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

Lunch with Keynote - Ellen Ebner

Ellen Ebner
Boeing

THE FUTURE OF FLIGHT

EVERYTHING FOR ZERO

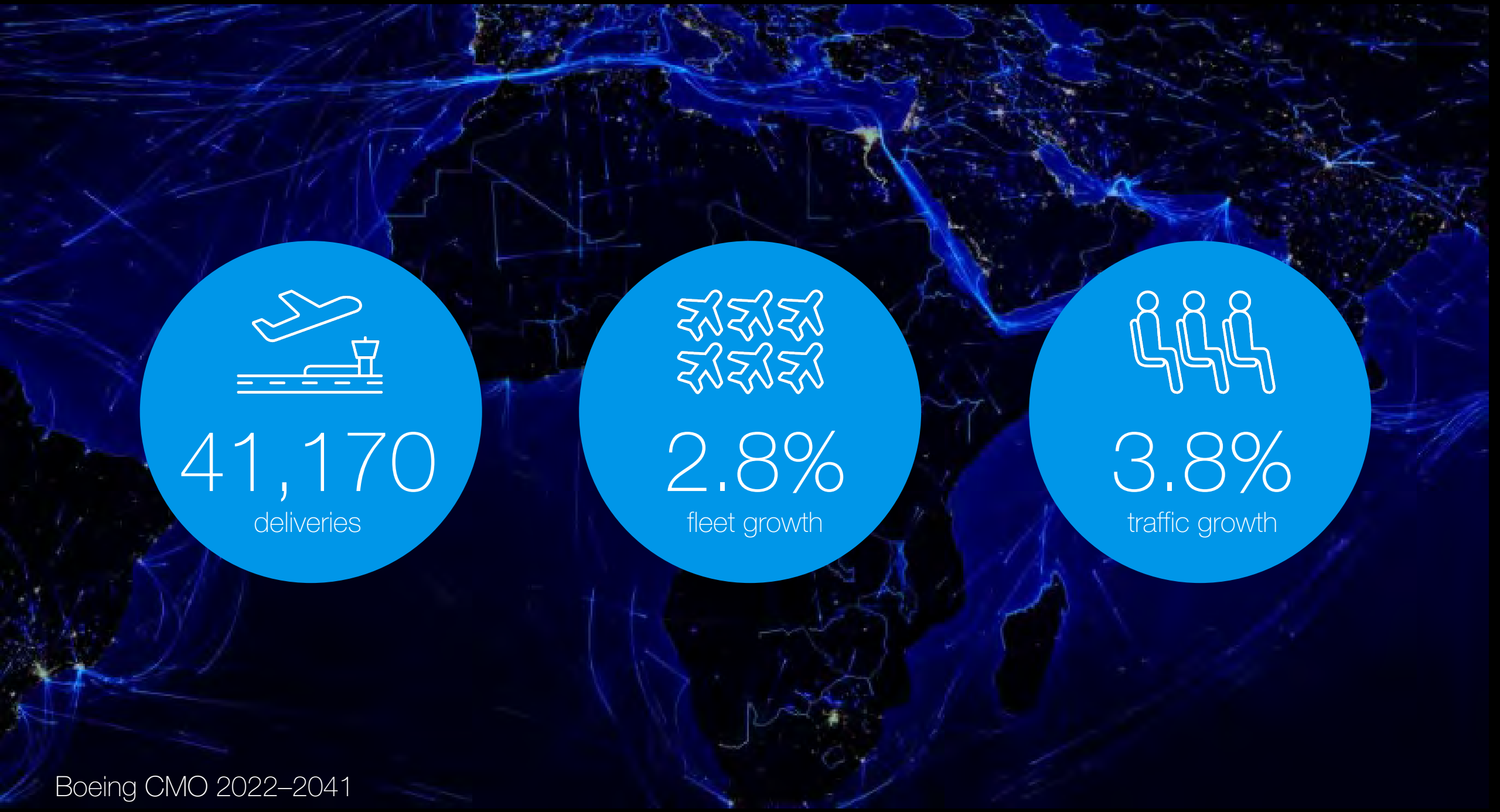
“We are embarked as pioneers on a new science and industry …

… Our job is to keep everlastingly at research and experiment,

to adapt our laboratories to production as soon as practicable,

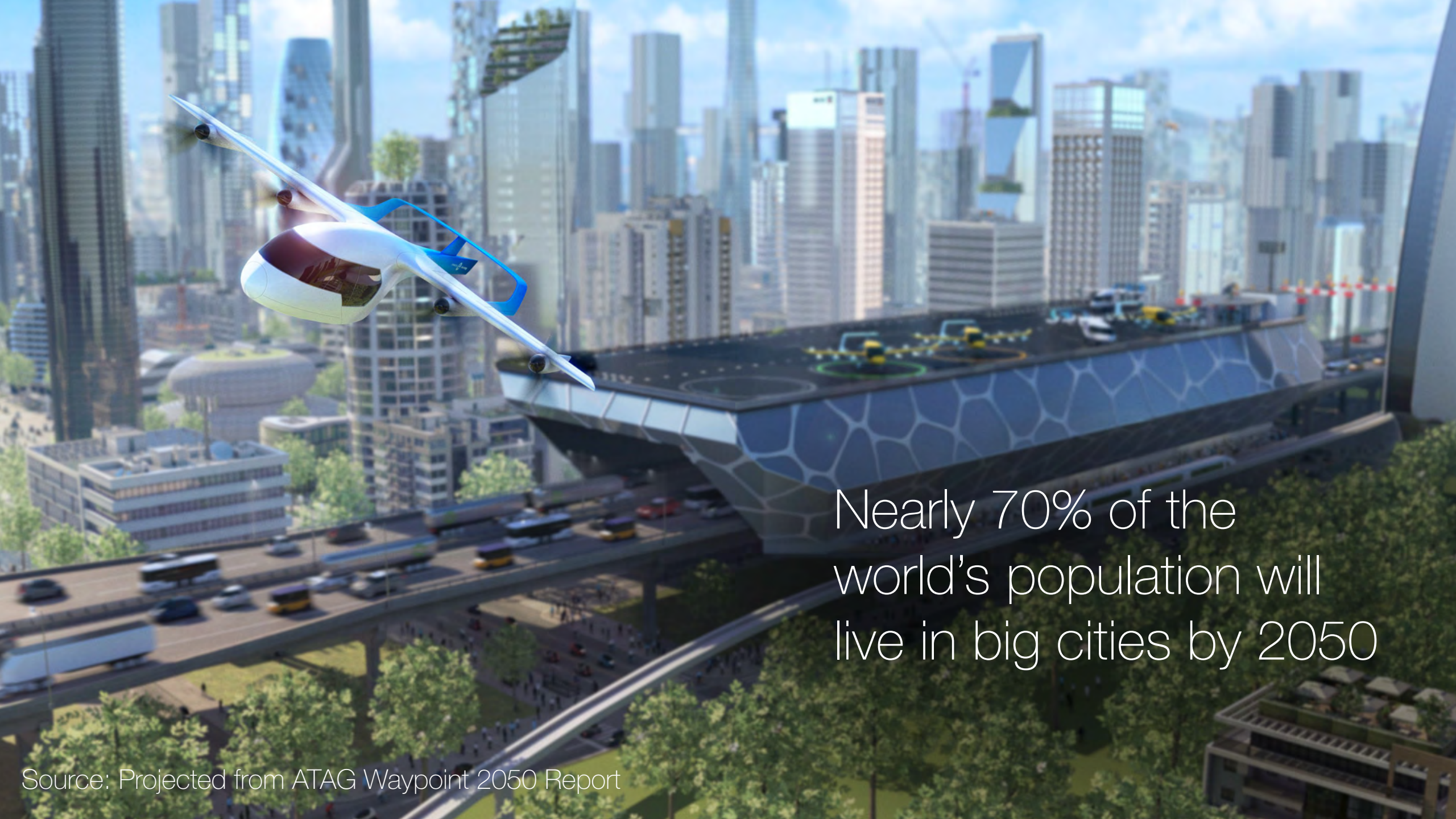
to let no new improvement in flying equipment pass us by.”

— Bill Boeing, 1929

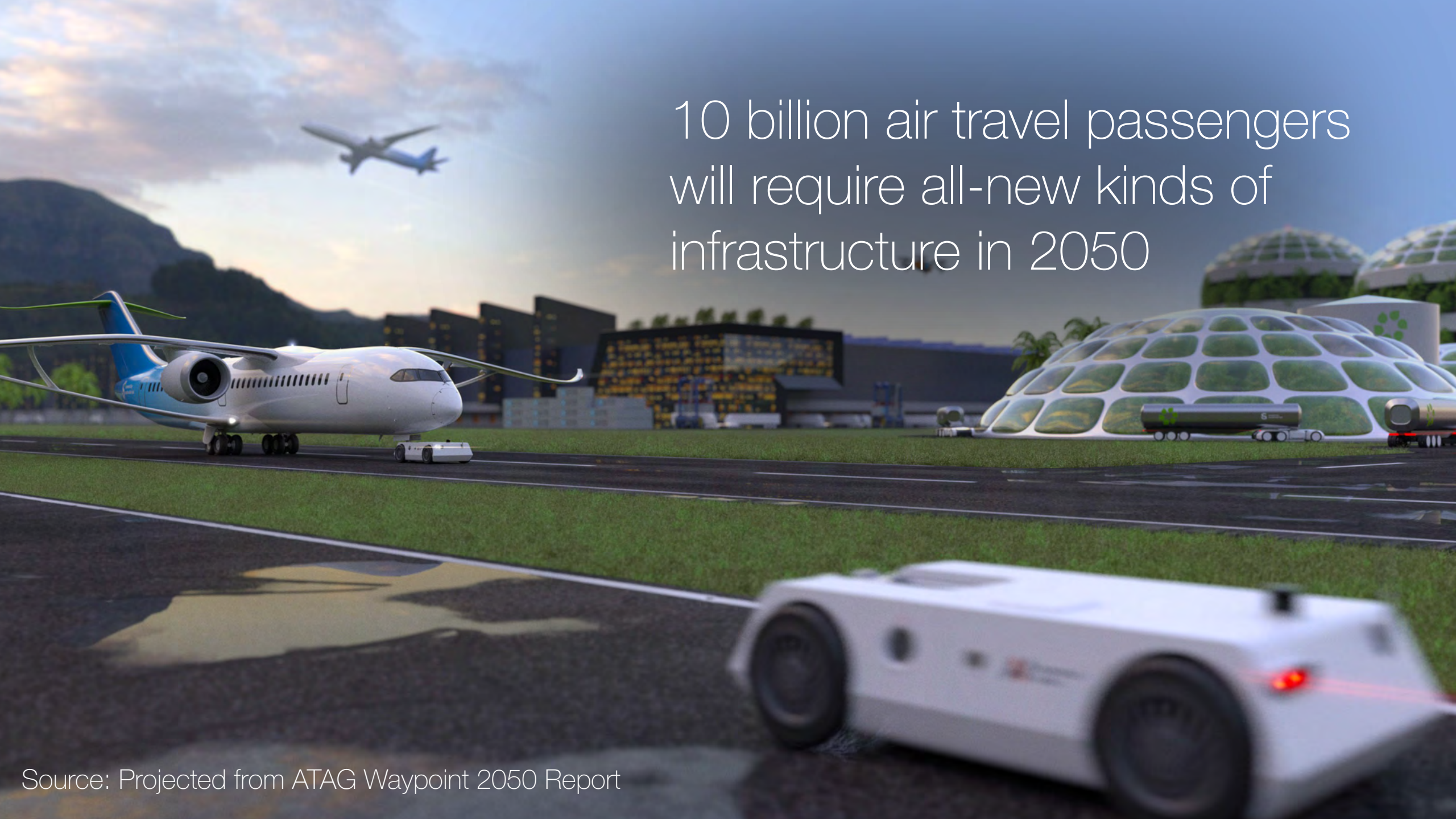


Boeing CMO 2022–2041


2050



Source: Projected from ATAG Waypoint 2050 Report

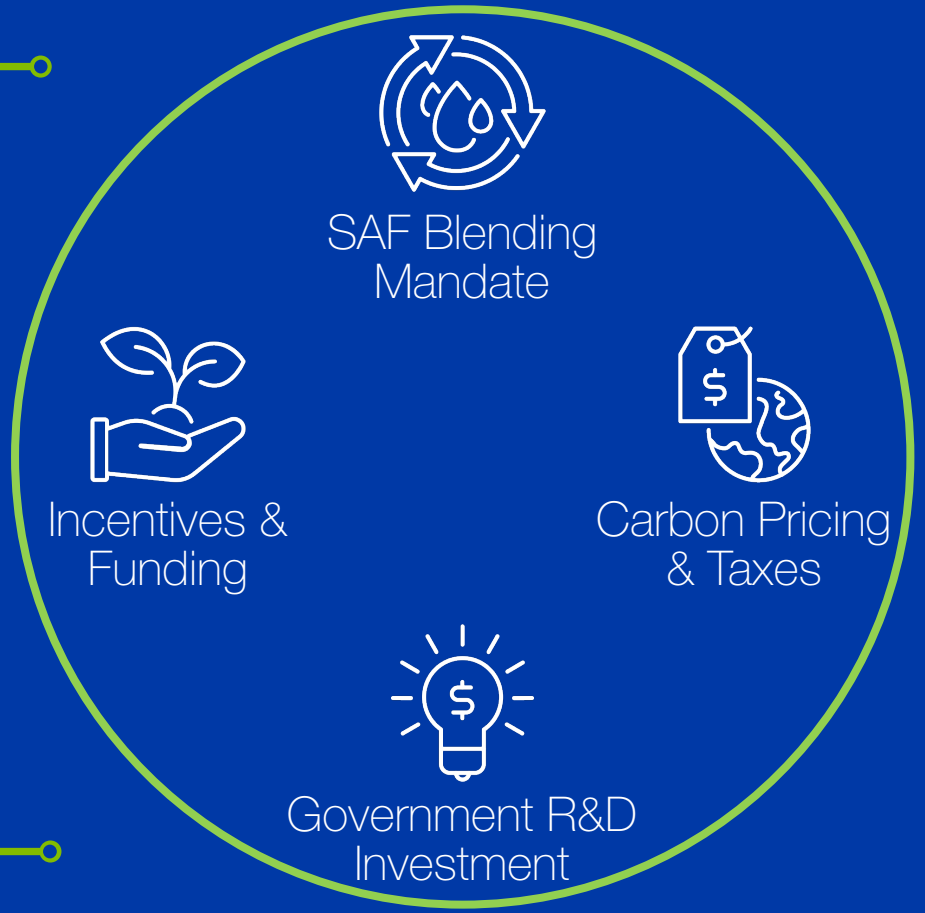


Source: Projected from ATAG Waypoint 2050 Report


Air travel will support 180 million
jobs and generate nearly $9 trillion
in economic activity in 2050
Source: Projected from ATAG Waypoint 2050 Report

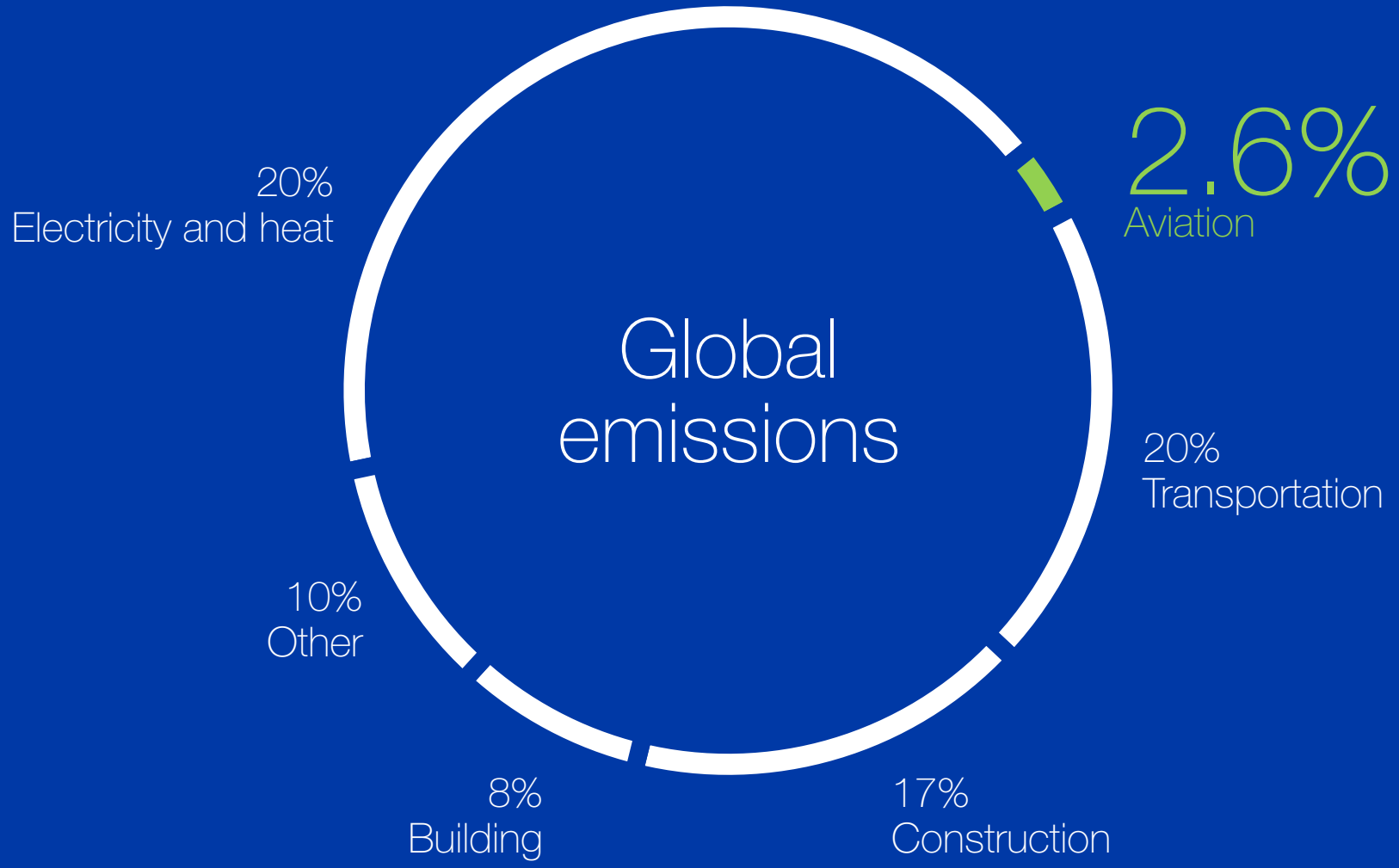
Policy trends

- Net Zero 2050
- Disclosure Requirements
- Short-Haul Mandates
- EU Taxonomy
- Renewable Energy

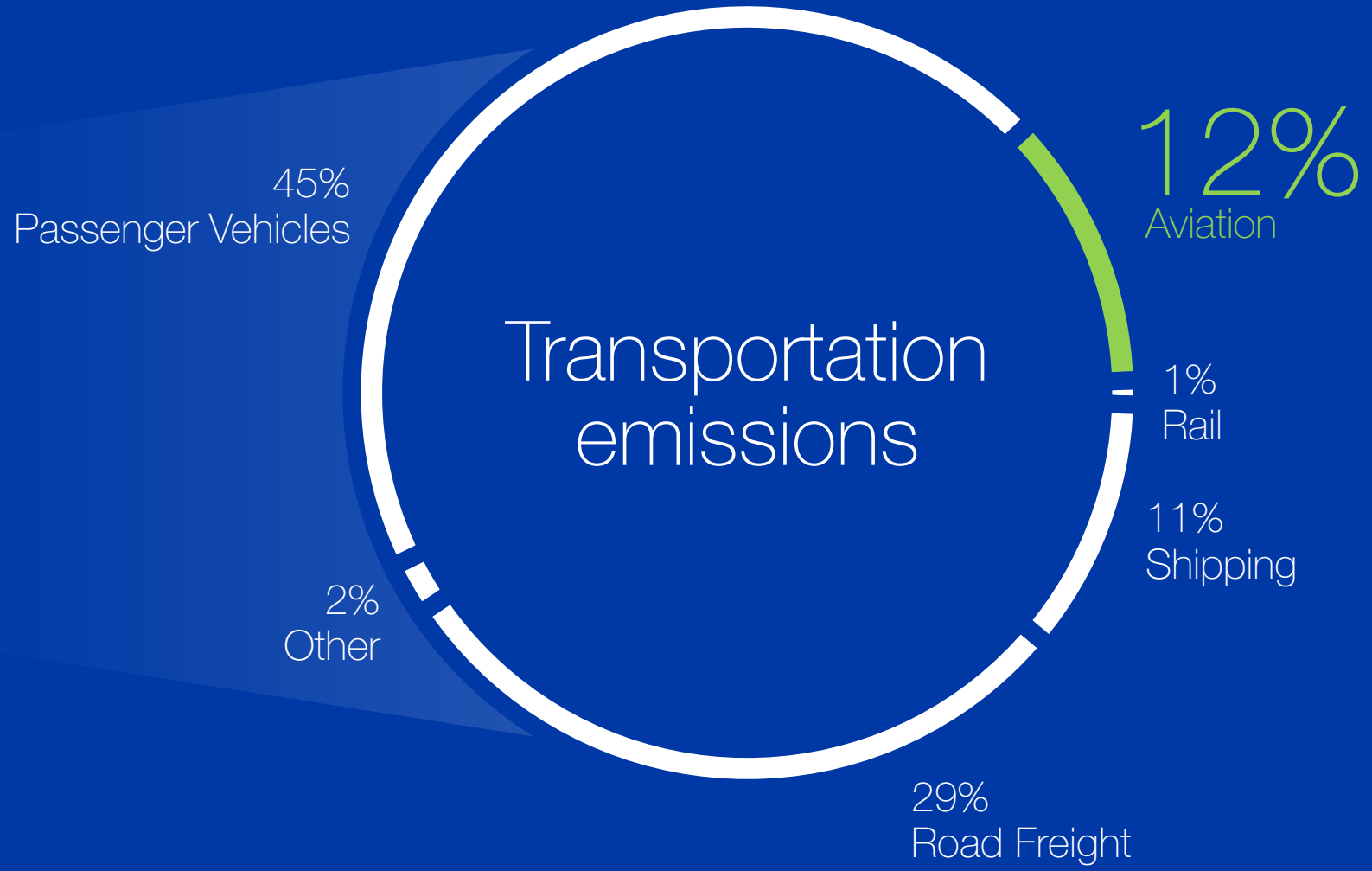


Aviation contributes 2.6% of total global emissions

Source: 2018, World Resources Institute



Source: 2018, World Resources Institute

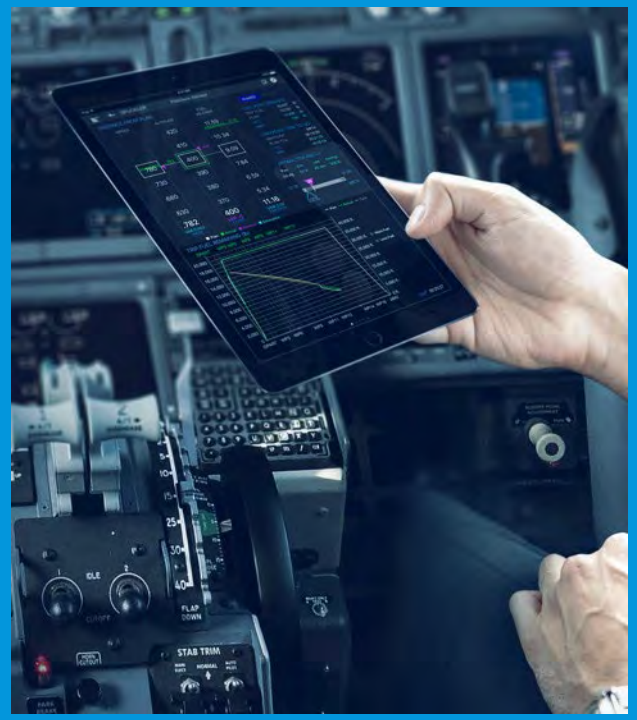


Source: 2018, World Resources Institute

EVERYTHING FOR ZERO

Our four strategies for decarbonizing aviation

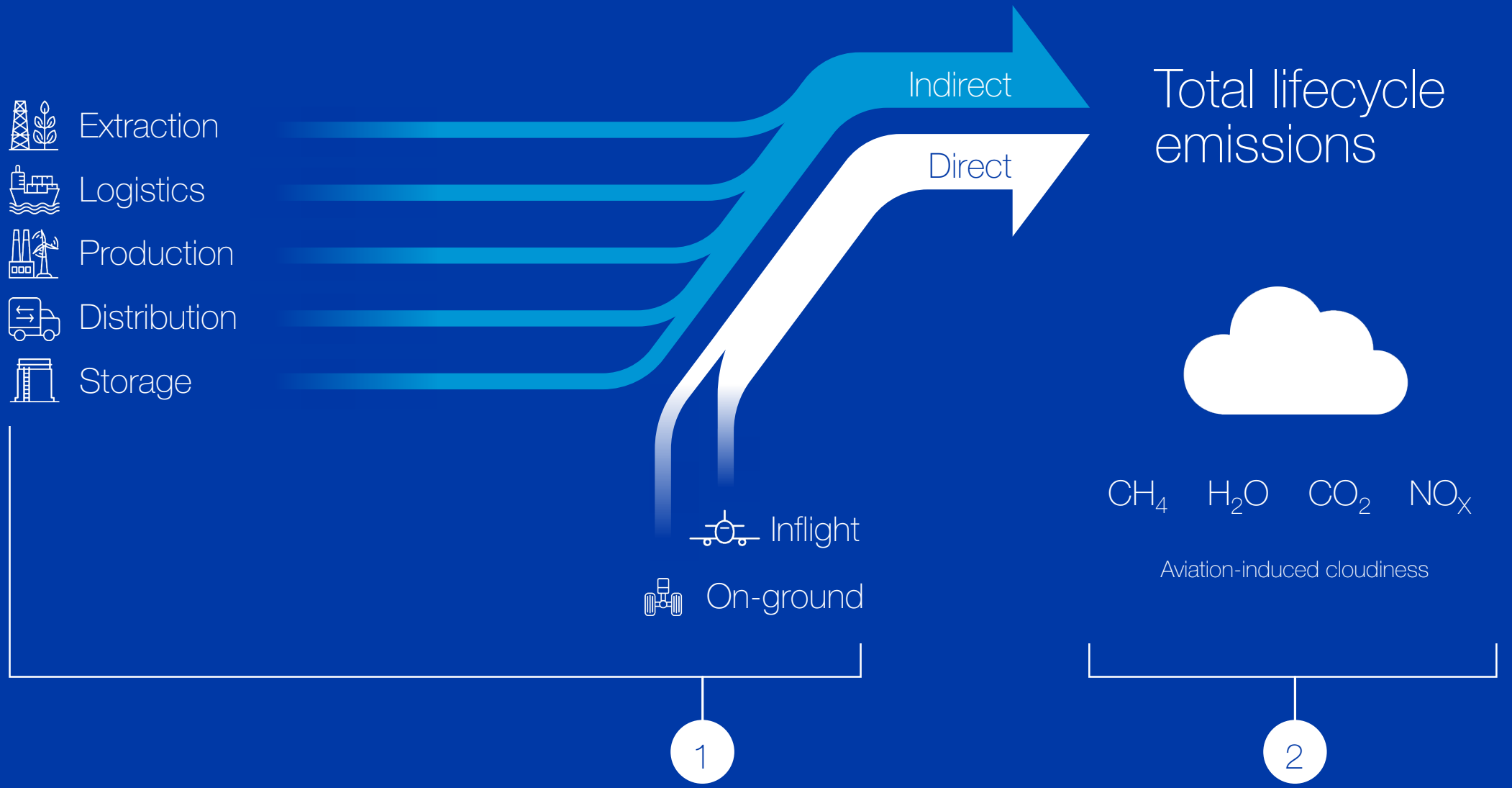
Fleet renewal



Operational efficiency

Renewable energy

Advanced technology



Zero-impact: Full lifecycle accounting Total climate effects

Meet Cascade

Sustainable Aviation Fuels

SAF is required

2008

2008
First SAF test flight

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

2010

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

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

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

2016

2018

2018
First commercial airplane test using 100% SAF

2018
Launched program for biofuel delivery flights from Boeing Delivery Centers

2020

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

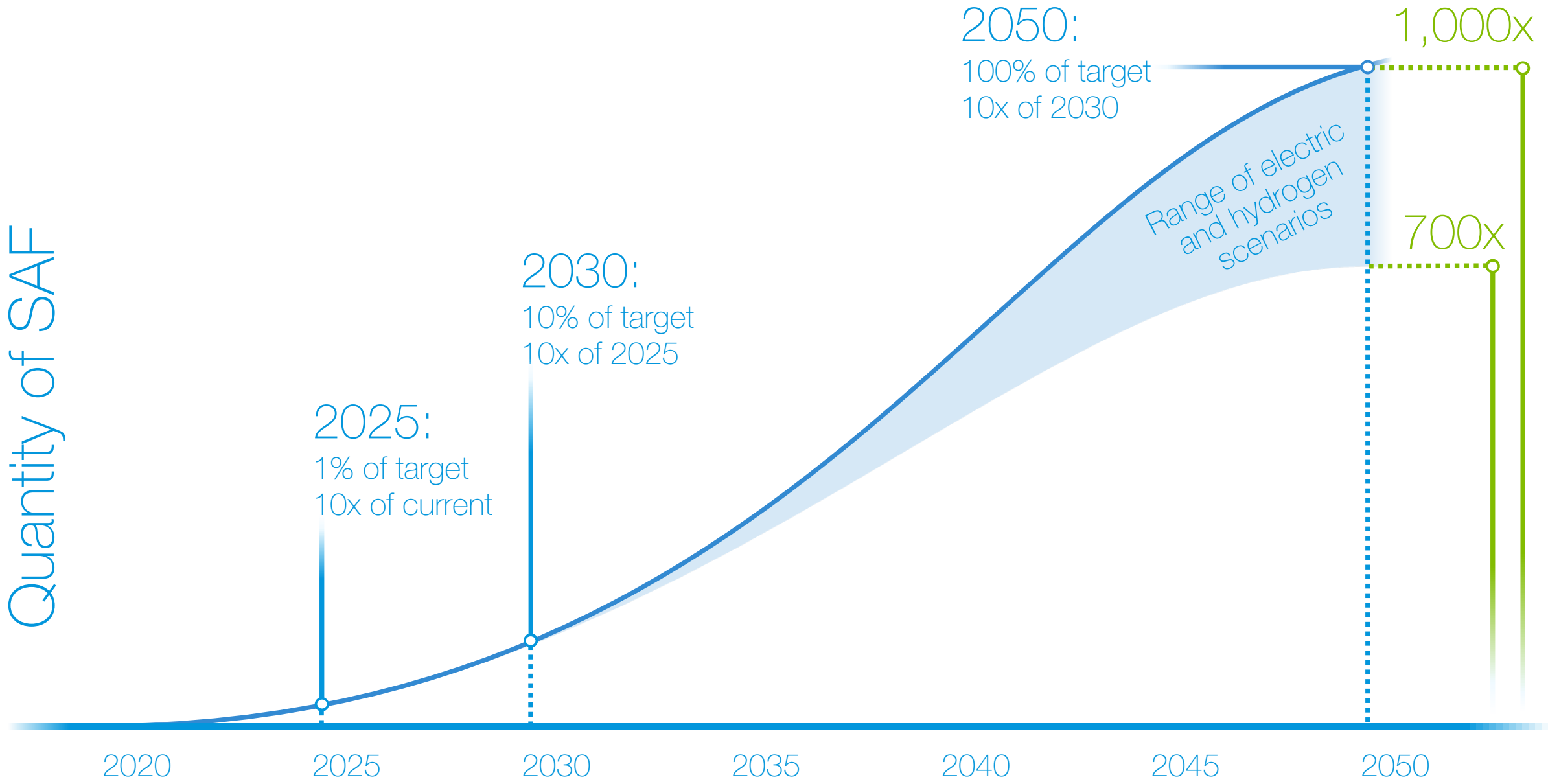
2022
2 million gallons of SAF procured for operations

2022

Industry view

		2020	2025	2030	2035	2040	2045	2050
~27% of CO2 emissions	**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	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
~73% of CO2	**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



Source: Projected from ATAG Waypoint 2050 Report

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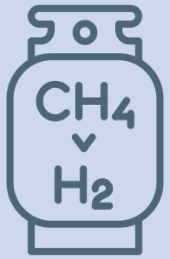
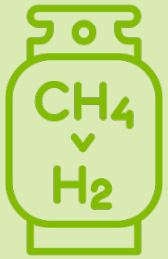
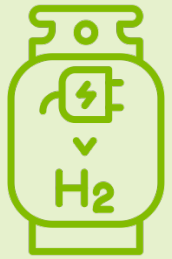
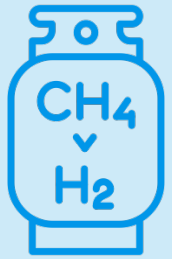
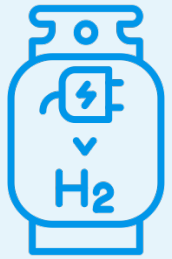
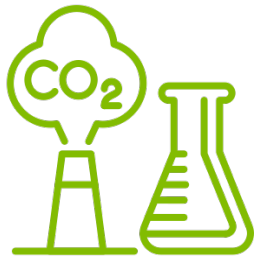
	Today	Drop-in or near-drop-in SAF			Non-drop-in energy carriers		
	Fossil Jet-A	Waste-and-biomass-based SAF	Power-and-biomass-to-liquid (PBtL)	Power-to-liquid	Hydrogen		Battery
H_2	Fossil H_2 	Bio and fossil H_2 produced from methane 	Bio and H_2 produced from low-carbon electricity 	H_2 from renewable grid 	Fossil H_2 produced from methane 	H_2 produced from low-carbon electricity 	Electricity from grid 
C	Fossil carbon 	Biomass and waste streams 	Biomass or waste stream 	Atmospheric or industrial CO_2 streams 			

MIT LABORATORY FOR AVIATION AND THE ENVIRONMENT

SAF &

SAF &

Electrification

Architecture

Battery electric

Fuel cells


N305XZ

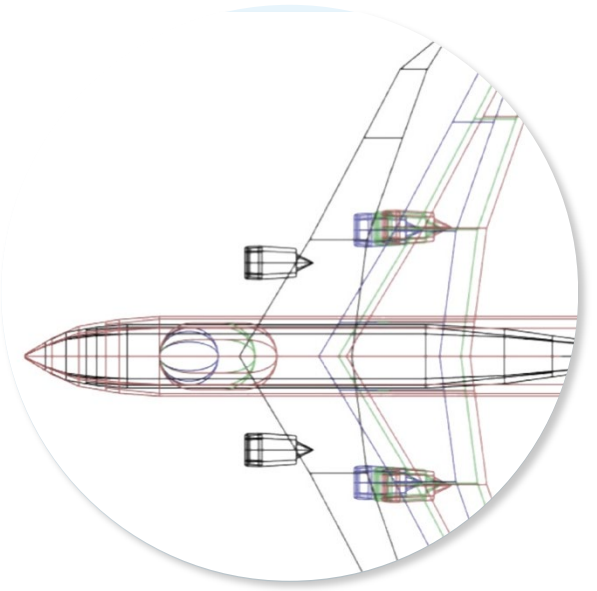
Hybrid propulsion

SAF &

Hydrogen

Hydrogen fuel cells and combustion

Onboard and airport storage and distribution



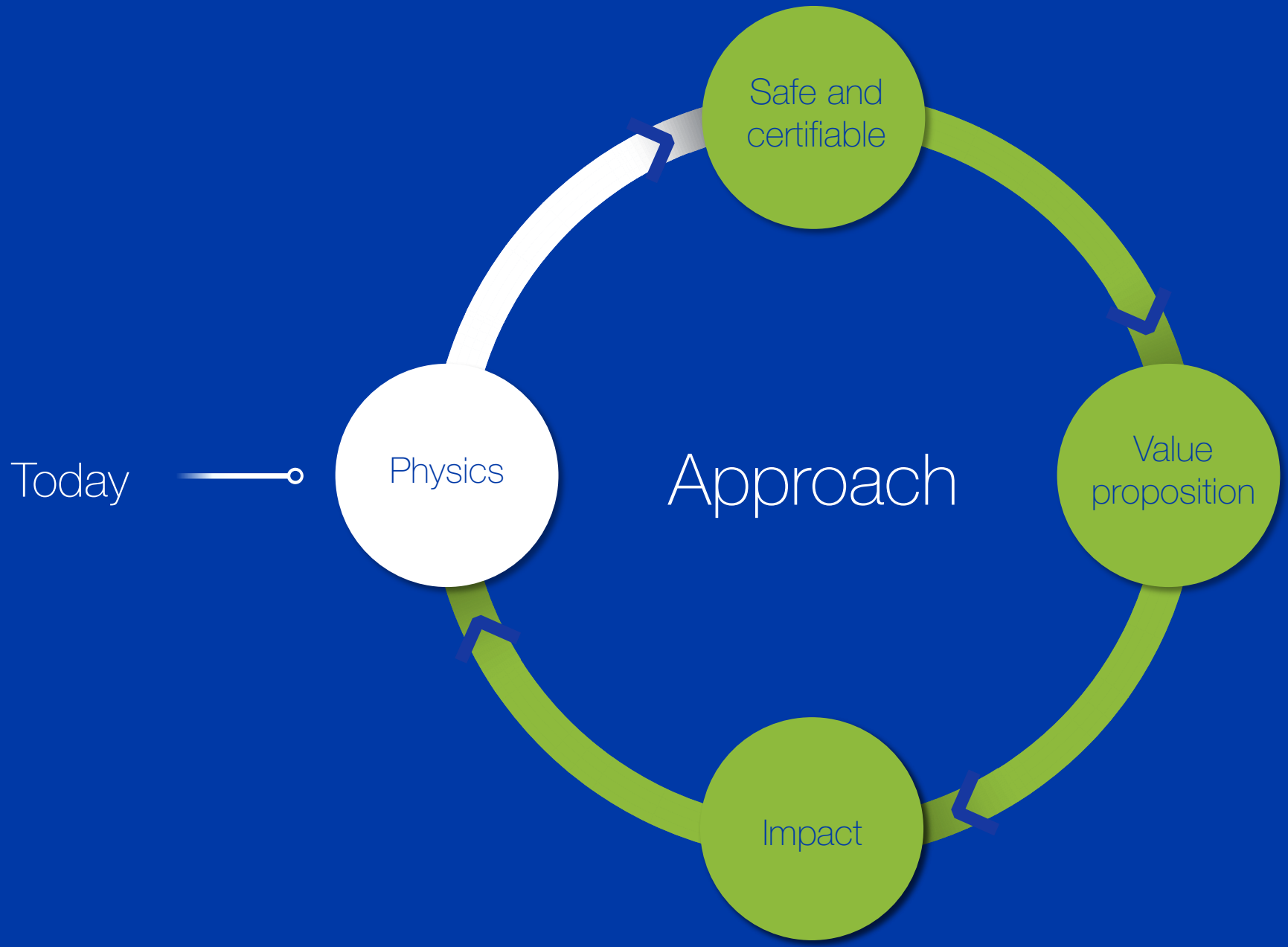
Airplane-level integration

World’s first piloted
H2 fuel cell aircraft

Hydrogen combustion

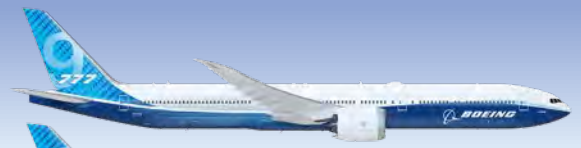
Composite cryotank

SAF &


Today
Physics
Approach
Safe and certifiable
Value proposition
Impact

Products

777-9



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777-8F

787-10

787-9

787-8

737 MAX 10

737 MAX 9

737 MAX 8

737 MAX 7

Wisk

Demonstrators

ecoDemonstrator

Transonic Truss-Based Wing (TTBW) Demonstrator

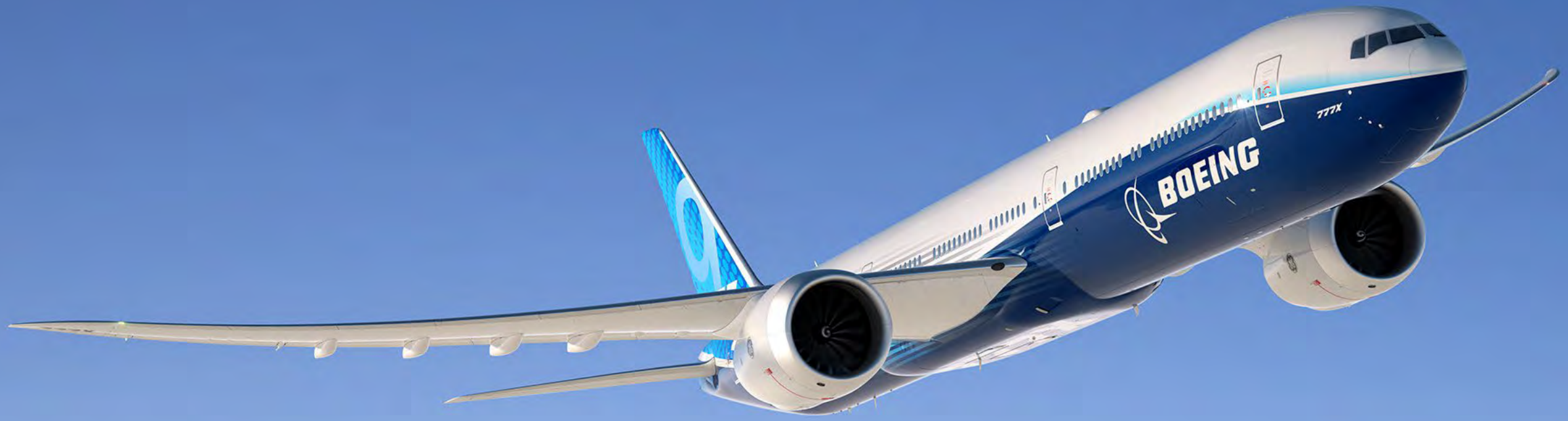
Hybrid Propulsion Demonstrator

Wisk Demonstrator

Future flight concepts

EVERYTHING FOR ZERO

Product



Demonstrator

Demonstrator

Future flight concepts

EVERYTHING FOR ZERO

SUSTAINABLE AEROSPACE TOGETHER

BOEING