

Welcome to the 15th webinar of the series on Sustainability - EU/SEA CCCA CORSIA Project

The webinar will start @

- 15h Bangkok/Jakarta/Hanoi Time
- 16h Singapore/Manila Time
- 10h Brussels/Cologne Time



Your safety is our mission.

CORSIA Eligible Fuels:

« the role of renewable fuels in decarbonizing aviation focusing on SAF and Hydrogen »

**Working for sustainable aviation.
Your safety is our mission.**



EU-SEA CCCA CORSIA project

Objective: Support to ASEAN MS in CO₂ reduction from International Aviation

Areas of Action:

- ✓ CORSIA Implementation
- ✓ Support to State Action Plan for CO₂ Reduction
- ✓ Emission data management systems
- ✓ Climate Change Policies (e.g. SAF)

Some practicalities & moderators



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→ **Q&A** after the speaker

→ Use Q&A section (Slido)

→ Vote up questions

→ **Free chat**, please
express yourself live

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slido.com
#SAF15



Webinar 15:

The role of renewable fuels in decarbonizing aviation focussing on SAF and Hydrogen

How will renewable fuels contribute to decarbonizing aviation and what are the different use cases? What is the status of the hydrogen development plan in aviation and what are its various applications? What kind of regulatory framework has impact on this development? How does the required technological transition look like and what synergies can be leveraged?



Our speakers today

Part 1



Steven Le Moing

@ steven.le-moing@airbus.com



Airbus



Corporate Affairs, Sustainable Aviation Fuels Mgmt.

Steven LE MOING is in charge, within Airbus Corporate Affairs, of Sustainable Aviation Fuel Program Management. Already dealing with Environment and Emissions, he started his career in Airbus sixteen years ago by addressing Aircraft Noise in operations.

Jumping on to another Environmental major topic was a great opportunity for him when he took over, since now four years, the topic of Sustainable Aviation Fuels (SAF) within Airbus Corporate Affairs department. His actions are focusing, through the pillar of SAF, on fostering Industry efforts in coping with CO2 emissions reduction targets as internationally endorsed. Below the mandatory activity to ensure Airbus products readiness and safety for existing and new pathways of Alternative Fuels, his Ambition is to maintain Airbus as a pioneer, a major actor and a decisive catalyst in the Sustainable Aviation Fuel's market emergence targeting production ramp up. Convinced that sustainability is criteria that cannot be put apart from any technical solution it will definitely be one of the subjects Airbus will closely scrutinize. Industry representative in several international bodies and organizations, Steven is eager to pave the way, all along with the value chain stakeholders, of the promising future of SAF. Convinced that the environment is definitely a major topic for aviation he is on board to address with enthusiasm present and future challenges.

Steven graduated from Toulouse University with a PhD in physics and started working in the early 2000s for an AIRBUS subcontractor on Aircraft Performances topics before integrating Airbus staff in end 2006.

Our speakers today

Part 1



Nicolas Jeuland

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Safran



Fuel Senior expert, Safran
Innovation

In 2014, Nicolas Jeuland joined Safran as a fellow expert in the field of fuels, alternative fuels and evaluation of aviation's environmental impact. He is coordinating Safran Research & Technology roadmap on SAF, hydrogen and non-CO2 impacts, as well as advocacy around these subjects.

He leads / has led several working groups in major EU initiatives, specifically: ACARE WG3 (Advisory Council for Aviation Research in Europe), Hydrogen Europe RM13, ETIP Bioenergy WG3 (European Technology and Innovation Platform on Bioenergy). Furthermore he is "Sherpa" of the chairman of the aviation pillar of the Renewable and Low-Carbon Fuels Value Chain Industrial Alliance.

Nicolas has previously been working for 15 years as head of 'Fuels, Lubricant and emissions department', and fuel expert for IFPEN (former French Institute of Petroleum). He is also reserve officer (Col) for the French energy logistic agency (SEO) in charge of decarbonisation roadmaps of armed forces, as well as associated member of the 'French Académie de l'Air et de l'Espace'.

Our speakers today

Part 2



Julien Lambert

@ julien.j.lambert@airbus.com



Airbus



Ecosystem Team – hydrogen at airports

Julien has started his career in the aviation industry about 15 years ago as a system engineer for Airbus.

He has always been dedicated to innovation topics: after deploying digital solutions for Airbus Flight Test Operations, he then jumped into a further future, and spent a couple of years in R&T, before joining ZEROe pre-programme.

He now belongs to the Ecosystem team, in charge of developing hydrogen infrastructure at airports.

Our speakers today

Part 3



Dr. Kan-Ern Liew

@ kan-ern.liew@airbus.com



Airbus



Head of Technology of Airbus
Malaysia

Dr. Kan-Ern LIEW is currently the Head of Technology of Airbus Malaysia. He is also the CEO of Aerospace Malaysia Innovation Centre (AMIC).

Established in 2011 and championed by the Malaysian government, AMIC was set up to encourage aerospace Research & Technology activities. Its founding lead members are the Airbus Group, Rolls Royce and CTRM.

Dr. Liew started his career at Airbus in 2006 under the Research and Technology department in Munich, Germany. His many years of research and technology development experience in Airbus covers the fields of power generation, fuel processing, catalysis, and alternative energy for aerospace application – where most of his patents are centered

He completed his Masters in Chemistry (MChem) from Nottingham Trent University, UK, and attained his Ph.D from the University of Montpellier in France.

Dr. Liew's portfolio covers the areas of aerospace manufacturing technology, robotics & automation, digitalisation, and sustainable aviation.

Agenda

AIRBUS SAFRAN

Airbus – SAFRAN views on SAF contributing to the decarbonization of the aviation industry

The role of Hydrogen: Innovative propulsion technologies & airport ground infrastructure

Airbus regional cooperation on SAF and hydrogen

SAF : A COMPULSORY BRICK FOR AVIATION CARBON NEUTRALITY TARGET

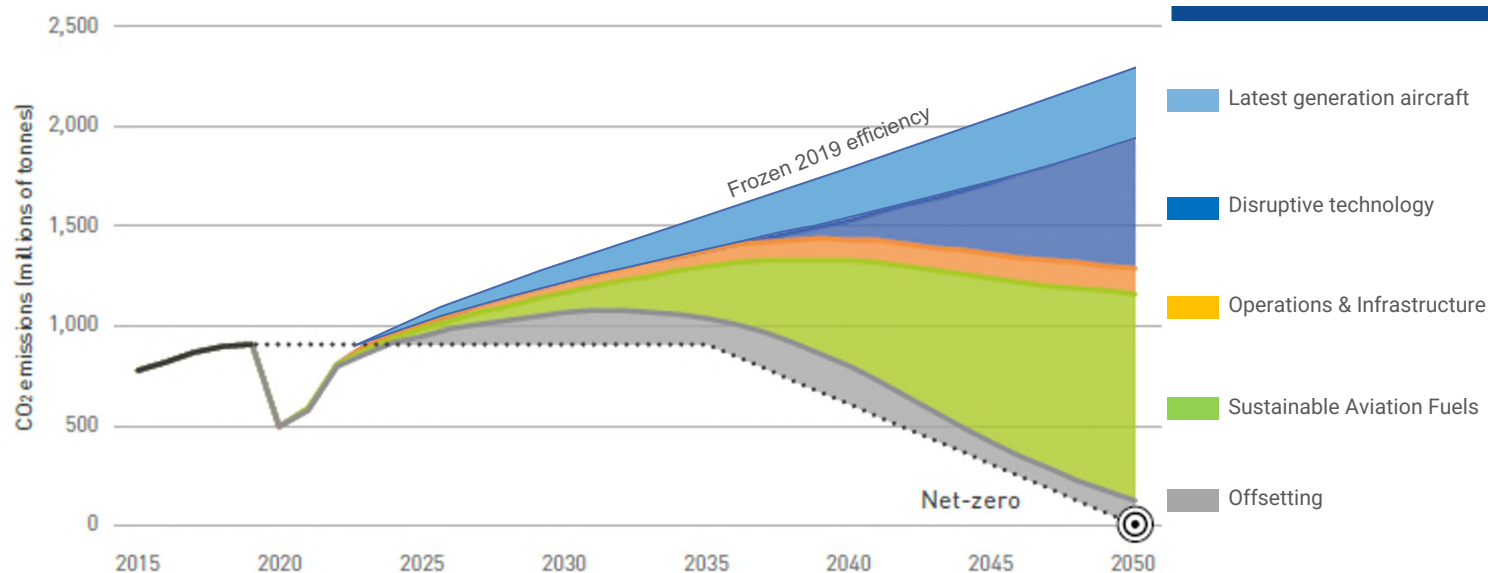
Steven Le Moing (Airbus) – Nicolas Jeuland (Safran)

AIRBUS

 **SAFRAN**

 **EASA**
European Union Aviation Safety Agency

Aviation industry global Net Zero commitment

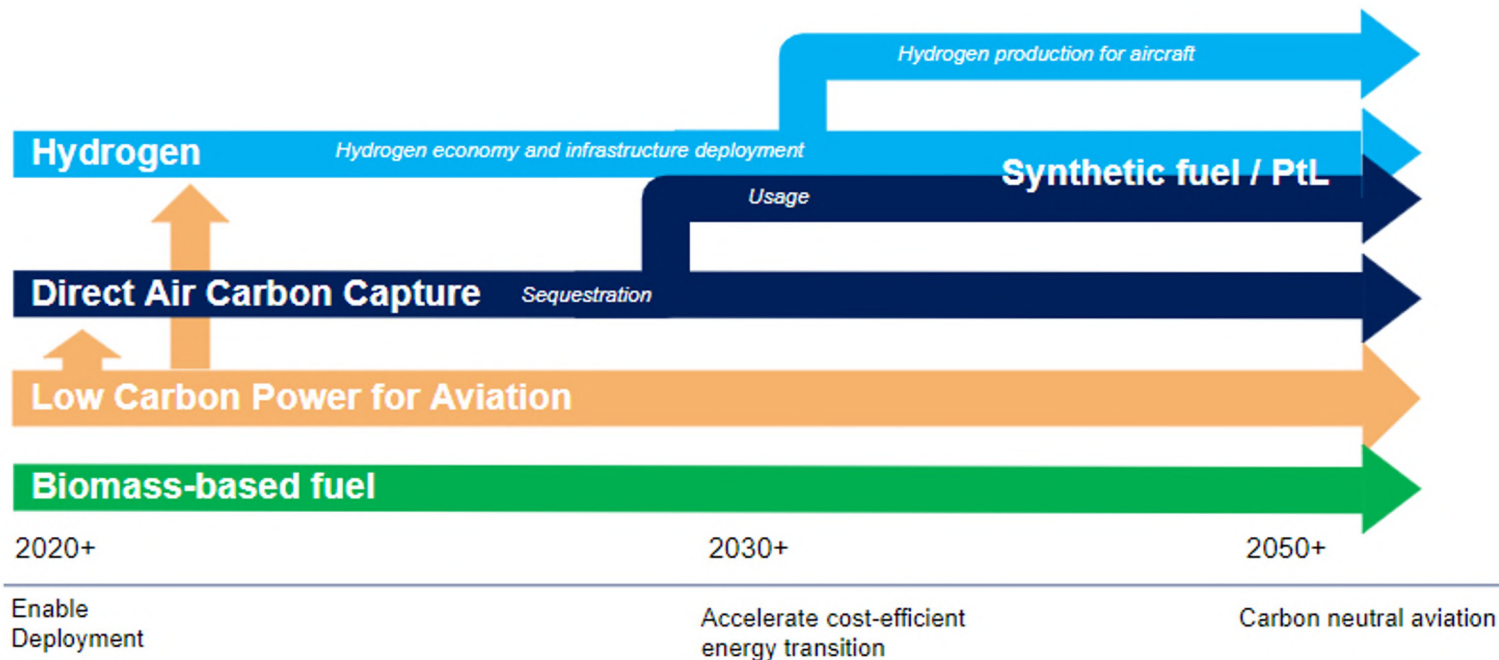


After the IATA 2021 AGM and ATAG declaration the whole aviation industry is now committed to net zero CO₂ emissions in 2050

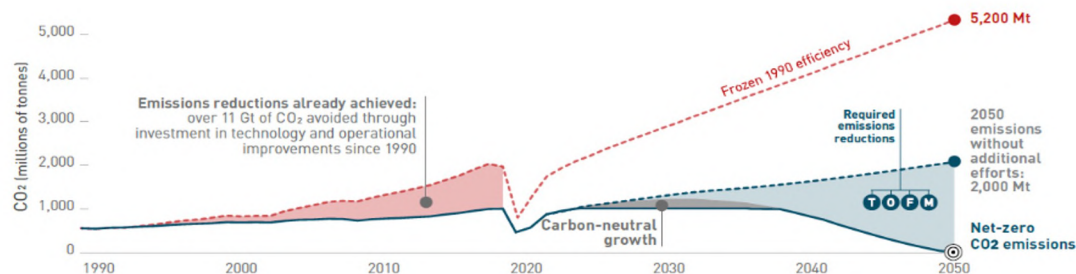
ATAG CO₂ Roadmap (most ambitious technology scenario & central traffic growth scenario: 3.1% CAGR 2019-2050)

Multiple solutions are required to reach this objective

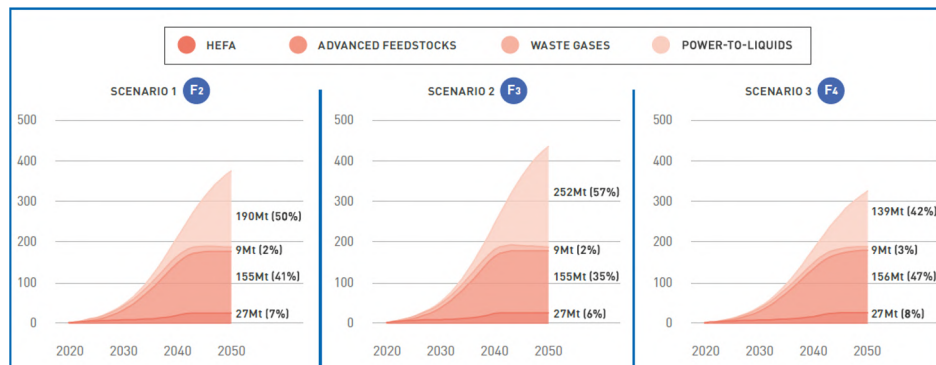
The Energy Roadmap



Aviation industry global SAF commitment

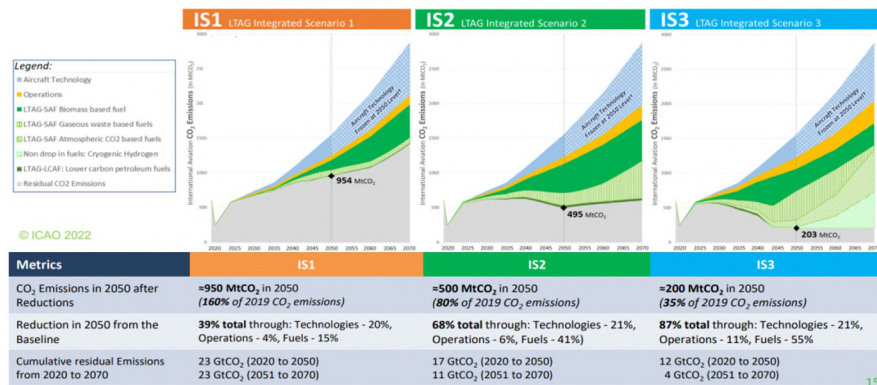


- Carbon Neutrality target in 2050 has been defined as critical target by aviation industry through ATAG commitment.

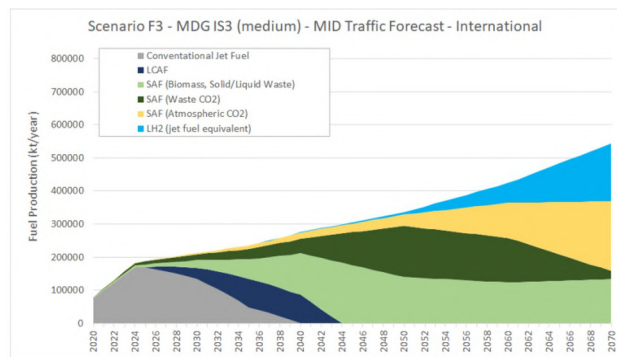


- In this decarbonization journey, SAF play a critical role, with massive incorporate rate needed in the years to come in all scenarii

ICAO Long Term Aspirational Goals



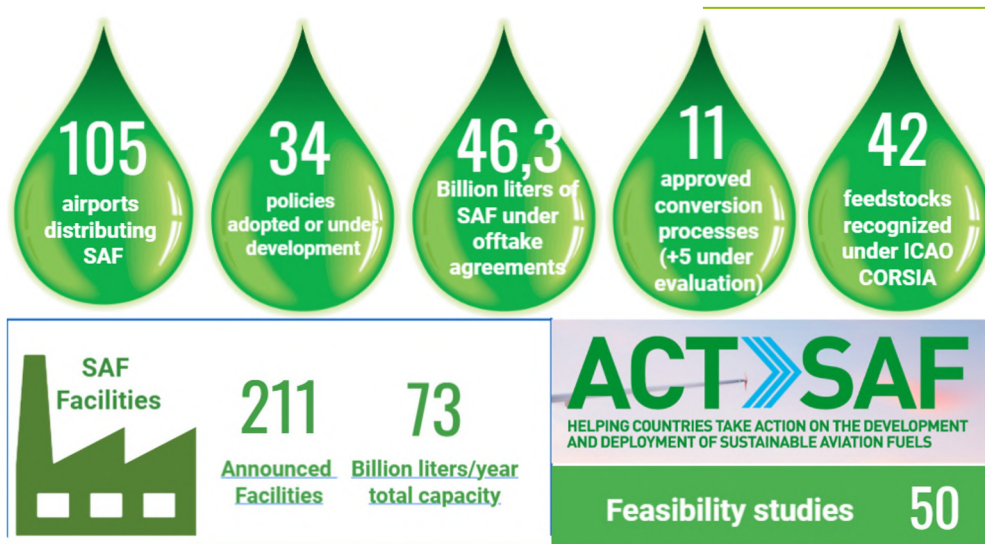
- In November 2022, the 41st ICAO Assembly adopted a **long-term global aspirational goal (LTAG)** for international aviation of net-zero carbon emissions by 2050, in support of the UNFCCC Paris Agreement's temperature goal. **This is a historic agreement**, endorsed by more than 180 countries, that reinforces the leadership of ICAO on issues relating to international aviation and climate change



In all the LTAG scenarios, SAF play a major role in the decarbonation of aviation

SAF are already a tangible reality

Source : ICAO

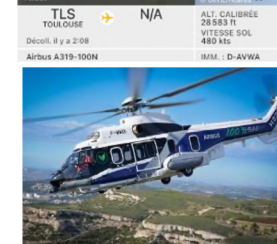


Up to 50%, with a roadmap to 100% compatibility

December 2021 : CFM / Airbus A319 100%SAF trial



November 2021 : Safran Helicopter Engines / Airbus helicopter first 100%SAF helicopter demonstration



But a massive ramp-up is compulsory in order to meet aviation environmental targets

The 3 main challenges of SAF deployment

Rapid and massive deployment

- Remove all technical barriers to SAF incorporation
- Fully assess the environmental potential of SAF
- Find the appropriate political support

Long term availability

- Assess the global biomass availability (2030-2050-2050+)
- Reduce pressure on SAF demand by ultra-efficient aircraft development and SAF availability increase through new pathways (including PtL/efuels and hydrogen pathways)

Build a global low carbon fuel roadmap

- Assess the global potential of Hydrogen for aviation
- Ensure the global low carbon fuel availability (biofuels / efuels / hydrogen)

A holistic collaborative approach



Validate

Validate the full compatibility of SAF with all products.



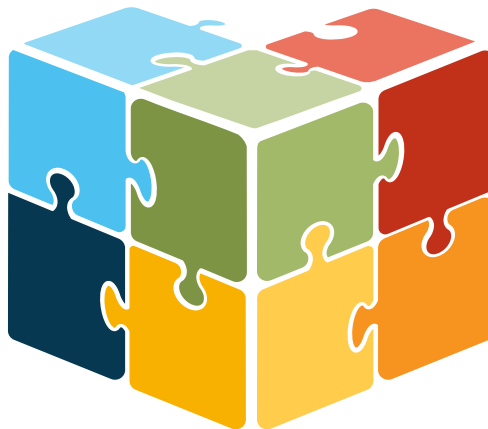
Assess

Assess the global potential of SAF (environmental, including non-CO2 effect, operational, economical...)



Develop

Mature technologies fully compatible with SAF (up to 100%) and study the global SAF/aircraft optimization



Demonstrate

Demonstrate the potential of SAF through ground or flight tests

Support

Support the development of SAF through global initiatives but also offtakes

Advocate

Advocate for SAF crucial interest for aviation and support global partnerships dedicated to SAF massive deployment

Airbus / Safran are leading projects in order to allow to remove technical barriers and aiming at 100%SAF compatibility



- Supporting the work led at ASTM on 100%SAF definition
- Validation of aircraft and fuel system compatibility with 100%SAF
- Testing 100%SAF with various chemical compositions in order to evaluating the full environmental potential (including contrails)

Towards a full fleet compatibility with 100%SAF before 2030

Airbus / Safran are demonstrating by example (delivery flights, internal operations, engine acceptance tests)



▪ AIRBUS

- 1st delivery with SAF from Toulouse in 2016, followed by Mobile in 2018
- 1st delivery from Hamburg in 2020
- Mirabel and Tianjin SAF supply in preparation
- Internal Operations with SAF
 - Beluga since end 2019
 - Flight Tests to start in 2022

▪ SAFRAN

- All engine reception tests being led with 10% SAF in 2021, 25% in 2023, target 35+% in 2025
- Safran Helicopter facility of Fareham in UK : 50% SAF on a daily basis from 2022

Airbus / Safran are leading projects in order to support SAF ramp-up (selected examples)



- Supporting the development of production units (see Safran investment in the German INERATEC PtL production company and Airbus investment in the US DG Fuels GFT production)

- Airbus / Qantas Australian Sustainable Aviation Fuel Partnership



- SAF@India (Airbus, Safran, Axens, AdP/GMR) : assessing the potential of SAF in India

Creating favourable ecosystem for SAF deployment : Alliances (Europe, US, APAC), OACI, WEF, ATAG, IATA



- Airbus and Safran are fully engaged in the various alliances worldwide aiming at supporting the deployment of SAF
- Main target : match production and demand
 - Ensure visibility and stability to investors
 - Set up appropriate support measures
 - All Airlines to get access to enough volume at fair price
 - Harmonized sustainability
- Alliances, private and public collaborations are relevant vehicles to foster ecosystem structuration for the establishment of a SAF market

▪ ICAO CAAF/3 meeting in November in Dubai will be key in passing ambitious messages on international coordination and need for SAF massive deployment

Industrial Alliances : A central tool for EU environmental policy



Renewable and Low-Carbon Fuels Alliance

Coordinate the whole value chain to boost the supply and demand for sustainable fuels

- Focus on Aviation and maritime sectors
- More than 180 members from energy and fuel producers to end-users such as airlines, shipowners, OEMs, ports and airports and financial sector

Concrete actions to be implemented

- Work on alternative fuels value chain
- Assess the enabling conditions
- Identifying financing opportunities and instruments to support the deployment of sustainable fuels
- Create of a pipeline of investment projects

Work already started

- First General Assembly on **12th July**
- Detailed Work programme 2022-2023
- 4 Roundtables created:
 - Feedstock and synergies
 - Aviation
 - Maritime
 - Access to private and public finance



HOW WILL THE ALLIANCE WORK?



CONNECTING PARTNERS:

The Alliance will be **open to a wide range of actors** – aircraft manufacturers, airlines, airports, energy companies and fuel providers, standardisation and certification agencies, passenger and environmental interest groups and regulators.



ESTABLISH RECOMMENDATIONS:

Working groups will focus on such issues as infrastructure requirements, provision of **new energy sources**, operating requirements and regulatory issues.



ENCOURAGE INVESTMENTS:

The Alliance will establish a **pipeline of projects** on the basis of an agreed roll-out plan for hydrogen and electric aircraft and **help attract private and public financing**.

Conclusion on SAF : Aviation industry mobilized in order to allow SAF deployment



- **Our goals :**
- Mature and implement ultra-efficient technologies in order to reduce fuel consumption
- Remove all technical barriers for the rapid and massive deployment of SAF (up to 100%)
- Foster the deployment of SAF through offtaking agreements and support to production projects
- Federate all actors through global initiatives (see EU RLCF alliance, EU ZeroEmissions Aviation Alliance)
- Reduce the pressure on SAF demand through ultra efficient technologies, but also the development of new technologies such as hydrogen



This project is funded by
the European Union

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Agenda

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Airbus – SAFRAN views on SAF contributing to the decarbonization of the aviation industry

The role of Hydrogen: Innovative propulsion technologies & airport ground infrastructure

Airbus regional cooperation on SAF and hydrogen

ZEROe

Towards the world's first zero-emission commercial aircraft



Julien Lambert, H2 Infrastructure Project Developer

AIRBUS

Airbus ambition

Pioneering Sustainable Aerospace for a Safe and United World



2030

Offer 100% SAF capability on our commercial aircraft



2035

Be the 1st major manufacturer to offer a decarbonized commercial aircraft



2050

Reach aviation* net-zero emission target

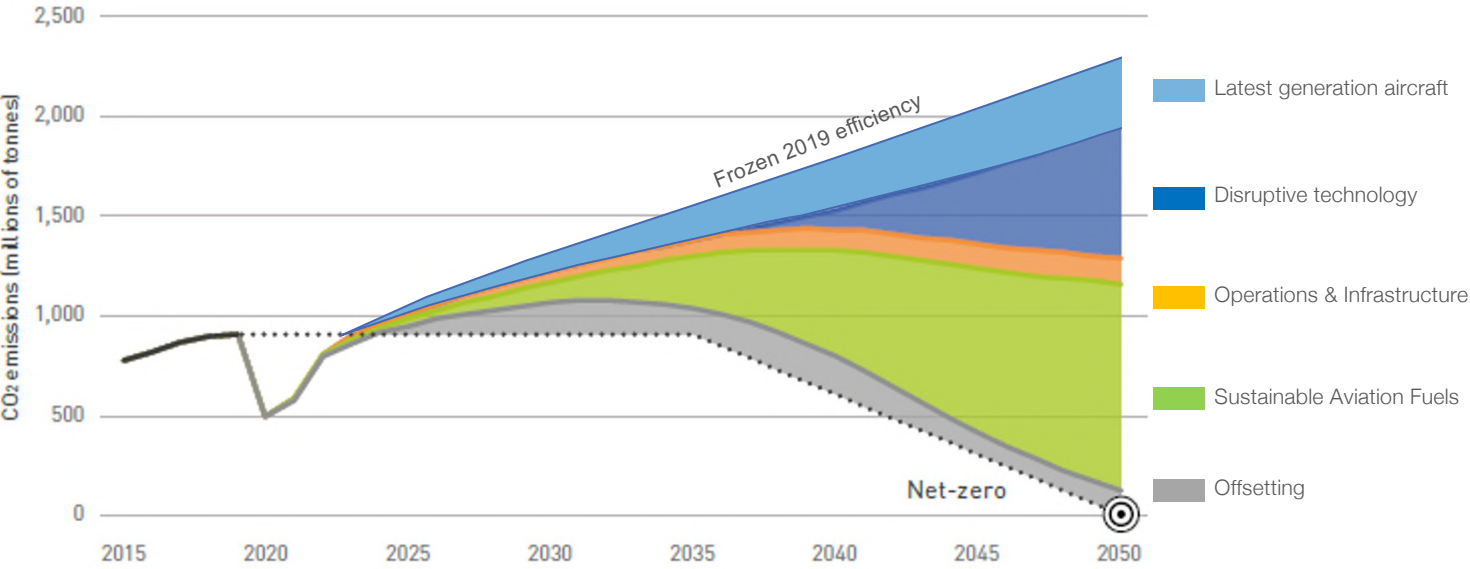
*A historical milestone was reached on 7 October 2022 at the 41st ICAO (International Civil Aviation Organization) Assembly: Net Zero Carbon emissions goal in 2050

Aviation's next big challenge

Net Zero in 2050

Multiple solutions are required

Airbus is leading the journey towards clean aerospace



ATAG waypoint 2050 (scenario 3: aspirational and aggressive technology perspective)

Why hydrogen?



Decarbonized

H₂ emits no CO₂* & has the potential to reduce non-CO₂ emissions (i.e. NO_x) & persistent contrails

(*if generated from renewables via electrolysis)



Declining costs

The cost of producing H₂ is likely to decline over the next decades as it gets widely adopted by various industries



Versatility

H₂ could be used as an ingredient of Sustainable Aviation Fuel* or directly on-board an aircraft through direct combustion or Fuel Cells

(*combined with captured CO₂ to produce Power-to-Liquid synthetic fuel)

Introducing Airbus ZEROe

Turboprop



<100

Passengers



Hydrogen
Hybrid Turboprop
Engines (x 2)



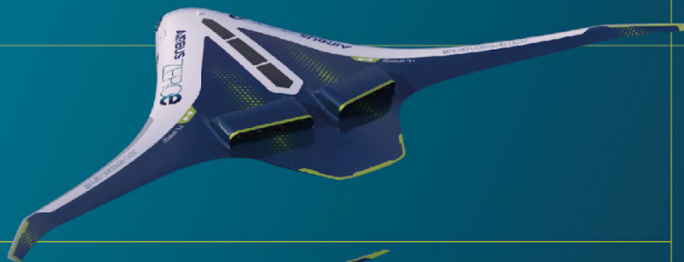
1,000+nm

Range



Liquid Hydrogen
Storage & Distribution
System

Blended-Wing Body



<200

Passengers



Hydrogen
Hybrid Turbofan
Engines (x 2)



2,000+nm

Range



Liquid Hydrogen
Storage & Distribution
System

Turbofan



ZEROe Hydrogen combustion demonstrator



A380 multimodal test platform

with its capacity to store large hydrogen tanks



Hydrogen combustion engine

located along the rear fuselage



4 liquid hydrogen tanks

stored in a caudal position



Liquid hydrogen distribution system

[Link to the video](#)

AIRBUS

ZEROe Fuel Cell demonstrator



A380 multimodal platform

to test and demonstrate all our hydrogen technologies



Megawatt power class



A fuel cell engine

located along the rear fuselage



Cryogenic liquid hydrogen tank

stored in the fuselage



Gaseous hydrogen distribution system



ZEROe LH2 refueling demonstrator



Airport Supply and Infrastructure

Outside airport ◀ ▶ Inside airport

LH2 import by trucks from external plant



GH2 import by pipeline



Low carbon electricity import



Truck-based

- Remote H2 production and liquefaction
- Airport supply by truck
- Suitable for small to medium levels of traffic

On-site

- H2 production and/or liquefaction on site
- Refuelling by bowser or hydrants
- Suitable for high levels of traffic

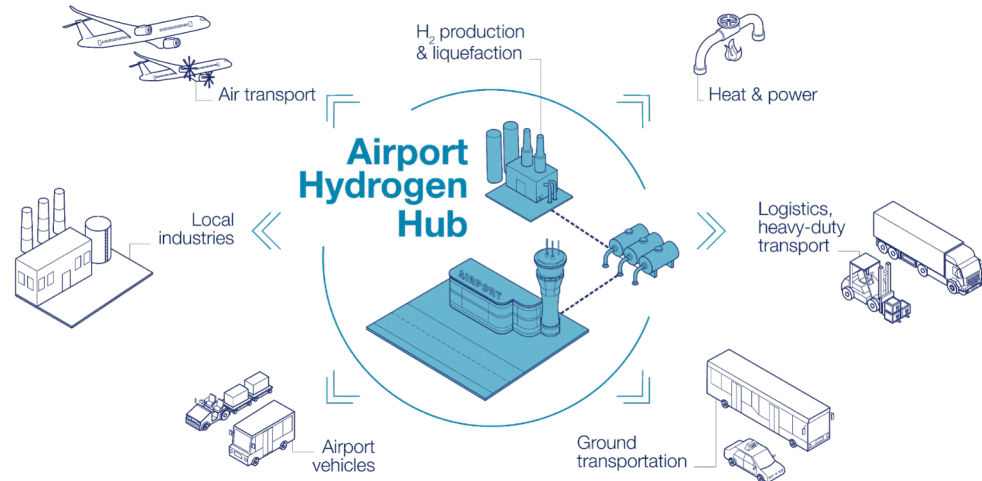
Hydrogen Hubs at airports

Hydrogen Hubs at airports will:

Prepare regulations and standards for the handling of H₂ at airports

Ensure that a large number of airports worldwide are supplied with liquid H₂ by 2035

Foster efficiency improvements and cost reductions in hydrogen liquefaction, storage and distribution



Thank you

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Agenda

AIRBUS SAFRAN

100% SAF by 2050

Hydrogen Sustainable and low-carbon fuels Sustainable aviation fuels Low-carbon aircraft Other

Airbus – SAFRAN views on SAF contributing to the decarbonization of the aviation industry

The role of Hydrogen: Innovative propulsion technologies & airport ground infrastructure

Singapore Thailand Malaysia Indonesia

South Korea Japan Australia New Zealand

Airbus regional cooperation on SAF and hydrogen



together
we are
Sustainable

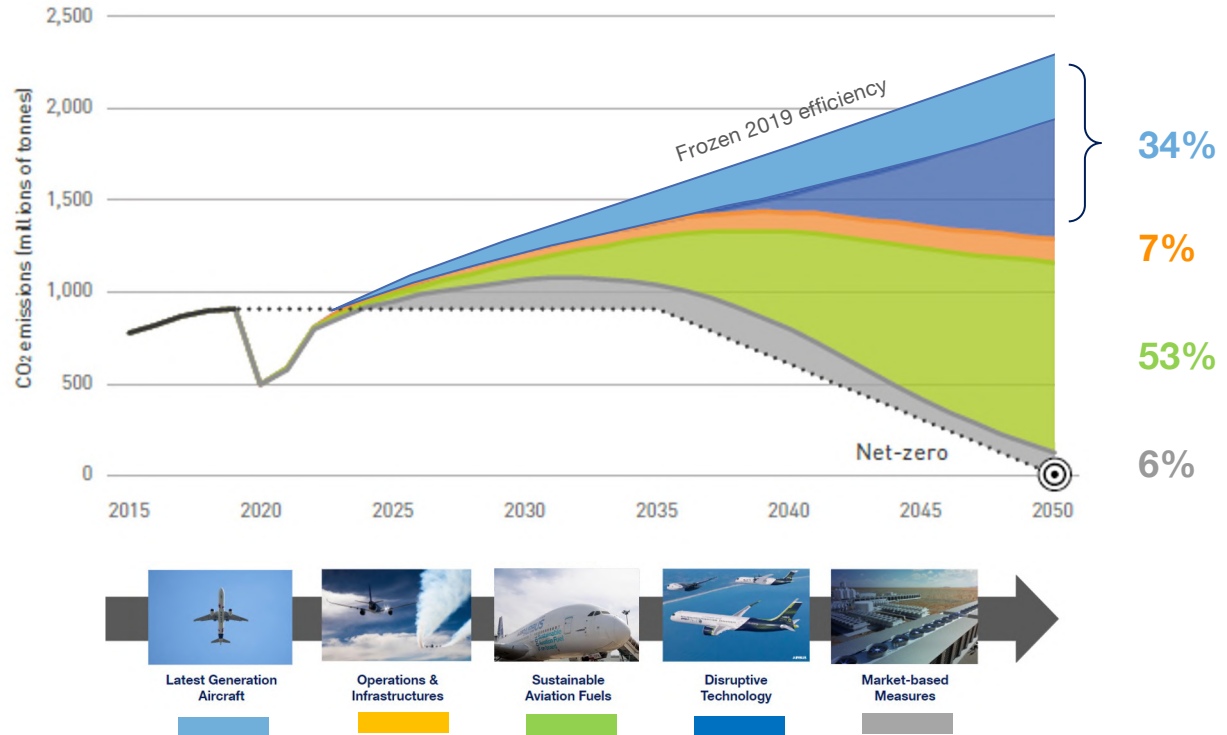
**Webinar 15: The role of
renewable fuels in
decarbonizing aviation
focussing on SAF and
Hydrogen**

10 October 2023

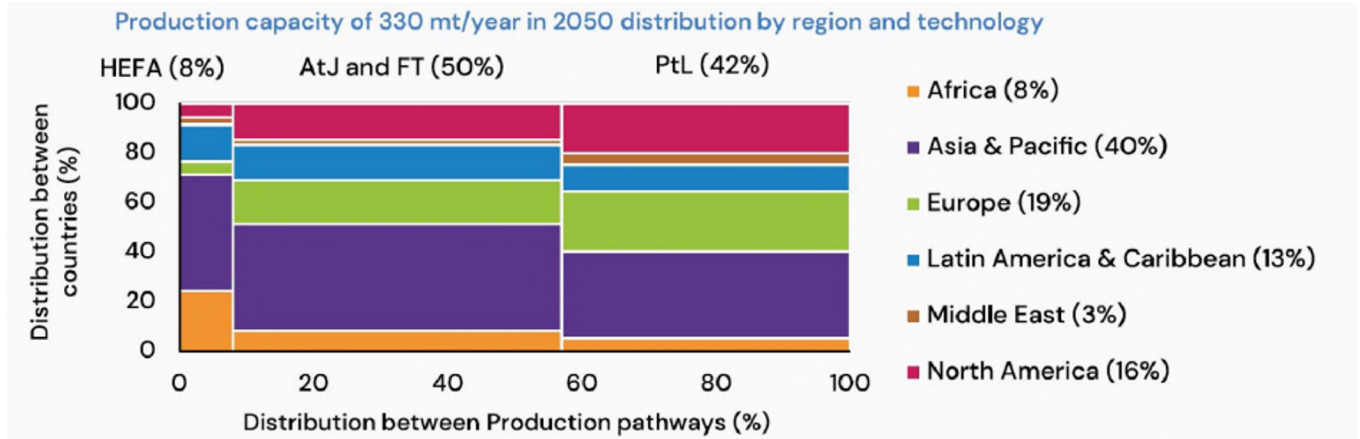
AIRBUS

There is no single solution to reduce aviation CO2 footprint

Airbus supports the ATAG most ambitious technology scenario

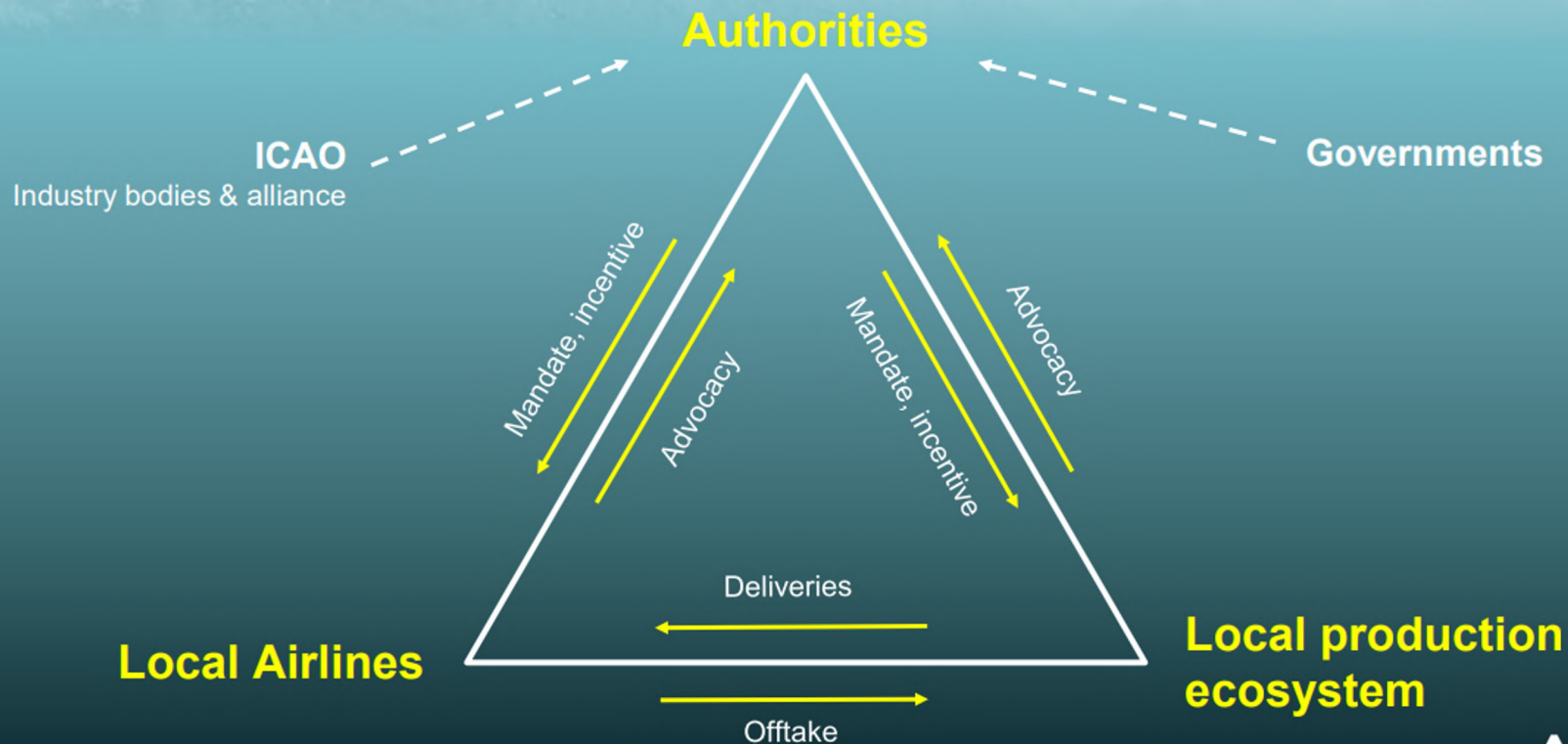


To reach 2050 Net-Zero target, SAF and especially the availability of AtJ and FT pathway SAF will be crucial



- Several pathway required
- Most current announced SAF production capacities are relying on HEFA technologies
- However only 8% of forecasted need by 2050
- Alcohol-to-Jet, FT, and PtL as a key pathway for the future

Building the Magic Triangle for SAF

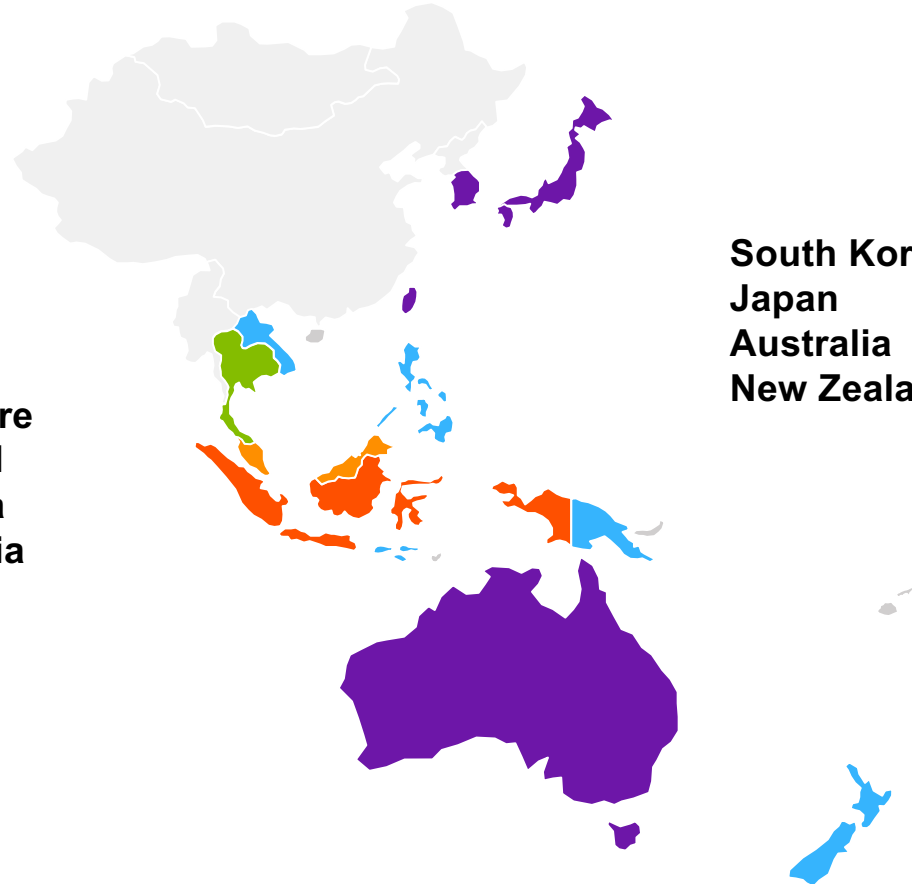


Activities around APAC



**Singapore
Thailand
Malaysia
Indonesia**

**South Korea
Japan
Australia
New Zealand**



Airbus part of 20-member Panel in Singapore



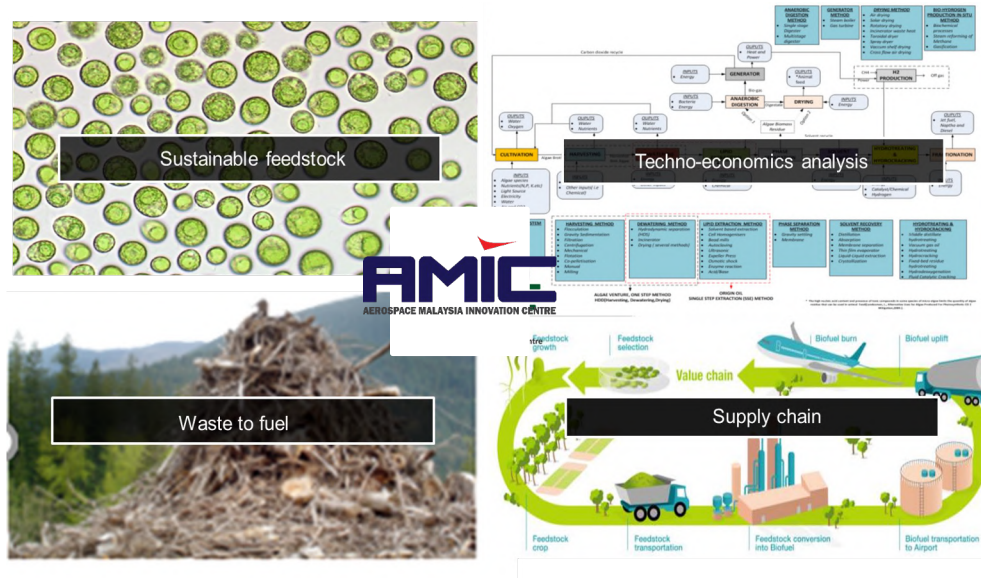
- International Advisory Panel (IAP), initiated by CAAS, consists of a 20-member panel ranging from authorities, international organizations, knowledge centres, technology partners, and industrial partners
- Supports the development of the Singapore Sustainable Air Hub Blueprint, which was launched in February 2022
- IAP works on assessing, identifying, and proposing opportunities or projects that Singapore, stakeholders, and industry can work on
- **15 recommendations**
 - **Airport**
 - **Airline**
 - **Air traffic management**

together
we are

45 Sustainable

AIRBUS

The sustainable aviation journey in Malaysia



- In Malaysia Airbus works together Aerospace Malaysia Innovation Centre (AMIC) for its sustainable aviation efforts
- Studies began in 2013 to look at identifying and assessing sustainable feedstocks, techno-economic analysis, waste to fuel potential, and supply chain evaluation
- AMIC is a member of several sustainable aviation related councils in Malaysia driving the decarbonization efforts of aviation & aerospace.

Kickstarting things in Australia



- Qantas & Airbus: Accelerating the establishment of SAF industry in Australia
- Joint commitment on US\$ 200 million for local investments for development, production of SAF and feedstock initiatives
- Qantas Group, Airbus, and Queensland Government: Investment into a production facility
- AtJ based technology, with target up to 100 million litres/year SAF (LanzaJet)
- **Enabler: Domestic produced SAF strategically enables Qantas to reach its commitment for SAF usage**

Supporting SAF developments in Japan



- ACT FOR SKY - a voluntary organization working to commercialise, promote, and expand the use of locally produced SAF
- Airbus jointly performed the country's 1st SAF powered helicopter flight at Nagoya Airport (mid-2022) with Nakanihon Air
- Supporting the establishment of a resilient Japanese supply chain for SAF
- **Cooperation & Collaboration: 31 companies to highlight the importance of SAF, awareness, carbon neutrality and achieving circular economy.**

together
we are

Airbus signs with Singapore parties for Hydrogen Hub evaluation



- Cooperation Agreement signed between Changi Airport Group, Linde, and Civil Aviation Authority of Singapore
- The cooperation centres around the study of potential for a future hydrogen hub in Singapore
- Shared ambition to leverage respective expertise to decarbonize the industry
- **Study: hydrogen transport, storage, and deliver at airports, including evaluation of H2 infrastructure**

Hydrogen-fuelled initiatives



- Airbus and Air New Zealand to pave the way towards decarbonization, evaluation of deploying hydrogen hubs at airports and its infrastructure
- New Zealand Hydrogen Aviation Consortium: Airbus, Air New Zealand, Christchurch Airport, Fortescue, Hirlinga Energy, and Fabrum



- MoU on the exploring the use of hydrogen at Seoul's Incheon Airport
- Collaboration sees Airbus, Air Liquide (Korea), Korea Air, and Incheon International Airport Corporation develop domestic airport infrastructure for deployment of hydrogen-powered commercial aircraft



Our purpose

We pioneer sustainable
aerospace for a safe
and united world

together
we are

Sustainable

able

AIRBUS

Questions and answers

Thank you.

Working for quieter and cleaner aviation.

Your safety is our mission.

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Thanks for joining!

... stay tuned for the upcoming sessions:

- Sustainability Certification of SAF - How does the deployment currently look like?
- Sustainable Aviation Fuel – The Producer’s Perspective.
- Financing SAF Production – Available funds (private and public)
- Partnerships along the SAF value chain – Showcasing the collaboration of leaders
- Book and Claim – What is it and how it will contribute to the scaling up of SAF?
- CO2 Emission Reduction Potentials - Levers to achieve Net-Zero aviation in 2050.





More than 45 years
ASEAN -EU relations



Shared ambitions



Shared challenges



Shared opportunities

Thank you for your attention

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An Agency of the European Union 