



Alternative Fuels for Aviation Overview

Ph. Novelli, ICAO Secretariat



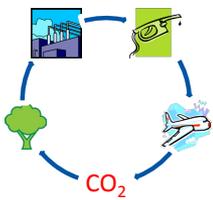
Changing the fuel to reduce emissions

- **Technological and operational improvements:** instrumental but not expected to close the gap with aspirational goal alone
- **Possible way:** to reduce the emissions generated by the fuel itself
- **Long term:** new source of liquid fuel ? hydrogen? electric aircraft ?
- **Short/medium term:** focus on drop-in liquid fuels



“Low carbon footprint” fuels

Fuel life cycle emissions



Biofuels: carbon uptaken by plant growth
⇒ neutral CO₂



Waste derived fuels:
⇒ “multiple use” of CO₂



A demonstrated solution for aviation

- First demo flights (commercial aircrafts) in 2008
- 3 alternative fuels approved for aviation in 2009, 2011 and 2014
- About 1700 commercial flights operated since 2011 by 17 airlines



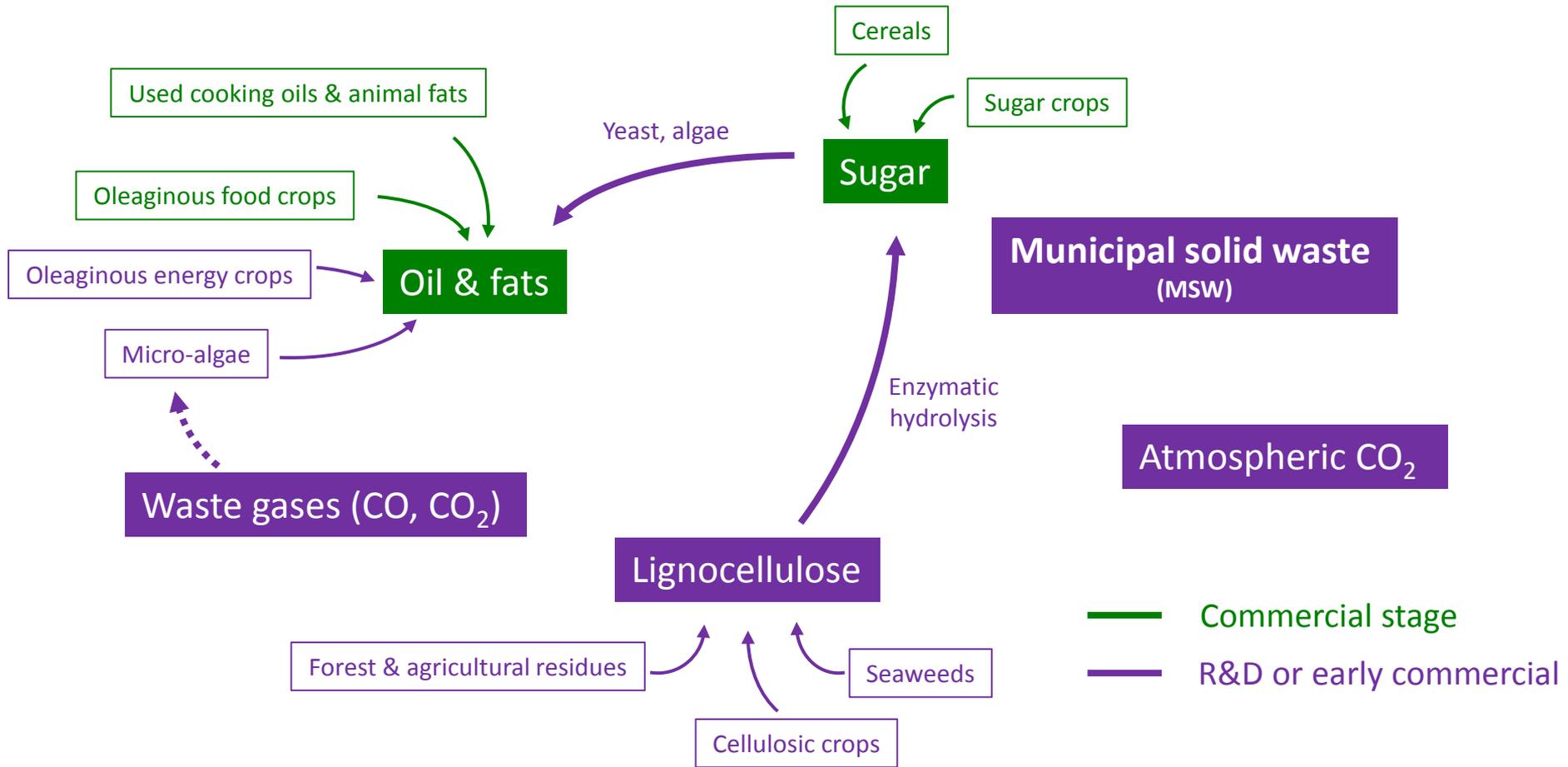


Still at the early stage

- **Not yet deployed**
 - **Some challenges on the road**
 - Bringing technologies to market
 - Decreasing production cost
 - Investing in conversion facilities
 - Producing enough feedstock
 - Ensuring sustainable deployment
- ⇒ **Supportive policy frameworks required**
- ⇒ **Time before large market penetration**



Many possible feedstocks





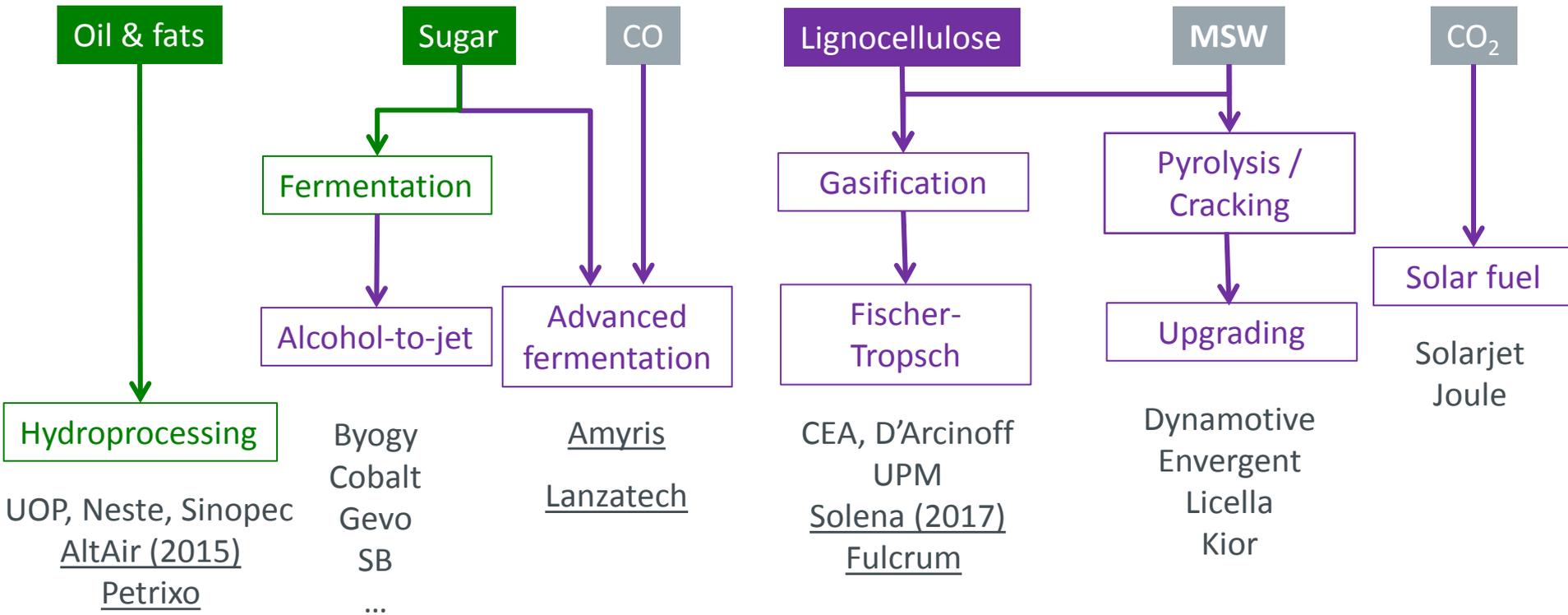
Challenges on feedstock

- **Increasing yields**
- **Reducing requirements** (water, fertilizers,...)
- **Decreasing feedstock costs**
- **Logistics**
- **Reducing requirement for lands**
 - Residues
 - **Low quality land** ⇒ **algae**
 - “**No lands**” ⇒ not biomass-based fuel : waste, waste gas, CO₂

⇒ **Sustainability**



Many possible pathways



Non exhaustive !

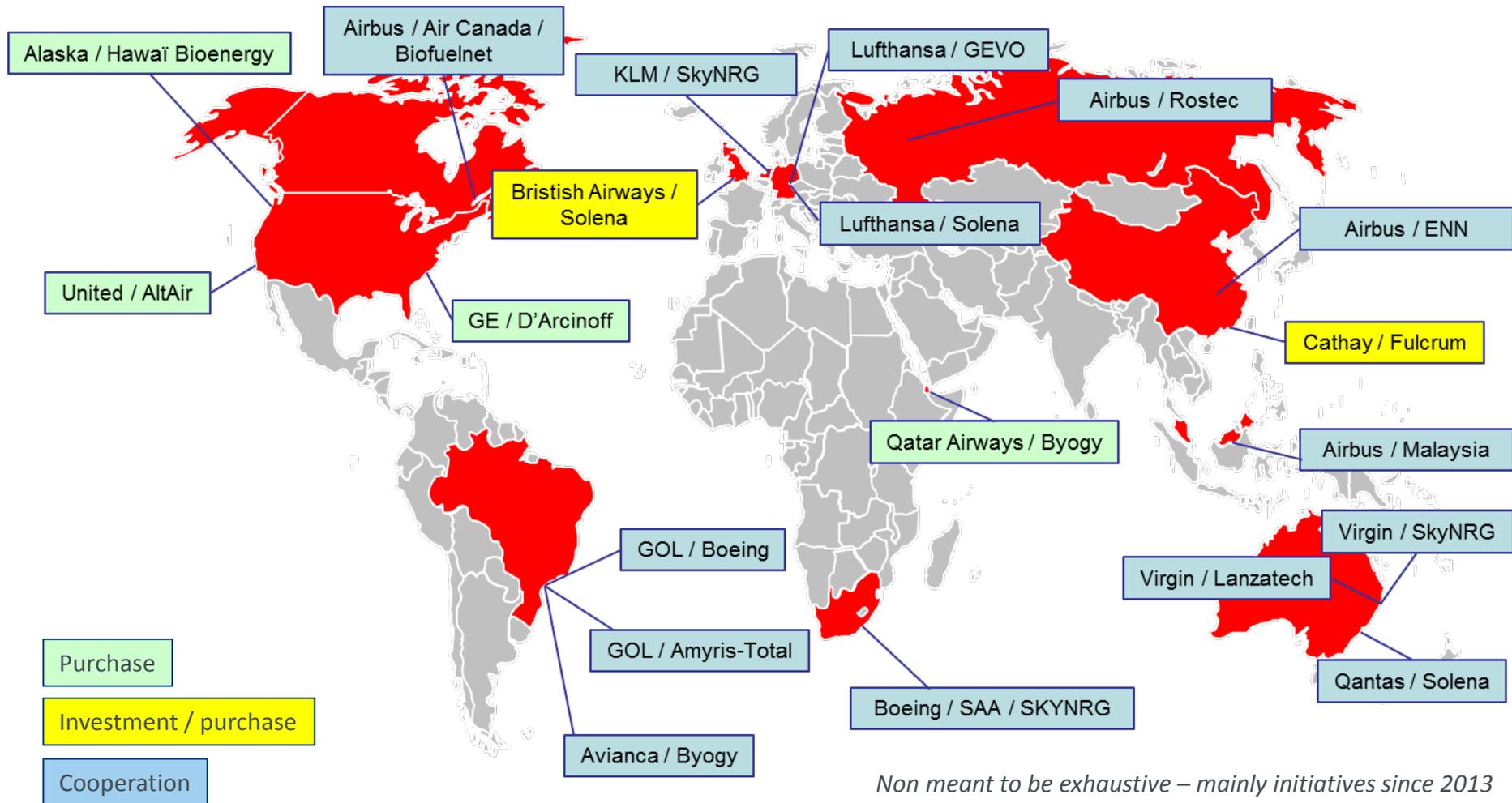


Challenges on conversion technology

- **Production cost**
- **Conversion efficiency**
- **Capital cost**
- **Enzymes, catalysts**
- **Demonstration**
- **Scale-up**



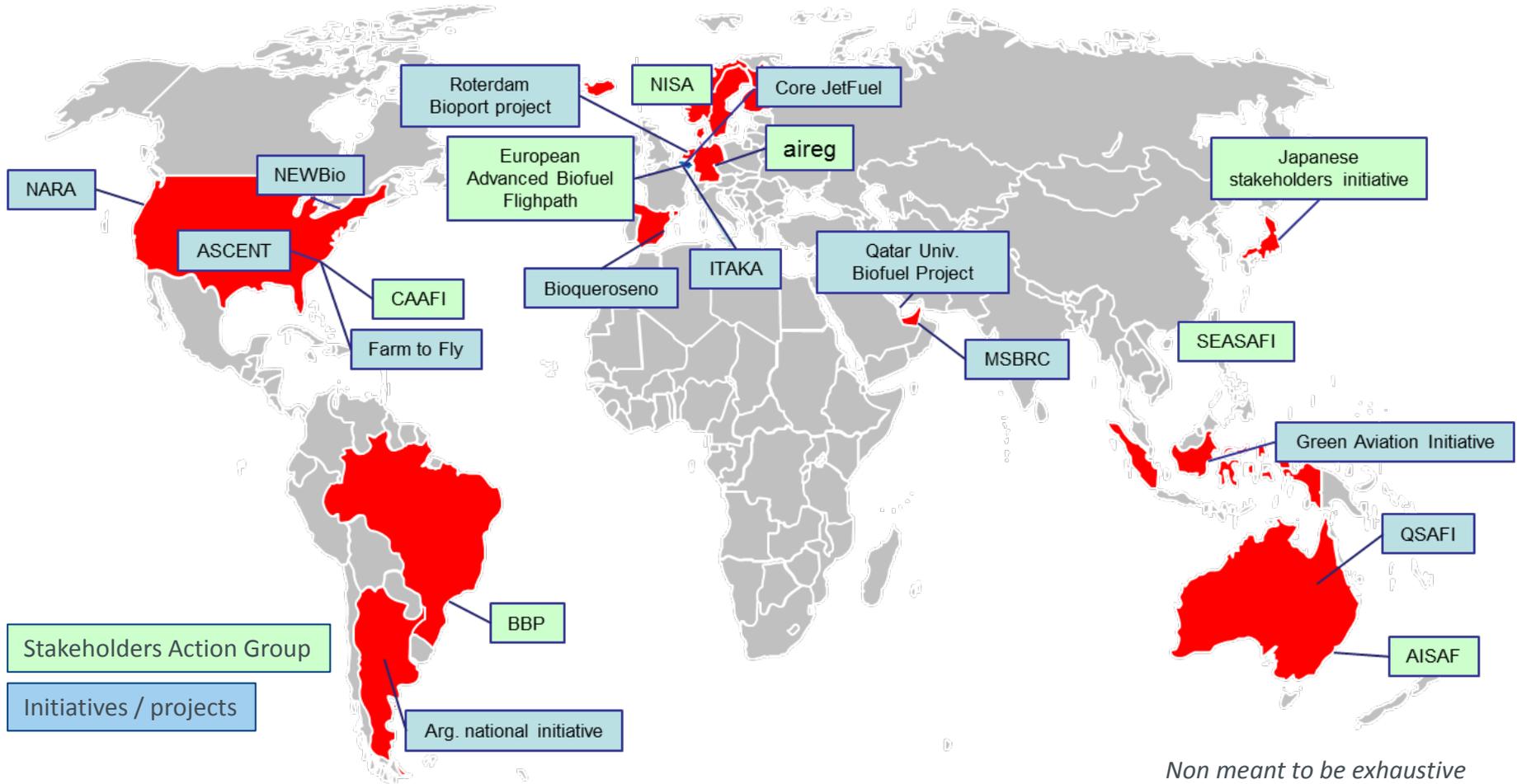
Airlines/Manufacturers initiatives



Non meant to be exhaustive – mainly initiatives since 2013



Multistakeholders initiatives





ICAO's role and activities

- Supporting Member States and stakeholders efforts through fostering exchanges, information sharing and further common work on sustainable alternative fuels



- Assessing potential emissions reductions from alternative fuels to 2050
⇒ **CAEP Alternative Fuels Task Force**
- Maintaining the Global Framework for Aviation Alternative Fuels (GFAAF)



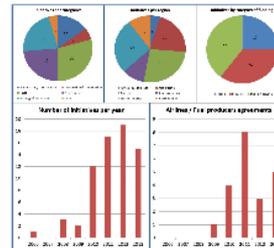
GFAAF

<http://www.icao.int/environmental-protection/GFAAF/Pages/default.aspx>

A living database on alternative jet fuels

The screenshot shows the GFAAF website interface. At the top, there is the ICAO logo and the text 'INTERNATIONAL CIVIL AVIATION ORGANIZATION A United Nations Specialized Agency'. A search bar and social media icons are also present. Below the header is a navigation menu with items like 'About ICAO', 'Strategic Objectives', 'Meetings & Events', 'Publications', 'Training', 'Online Store', and 'Employment'. A sidebar on the left lists categories: 'GFAAF', 'News and Activities', 'Initiatives & Projects', 'Facts & Figures', 'Literature Review', 'Aviation Fuels', 'General Documentation', 'Links', and 'Environment home page'. The main content area features a title 'ICAO Global Framework for Aviation Alternative Fuels' and four image-based links: 'News and Activities', 'Initiatives and Projects', 'Literature Review', and 'Links'. Below this is a 'Latest News' section with two entries: 'Cathay Pacific invests in Fulcrum BioEnergy and enters a 10 years off-take agreement' (dated 2014-08-12) and 'Boeing, SAA and SkyNRG to collaborate on biofuel production from hybrid tobacco crop' (dated 2014-08-08). A paragraph below the news section states: 'The Global Framework for Aviation Alternative Fuels (GFAAF) was launched at the ICAO Conference on Aviation and Alternative Fuels in 2009 as part of ICAO strategy to support solutions that reduce aviation contribution to climate change. It provides a continuously updated database about activities and developments in the field of alternatives for aviation, as well as useful documentation and links, to support information sharing and dissemination for the benefit of aviation fuels community.'

Facts & Figures



New! Approaches to the Sustainability of Alternative Fuels in Aviation

An introduction to the sustainability of alternative fuels in aviation, with an overview of existing tools to assess or ensure sustainability (August 2014).

See also:

Overview of Biojet Fuels in 2013 - A paper originally published in IATA 2013 Report on Alternative Fuels as a contribution from ICAO Secretariat (March 2014).



Conclusions

- **A rich and evolving landscape**
- **Feedstock will be key**
- **Future likely to be a combination of solutions**
- **Potential “game changers”:** algae, solar fuel
- **Cooperation is instrumental**
- **In a longer term: hydrogen and electricity?**
 - ⇒ But H₂ and electricity are only energy carriers...