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## GREEN GROW THE (REFINERIES) - LOW-CARBON PROGRAMS SPUR MORE RENEWABLE DIESEL

**July 6, 2020**

They're generally small in size, but renewable diesel refineries are popping up in many parts of the U.S., incentivized by government programs aimed at reducing carbon emissions and very gradually weaning Americans — and Canadians — from crude oil-based diesel fuel. Recently, HollyFrontier Corp. announced that it will be converting its decades-old Cheyenne, WY, refinery into a renewable diesel facility. While the news of another entrant into the renewable diesel market is not surprising, the complete shutdown and transformation of an existing refinery for this purpose marks only the second time this has occurred in the U.S. Today, we discuss HollyFrontier's plans and provide an update on renewable diesel supply and demand dynamics.

The production and consumption of renewable diesel have taken off in recent years due to regulatory incentives that encourage its use. In December, we wrote an article ([Playin' by the Rules](#)) that covered a lot of the background on renewable diesel, including an explanation of what it is, the regulatory programs that make its manufacture and import profitable, and a listing of the announced projects as of that point in time. (If you would like to hear more details on technology applications and other key points, Baker & O'Brien recently uploaded a webinar on the topic). Here are the most salient points:

- Renewable diesel is not the same as biodiesel. While it is made from similar feedstocks — vegetable oil, waste cooking oil, animal fats, etc. — the process used to make renewable diesel results in a different chemical structure than biodiesel. These chemical differences make it similar to petroleum-based diesel and allow it to function as a “drop-in” fuel, which means it can be transported by pipeline and be blended with traditional diesel at higher ratios than the 5%-20% limit for biodiesel.
- The U.S. renewable diesel sector is currently incentivized by two federal programs and two regional programs. At the federal level, there's the Renewable Fuel Standard (RFS), which includes a Renewable Identification Number (RIN) program for tracking the production and blending of ethanol and other renewable fuels, and for ensuring blender compliance with the RFS; each gallon of renewable diesel generates 1.7 D4 RINs (see [Money for Nothing](#)). Renewable diesel also benefits from a \$1.00/gallon (gal) incentive from the federal Blender's Tax Credit (BTC) program, which was recently extended through 2022. On the regional level, renewable diesel qualifies for Low Carbon Fuel Standard (LCFS) credits under the California program, which means most of this fuel is being consumed in California right now. Oregon and British Columbia have programs similar to California.
- More regulations are proposed in Washington State, Colorado, the northeastern U.S., and Canada that, if approved, should incentivize additional demand growth for renewable diesel, among other non-petroleum-based fuel alternatives. Figure 1 summarizes the existing and proposed transportation-sector carbon policies, including targets for carbon intensity (CI), a measure of the emission rate relative to output or usage.



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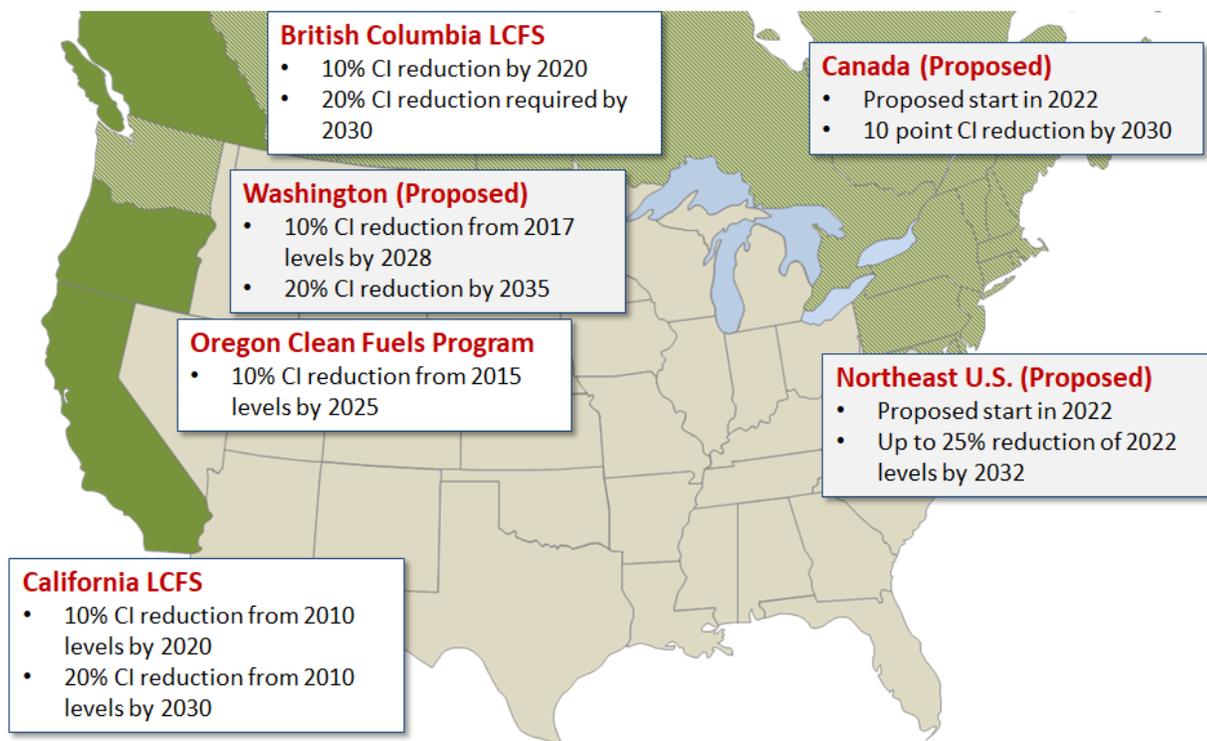


Figure 1. Existing and Proposed Transportation Sector Carbon Policies in the U.S. and Canada, including carbon intensity (CI) targets. (Note: Colorado is not highlighted due to limited information.)

With these regulatory incentives, interest in the manufacture of renewable diesel has flourished across the U.S. The current demand for renewable diesel in the U.S. is met from production by a number of facilities in the U.S. Gulf Coast and Midwest regions with a combined capacity of 31 to 36 Mb/d (more on this below), or by imports, most of them from Singapore. Renewable diesel production capacity in the U.S. is set to expand significantly over the next few years — a review of announced projects suggests that capacity could be increased by as much as 182 Mb/d by 2024, with a majority of new capacity being planned through partnerships with refining companies such as Valero, Shell, and Phillips 66.

Most of the planned capacity also involves entirely new renewable diesel refineries. HollyFrontier’s recently announced project in Cheyenne is different in that it is the second to involve the transformation of an existing, conventional refinery into a renewable diesel facility — its only predecessor in that regard is Marathon Petroleum’s 19-Mb/d refinery in Dickinson, ND, which is in the process of being converted to a 12-Mb/d renewable diesel refinery that will process refined soy oil and other organically derived feedstocks. HollyFrontier’s Cheyenne refinery has been around for 86 years (see Figure 2 below) and its current crude oil processing capacity is about 50 Mb/d.



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*Figure 2. HollyFrontier's Existing Cheyenne Refinery. Source: HollyFrontier*

The refinery is a relatively complex facility in that it has additional product conversion capacity, including a fluid catalytic cracker unit (FCCU) and coker unit, that allows the refinery to produce higher-value, lighter hydrocarbon products. Its Rocky Mountains location and configuration provide the refinery access to — and the ability to convert — what have been price-advantaged crude oils, such as heavy crude from Western Canada (Western Canadian Select, or WCS, Lloydminster, and others), as well as light crude from the nearby Bakken and Niobrara. Most of the refined products marketed from Cheyenne have been headed for local PADD 4 (Rockies) markets such as Denver, CO, among others. As PADD 4 is typically a net receiver of refined products from the Texas Panhandle and Midwest, which has the effect of keeping prices at elevated levels, it is generally an attractive market for refiners. However, it's known for strong seasonal swings in demand — more so than other parts of the country.

Even with ample crude oil access and local product-marketing opportunities, the refinery struggled with its performance. HollyFrontier has noted that future free cash flow generation at Cheyenne has been challenged due to COVID-19, compressed crude differentials, uncompetitive operating and maintenance costs, and the anticipated loss of the Environmental Protection Agency's (EPA) small refinery exemption, which has delayed the requirements for compliance with RINs and some other environmental mandates. The refinery went through a sales process to find a potential acquirer, but after evaluating options, HollyFrontier decided the shutdown, decommissioning, and conversion of the facility to renewable diesel production would be more beneficial to shareholders.

As for the conversion project itself, the \$125-\$175 million investment will transform the 50-Mb/d conventional refinery to a 5.9-Mb/d (90-MMgal/year) renewable diesel refinery. Notably, HollyFrontier will repurpose some existing equipment at the site. The company has said it expects the project to be completed in the first quarter of 2022, and its expected returns are enormous: \$40 million/year in free cash flow, which equates to \$0.44/gal or \$18.67/bbl. in cash.



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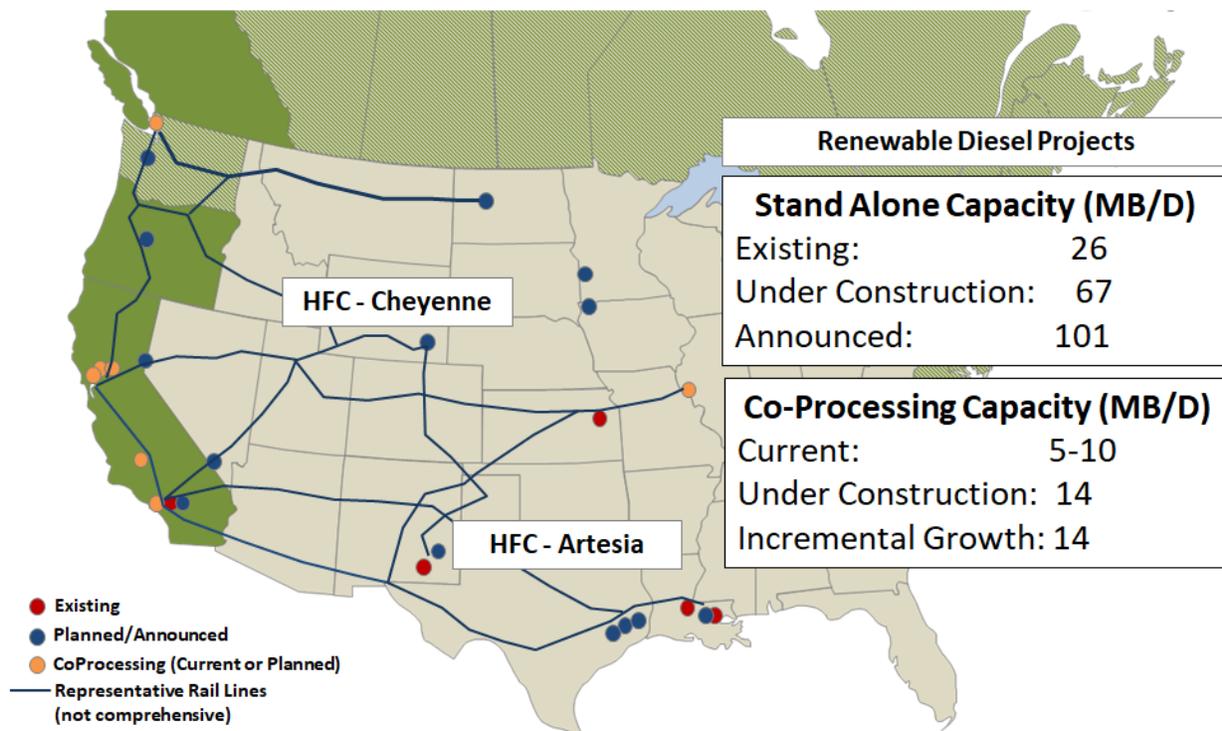


Figure 3. Renewable Diesel Projects and Rail Logistics. Source: Baker & O'Brien

HollyFrontier is also developing a standalone renewable diesel facility and feed pretreatment unit at its Artesia, NM, refinery site, also due to begin operating in 2022. This facility will be a little larger than the Cheyenne facility, with a capacity of 7.8 Mb/d (125 MMgal/year). The pretreatment unit at Artesia will provide 80% of the required feedstocks for both facilities, with pretreated feed being delivered to Cheyenne by rail. HollyFrontier has said it is planning to market its renewable diesel in California, like everyone else, but the company also would be able to easily access other West Coast and central Canada markets by rail (blue lines in Figure 3 above) should those become attractive.

With all these renewable diesel plants being proposed, do we run the risk of flooding the market with too much renewable diesel? Well, here is where it gets interesting. Baker & O'Brien modeled the potential demand for renewable diesel in California under the LCFS program as well as certain other regions, such as Oregon, Washington, British Columbia, and the rest of Canada. That was then compared to the potential supply, based on existing projects (red dots in Figure 3), projects under construction or announced (blue dots), and co-processing plants and projects (yellow dots), which produce both conventional and small volumes of renewable diesel.

Figure 4 shows what we came up with. The stacked bars represent the potential supply of renewable diesel by year from either existing capacity (dark-blue bar segments), existing and planned co-processing (red bar segments), projects under construction (light-blue bar segments), announced standalone projects (green bar segments), and imports (purple bar segments). The lines present two demand scenarios: (1) renewable diesel demand from California, Oregon, and British Columbia only under the existing regulations in place currently (solid black line); and (2) demand in those same three regions, plus Washington and Canada as a whole, assuming the LCFS program is enacted in those jurisdictions (red line).



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## North America Renewable Diesel Supply & Demand

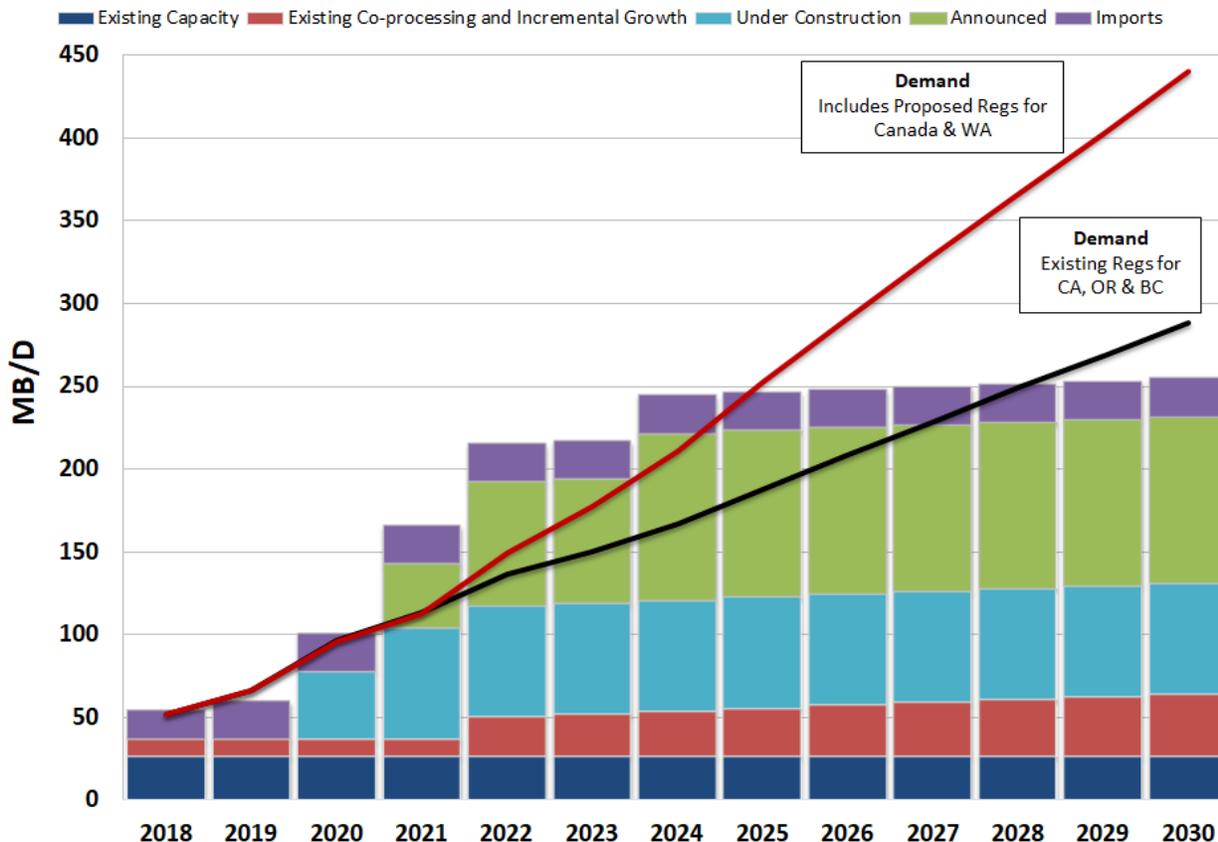


Figure 4. North American Renewable Diesel Supply and Demand. Source: Baker & O'Brien

Note that we have not estimated what the demand might look like if the other carbon programs mentioned above (in the U.S. Northeast and Colorado) are also adopted. The key takeaway from this chart is that more capacity will be needed beyond what is now in place or under construction. In the near-term, though, if carbon programs aren't expanded in other regions, the data indicates that U.S. renewable diesel refinery capacity plus imports may well exceed what is needed.

Note: The article was authored by Amy Kalt of Baker & O'Brien and published on RBN Energy's Daily Energy Post on July 6, 2020.

"Green Grow the Rushes" was written by Bill Berry, Peter Buck, Mike Mills, and Michael Stipe, and appears as the second song on side two of R.E.M.'s third studio album, *Fables of the Reconstruction*. Personnel on the record were: Michael Stipe (lead vocals), Peter Buck (guitar, banjo, harmonica), Mike Mills (bass, piano, backing vocals), and Bill Berry (drums, backing vocals).

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