacity

B. Consumption forecasts

Gasoline and diesel

Per the methodology developed by ICF, gasoline consumption for the compliance period is based on growth factors applied to the most recent actual year of gasoline consumption available in the Clean Fuels Program database. For the 2019 forecast, this was calendar year 2017 and amounted to 1,626 million gallons including ethanol. Growth factors for the two year period between the actual observation and the forecast for the compliance period come from ODOT's mid-year revenue forecast. This resulted in a calendar year 2019 total gasoline estimate of 1,601 million gallons. To produce a pure gasoline (CBOB) estimate, ethanol is backed out.

ODOT reports and projects total motor fuel growth, including both gasoline and diesel. In order to derive growth estimates for gasoline, the growth in the diesel-based weight-mile tax is used to back out growth factors for gasoline via the following equation:

$$\text{Motor Fuel growth}_t = \text{alpha}*\text{gasoline\_growth}_t + \text{beta}*\text{diesel\_growth}_t$$

Where t is the year in question.

Similar to gasoline, diesel consumption for the compliance period is based on growth factors applied to the most recent actual per the CFP database. For the 2019 forecast, this was calendar year 2017 and equaled 750 million gallons consumed, including bio- and renewable-diesel. The growth factors are again derived from ODOT's mid-year revenue forecast. In order to produce a pure fossil-based diesel consumption estimate, bio- and renewable diesel are backed out. Given that both of the latter are projected using a low and high blend rate range, this produces a low and high projection for diesel consumption.

Ethanol

As with fossil fuels, the base-year consumption for ethanol comes from CFP data. A blend rate is estimated and applied to the total gasoline consumption value. For the 2019 forecast cycle, the blend rate for ethanol was 10.3 percent, which when applied to the gasoline forecast results in an ethanol projection for 2019 of 165 million gallons.

Biodiesel and renewable diesel

A range of blend rates is derived from CFP reporting and applied to the total diesel volumes to produce low and high estimates for biodiesel and renewable diesel consumption for the compliance period. For biodiesel, the blend rate assumption ranged from 6.9 percent to 10.0 percent and resulted in a consumption forecast ranging from 53 to 77 million gallons. For renewable diesel, the blend rate values range from 1.3 percent to 6.5 percent and produce consumption values for the compliance period ranging from 10 to 50 million gallons.

On-road electricity

Consumption of electricity for on-road vehicles is based on a projection of the number of plug-in hybrid and battery electric vehicles in use for the compliance period. DMV vehicle registration data provides actual vehicle numbers historically, from which growth projections and variances are derived to produce a range of electric vehicles projected to be in operation for the compliance period. Historical data from the California Air Resources Board on electric vehicle charging and operation provide estimates for kilowatt hours consumed daily and days driven to produce an annual electricity consumption forecast. For the 2019 forecast, these computations result in consumption of on-road electricity, converted into gasoline gallon equivalents, of between 2.36 million and 2.57 million gallons.

Natural Gas and Propane

Consumption of natural gas and propane are based on data reported to the Clean Fuels Program, as well as DMV registration data for such vehicles. In addition, national data on mileage of such vehicles and fuel economy are employed to estimate and project utilization of natural gas and propane for on-road transportation. This results in consumption estimates for natural gas of 4 to 14 million diesel gallon equivalents and for propane of 0.8 to 1.4 million gasoline gallons equivalents.

C. Fuel Supply estimation

Fuel supply available to Oregon markets are estimated for ethanol, biodiesel and renewable diesel. Data on suppliers most likely to deliver fuels to Oregon, including nameplate capacity and carbon intensities, are compiled from the following sources:

a. Renewable Fuels Association
b. National Biodiesel Board
c. Energy Information Administration
d. Individual Suppliers (i.e., Guardian Energy, Pacific Ethanol, SeQuential Biodiesel, etc.)

D. Deficit and Credit calculations

Deficit and Credit forecasts are generally derived using energy densities published by the Department of Environmental Quality, as well as estimated and target carbon intensities published here (see Tables 1, 2, and 4 starting on page 209). The most recent versions of these tables are available here.

The following are the formulas resulting in the deficits and credits presented in Table 7 of the 2019 Clean Fuels Forecast.

Gasoline

$Deficit_G = CBOB * ED_G * (CIT_G - CIA_G)/1{,}000{,}000$

Diesel

$Deficit_D = V_D * ED_D * (CIT_D - CIA_D)/1{,}000{,}000$

Ethanol

$Credit_E = V_E * ED_E * (CIT_E - CIA_E)/1{,}000{,}000$

Biodiesel

$Credit_{BD} = V_{BD} * ED_{BD} * (CIT_D – CIA_{BD})/1{,}000{,}000$

Renewable Diesel

$Credit_{RD} = V_{RD} * ED_{RD} * (CIT_D – CIA_{RD})/1{,}000{,}000$

Electricity

$Credit_C = K_C * EER_E * ED_E * (CIT_G – (CIA_C/EER_E)/1{,}000{,}000$

Natural Gas

$Credit_{NG} = V_{NG} * ED_{NG} * (CIT_G – CIA_{NG})/1{,}000{,}000$

Propane

$Credit_P = V_P * ED_P * (CIT_D – CIA_P)/1{,}000{,}000$

Where:

G = Gasoline
CBOB = Conventional Blendstock for Oxygenated Blending
ED = Energy Density
V = Volume consumed
CIT = Carbon Intensity Target
CIA = Carbon Intensity Actual
D = Diesel
E = Ethanol
BD = Biodiesel
RD = Renewable Diesel
C = Electricity
K = Total Kilowatts (Total Electric Vehicles * Kilowatts Per Vehicle per Year)
EER = Energy Economy Ratio
NG = Natural Gas
P = Propane