

## Achieved the flight using sustainable aviation fuel (SAF) made from woody biomass

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Toyo Engineering Corporation

Toyo Engineering Corporation (TOYO, President and CEO Haruo Nagamatsu), in collaboration with New Energy and Industrial Technology Development Organization (NEDO), Mitsubishi Power, Ltd., JERA Co., Inc., and Japan Aerospace Exploration Agency (JAXA), have successfully completed demonstration of “neat” biojet fuel\*1 production from woody chips through “gasification FT synthesis technology”\*2. The produced SAF\*3 was supplied to a commercial flight (Japan Airlines Co., Ltd./ JL515: Tokyo to Sapporo on 17th June, 2021), and this is the world’s first flight using SAF derived from woody biomass through gasification FT synthesis technology.



Figure 1 Aircraft “A350-900” used for the flight (courtesy of Japan Airlines)

The project has been executed since 2017 under the entrustment of NEDO’s “Biojet Fuel Production Technology Development Project \*4” , which envisages commercialization of biojet fuel to reduce CO2 emissions attributable to jet fuel usage, and has achieved the demonstration of integrated production technology including supply chain establishment from raw material procurement to the biojet fuel supply to aircraft.

In this project, the demonstration plant facility, which has 0.7 ton/day of woody biomass processing and about 27 liter/day of neat biojet fuel production capacity, was constructed on the premises of JERA’s Shin-Nagoya Thermal Power Station. To demonstrate neat biojet fuel production, proprietary technologies and expertise of consortium members was applied; namely facility operation and fuel procurement know-how by JERA, atmospheric oxygen/steam-blown entrained-flow type gasification technology by Mitsubishi Power, engineering of FT synthesis technology, synthetic oil hydro-cracking\*5, distillation and blending\*6 and subsequent supply chain establishment by TOYO, and evaluation capability of jet fuel combustion characteristics by JAXA.

The neat biojet fuel first produced in the demonstration facility was confirmed full conformance to ASTM D7566 Annex1\*7 in August 2020, and full amount of the neat biojet fuel produced since then (2,366L) were also confirmed its conformity. Furthermore, in March 2021, it was confirmed that SAF, which was a blend of the neat biojet fuel and conventional petroleum-derived jet fuel (JET A-1), conforms to the standard.

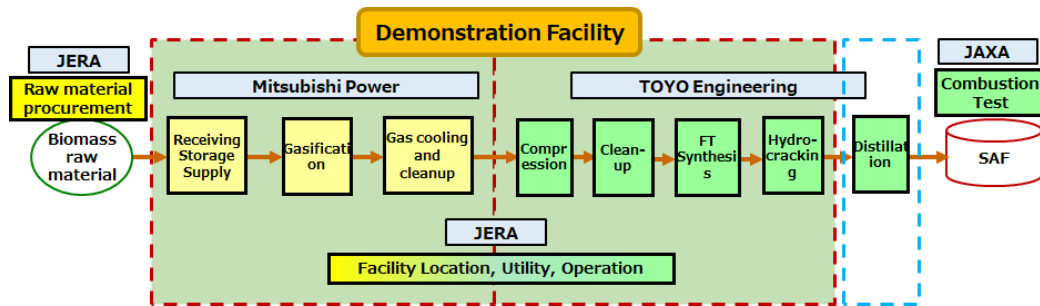


Figure 2 Process from raw material procurement to neat biojet fuel production



Figure 3 Demonstration Plant



Figure 4 Produced SAF

TOYO applied the microchannel FT synthesis technology owned by Velocys\*8 to the demonstration facility. The technology can make FT reactor 1/10 smaller than conventional FT technologies, is suitable for small to medium production capacity plants such as biomass gasification and is easy to scale-up. In 2010s, TOYO made its first achievement in a small GTL\*9 demonstration conducted jointly with Velocys. This technology also demonstrated high efficiency and stable performance at this NEDO pilot plant, and contributed to the production of high-quality SAF, green naphtha and green diesel.

The aviation industry, including the International Civil Aviation Organization (ICAO), is working on measures to curb global warming by reducing greenhouse gas emissions associated with aircraft operations, and the introduction of SAF is positioned as one of the effective means.

TOYO will continue to promote efforts toward the establishment of commercial-scale biojet fuel production technology with its FT synthesis technology, and contribute to carbon neutrality and reduction of global

environmental load in the aviation field.

- \*1) Neat biojet fuel: pure unblended jet fuel derived from 100% biomass material
- \*2) FT (Fischer-Tropsch) synthesis: Technology for synthesizing liquid hydrocarbons from syngas (mixed gas of carbon monoxide and hydrogen) using a catalyst
- \*3) SAF: Sustainable Aviation Fuel
- \*4) NEDO's Biojet Fuel Production Technology Development Project:  
project summary: [https://www.nedo.go.jp/english/activities/activities\\_ZZJP\\_100127.html](https://www.nedo.go.jp/english/activities/activities_ZZJP_100127.html)  
project period : FY2017~FY2024
- \*5) hydro-cracking: implemented with a catalyst provided by UOP LLC / Nikki Universal Co., Ltd.
- \*6) blending: Using in commercial flight, SAF has to comply with standards\*6 of ASTM (American Society for Testing and Materials) and blend with a conventional petroleum-derived jet fuel (JET A-1)
- \*7) ASTM D7566 Annex 1 : Standard for Fischer-Tropsch (FT) conversion process
- \*8) microchannel FT synthesis technology : TOYO concluded a comprehensive collaboration agreement with Velocys in in the field of renewable fuels such as SAF.  
<https://www.toyo-eng.com/jp/en/company/news/?n=564&by=2021>
- \*9) GTL : Gas to Liquid. A process technology that converts natural gas into synthetic gas and uses FT synthesis technology to convert into kerosene, etc.

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