

INTELLIGENCE THAT WORKS

Washington Department of Commerce Clean Fuel Forecast

September 9, 2022

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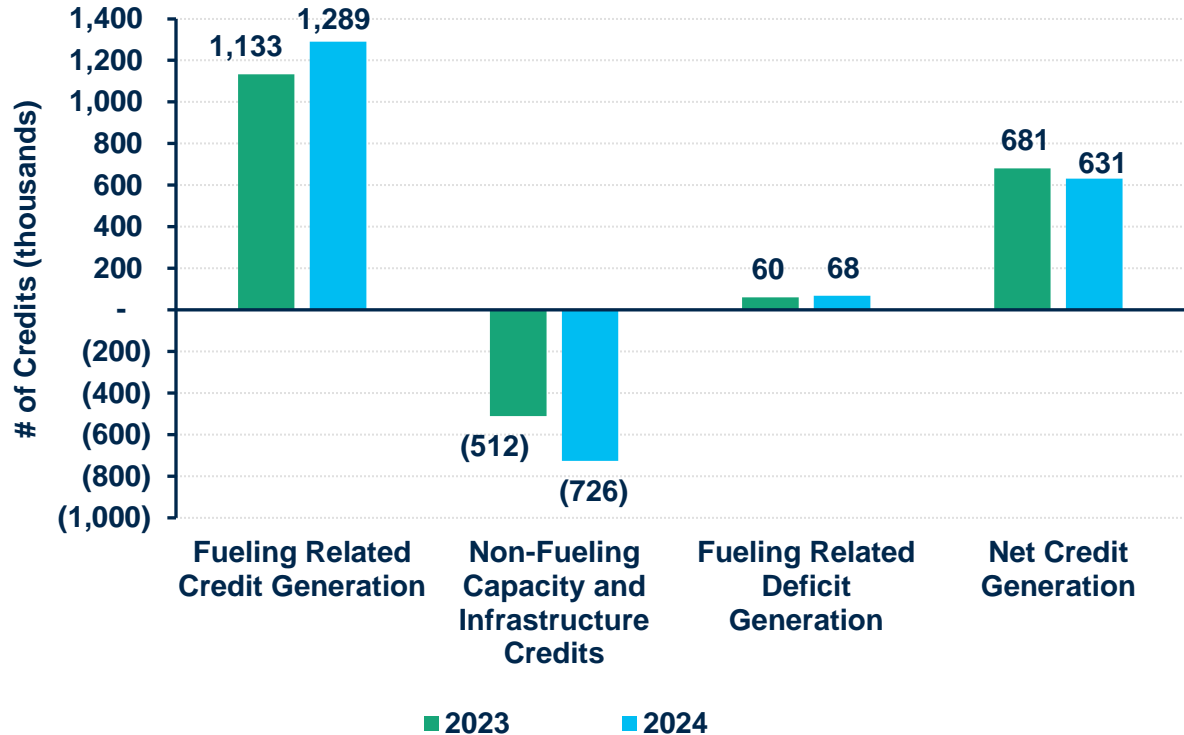
Credits/Deficits and Bank Balance

Credit/Deficit Generation

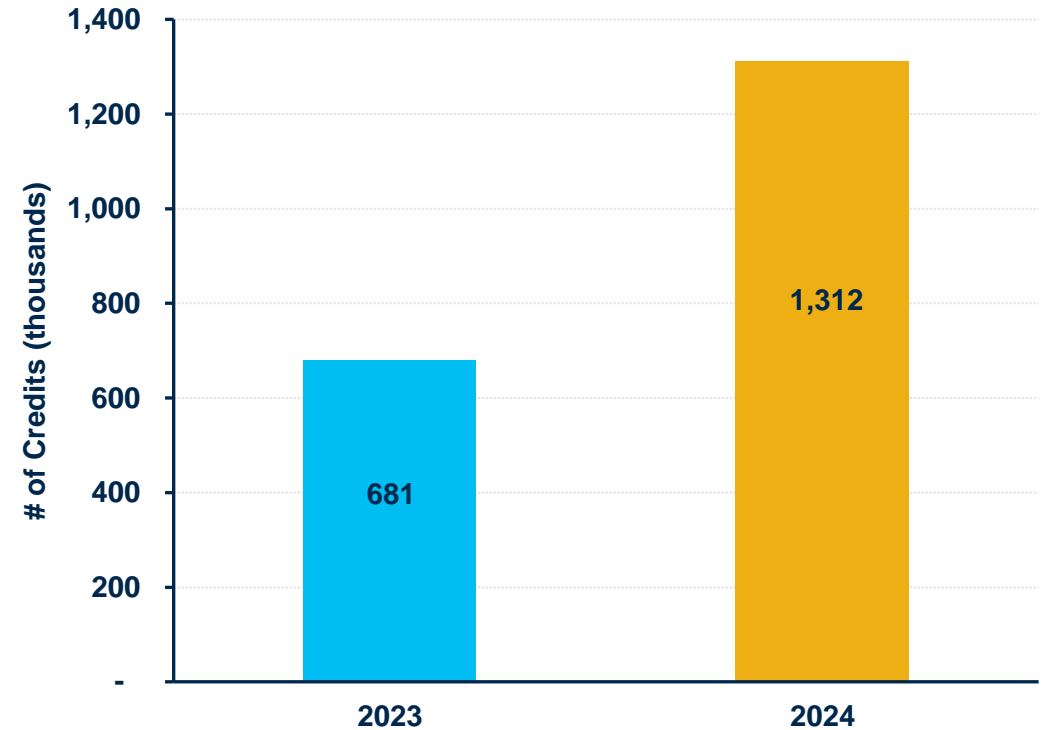
Over the first two compliance years, CI targets allow significant credit banking for future compliance periods.

- Credits are generated and banked by utilizing low carbon fossil fuel alternatives such as biofuels or electricity. As CI targets become more stringent in future years, this bank can be drawn down alongside greater low carbon fuel adoption to achieve compliance.

Annual Credit/Deficit Generation Categories



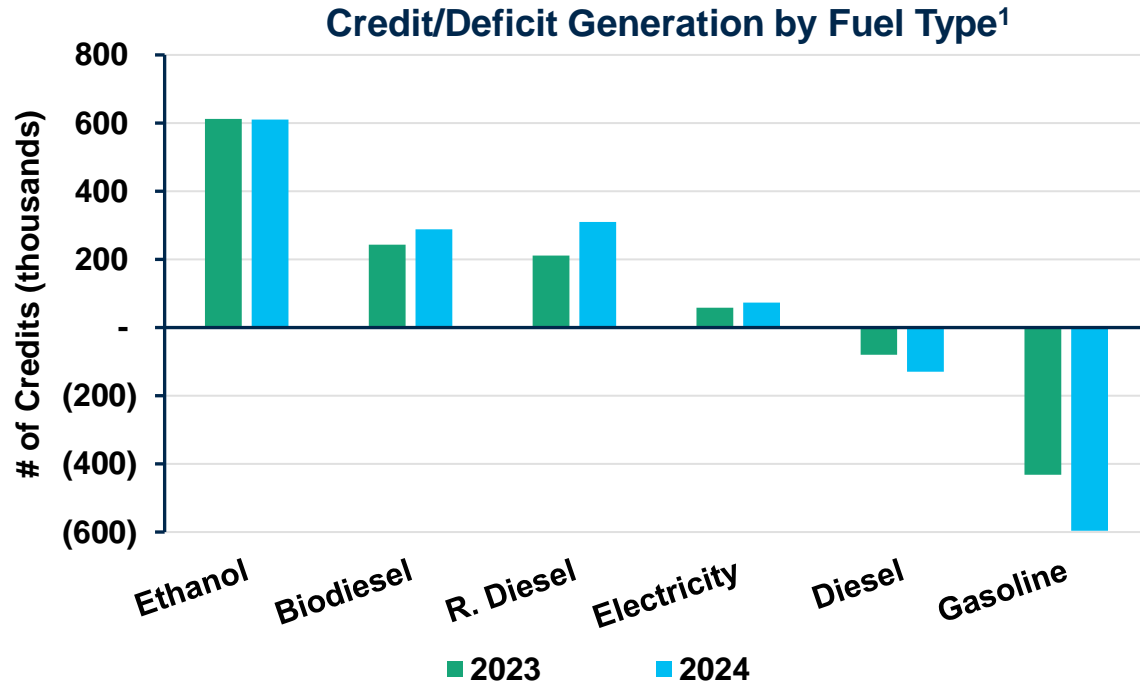
Annual Bank Ending Balance



Credit/Deficit Generation by Fuel Type

In the first two compliance years, ethanol and diesel substitutes more than offset gasoline and diesel deficits.

- Although fossil fuels generate significant deficits in 2023 and 2024, the CI targets in these years allow for biofuels and electricity to generate enough credits to allow for meaningful banking.



| Fuel Type | 2023 | 2024 |
|------------------------------|----------------|----------------|
| Ethanol | 612,842 | 610,577 |
| Biodiesel | 243,691 | 288,961 |
| Renewable Diesel | 211,382 | 310,387 |
| Electricity | 58,680 | 73,104 |
| Propane | 5,814 | 5,847 |
| Renewable Natural Gas | 361 | 395 |
| Natural Gas | 61 | 35 |
| Diesel | (79,611) | (129,711) |
| Gasoline | (432,009) | (596,263) |
| Net Credit Generation | 621,160 | 563,333 |

1. Propane, RNG, and natural gas have been removed from this chart as they generate a comparatively small number of credits and do not show up on the visual.



2

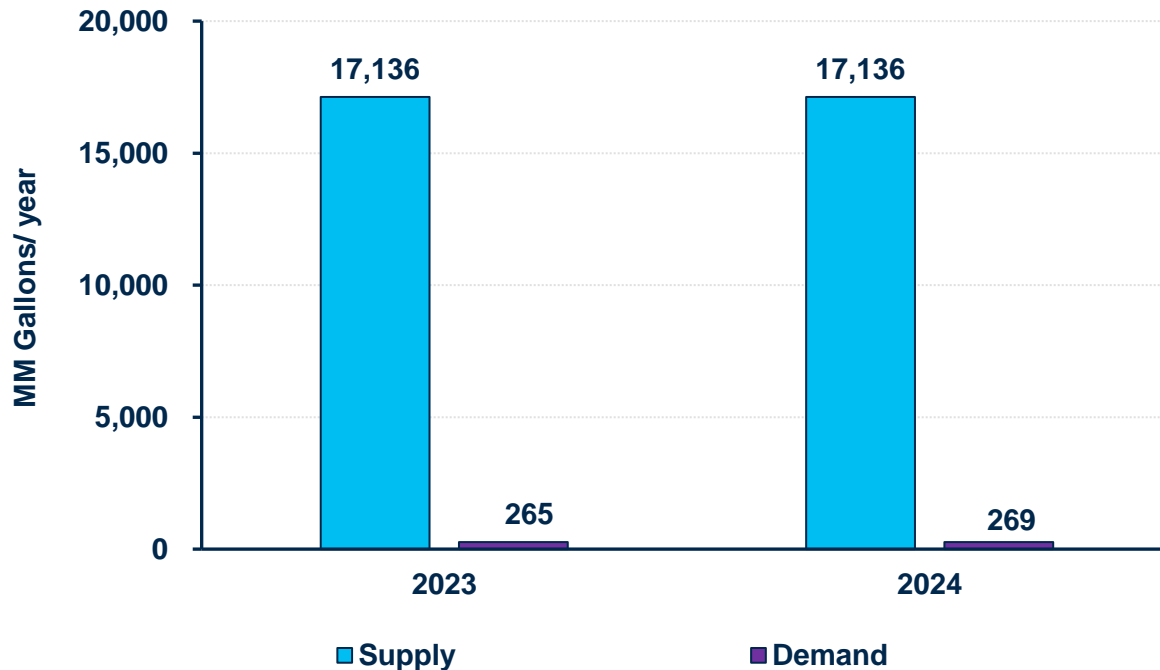
Fuel Supply and Demand Forecasts

Ethanol Forecast

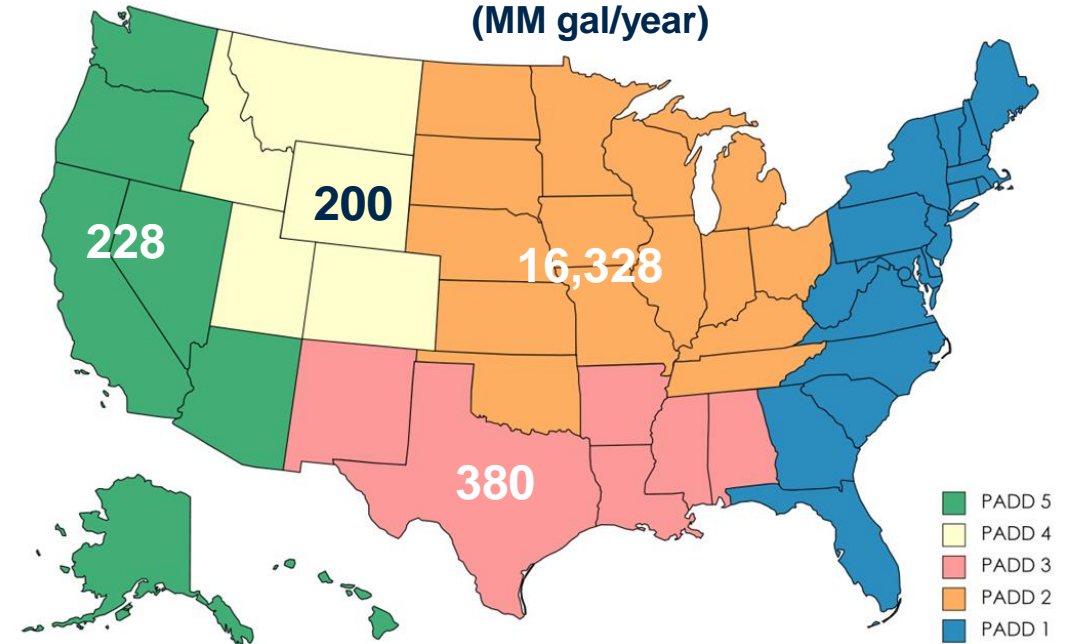
Washington’s ethanol demand is met primarily from the Midwest, supplemented by some Western production. Together they produce more than enough to meet the state’s anticipated demand.

- Washington sources much of its ethanol from the Midwest, blending the ethanol with gasoline at petroleum terminals or refineries.

Washington Available Ethanol Supply vs Demand



Available Ethanol Supply by PADD (MM gal/year)

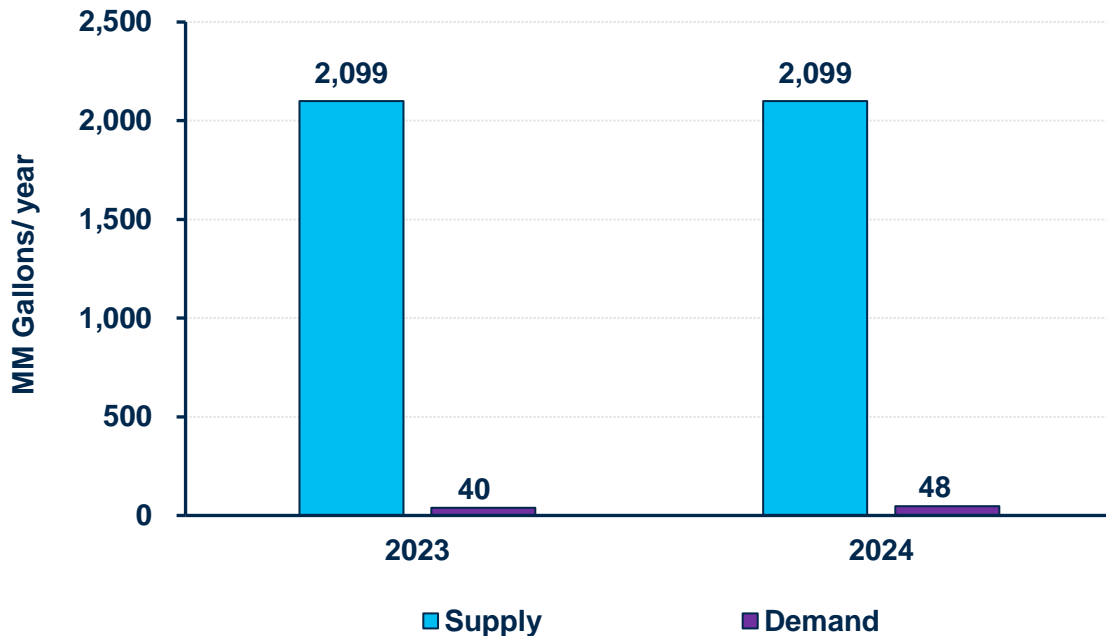


Biodiesel Forecast

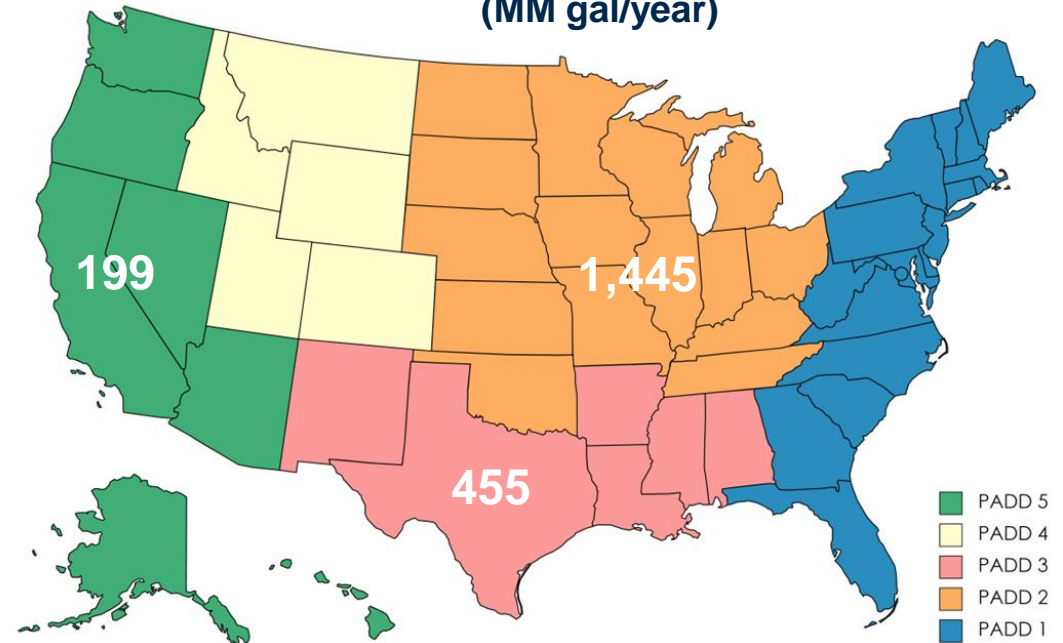
Washington currently produces enough biodiesel in-state to meet its anticipated demand. Additionally, other western and central states produce more than enough to serve regional demand and support higher blending.

- Washington alone can produce 107 MM gal/year of biodiesel from the REG Grays Harbor Biorefinery in western Washington.

Washington Available Biodiesel Supply vs Demand



Available Biodiesel Supply by PADD (MM gal/year)

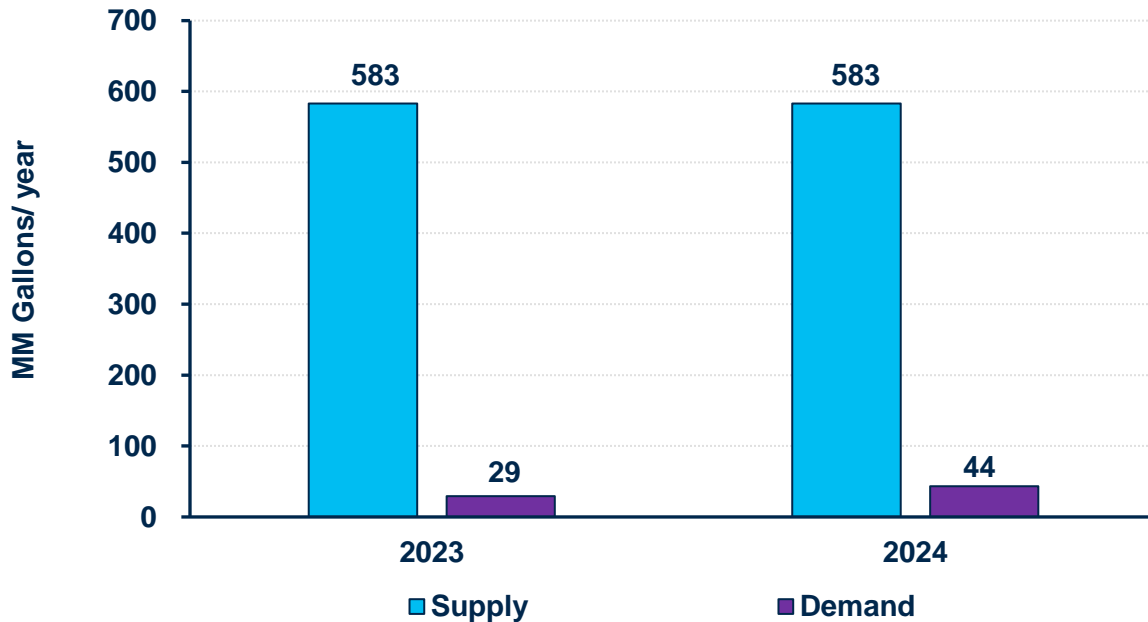


Renewable Diesel Forecast

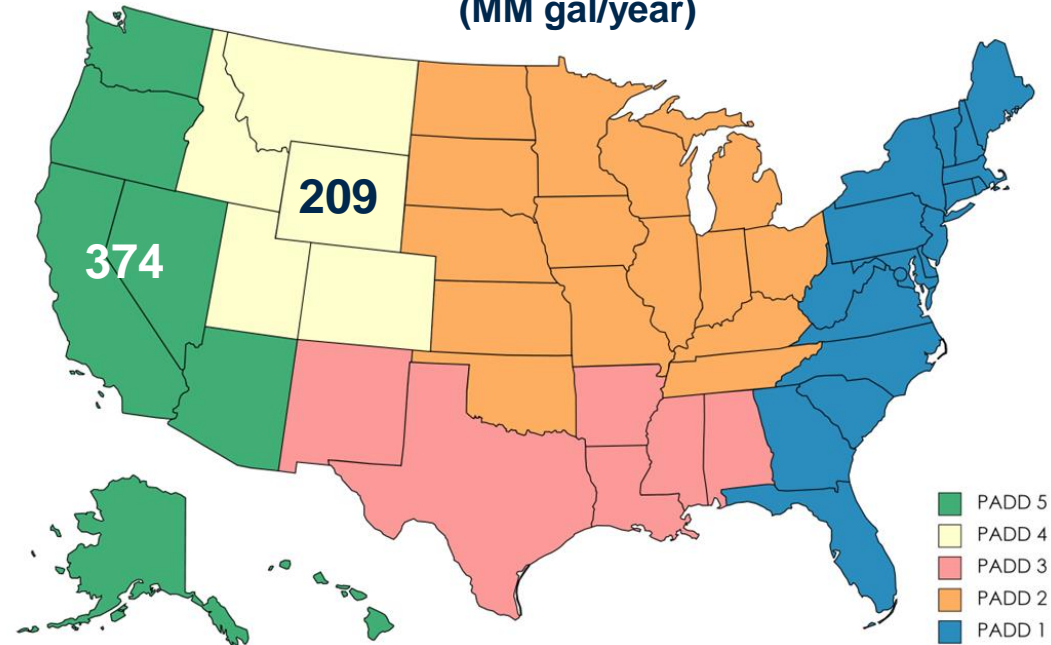
Washington is projected to produce enough renewable diesel to meet its needs. By 2023, the state will produce a total 109 MM gal/year of renewable diesel, much more than its anticipated demand.

- Renewable diesel production capacity in the west includes Washington’s BP’s Cherry Point facility, which currently produces 66 MM gal/year and is expected to be expanded to produce a total 109 MM gal/year by 2023.

Washington Available Renewable Diesel Supply vs Demand



Available Renewable Diesel Supply by PADD (MM gal/year)

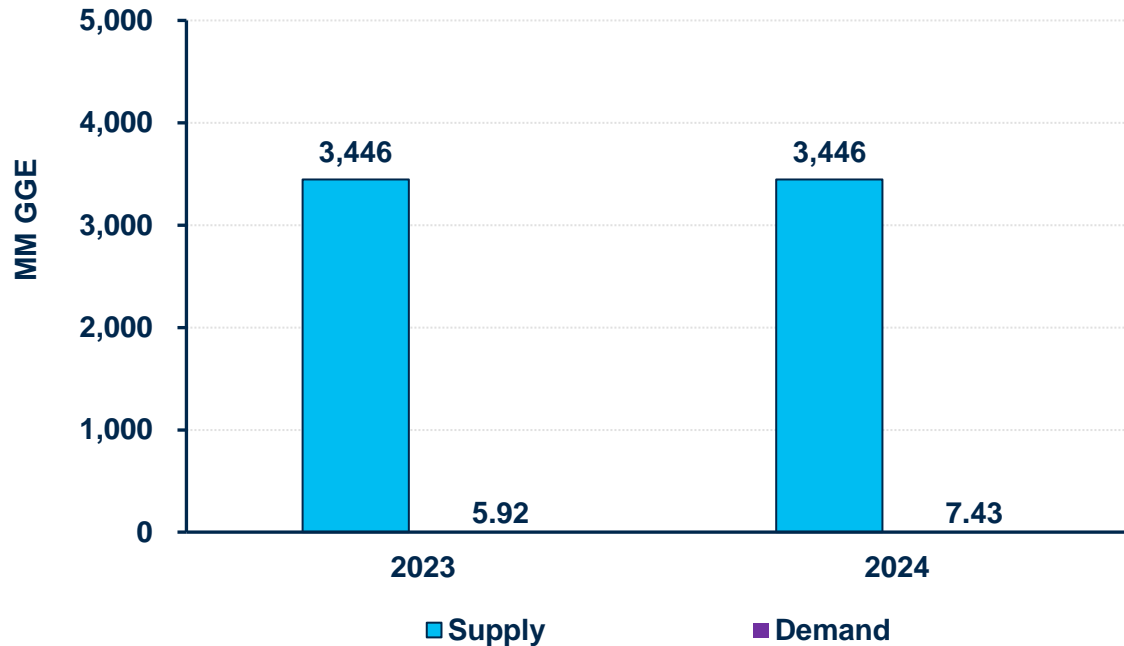


Electricity Forecast

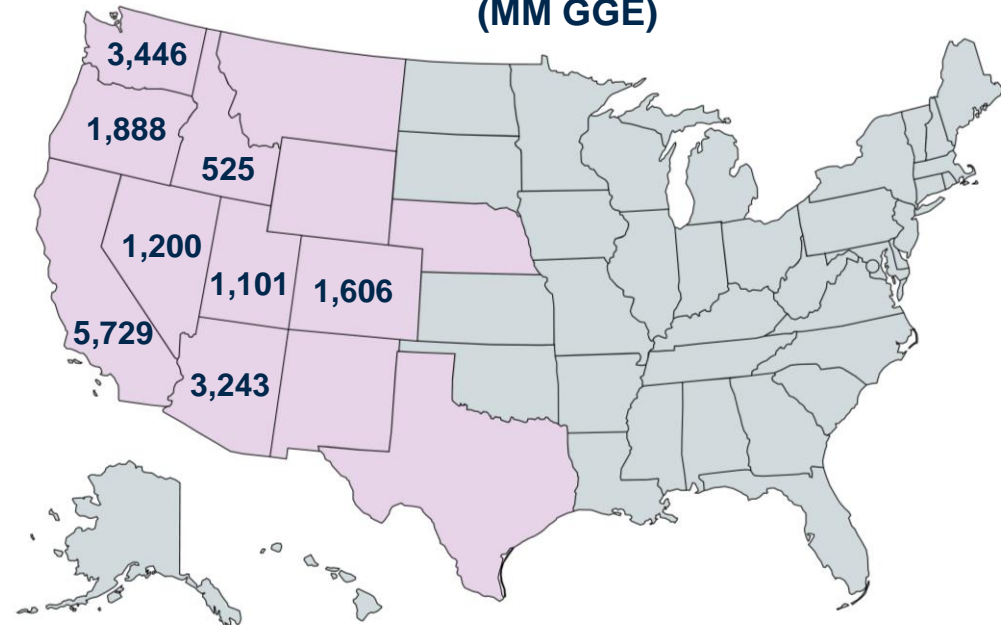
While Washington requires 7.4 MM GGE of electricity by 2024, transportation is projected to be a very small fraction of overall generation during 2023 and 2024. Washington’s energy supply is overwhelmingly produced by non-emitting resources.

- Washington’s electric vehicle stock is expected to reach 92,000 Battery EV’s and 11,800 Plug-in Hybrids by 2024.

Washington Available Electricity Supply vs Demand



WECC Available Electricity Supply (MM GGE)

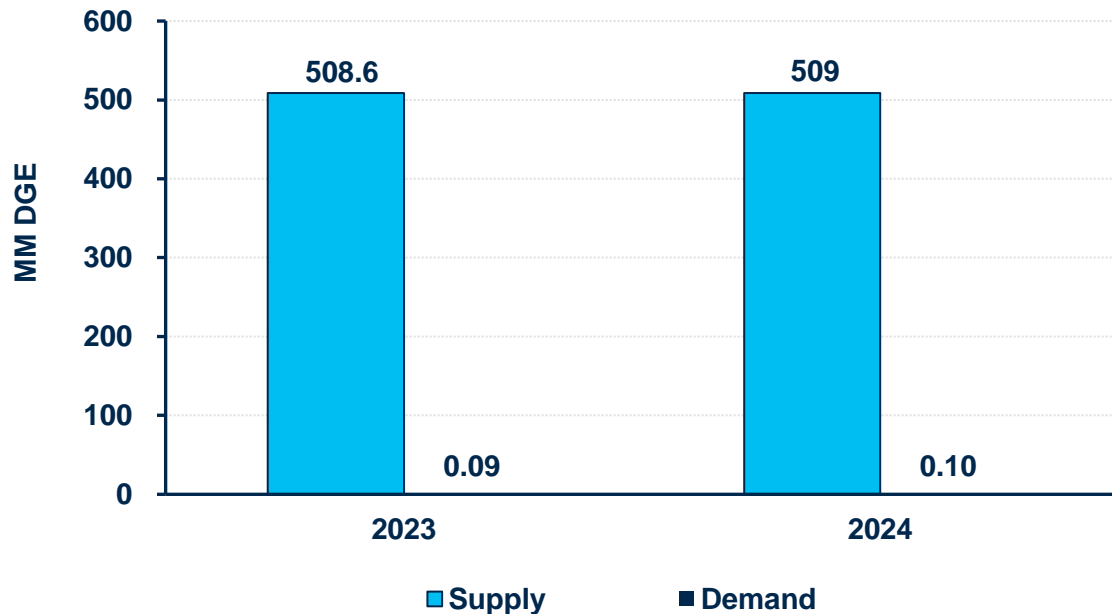


Renewable Natural Gas Forecast

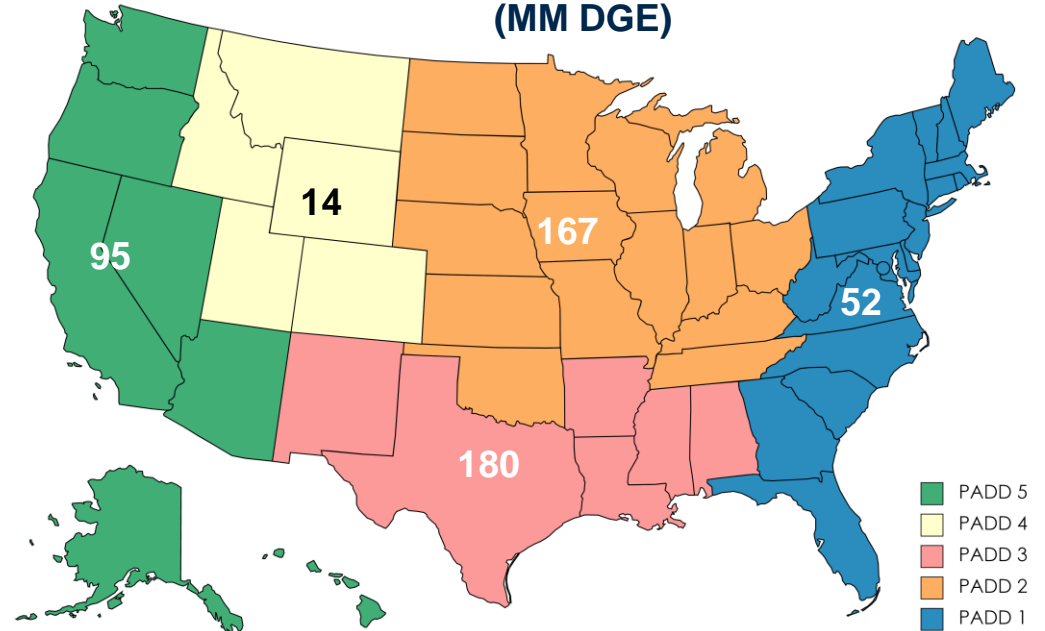
Washington maintains a production capacity of 29 MM gal/year, many orders of magnitude above the state’s projected demand. Most of this capacity currently is exported or used for non-fuel applications.

- In the U.S., landfills account for three quarters of RNG production, while livestock, food waste, and water treatment facilities account for the remaining quarter. Most capacity is currently not used for transportation, but much can be converted.

Washington Available RNG Supply vs Demand



Available RNG Supply by PADD (MM DGE)





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Methodology

Fuel Consumption Forecast Methodology

BRG calculated Washington's future demand using the methodologies described below.

- Each fuel requires a different approach to account for a variety of assumptions and ensure the accuracy of the forecast.

| Fuel | Description |
|--|--|
| Gasoline & Diesel | BRG used the State of Washington's consumption forecasts for blended gasoline and diesel as a basis for its forecast. BRG estimated the blend rates of alternative fuels based upon historical trends in Washington and other markets. BRG then subtracted the volumes of alternative fuels from Washington's gasoline and diesel forecasts to determine the volume of clear gasoline and diesel demand in the state. |
| Ethanol, Biodiesel, & Renewable Diesel | BRG estimated the blend rate of each alternative fuel based upon analysis of Washington historical blending rates, incremental ability to blend in response to the CFS, historical increases in blending due to CFS policy enactment in Oregon and California, Washington's ability to access fuels, and technical blending limits. Using these blend rates, along with the State's consumption forecasts for gasoline and diesel BRG projected Washington's consumption of these fuels. |
| Natural Gas, Renewable Natural Gas, & Propane: | BRG utilized State of Washington data on the number of CNG vehicles registered and the average annual consumption per vehicle for its forecast. Renewable natural gas consumption is assumed to follow the same trends observed in Oregon following the implementation of the Oregon CFS. To forecast propane consumption, BRG relied upon Washington's average allocation of propane consumption calculated using data from the EIA AEO Pacific Consumption Forecast. |
| Electricity | Using data on BEV and PHEV registrations in Washington as well as vehicle performance data from the US DOE, BRG calculated the average electricity use per vehicle on an annual basis. BRG then applied this average to the state's projected stock of BEVs and PHEVs to forecast future electricity use by these vehicles. |

Available Volumes and Constraints Considered

BRG relied upon federal and state data in determining the fuel volumes available to Washington.

Available volumes were forecasted using U.S. Energy Information Administration production facility capacity data and transportation related data from Washington State OFM and Washington Department of Licensing.

Key constraints considered in the analysis which will be expanded on in the final report include:

- Renewable fuel feedstock limitations
- Competition for fuels with neighboring state and provincial programs
- Existing contracts for renewable fuels
- Trans-Cascades transportation constraints
- Infrastructure buildout for electric and natural gas vehicles



Appendix

Overview

We forecasted Washington's consumption of fuel types reported under the Clean Fuels Program to determine the number of credits needed to achieve compliance under the Program.

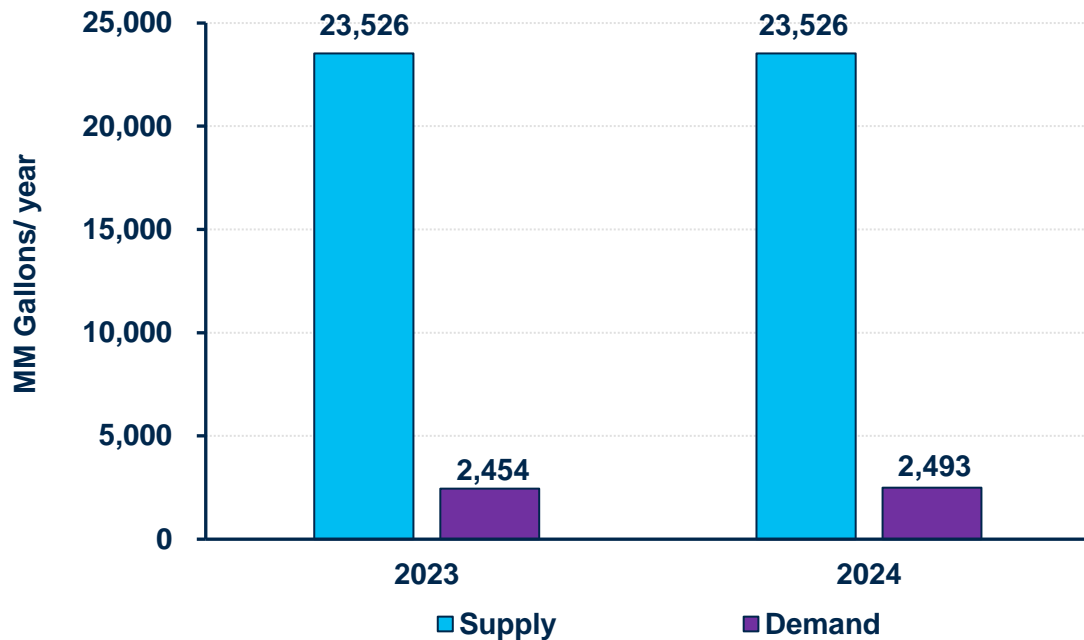
Summary Table of Fuel Consumption Forecast

| Fuel Type | Unit | 2021 | 2022 | 2023 | 2024 |
|----------------------------------|-------------------|----------------|----------------|----------------|----------------|
| Fossil Gasoline | MM Gallons | 2,250.8 | 2,399.7 | 2,453.9 | 2,492.7 |
| Ethanol | MM Gallons | 243.2 | 259.3 | 265.1 | 269.3 |
| Ethanol Blend Rate | % | 9.75% | 9.75% | 9.75% | 9.75% |
| Total Gasoline | MM Gallons | 2,494.0 | 2,659.0 | 2,719.0 | 2,762.0 |
| Fossil Diesel | MM Gallons | 707.9 | 757.6 | 712.6 | 699.5 |
| Biodiesel | MM Gallons | 18.2 | 19.4 | 40.0 | 48.0 |
| Biodiesel Blend Rate | % | 2.5% | 2.5% | 5.1% | 6.1% |
| Renewable Diesel | MM Gallons | 0.0 | 0.0 | 29.3 | 43.5 |
| Renewable Diesel Blend Rate | % | 0.0% | 0.0% | 3.8% | 5.5% |
| Total Diesel | MM Gallons | 726.0 | 777.0 | 782.0 | 791.0 |
| Electricity (BEVs) | GWh | 102.9 | 130.4 | 173.9 | 221.2 |
| Electricity (PHEVs) | GWh | 19.9 | 22.2 | 25.8 | 29.2 |
| Electricity | MM GGE | 3.6 | 4.5 | 5.9 | 7.4 |
| Natural Gas | MM DGE | 0.0874 | 0.0874 | 0.0185 | 0.0109 |
| Renewable Natural Gas | MM DGE | 0.0000 | 0.0000 | 0.0689 | 0.0765 |
| Renewable Natural Gas Blend Rate | % | 0.00% | 0.00% | 78.87% | 87.50% |
| Total Natural Gas | MM DGE | 0.0874 | 0.0874 | 0.0874 | 0.0874 |
| Propane | MM Gallons | 2.0 | 2.3 | 2.5 | 2.5 |

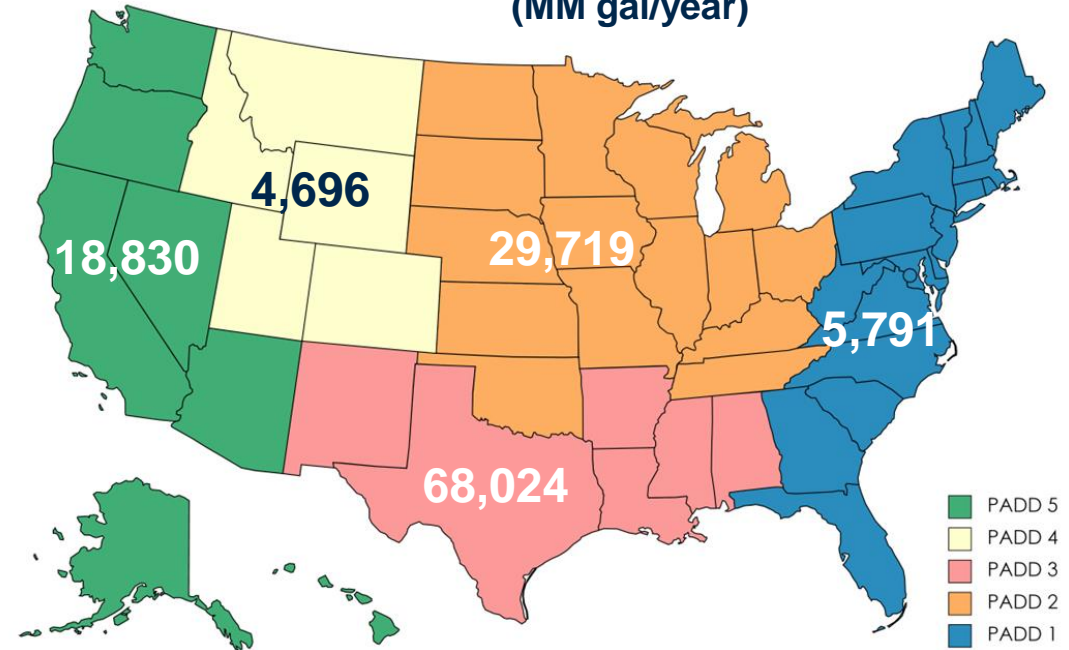
Gasoline Forecast

While Washington's gasoline demand is projected to increase by 10.7% to 2,493 million gallons annually from 2021 to 2024, the West Coast produces a total of 18,830 MM gal/year, enough to meet the state's demand.

Washington Available Gasoline Supply vs Demand



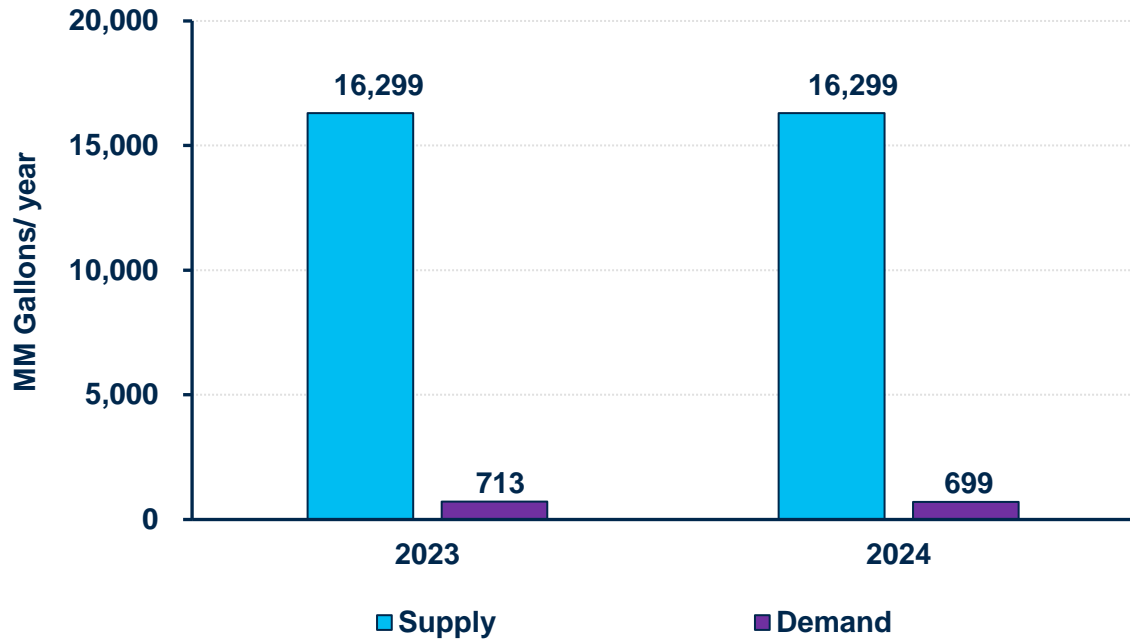
Available Gasoline Supply by PADD (MM gal/year)



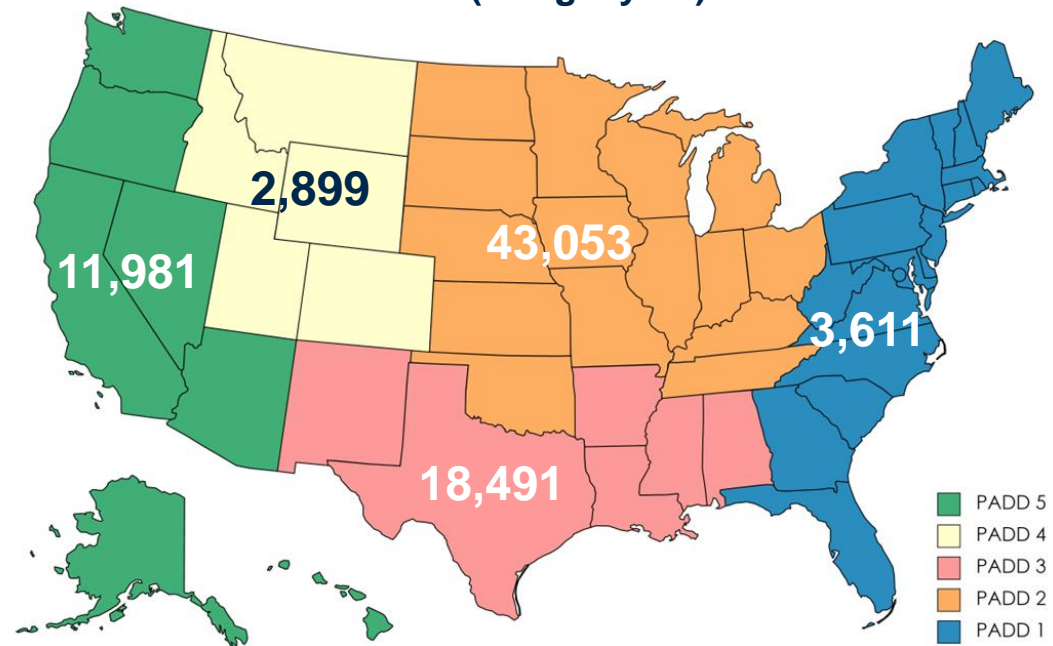
Diesel Forecast

Diesel demand is projected to decrease by 1.2% to 699 MM gal/year from 2021 to 2024. West Coast states produces a total of 11,981 MM gal/year, more than enough diesel to meet Washington’s demand.

Washington Available Diesel Supply vs Demand



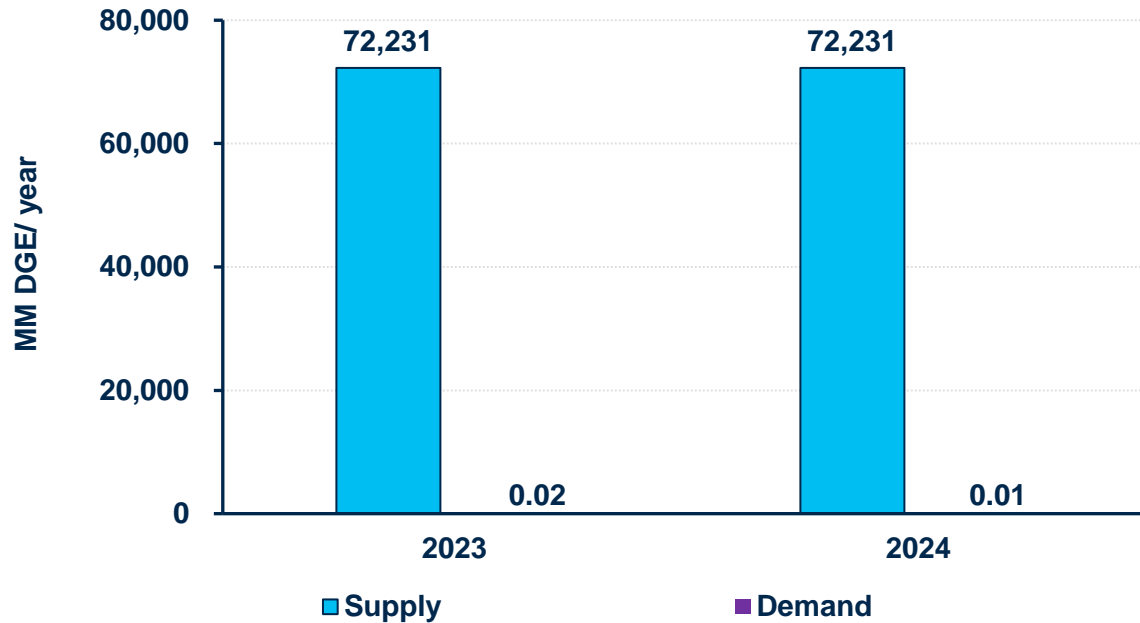
Available Diesel Supply by PADD (MM gal/year)



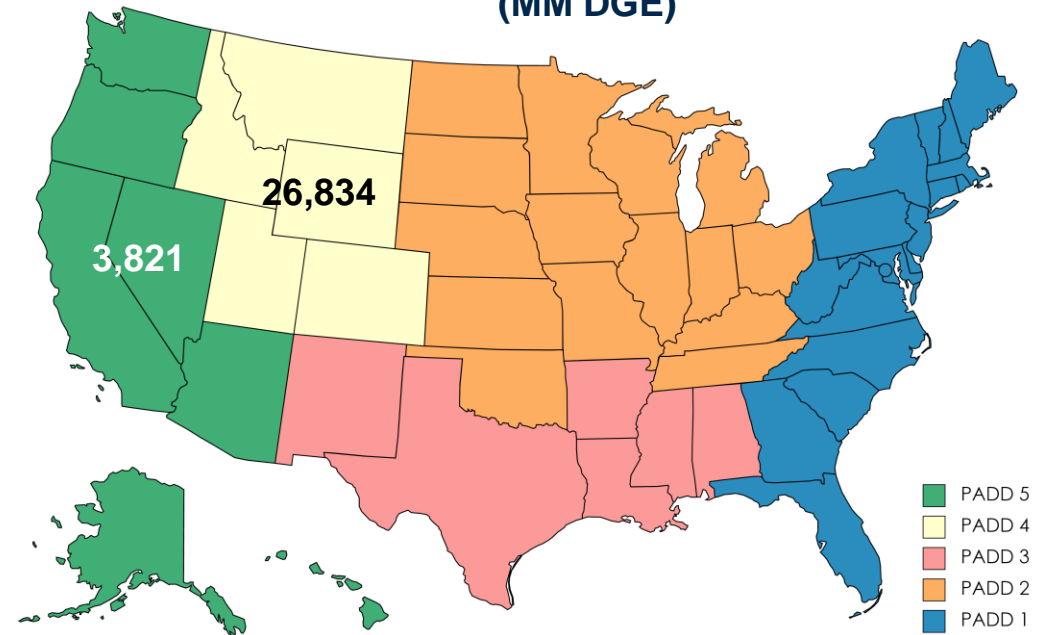
Natural Gas Forecast

With the implementation of the CFS, natural gas consumption in the transportation sector is projected to be largely replaced with renewable natural gas, reducing the use of fossil natural gas by 87% from 2021 to 2024.

Washington Available Natural Gas Supply vs Demand



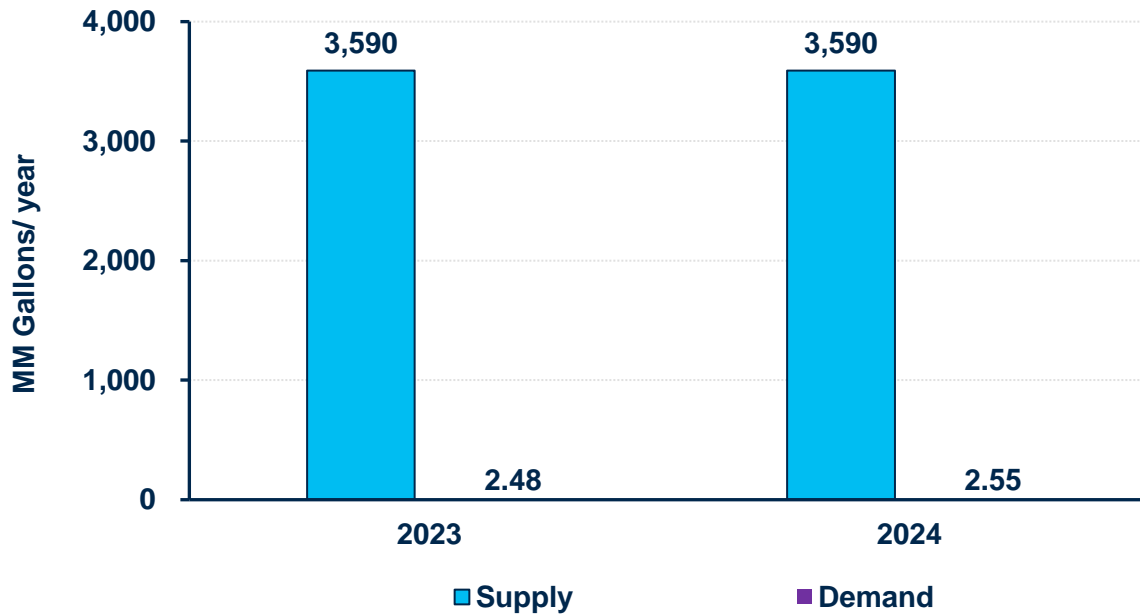
Available Natural Gas Supply by PADD (MM DGE)



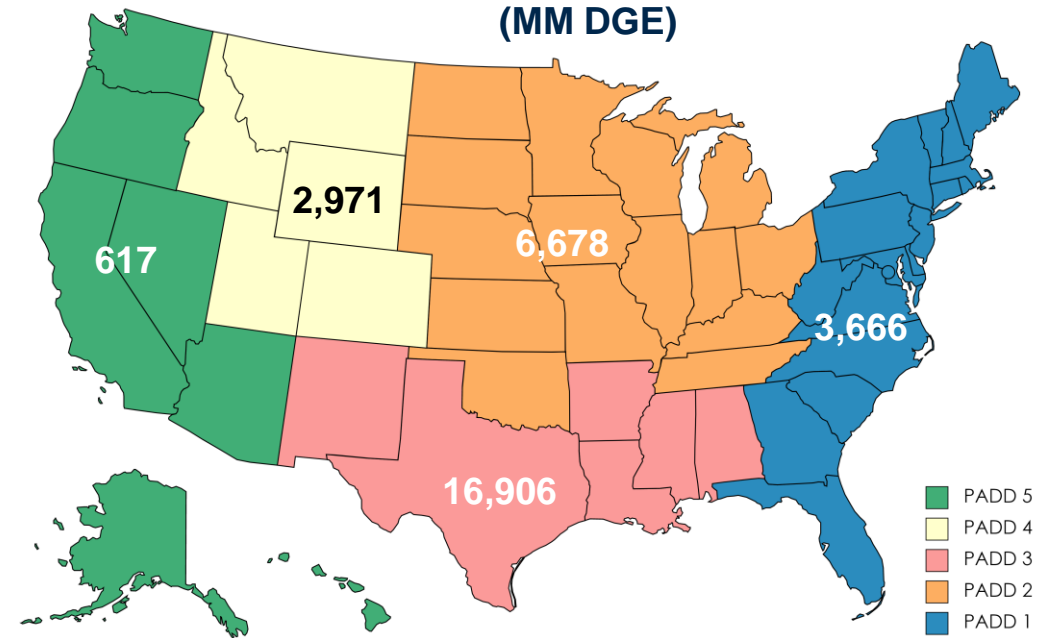
Propane Consumption Forecast

While Washington does not produce propane, western and rocky mountain states produce more than enough propane from natural gas fields and refineries.

Washington Propane Supply vs Demand



US Propane Supply by PADD (MM DGE)



Credit Generation Calculations and Inputs

To calculate the credits generated, BRG utilized the projected consumption of each fuel multiplied by the differential between the fuels' CI factors and the CI targets set by the Department of Ecology.

In this calculation, BRG used carbon intensities from the current WA GREET model prepared by Life Cycle Associates for the WA Department of Ecology.

Each low carbon fuel CI is compared to the CI of the fuel it would replace. For example, ethanol is a replacement fuel for gasoline while biodiesel is a replacement fuel for fossil diesel. Fuels with negative CI differentials (fossil gasoline and diesel) generate a credit deficit while fuels with a positive CI differential generate credits.

These differentials are multiplied by the fuel's consumption forecast (converted into megajoules) to calculate the credits or deficits generated by each.

Carbon Intensity Assumptions, by fuel

| Fuel | CI Input for Credit Calculations | Washington CI Targets |
|------------------------------------|----------------------------------|-----------------------|
| Gasoline | 100.46 | 99.57 |
| Ethanol | 73.15 | NA |
| Diesel | 101.18 | 100.92 |
| Biodiesel | 55.33 | NA |
| Renewable Diesel | 51.08 | NA |
| Natural Gas | 77.85 | NA |
| Renewable Natural Gas | 64.52 | NA |
| Propane | 76.11 | NA |
| Electricity (Post-EER Adjustment)* | 17.50 | NA |

*We assume an EER Adjustment of 3.4.

