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ICAO SEMINAR ON
ALTERNATIVE FUELS 2017
ICAO Headquarters, Montréal, 8-9 February 2017



Bioqueroseno & ITAKA

María de la Rica & Inma Gómez

Session 4 – Catalysing Energies: Initiatives & Partnerships for Aviation Alternative Fuels





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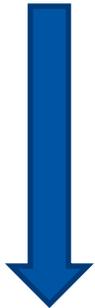
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Background

ITAKA is a collaborative project framed in the implementation of **GLOBAL, EU** and **NATIONAL** policies:



2009: 1st International Conference on Aviation Biofuels held by **ICAO**



2010: **SPAIN** sets off a study to explore the potentials of aviation biofuels

2011: The **EC** presents the **EU Advanced Biofuels Flightpath**



2011: **SPAIN** launches the National **Bioqueroseno Initiative**

2012: **ITAKA** starts

2016: **ITAKA** ends





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Background

A key point was to promote and create an efficient **supply** chain, from **SUPPLY** (biomass cultivation and conversion) up to **DEMAND** (airlines and standards)



ITAKA linked **supply and demand** by connecting the **full value-chain**: feedstock grower, biofuel producer, distributor and airlines.





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Partners

	SENASA Project Coordinator
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	Airbus Group
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	Camelina Company España (CCE)
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	Consorzio per la Ricerca e la Dimostrazione Sulle Energie Rinnovabili (RE-CORD)
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	EMBRAER
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	Neste
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	Asociația Centrul de Biotehnologii Microbiene BIOTEHGEN
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	Compañía Logística de Hidrocarburos S.A. (CLH)
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	École Polytechnique Fédérale de Lausanne (EPFL)
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	Manchester Metropolitan University (MMU)
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	SkyNRG
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✓ demonstrate the readiness of SPK large-scale production & use





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ITAKA Outcomes



Itaka

SENASA



Project structure

1.- PRODUCTION

- *Feedstock*
- *Conversion technology*

2.- LOGISTICS and LARGE SCALE USE

- *Logistics*
- *Engine and fuel systems testing*

3.- SUSTAINABILITY ASSESSMENT

4.- OUTREACH





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Feedstock

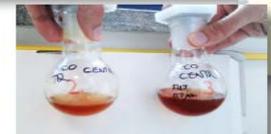
PRODUCTION

Camelina large scale plantations (<15.000 ha for production and 1719 R&D plots) **4** in Spain + **2** in Romania

- Selected and new camelina **varieties adapted** for Europe and with increased **oil content** (20 varieties tested)
- Optimized camelina **growing protocols**, tested with **536 farmers, in 16 regions**
- Testing camelina cultivation in **polluted land**
- Marketing **co-products** (meal, husks, straw) & **crushing** improvement tests

Used Cooking Oil (UCO)

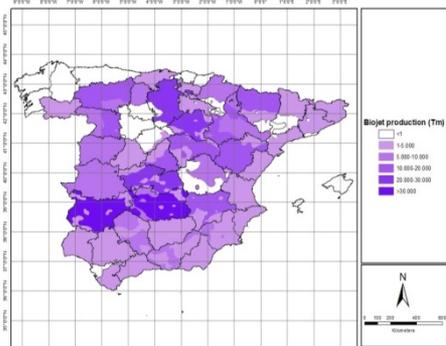
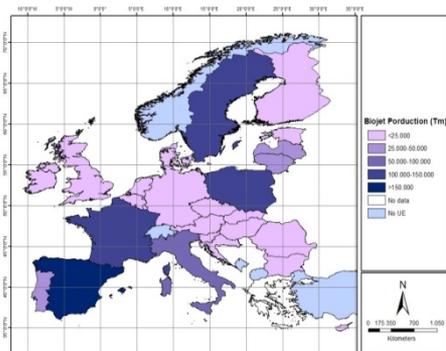
- **Market** analysis (availability and costs)
- Innovative **pre-treatment** and upgrading methods studied, catalytic pyrolysis





Total potential sustainable camelina land

- 7.5 M ha left fallow every year in EU
- from those, 2.1 M ha (25% in Spain) could be used to produce **sustainable camelina oil** equivalent to **700,000 tons of camelina biojet** yearly
 - saving over 1.7 Mt of CO_{2eq}
 - substituting > 1% of the jet fuel consumption in the EU.





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PRODUCTION

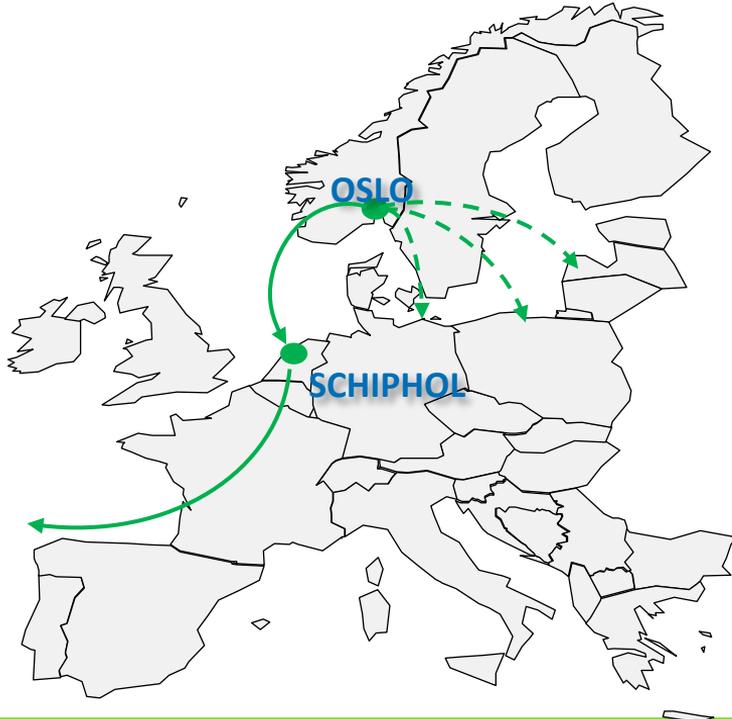
Conversion technology



- **Improved refining facilities** (better adapted to biojet requirements vs. renewable diesel)
- Adapted **protocol** for in house **quality testing**
- Coordination with the UCO catalytic pyrolysis tests
- HEFA vs. HEFA+? Lower production costs but lower blends



LOGISTICS and LARGE SCALE USE



2014 Biofuel @ Schiphol



- 18 KLM flights on A330 from Amsterdam to Aruba
- Fully segregated biojet fuel logistics

2016 Biofuel @ Oslo



- Fully segregated biojet fuel logistics for 80 KLM flights on E190 from Oslo to Amsterdam
- Non-dedicated airport logistics: Biofuel supply via airport tank farm & hydrant





Fully segregated biojet logistics



Schiphol & Oslo:
KLM/Airbus flights in 2014
KLM/Embraer flights in 2016

- 1 Bio jet production
- 2 Blending & Certification to Jet A-1
- 3 Distribution to airport
- 4 Airport logistics
- 5 Aircraft fueling & biofuel flights

Non-segregated logistics: use existing jet infra



ITAKA/AirBP 2016 supply via Oslo airport tankfarm



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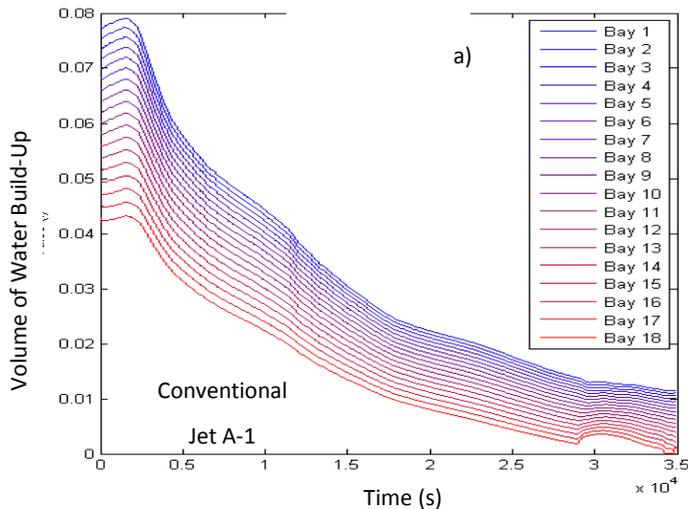
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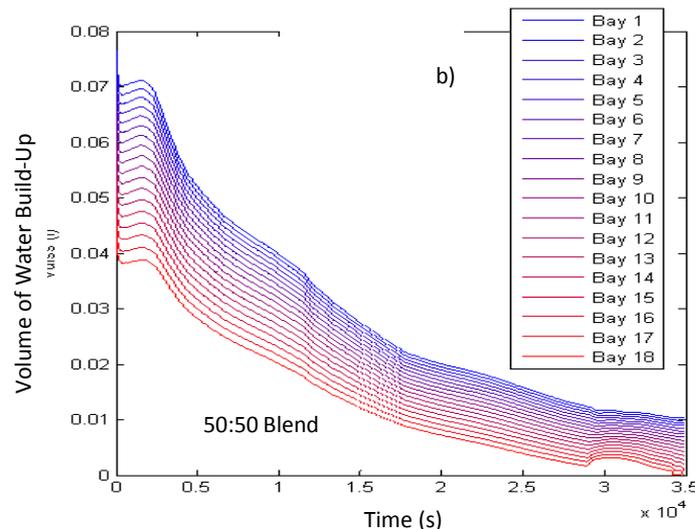
Water solubility of biofuels

50:50 HEFA Jet A-1:Conventional Jet A-1

Water Build-Up vs. Time



Water Build-Up vs. Time



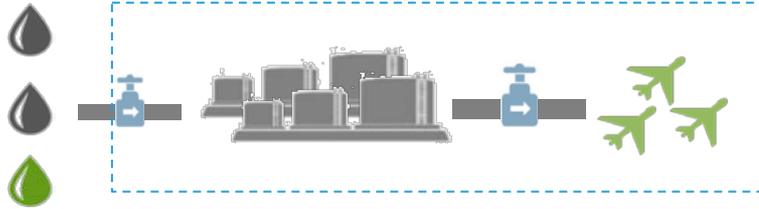
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Per flight...





Biojet physically delivered to all aircrafts fueled from shared airport hydrant system



- No physical tracing of biojet possible
- No distinction in bio/fossil batches in airport administration
- Airline paid for it, wants to claim GHG savings (e.g. EU ETS)

How it worked for Oslo deliveries...

- ▶ **1. Traceability & Proofs of biojet delivery up to airport:**
 - Batch numbers & bio ratio on product quality certificates and transport documents forming closed chain
- ▶ **2. Proofs of Sustainability (PoS) up to airline:**
 - PoS demonstrates EU RED compliance of biojet (audited by independent certification bodies) and shows volumes transferred
 - PoS sent from producer to supplier to airline in Nabisy (the German biofuel accounting system)
- ▶ Two document chains connected via declaration on identity by Neste linking volume registered in Nabisy with identical volume and batch number on their delivery documentation
- ▶ Airline reported biojet consumption via Nabisy and claimed GHG reductions under EU ETS



Emissions effects – APU tests

Effects with increasing blend ratio

Engine performance:

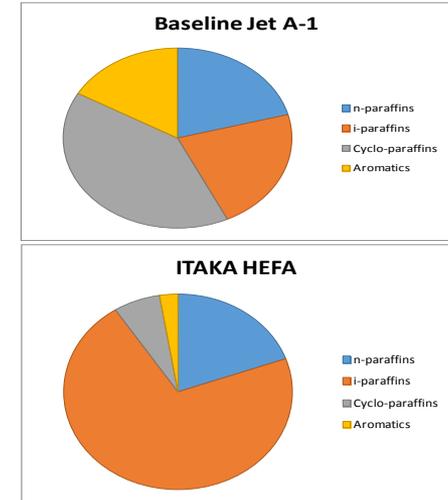
- ✓ A reduction in fuel flow (kg/sec)
- ✓ A small reduction in the engine EGT

Gaseous emission species:

- ✓ CO is slightly reduced.
- ✓ UHC no change / slight reduction.
- ✓ NO_x remains approximately constant.
- ✓ CO₂ is linearly reduced.
- ✓ H₂O is linearly increased.

Particulate matter characterization:

- ✓ A pronounced and linear reduction in SAE smoke number.
- ✓ A significant reduction in nvPM mass & number emissions is accompanied by a move to smaller size.



ITAKA HEFA significantly different chemical composition to JetA1



3.- SUSTAINABILITY ASSESSMENT:



- **GHG savings** estimated to potential achieve 66%, RSB certification for the CCE camelina oil plantations
- **Low ILUC risk assessment framework:** fallow land rotation, no demand of additional land or substitution of crops
- Several **sustainability checks**, inc. **LCIA** and **SEIA**



4.- OUTREACH:



ITAKA worked to build-up a strong partnership to **contribute to a worldwide effort.**

Detailed project results are available at www.itaka-project.eu or upon request



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Beijing

Asia and Pacific
(APAC) Office
Bangkok



María de la Rica

Inmaculada Gomez

THANK YOU