

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/p2xfuels/reageren/2>

RE: Innovation Projects for the Production of Aviation Fuels from CO₂ and Hydrogen

LanzaJet and LanzaTech appreciate the opportunity to respond jointly to the Dutch Government's consultation on a support scheme for the development of "power to X" aviation fuels (P2X) technologies in the Netherlands.

LanzaJet is an industry-leading sustainable aviation fuel (SAF) producer. We use our 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 and demonstration, LanzaJet launched in 2020 with a clear mission—to scale the SAF market and enable the decarbonisation 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.

LanzaTech Global, Inc. (NASDAQ: LNZA) is a carbon recycling company transforming waste carbon into sustainable fuels, chemicals, and materials for everyday products. LanzaTech's carbon recycling technology is like retrofitting a brewery onto an emission source like a steel mill or a landfill site, but instead of using sugars and yeast to make beer, pollution is converted by bacteria to ethanol, which is an intermediate to fuels and chemicals. Together with its licensee partners, the LanzaTech started up three new commercial-scale plants this year bringing the total number of operating commercial LanzaTech plants to six. The total installed nameplate production capacity across the operating fleet is approximately 310,000 tons per year of ethanol with the ability to abate more than 500,000 tons per year of carbon that would otherwise enter our atmosphere.

LanzaJet and LanzaTech have combined our groundbreaking technologies into a joint solution for producing P2X aviation fuels on a global scale: CirculAir. Our CirculAir platform first utilizes LanzaTech's gas fermentation technology to convert nearly any waste resource—including CO₂ or other waste carbon oxides combined with renewable power—into CarbonSmart ethanol. Then, LanzaJet takes the ethanol and converts it into drop-in SAF through our proprietary ATJ technology. SAF made through this process is considered a power to liquid fuel under the EU Renewable Energy Directive and can achieve emissions reductions of 85% or more from the fossil jet fuel baseline. CirculAir exemplifies the circular economy by transforming waste into SAF, closing the loop on carbon emissions that would otherwise harm the environment. By continually

recycling carbon emissions, CirculAir achieves the necessary economies of scale, reducing the cost of SAF and making it more competitive with traditional fuels.

LanzaJet and LanzaTech applaud the Dutch Government for its efforts invest directly in the development of P2X fuels for the aviation sector in the Netherlands.

Consultation questions

1. Are you considering submitting one or more applications (projects) if there would be an opening for P2X fuels of the DEI+ described above?

We would strongly consider submitting one or more applications for projects in our pipeline, provided that the conditions are appropriate. Most important, as we elaborate below, is that the scheme supports larger-scale commercial technology demonstration projects rather than only pilot projects.

2. A first opening round of this theme could take place in November 2025. In this first opening, we only want to allow pilot projects, because demonstration projects (i.e. investment support for an operator of an installation, TRL 7/8) cannot be supported under the GBER article 25. Is this a problem for you and if so, why?

We strongly urge the Dutch government to focus the subsidy scheme on demonstration and commercialization instead of pilot projects. At a minimum, the scheme should be opened to include demonstration projects alongside pilots.

As an industry, SAF has an abundance 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 (HEFA).¹ While investment in early-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.

LanzaJet and LanzaTech understand concerns raised in the consultation about the quick exhaustion of budgets for projects involving P2X-fuels, Hydrogen and Green Chemistry.² However, 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.³ 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

¹ See <https://www.icao.int/environmental-protection/GFAAF/Pages/Conversion-processes.aspx>

² See section “What are the consequences” at <https://www.internetconsultatie.nl/p2xfuels/b1>.

³ See <https://www.gov.uk/government/publications/advanced-fuels-fund-competition-winners/advanced-fuels-fund-aff-competition-winners>

planned Revenue Certainty Mechanism.⁴ Rather, the government should focus the scheme on a small number of awards for larger demonstration plants with reasonable probability of successfully achieving P2X production. (We do note that the AFF did provide large grants—more than £20 million—to two projects.)

Our technology, like many other SAF and P2X technologies, has already been proven at pilot scale. LanzaTech's gas fermentation technology is employed today at six commercial scale plants utilizing the industrial waste gases produced by steel mills and ferroalloy plants. Two pilot projects backed by the U.S. Department of Energy (US DOE) are underway to apply the gas fermentation technology to the CO₂ captured from ethanol⁵ and ethylene⁶ production facilities in the U.S. (We note that the latter, Project Secure, is the recipient of a \$200M investment from the US DOE Industrial Demonstrations Program—an amount that will dramatically increase the likelihood that the project will reach FID.) LanzaJet's alcohol-to-jet technology is already deployed at our first-of-a-kind commercial scale SAF production facility in Georgia, which currently utilizes biogenic sources of ethanol. At this stage, additional pilot projects would be redundant; we are ready to demonstrate and scale the full process—from CO₂ to jet fuel.

The conditions are now right for P2X demonstration projects to be successful. With the RefuelEU Aviation and UK SAF Mandates coming online to guarantee market demand for P2X fuels and the growing number of companies and processes at high levels of technology readiness—all that is needed is an extra push from governments to give investors the confidence they need to deploy the technologies at scale.

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

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.

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

LanzaJet is an SME (medium). LanzaTech is a large company.

5. What are the estimated project costs in euros?

For a demonstration facility producing 30-100 million litres of P2X aviation fuels per year, 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.

⁴ See <https://www.gov.uk/government/publications/revenue-certainty-mechanism-for-saf-delivery-plan>

⁵ Carbon Refining: Corn Ethanol 2.0. See <https://www.energy.gov/sites/default/files/2024-04/CX-029951.pdf>

⁶ Project Secure. See <https://ir.lanzatech.com/static-files/3c07aa0b-e081-48c7-b42c-7e3df7ed75dc>

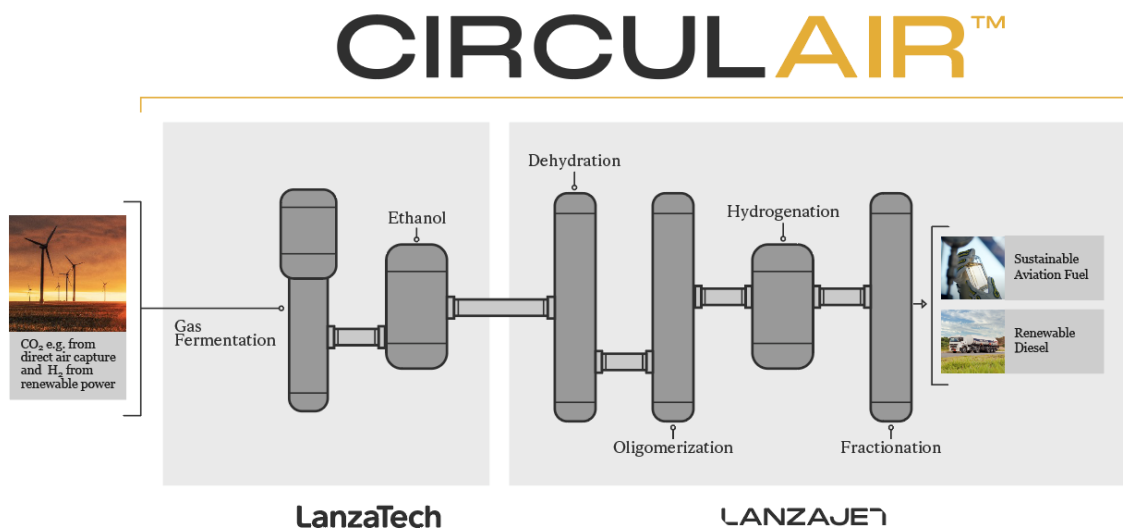
6. Does your project focus on the entire production process of P2X fuels, or on individual process steps? At what TRL level is your technology now?

CirculAir projects typically focus on the entire production process: starting with CO₂ and green hydrogen, converted to ethanol via gas fermentation, and then upgraded to P2X aviation fuel via the alcohol-to-jet process.

However, we encourage the Ministry of Infrastructure and Water Management to provide flexibility on this front for P2X demonstration plants. A key advantage of the CirculAir program is its flexibility: PTL ethanol production and ATJ conversion can be integrated, standalone, or hybrid—depending on what is most optimal for a given project. For example, the availability of renewable power and green hydrogen could constrain ethanol production at a fully integrated P2X facility sited in the Netherlands. In this case, it may be more economically efficient and less risky to build the fully integrated production process and supplement with additional ethanol produced off site, allowing for economies of scale on the ATJ unit. Additionally, P2X ethanol production should be allowed to supply standalone ATJ facilities that will come online in parallel as the market develops.

In sum, as long as the SAF is produced in the Netherlands from ethanol derived from CO₂ and green hydrogen (P2X), diversifying the sources of this key intermediate should be encouraged, rather than disqualified from this funding opportunity. ATJ and P2X ethanol units should be eligible, provided they are in the Netherlands, regardless of whether they are standalone, integrated, or hybrid.

CirculAir's P2X offering is currently at TRL 8.



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

N/A

8. If you focus on individual process steps, what do you think of a requirement that makes it mandatory for you to demonstrate that you can produce your intermediate products from CO₂ and H₂?

N/A

9. What do you think of a potential obligation that your pilot project within this theme should produce renewable fuels of non-biogenic origin, as described in the Renewable Energy Directive Article 29a (paragraph 1)?

We are supportive of an obligation that subsidized projects produce fuels certified as RFNBOs per the EU Renewable Energy Directive. As the ReFuelEU Aviation scheme already defines the European market for such fuels, compliance would naturally be a central goal of any demonstration project we undertake.

10. What are the crucial conditions for the realisation of your project? Please indicate 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.⁷ The UK Advanced Fuels Fund also provided two grants of greater than £20M, including one to LanzaTech's own Project Dragon.

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.

11. 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.

⁷ <https://www.faa.gov/general/fueling-aviations-sustainable-transition-fast-grants>

12. Are there other aspects in the above-described theme for P2X fuels in the DEI+ that would hinder you from applying for this subsidy?

We encourage the Dutch Government to relax the requirement that entrepreneurs have a permanent establishment or subsidiary in the Netherlands at the time of application. While establishing such a subsidiary could be a condition for receiving any awarded subsidy or a requirement for projects once they hit an established milestone, it should not be a requirement simply to apply for this subsidy or be conditionally awarded, as many projects simply would not be far enough along yet. As a nascent industry, the universe of companies producing SAF—particularly P2X SAF—is quite limited. Relaxing this requirement 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.

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

There are no additional matters.

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

LanzaJet and LanzaTech thank the Ministry for the opportunity to respond and for your interest in building a P2X industry in the Netherlands. We hope that our comments are helpful. Please do not hesitate to reach out if you have any questions.