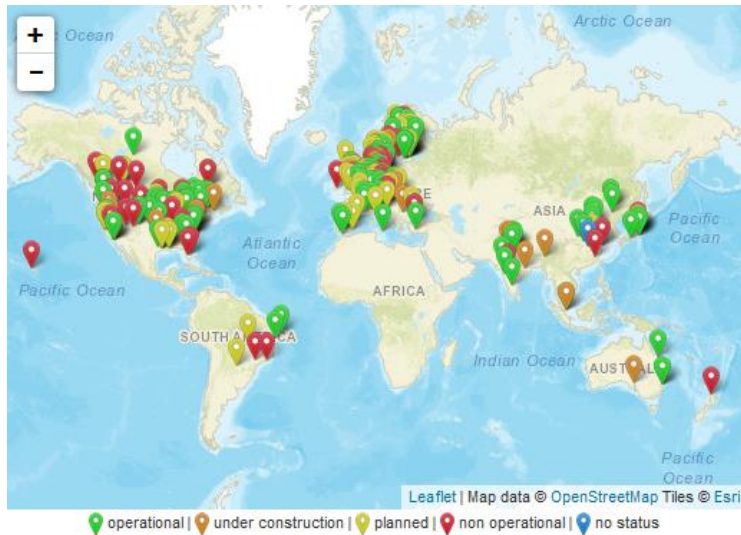




**IEA Bioenergy**  
Technology Collaboration Programme

**Task 39**  
IEA Bioenergy



# Advanced Biofuels Demonstration Facilities

Currents status and update

Andrea Sonnleitner, Dina Bacovsky,  
BEST - Bioenergy and Sustainable Technologies

Virtual Task 39 Business Meeting, 08/11/2021

*The IEA Bioenergy Technology Collaboration Programme (TCP) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Bioenergy TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.*

**Technology Collaboration Programme**

by **iea**

# Status of Demoplants Database

- Continuous integration of new information
- Annual Update with support of Task members
- ~290 entries
- ~220 entries TRL 6-9
- Technologies covered:
  - gasification
  - fermentation
  - hydrotreatment
  - fast pyrolysis
  - hydrothermal liquefaction
  - lignin depolymerisation
  - **New: E-Fuels Biomass Hybrids**

This database has been elaborated and is maintained by

**BEST**  
Bioenergy and Sustainable Technologies

Explanations and definitions

To add your project please contact [Dina Bacovsky](#)

Links to other databases

[IEA Bioenergy Database Biomass conversion facilities](#)

[Task 32 Database Biomass Cofiring initiatives](#)

[Task 33 Database Gasification of Biomass and Waste](#)

[Task 34 Database Pyrolysis Demoplants](#)

Publication based on this database "Status of Advanced Biofuels Demonstration Facilities in 2012"

[English](#) | [Chinese](#)

Database on facilities for the production of advanced liquid and gaseous biofuels for transport

**Task 39**  
IEA Bioenergy

Filter Projects

Projects

Search Owner/Name/Input Submit

| Owner                           | Name                                 | Location       |      |
|---------------------------------|--------------------------------------|----------------|------|
| Aarhus University               | Center for Biorefining Technologies  | Denmark        | Info |
| Advanced Biofuels Solutions Ltd | Swindon Advanced Biofuels Plant      | United Kingdom | Info |
| Advanced Plasma Power Ltd       | BioSNG pilot plant                   | United Kingdom | Info |
| Aemetis                         | Aemetis Commercial                   | United States  | Info |
| Aemetis                         | pilot                                | United States  | Info |
| AgBioEn                         | Australian renewable energy facility | Australia      | Info |
| AlphaJet Inc.                   | AlphaJet Pilot Plant                 | United States  | Info |
| ALTACA ENERGY                   | ALTACA ENERGY                        | Turkey         | Info |
| American Process                | Thomaston GP3+ Biorefinery           | United States  | Info |
| American Process                | Alpena Biorefinery                   | United States  | Info |

Map

Legend: operational | under construction | planned | non operational | no status

Leaflet | Map data © OpenStreetMap contributors

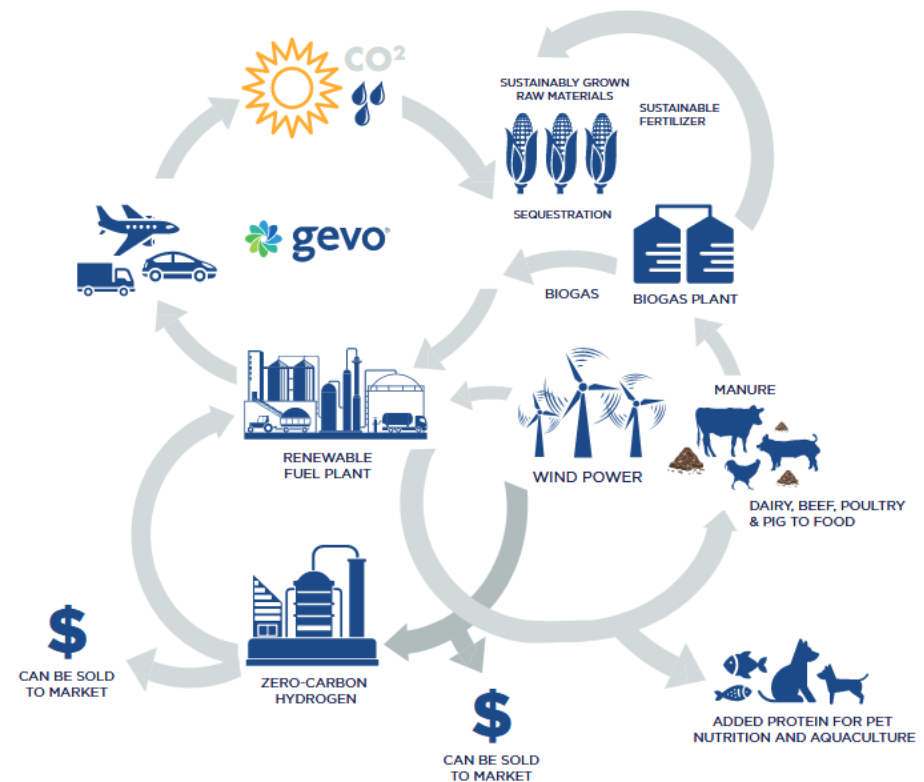
# E-Fuels Biomass Hybrids ≥ TRL 6

- Technologies using a combination of biomass and electric power (coming from biomass) or green hydrogen to produce fuels

| Owner                    | Project                         | Location          | TRL Level | Status             | Startup | Product            |
|--------------------------|---------------------------------|-------------------|-----------|--------------------|---------|--------------------|
| Audi AG                  | Audi e-gas                      | Germany           | TRL 8     | operational        | 2013    | SNG                |
| STORE&GO                 | STORE&GO<br>Demonstration plant | Germany           | TRL 6-7   | operational        | 2018    | SNG                |
| Enerkem                  | Varennnes Carbon<br>Recycling   | Canada            | TRL 6-7   | under construction | 2023    | other              |
| Nordic<br>Electrofuel AS | E-fuel 1                        | Norway            | TRL 8     | planned            | 2024    | FT liquids         |
| Gevo                     | Net-Zero 1                      | United<br>States  | TRL 9     | planned            | 2024    | jet fuel component |
| Proman                   | Cromarty Clean Fuels<br>Project | United<br>Kingdom | TRL 6-7   | planned            |         | methanol           |

# Hybrid: Gevo - Net-zero 1

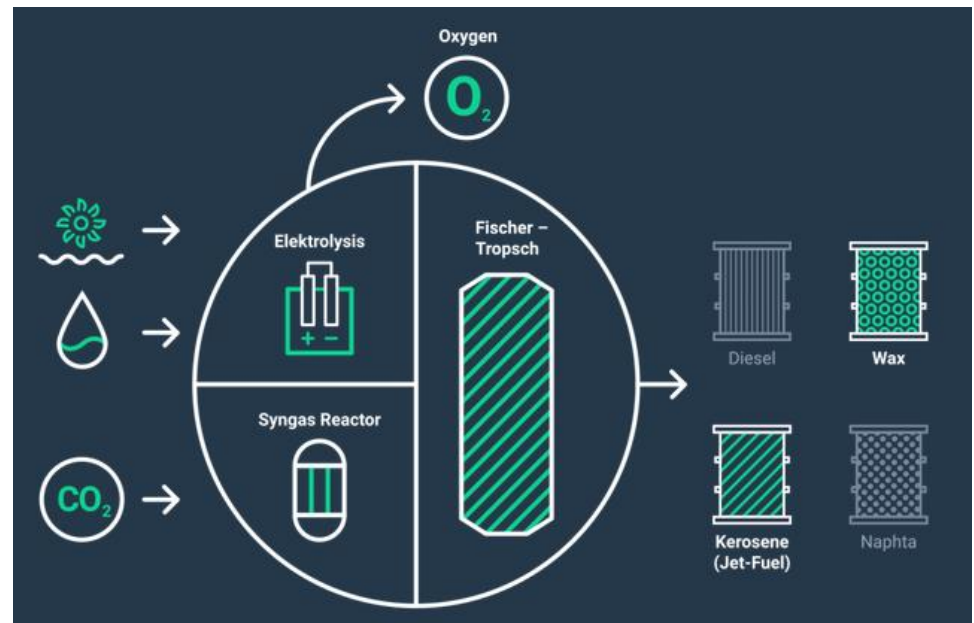
- Planned, Start-up 2024
- United States
- Products: renewable jet fuel, gasoline, high value protein products and corn oil products
- jet fuel component 170,000 m3/y
- Green hydrogen is expected to be made from water and renewable electricity



[https://gevo.com/wp-content/uploads/2021/09/Gevo\\_LakePreston\\_one-sheet\\_revised-08-31-21\\_FINAL2.pdf](https://gevo.com/wp-content/uploads/2021/09/Gevo_LakePreston_one-sheet_revised-08-31-21_FINAL2.pdf)

# E-Fuel: Nordic Electrofuels AS

- Nordic Electrofuel AS
- Power-to-Liquid jetfuel plant
- Start-up 2024
- Norway
- FT liquids 8,000 t/y



- <https://nordicelectrofuel.no/>

# Hydrotreatment Facilities TRL 6-9

## Products

- Renewable Diesel HVO
- Diesel with renewable content
- jet fuel component

## 42 Facilities

- 23 planned
- 17 operational or under construction

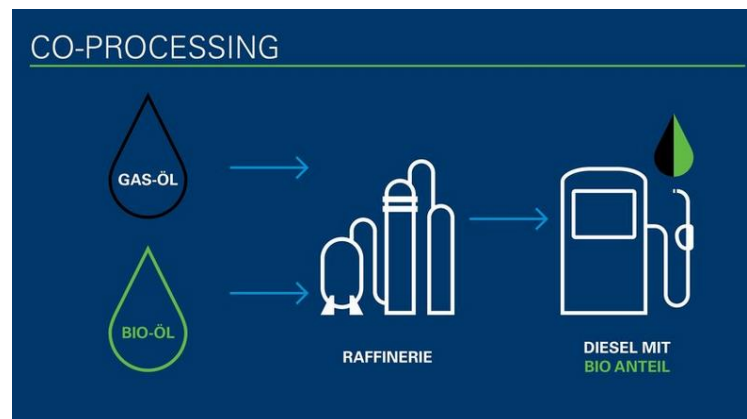


# Hydrotreatment - Capacity >200,000 t/a

| Project Owner        | Project name                       | Country       | Status             | Startup | Production    | Capacity |
|----------------------|------------------------------------|---------------|--------------------|---------|---------------|----------|
| Phillips 66          | Rodeo Renewed                      | United States | planned            | 2024    | 1,600,000 t/y |          |
| Neste                | Singapore expansion                | Singapore     | under construction | 2022    | 1,300,000 t/y |          |
| Preem                | Preem HVO diesel and biojet        | Sweden        | planned            | 2023    | 1,300,000 t/y |          |
| REG Geismar          | REG Geismar Expansion              | United States | planned            | 2023    | 1,032,000 t/y |          |
| ECB Group            | Omega Green Project                | Paraguay      | planned            | 2023    | 920,000 t/y   |          |
| World Energy         | Paramount Expansion                | United States | planned            | 2022    | 800,000 t/y   |          |
| Neste                | Rotterdam                          | Netherlands   | operational        | 2011    | 800,000 t/y   |          |
| Neste                | Singapore                          | Singapore     | operational        | 2010    | 800,000 t/y   |          |
| Preem                | Preem HVO 2015                     | Sweden        | operational        | 2015    | 800,000 t/y   |          |
| Neste                | Rotterdam expansion                | Netherlands   | planned            | 2025    | 800,000 t/y   |          |
| Preem                | Revamp Synsat unit                 | Sweden        | planned            | 2024    | 760,000 t/y   |          |
| Eni                  | Biorefinery Gela                   | Italy         | operational        | 2019    | 750,000 t/y   |          |
| Total                | La Mede                            | France        | operational        | 2019    | 500,000 t/y   |          |
| Neste                | Modify Rotterdam refinery for SAF  | Netherlands   | planned            | 2023    | 500,000 t/y   |          |
| UPM Biofuels         | UPM Kotka                          | Finland       | planned            | n.a.    | 500,000 t/y   |          |
| Diamond Green Diesel | Diamond Green Diesel               | United States | operational        | 2014    | 411,857 t/y   |          |
| ENI                  | Biorefinery Venice                 | Italy         | operational        | 2014    | 360,000 t/y   |          |
| Emerald Biofuels     | Emerald one                        | United States | planned            | n.a.    | 333,600 t/y   |          |
| CVR Energy Inc.      | Wynnewood renewable diesel project | United States | under construction | 2021    | 302,400 t/y   |          |
| Total                | Coprocessing Expansion Port Arthur | United States | planned            | 2024    | 300,000 t/y   |          |

# Co-processing plants

- Example: OMV / Austria, planned, Start-up 2023
- Co-processing of biogenic oil in existing mineral oil refinery
- 200,000 t/a of oil from oilcrops, oils and fats
- Product: Diesel with biogenic content



# Hydrothermal Liquefaction

- 3 demonstration facilities on TRL 6-7 producing bio-oil from lignocellulosics and forest residues

| Owner                                              | Project                        | Location  | Status                | Startup | Output Capacity [t/a] |
|----------------------------------------------------|--------------------------------|-----------|-----------------------|---------|-----------------------|
| Arbios Biotech<br>(JV Canfor Licella)              | Low Carbon Biofuel Plant       | Canada    | planned               | 2023    | 9,550                 |
| Silva Green Fuel<br>(JV of Statkraft<br>and Sodra) | industrial scale demo          | Norway    | under<br>construction | 2021    | 1,400                 |
| Licella                                            | Commercial demonstration plant | Australia | operational           | 2008    | 350                   |



# Hydrothermal Liquefaction - Example

- Arbios Biotech (Arbios) joint venture of Canadian Forest Products Ltd. (Canfor) and Licella Holdings Ltd. (Licella)
- Start-up 2023
- 25,000 dry tonnes of wood residue to 50,000 barrels of sustainable bio-oil

<https://arbiosbiotech.com/cat-htr-process>



# Jet Fuel Component Production Facilities

## TRL 6-9

### 3 Technology routes

- Hydrotreatment
- Gasification/FT
- Alcohol to Jet

### 40 Facilities

- 26 planned
- 13 operational, commissioning or under construction



# Jet Fuel Components from Hydrotreatment

| Project Owner       | Project name                          | Country        | TRL     | Status             | Startup |
|---------------------|---------------------------------------|----------------|---------|--------------------|---------|
| Neste               | Porvoo 1                              | Finland        | TRL 8   | operational        | 2007    |
| Neste               | Porvoo 2                              | Finland        | TRL 8   | operational        | 2009    |
| Neste               | Singapore                             | Singapore      | TRL 8   | operational        | 2010    |
| Neste               | Rotterdam                             | Netherlands    | TRL 8   | operational        | 2011    |
| Eni                 | Biorefinery Gela                      | Italy          | TRL 8   | operational        | 2019    |
| Total               | La Mede                               | France         | TRL 9   | operational        | 2019    |
| World Energy        | Paramount                             | United States  | TRL 6-7 | operational        | 2020    |
| Neste               | Singapore expansion                   | Singapore      | TRL 9   | under construction | 2022    |
| flexJET Consortium  | flexJET Demo                          | United Kingdom | TRL 6-7 | planned            | 2022    |
| SkyNRG              | DSL-01                                | Netherlands    | TRL 9   | planned            | 2022    |
| St1                 | St1 HVO                               | Sweden         | TRL 9   | planned            | 2022    |
| World Energy        | Paramount Expansion                   | United States  | TRL 8   | planned            | 2022    |
| ECB Group           | Omega Green Project                   | Paraguay       | TRL 8   | planned            | 2023    |
| Neste               | Modify Rotterdam refinery for SAF     | Netherlands    | TRL 9   | planned            | 2023    |
| Preem               | Preem HVO diesel and biojet           | Sweden         | TRL 9   | planned            | 2023    |
| Repsol              | Low Emissions Advanced biofuels plant | Spain          | TRL 9   | planned            | 2023    |
| Phillips 66         | Rodeo Renewed                         | United States  | TRL 9   | planned            | 2024    |
| Total               | Grandpuits                            | France         | TRL 9   | planned            | 2024    |
| Greenenergy         | Advanced biofuels project             | United Kingdom | TRL 9   | planned            | 2025    |
| Japanese Consortium | NEDO UCO to SAF Project               | Japan          | TRL 9   | planned            | 2025    |
| Neste               | Rotterdam expansion                   | Netherlands    | TRL 9   | planned            | 2025    |



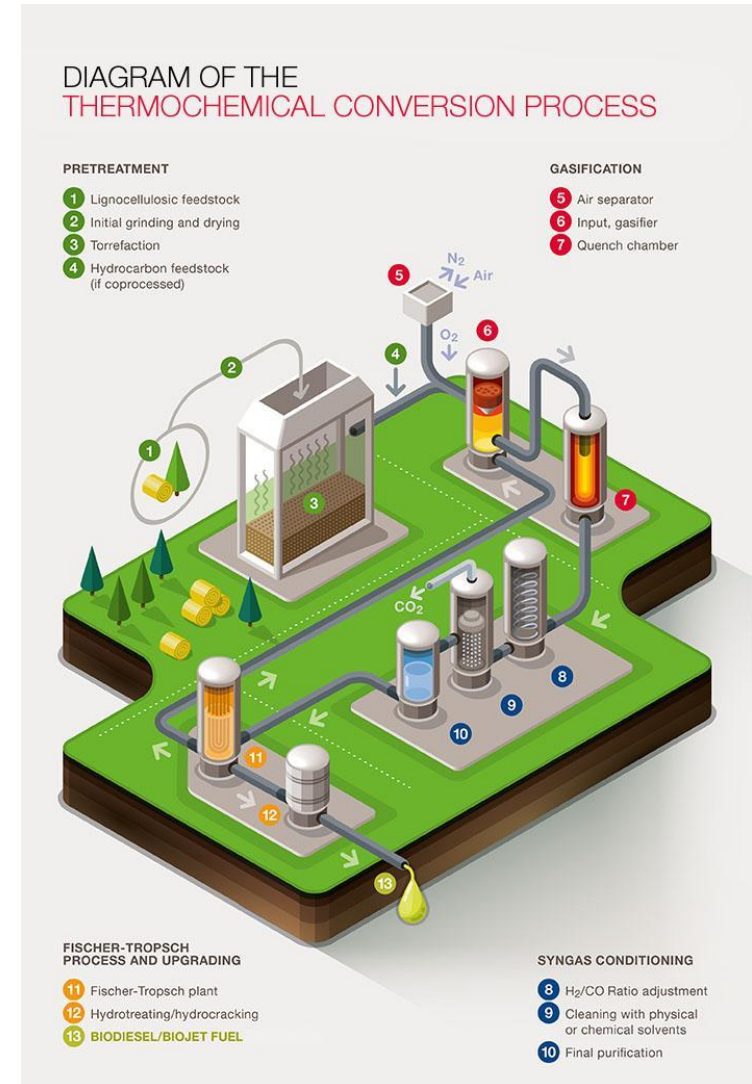
# Jet Fuel Components from Gasification and FT

- Input material: organic residues and waste streams, forest residues and lignocellulosics

| Project Owner                                                     | Project name                         | Country        | TRL     | Status             | Startup |
|-------------------------------------------------------------------|--------------------------------------|----------------|---------|--------------------|---------|
| Fulcrum (Sierra Biofuels)                                         | Sierra                               | United States  | TRL 8   | commissioning      | 2021    |
| Total                                                             | BioTfuel demo                        | France         | TRL 6-7 | operational        | 2021    |
| Red Rock Biofuels                                                 | Commercial                           | United States  | TRL 8   | under construction | 2022    |
| AgBioEn                                                           | Australian renewable energy facility | Australia      | TRL 6-7 | under construction |         |
| Fulcrum Bioenergy                                                 | Centerpoint                          | United States  | TRL 9   | planned            | 2023    |
| Velocys                                                           | Altalto                              | United Kingdom | TRL 8   | planned            | 2025    |
| Fulcrum BioEnergy                                                 | Fulcrum NorthPoint                   | United Kingdom | TRL 8   | planned            | 2025    |
| Joint Venture of Air Liquide, Enkern, Port of Rotterdam and Shell | W2C - Waste to jet                   | Netherlands    | TRL 8   | planned            | 2026    |
| Toyo and Velocys                                                  | Biomass-to-jet fuel project          | Japan          | TRL 9   | planned            |         |
| Fulcrum Bioenergy                                                 | Chicago                              | United States  | TRL 8   | planned            |         |
| Fulcrum Bioenergy                                                 | Japan                                | Japan          | TRL 8   | planned            |         |

# BioTFuel Demonstration plant

- Production of Biofuels via thermochemical conversion
- Dunkirk, France
- TotalEnergies and five partners
- Operational since 2021
- TRL 6-7
- 8,000 t/a FT Liquids
- <https://totalenergies.com/energy-expertise/projects/bioenergies/biotfuel-converting-plant-wastes-into-fuel>



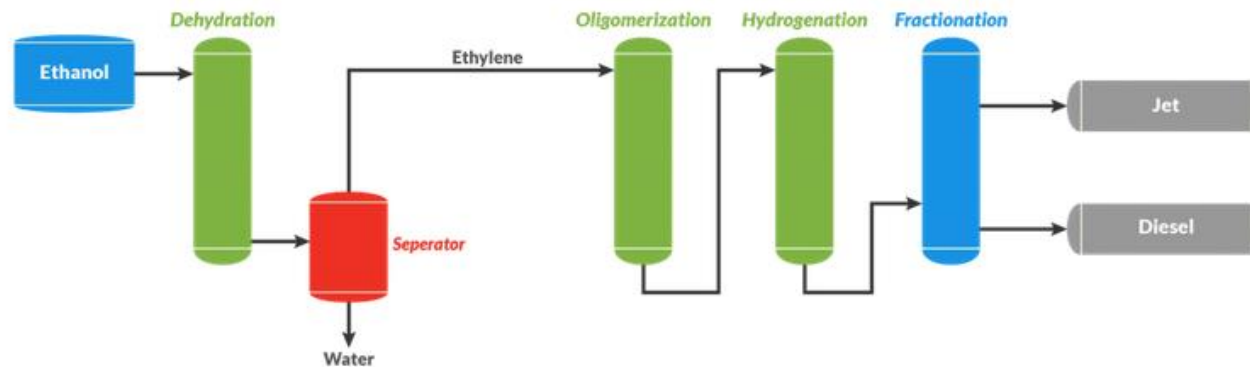
# Jet Fuel Components from Alcohol to Jet

- Input: different alcohols (e.g. Isobutanol, Ethanol, propanol, butanol, pentanol, Sugar starch crops, ...)

| Project Owner       | Project name                                                          | Country        | TRL     | Status      | Startup |
|---------------------|-----------------------------------------------------------------------|----------------|---------|-------------|---------|
| Gevo                | Silsbee                                                               | United States  | TRL 6-7 | operational | 2020    |
| LanzaJet            | Freedom Pines                                                         | United States  | TRL 8   | planned     | 2022    |
| Gevo                | Luverne                                                               | United States  | TRL 8   | planned     | 2023    |
| Swedish Biofuels AB | Swedish Biofuels                                                      | Sweden         | TRL 6-7 | planned     | 2023    |
| Gevo                | Net-Zero 1                                                            | United States  | TRL 9   | planned     | 2024    |
| FLITE               | LanzaJet™ Alcohol to Jet (AtJ)                                        | Netherlands    | TRL 8   | planned     | 2024    |
| LanzaTech UK        | DRAGON Decarbonizing and Reimagining Aviation for the Goal Of Netzero | United Kingdom | TRL 8   | planned     |         |

# LanzaJet ATJ Technology

- Commercial Facility Freedom Pines - Start-up 2022
  - United States, Capacity 38,000 m<sup>3</sup>/a
  - Source: sustainable and waste-based ethanol
  - Production of SAF and renewable diesel
- 
- <https://www.lanzajet.com/where-we-operate/>



# Trends in Advanced Biofuels Production plants

- **Diversification and combination of technologies** (including E-Fuels, Hybrid Systems, Co-processing, Alcohol to jet, ...)
- Rising number of **HVO and SAF facilities** and many in planning phase
- The **Commerzialisatation progresses** for some technologies f.e. Hydrotreatment
- Utilization of **waste streams and waste streams from non-biologic origin** for advanced fuels production

Thank you!

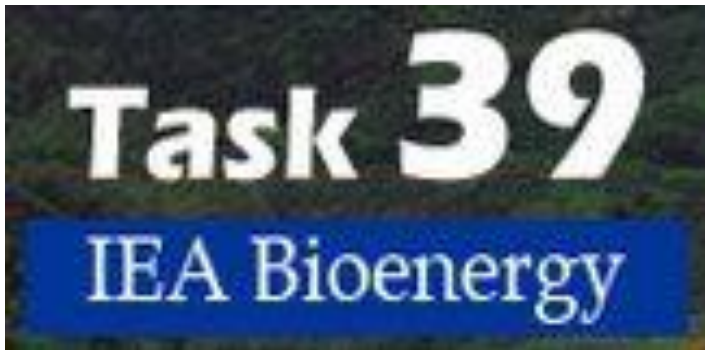
Please forward us new information on  
plants and activities!

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