

MONEY REALLY DOES

GROW ON TREES

California incentives unlock profits in Texas for technology that turns lumber waste into fuels.

California's zealous drive to cut carbon dioxide emissions has unlocked profits for a novel technology that turns lumber industry waste into gasoline and jet fuel. And Texas is set to capitalize on it. ¶ Thousands of miles away from the west coast, southeast Texas appears to be the perfect place to commercialize that process, entrepreneurs say – and they're planning to invest over \$3 billion in renewable fuels plants over the next decade. ¶ "California took a leadership position," said Tim Vail, the co-founder and CEO of Houston-based Arbor Renewable Gas LLC, which is building a renewable fuels plant in Beaumont. "They've enacted a program that drives adoption in these new technologies and fuels. And without that, it would have been very hard to make the case."

When it starts operating around the second quarter of 2024, Vail's Beaumont plant will use roughly 1,000 tons of wood chips to create 1,000 barrels of gasoline every day, or 42,000 gallons. And that gasoline can be used in any car on the road today – it will be chemically identical to the gasoline refined and blended down the street.

That's not a lot of product output for the \$325 million Arbor plans to invest to build the plant's first train. Just a few miles away in Port Arthur, the continent's largest refinery can make up to 275,000 barrels of fuel every day, according to its owner, Houston-based Motiva Enterprises LLC.

But the fuel is not the point.

For every gallon sold, renewable fuels manufacturers can get 75% to 80% of their revenue from financial instruments called credits. Only 20% to 25% comes from selling the fuel itself, they said.

"It goes into a marketplace that is so large that our volumes will never be meaningful from that standpoint, but from a carbon intensity standpoint, they're extremely meaningful," Vail said. "What's valuable is the environmental attributes that are attached to that gasoline, and that's what we can monetize through a couple of different mechanisms, depending on where we sell it."

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GROWTH PLANS

Vail is no stranger to Beaumont. Earlier in his career, Vail started G2X Energy, which developed and built a natural gas-to-methanol manufacturing plant in Beaumont called Natgasoline LLC.

Around the time Natgasoline started up in 2018, G2X Energy sold to investors and rebranded as Proman USA. Vail and his co-founder, investment banker John Kennedy III, started Arbor Renewable Gas in October 2019.

They saw potential in California's Low Carbon Fuel Standard program and envisioned profiting off of it, somehow. Like Goldilocks, they evaluated different fuels that could fit the LCFS credit criteria: hydrogen had so much promise, but it was too difficult to store and transport. The renewable diesel market was too saturated with oil majors.

"We looked at renewable gasoline as a great opportunity because, one, it utilizes the same suites of technology that I've used before: gasification and methanol production," Vail said. "And two, it makes a product that is fungible. It's a drop-in fuel."

Arbor committed to the Beaumont site in the fall of 2021, then started ordering long-lead time parts for the facility in December. The company made a final invest-

ment decision on the project's first train in February.

The first phase will receive at least \$21 million in property tax breaks from the school district under Chapter 313 of the state tax code.



Tim Vail

Vail said he expects the facility to be the world's largest and first commercial renewable gasoline plant

when it starts up in two years. After that, the Houston developer plans to build three more identical trains at the site starting in 2025, eventually topping \$1.4 billion of investment, then start construction on other sites, Vail said.

"Our goal is to build out here in southeast Texas and in Louisiana, kind of following the woodshed, but eventually, it would be great to go to California and Oregon, the Pacific Northwest," Vail said. "The Canadians also have some excellent programs and a lot of forestry residuals. But we need to get the plant built and running and debugged before we move into those environments."

About 60 miles north of Arbor's future gasoline plant, Scottsdale, Arizona-based developer USA BioEnergy is developing a two-train plant in Bon Wier, Texas, that will be able to manufacture sustainable aviation fuel, the gasoline blendstock naphtha, and diesel. Its first train should have the capacity to turn about 2,700 tons of wood waste into 2,200 barrels of gasoline per day, the company said.

USA BioEnergy has been promised \$150 million in state and local tax breaks for that site and plans to make an FID in about a year, CEO Nick Andrews said.

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Houston-based Arbor Renewable Gas has started construction on its first plant, located in Beaumont.

ARBOR RENEWABLE GAS

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The first train in Bon Wier isn't planned to break ground until April 2024, about when operations at Arbor's plant could begin. But USA BioEnergy has agreements in place for two additional sites in the southeast, with ambitions to build out 12 total phases of renewable fuels plants across six or more sites, Andrews said.

Both companies have been coy about their customers. Arbor has an offtake agreement with "a large, well-known name," Vail said. USA BioEnergy has already sold all of the fuel it expects to make in its first 10 manufacturing trains, Andrews said, with customers including a trading and logistics company and multiple airlines.

NEGATIVE CARBON FUEL

Manufacturers can create and sell several different credits from making a single gallon of renewable fuel, but the linchpin is California's Low Carbon Fuel Standard or LCFS, Vail and Andrews both said.

Both USA BioEnergy and Arbor are planning to sell most, if not all, of their fuel in California so they can earn LCFS credits. Other states, including Oregon, Washington, and New Mexico, have enacted their own LCFS programs, but those credit markets are less attractive today because they're trading lower, USA BioEnergy CFO Ellen Wesley said.

"I'd like to see that happen in Texas," Andrews said regarding LCFS credit programs. "I mean, there's probably three legislative sessions that are going to happen between now and the time we start producing fuel, so of course I'll be trying to advocate for that. But California is really, truly the only game in town."

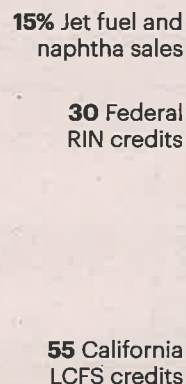
After California, Europe is another potential market because also offers ample credits for such fuels, Vail said. He views the process of getting Arbor's fuels certified in Europe as a de-risking measure.

"Because we're so credit-driv-

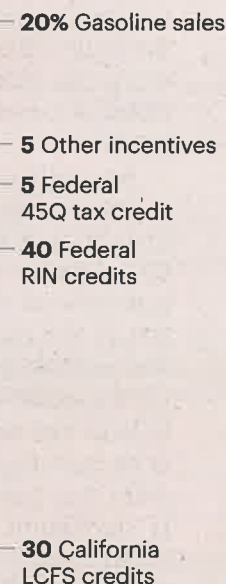
WHAT'S IN A GALLON?

Texas' renewable fuels manufacturers estimate that most of their revenue will come from credits, not the fuel itself. Here's how both companies break it down.

USA BIOENERGY



ARBOR RENEWABLE GAS



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en, if we had a political issue here – let's say that one of the programs was stopped or the value was greatly diminished – then we can go to Europe or vice versa," Vail said. "We're hedging our bets, so to speak, by being able to sell in the two largest carbon markets, which are continental Europe and California."

A key part of both companies' business models is driving down the carbon intensity, or CI, scores of their products. That's the metric California uses to determine which companies earn LCFS credits for selling fuel in their state and which companies need to buy those credits to make up for their emissions.

If you sell fuel with a CI score lower than the standard – which moves over time – you are granted LCFS carbon removal credits. But if you sell fuel with a CI score above the standard, that makes you an obligated party: You're obligated to buy the credits generated by others'

low carbon fuels.

The lower a fuel's CI score, the more LCFS carbon removal credits it generates and the more money the manufacturer can make selling the credits. Renewable fuels made from waste wood emit very little carbon dioxide, automatically granting them low CI scores.

The gasification processes Arbor and USA BioEnergy will use to make renewable fuels result in a biogenic carbon dioxide by-product, but those emissions aren't any higher than what the wood waste would have emitted on the forest floor. Both companies found that sequestering that stream of CO₂ by sending it underground for permanent storage would result in fuel with a negative CI score: meaning that it actually removes carbon dioxide.

"Sequestration is important for a company like mine because of the 45Q tax credit and the fact that I get a lower CI score, and that's what incentivizes us to sequester that CO₂ as opposed to venting it," Vail said.

\$3B

Amount of money entrepreneurs in California are ready to pump into southeast Texas to turn lumber industry waste into gasoline and jet fuel.

Standard, fossil-fuel derived California gasoline has a CI score of about 100. Arbor's gasoline will have a CI score of negative 76, Vail said. When USA BioEnergy starts up the Bon Wier plant, its sustainable aviation fuel will have a CI score lower than negative 200, Andrews said.

"When our airline offtakers use our very low carbon intensity score fuel – when they blend it with Jet A – they're able to meet some of their decarbonization goals," Andrews said. "Ideally, we're going to deliver over 100 million gallons of sustainable aviation fuel into LAX, and our airline partners who are purchasing that low carbon intensity score fuel will be able to – with our help – sequester 50 million metric tons of greenhouse gases over a 20 year period."

LOCATION, LOCATION, LOCATION

The gasification technology preferred by Arbor and USA BioEnergy requires abundant wood waste, which is part of what attracted the

companies to the southeast.

In reality, access to lumber and the burgeoning carbon sequestration industry were both requirements for site selection, Andrews said.

Both Andrews and Vail said their companies have agreements with third parties who will take their CO₂ streams and sequester the gas elsewhere. That means their sites needed to be relatively close to existing CO₂ pipelines.

"If you look at our site selection matrix, we start with CO₂ offtake as the first lever," Andrews said. "Our intended purpose is to have the lowest carbon intensity score in the industry."

But any renewable fuels plant using Arbor or USA BioEnergy's business model also needs to be close to the trees. Southern yellow pine trees grow in abundance in east Texas, western Louisiana, and southern Arkansas, Andrews said, making them a cheap and reliable feedstock choice. Typically, those trees are used for homebuilding



Nick Andrews

and other projects requiring strong wood that resists molding or rotting.

Southern yellow pine plantation managers typically overplant their land at first, Andrews said. After a few years, managers usually select about a third of the trees to chop down, a process called pre-commercial thinning, allowing the remaining trees to thrive in adequate sunlight and soil, he said.

The fallen trees will provide the feedstock for both companies' facilities. Typically, those thinnings can be sold to the pulp and paper market or left on the forest floor, Vail said.

"That's the beauty about working with these properly managed forest plantations: They're growing those trees for the purpose of selling it for lumber later, and we just kind of come in and help with their

thinning activities," Andrews said.

In an earlier life, USA BioEnergy's site on the Neches River was home to a plywood plant. It has little to no existing infrastructure that the company can use for the new facility, Andrews said. But it's surrounded by feedstock.

The company commissioned a study, Andrews said, which found that the first phase of USA BioEnergy's facility running at full capacity – using 1 million tons of wood waste per year – would utilize 20% of the available supply within only 75 miles of the Bon Wier site.

Arbor's Beaumont site is further from its feedstock but well-situated from an industrial infrastructure standpoint, Vail said.

"It needs to be where there's an industrial base," Vail said. "That's why we like Beaumont so much. It's been really good to me. Plenty of great people, lots of workers, training centers, industrial supplies – everything that goes into building and operating one of those plants." ❧

MEET THE TREES

SOUTHERN YELLOW PINES

The name refers to multiple species of coniferous trees known for their yellow wood, including:

- ▶ Loblolly pine
- ▶ Longleaf pine
- ▶ Shortleaf pine
- ▶ Table Mountain pine
- ▶ White pine
- ▶ Spruce pine

Location: native to the eastern portion of the United States from parts of New York south to northern Florida and west to Texas.

SOURCE: GARDENING
KNOW HOW, USDA
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