



EUBCE 2019
27TH EUROPEAN BIOMASS
CONFERENCE & EXHIBITION

27 - 30 MAY CONFERENCE AND EXHIBITION
31 MAY TECHNICAL TOURS
LISBON - PORTUGAL
LISBON CONGRESS CENTER - CCL

FLYING GREEN



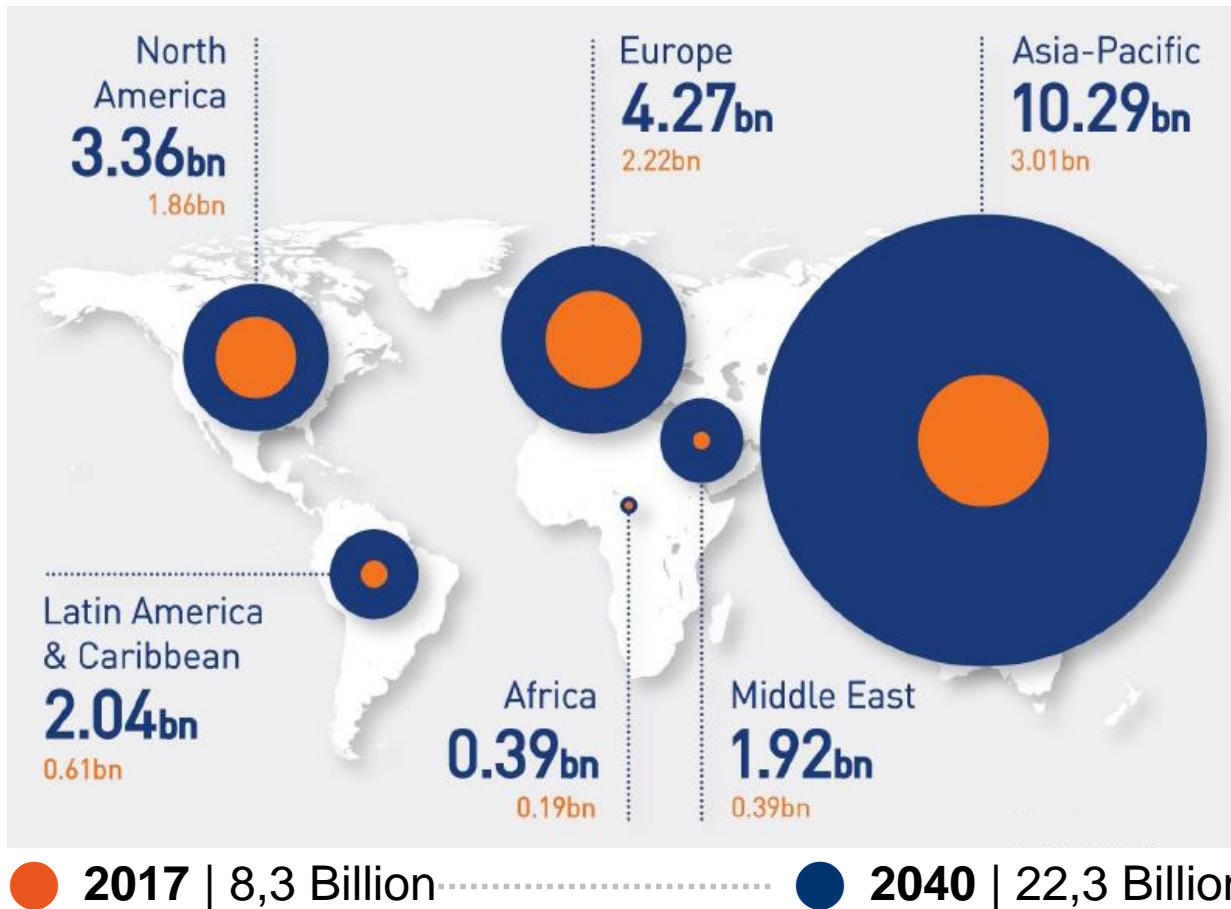
SUSTAINABLE AVIATION FUELS

OFFSETING THE ENVIRONMENTAL IMPACT OF A FAST GROWING
INDUSTRY

Prepared by Stéphane Thion

AIR PASSENGER IS SKYROCKETING

14 BILLION NEW PASSENGERS BETWEEN 2017 AND 2040

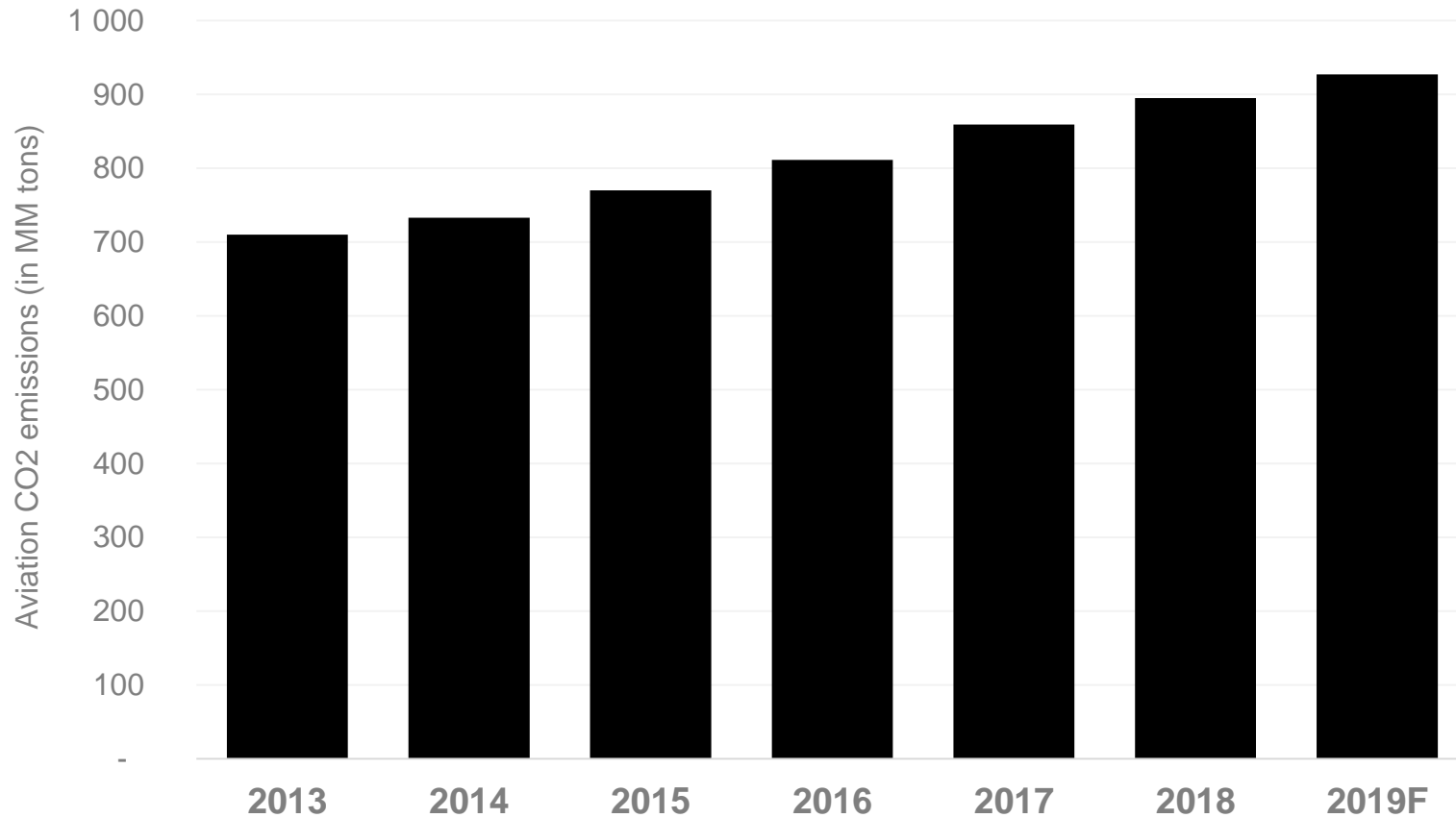


Air transport is growing at a 6% per year in numbers of passengers

Source: Kilde, ACI Europe

AVIATION IS A GROWING SOURCE OF CO₂ EMISSIONS

AVERAGING MORE THAN 4% ANNUAL GROWTH

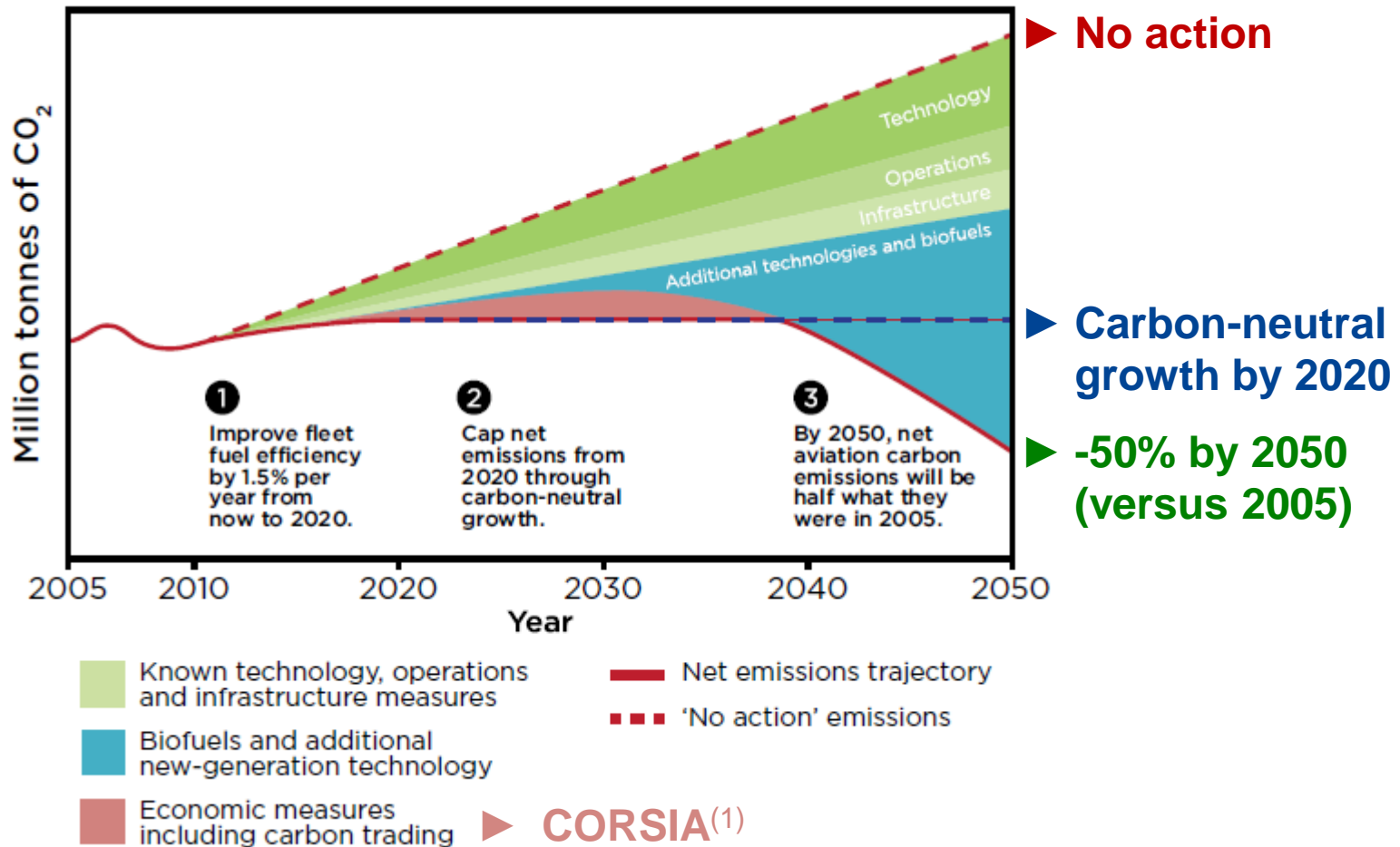


Aviation represents 2,5% of global CO₂ emissions!

Source: IATA, Industry Statistics, Factsheets, December 2018

INTERNATIONAL AVIATION CLIMATE TARGET

AMBITIOUS GOALS TO CUT CO₂ EMISSIONS 50% BY 2050 (VS 2005)



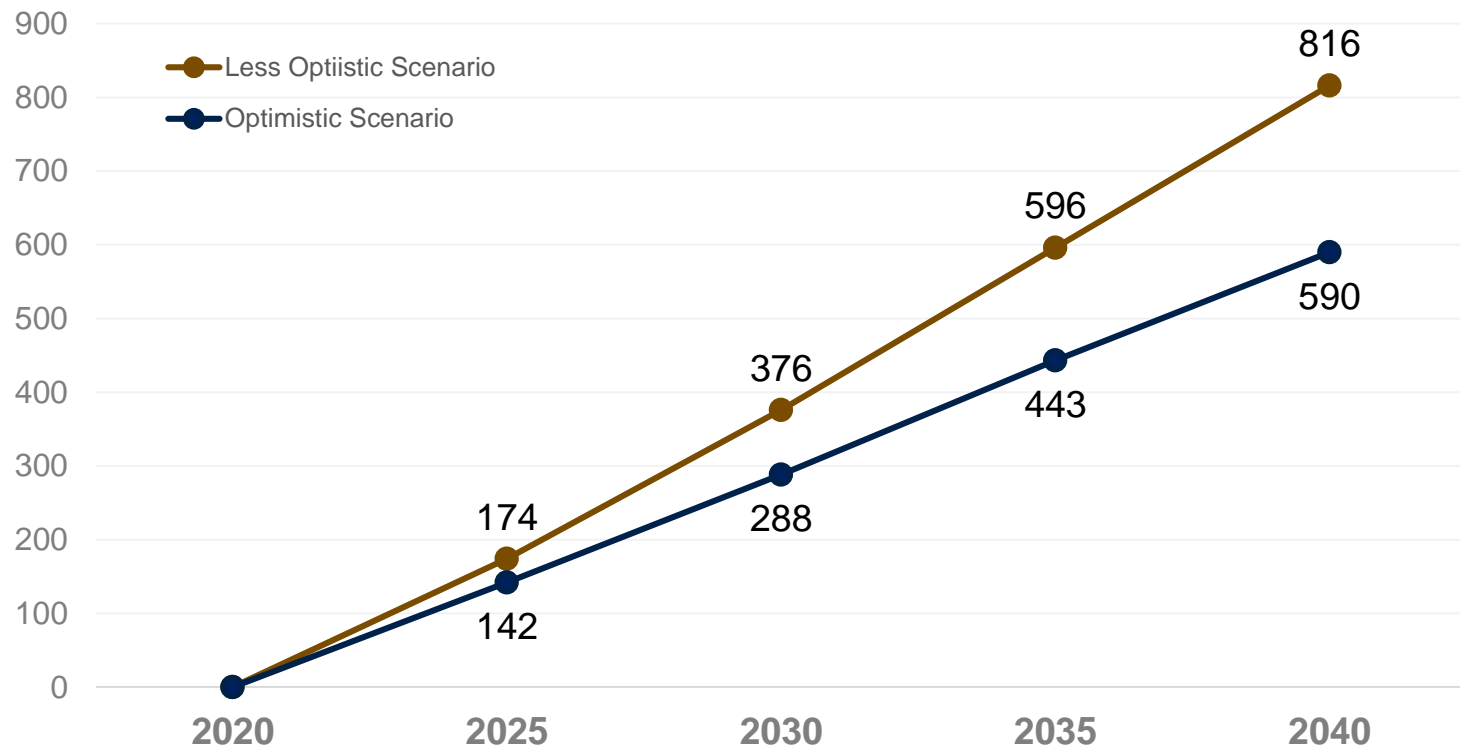
Biofuels are a pillar towards a sustainable aviation

⁽¹⁾ Carbon Offsetting and Reduction Scheme for International Aviation

Source: ICAO's Air Transport Action Group

CARBON NEUTRAL GROWTH 2020

ESTIMATED QUANTITIES OF CO₂ TO OFFSET (IN MM TONS)



**Up to 800MM tons of CO₂ to offset in 2040
(~2016 total global emissions)**

Source: ICAO's Committee on Aviation Environmental Protection (CAEP) analysis, 2016

SAF PLACE IN A DECARBONIZED AVIATION INDUSTRY

FROM SMALL DEMONSTRATION QUANTITIES (>160,000 COMMERCIAL FLIGHTS SINCE 2008) TO AROUND 100MM TONS BY 2040!

2018 SAF < 0,1% total aviation fuel consumption

Year	CO ₂ to offset	Fuel share (ICAO)	Fossil fuel equivalent ⁽¹⁾	SAF equivalent ⁽²⁾
2018 (Actual)	-	-	-	12
2025	160,000	10%	5,000	7,000
2030	330,000	15%	16,000	22,000
2035	520,000	20%	33,000	46,000
2040	700,000	30%	66,000	92,000

Figures in '000 tons

How to deliver such high levels of SAF production?

⁽¹⁾ 3,17g CO₂ emission per g of fossil fuel ⁽²⁾ Considering SAF provides a 60% reduction in GHG emissions

TECHNOLOGY DEVELOPMENT IS ESSENTIAL

ASTM APPROVAL PROCESS IS STRICT AND COSTLY BUT CRITICAL TO INCREASE SAF AVAILABILITY

Approved Pathways	FT-SPK (A) Synthesized Paraffinic Kerosene	HEFA Hydroprocessed Esters & Fatty Acids	SIP Synthesized Iso-Paraffins	AtJ ⁽¹⁾ Alcohol To Jet	Co-processing
Year of approval Time until approval	2009 (2015) 3 years	2011 3 years	2014 3 years	2016 (2018) 5½ years	2018
Feedstocks	Biomass, MSW (Coal, Gas)	FOGs	Sugars	Starches, sugars, cellul. biomass	FOGs ⁽²⁾
Blend limit	50%	50%	10%	30-50%	5%
Status	Demo	Commercial	Commercial	Pilot/Demo	-

7 approved pathways within the last 10 years (3+ years until approval)

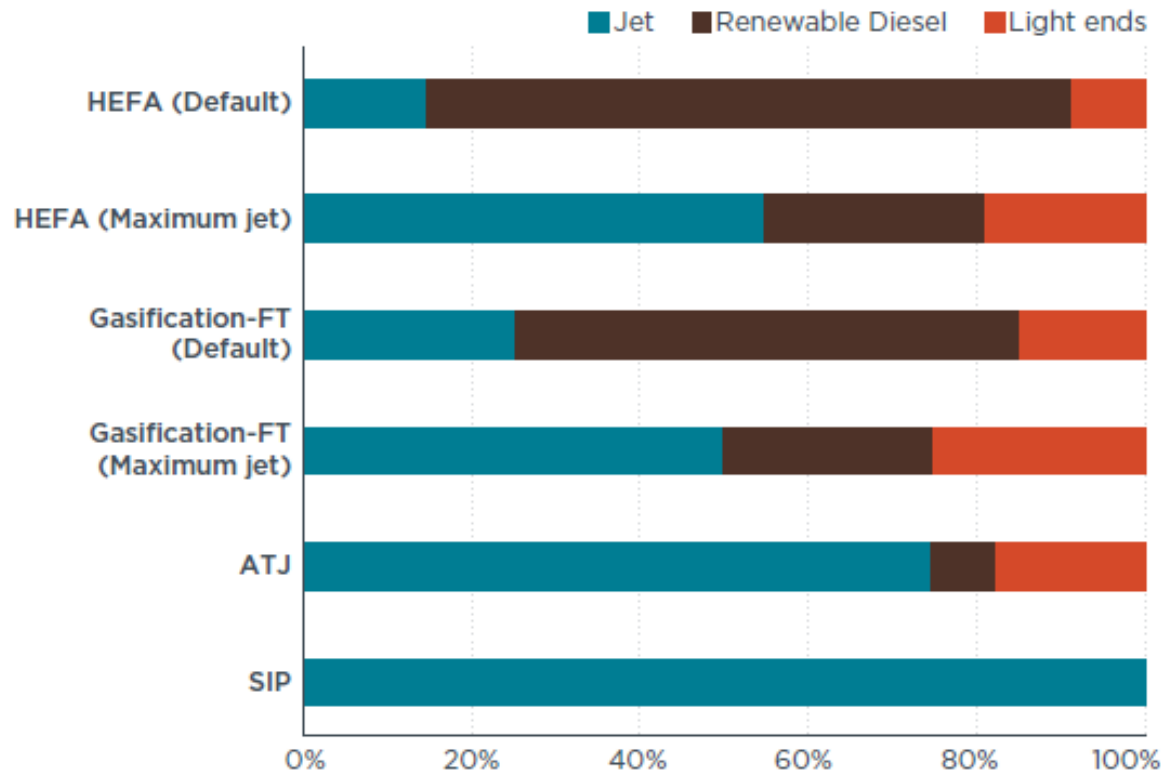
8 pathways actively pursuing certification (1 phase 2, 5 phase 1, 2 inactive)

Accelerating new pathways approvals is key to developing a secure and sustainable aviation industry

⁽¹⁾ From Isobutanol (Gevo) or Ethanol (Lanzatech) ⁽²⁾ Work toward adding FT derived biocrude feedstocks

PRODUCTION EFFICIENCY AND OUTPUT

DIESEL VS. JET

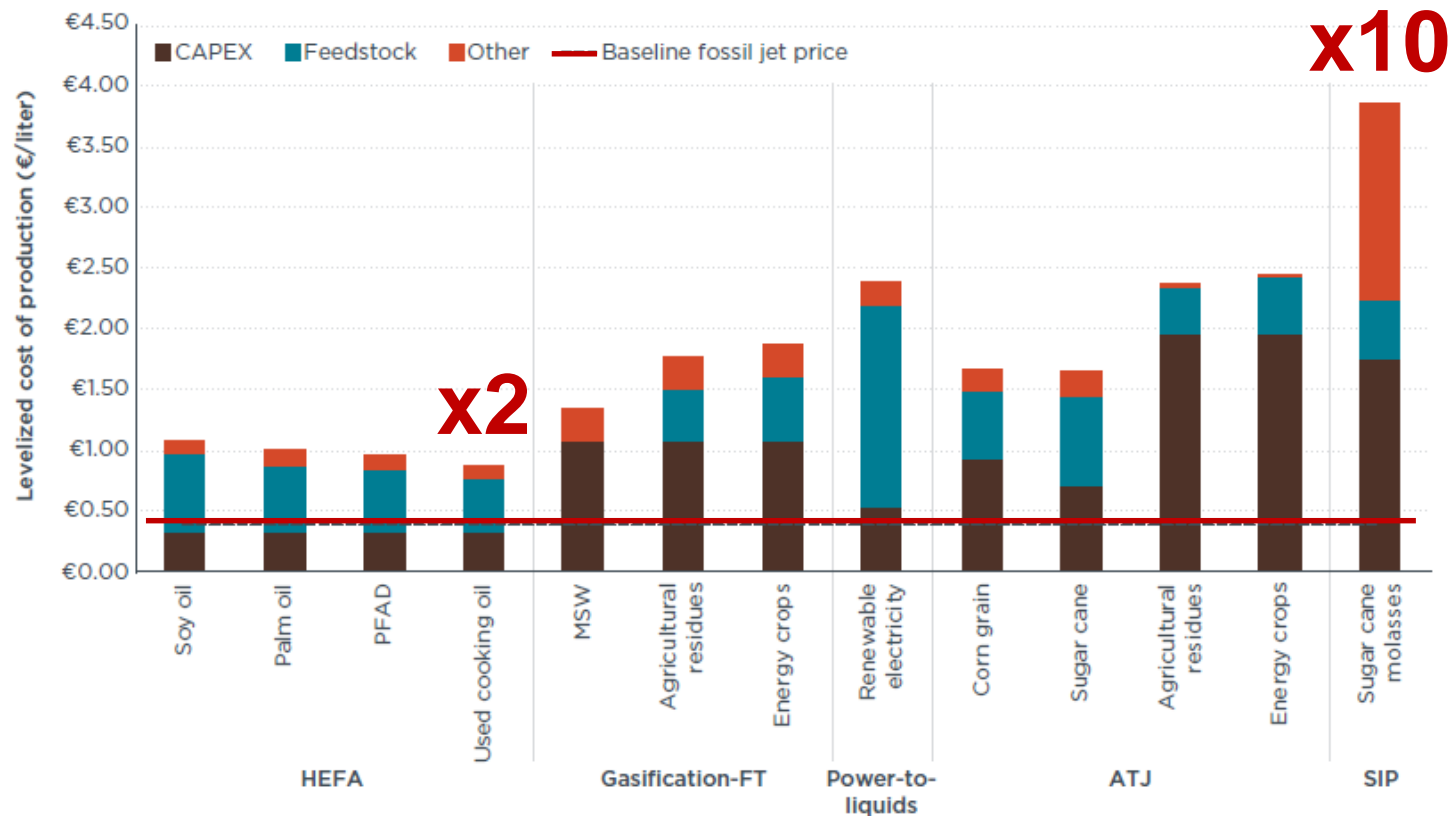


Commercially available processes chemically predisposed to favor diesel

Source : The cost of supporting alternative jet fuels in the EU, International Council on Clean Transportation, March 2019

SAF COST RELATIVE TO CONVENTIONAL

AT LEAST TWICE THE PRICE OF FOSSIL JET PRICE



Impossible today for SAF to compete in a market without strong policy support

Source : The cost of supporting alternative jet fuels in the EU, International Council on Clean Transportation, March 2019

POLICIES ARE CRITICAL TO STIMULATE SAF DEMAND

WITHOUT SUPPORTIVE POLICIES SAF SCALE UP IS UNLEKELY

Today



United States

RFS2 – SAF generate RINs



European Union

RED – Voluntary
RED II – x 1.2 (but no mandate)



Norway

Mandate – 1% in 2019, 30% in 2030



Indonesia

Mandate – 2% (not enforced)

Tomorrow



ICAO

Carbon compensation (CORSIA)



Canada

Multiplier considered



Brazil

Tax exemptions on internal flights



China

Goal of 30% by 2030



Spain

Mandate proposition 2%



Sweden

Mandate proposition on internal flights



France

Mandate proposition 2% by 2025

Need for clear & stable long term policies!

THE FRENCH EXAMPLE

A MANDATE BY 2020?



Green Deal

Evaluate (1) feedstocks/technologies, (2) logistic, and (3) support mechanisms



Possible roadmap

Minister of transport official announced 2% SAF by 2025

Année	Volume Kérosène (Scénario AMS de la SNBC)	Cible à atteindre, % d'incorporation en volume	Equivalence en tonnage de biocarburants
2020	7 800 000 tonnes	0,5%	40 000 tonnes
2025	8 400 000 tonnes	2,0%	170 000 tonnes
2030	9 000 000 tonnes	5,0%	450 000 tonnes

450,000 tons of SAF in France by 2030?

THE SUSTAINABILITY EFFECTS

A GROWING SOCIETAL AND POLITICAL PRESSURE

Growing societal and political pressure

- Circular economy
- Reduce pressure on resources
- Deforestation
- Compliance with regulations (RED, CORSIA)

Feedstock access and certification

- Plant and animal fats, oils and greases
- Lignocellulosic waste and residues
- Traceability, ILUC

Supply chain transparency

- Certified GHG benefits

SUMMARY

PATH TO SAF DEPLOYMENT

Technology development

Accelerate new pathways approvals

Economics

Reduce production costs

Policies

Set stable long term policy measures

Sustainability

Access feedstocks while meeting societal and political expectations

READY FOR TAKE OFF!

THANKS FOR YOUR ATTENTION

