2022 Clean Fuels Forecast

Background

Oregon Revised Statutes Chapter 468A, Section 272 authorizes the Office of Economic Analysis (OEA), with substantial assistance from the Department of Environmental Quality, to assess the availability of fossil and alternative fuels to Oregon. In particular, the forecast is to determine whether fuel supply will be sufficient to generate the necessary number of carbon reduction credits from alternative fuels (ethanol, electricity, and diesel substitutes - including biodiesel, renewable diesel, natural gas, and propane) 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.

In preparing the forecast, the Office of Economic Analysis has formed a Clean Fuels Forecast Advisory Committee comprised of relevant experts and stakeholders to assist in reviewing forecast assumptions, as well as methodological considerations and potential data sources. A membership list can be found in Appendix A.

Data Sources

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

- Oregon Fuels Reporting System (OFRS)
- Fuel Pathway Codes (carbon intensity values) approved in Oregon and California
- Oregon Department of Transportation's (ODOT) Revenue Forecast
- Oregon Department of Transportation's Electric Vehicle Forecast
- Annual Energy Outlook and other resources from the US Energy Information Administration
- Trade associations (Renewable Fuels Association and the National Biodiesel Board) on their members' production capacity

Clean Fuels Program 2022 Reported Volumes Forecast

To determine the amount of deficits that will be generated in 2022, and thus the amount of credits needed for compliance, a forecast for the volumes reported to the Clean Fuels Program of all relevant fuels is made. The following are the volume projections for each fuel type.

Motor Gasoline

1,423.7 million gallons of gasoline, including ethanol, were reported to the program in 2020, the most recent year of data available. This represented an 18.1 percent decrease from 2019 as the Covid-19 pandemic dramatically reduced light-duty vehicle miles traveled. This decrease was significantly steeper than the decline in taxable sales of gasoline per ODOT. As such, the forecast for reported gasoline to the Clean Fuels Program is 4.9 percent on an annualized basis over the two-year forecast horizon, somewhat stronger than the ODOT forecast. After subtracting the projected amount of ethanol (see below), the final forecast for conventional gasoline is 1,565.3 million gallons.

Diesel

According to CFP reported data, 759.4 million gallons of diesel, including bio- and renewable diesel, were reported to the program in 2020, the most recent year of data collected. Growth projections exhibited in the Oregon Department of Transportation's April 2021 forecast total 1.1 percent annualized from 2020 to 2022. However, due to the disparity between the two measures in 2020 and after discussion by the advisory committee, the forecast was increased to an annualized 4.1 percent. This results in a projected 822.7 million gallons of total diesel. After subtracting biodiesel and renewable diesel (see below), the final forecast for conventional diesel in 2022 is 687.0 million gallons. Owing to strong growth in the diesel alternatives, this represents a mere 1.1 percent growth in conventional diesel on an annualized basis.

Ethanol

The amount of ethanol reported for 2020 equaled 141.7 million gallons. The amount of ethanol projected for 2022 is based on a blend rate assumption driven by historical observations and trends, as well as blend rates observed in California. The latest observation for an ethanol blend rate, for calendar year 2020, was 10.0 percent. Given the passage of House Bill 3051, which allows for blends above 10 percent, the assumption for 2022 is 10.1 percent. This results in a forecast for reported ethanol of 158.1 million gallons, which is 5.6 percent above the 2020 volume on an annualized basis.

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. For this forecast, a new electric vehicle forecast developed by the Department of Transportation has been adopted. The committee discussed supply constraints affecting vehicle sales in the near term, and consequently the electric vehicle forecast has been lowered through the end of 2022. The forecast equals an average of 19,779 Plug-in Hybrids and 32,839 Battery Electric vehicles. Historical volumes of electricity, including estimates for residential charging, are used to calculate average Kilowatt-hours per vehicle year. Allowing for growth due to advancements in battery technology and enhanced charging infrastructure, this parameter equals 4,474 Kilowatt-hours per year for 2022. When converted to gasoline gallon equivalents, the forecast is 7.0 million gallons including residential charging. This is equivalent to a 37.3 percent increase from 2020 on an annualized basis, sizable growth due in part to the low 2020 base year caused by the pandemic.

Biodiesel

The reported volume of biodiesel in 2020 amounted to 68.6 million gallons. The amount of biodiesel projected for 2022 is based on a blend rate assumption driven by historical observations and patterns. The biodiesel blend rate is expected to rise from 9.0 percent in 2020 to 10.5 percent for the 2022 compliance period, resulting in a volume projection of 86.4 million gallons. This represents growth of 12.2 percent from the 2020 actual on an annualized basis.

Renewable Diesel

The amount of renewable diesel reported in 2020 was 18.3 million gallons. Similar to biodiesel, the forecast for renewable diesel is driven by the assumption of the fraction of total diesel reported comprised of renewable diesel. The blend rate observed for 2020 in the Clean Fuels data was 2.4 percent. The committee discussed recent and planned increases in production capacity and felt that an assumption of 6.0 percent for 2022 was reasonable. This leads to a forecast for reported renewable diesel of 49.4 million gallons, a 64.3 percent increase from the 2020 value on an annualized basis.

Natural Gas and Liquified Petroleum Gas

The amount of natural gas, including renewable natural gas (biogas), reported in 2020 in diesel gallon equivalents equaled 3.7 million gallons. Annualized growth from the 2020 base year to 2022 is assumed to be 29.9 percent. This results in a forecast of 6.2 million gallons. The blend rate for renewable natural gas is expected to increase from 78.9 percent in 2020 to 90.0 percent in 2022.

Liguified Petroleum Gas exhibits the smallest quantity of alternative fuel reported in 2020 at 1.5 million gasoline gallon equivalents. Annualized growth from the 2020 base year to 2022 is assumed to be 59.7 percent, resulting in a forecast of 3.8 million gallons.

The following table presents the 2022 reported volumes forecast in detail. Note that the percent change figures for 2022 represent annual growth from the last available actuals in 2020.

Table 1: Summary of fossil and alternative fuel volumes

(Mil. gallons, percent)	2019	2020	2021F	2022F	annual %ch vs. 2020
Conventional Gasoline	1,565.4	1,282.0	1,403.7	1,407.2	4.8%
Ethanol	174.0	141.7	157.7	158.1	5.6%
Ethanol Blend Rate	*10.0%*	*10.0%*	*10.1%*	*10.1%*	
Blendstock	1,739.4	1,423.7	1,561.5	1,565.3	4.9%
Fossil Diesel	719.3	672.5	717.4	687.0	1.1%
Biodiesel	60.1	68.6	80.6	86.4	12.2%
Biodiesel Blend Rate	*7.5%*	*9.0%*	*9.8%*	*10.5%*	
Renewable Diesel	16.8	18.3	24.7	49.4	64.3%
Renew diesel Blend Rate	*2.1%*	*2.4%*	*3.0%*	*6.0%*	
Total Diesel	796.1	759.4	822.7	822.7	4.1%
Electricity (on-road)	2.9	3.7	5.2	6.9	37.3%
Electricity (off-road)	2.2	3.2	4.9	8.0	57.3%
Fossil Natural Gas	1.2	0.8	0.6	0.6	-10.6%
Biogas	2.2	2.9	4.0	5.6	38.8%
Biogas Blend Rate	*65.3%*	*78.9%*	*87.5%*	*90.0%*	
Total Natural Gas	3.4	3.7	4.6	6.2	29.9%
Liquified Petroleum Gas	2.1	1.5	2.2	3.8	59.7%
On-road electricity include calculation of residential charging.					

Deficit and Credit Generation and Banked Credits

In order to estimate the number of deficits and credits associated with the reporting of each fuel type, the energy densities and carbon intensity differentials must be known. Most of the pertinent parameters are published here in administrative rule by the Department of Environmental Quality (see Tables 1, 2, 4, 6 and 7 in the PDF document referenced halfway down the page). The following table presents these parameters for each fuel. The highlighted carbon intensities for ethanol, biodiesel, renewable diesel and electricity are not set in rule and were discussed in detail by the advisory committee. As noted above concerning on-road electricity consumption, the average Kilowatt-hours per year is assumed to be 4,474. Finally, energy economy ratios are presented for electric and natural gas engines.

Table 2: Parameter values for the 2022 forecast

	Energy Density	Carbon Intensity Target	Carbon Intensity Assumption
Gasoline	122.48	93.15	100.14
Ethanol	81.51	93.15	46.50
Diesel	134.48	93.81	100.74
Biodiesel	126.13	93.81	31.50
Renewable Diesel	129.65	93.81	34.75
Electricity	3.60	93.15	63.47
KWh/vehicle	*4474*		
EERelect	*3.40*		
EER_NG	*0.90*		
Natural Gas	134.48	93.81	79.98
Biogas	134.48	93.81	49.00
Liq. Petroleum Gas	89.63	93.15	80.88

Banked Credits

The number of credits and deficits is taken from the OFRS. The number of gross credits registered through the end of calendar year 2020 equaled 5.1 million, while the number of deficits amounted to 4.3 million. The net credits banked equaled 826,429. OEA currently projects that another 124,224 net credits will be added to the bank in 2021. The total projected banked credits at the beginning of the 2022 compliance period is now expected to total 950,663.

Table 3: Summary of actual and projected net banked credits

Year	Deficits	Credits	Net Banked Credits
2016	-594,832	809,411	214,579
2017	-644,372	855,272	210,900
2018	-864,883	943,646	78,763
2019	-1,001,808	1,224,971	223,163
2020	-1,169,218	1,268,252	99,034
2021(est.)	-1,473,139	1,597,363	124,224
Total	-5,748,252	6,698,915	950,663

Credit and Deficit Summary

The table below summarizes the forecast for deficit generation and credit generation. The 2022 forecast calls for just shy of 100,000 net credits to be added to the credit bank. The equations for calculating the deficits and credits can be found in Appendix B.

Table 4: Summary of Deficits and Credits

Deficits	Gasoline	-1,204,778
	Diesel	-640,237
Deficit Total		**-1,845,015**
Credits	Ethanol	601,159
	Biodiesel	678,936
	Renewable Diesel	377,990
	Electricity, on-road	214,627
	Electricity, off-road	41,027
	Natural Gas	26,812
	Liquified Petroleum Gas	4,137
Credit Total		**1,944,689**

2022 Net Credits/Deficits	**99,674**
2021 Estimated Ending Banked Credits	**950,663**
Total Net Credits/Deficits	**1,050,336**

Forecasted Fuel Supply Deferral Analysis

As shown above, the forecast does not imply such an action.

Potential Supply of Alternative Fuels

Oregon Revised Statutes Chapter 468A, Section 272 directs the Office of Economic Analysis to estimate the "potential volumes of gasoline, gasoline substitutes and gasoline alternatives and diesel, diesel fuel substitutes and diesel alternatives available to Oregon." In order to make such estimates, a number of assumptions must be made. Potential is read to mean "could be made available to Oregon under a wide range of market conditions". Currently, suppliers must be registered by the Department of Environmental Quality to deliver fuel into Oregon. In addition, they must report volumes of fuel sold in Oregon to the OFRS. Thus, the capacity of facilities that were certified for the most recent compliance period (2021) is assumed to be theoretically "available" to Oregon.

In addition to estimating potential supply, the Office of Economic Analysis is directed to consider "Constraints that may be preventing access to available and cost-effective low carbon fuels by Oregon, such as geographic and logistical factors, and alleviating factors to the constraints". Only biofuels that might pose a supply constraint that could ultimately limit the number of credits available to deficit holders are called out explicitly. Should supply issues arise for the more mature fuel markets such as conventional gasoline and diesel, as well as electricity, such issues would be added to the report. This is not anticipated for the foreseeable future.

Ethanol

As exhibited in Table 5, the potential supply of ethanol to Oregon per the methodology outlined above is 1.8 billion gallons. This compares to a projected reported volume for ethanol of 158.1 million gallons for the 2022 compliance period.

Table 5: Ethanol Supply

Ethanol Supply Available to Oregon
(Existing Suppliers in 2021)

State	Nameplate Capacity (Mil. Gallons)	Number of Facilities
South Dakota	697	8
Nebraska	555	7
North Dakota	215	2
Colorado	120	2
Minnesota	118	2
Iowa	70	1
Oregon	43	1
Total Oregon Suppliers	1,818	23

Data from Clean Fuels Program.

Biodiesel

Table 6 presents the potential supply of biodiesel to Oregon, equaling 466 million gallons in capacity for certified facilities in 2021. This compares to a projected volume of biodiesel in 2022 of 86.4 million gallons.

Table 6: Biodiesel Supply

Biodiesel Supply Available to Oregon
(Existing Suppliers in 2021)

Locality	Nameplate Capacity (Mil. Gallons)	Number of Facilities
Iowa	129	3
Washington	100	1
Canada	70	2
Illinois	60	1
Arkansas	59	1
Minnesota	30	1
Oregon	17	1
Total Oregon Suppliers	466	10

Data from Clean Fuels Program.

Renewable Diesel

As presented below, the potential supply of renewable diesel to Oregon equals 772 million gallons. This compares to a projected volume of renewable diesel in 2022 of 49.4 million gallons.

Table 7: Renewable Diesel Supply

Renewable Diesel Supply Available to Oregon
(Existing Suppliers in 2021)

Locality	Nameplate Capacity (Mil. Gallons)	Number of Facilities
Singapore	291	1
North Dakota	184	1
California	180	1
Louisiana	75	1
Washington	42	1
Total Oregon Suppliers	772	5

Data from the Clean Fuels Program

Renewable Natural Gas
The amount of renewable natural gas potentially available to Oregon amounts to 24.7 billion gasoline gallon equivalents. This compares to a projected volume for this biofuel of 6.2 million gallon equivalents in 2022.

Table 8: Renewable Natural Gas

Renewable Natural Gas Supply Available to Oregon
(Existing Suppliers in 2021)

Locality	Nameplate Capacity (Mil. Gallons)	Number of Facilities
Canada	14.0	1
Texas	5.0	1
Louisiana	4.3	1
Tennessee	1.1	1
Nebraska	0.3	1
Pennsylvania	0.0	1
Washington	0.0	1
Wisconsin	0.0	1
Total Oregon Suppliers	24.7	8.0

Data from the Clean Fuels Program

Forecast Risks

A risk is defined as a deviation from one or more assumptions that would alter the conclusion outlined in the previous sections. There are a number of potential risks to this 2022 Clean Fuels Forecast, both positive and negative and they are:

(a) The most fundamental risk to the forecast amounts to potential deviations from the assumptions highlighted in each fuel type discussion. In particular, blend rates and carbon intensities for biofuels could be subject to significant error. In addition, this forecast contrasts with prior forecasts in that it assumes that the incentives inherent in the value of the credits generated by supplying alternative fuels will drive the carbon intensities of these fuels downward. Failure to realize these declines would result in fewer credits than currently anticipated.
(b) This forecast represents a "current law" representation of the compliance period in question. OEA's methodology does not take potential future state policy actions into account.
(c) There is a discrepancy between the diesel consumption numbers reported to the Clean Fuels Program data and the taxable gallons tabulated by ODOT. Explicitly, more gallons of diesel are reported to the former than the latter. This forecast applies projected growth of taxable diesel, at least initially, to the base year 2020 reported volumes of diesel in the CFP. To the degree that taxable gallons per ODOT are not a perfect proxy for reported gallons in the CFP, actual reporting of diesel to the Clean Fuels program, and thereby the number of deficits generated could deviate from this forecast.

(d) The ethanol availability presented above is not comprehensive and does not include other potential sources, such as sugarcane ethanol imported from Brazil. Given that potential supply characterized in table 5 greatly exceeds the projected 2022 volume, this is not an immediate threat to the forecast. However, it may need to be addressed as consumption increases or as carbon intensity targets are lowered.

Accessibility

Documents can be provided upon request in an alternate format for individuals with disabilities or in a language other than English for people with limited English skills. To request a document in another format or language, call Michael Kennedy in the Office of Economic Analysis at (503) 378-5732 or email him at michael.kennedy@oregon.gov

Appendix A

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Appendix B

The following are the formulas resulting in the deficits and credits presented in Table 4 of the 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

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

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

$Credit_C = K_C * EER_C * ED_C * (CIT_G - (CIA_C/EER_C)/1{,}000{,}000$

Natural Gas

$Credit_{NG} = V_{FNG} * ED_D * EER_{NG} * (CIT_D - (CIA_{FNG}/ EER_{NG})/1{,}000{,}000 + V_{RNG} * ED_D * EER_{NG} * (CIT_D - (CIA_{RNG}/ EER_{NG})/1{,}000{,}000$

Propane

$Credit_P = V_P * ED_P * (CIT_G - CIA_P)/1{,}000{,}000$

Table B.1: Definition of Symbols

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