

Presented by

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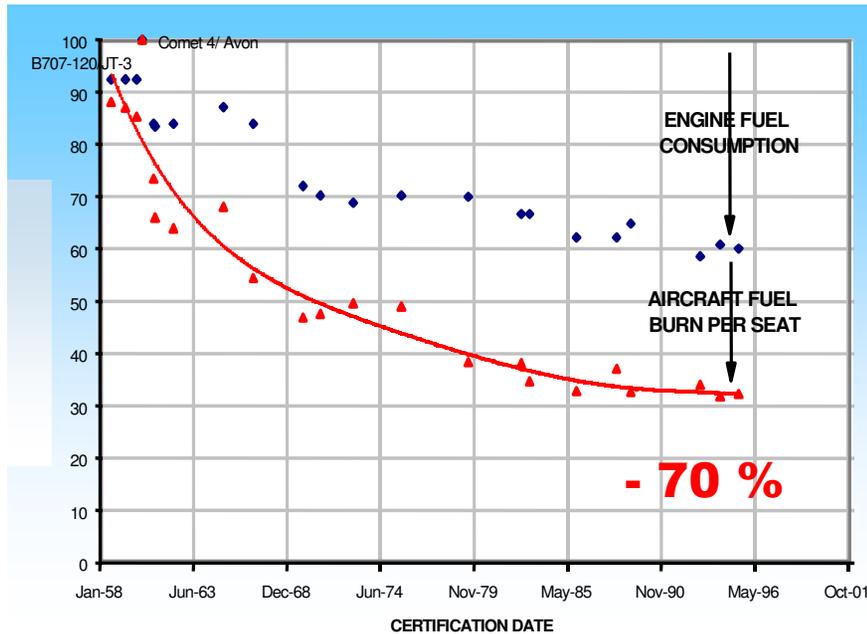


Aviation Alternative Fuels Towards sustainable air travel

A manufacturer's perspective

ICAO Side-event – Bonn – June 3rd, 2009

Manufacturers's challenges



- Maintain or improve our historical level of fuel efficiency improvements
 - ▶ New engines
 - ▶ Lighter materials
 - ▶ Advanced aerodynamics
 - ▶ Optimized integration processes
 - ▶ New concepts
- Find out, experiment and develop alternative fuels for aviation
 - ▶ Same or better operational performance
 - ▶ Drop-in fuel
 - ▶ Lower CO2 emissions (on a life-cycle basis)
 - ▶ Additional environmental savings



What is the future of jet fuel?

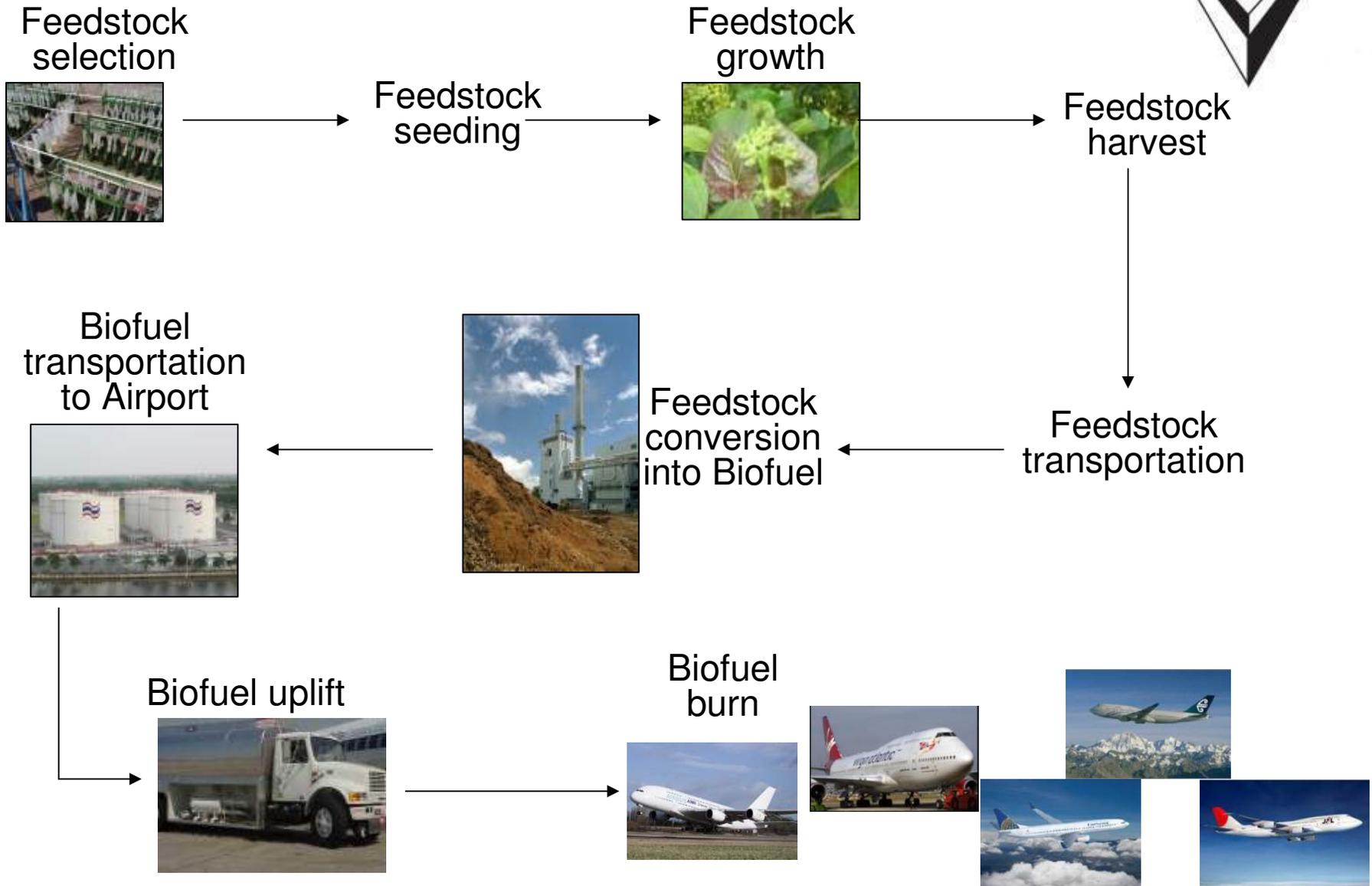


Potential alternative fuel candidates

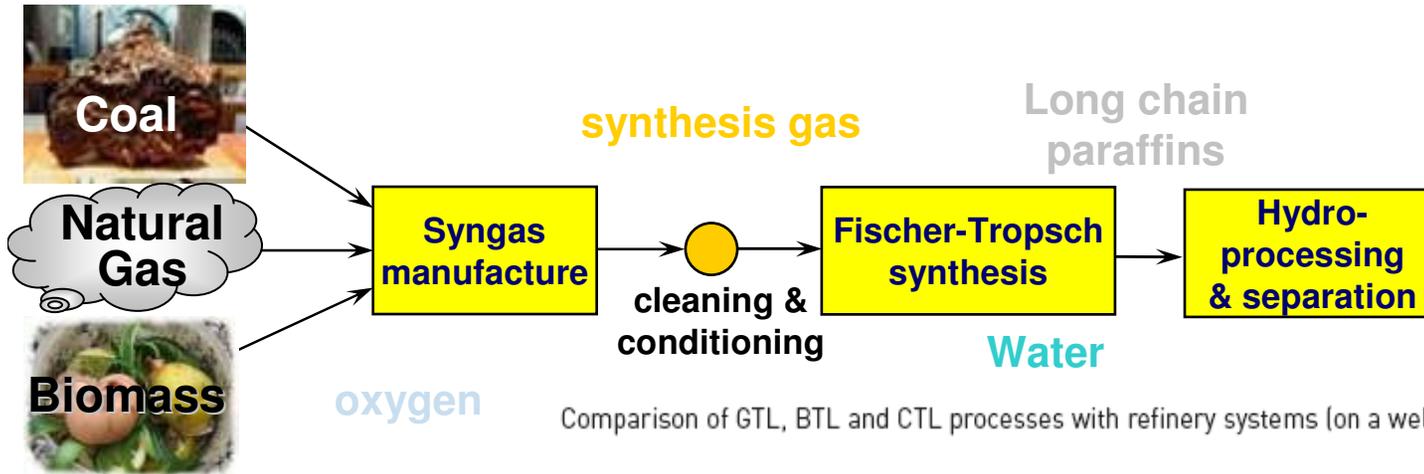


		TYPE					
		Conventional Jet Fuel ("Kerosene")	Alcohols	Bio Esters	Synthetic FT- Fuels	Hydrogenated Biomass	Cryogenic Fuels
CATEGORY	<u>Non-Renewable (Fossil)</u>	 Jet Fuel			Coal To Liquid (CTL) Gas To Liquid (GTL) 		Liquefied Natural Gas
	<u>Renewable</u>		Ethanol ... 35% lower energy content 	Fatty Acid Methyl Esters (FAME), ... 	Biomass To Liquid (BTL) 	Hydrogenated Biomass Oils 	Liquid Hydrogen Low energy content per unit volume, Availability, Infrastructure
			10% lower energy content, -5°C Freeze point... 				

Alternative Fuels Lifecycle (e.g. Bio Fuels)

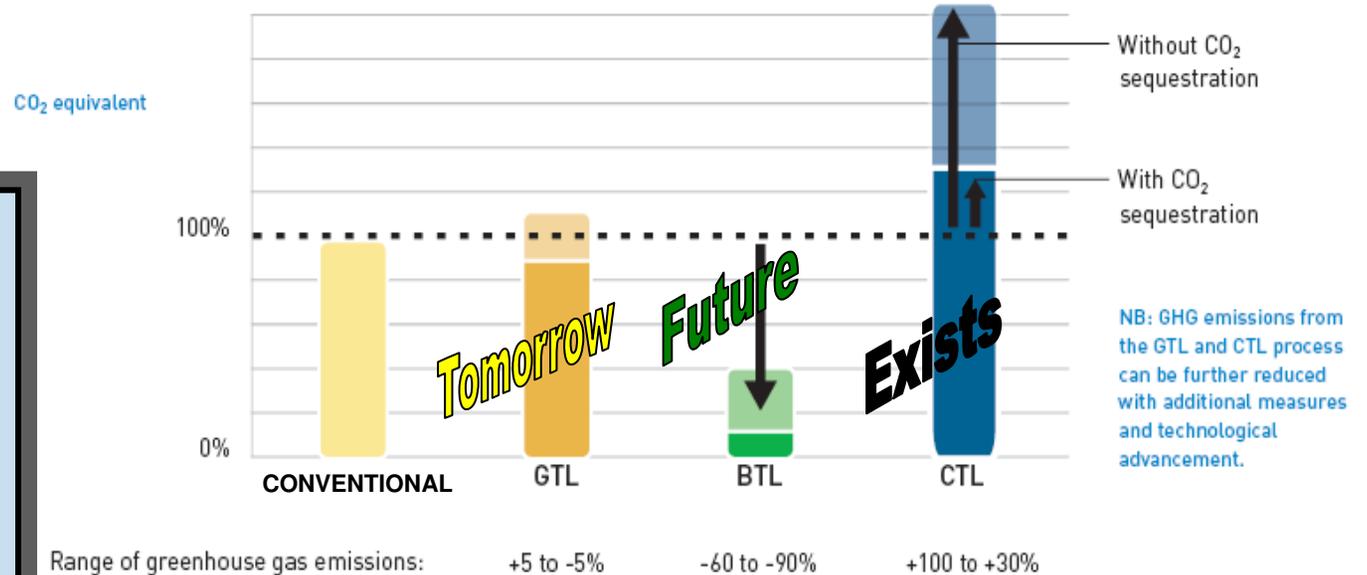


Synthetic fuels for commercial aviation (XTL)



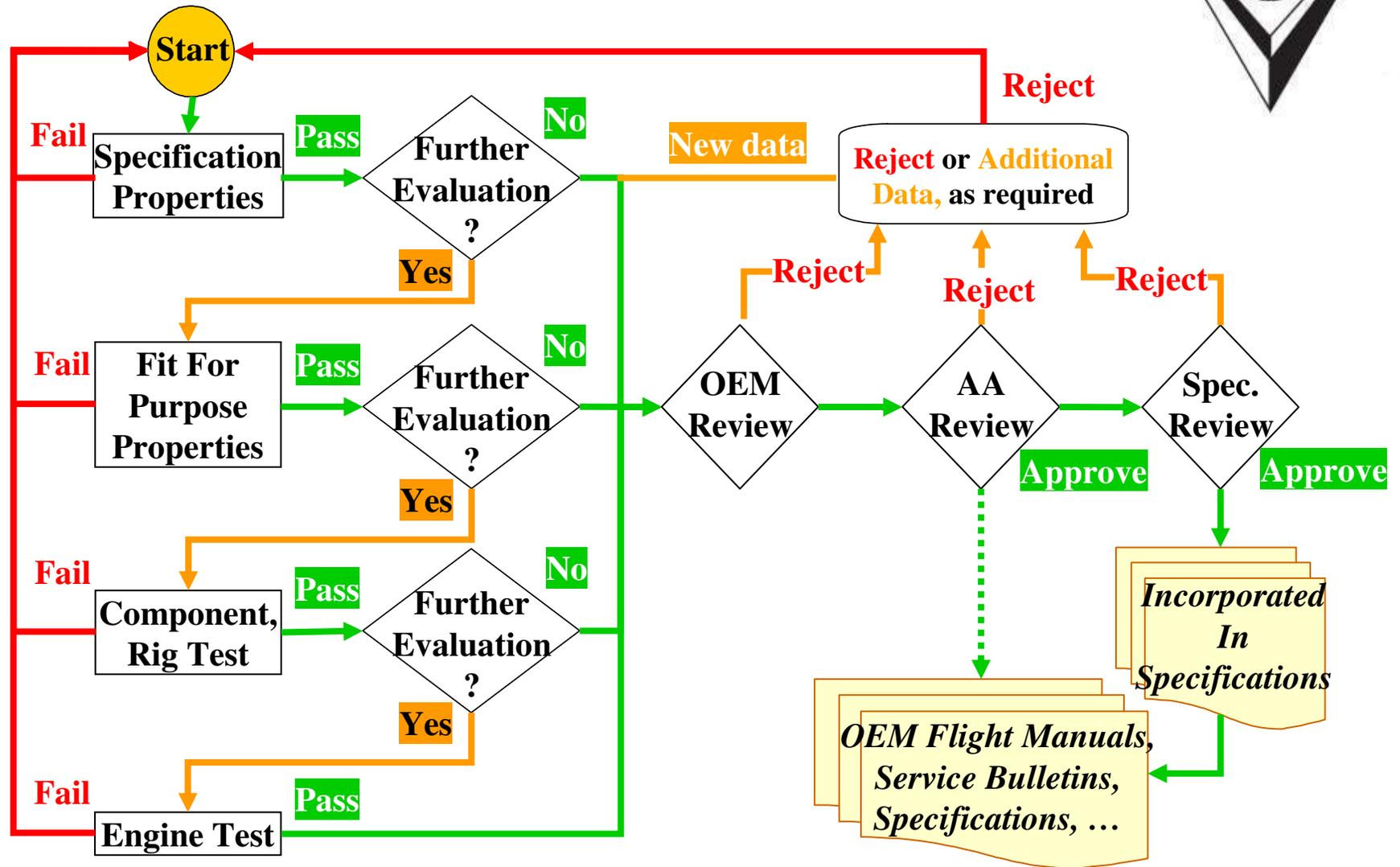
Comparison of GTL, BTL and CTL processes with refinery systems (on a well-to-wheel basis)

End product is the same regardless of feedstock and has no memory of where the carbon / hydrogen came from



Source: ASFE 2007 (Bosch, Daimler Chrysler, Renault, Shell, Sasol Chevron, Volkswagen)

Overview of alternative fuels approval



OEMs engine and combustor test program



- To assess effects of SASOL fully synthetic jet fuel (FSJF – CTL) on engine performance and operation, engine manufacturers (RR, P&W, GE and Honeywell), in coordination with SwRI, conducted engine and combustor tests:
 - ▶ Engine performance and endurance (P&W)
 - ▶ Emissions (United Technologies – P&W)
 - ▶ Low temperature atomization (Honeywell)
 - ▶ Cold ignition, altitude relight and lean blowout (RR and Honeywell)

Demonstrate technical feasibility

Flight tests



- Feb 1st, 2008
 - ▶ Airbus A380 – Rolls-Royce Engines
 - ▶ Blend 40% GTL (Shell Technology Centre – UK)



- Feb 24th, 2008
 - ▶ Virgin Boeing 747-400 – General Electric Engines
 - ▶ Blend 20% from babassu nuts and coconuts



- Dec 30th, 2008
 - ▶ ANZ Boeing 747-400 – Rolls-Royce Engines
 - ▶ Blend 50% - HRJ from jatropha



- Jan 7th, 2009
 - ▶ Continental Boeing 737-800 –CFM (GE-Snecma) Engines
 - ▶ Blend 50% - HRJ from algae / jatropha



- Jan 30th, 2009
 - ▶ JAL Boeing 747-300 – P&W Engines
 - ▶ Blend 50% - HRJ from camelina / jatropha / algae

A matter of partnership



CAAIFI's goal is to promote the development of alternative fuel options that offer equivalent levels of safety and compare favourably with petroleum based jet fuel on cost and environmental bases, with the specific goal of enhancing security of energy supply.

European Commission DG TREN: New feasibility study SWAFEA

- establish a comparative analysis of alternative fuel options
- + environmental + business case analysis;
- input to policy makers, suggest roadmap



Partners : Onera, Bauhaus Luftfahrt, German Aerospace Center (DLR), Altran, IFP, University of Sheffield, AIRBUS, AIR FRANCE, CERFACS, CONCAWE, EADS-IW, EMBRAER, ERDYN, IATA, INERIS, INRA, ROLLS ROYCE (UK and Germany), SHELL, SNECMA.

Sustainable Aviation Fuel Users Group

Partners : Air France, KLM, UOP, Air New Zealand, ANA, JAL, Virgin, Gulf Air, Cargolux, SAS, Boeing

...and many more

Partnership with ICAO



- February 2009 workshop
 - ▶ Participation of various ICCAIA member companies
- Side event in Bonn – June 2009
 - ▶ ICCAIA supports the event
- ICAO conference on Aviation alternative fuels
 - ▶ ICCAIA supports the event
 - ▶ ICCAIA is an active member of the process to set up the global framework (technical, certification, economic...) for alternative fuels for aviation

Aviation is uniquely structured to maximise benefits of sustainable bio-fuels



◆ Tens of thousands fueling stations

● Hundreds of millions of vehicles



◆ Several hundred fueling stations (airports)

● 20,000 vehicles

A stable and manageable market to demonstrate the sustainability of alternative fuels for aviation.