TotalEnergies

Sustainable Aviation Fuels

Ready for take off

CAAFI Symposium

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June 2021

May 28th: Total is transforming and becoming TotalEnergies

TotalEnergies

OUR BELIEF
Energy is life.
We all need it and it's a source of progress.
So today, to contribute to the sustainable development of the planet facing the climate challenge, we are moving forward, together, towards new energies.

Our ambition is to be a world-class player in the energy transition.

Patrick Pouyanné
Chairman & Chief Executive Officer

OIL NATURAL GAS ELECTRICITY HYDROGEN BIOMASS WIND SOLAR


Our New
Climate Ambition
Get to
Net Zero
by 2050
#MakeThingsBetter

OUR AMBITION

GETTING TO NET ZERO

TotalEnergies share the ambition to get to Net Zero by 2050 together with society for its global business (Scope 1+2+3)

3 major steps to get TotalEnergies to Net Zero

1	**Net Zero on Operations by 2050 or sooner** (Scope 1+2)
2	**Net Zero in Europe by 2050 or sooner** (Scope 1+2+3)
3	**60% or more Net Carbon Intensity reduction by 2050** (Scope 1+2+3)

TotalEnergies HISTORIC COMMITMENT TO SAF

OVER 150 SUCCESSFUL COMMERCIAL FLIGHTS SINCE 2014

(1) Cathay Pacific, China Airlines, Iberia, China Southern, Japan Airlines

BECOMING A LEADER IN RENEWABLE FUELS

CAPTURING SYNERGIES WITH EXISTING ASSETS

Convert existing sites

La Mède
HVO Capacity 500 Kt/y
Incl. **100 Kt/y SAF**

Grandpuits
First Zero oil platform,
SAF 170 Kt/y (HVO 90)
Start-up 2024

Increase Coprocessing

Europe
300 Kt/y starting-up over 2022-24
SAF ~100Kt/y post 2027

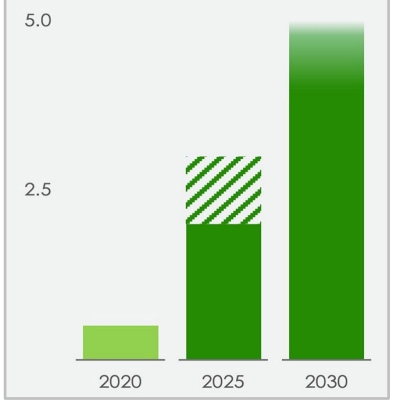
United States
Evaluating project in **Port Arthur** refinery

Expand existing new complexes

South Korea
Evaluating projects in Daesan. 500 Kt/y

Exploring projects (active discussions) with partners in Japan, Middle East, and the Unites States

Renewable Fuels production Mt/y



Renewable fuels : at least 2 Mt/year by 2025 and nearly 5 Mt/year by 2030

SAF: 500 kt/year by 2025 and up to 1.5 Mt/year by 2030, depending on market interest

Paris, May 18th, 2021

TotalEnergies, Air France-KLM, Groupe ADP and Airbus have joined forces to carry out the **first long-haul flight** (Paris-Montreal) **powered by SAF produced in France** (La Mède & Oudalle) **by TotalEnergies.** Blend of Jet A1 and **16% of SAF made from Used Cooking Oil.**

TotalEnergies APPROACH TO SAF FEEDSTOCK

ALL FEEDSTOCKS MUST FULFILL SUSTAINABILITY CRITERIA. SUPPLY WILL BE RESTRICTED BY LOGISTICS AND COMPETING DEMANDS.

SUSTAINABILITY

What type of feedstock is environmentally & socio-politically sustainable

- TOTAL does not consider 1G crop-based feedstock
- Recycling carbon (fossil-based feedstocks) as long as reductions in GHG emissions achieved
- Low carbon electricity from renewable source (solar, wind)

OPTIONALITY

Which industries are today's and futures use of feedstock

- Multiple industries competing for feedstocks and in particular road transport
- Aviation approach:
  - No food competition
  - Limited change in competing use (legislation)

COLLECTABILITY

What is the amount of feedstock economically reasonable to collect (and transport)?

- Degree of fragmentation
- Existence of infrastructure
- Geographical conditions

TotalEnergies THREE-STAGE TECHNOLOGY DEV.

TotalEnergies VIEWS TECHNOLOGY DEVELOPMENT AS CRITICAL. WE STARTED WORKING ON ALL THREE STAGES

❶ Scale up

Technology – Lipids hydrogenation

Feedstocks – Waste & residue lipids, Pyrolysis and Algae oils

- Scale-up production from sustainable lipids
- **Technology breakthrough**! Upgrade pyrolysis biocrude and develop algae-based oil use

❷ Expand

Technology – ATJ & GAS+X

Feedstocks – Ethanol, MSW, Wood and Ag residues, CO2, CO

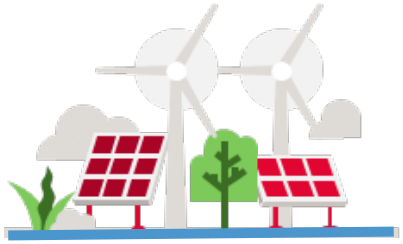
- Advanced and waste feedstocks provide large practical potential

❸ Develop

Technology – PTL

Feedstocks – Renewable electricity, CO2, CO

- Tap into a nearly unlimited resources
- Develop e-Fuels as renewable electricity and technology costs decline



WHAT SAF NEEDS TO TAKEOFF?

*THE **ASAP** FACTORS*

A

Availability

No significant SAF commercial volumes

- SAF volume today less than 0.01% of total fuel demand
- **But over 3,0Mt in announced capacity by 2025**

S

Sustainability

SAF standards to meet societal and political expectations

- Supply chain transparency with certified GHG benefits
- **Wastes and residues feedstocks preferred but limited in availability**

A

Affordability

SAF cost premium over conventional fossil jet

- SAF cost at least 4 times jet fuel which Jet fuel cost is the largest overhead expense for airlines
- **Further technological development and improved economics are needed**

P

Policy

Limited to some SAF national initiatives

- Policy mechanisms gathering pace but limited to national initiatives
- **Stable long term policy measures are crucial to scale up SAF demand**

EXECUTIVE SUMMARY

Growing pressure on the aviation sector to decarbonize its activity.

Liquid fuels are hard to substitute for long haul flights. Sustainable Aviation Fuels (SAF) are alternative to Conventional Aviation Fuels (CAF). They contribute in **reducing CO_2 emissions** and **do not require changes in existing infrastructures/aircraft**.

Cost of **SAF is superior to min 4 times fossil jet market price**. SAF development requires a supporting regulation. First regulatory mandates are appearing in Europe. With appropriate legislation and technology development, **SAF market could exceed 200Mt by 2050** (40% of the forecasted jetfuel market).

TotalEnergies aims at becoming a leader in renewable diesel / jet production while capturing synergies with existing assets. Grandpuits bio-refinery expected to produce 170kt SAF by 2024 using residual oils hydrotreatment technology (HEFA). We are exploring alternative routes to bring SAF to markets as early as 2021.

Among the 7 SAF approved pathways, **lipids hydrogenation** is the only commercial and the **least expensive technology to produce today**. However, its development could be **limited by the feedstock availability** (need to secure oil waste & residues feedstock).

TotalEnergies R&D concentrate efforts in developing 3 routes: (1) lipids hydrog. for assets development, (2) Other pathways including AtJ and FT, (3) E-fuels, even if currently limited by available renewable cheap power.

TotalEnergies

Thanks for your attention

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