

» FROM FOREST RESIDUES TO FUEL

How Woody Biomass Is Powering the Next Wave of Renewable Energy

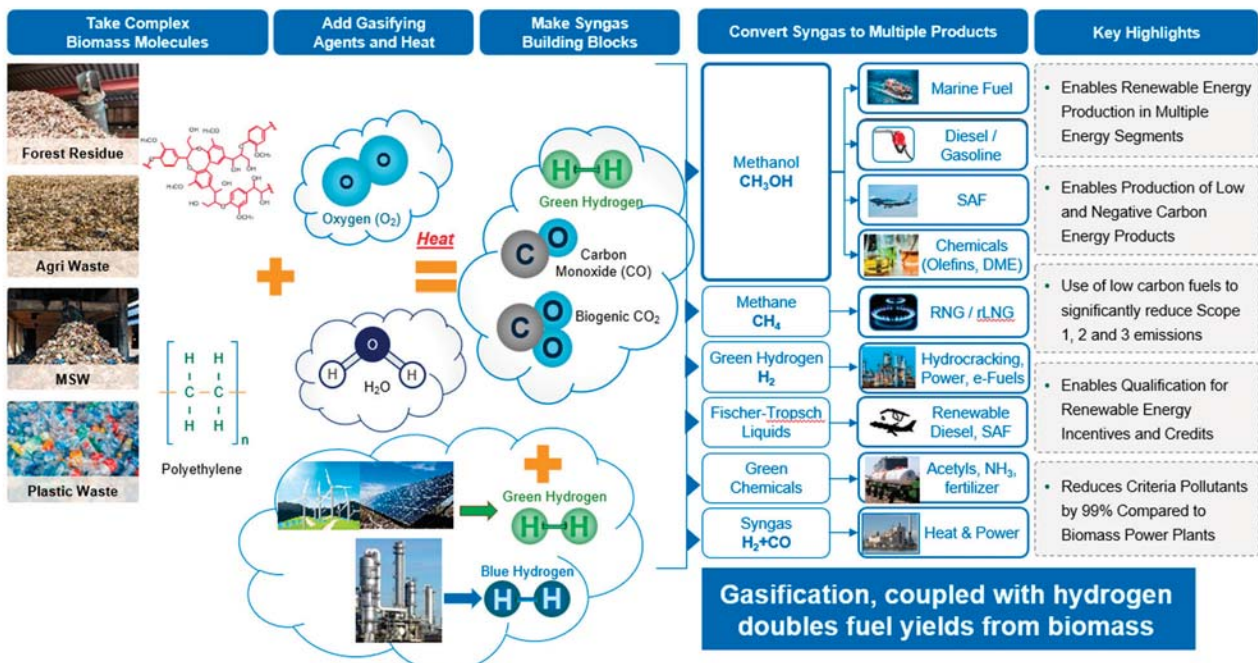
By Jeanne Harmor, NCFE Director of Communications

From mill closures to market disruptions, the U.S. forest products industry faced significant challenges in 2025. The industry's evolving landscape has driven the need to establish innovative markets for forest residues. Forest-to-fuels is an emerging market solution that has been years in the making. From sustainable aviation fuel (SAF) to methanol, the gasification of biomass has created opportunities to produce multiple low-carbon fuels to support the forest products industry and adjacent industries alike. The NCFE spoke with Cliff Keeler, vice president of business development at SunGas Renewables, to learn why sustainable fuels — especially green methanol — are drawing global attention, and how the production of these sustainable fuels can impact the outlook of the forest products industry.

Who Is SunGas Renewables?

The story of SunGas Renewables begins with GTI Energy, the creator of U-GAS® gasification technology, which is the foundation of SunGas technical offerings for large-scale production of renewable fuels, clean chemicals, and power from low-carbon feedstocks. Over time, GTI Energy, with its commercialization partners, built a strong international portfolio of 21 successful operating gasifiers.

Gasification of Biomass Provides Optionality to Produce Multiple Low Carbon Fuels



As the company evaluated its portfolio, it became clear that gasification was the key to scaling impact. SunGas Renewables was formed in 2019, and in 2024, a strategic partnership with green molecules company C2X later resulted in C2X becoming the majority owner of SunGas. A.P. Moller Holdings, the parent company of A.P. Moller Maersk (Maersk), a global shipping and logistics company, is the majority owner of C2X, linking SunGas directly to the growing demand for sustainable marine fuels.

Global Demand Drives Local Opportunity

The International Maritime Organization's (IMO) 2024–2029 strategic plan aligns closely with the United Nations' 2030 Agenda for Sustainable Development, which includes a goal of ensuring access to affordable, reliable, sustainable, and modern energy for all. In support of this agenda, one of the IMO's strategic priorities is to respond to climate change by reducing greenhouse gas emissions from international shipping — measured in part by tracking total carbon dioxide emissions from the sector.

These global initiatives and other potential mandates have pushed Maersk and additional major shipping companies to commit to reducing emissions from the marine industry. As a result, interest in green methanol as a marine fuel has grown rapidly, with more than 300 methanol-powered ships currently in operation or under construction worldwide. Based on these initiatives and potential mandates, global demand is expected to reach approximately 25 million tons of green methanol per year by 2030, with continued growth beyond that.

Green methanol has a significantly lower carbon intensity than diesel, and the infrastructure needed to support its use is already being developed. "More ships are being designed to run on this fuel because the industry sees green methanol as one of the primary pathways to reduce its footprint," said Keeler.

This growing global demand for sustainable marine fuels is creating new market opportunities for the U.S. forest products industry.

Why Forestry Feedstocks Make Sense

So, what role do forests play in all of this? Woody biomass (forestry residues like sawdust, branches, and thinnings) is a scalable feedstock which can be used to

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Why Forest Residues for Feedstock?

Pilot and demo plants have processed all these feedstocks but...



create methanol through gasification.

“SunGas takes forestry residues, agri-waste, and complex biomass molecules, and we add oxygen and steam to create a synthesis gas (syngas) of hydrogen (H), carbon monoxide (CO), and carbon dioxide (CO₂),” said Keeler. “Once you have those three molecules, you can produce a variety of sustainable biofuels such as methanol, sustainable aviation fuel (SAF), renewable natural gas (RNG), etc.”

Historically, gasification has primarily been used in coal, but utilizing biomass is a sustainable alternative.

“The advantage is that biomass contains biogenic molecules, meaning they have very low net carbon intensity,” said Keeler.

Forestry residues are the perfect biomass components for syngas because the elements have consistent chemistry — which is ideal for gasification — while posing low processing risk. Woody biomass does not need to be pelletized for processing, and is low in ash, alkali content, and contaminants compared to various agri-waste and municipal solid waste feedstocks, which both pose higher processing risks and costs.

Because fuels derived from syngas are being sold to both U.S. and European entities, certain benchmarks need to be met to align with Europe’s strict sustainability standards.

“Clients won’t execute offtake agreements if the standards aren’t met,” said Keeler. “Fuels produced from woody biomass, like methanol for marine shipping or SAF, need to be certified by the International Sustainability and Carbon Certification body as well as comply with sustainable forestry practices such as the Sustainable Forestry Initiative standards. In turn, we won’t receive investment

to fund our projects if these offtake agreements aren’t signed, which can delay a project that is already in motion.”

Another point to consider is that the need for forestry feedstocks turns into a market benefit for forest landowners and managers. Those in the industry can take advantage of new revenue streams for their forest thinning and resulting residues, which in turn contributes to improved forest health and reduced waste.

Proven Technology: Lessons from Existing Projects

Internationally, woody biomass facilities have demonstrated success and market viability. One example is a plant in Skive, Denmark that has been in operation since 2008. This plant processes 100 tons of woody biomass per day, utilizing a combined

heat and power approach, which is popular in Europe. Syngas is burned in engines to create power and heat water, which is circulated through pipelines to heat homes as part of a district heating effort. The plant operates nine months out of the year to support communities in the colder months and is still operating in this capacity today. This plant, along with the success of many other woody biomass plants overseas, has inspired the development of similar operations in the U.S.

The Beaver Lake Biofuels Project

In partnership with C2X, SunGas is taking a leading role in carbon removal and the production of advanced biofuels through its flagship project, Beaver Lake Biofuels (Beaver Lake), in Pineville, Louisiana. This \$2.5 billion project is utilizing a former International Paper site that closed in 2009. It is expected to economically revitalize the community by creating more than 1,150 construction jobs, as well as more than 650 direct and indirect new jobs.

Once it is up and running, Beaver Lake is expected to produce approximately 550,000 metric tons of green methanol per year for marine fuel uses and as a chemical feedstock, and 1 million tons of biogenic CO₂ will be transported by pipeline for permanent storage.

“The Pineville site works because much of the existing infrastructure is in place,” said Keeler. “Access to water and natural gas is vital to our operation, minimizing costs down the line. Additionally, many CO₂ sequestration sites are being developed throughout the state. Former mills are typically a perfect fit for projects like this because much of the necessary infrastructure

SunGas S1000 Can Process A Wide Range of Feedstock Materials ⁽¹⁾		300 MTPA of Feedstock Services Meaningful Energy Demand ⁽²⁾			
		SunGas Implied Annual Low Carbon Fuels Production			
		Thermochemical Biomass Only		H ₂ -Boosted Thermochemical Biomass	
FOREST RESIDUE	SAF Methanol RNG	34 MTPA	43% US Demand	75 MTPA	105% US Demand
LUMBER MILL WASTE					
PAPER MILL WASTE		75 MTPA	20% Global marine fuel	165 MTPA	50% Global marine fuel
WOOD PELLETS					
AGRICULTURAL RESIDUES		3 TCF	15% US Demand, excluding Power Gen	7 TCF	35% US Demand, excluding Power Gen

Abundant feedstocks can provide meaningful green fuel volumes.

REFERENCE NOTES: 1) SunGas certifies the S1000 for many feedstocks today. Certain feedstocks may require further testing and qualification. 2) SunGas calculations based on: U.S. Department of Energy 2023 Billion-Ton Report: Executive Summary, Table ES-2. Only forest residues and agricultural residues considered. <https://www.energy.gov/eere/bioenergy/2023-billion-ton-report-assessment-us-renewable-carbon-resources>

and wood resources are accessible.”

The Beaver Lake project is expected to receive its final investment later this year, will start construction in late 2026, and plans to be commercially operable in 2029.

Can Forest-to-Fuels Revitalize the U.S. Forest Industry?

According to Keeler, forest-to-fuels is one of the most viable options in revitalizing the U.S. forest industry, as there is a substantial market need for renewable fuels.

“Today, there is nowhere near enough supply of renewable fuels to meet the global demand,” said Keeler. “Currently, used cooking oils and other substances are used to create SAF, but there isn’t enough of it. We need billions of gallons to meet new global fuel markets in the airline and marine industries. The forest industry is going to be a significant wedge in giving us the supply we need.”

The Department of Energy Billion Ton Study reports that we have a billion tons of biomass in the U.S., and of that, SunGas thinks that 300 million tons per year is available to create SAF, methanol, and RNG.

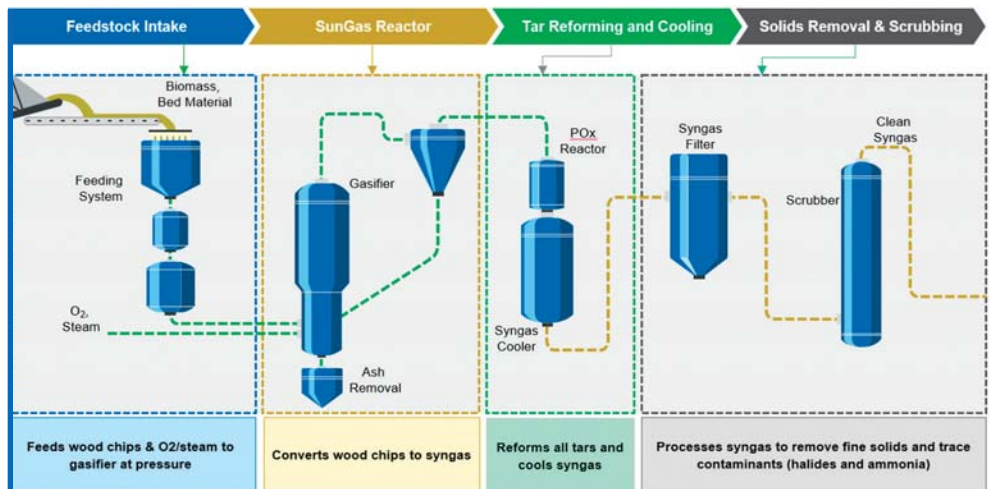
The Future of Woody Biomass Markets

In reviewing market trends, Keeler has a positive outlook on what the next five to 10 years could look like for the future of woody biomass.

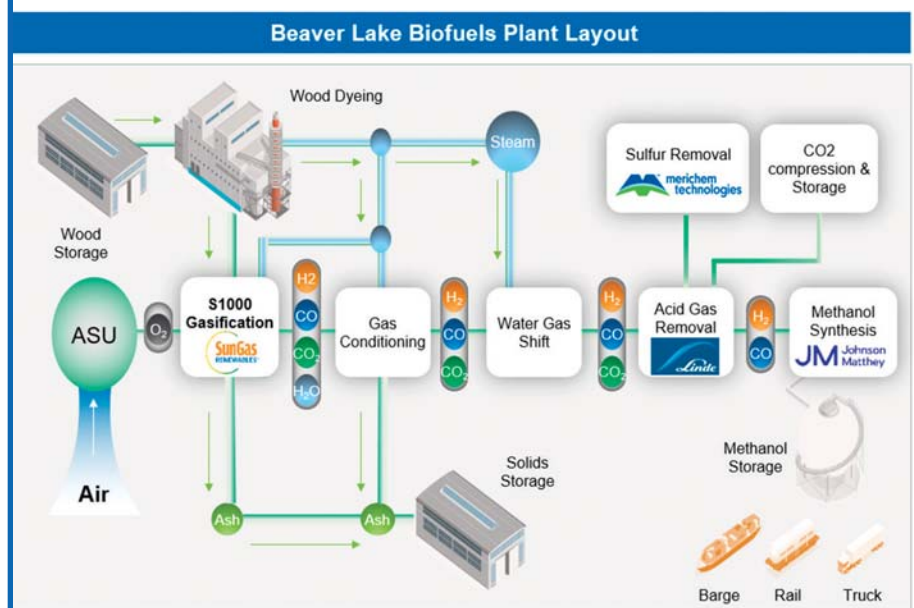
“Since projects using forest byproducts for fuel production are new in the U.S., and significant funding is involved, I see slow movement over the next three years, but not without deliberate progress made in this space,” said Keeler. “Five years from now, progress will accelerate as more projects come online. From there, I see a dramatic shift in how forest residues are utilized for biofuel production.”

Woody biomass is a market worth watching, as it has been proven to be a strategic, sustainable resource for many industries. Successful collaboration between forestry, energy, and global and domestic markets will be crucial as industries work together to achieve goals for sustainability.

As these markets develop, forest landowners, managers, and industry leaders have an opportunity to engage early, positioning their operations to supply feedstocks, support project development, and help shape sustainability standards. Proactive collaboration today will ensure the forest products industry plays a leading role in meeting tomorrow’s renewable energy demand. ■



This diagram demonstrates how SunGas’ S1000™ process works.



This diagram demonstrates the layout plans for the Beaver Lake Biofuels plant.



This is a bird’s eye view of the Beaver Lake Biofuels plant, already in progress in Pineville, Louisiana.