

October 20, 2024

Government of the Netherlands

Ministry of Infrastructure and Waterworks, Ministry of Climate and Green Growth

Submitted Via Web to https://www.internetconsultatie.nl/alcoholtojet_fuels/b1

Re: Innovation for Alcohol to Jet Techniques Based on Biogenic (Residual) Streams

LanzaJet, Inc. (LanzaJet) appreciates the opportunity to comment on the Dutch Government's consultation on an incentive scheme to support the development of production techniques and scaling of Alcohol-to-Jet (AtJ) fuels.

LanzaJet is an industry-leading sustainable aviation fuel (SAF) producer using our innovative, proprietary alcohol-to-jet (AtJ) process to convert any source of low-carbon, sustainable ethanol into drop-in SAF and renewable diesel. Following a decade of technology development, LanzaJet was launched in 2020 with a clear mission—to scale the SAF market and enable the decarbonization of the aviation sector. To that end, we have constructed a first-of-a-kind, 38 million litres per year commercial scale SAF facility in Soperton, Georgia, U.S., which will produce SAF beginning in 2024. LanzaJet's equity investors include LanzaTech, Suncor, Mitsui, British Airways, ANA, Shell, Southwest, Groupe ADP, Microsoft, MUFG, and Airbus.

LanzaJet applauds the Netherlands Ministry of Climate and Green Growth and the Ministry of Infrastructure and Water Management for this initiative to invest in the scale-up of alcohol-to-jet technologies. As a general point, LanzaJet urges the Netherlands to emphasize commercialization of AtJ technologies as a central goal of this fund. To date, there has been extensive work on early-stage research and pilot projects leading to ATSM approval for eight SAF pathways, with at least eleven more underway. However, only one of those pathways is currently regularly deployed at commercial scale around the world. Rather than funding more research and pilot programs, we encourage the Dutch government to focus on addressing the current bottleneck: a shortage of investment capital to push technologies beyond pilot scale into full scale commercial production globally.

Consultation Questions

Questions about the project

- 1. Are you considering submitting one or more applications (projects) if there is an opening for the AtJ theme of the DEI+, as described above?**

LanzaJet would strongly consider submitting one or more applications for projects in our pipeline in Europe.

1. Have you already obtained the necessary permits for your project or, if not, when do you expect to obtain the permits?

Our projects that could be sited in the Netherlands are still in early stages of development. In our view, receipt of government support and grants (such as this subsidy) is a pre-requisite to site selection and permitting. In fact, receiving a conditional award from the Dutch government has the potential to influence site selection (and permitting) activities in favor of sites located within the Netherlands.

2. A first opening round of this theme could take place in 2025. From when do you think you can submit an application to the?

We could submit an application starting in late 2025. We have dedicated staff with a proven track record of success with applying for and winning grant awards.

If you want to realize a demonstration project, please react to question 4 to 8

3. Is your company a large company or an SME?

LanzaJet is an SME (medium).

4. What is the intended size of the installation (tons of kerosene per year)?

We expect that projects built in the Netherlands would aim for a capacity of about 100,000 tonnes of fuel per year at a minimum. Our mission is to scale the AtJ technology and the SAF industry, so we seek to achieve greater economies of scale wherever possible.

5. What are the estimated investment costs in euros?

For a facility producing 100,000 tonnes per year or more, a subsidy of at least €25-50 million would be needed to be materially helpful. This would remain within the funding levels offered under the DEI+ program.

We caution the government against spreading the subsidy budget too thin—across many pilots that will ultimately not result in ongoing production at scale. As an example, the UK Advanced Fuels Fund (AFF) aims to develop commercial scale SAF projects utilizing emerging technologies.¹ From 2022 to 2023, the AFF spread about £135M across 13 projects (14 awards). Half of the awards were for less than £7M, which, while directionally helpful, is not enough to make a meaningful difference in the overall risk profile or bankability of a commercial scale SAF project. As such, many (if not all) of these projects will require further support, such as from the planned Revenue Certainty Mechanism.² Rather, the government should focus the scheme on a small number of awards for larger demonstration plants with reasonable probability of successfully

¹ See <https://www.gov.uk/government/publications/advanced-fuels-fund-competition-winners/advanced-fuels-fund-aff-competition-winners>

² See <https://www.gov.uk/government/publications/revenue-certainty-mechanism-for-saf-delivery-plan>

achieving AtJ production. (We do note that the AFF did provide large grants—more than £20 million—to two projects.)

6. Would a DEI+ subsidy be sufficient to realize your project? If not, what is needed extra?

As our goal is to deploy our AtJ technology at commercial scale, €25-50 million should be considered a minimum range to have an impact on a project's ability to reach FID. As actual investment costs are much higher, any additional amount beyond this range would produce greater certainty for the projects as well as reducing the costs of the final product itself. As an example, the USD \$50 million (€46 million) grant that LanzaJet received from Breakthrough Energy Catalyst for our Freedom Pines Facility in Georgia was critical to financing our facility, maintaining construction timelines, and speeding up LanzaJet's journey to commercialization in the United States. Had LanzaJet needed to otherwise finance that capital, it would have added USD \$0.80 per gallon (€250/tonne) to the cost of production.

7. When do you want to take the financial investment decision (FID)?

We have committed to producing 1 billion gallons (3 million tonnes) of SAF by 2030. In line with this goal, we aim to announce FID for additional projects before 2027.

If you want to realize a pilot project, please react to question 9 till 12:

8. Is your company a large company, an SME, or are you a research organization?

N/A

9. What are the estimated project costs in euros?

N/A

10. Does your project focus on kerosene production, or on individual process steps?

N/A

11. If you focus on individual process steps, can you briefly indicate what you focus on?

N/A

Raw materials

12. Which specific biogenic raw materials do you intend to use in the installation and what are their origin and current application?

Our AtJ process benefits from the flexibility to utilize any source of low-carbon, sustainable ethanol. For our projects in Europe, we intend to secure either biogenic feedstocks that appear on the EU Renewable Energy Directive Annex IX-A list or sources of carbon dioxide and green hydrogen that would produce a renewable fuel of non-biologic origin. (See our joint response with LanzaTech to the parallel consultation on P2X fuels.)

While we understand that this consultation is intended to support only AtJ SAF produced from biogenic materials, we do encourage the Dutch government to provide flexibility by recognizing facilities that could utilize both types of feedstock. We strongly believe that the ability to diversify the source of feedstock (within the range of feedstocks permitted for aviation fuels under the ReFuelEU Aviation) reduces risk, enables economies of scale, and ultimately increases the chance of a project's success.

13. Will the input stream change during the lifetime of the installation?

See our response to question 13.

14. For pilot projects focused on individual steps: what do you think of a requirement that makes it mandatory for you to demonstrate that the intermediate you produce can be produced based on Annex IX-A raw materials as described in the Renewable Energy Directive?

We are supportive of an obligation that subsidized projects produce fuels that meet the requirements for SAF feedstock under the ReFuelEU Aviation scheme. As that scheme already defines the European market for such fuels, compliance would naturally be a central goal of any demonstration project we undertake. As we elaborate in question 13, we do believe that flexibility should be allowed for AtJ facilities using ethanol derived from Annex IX-A feedstocks AND carbon dioxide combined with green hydrogen. Given that the Dutch government is actively seeking to subsidize both types of SAF anyway, we see no justification for requiring them to be produced in separate facilities to be eligible for a subsidy.

15. Is it necessary and/or desirable to require ASTM D7566 Annex A5(American Society for Testing and Materials) approval of an AtJ demonstration project? And why?

The Dutch government should include ASTM approval as a requirement for receiving this subsidy.

As an industry, SAF has plenty of technology but lacks scale. There are currently eight ASTM-approved SAF production pathways and at least another eleven approvals underway, yet only one is fully commercially mature and widely deployed at scale (HEFA).³ While investment in early-

³ See <https://www.icao.int/environmental-protection/GFAAF/Pages/Conversion-processes.aspx>

stage research and pilot projects has been abundant, investment in demonstration and commercial scale plants has been comparatively absent. As a result, these technologies are proven but remain risky and capital intensive to deploy at scale. We urge the Dutch Government to help fill this gap by prioritizing larger projects utilizing technologies that have already achieved ASTM approval.

16. Is it necessary and/or desirable to require ASTM D7566 Annex A5 approval of an AtJ pilot project that produces biokerosene? And why?

As we elaborate in question 16, we urge the Dutch governments to prioritize scaling of proven AtJ technologies. Given the number of proven technologies already available, subsidy funds should be focused squarely on demonstration and commercial scale projects, rather than pilots, and should be reserved for technologies that are already ASTM approved.

17. Is it necessary and/or desirable to require - and also consider eligible for subsidy - activities that contribute to the ASTM certification of biokerosene from AtJ processes which do not produce fuels approved in ASTM D7566 Annex A5?

See our responses to questions 15 and 16. Funds should not be used to contribute to ASTM certification of additional pathways.

Other

18. Are there other aspects of the AtJ theme in the DEI+ described above that would hinder you from applying for this subsidy?

The requirement that entrepreneurs applying for demonstration project funding have a permanent establishment or subsidiary in the Netherlands at the time of application or this subsidy could be a hindrance. While establishing such a subsidiary could be a condition for receiving any awarded subsidy or could be a requirement upon reaching a certain project milestone, it should not be a requirement simply to apply for or be conditionally awarded this subsidy. As a nascent industry, the universe of companies producing SAF—particularly P2X SAF—is quite limited. Relaxing this requirement—at least for application stage—will significantly broaden the potential pool of applicants, ensuring that projects compete on technical and economic viability, rather than paperwork. As a result, the award will be more likely to realize economic and environmental benefits for the Netherlands.

19. What are the crucial conditions for realizing the project? Indicate them as concretely and specifically as possible.

As a general rule, awards should seek to reduce risk and capital cost enough to enable demonstration projects of meaningful scale to reach FID.

1. Awards must be large enough to meaningfully decrease the amount of capital that must be financed separately and send a strong signal of confidence to investors. We view €25-50 million as a minimum level of subsidy to be effective. As an example, the US FAST-SAF grant programs recently awarded \$291M to 36 projects, several of which received amounts in or above that range.⁴ The UK Advanced Fuels Fund also provided two grants of greater than £20M.

2. Awards must be patient (allow at least 5 years for projects to be complete). Governments should bear in mind that, in addition to building SAF projects using new technologies, awardees will also be subject to new supply chains providing inputs from other, similarly nascent industries like green hydrogen.

20. How much time do you expect to need for submitting an application, counted from the moment of definitive announcement of a scheme?

We request a minimum of 3-6 months to prepare a strong application.

21. Are there any other matters you would like to mention that have not yet been addressed?

There are no additional matters.

22. May we contact you if we have additional questions? so, please provide your contact details here. Organization name, contact person name, email address.

LanzaJet thanks the Ministry for the opportunity to respond and for your interest in building an AtJ industry in the Netherlands. We hope that our comments are helpful. Please do not hesitate to reach out if you have any questions.

⁴ <https://www.faa.gov/general/fueling-aviations-sustainable-transition-fast-grants>