Airbus Decarbonisation

Safety Forum - 1st July 2022
Safe Sustainability
Session 3 - Technology and Future Projects

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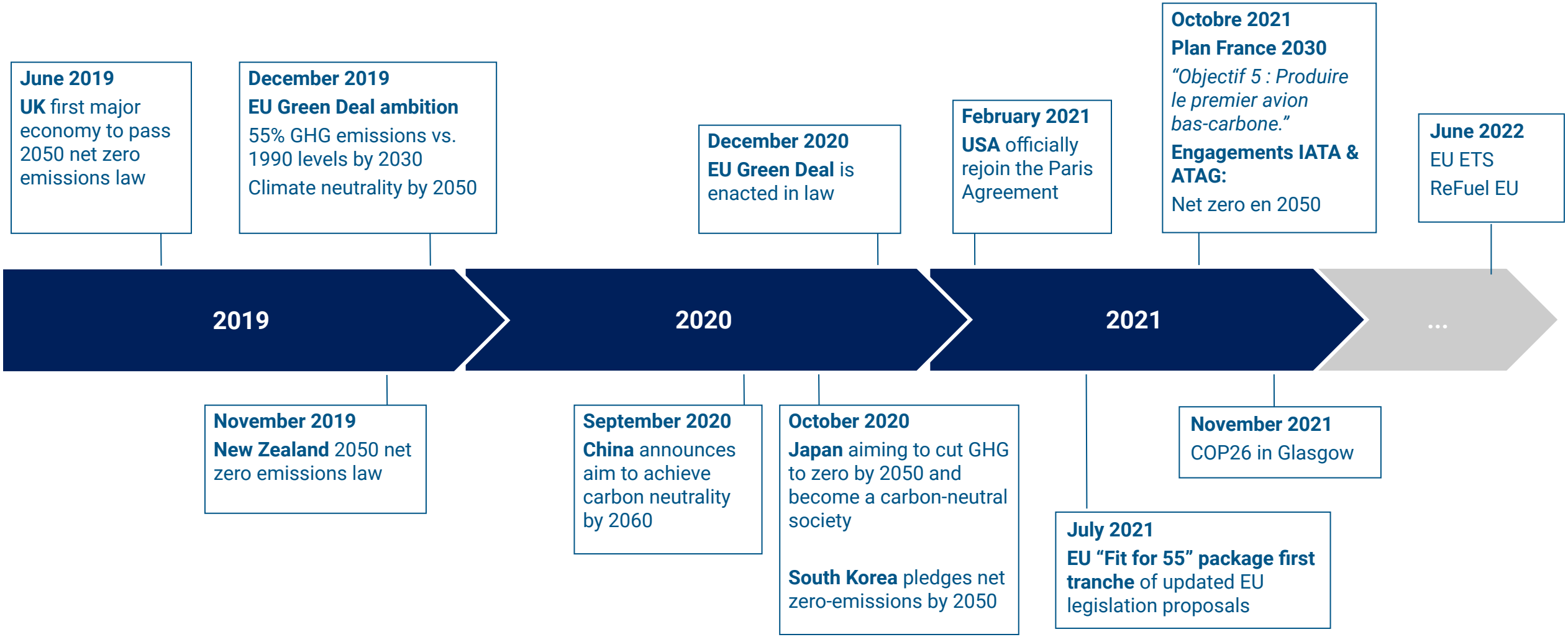
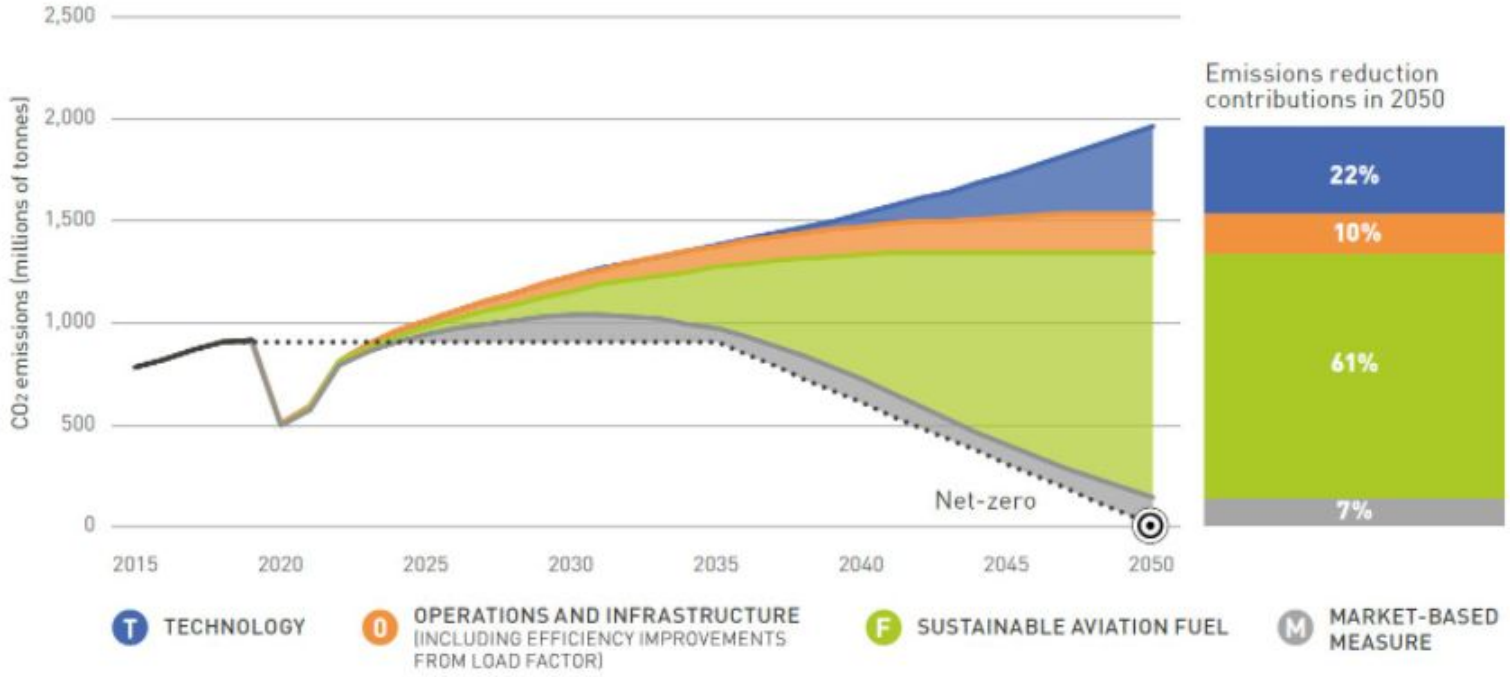
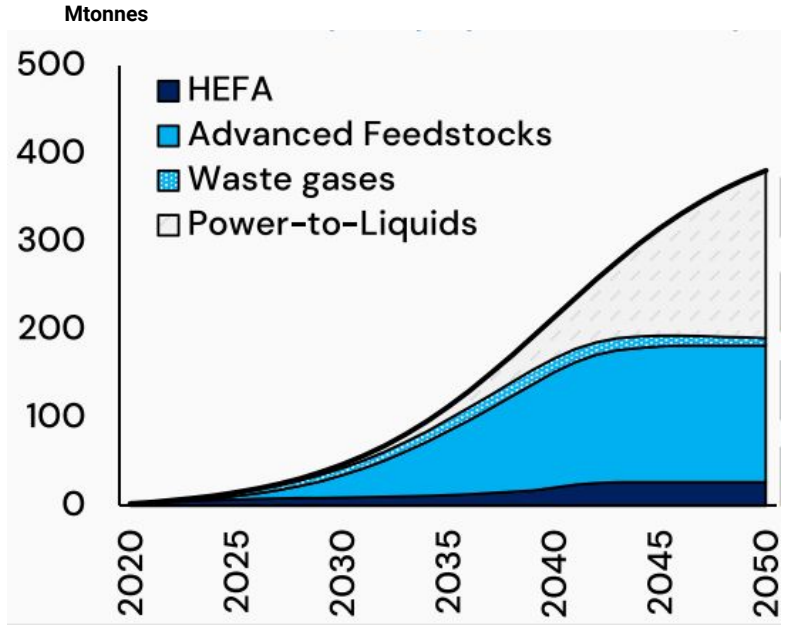
Fast evolving societal & regulatory expectation



Aviation main lever arms to drive CO2 emission to zero

ATAG Waypoint 2050 scenario: "*Pushing technology and operations*" (updated Sep.21 - scenario 2)





More ambitious carbon budget, now aligned with a net zero ambition

400 to 500Mt (~50% bio-mass based)

The Net-Zero aviation ambition by 2050 relies on the switch from fossil kerosene fuel to SAF and LH2.
Energy efficiency of novel aircraft design within the future operational context will remain, more than ever, paramount

Source: ATAG WayPoint 2050, Sep 27th 2021

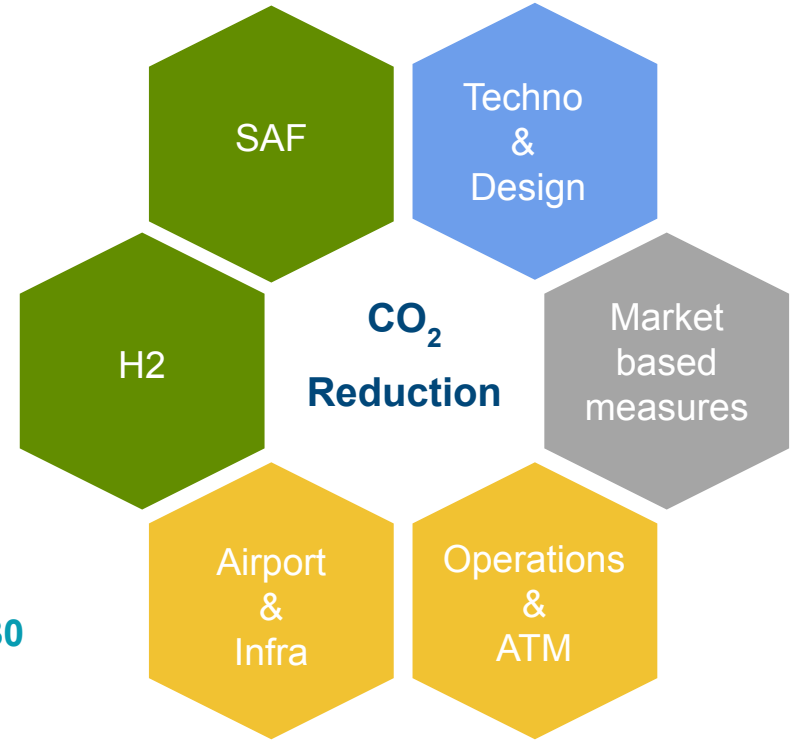
ATAG: Air Transport Action Group

Climate Change - Aviation Ambitions

New target of the aviation sector is Net Zero CO_2 emissions by 2050

Aviation commitments

- 10/19: **IAG -** net zero carbon emissions by 2050
- 11/19: **EasyJet** - offset CO_2 emissions from all its flights
- 11/19: **Qantas -** net zero emissions by 2050
- 02/20: **Delta -** mitigate all emissions from 03/2020 forward
- 09/20: **Finnair -** carbon neutral by 2045
- 10/20: **United Airlines** - becoming carbon neutral by 2050
- 09/20: **Japan airlines** - net zero carbon emissions by 2050
- 10/20: **American Airlines** - net zero carbon emissions by 2050
- …
- **10/21: IATA & ATAG commitment to net zero carbon emissions by 2050**



Decarbonation levers

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- **100% Sustainable Aviation Fuel capability on our commercial aircraft before 2030**
- **1st major manufacturer to offer a Zero CO_2 commercial aircraft by 2035**
- **Pursue net-zero CO_2 emission ambition through ATAG roadmap by 2050**

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Improve energy efficiency, prepare the energy transition

MATURING EXISTING PRODUCTS AND THEIR PRODUCTION

TOWARDS NEW ENERGY CARRIERS

Key Challenges

- Compatibility with 100% SAF
- Systems enhancements for optimised operations
- Decarbonisation of ground operations
- Maturity and incremental improvements
- Integration of novel propulsions architectures (open fan, hybrid electric, etc.)
- Safety
- Noise and comfort
- Radical evolution of airframe and propulsion systems...
- And likely on the industrial system

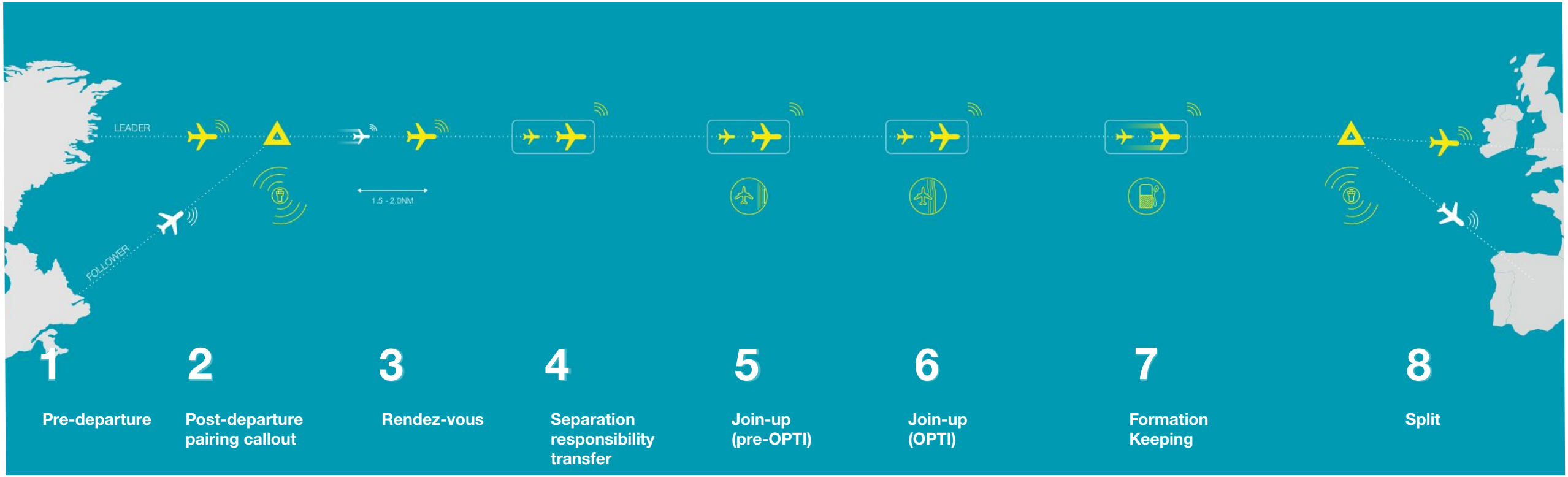
fello' fly
Wake Energy Retrieval

Follower

Leader

- A large amount of kinetic energy is left behind aircraft in their wakes
- A follower aircraft positioned in the smooth updraft can save fuel and reduce emissions

Initial Concept of Operations



Oceanic CONOPS agreed with project collaborating partners for advancing industry rulemaking

SAS Frenchbee dgac DSNA EUROCONTROL NAV CANADA IAA

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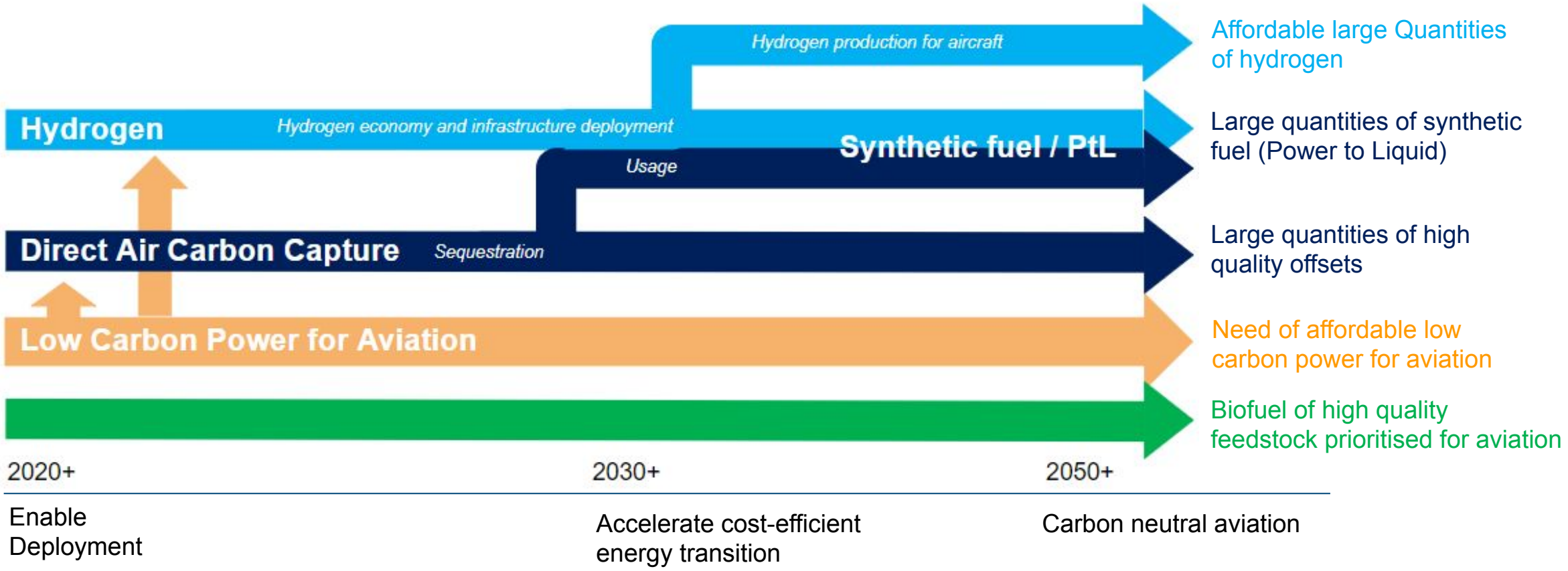
Reducing Aviation's Climate Impact: The Energy Roadmap

Availability of affordable low carbon energy is at the core of aviation sustainable development



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What about SAF?

An intermediate carbon-reduction solution for aircraft over short to medium terms

Up to 50% SAF blend can be used to fuel single-aisle & wide-body aircraft

Up to 85% CO_2 reduction across the entire SAF lifecycle

+350,000 flights operated on SAF

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Airbus and partners leading 100% SAF journey

Pioneering Emission and Climate Impact of Alternative Fuels

SAF is a key decarbonisation pillar

Collaboration with key Airbus partners:

- ECLIF3: Rolls-Royce, DLR, Neste & research institutions (NRC of Canada and the University of Manchester)
- VOLCAN: Safran, Dassault Aviation, ONERA, Total Energies

The first 100% SAF test flight with an A350 took place on March 17th, 2021

The first 100% SAF test flight with an A319neo is took place on Oct 30th 2021

Airbus aircraft to be fully compatible with 100% SAF by 2030

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ZEROe

Zero emission concept aircraft powered by Hydrogen

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Hydrogen as a Fuel
H_2 aircraft basis

H_2 Properties and storage

	Kerosene		H2	
	1b, 273K Liquid	1b, 273K Gas	700b Gas	20K Liquid
Specific Energy (MJ/kg)	42,8	120	120	120
Density (kg/m^3)	800	0.09	42	71

3x more specific energy

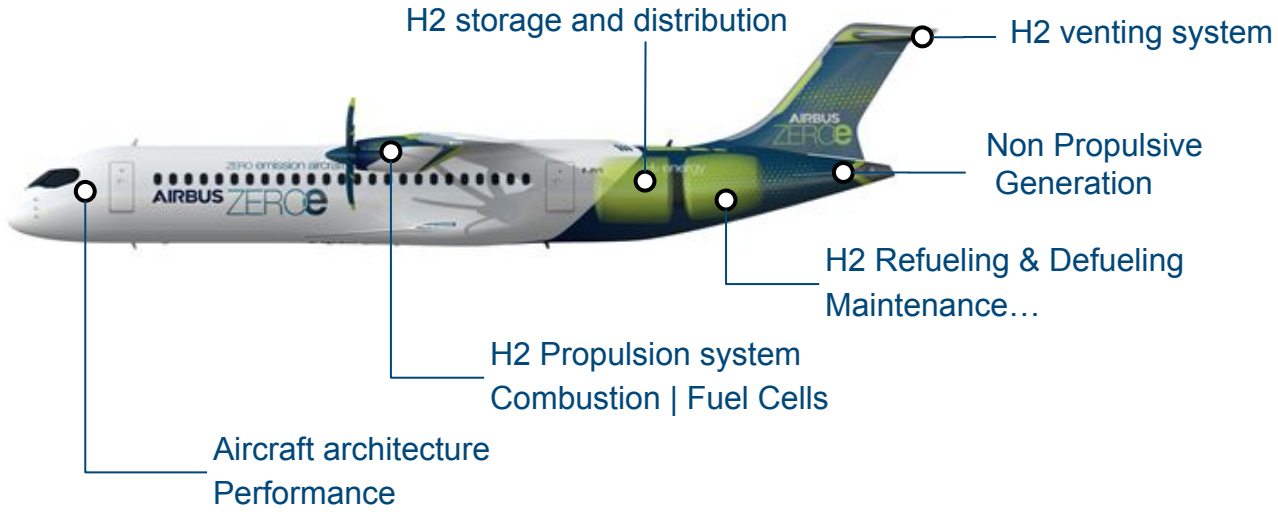
4x more space required to store LH_2 @ (iso energy)

What' needed for making an H_2 aircraft?

- Technologies satisfying aeronautic standard for H_2 storage, Distribution and Thrust generation
- Safety level at least equivalent to legacy aircraft Specific certification rules & means of compliance
- New overall aircraft architecture
- Infrastructures and operations adapted to H_2 aircraft

The changes driven by the use of H2 as a fuel impose to review aircraft architecture & ops

H_2 Aircraft specificities



H_2 flight vehicles heritage

Operational LOx/LH2 Space Launchers & techno, since ~40 years in UE (but: limited lifetime, lower safety standard…)

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Thank you

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