Fastmarkets

CleanJoule seeks to break SAF blend wall, lower price

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Startup producer CleanJoule says its sustainable aviation fuel (SAF) process could allow for blends of up to 100%, and could eventually be priced competitively with conventional jet fuel, Mukund Karanjikar, chief executive officer and co-founder, told Fastmarkets on Tuesday October 1.

CleanJoule is seeking initial approval from the American Society for Testing and Materials (ASTM) for its SAF, which is mostly made up of cycloparaffins (also known as cycloalkanes).

Cycloparaffins occur naturally in conventional jet fuel and in SAF, at lower proportions.

The higher proportion of cycloparaffins mean that CleanJoule's SAF does not need to be mixed with polluting aromatics, and it has a high enough density that it can be used up to 100%.

Aromatics are responsible for up to 90% of particulate emissions (soot and contrails) from jet engines, according to the US Department of Energy's Sustainable Aviation Fuel Review of Technical Pathways report.

Aromatics don't naturally occur in most SAFs and have to be blended back in to ensure that O-rings and seals in airplane fuel systems swell properly to prevent leaks. A higher percentage of cycloparaffins also causes the O-rings and seals to swell, negating the need for aromatics, Karanjikar said.

The Energy Department's report says that replacing aromatics with cycloalkanes is a goal for SAF production.

CleanJoule's SAF can be used up to 100% because of its higher density, at 0.81 kg per liter.

"This is the problem that nobody wants to talk about," Karanjikar said, regarding ASTM specifications for conventional jet fuel (Jet A). "The first line on that says 'thou shalt not have density less than 0.775 [kg per liter],'" while most SAF has a density of 0.75 kg per liter or lower.

The rules for minimum jet fuel density ensure that airplanes will consistently get the minimum calculated mileage from fuel and not be caught short of fuel during flights.

“Now you’re stuck with finding Jet A for blending that weighs a minimum of 0.8 [kg per liter],” Karanjikar said, adding that this was a particular problem in Europe, where jet fuel tends to be less dense than in the US.

“Therefore, Europe can never hit the 50% mark on blending [SAF with jet fuel],” Karanjikar said.

The higher density of CleanJoule’s SAF means that it gets 10% more efficiency on mileage than conventional jet fuel, Karanjikar said.

CleanJoule is not the first company to seek ASTM approval for a high-cycloparaffin SAF, but it could be the first to receive approval. Shell previously submitted an application for its IH2, a similar fuel, but sought approval for use at 100%, Karanjikar said.

“ASTM only just formed a working group to write the specification for 100% SAF,” Karanjikar said, a process he said could take several years.

CleanJoule is starting with requesting approval at 10% blending, the easiest and most well-established specification, and expects the process to take 12-24 months.

“We want to grow with the community. It’s an ecosystem,” Karanjikar said. “We are true believers in decarbonization. As much as making the business case for it, if you anchor it to some unrealistic expectation [like 100% blend approval immediately], that’s not the way to go. We are growing methodically.”

With extraordinary carbon efficiency, very low use of hydrogen and very low energy consumption, “we project our process at scale to be cost-competitive with Jet A,” Karanjikar said.

“Without which, by the way, there isn’t the business case,” Karanjikar added.

CleanJoule’s goal is an aviation economy completely independent of petroleum, Karanjikar said. For society to go on, “habitable conditions must go on as well,” Karanjikar said.

SAF production from biomass, as CleanJoule’s process entails, “is a huge opportunity for countries, for societies. There are only a few countries that produce petroleum,” Karanjikar said. “Every country can produce biomass. It’s an opportunity to bridge an agrarian- and forestry-driven economy with the next generation.”

CleanJoule is building a pilot facility that could produce up to 30,000 gallons of SAF per year, to be completed in 2026 at the earliest, after ASTM approval for the process.