

Oct 25th, 11:45 AM - 1:00 PM

Lunch with Keynote - Ellen Ebner

Ellen Ebner
Boeing

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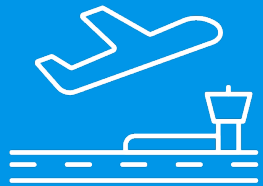


THE FUTURE OF FLIGHT

EVERYTHING FOR ZERO

“ We are embarked as pioneers on a new science and industry ...
... Our job is to keep everlastingly at research and experiment,
to adapt our laboratories to production as soon as practicable,
to let no new improvement in flying equipment pass us by.”

— Bill Boeing, 1929



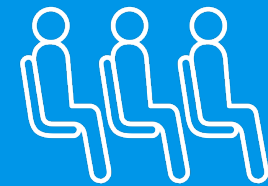
41,170

deliveries



2.8%

fleet growth

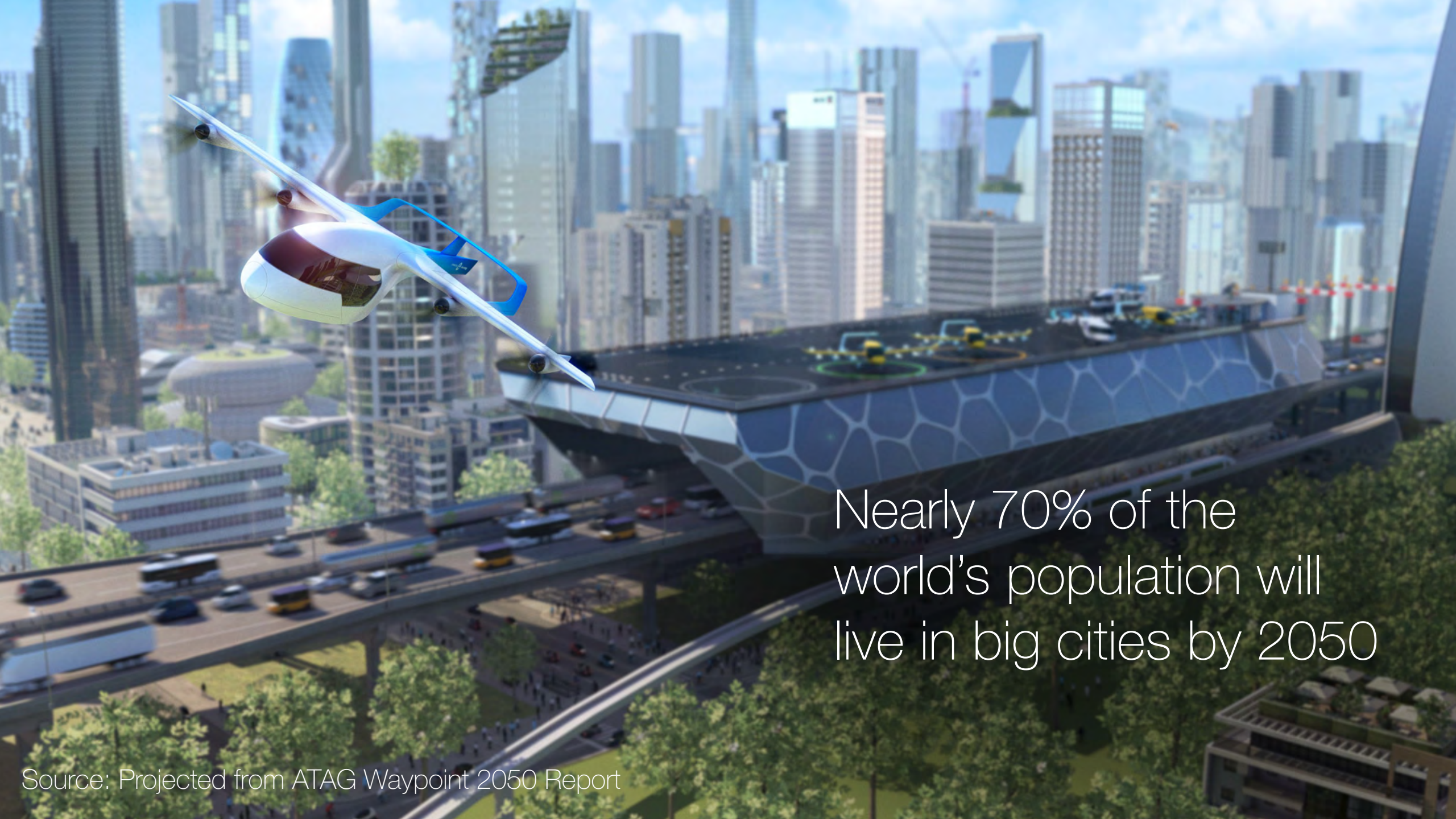


3.8%

traffic growth

2050





Nearly 70% of the world's population will live in big cities by 2050

Source: Projected from ATAG Waypoint 2050 Report



10 billion air travel passengers
will require all-new kinds of
infrastructure in 2050

Source: Projected from ATAG Waypoint 2050 Report

Air travel will support 180 million jobs and generate nearly \$9 trillion in economic activity in 2050



Source: Projected from ATAG Waypoint 2050 Report

Policy trends

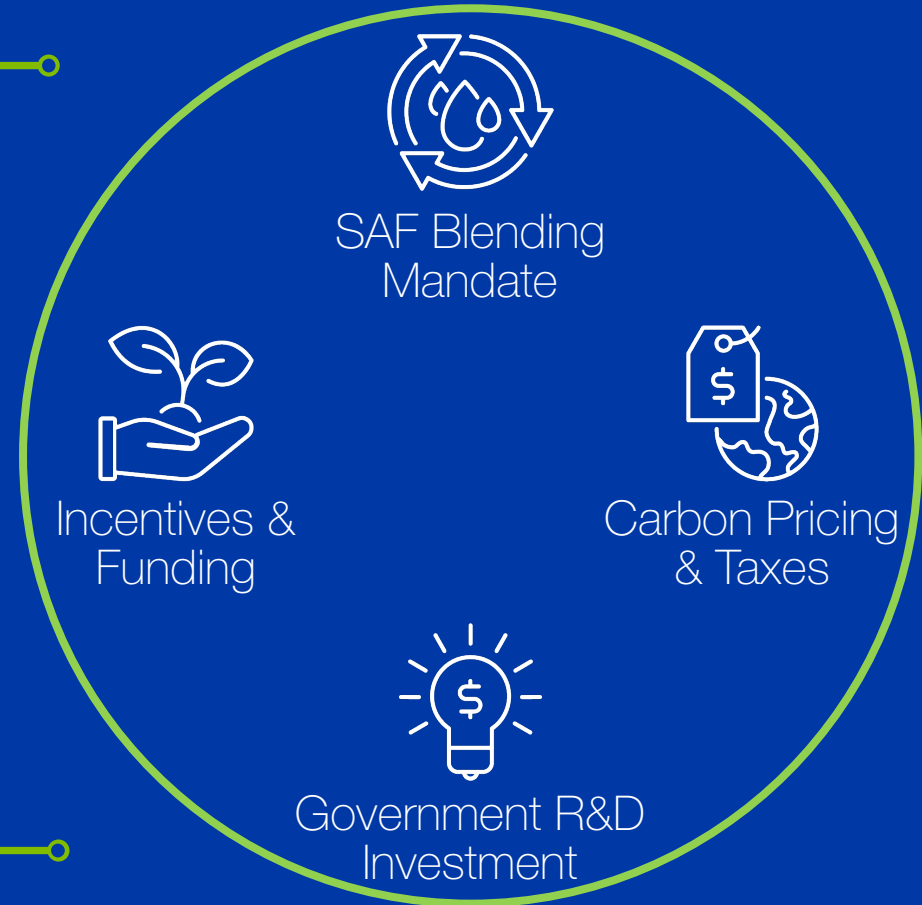
Net Zero 2050

Disclosure Requirements

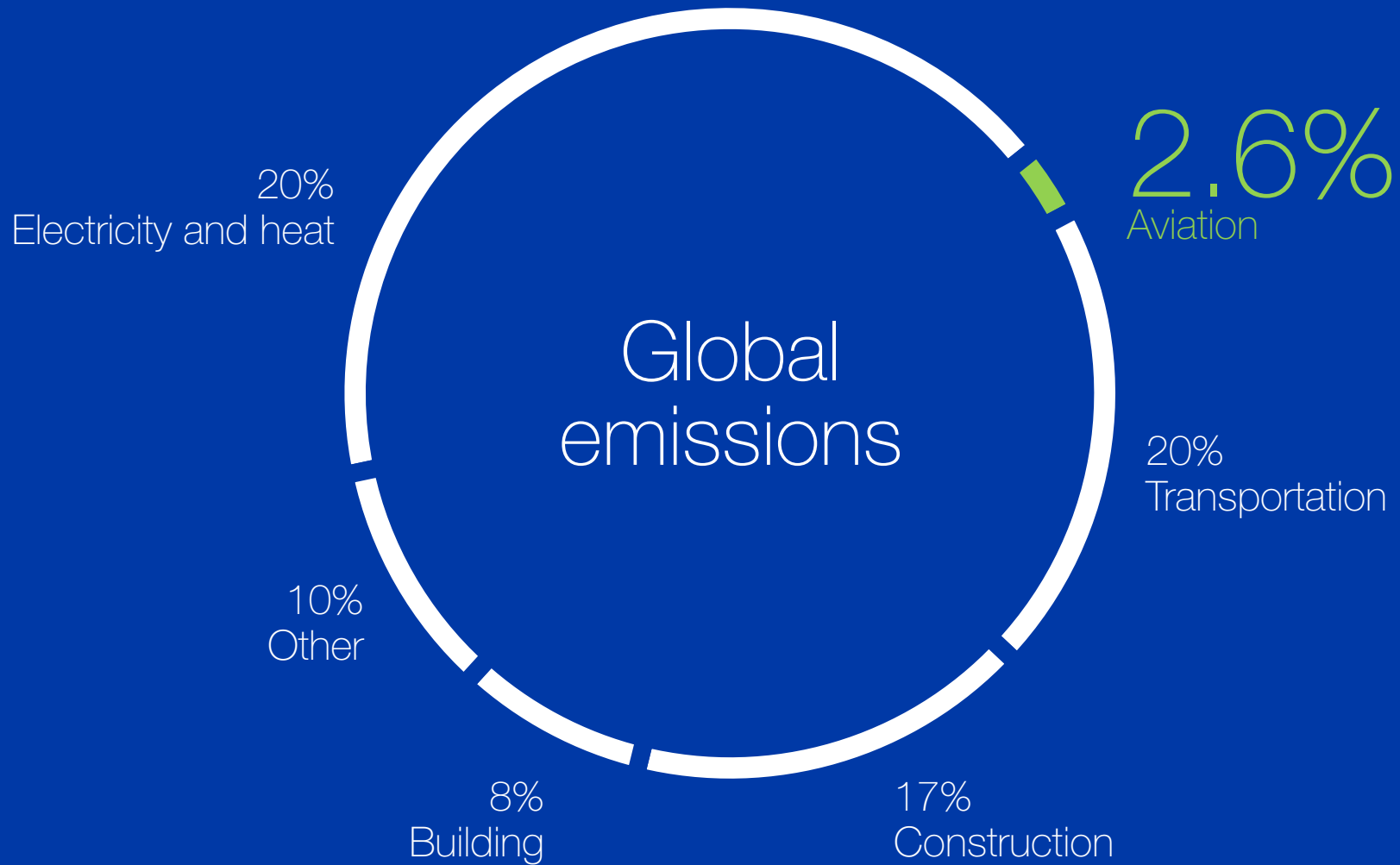
Short-Haul Mandates

EU Taxonomy

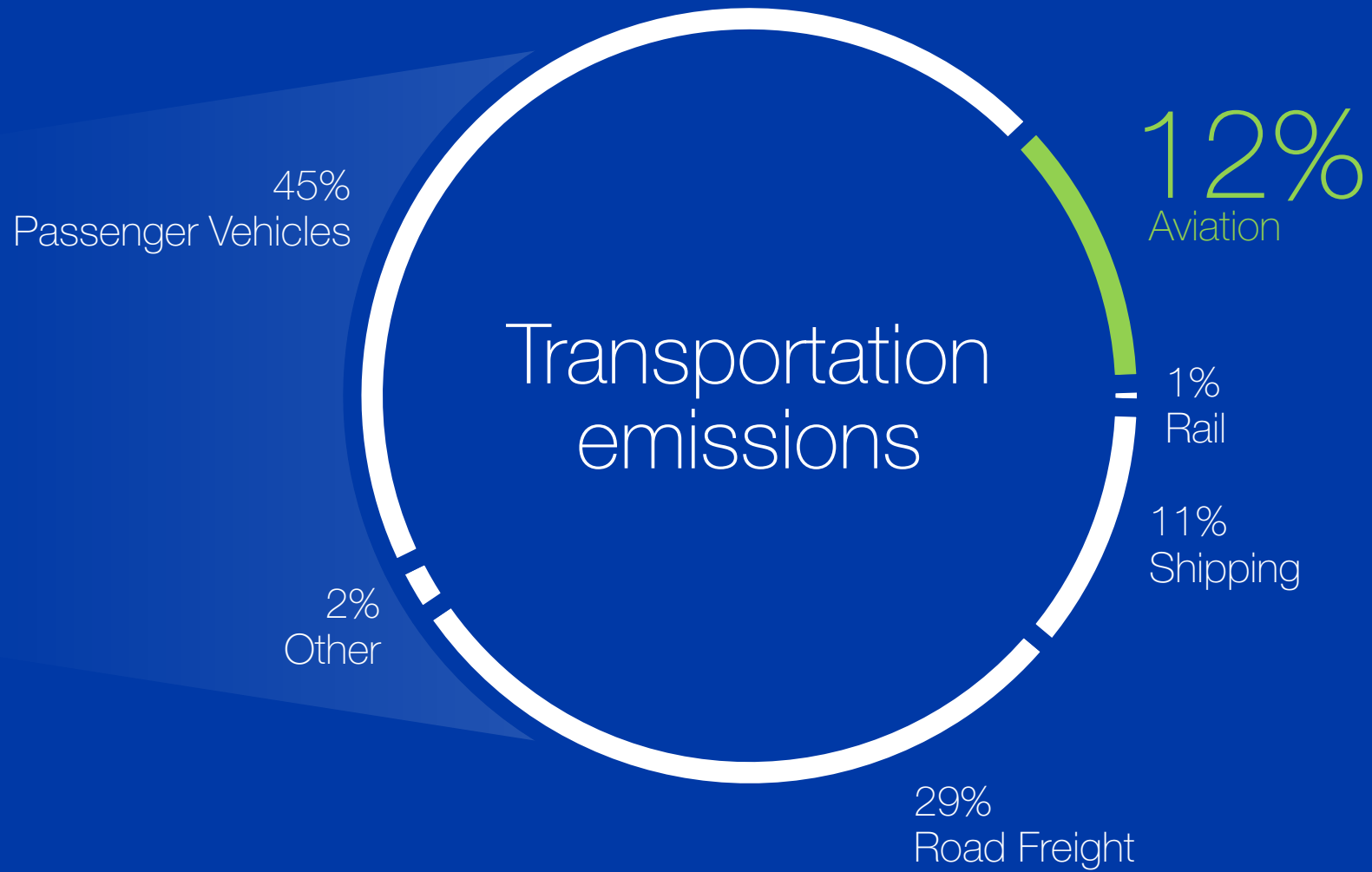
Renewable Energy



Aviation contributes 2.6% of
total global emissions



Source: 2018, World Resources Institute



Source: 2018, World Resources Institute

EVERYTHING FOR ZERO

Our four strategies for
decarbonizing aviation

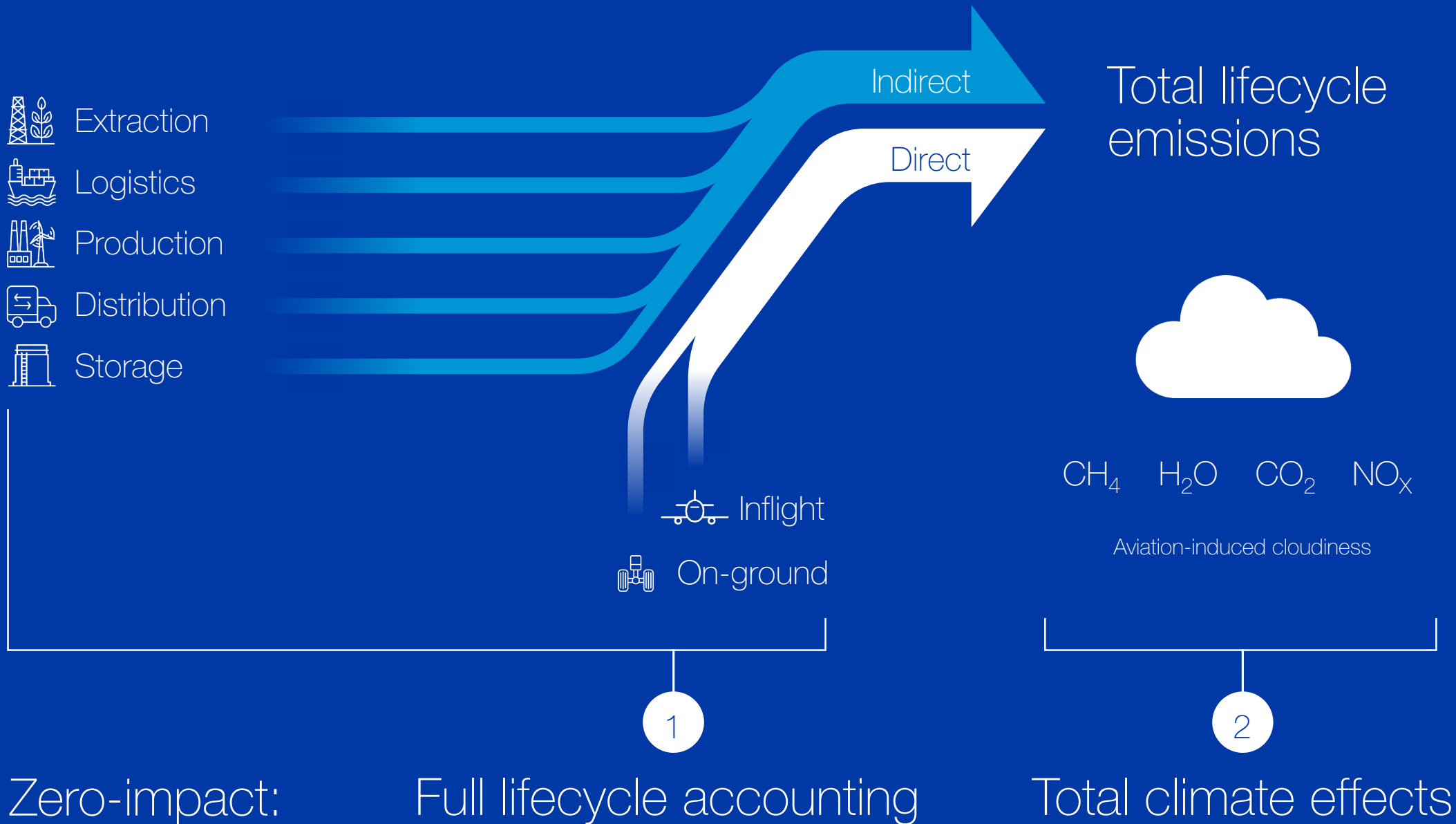


Fleet
renewal

Operational
efficiency

Renewable
energy

Advanced
technology



Zero-impact:

Full lifecycle accounting

Total climate effects

Meet Cascade

Sustainable Aviation Fuels

SAF is required

2009
Co-founded
Sustainable
Aviation Fuel
Users Group
(SAFUG)



2010
Boeing supports the
supersonic flight of a U.S.
Navy F/A-18 on a 50/50
SAF blend - U.S. Navy
photo

2014
Proposed and
partnered with Neste
on ASTM approval of
Green Diesel pathway



2018
First commercial
airplane test using
100% SAF

2018
Launched program
for biofuel delivery
flights from Boeing
Delivery Centers



2022
2 million gallons
of SAF
procured for
operations

2008

2010

2012

2014

2016

2018

2020

2022

2008
First SAF test flight



2011
Led research
approval of HEFA
pathway

2011
First regional
multi-stakeholder
roadmaps in the
US and Australia

2012
Used biofuel on every
ecoDemonstrator program
since 2012



2021
Committed to deliver
100% SAF capable
airplanes by 2030



2021
Boeing-
SkyNRG
partnership

2021
Partnered with United
Airlines on first
passenger flight with
100% SAF in one
engine and Rolls-Royce
on 100% SAF flight

2021
Partnered with NASA
to test the emissions
of SAF



BOEING

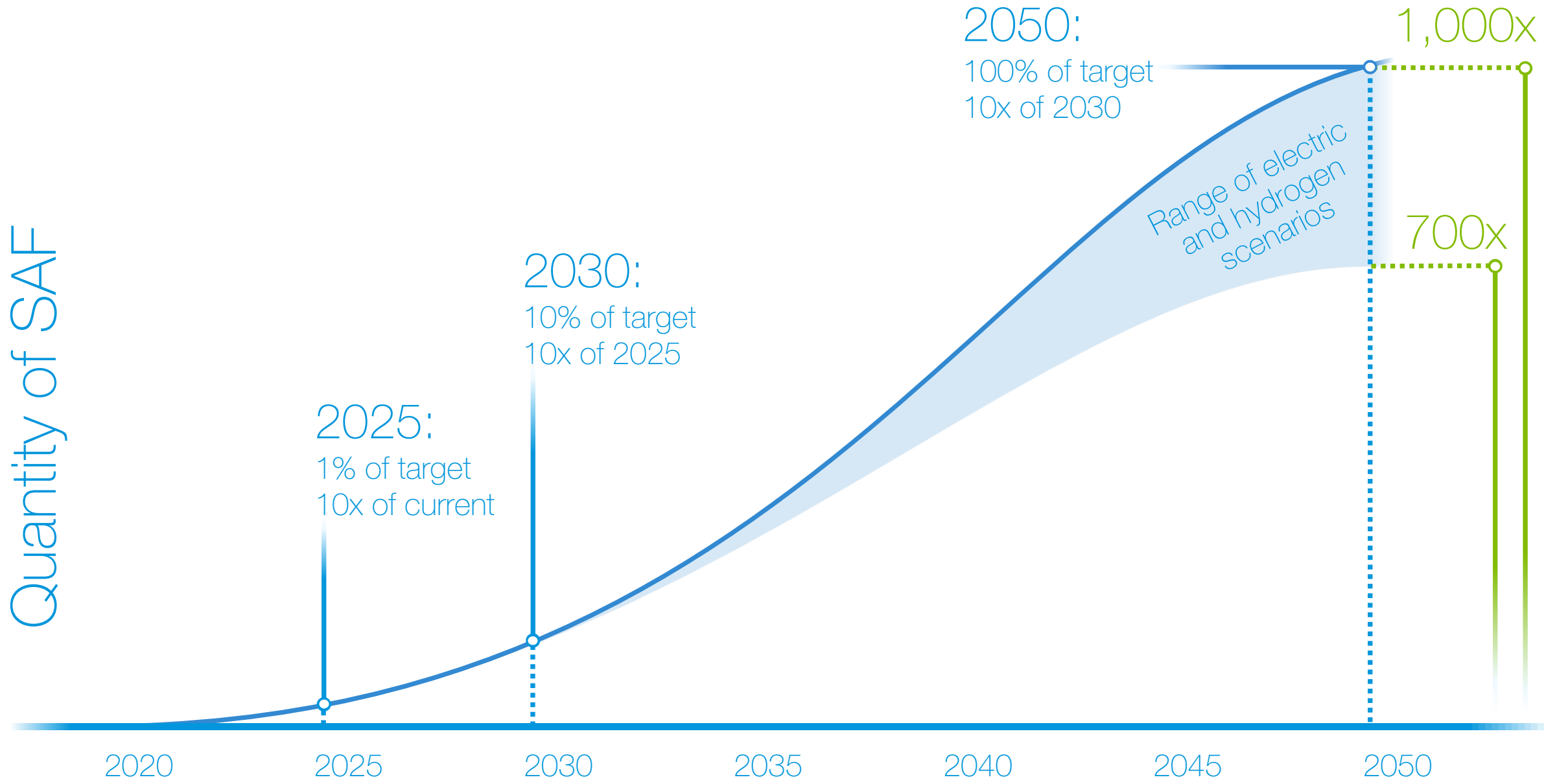
Industry view

	2020	2025	2030	2035	2040	2045	2050	
~27% of CO2 emissions ~73% of CO2	Commuter 9-50 seats <60 minute flights <1% of industry CO2	SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	
	Regional 50-100 seats 30-90 minute flights ~3% of industry CO2	SAF	SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF
	Short haul 100-150 seats 45-120 minute flights ~24% of industry CO2	SAF	SAF	SAF	SAF potentially some Hydrogen	Hydrogen and/or SAF	Hydrogen and/or SAF	Hydrogen and/or SAF
	Medium haul » 100-150 seats » 60-150 minute flights » ~43% of industry CO2	SAF	SAF	SAF	SAF	SAF potentially some Hydrogen	SAF potentially some Hydrogen	SAF potentially some Hydrogen
	Long haul 250+ seats 150+ minute flights ~30% of industry CO2	SAF	SAF	SAF	SAF	SAF	SAF	SAF

Source: ATAG Waypoint 2050 Report



Quantity of SAF



Source: Projected from ATAG Waypoint 2050 Report



In Collaboration with
McKinsey & Company



Clean Skies for Tomorrow

Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation

INSIGHT REPORT
NOVEMBER 2020

United States

2021 Aviation Climate Action Plan

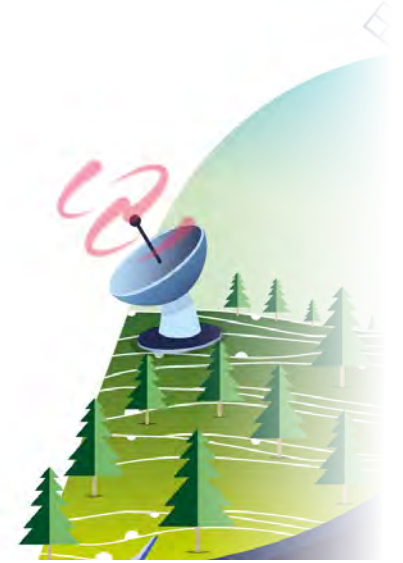


WAYPOINT

2050

AN AIR TRANSPORT ACTION GROUP PROJECT

Balancing growth in connectivity with a comprehensive global air transport response to the climate emergency:
a vision of net-zero aviation by mid-century.



The **Making Mission Possible** Series

Bioresources within a Net-Zero Emissions Economy:

Making a Sustainable Approach Possible

July 2021

Version 1.0



Energy
Transitions
Commission

iea

Net Zero by 2050

A Roadmap for the Global Energy Sector



DESTINATION ZERO
THE TECHNOLOGY JOURNEY TO 2050



Today

Drop-in or near-drop-in SAF

Non-drop-in energy carriers

Fossil Jet-A

Waste-and-biomass-based SAF

Power-and-biomass-to-liquid (PBtL)

Power-to-liquid

Hydrogen

Battery

Fossil H₂

Bio and fossil H₂ produced from methane

Bio and H₂ produced from low-carbon electricity

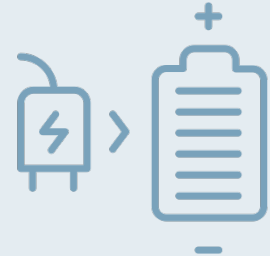
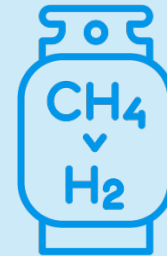
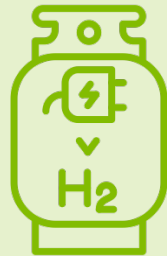
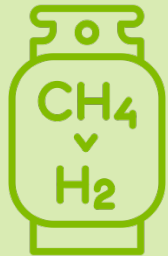
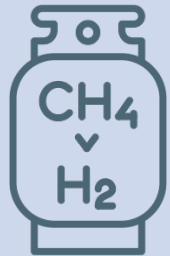
H₂ from renewable grid

Fossil H₂ produced from methane

H₂ produced from low-carbon electricity

Electricity from grid

H₂



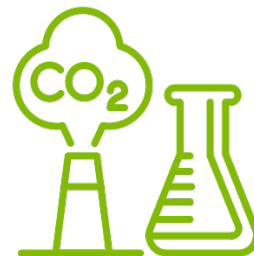
Fossil carbon

Biomass and waste streams

Biomass or waste stream

Atmospheric or industrial CO₂ streams

C



SAF &

SAF &

Electrification



Architecture



Battery electric



Fuel cells



Hybrid propulsion



SAF &

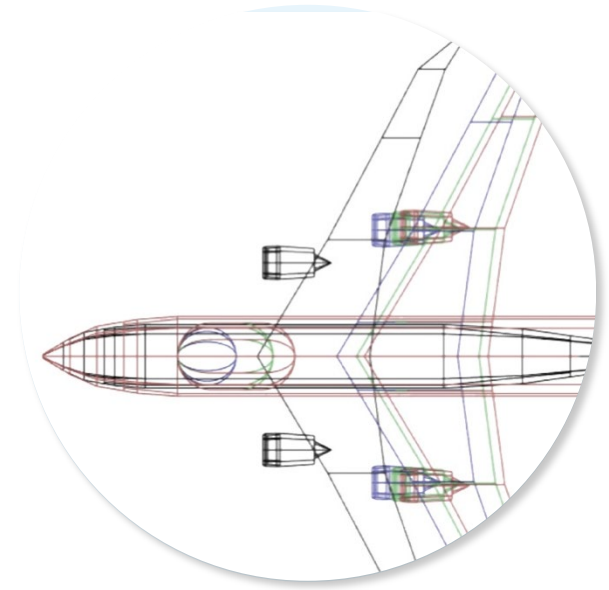
Hydrogen



Hydrogen fuel cells
and combustion



Onboard and airport
storage and distribution



Airplane-level
integration



World's first piloted H2 fuel cell aircraft

Hydrogen combustion

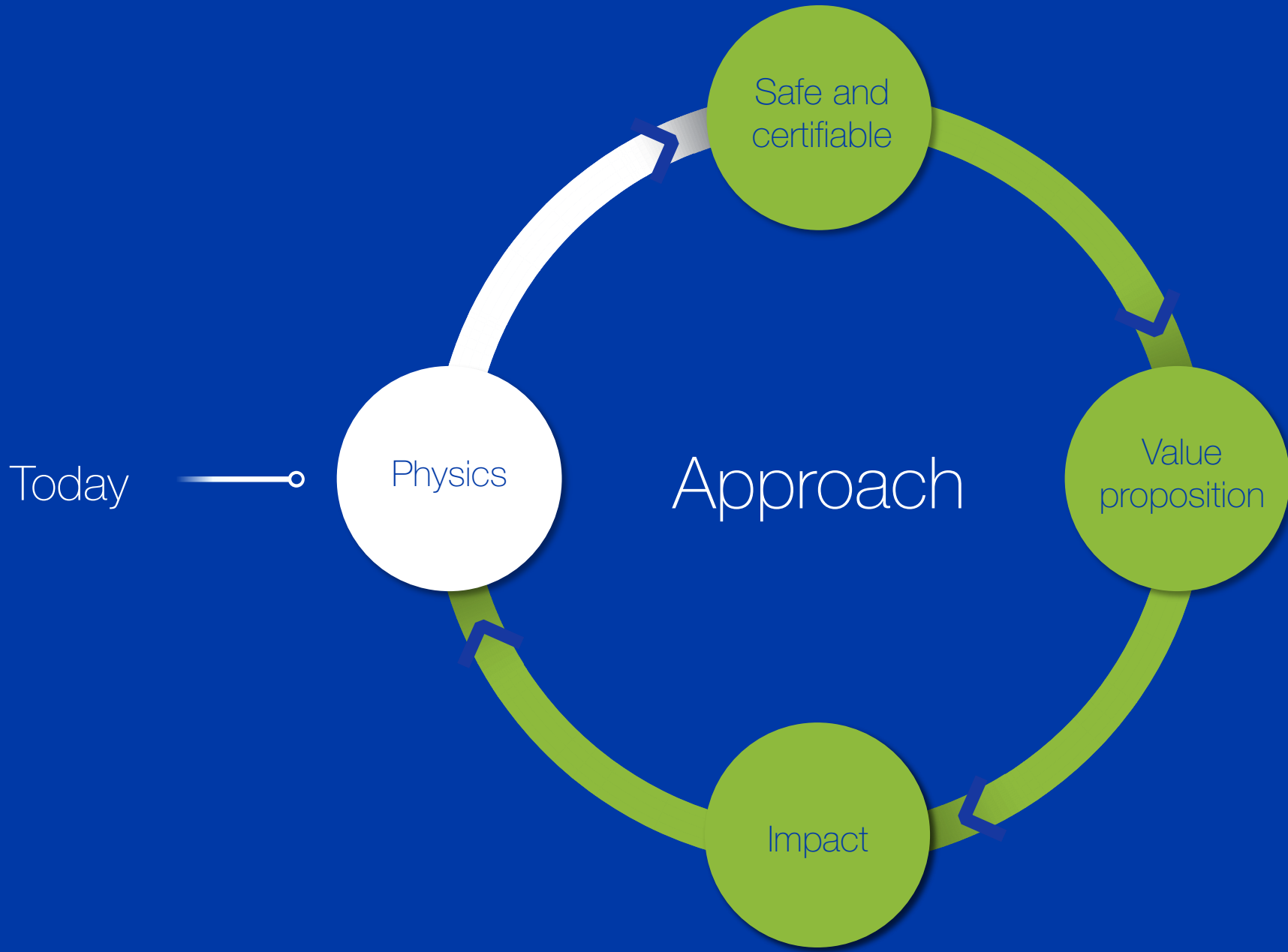




Composite cryotank



SAF & X



Products



Demonstrators



Future flight concepts



EVERYTHING FOR ZERO

Product



Demonstrator



Demonstrator



Future flight concepts



EVERYTHING FOR ZERO

SUSTAINABLE AEROSPACE TOGETHER

