BIO4A - Advanced sustainable BIOfuels for Aviation BIO4A

Scaling-up SAF production in Europe: lessons learnt from 5 years of BIO4A, introduction to the project industrial component

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Call: LCE-20-2016-2017 Topic: Aviation Biofuels
Project title: Advanced sustainable BIOfuels for Aviation (BIO4A)

PROJECT CONCEPT

Accelerate the deployment of Aviation Biofuels, enabling commercial production. Supporting the accomplishment of pre-commercial plant(s) for advanced biofuels for aviation based on sustainable biomass feedstock.

PROJECT OBJECTIVES

1) To bring HEFA to full commercial scale in new plant using residual lipids (Used Cooking Oil - UCO);
2) To investigate alternative supply of sustainable feedstocks recovering EU MED marginal land for drought resistant crop production;
3) To test the entire chain and logistic at industrial scale, and assess environmental performances.
4) Positive GHG and energy balance expected

Highlights (technological/non-technological):

- New Aviation Biofuel plant producing HEFA
- Production and test of HEFA in commercial flights in non-segregated mode
- R&D Work on marginal land in Spain and Italy recovered by biochar/compost addition producing non-food sustainable lipids
- Dedicated Dissemination, Communication and Exploitation action

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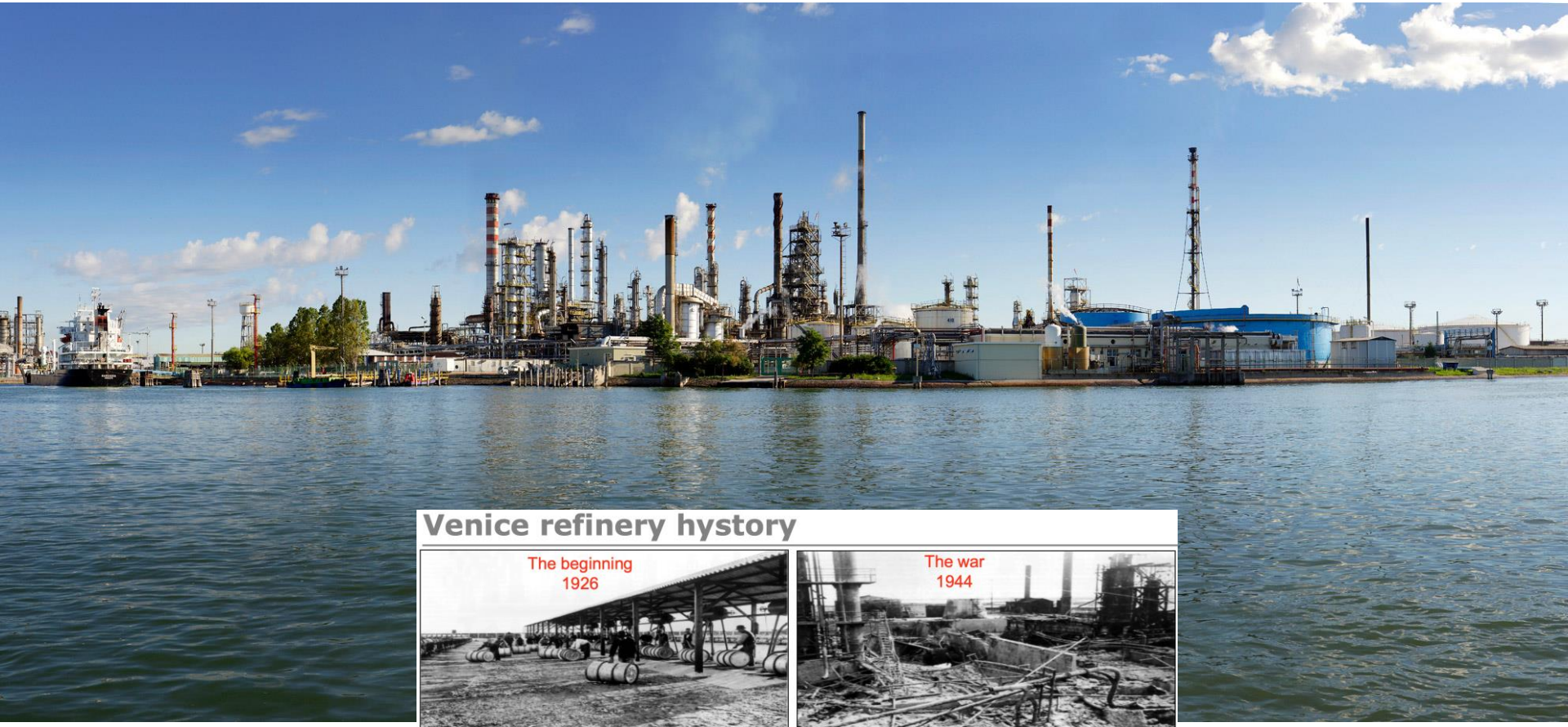
Industrial Activities M1 – M52



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Industrial Activities M1 – M52

GELA Biorefinery

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Industrial Activities M1 – M52

Current Status

- ✓ 1000 metric tons of HEFA produced by ENI in Gela from residual lipids
- ✓ HEFA is ASTM compliant (KPI attained)
- ✓ Internalized distillation step from HVO to HEFA by ENI in Livorno: revamping of unused, former distillation column
- ✓ Value chain demonstrated
- ✓ Flight plan delivered (SKYNRG)

Next steps

- ✓ Blending operations in Amsterdam by SKYNRG/KLM
- ✓ Fuel delivered to Schipol Airport
- ✓ Offtake by KLM for commercial flights

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R&D Activities M1 – M52

Current Status

- ✓ Year 3 agronomic field trials in Spain on marginal land completed, biochar protocol identified (CCE, RE-CORD)
- ✓ Year 1 agronomic field trials (larger scale) in Italy completed, biochar protocol confirmed (RE-CORD)
- ✓ Lysimeters Experiment Completed (RE-CORD)
- ✓ Larger climatic chamber for lysimeters experiments completed (RE-CORD)

- ✓ Assessment of potential for drought-resistant oil crop in marginal land of Southern Europe and abroad completed (JRC)
- ✓ Business case completed (SKYNRG)
- ✓ Waste feedstock market analysis completed (SKYNRG)
- ✓ Report on Market Dynamics delivered (SKYNRG)
- ✓ Environmental Assessment completed
- ✓ New drought-resistant Camelina variety patented (CCE)
- ✓ IPR Strategy identified (RE-CORD, CCE, ALL)
- ✓ Environmental and Social LCA to be published in April 2023

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R&D Activities M1 – M52

R&D Activities on biochar production plant from woodchips and agroresidues

- ✓ Design and test activities on Moving bed pyrolysis reactor model adaptation and innovative concept prototype (SPYRO)
- ✓ Mechanical works on Fixed bed carbonization unit.
- ✓ Moving bed carbonization unit installed, in operation since 2020.

R&D Activities performed on UCO pre-treatment to contribute to and enhance the long-term supply of this feedstock

✓ Hydrolysis and non-catalytic thermochemical conversion tests performed for alternative FFA production pathway

REDII Esca factor – Carbon Stock calculation

ANNEX V

METHODOLOGY FOR DETERMINING THE EMISSION SAVINGS FROM SOIL CARBON ACCUMULATION VIA IMPROVED AGRICULTURAL MANAGEMENT

Economic operators seeking to claim emission savings from soil carbon accumulation via improved agricultural management ($\mathbf{e_{sca}}$) in terms of g CO_2eq/MJ should use the following formula to calculate their actual values:

$$e_{sca} = (CS_A - CS_R) \times 3{,}664 \times 10^6 \times \frac{1}{n} \times \frac{1}{P} - e_f$$

Where:

CS_R	is the mass of soil carbon stock per unit area associated with the reference crop management practice in Mg of C per ha.
CS_A	is the mass of soil estimated carbon stock per unit area associated with the actual crop management practices after at least 10 years of application in Mg of C per ha.
3,664	is the quotient obtained by dividing the molecular weight of CO_2 (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) in g CO_{2eq}/g C.
n	is the period (in years) of the cultivation of the crop considered.
P	is the productivity of the crop (measured as MJ biofuel or bioliquid energy per ha per year).
ef	emissions from the increased fertilisers or herbicide use

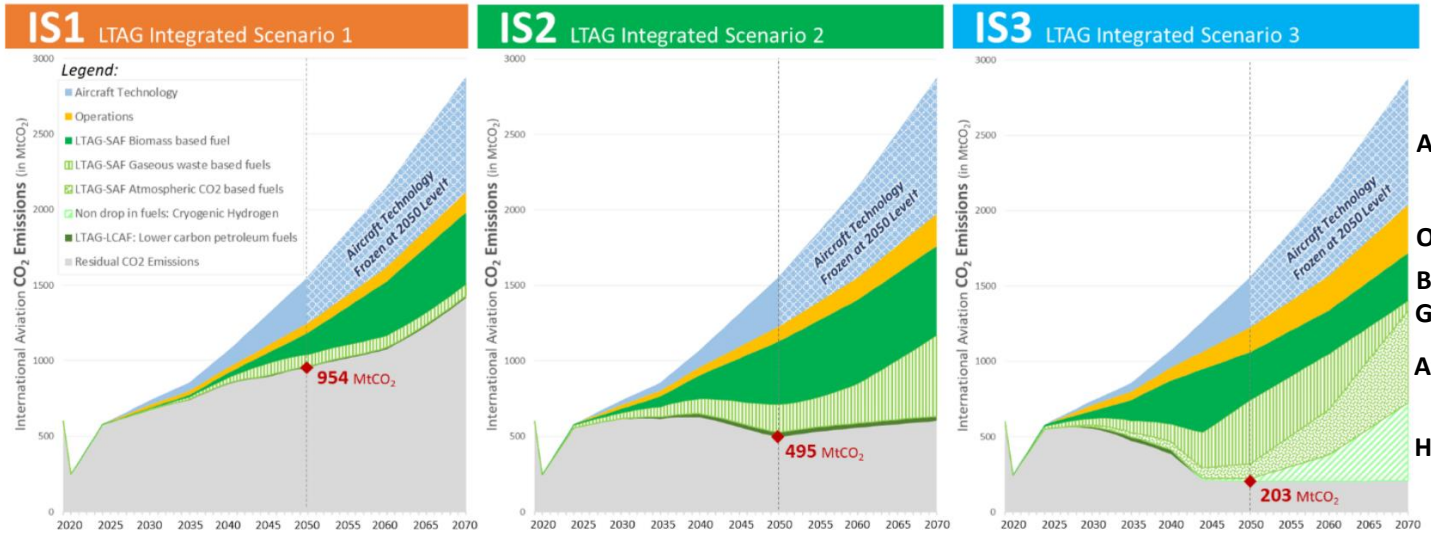
Biochar is included as an improved agricultural practice for Soil Carbon Accumulation

ICAO LTAG Scenarios

- **Integrated Scenario 1 (IS1)** : high readiness/attainability and low aspiration.
- **Integrated Scenario 2 (IS2)** : middle readiness/attainability and middle aspiration. mid-point 1 & 2
- **Integrated Scenario 3 (IS3)** : low readiness/attainability and high aspiration.

None of the scenarios reach zero CO_2 emissions *using* ***in-sector measures*** *(i.e. technology, operations, and fuels)*

- ***Aircraft Techn:*** *Advanced tube and wing, unconventional airframe/propulsion concept aircraft, non-drop-in fuels such as battery electric etc*
- ***Operations****: improvements in the performance of flights across all phases*



† Caution required with the interpretation of absolute CO_2 emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO_2 emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO_2 emissions from international aviation associated with LTAG Integrated Scenarios

Sustainable Aviation Fuels

- **142** Mt CAF at 2010 → 570-**860** Mt at 2050 (Intern. Aviation) + 400-600 % !!
- **100% CAF** substitution (**MAX** scenario) – **170 new biorefineries each year** from **2020 to 2050** (15-60 $B/y) - **MAX** would reduce **CO_2 emission by 63%** ***Source: UN-ICAO, 2017***

→ Opportunity for nature-based inter-sector C offsetting solutions (**compensation**) in future scenarios

EU actions on Carbon and Sust.Fuels

EUROPEAN COMMISSION

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles.

EC 15.12.2021, COM(2021) 800 final

EN **EN**

EUROPEAN COMMISSION

Brussels, 30.11.2022
COM(2022) 672 final

2022/0394 (COD)

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a Union certification framework for carbon removals.

EC 30.11.2022, COM(2022) 672 final

EN **EN**

COMMISSION IMPLEMENTING REGULATION (EU) 2022/996 of 14 June 2022
on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land- use change-risk criteria

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (1), and in particular Article 30(8) thereof,

Whereas:

(1) Directive (EU) 2018/2001 expands the role of voluntary schemes to include the certification of the compliance of biomass fuels with sustainability and greenhouse gas (GHG) emissions saving criteria and the compliance of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels with the respective GHG emissions saving criteria. Furthermore, the voluntary schemes can be used to certify biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

(2) In order to establish whether biofuels, bioliquids, biomass fuels, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of Directive (EU) 2018/2001, the correct and harmonised functioning of voluntary schemes is essential. Harmonised rules should therefore be established, to apply across the certification system, bringing about the necessary legal certainty on the rules applicable to economic operators and voluntary schemes.

(3) With a view to minimising the administrative burden, the implementing rules should be proportionate and limited to what is required to ensure that compliance with the sustainability and GHG emissions saving criteria and other requirements is verified in an adequate and harmonised manner that minimises the risk of fraud to the greatest extent possible. The implementing rules should therefore not be considered as a comprehensive standard but rather as minimum requirements. The voluntary schemes may accordingly complement these rules as appropriate.

(4) Economic operators may decide at any time to participate in a different voluntary scheme. However, in order to prevent an economic operator that has failed an audit under one scheme from immediately applying for certification under another scheme, all schemes receiving an application from an economic operator should require that operator to supply information about whether it failed an audit in the previous 5 years. This should also apply to situations where the economic operator has a new legal personality but remains the same in substance, so that minor or purely formal changes, for instance, in the governance structure or the scope of activities, do not exempt the new economic operator from such a rule.

(1) OJ L 328, 21.12.2018, p. 82.

BIO4A – Lessons learnt from industrial component

Production of HEFA is possible, but challenging

- **Current SAF supply** remains low—less than **0.05 %** of total EU aviation fuel use *(EASA: EU Envir.Report 2022, EASA)*
- SAF volumes in the EU will increase very fast
  - ✓ ***SAF**: 2% 2025, 5-6 % 2030, 32-37% 2040, 38-54% 2045, 63-85% 3050, of which*
  - ✓ ***Synthetic fuels** (eFuels): 0.04% 2025, 0.7-2% 2030, 5% 2035, 8-13% 2040, 11-27% 2045, 28-50% 2050*
- HEFA Technology is ready, **capacity expanded** through BIO4A
- Key issue is to develop **supply chains** for sustainable lipids compliant with REDII (III)
- **New value chains** (e.g. lignocellulosic) must quickly rump-up to full industrial scale
- **Book & Claim**?
- **<u>In-sector measures not sufficient in any scenario</u>**

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Thanks for your attention!

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