# Clean Commercial Aircraft

## Reducing the climate impact of flying

Amanda Simpson
Airbus Americas Vice President, Research and Technology
23 November 2021 – ACI World General Assembly

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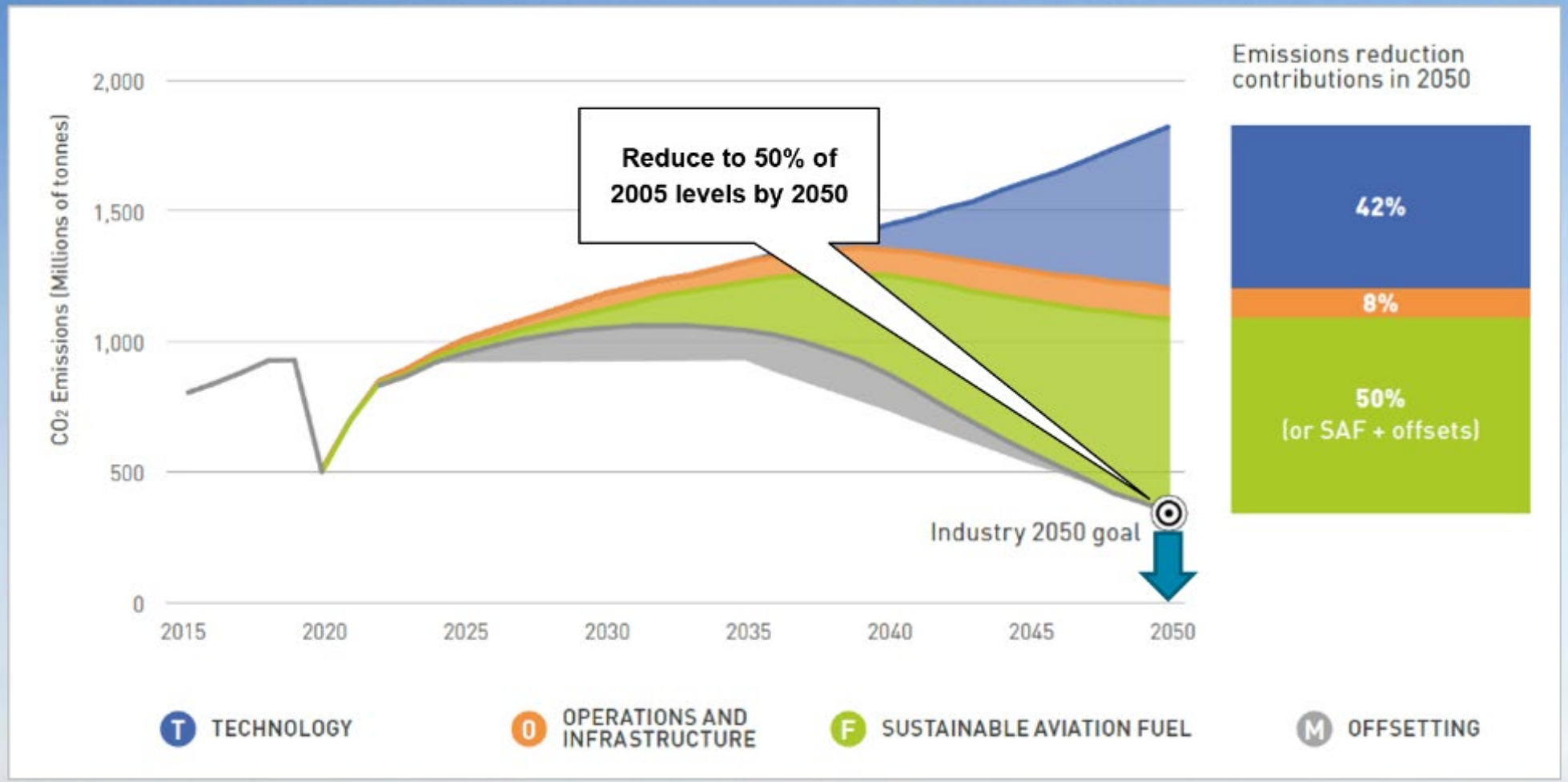
# Aviation targets

Multiple solutions are necessary to meet emission reduction targets




Source: Air Transportation Action Group (ATAG)

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# Aviation's path towards zero emissions

Emissions per passenger kilometre (%)

**-50**% achieved
due to:

- optimised aerodynamics
- advanced materials
- next-gen engines

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## Addressing the remaining 50%

- 8% — Improved ATM & Aircraft Operations
- 42% — New Engine & Aircraft Technologies
- 50% — Sustainable Aviation Fuels

1990 2000 2021 2050 **2060**


# Sustainable Aviation Fuel

- **An intermediate carbon-reduction solution** for single-aisle & regional aircraft over short to medium terms
- **Up to 50% SAF blend** can be used to fuel single-aisle aircraft today
- **Up to 85%** $CO_2$ reduction across the entire lifecycle
- **+300,000 flights** operated on SAF

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## Air Traffic Management

**Airbus contributes to ATM research and deployment**

Single European Sky ATM Research (SESAR) and NextGen

4D Trajectory Based Operations

Continuous Descent Operations

Required Navigation Performance (RNP) procedures

Fello'Fly



## Streamlined Flight Operations - NAVBLUE

helps airlines on their path to sustainability and fuel efficiency


N-Flight Planning

MONITOR
*SkyBreathe®*
*MyFuelCoach™ App*

OPTIMIZE
*Performance Factor Optimizer*

Airspace Design

Fuel & Flight Efficiency Consulting & Training

## Streamlined Flight Operations - Upgrade Services

Modify aircraft to operate their Airbus fleet in a more sustainable way

Descent Profile Optimisation (DPO)

Air Management Function (AMF)

Sharklet retrofit



## Airports and Ground Operations

Reduce emissions during taxiing, towing and parking

**Airbus solutions to decarbonise airports**

APU Off solutions

Reduced Engine Taxi & Single Engine Taxiing without APU

Engine Off solutions TaxiBot

Adaptation to Sustainable Aviation Fuel and future alternative fuel like hydrogen

# Automation for Operations

Optimizing flight paths, air traffic flow, airline scheduling, and aircraft operations to minimize fuel burn and emissions

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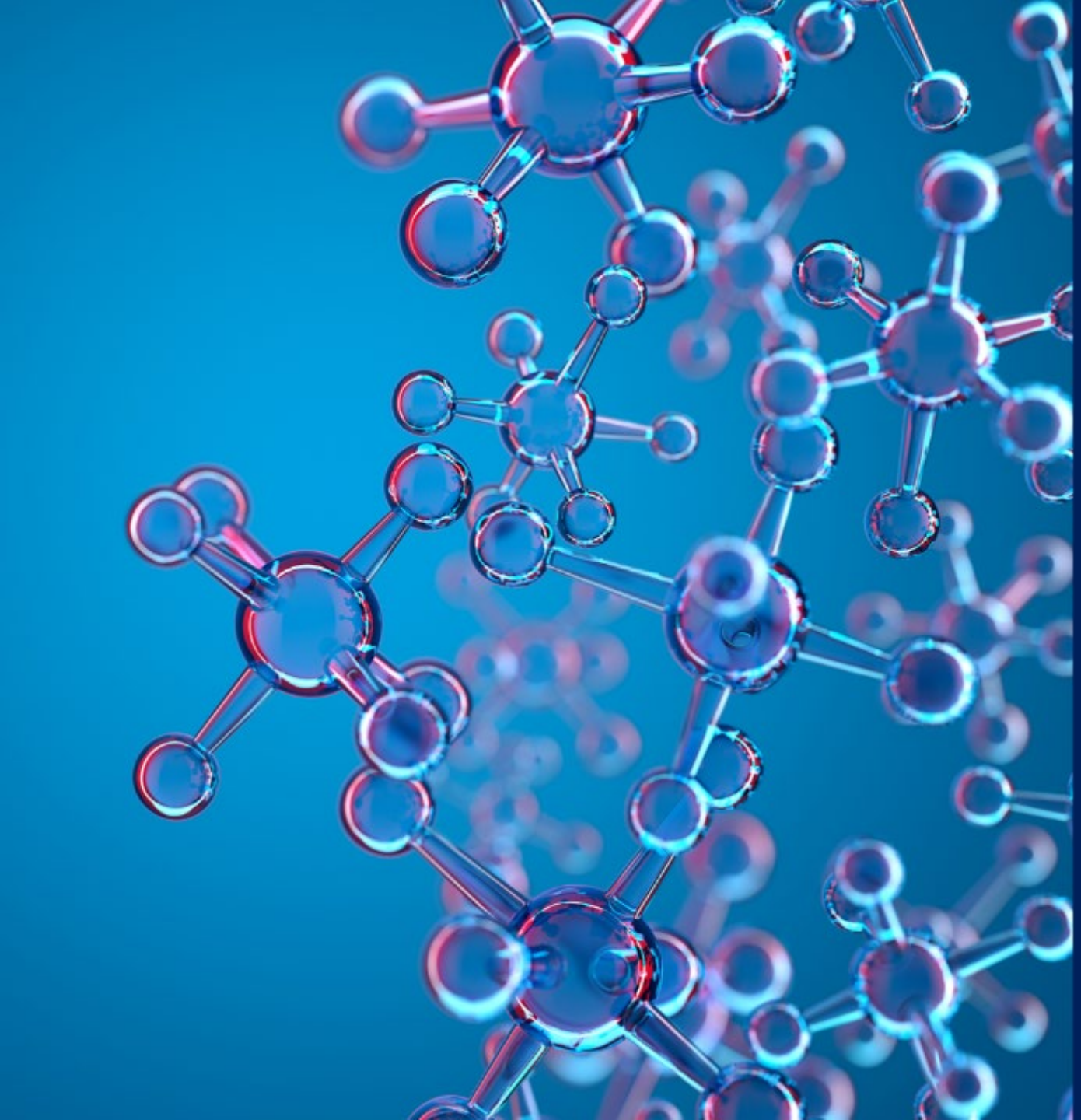



# Why hydrogen?

**Zero emission**: $H_2$ emits no $CO_2^*$ & has the potential to reduce non-$CO_2$ emissions (i.e. NOx) & persistent contrails
(*if generated from renewables via electrolysis)

**Declining costs**: the cost of producing $H_2$ is likely to decline over the next decade, which will make zero-emission flying increasingly economical

**Energy dense**: $H_2$ is 3X lighter than jet fuel but has a lower volumetric density, thereby requiring a different storage solution on aircraft

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# $H_2$ technology for aviation

- **Hydrogen combustion**: generating thrust by burning liquid hydrogen
- **Hydrogen fuel cells**: converting energy stored in $H_2$ into electrical energy to power electric motors
- **Synthetic fuels**: using a net-zero carbon fuel derived from renewable hydrogen & $CO_2$

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# 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


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# Our path to ZEROe

**Exploring** various technology pathways & aircraft configurations

**Targeting** all aspects: climate impact, aircraft design, safety, maintenance, industrialization, operations, market, infrastructure, ecosystem, etc.

**Collaborating** with all stakeholders to drive down costs & grow the ecosystem

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# Key dates

- **2018**: Project launch
- **2020**: Pre-program launch
- **2025**: Product selection
- **2035**: Estimated entry-into-service

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# Challenges to $H_2$ adoption

- **Technology compatibility**: bringing weight & cost down
- **$H_2$ availability & cost**: growth of renewable electricity will increase cost-competitiveness
- **Infrastructure**: repurposing existing & on-site production are all options
- **Regulatory acceptance**: changing public perceptions

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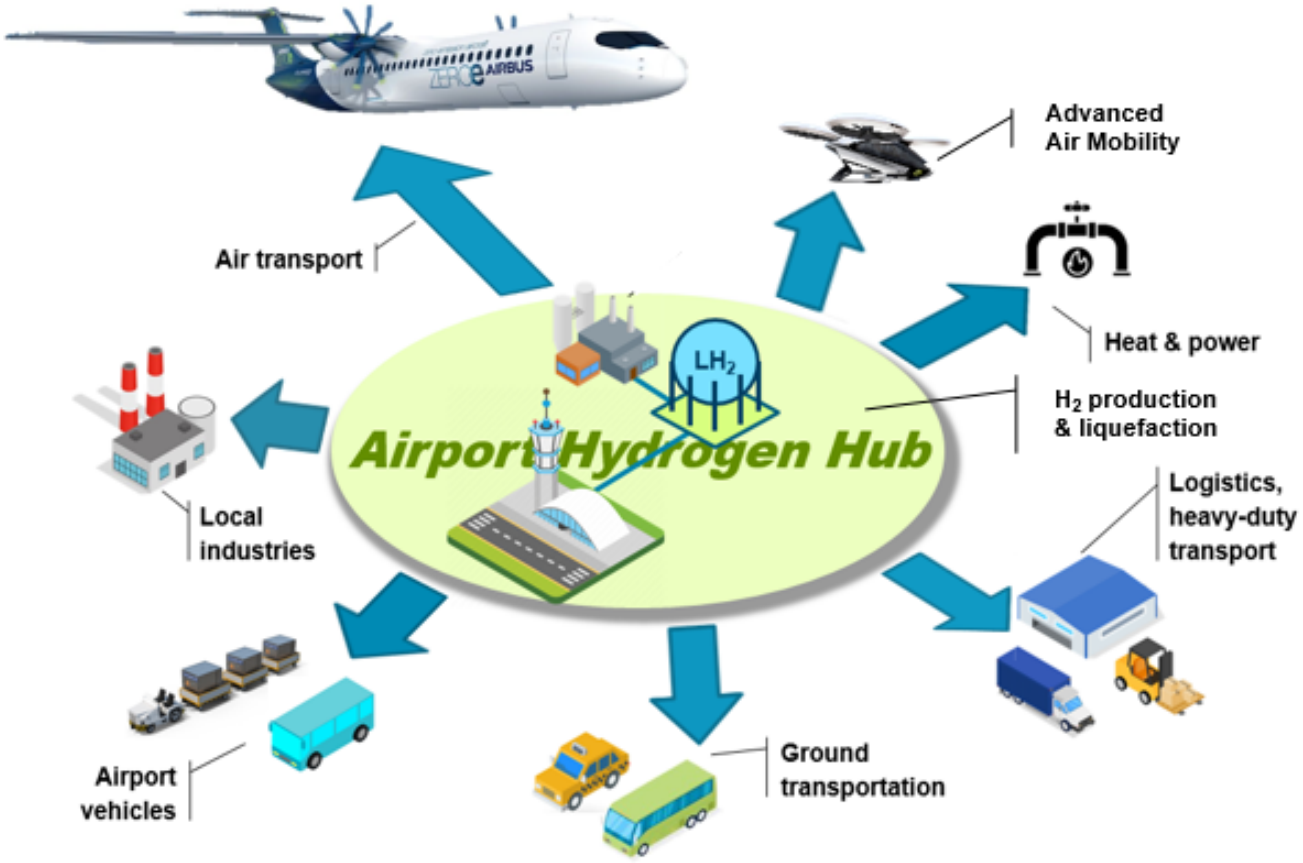


# Airports as Hydrogen Hubs

**Addresses** high demand coming from different hydrogen-powered utilities

**Creates** synergies with Green Hydrogen production facilities

**Fosters** efficiency improvements and cost reductions in hydrogen liquefaction, storage and distribution.

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AIRBUS ZEROe
ZERO emission aircraft
H2 energy
AIRBUS ZEROe
We pioneer sustainable aerospace for a safe and united world
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