Alternative Fuels for Aviation:
a green perspective for Aviation

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ΥΠΗΡΕΣΙΑ ΠΟΛΙΤΙΚΗΣ ΑΕΡΟΠΟΡΙΑΣ

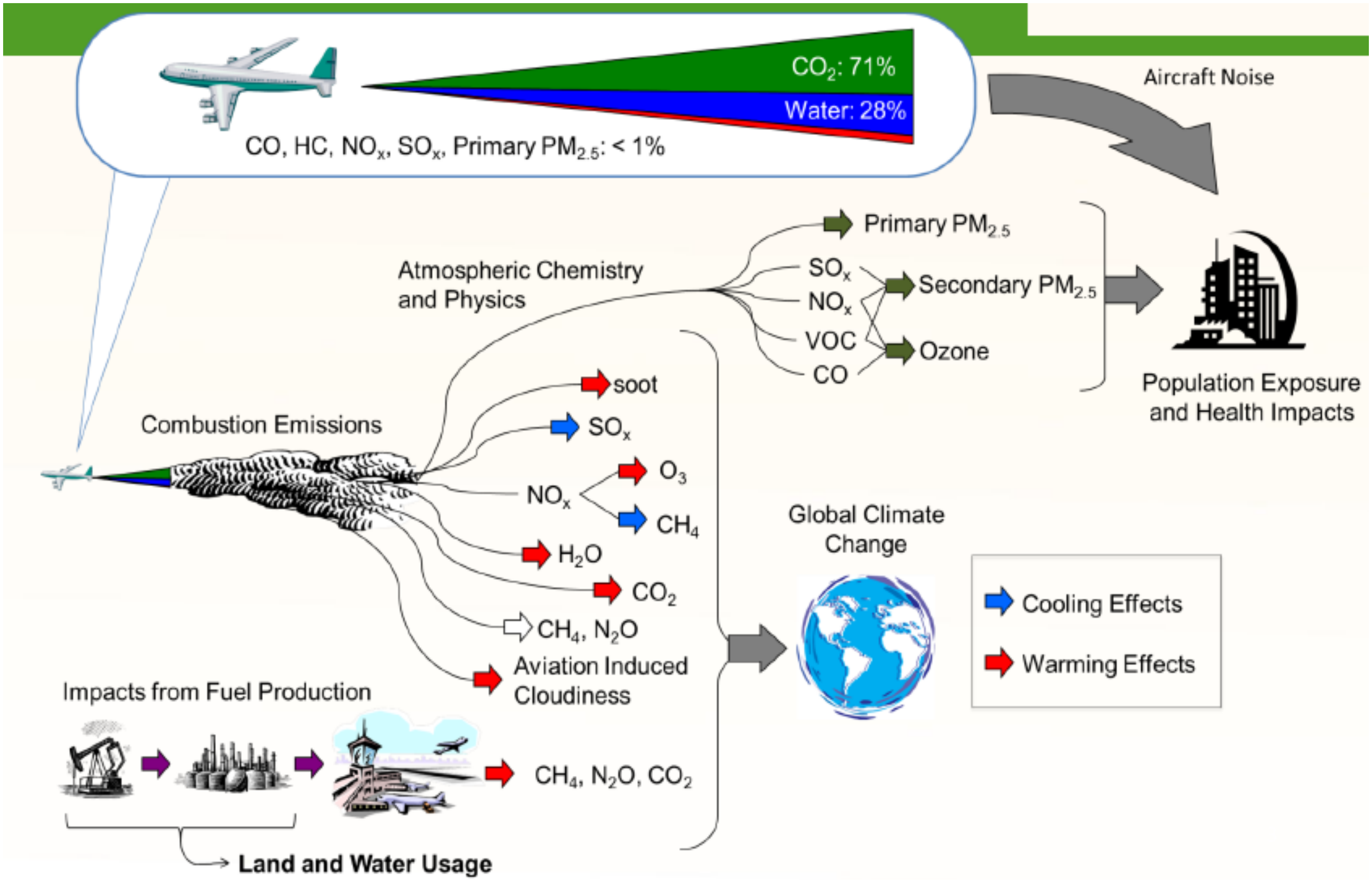
Presentation Content

- Introduction
- Milestones in aviation fuel development
- Alternative fuels Sustainability
- Life cycle analysis
- Environmental and societal impacts
- Conclusions

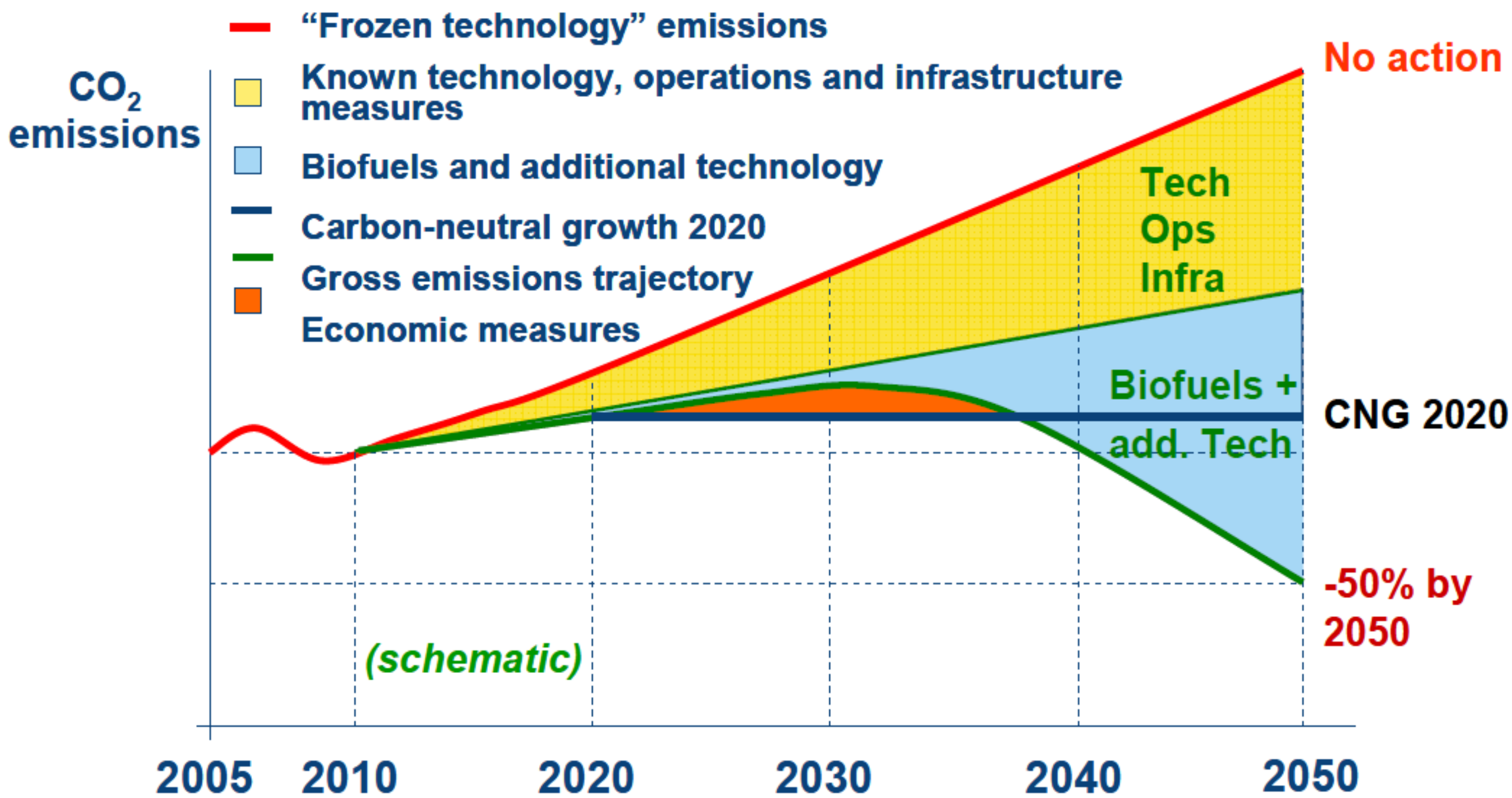
Introduction

- Aviation's mission is to build more fuel efficient aircraft fleet and operate it safely while minimizing environmental impacts
- GHG emissions and climate change driver for the introduction of alternative fuels in aviation
- Drop-in fuels are the only current candidates for aviation, since any perceived production cost advantages of non-drop-in fuels cannot compensate costly incompatibilities with the current equipment and infrastructure
- Regulations in Europe, United States and other countries promote the use of renewable energies
- Environmental certification following sustainability framework should ensure the sustainability of biofuels production

Aviation Impact on Environment

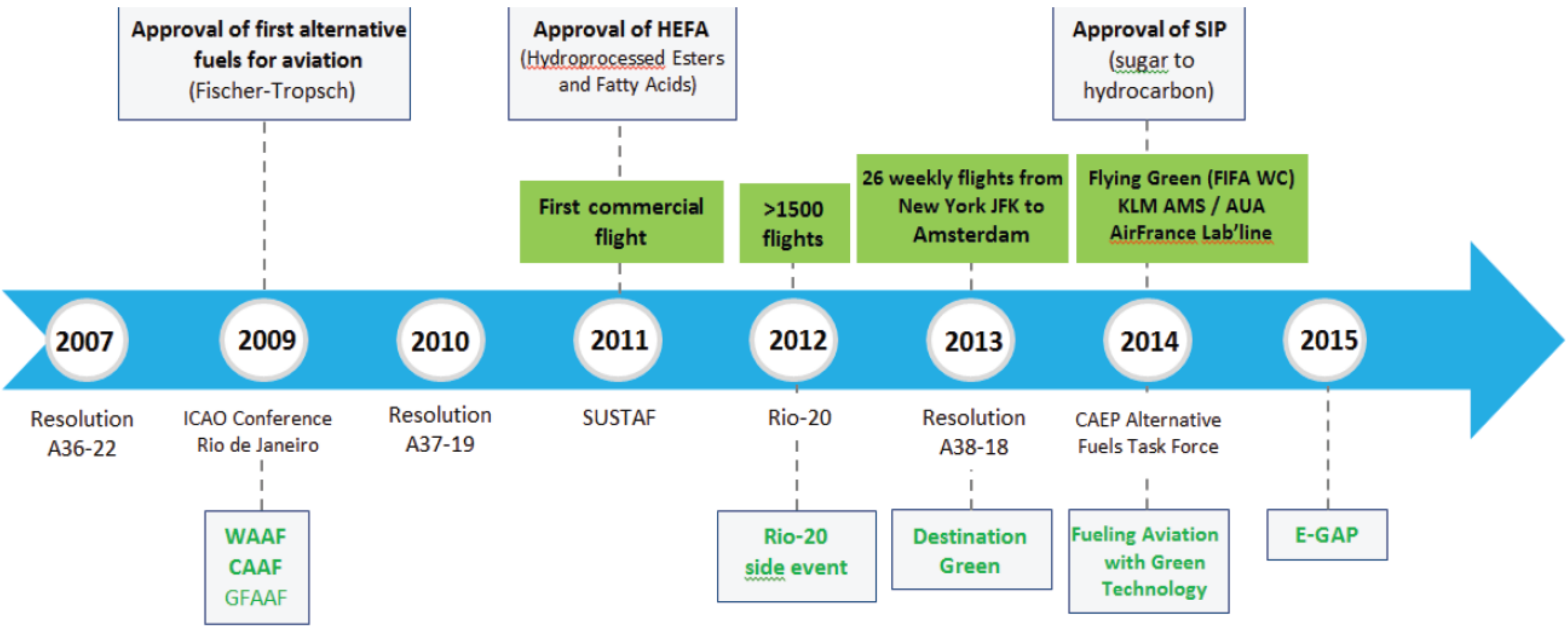


Aviation Emissions Reduction Roadmap



The aviation community calls for a reduction of the sector emissions, by setting aspirational goals for Carbon Neutral Growth by 2020 (CNG2020)

Milestones in aviation fuel development



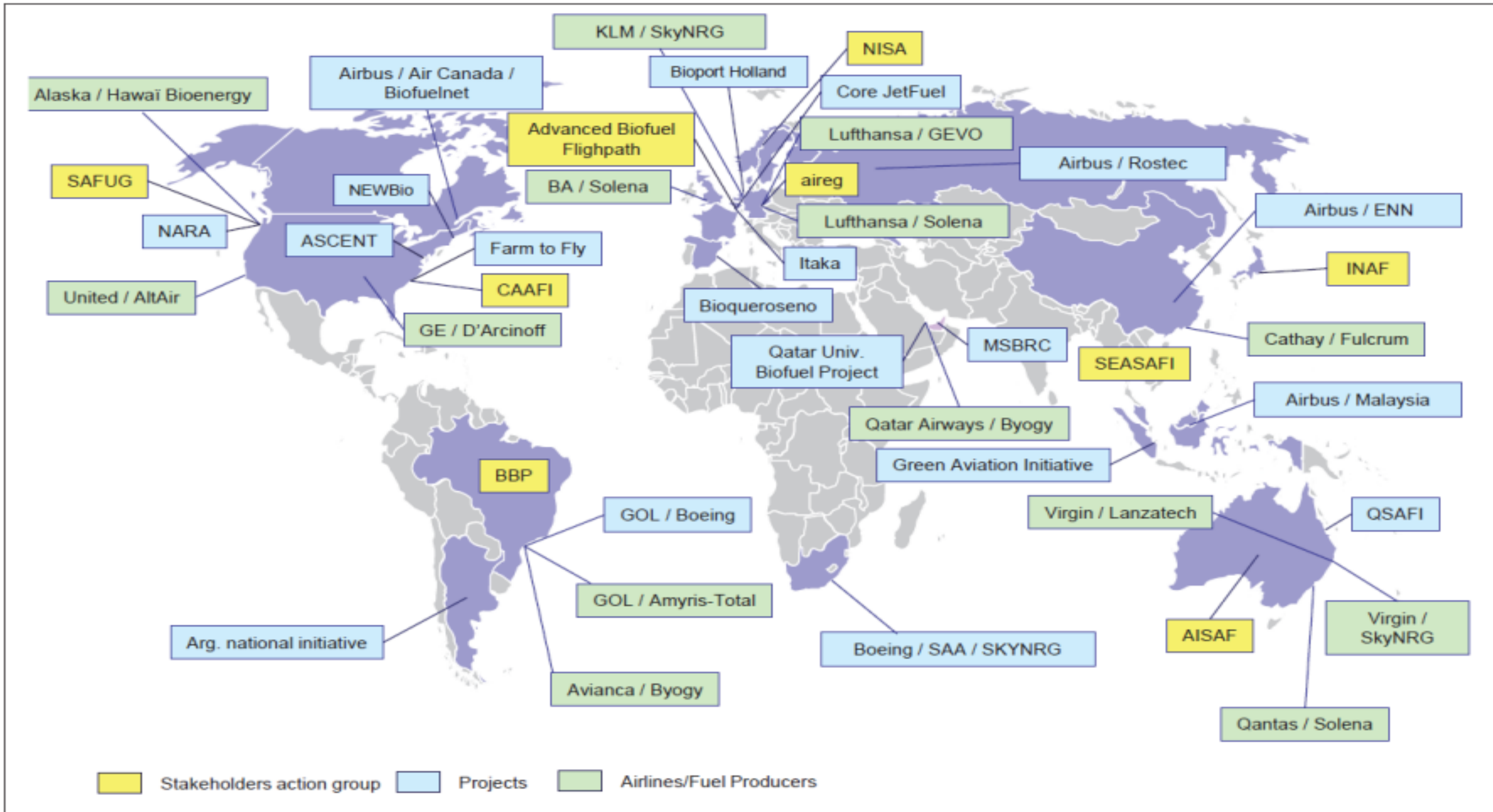
Milestones in aviation fuel development

2016

- Oslo Airport in Norway: world’s first operational “bioport” offering 2.5 million litres of aviation biofuel annually to its users
- Los Angeles International Airport in the United States, will have more than 56.8 million litres of aviation biofuel available over a 3-year period
- Fifth pathway for alternative jet fuel approved on April by ASTM
- US Navy incorporated alternative fuel into operational supplies and successfully completed flight tests on one of their jet fighters, using a 100-percent advanced biofuel, as a drop-in renewable jet fuel.

NATIONAL AND INTERNATIONAL INITIATIVES

Numerous initiatives are actively working on sustainability frameworks and certification schemes

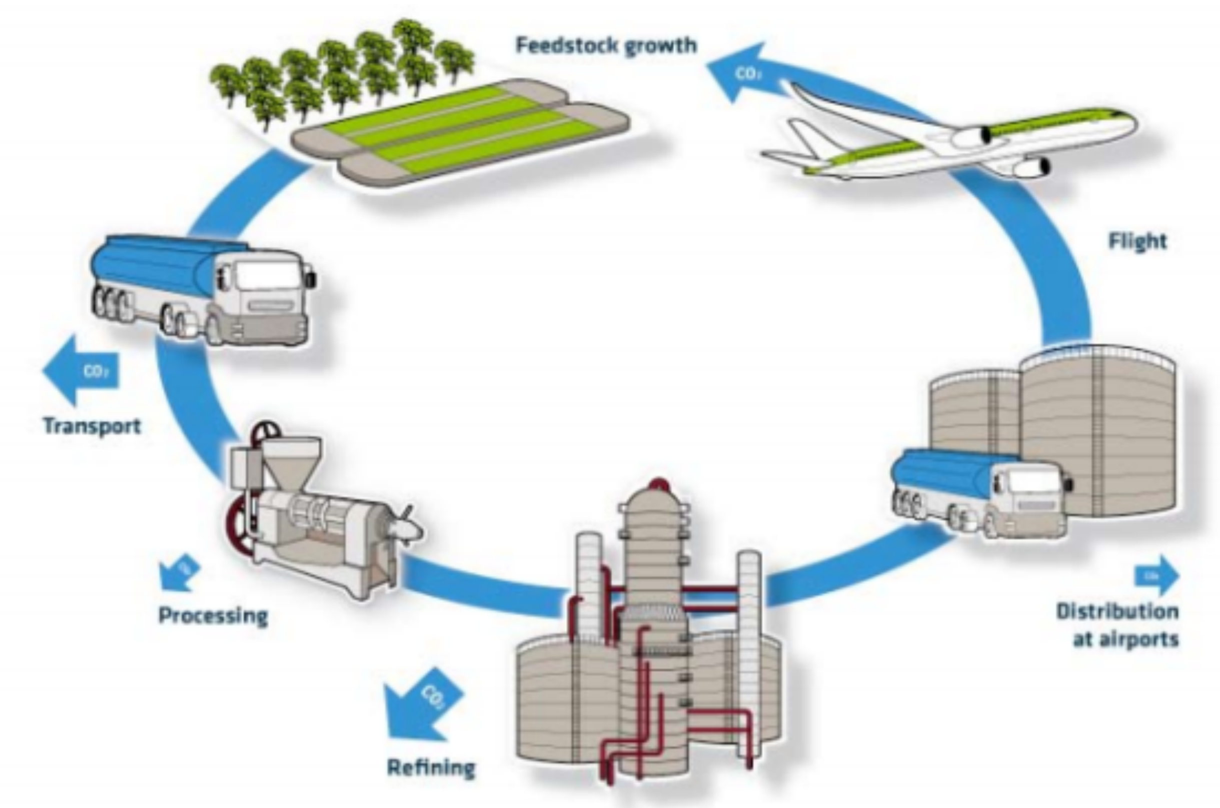


European Renewable Energy Directive (RED)

- European Renewable Energy Directive (RED) sets binding targets at European level for the introduction of renewable energy by 2020

No specific quota defined for aviation but **consumption of biofuels in aviation** can contribute to achievement of **target 10%.**

Alternative fuels Sustainability



Biojetfuel production feedstocks

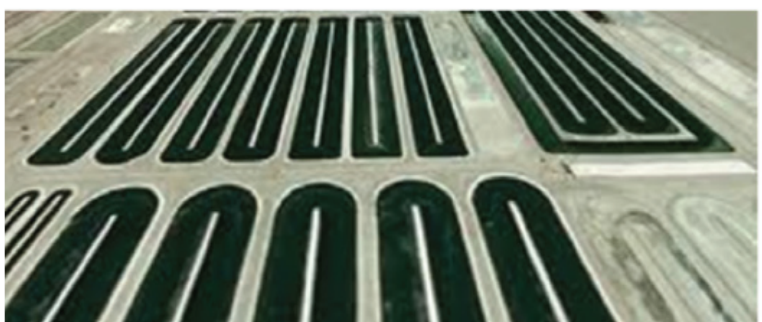
Jatropha

Pongamia

Mustard

Camelina

Autotrophic algae



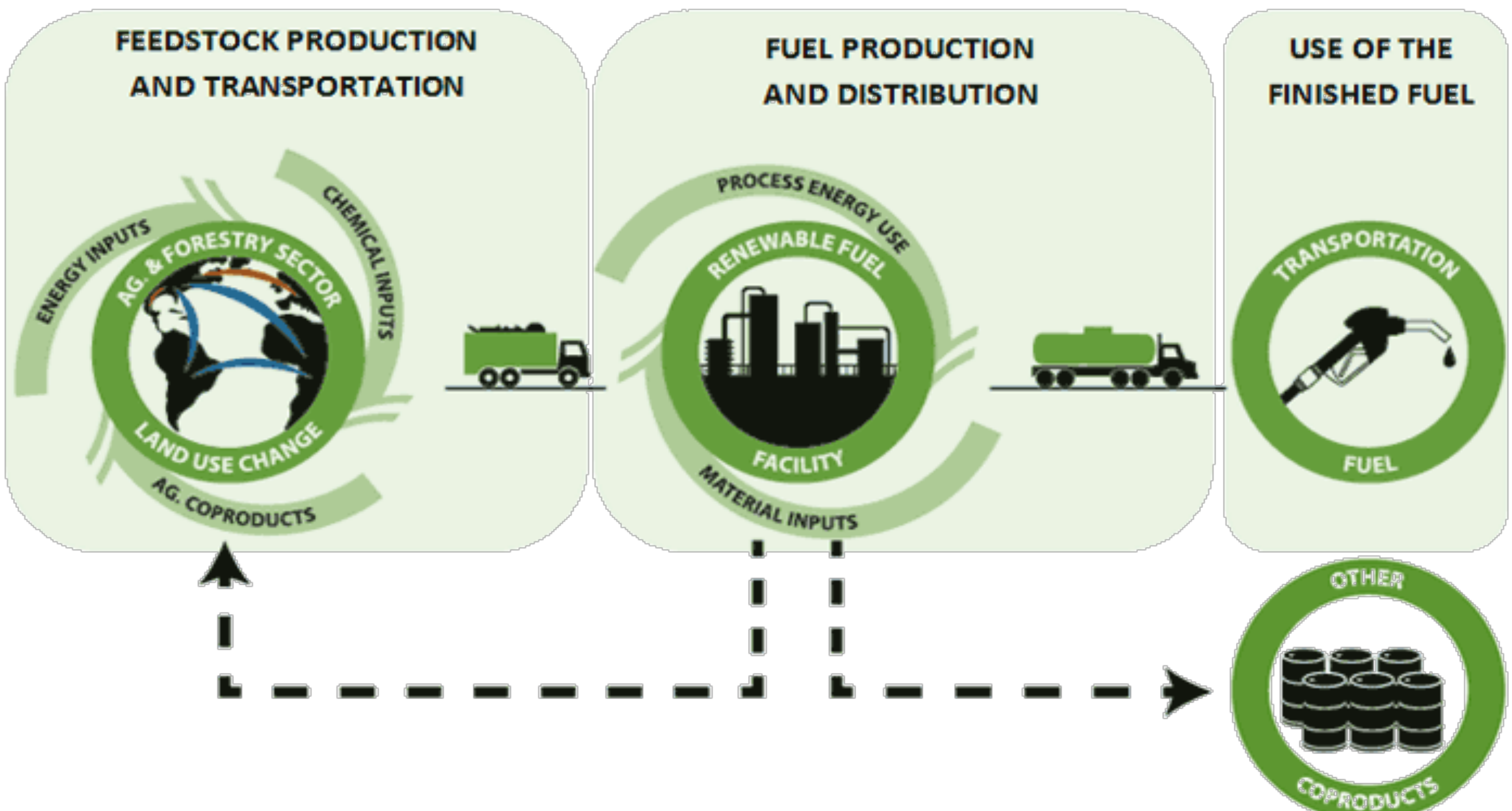
Heterotrophic algae

Biojetfuel production feedstocks

- Nowadays alternative jet fuels for aviation can be produced through the following pathways:
  - Fischer-Tropsch Synthetic Kerosene with Aromatics (FT-SKA)
  - Fischer-Tropsch Synthetic Paraffinic Kerosene (FT-SPK)
  - Hydroprocessed Esters and Fatty Acids (HEFA-SPK)
  - Hydroprocessed Fermented Sugar-Synthetic Isoparaffins (HFS-SIP)
  - Alcohol to Jet Synthetic Paraffinic Kerosene (ATJ-SPK)
- Methods are approved by the standards-setting organization, American Society for Testing Materials (ASTM) to enable the conversion of a broad range of renewable sources of biomass into sustainable jet fuel.

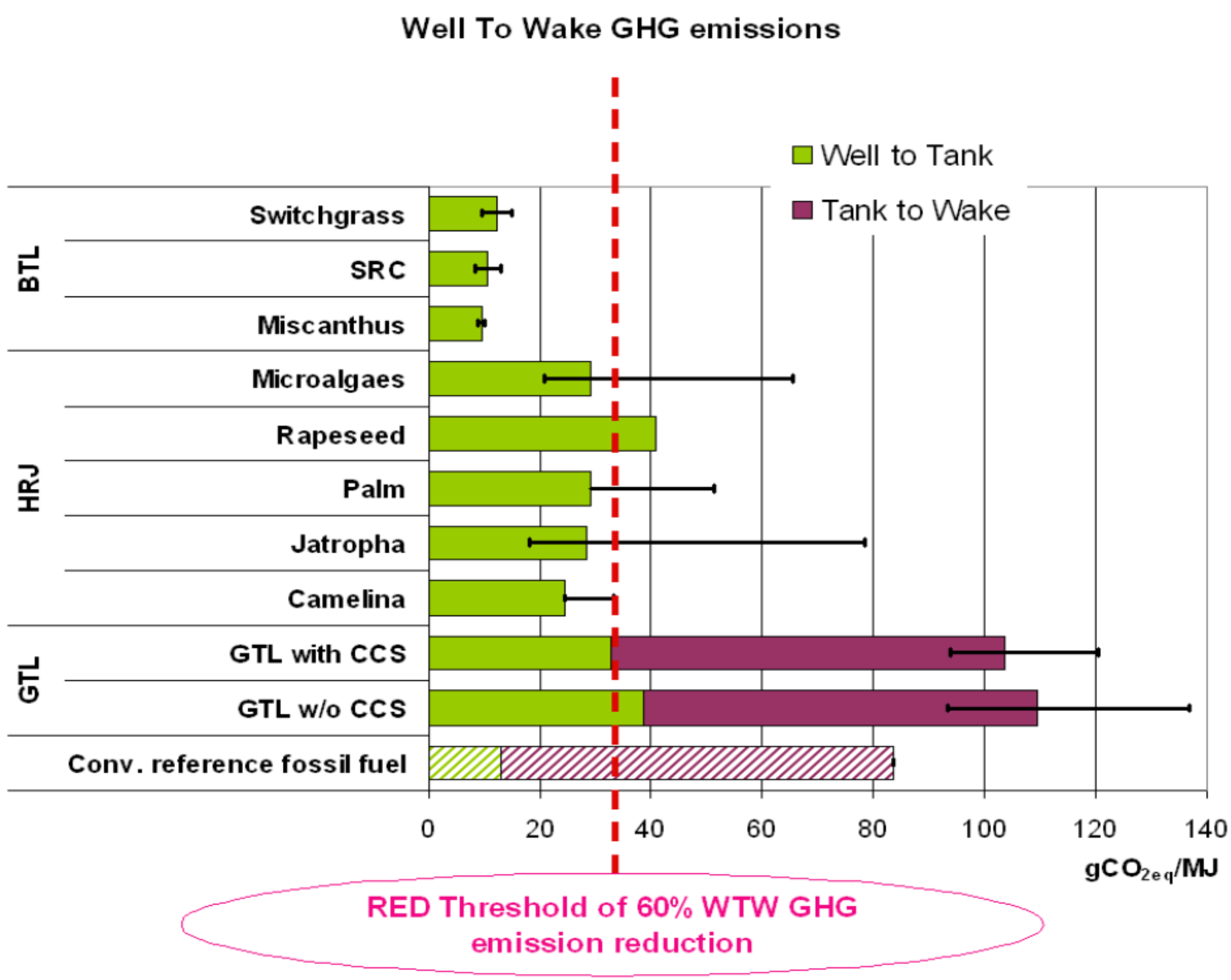
Life Cycle Assessment (LCA)

- LCA is the systematic analysis of the environmental impact of products during their entire life cycle. It comprises production, use and disposal phases.
- Environmental impacts are evaluated throughout, also including the upstream and downstream processes associated with the production and disposal



Life Cycle Assessment (LCA)

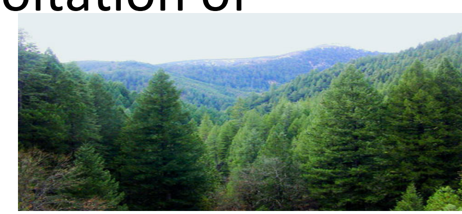
Alternative fuels evaluation on the whole life cycle is presented and compared to RED threshold of 60% Well to Wake GHG emissions



ENVIRONMENTAL AND SOCIETAL IMPACTS

- **Competition with food**
  - first negative drive associated with biofuels development
  - impact on food product prices

- **Deforestation and biodiversity**
  - Deforestation is also a major source of biodiversity loss
  - Biodiversity can also be endangered by over exploitation of forests without deforestation



- **Indirect Land Use Change**
  - iLUC results from displacement of cultures because of the deployment of energy crops on areas used for other purposes and especially for food production
  - ILUC is difficult to observe and to calculate

ENVIRONMENTAL AND SOCIETAL IMPACTS

- **Atmospheric impacts**
  - positive factor for local air quality
  - due to their low aromatics and sulphur contents leads to a strong reduction of particulates emissions of aircraft engines
  - soot initial concentration at the engine nozzle exit may be reduced by 30% to 90% at cruise conditions

- **Irrigation and Water Availability**
  - Water is clearly a critical issue
  - Irrigation should be considered carefully
- **Societal and economical impacts**
  - Large commercial cultures implies reallocation of land and resources
  - Existence of policy measures and incentives along with access to credit is also prerequisite to induce bottlenecks in developing countries

CONCLUSIONS

- Energy supply security and green house gas (GHG) emissions reduction are key challenges for future aviation
- Aviation biofuels offer significant reduction of the GHG emissions
- Reaching the biomass production potential requires a significant effort and investment in agriculture, putting in cultivation large amount of lands that are not cultivated today, the availability of fertilizers and of manpower
- While large-scale utilization of biomass for fuel production poses environmental and social risks, PtL and StL fuel pathways enable the technical conversion of solar energy into renewable liquid fuels without the need for intermediate biomass production

CONCLUSIONS

- Potential benefits compared to kerosene can only be achieved if no negative impact of land use change is associated to the feedstock production
- Environmental certification following sustainability frameworks is the principal way to ensure the sustainability of biofuels production
- Present regulations in Europe should be harmonized to more efficiently enforce sustainability of aviation biofuels
- Similar measures are required at ICAO level for a worldwide application in accordance with ICAO's resolution on climate change
- Aviation fuel being a global commodity, harmonisation of sustainability regulations should be searched among the various world areas

Thank you for your attention

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