Contributions to emission reductions and constraints on fuel properties

Airframe perspective: Constraints & Chances

Presented by
Ross WALKER, Engineering Programme Manager Sustainable Fuel

AIRBUS

Agenda

Sustainable Fuels for Aviation

- Context
- Constraints
- Opportunities

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Context

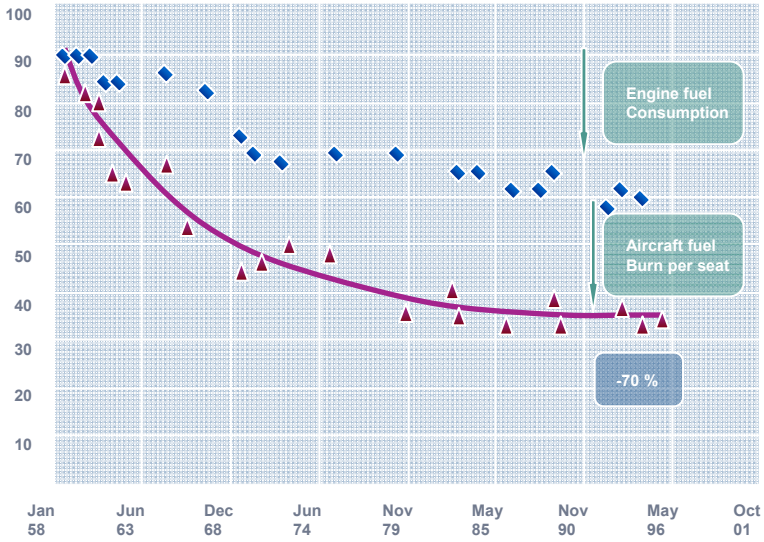
around 1 700 airlines;
fly in excess of 23 000 aircraft;
serving in excess of 3 750 airports;
burning 1 500 000 000 barrels of JET A1 per year

Source ATAG

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

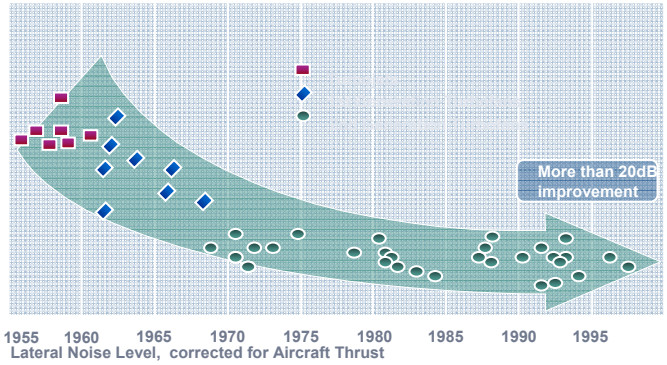
Context

70% CO2 emissions reduction



90% NOx emissions reduction

75% noise reduction



A380 compared to a smaller aircraft flying today

Innovation driven by economics & environmental regulations

Source ATAG

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Agenda

Sustainable Fuels for Aviation

- Context
- Constraints
- Opportunities

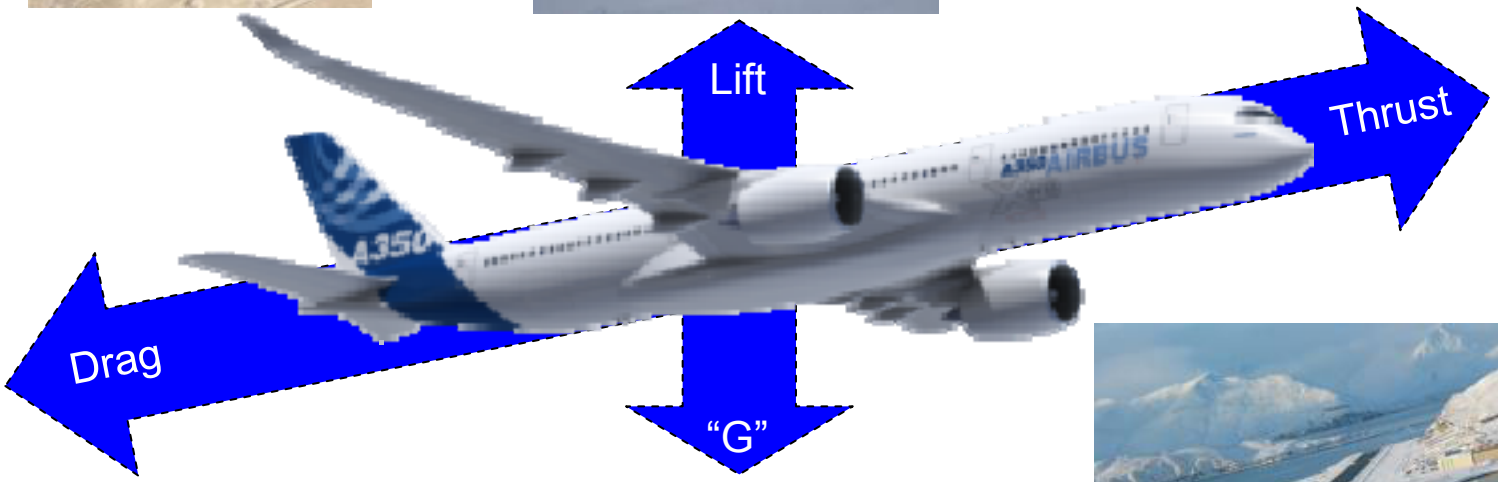
© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints

+50C

-50C

FL 430



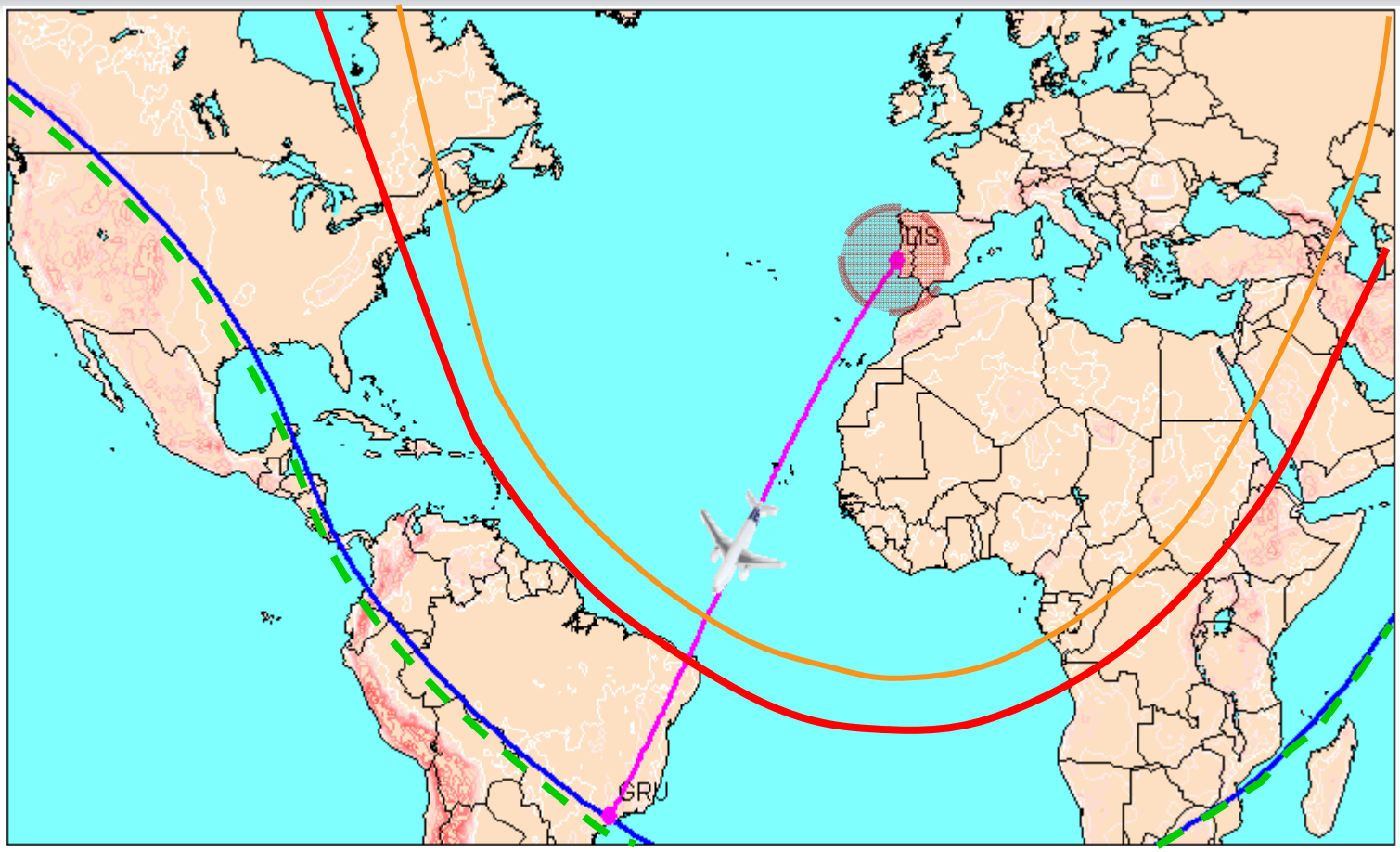
water

< Sea level

environment

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints



Ethanol

FAME freezes at -5C normal operation

FAME Flight level limited by freeze point

JET A-1 Petroleum

JET A1 xTL & HEFA

average aircraft life is 30 years: existing fleet & infrastructure optimised for JET A1

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints

- Aircraft fuel system
  - **Material compatibility**
    - Seals
    - Metals
    - Plastics

  - **Engine feed**
    - Air solubility
    - Lubricity
    - Water / ice

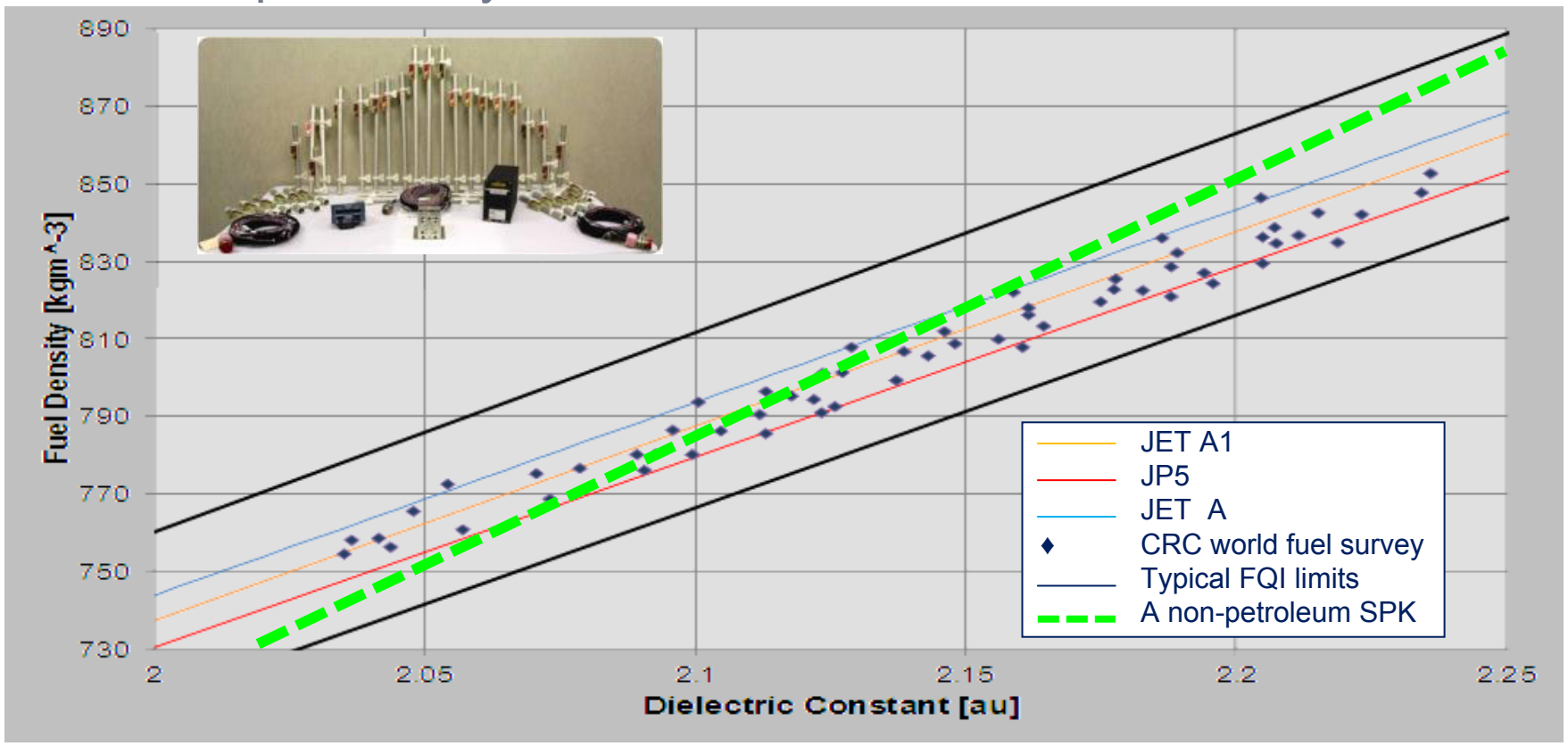
  - **Gauging**
    - Relationship of density/electrical permittivity/temperature

safety and aircraft operations

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints

- Electrical permittivity of fuel



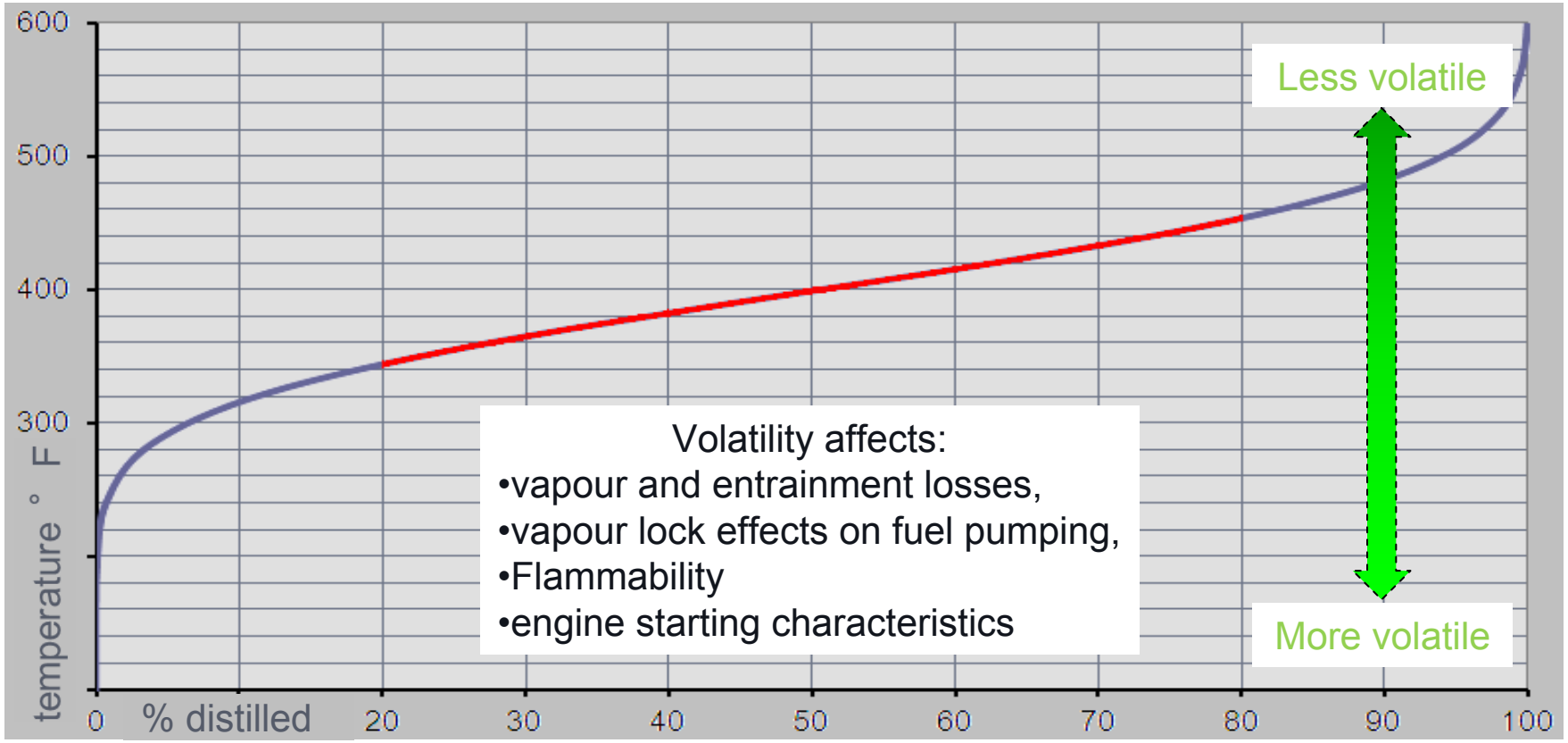
safety and aircraft operations

Source CRC Handbook

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints

- Typical distillation curve of JET A1

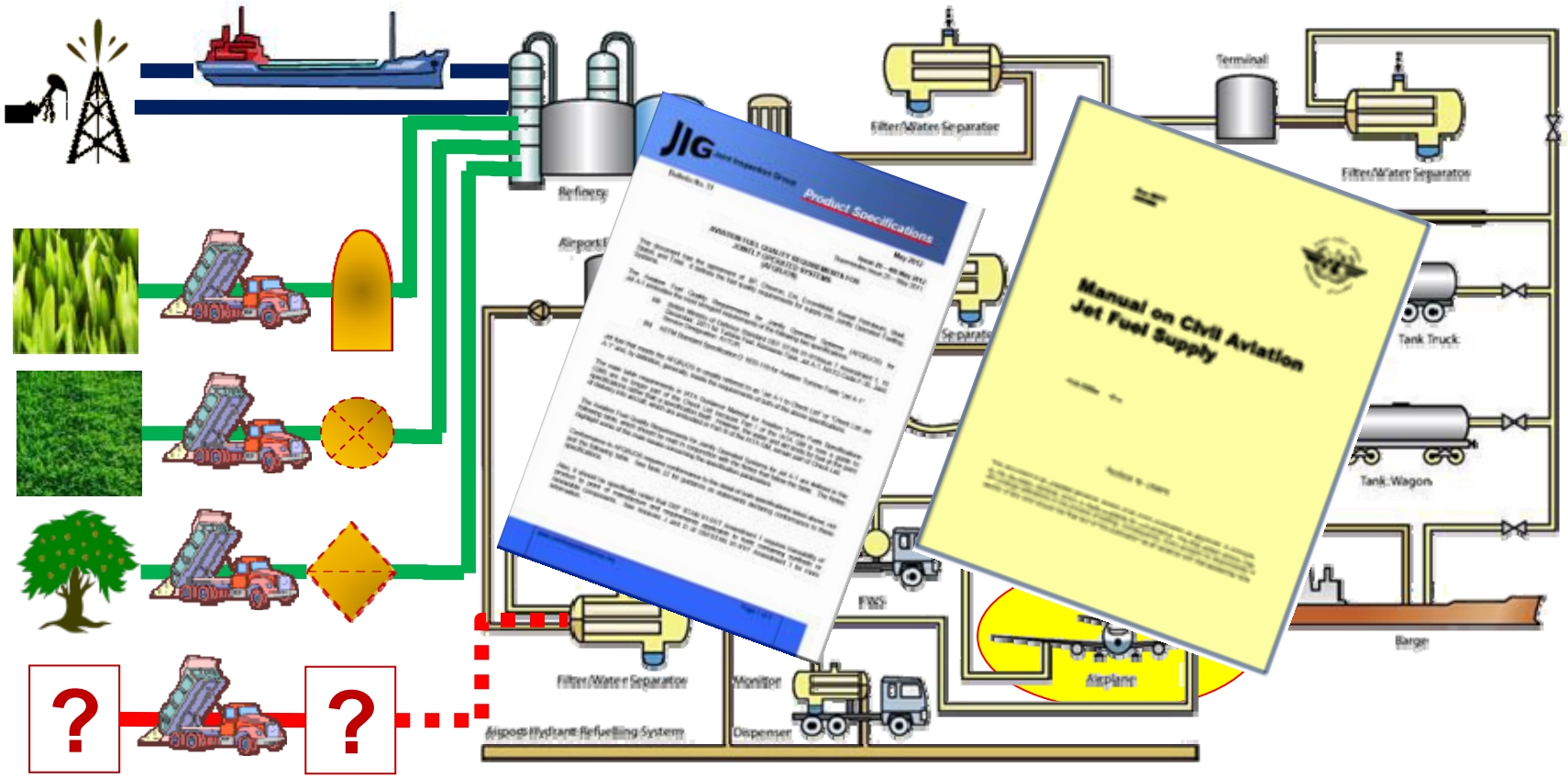


safety and aircraft operations

Source CRC Handbook

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints



fuel quality assurance

Source B*

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Constraints

U.S. AIR FORCE

Alternative Fuel Pricing

Producer	Type	Amount (gals)	Total Cost (millions)	Price (per gal)
Syntroleum Corp	FT	100,000	$2.000	$20.00
Shell Malaysia	FT	281,000	$0.958	$3.41
SASOL	FT	395,000	$1.541	$3.90
Sustainable Oil	HRJ	100,000	$6.680	$66.80
Honeywell UOP	HRJ	100,000	$6.400	$64.00
Sustainable Oil	HRJ	100,000	$3.480	$34.80
Honeywell UOP	HRJ	100,000	$3.240	$32.40
Sustainable/Dynamic Fuels	HRJ	35,000	$2.056	$58.74
Gevo	ATJ	11,000	$0.649	$59.00

Integrity - Service - Excellence

IATA JET A1 average 5th April 2013

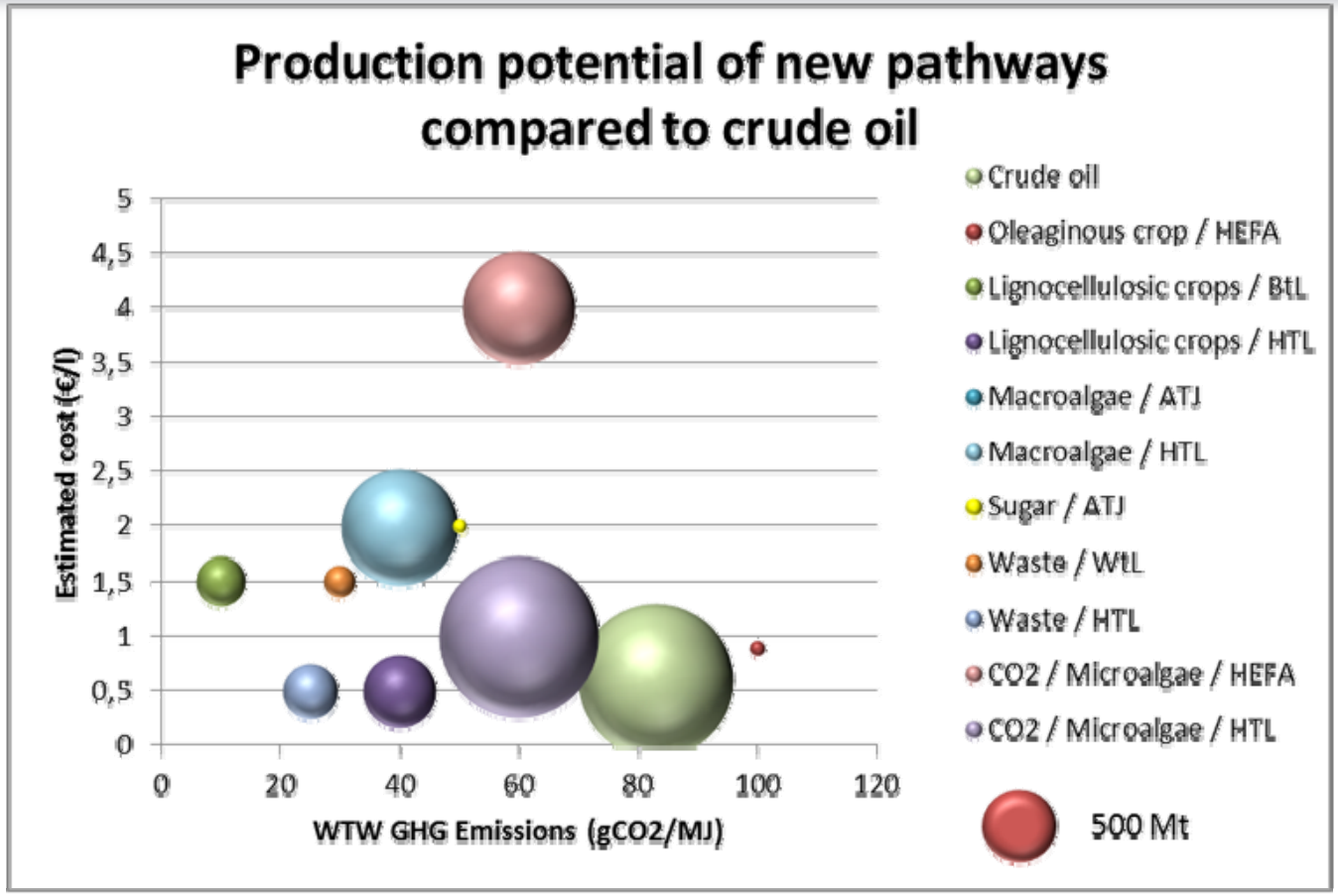
2$88 / US gal ~ 2€22 / US gal
0$63 / litre ~ 0€48 / litre

cost

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

AIRBUS

Constraints



availability & cost

Source EADS

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Agenda

Sustainable Fuels for Aviation

- Context
- Constraints
- Opportunities

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Opportunities

assure safety and aircraft operations

balance between functionality, environmental impact, economics

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Opportunities

- Aircraft fuel system
  - **Material compatibility**
    - Seals
    - Metals
    - Plastics

  - **Engine feed**
    - Air solubility
    - Lubricity
    - Water / ice

  - **Gauging**
    - Relationship of density/electrical permittivity/temperature

safety and aircraft operations

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Opportunities

Conventional petroleum JET A1

Fischer-Tropsch JET A1

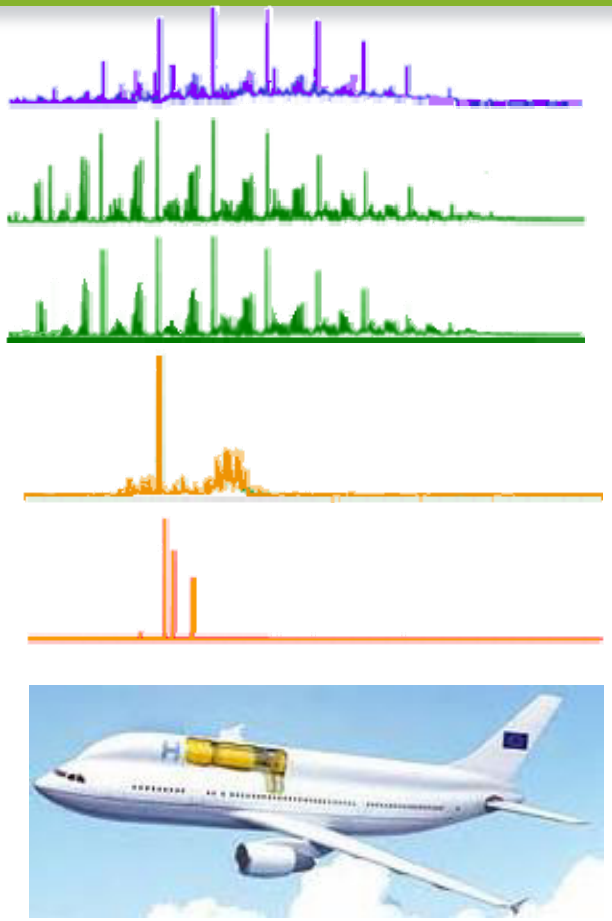
HEFA JET A1

ATJ JET A1?

DSHC JET A1?

Liquid Methane (CH_4)?

Liquid Hydrogen (H_2)?



Today

Baseline JET A1

~ 1% higher energy

Tomorrow

Low Sulphur
Low Aromatics

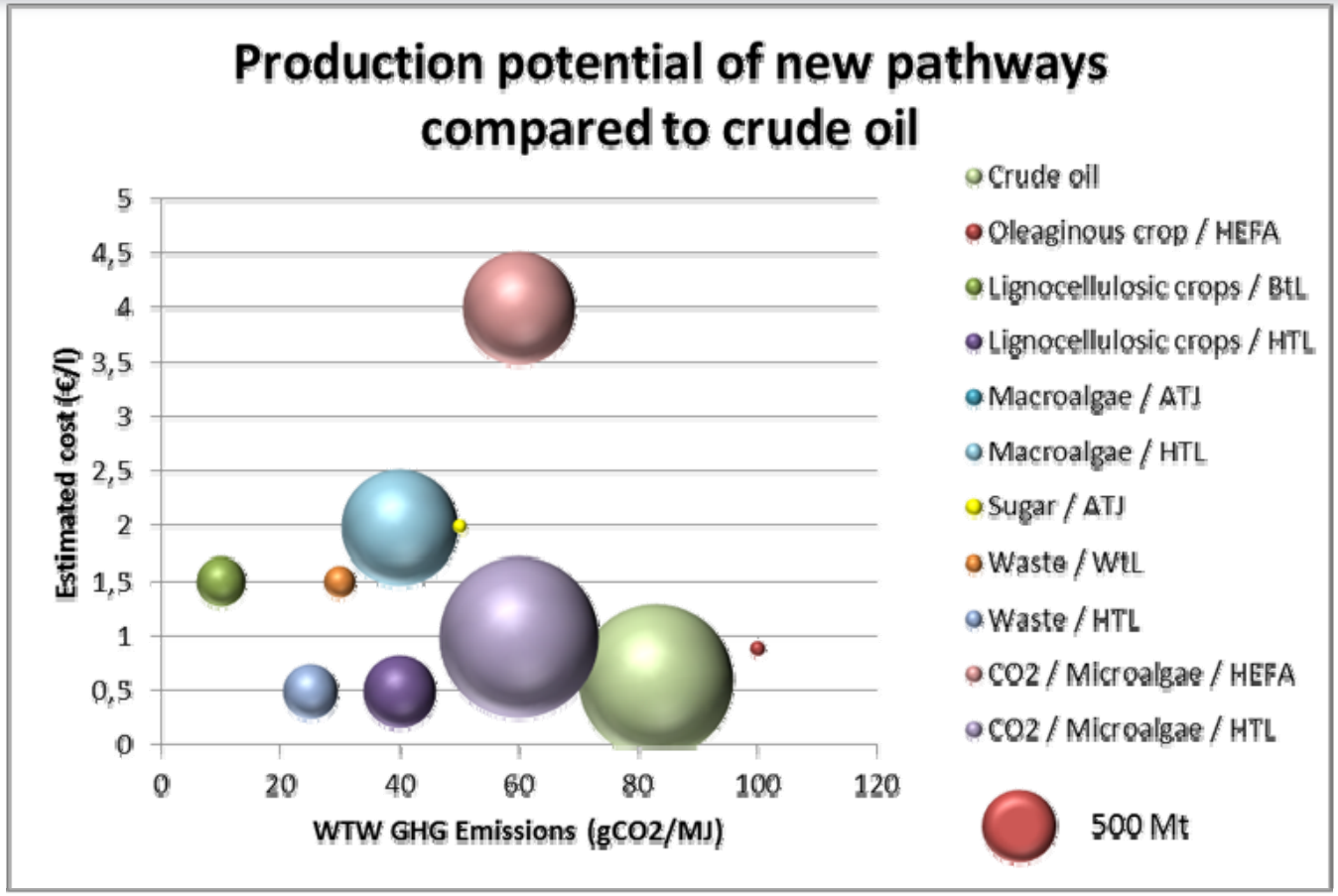
2050 ?

Low emissions?

functionality, environmental impact, economics

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

Opportunities



availability & cost

Source EADS

© AIRBUS Operations S.A.S. All rights reserved. Confidential and proprietary document.

© AIRBUS S.A.S. All rights reserved. Confidential and proprietary document. This document and all information contained herein is the sole property of AIRBUS S.A.S. No intellectual property rights are granted by the delivery of this document or the disclosure of its content. This document shall not be reproduced or disclosed to a third party without the express written consent of AIRBUS S.A.S. This document and its content shall not be used for any purpose other than that for which it is supplied. The statements made herein do not constitute an offer. They are based on the mentioned assumptions and are expressed in good faith. Where the supporting grounds for these statements are not shown, AIRBUS S.A.S. will be pleased to explain the basis thereof.
AIRBUS, its logo, A300, A310, A318, A319, A320, A321, A330, A340, A350, A380, A400M are registered trademarks.