

# The European Commission's science and knowledge service

Joint Research Centre

## Alternative Aviation Fuels: Life-Cycle Emissions and Energy Profiles

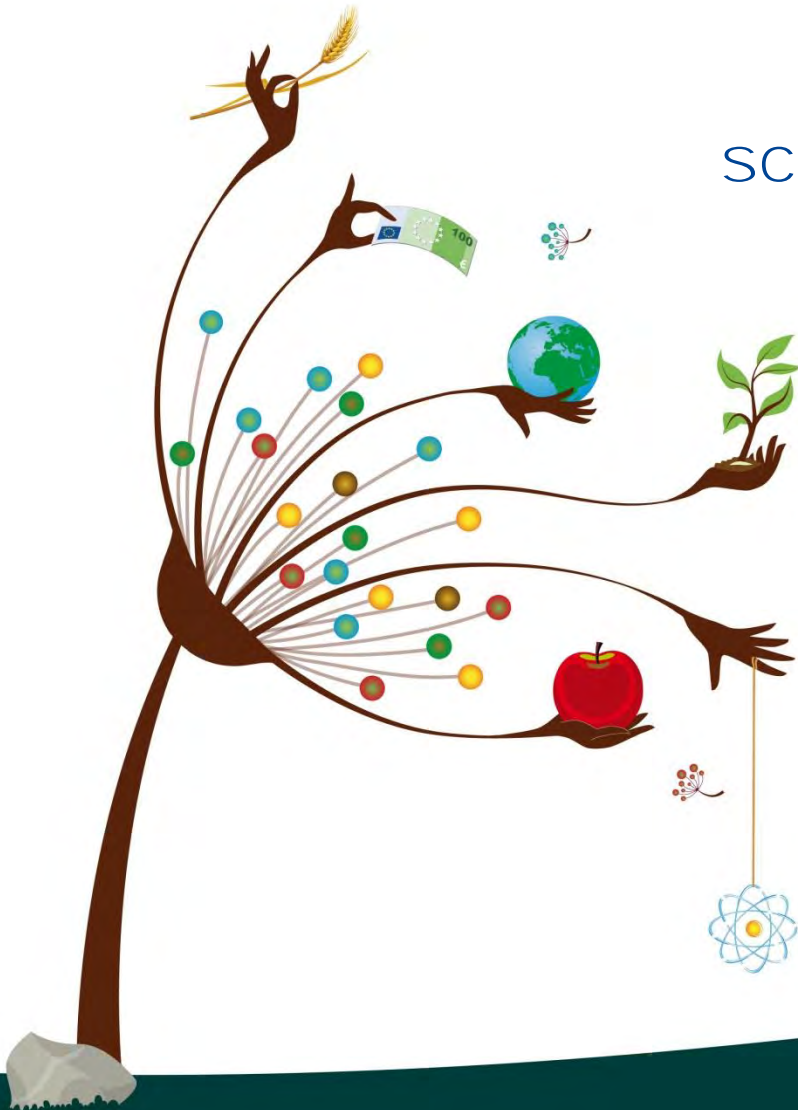
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*Energy, Transport and Climate Change*

*2<sup>nd</sup> ECATS Conference*

*Athens – 7-9 November 2016*





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## JRC Role – Facts and Figures

- 6 locations in 5 Member States
- **1 500 core research staff**, out of around 3 000 total staff
- **83%** of core research staff with **PhDs**
- Research fellows and visiting scientists
- **42 large-scale research facilities**, more than 110 online databases
- More than **100 economic, bio-physical and nuclear models**



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## JRC Role – Facts and Figures

- **Focus** on the **priorities** of the Commission (80% of activities co-designed with partner DGs)
- Work for **more than 20 policy DGs** and several **project teams**
- Expertise in a **wide range of areas**, from economic and financial analysis through to energy and transport, health, environment and nuclear safeguards



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## JRC Role – Facts and Figures

- **Independent** of private, commercial or national interests
- **Policy-neutral:** has no policy agenda of its own
- **30%** of activities in **policy preparation**, **70%** in **implementation**
- **Transversal** service - cuts across policy silos

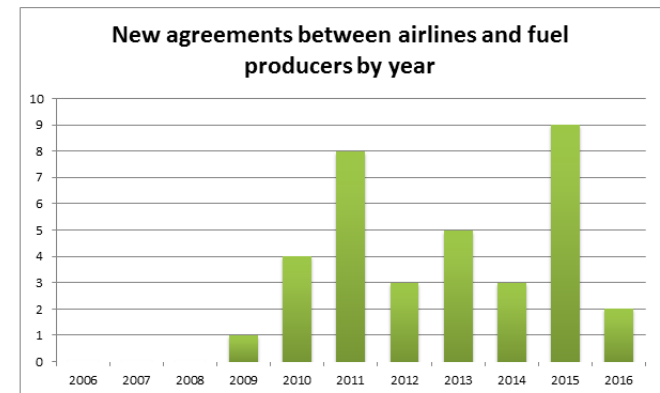
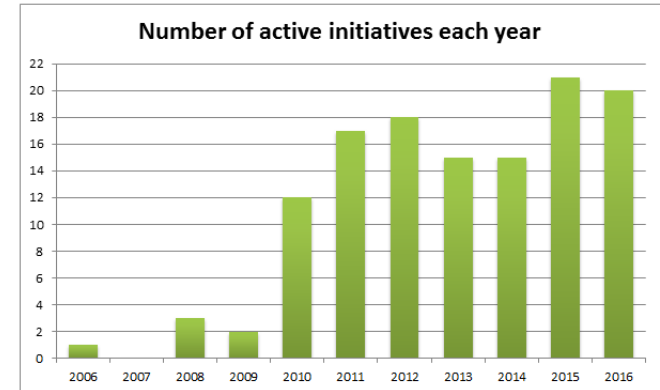
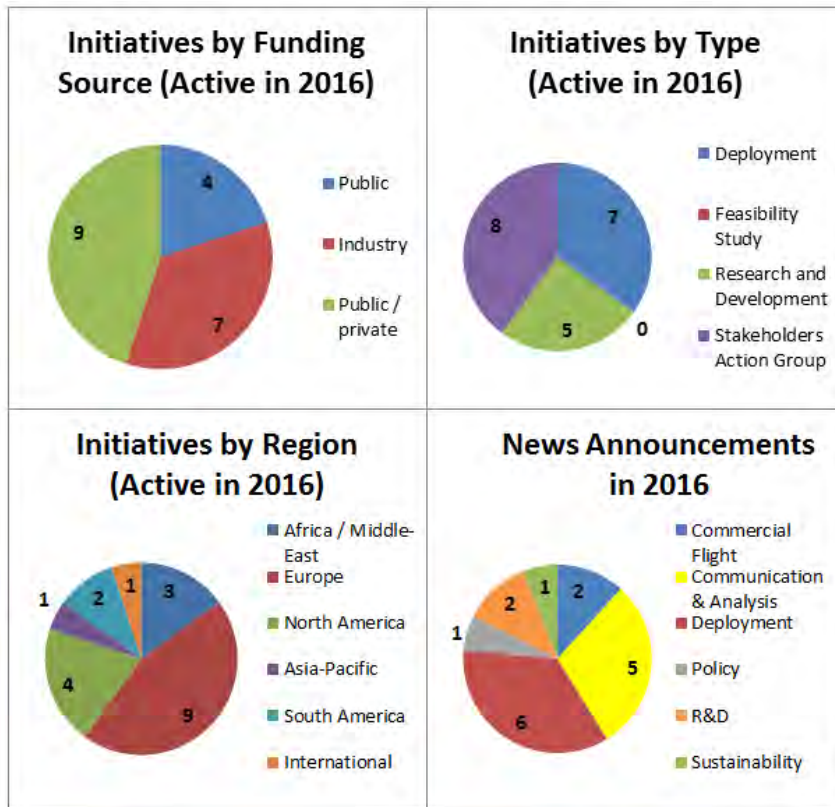
# Alternative Aviation Fuels: Life-Cycle Emission and Energy Profiles

## Overview

- General remarks
- JRC AJF study: overview and foremost considerations
- Key points:
  - Greenhouse Gas Savings and Energy Efficiency
  - Marginal or Average Values
  - Co-product Methods
- Conclusions

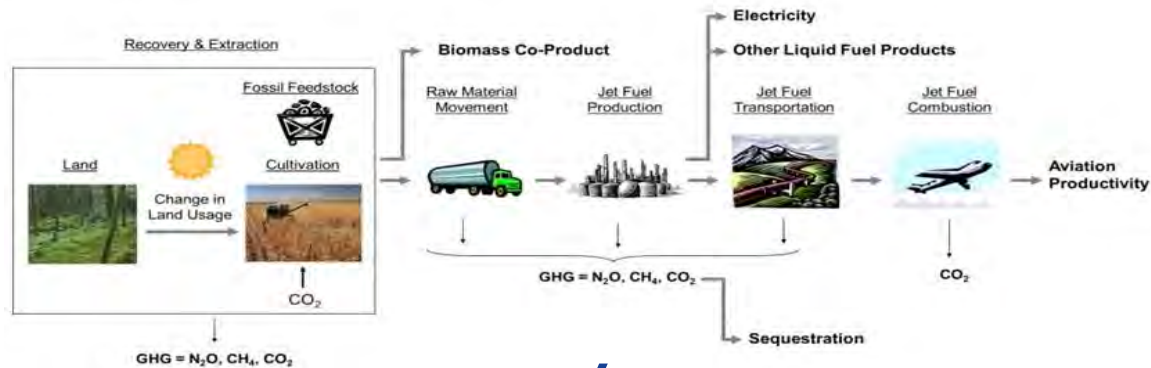
# Alternative Jet Fuels

## ...a growing role towards sector's decarbonisation



# Opening consideration on system boundaries

So-called **“Well-to-Wake”** analysis



≠

**“Life-cycle analysis”**



Implicit assumption:

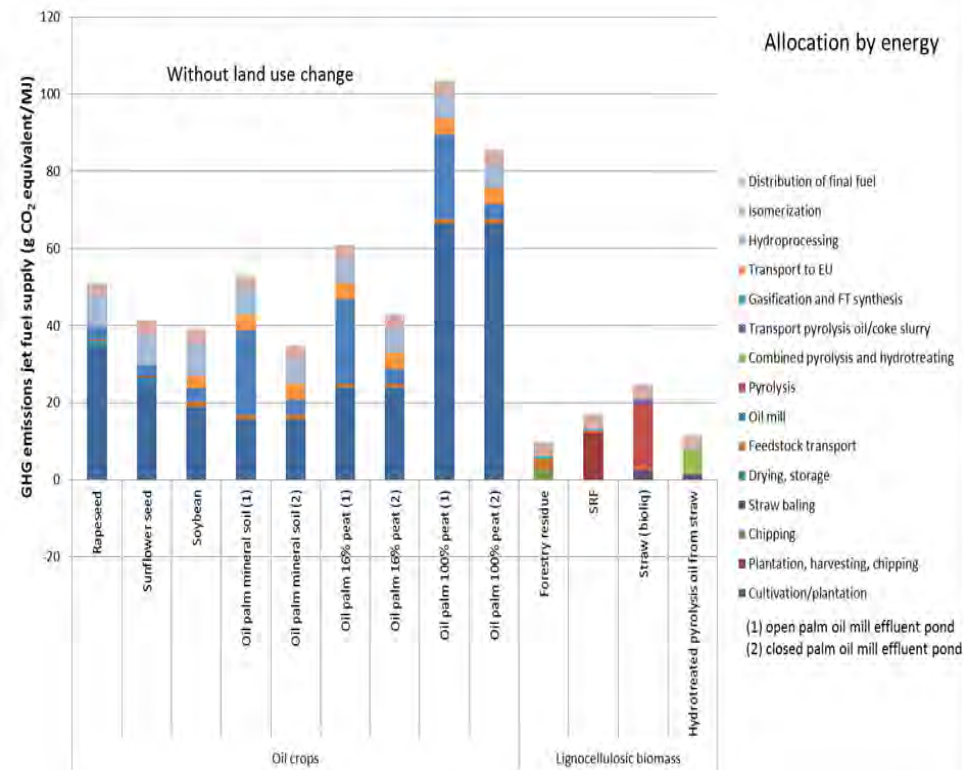
Effects are the same  
wherever they occur

- GHG emissions acting at global scale
- False for other metrics (air, water, ...)

# JRC AJF study foremost considerations

GHG emissions profiles and energy efficiency of representative alternative jet fuels tell us:

- Transparent methodology choices /assumptions: a fundamental element for correct “reading” of results.
- Variety of results across studies: results likely to be “similar” in fact rather than the same: tricky to define values in a regulatory framework at global scale.
- The specific pathway is critical: there is no “good” or “bad” feedstock/conversion process: dis/incentives to steer performance...and deployment!
- Generally: a given GHG reduction potential is achieved at the cost of higher energy expended per fuel unit produced.





# GHG savings and energy efficiency

Growing relevance  
(...of GHG emissions  
generated by aviation)



Focus on GHG emissions  
reduction potential of  
AJFs

???

What about energy  
efficiency of AJFs

...in other words...

Question

if energy efficiency is  
considered, which AJFs are still  
an efficient option?



Functional unit considered:  
MJ expended (both fossil and  
renewable) to produce MJ of  
final fuel



# Marginal or Average Values

Aim: to assess the marginal impact of extra (or less of) any given fuel



reflecting rational choices of economic operators

The marginal/incremental approach is instrumental to:

- Guide judgements on the potential benefits of substituting conventional fuels by alternatives;
- For future fuels: understand where the additional energy resource would come from (if demand for a new fuel were to increase).



Marginal refining emissions  
Marginal natural gas  
Marginal processing of biofuel (new bio-refinery)



Average emissions as proxy:  
EU electricity emissions  
Crops cultivation: marginal emissions for *extra* crop:  
from yield intensification  
expansion onto marginal cropland

# Co-product methods: a critical choice

Processes in fuel supply chain may produce multiple products (besides aviation fuel) and interplay with GHG performance of other sectors/markets.

The **guiding principle** (to opt for an allocation method) **is** the transparent assessment of LCA effects on fuel pathways carbon reductions minimizing distortion.

...While **accounting for** knowledge on:

- actual use of the co-products;
- level of understanding of co-products markets, (incl. its maturity and stability);
- relative magnitude and value of fuel products vs. co-products;

**Energy allocation** is okay for co-products valued based on their energy content

**But...**

not a robust choice for co-products not valued on the basis of their energy content



main advantage of **substitution method** (tracking the fate of co-products) becomes shaky

- Considering uncertainties, and
- Recognising limited knowledge and data availability for the majority of co-product markets



## Conclusions

- AJFs have considerable potential ahead: careful consideration and action to avoid/minimize negative externalities.
- Net GHG benefits if tackling climate change is the goal
- **No “good” or “bad” pathway and robust assessment:**
  - Efficient allocation of (scarce) resources: GHG emissions AND energy efficiency
  - Guidance to economic operators: preference to marginal vs average values
  - Net GHG emissions’ benefits: impacts on other sectors/markets via co-products
- Robust sustainability criteria and implementation schemes in the deployment of AJFs to avoid:
  - Missing the goal (tackle climate change)
  - Misleading investment signals to economic operators

Thank you for your attention!



...Happy to take your questions

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