ATAG
AIR TRANSPORT ACTION GROUP

WAYPOINT 2050

AN AIR TRANSPORT ACTION GROUP PROJECT

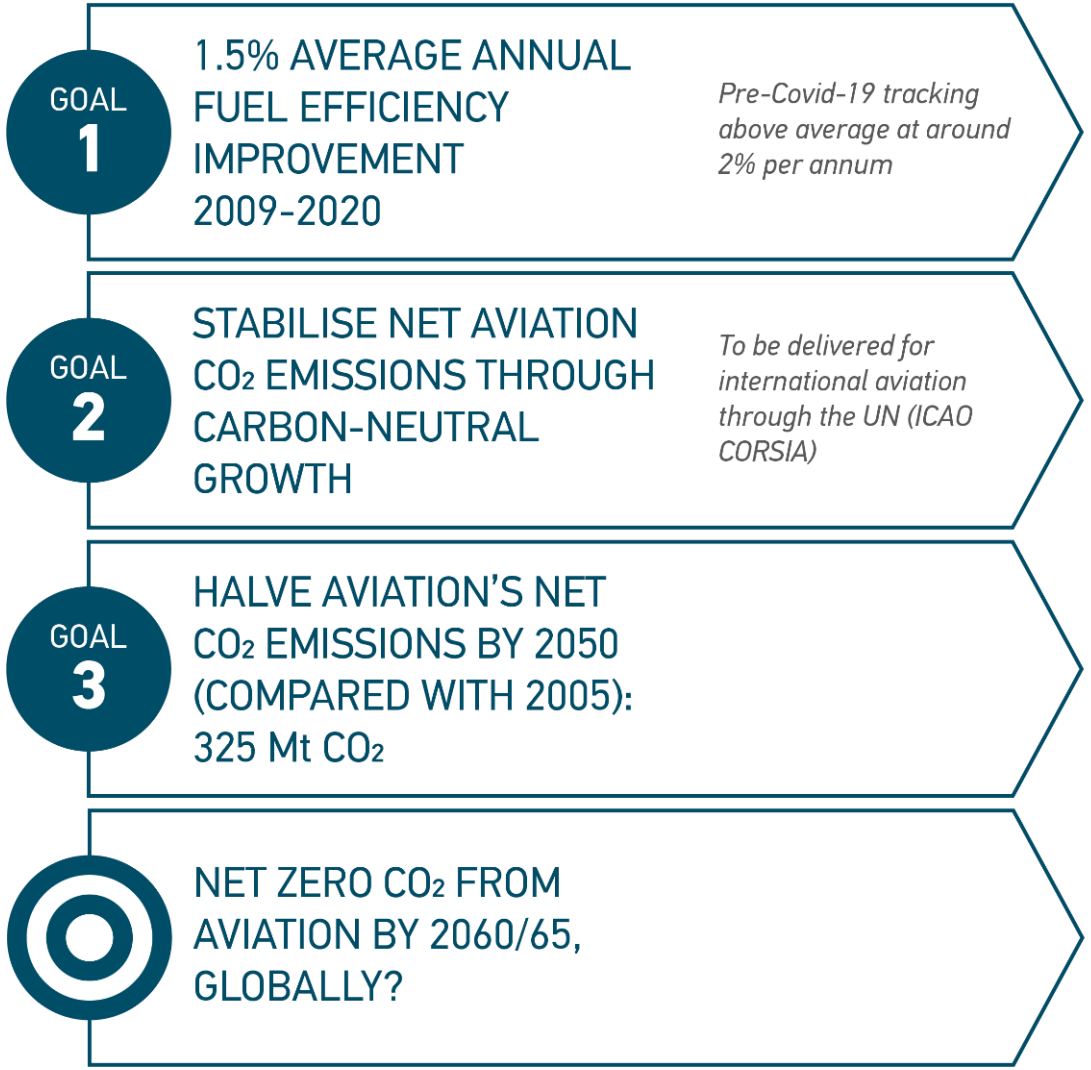
CAAFI Webinar

27 January 2021

Background and Objective

- **Air transport established sector-wide climate goals in 2009.**

- **Waypoint 2050 investigates and provides details of the pathway to meeting the long-term goal.**



Scope of Waypoint 2050

	ICAO	UNFCCC Paris Agreement
Included in industry 2050 goal: emissions from the global (commercial) use of jet fuel	▪ CO_2 emissions from international aviation (fuel burn gate-to-gate)	▪ CO_2 emissions from domestic aviation (fuel burn gate-to-gate)
Emissions from military, government, general aviation and air taxi mobility services not included in the industry goals.		▪ Airport emissions ▪ Emissions from ground service equipment and road vehicles ▪ Terminals, maintenance facilities, offices ▪ Air traffic control

Development of the analysis

Experts in five working groups developed forecasts, scenarios, potential pathways

These were developed into consolidated scenarios to meet the industry goal

And then a look to how we can go beyond that

- Traffic forecasting
- T Technology developments
- O Operations and infrastructure
- F Sustainable aviation fuel
- M Offsetting (market-based measures)

Scenario 0

Scenario 1

Scenario 2

Scenario 3

Industry **2050** goal

325 Mt CO_2

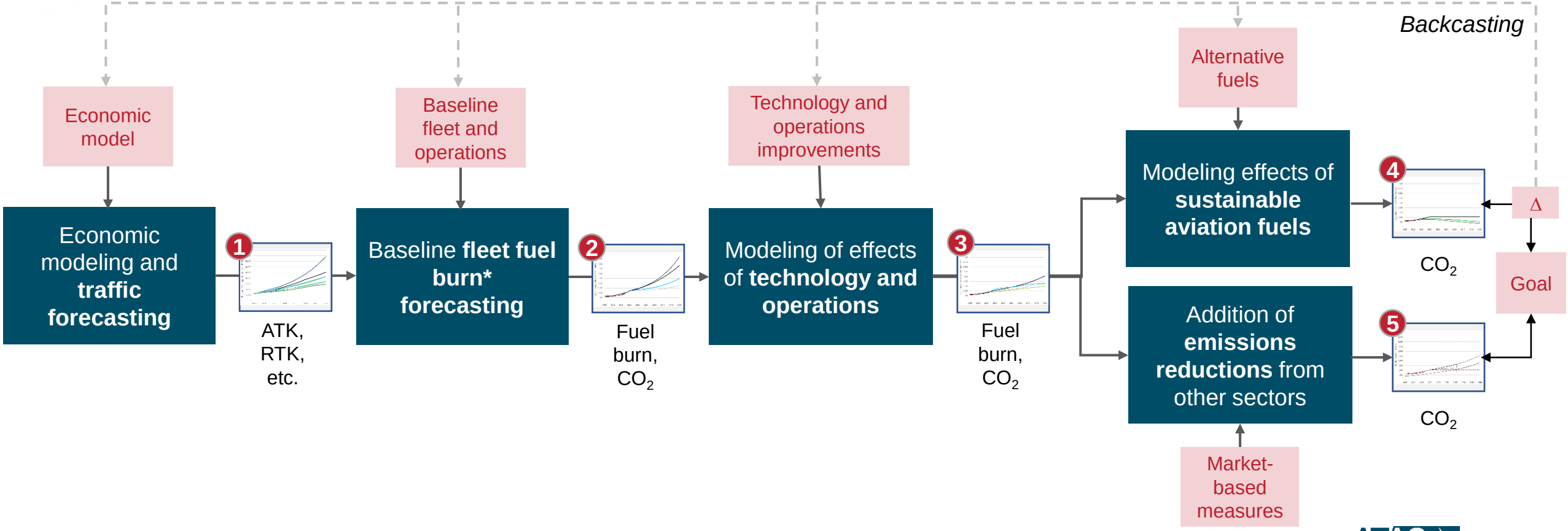
When is net-zero possible, globally?

Each of these generated many hundreds of individual pathways and possibilities. Representative scenarios were explored. The impact of the Covid-19 shutdown on air traffic was included in July 2020.

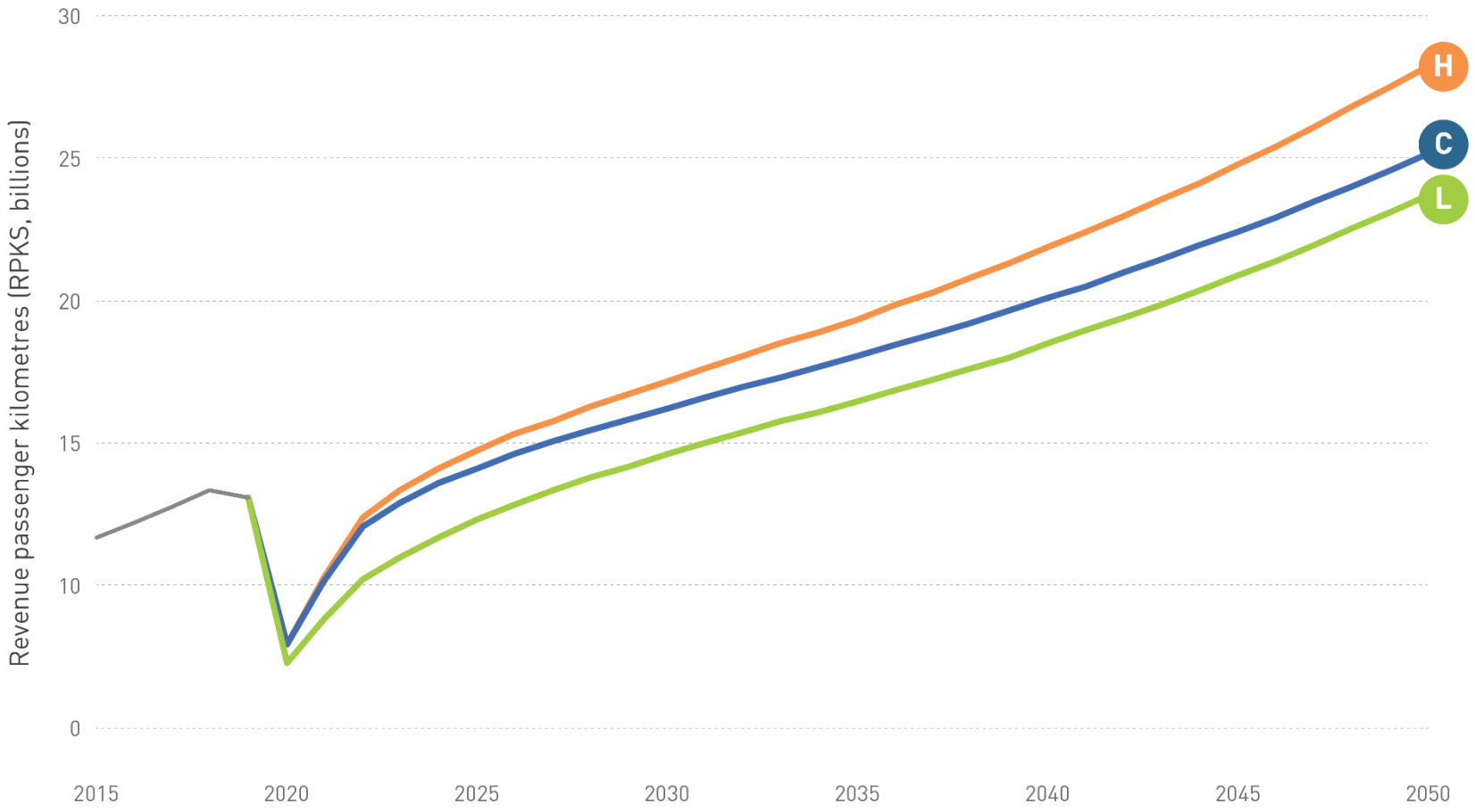
*Taking into account the **state of technology research**; the **timeframe** (i.e. can new technologies go through certification and entry-into-service in time?); **political considerations** (governments setting goals and helping achieve them); **investment likelihood**.*

Methodology

Development of potential CO_2 emissions paths towards the aviation 2050 carbon goal



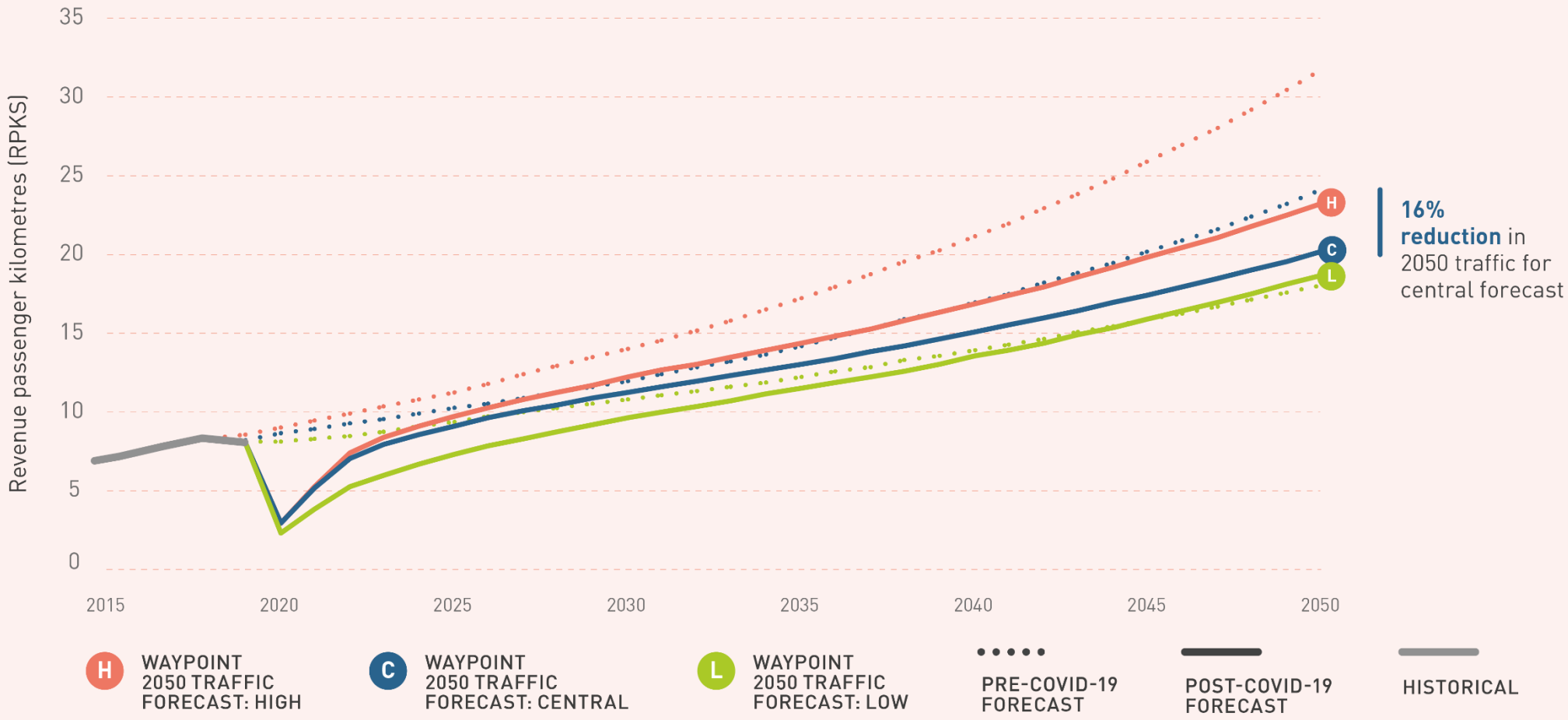
The Waypoint 2050 forecasts



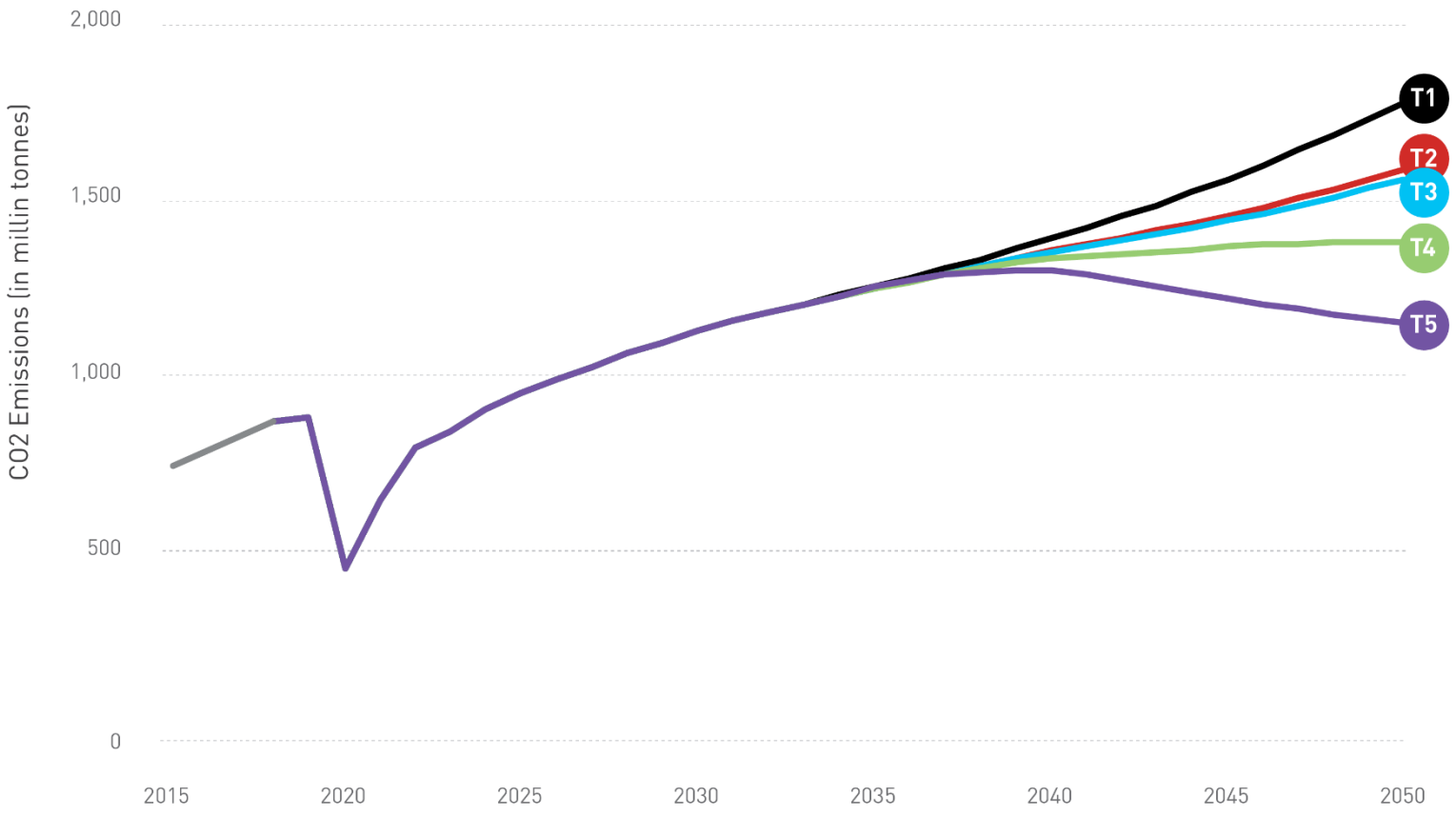
Scenario	Description	2050 RPKs	CAGR
H High growth	Return to globalisation with a continuation of high growth trends seen in recent years, but from a revised base due to the impact of Covid-19.	23 trn	3.5%
C Central scenario	Continuation of historical trends, but a reduction compared with recent high-growth and taking into account the impact of Covid-19.	20 trn	3.0%
L Low growth	Protectionism deepens along with a reduction in mobility on top of Covid-19 impact.	19 trn	2.7%

The **central scenario** was used for all Waypoint 2050 modelling work

Covid19 expected to have long term impacts on aviation traffic
(compared to pre-Covid19 forecasts)

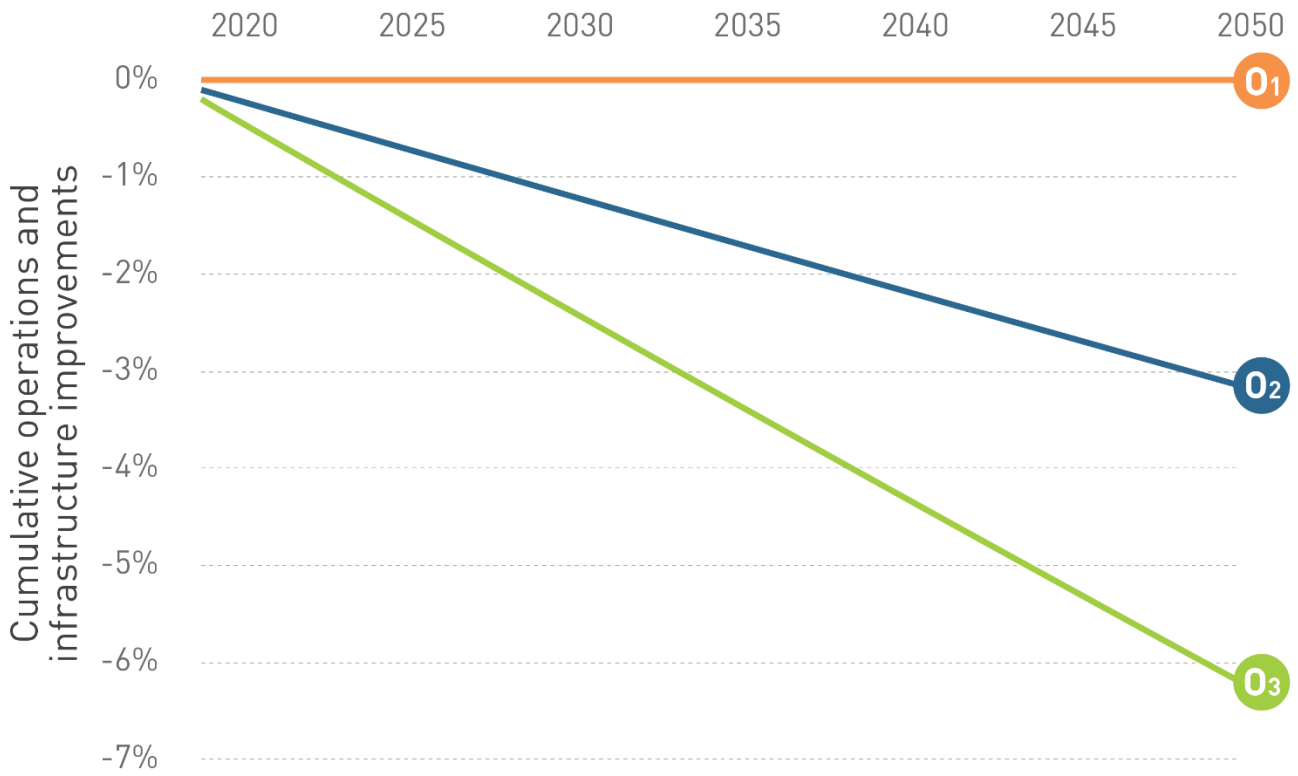


System/fleet level contribution from aircraft technology improvements



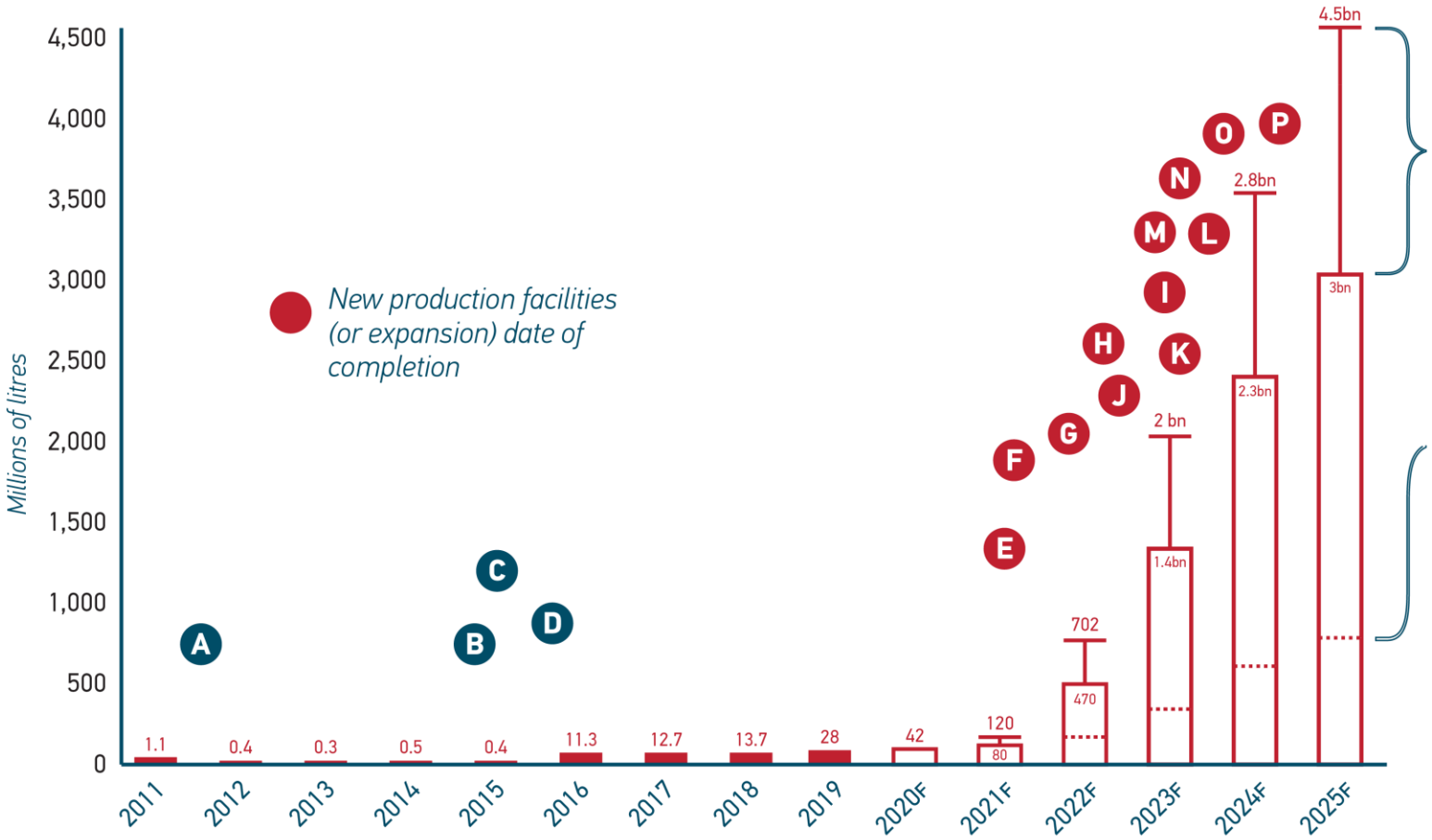
Scenario	Description
T_1 **Baseline**	Current fleet efficiency continues with slight improvement as older aircraft are replaced by today's most efficient new models. Not a realistic scenario.
T_2 **Conservative: evolutionary technologies only**	A new generation of aircraft follows current models, but just as an evolution of current configurations and propulsion.
T_3 **New configurations**	Revolutionary configurations of aircraft with new structural elements and new types of propulsion.
T_4 **Towards electrification**	Technology shift towards electric propulsion and hybrid systems. Entering the fleet from 2035-2040.
T_5 **Aspirational technology**	A revolutionary shift towards zero emissions aircraft for the narrow body segment earlier (~2030) and for larger aircraft than the T4 scenario.

Operational efficiency scenarios for Waypoint 2050



Scenario	Description	Avg annual improvement
O_1 **Low improvement**	Investments in operational and infrastructure efficiencies are counterbalanced by congestion increases. Despite what looks like no improvement, if investment in operational efficiency did not take place, increasing traffic would lead to a worsening situation.	0.00%
O_2 **Mid improvement**	Substantial investments in operational and infrastructure efficiencies.	0.10%
O_3 **High improvement**	Substantial investments in operational and infrastructure efficiencies.	0.20%

Short-term deployment ramp-up of SAF



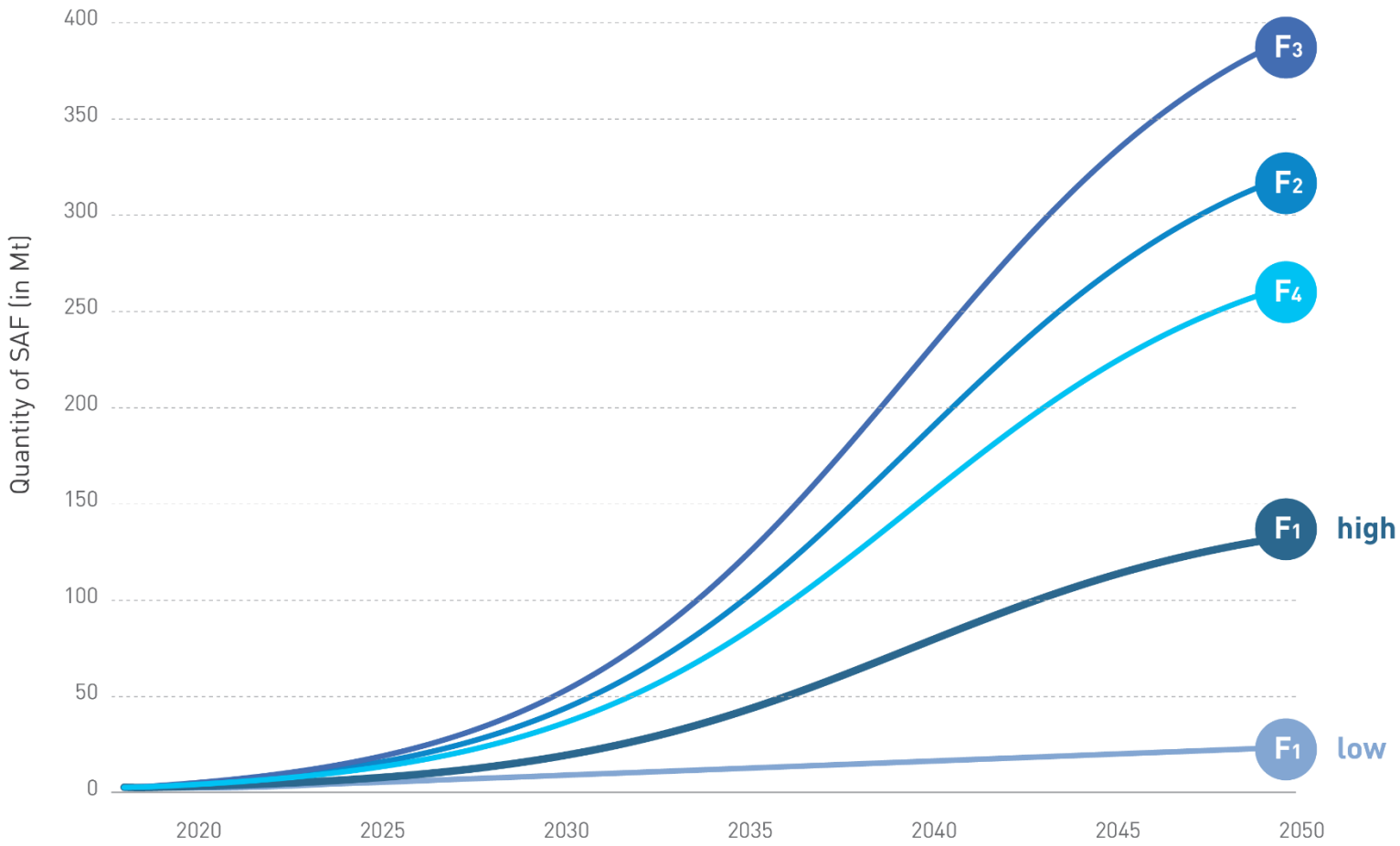
Difference between a low take-up of SAF from production facilities *(lower number)* and a high take-up, driven by policy and airline decision-making. The top number represents the full possible output of SAF production already in operation, under construction or in advance planning and financing.

Without the correct policy measures, the fuel output could be optimised to go to other forms of transport – the lowest dotted line represents the least uptake of SAF (output goes to road transport).

This analysis does not include SAF capacity that has not yet been announced, is in concept stage, nor the impact of aggressive policy support which could double the potential by 2025.

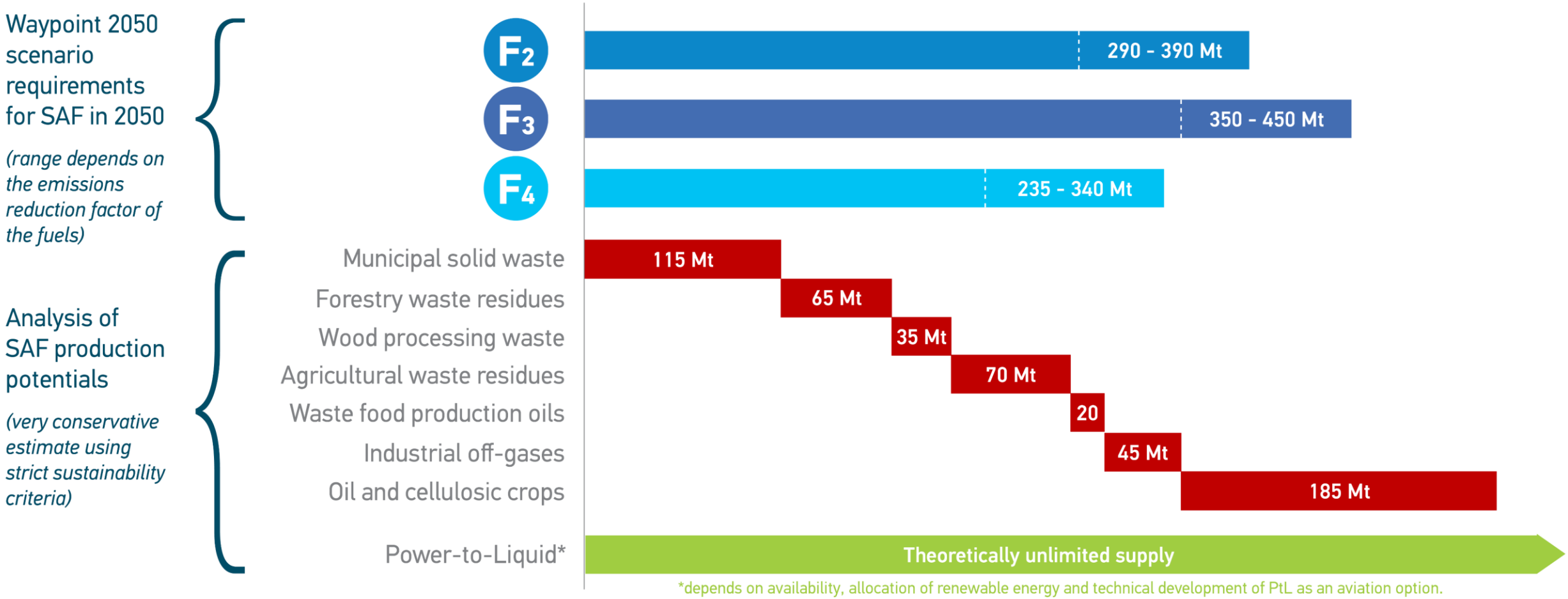
- A **Neste** (Singapore / Finland)
- B **Gevo** (USA)
- C **Amyris** (Brazil)
- D **World Energy** (USA)
- E **World Energy** (USA)
- F **Fulcrum** (USA)
- G **Neste** (Singapore)
- H **LanzaTech** (North Asia)
- I **SkyNRG** (Netherlands)
- J **UPM** (USA)
- K **Red Rock** (USA)
- L **Total** (France)
- M **Diamond Green** (USA)
- N **REG** (USA)
- O **Preem** (Sweden)
- P **Velocys** (UK)

Waypoint 2050 forecasts for SAF



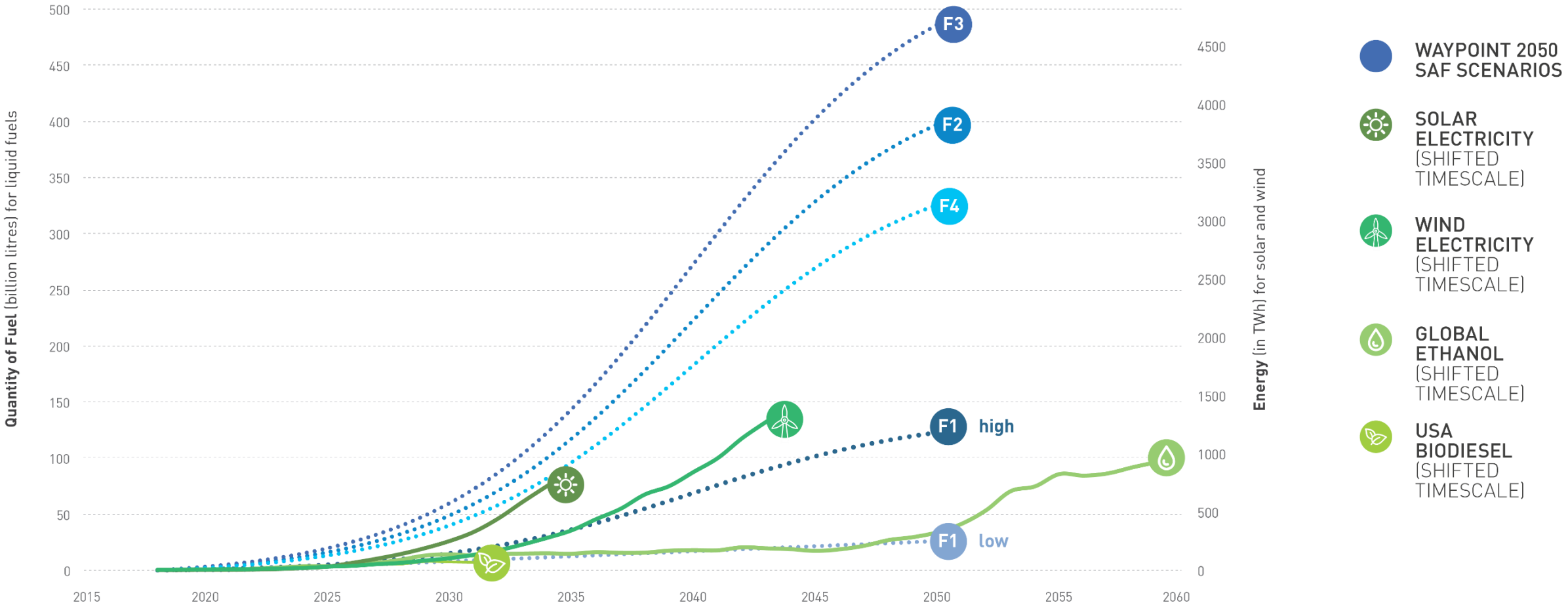
Scenario	Description	2050 Mt SAF	2050 % of fuel supply
F1 F1 **Current trends – baseline**	Scenarios based on near-/mid-term forecasts for SAF.	20-144	5 – 30%
F2 **Pushing technology and SAF**	**Backcast** with a ramp-up in SAF production	290-390	82%
F3 **Aggressive SAF**	**Backcast** with a priority placed on SAF investment by the industry	350-450	86%
F4 **Aspirational technology**	**Backcast** with SAF filling the gap following radical technology developments	235-340	77%

SAF production potential compared with forecast requirements



Source: WEF Clean Skies for Tomorrow analysis with ATAG and IATA additions

Waypoint 2050 SAF scenarios in context with historical ramp-up of other renewable energy sources

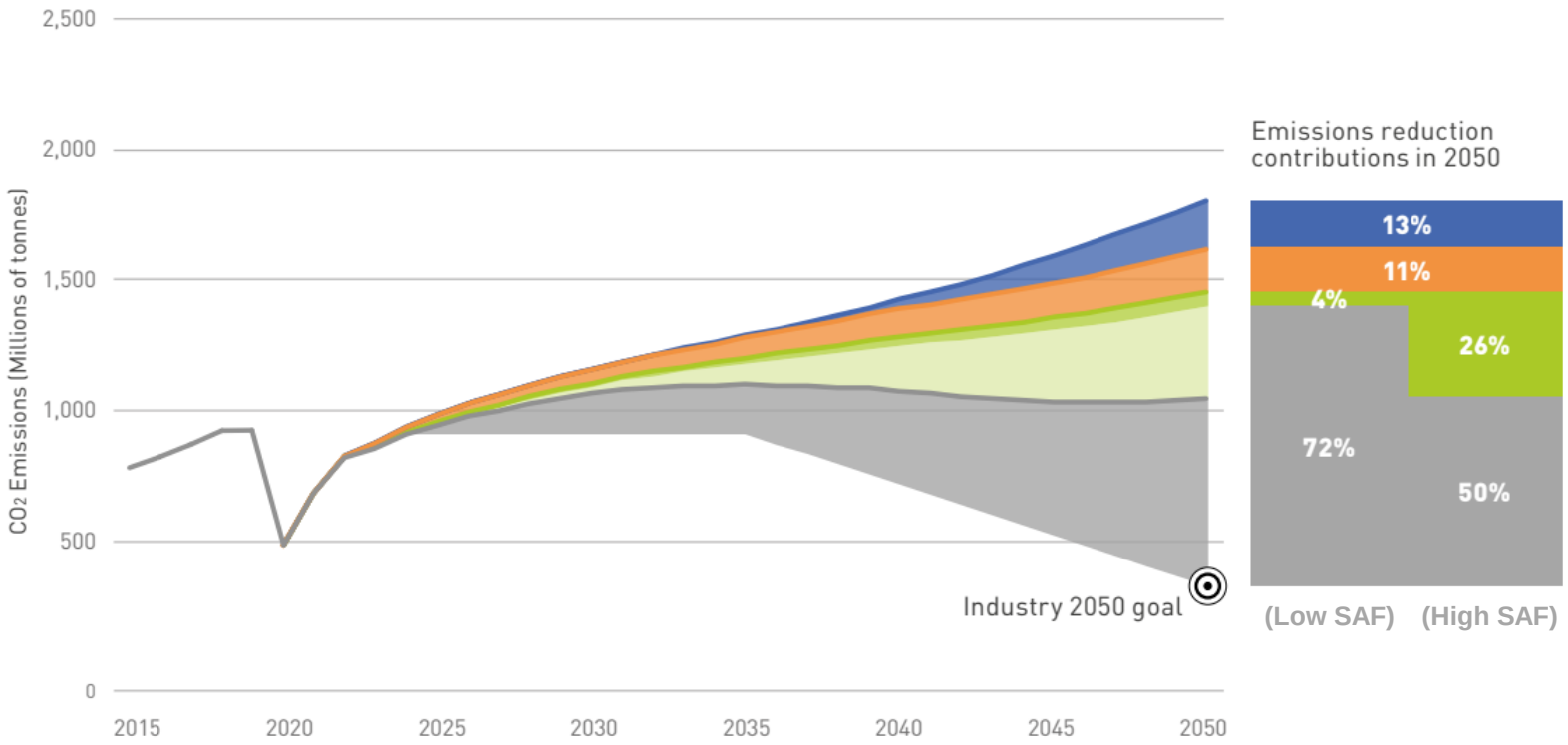


The role of offsetting in Waypoint 2050 scenarios

- Waypoint 2050 scenarios do not rely on offsetting as a central pillar of action:
  - Offsetting will be needed in the mid-term as new technologies are developed and SAF is scaled-up.
  - In the long-term, offsets will still be needed to deal with remaining residual emissions, or if they make more sense (economically or environmentally) than shifting to in-sector reductions.
  - However, the expectation is that both the 2050 goal and net-zero are achievable without large-scale offsetting as the core component of action.

Scenario 0: baseline / continuation of current trends

A continuation of current trends with no special emphasis on efficiency improvements (not a realistic scenario, but sets baseline)



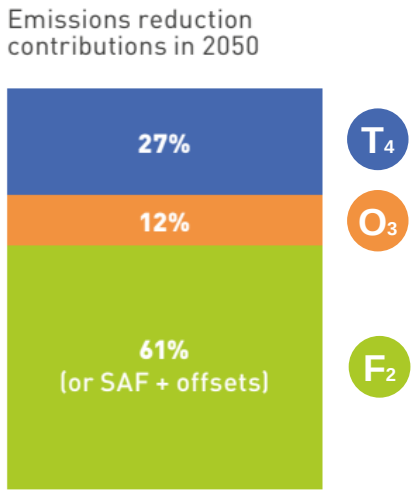
Traffic growth	C	Central scenario: 3.0% CAGR 2019-2050
Technology developments	T_2	Continuation of current development cycle and performance improvement (the next generation of 'tube-and-wing')
Operations and infrastructure improvements	O_2	Mid-range improvements and airline load factor improvements
Sustainable aviation fuel	F_1 F_2	Low- to high-range continuation of current investment curve delivering between 20-144 Mt of SAF with a 90% emissions reduction factor by 2050
Offsets (or other carbon mitigation options)	YES	Required to meet goal, in the order of 740-1,100 Mt of offsets

Meeting the industry goal by exploring different levers

Scenario 1

Pushing technology and operations

Industry prioritises technology and operational improvements

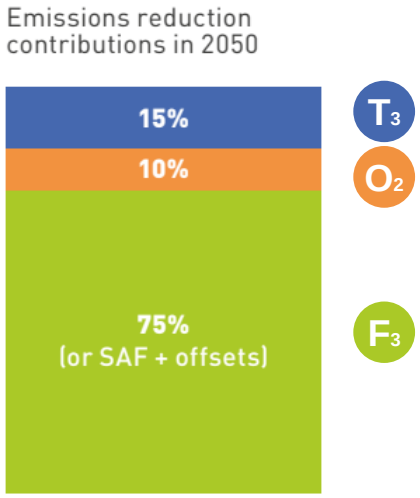


Electric and hybrid short-range (<100 seat) aircraft from 2035/2040. High-range operational improvements. 290-390 Mt of SAF by 2050.

Scenario 2

Aggressive sustainable aviation fuel deployment

Industry prioritises investment in sustainable aviation fuel over technology

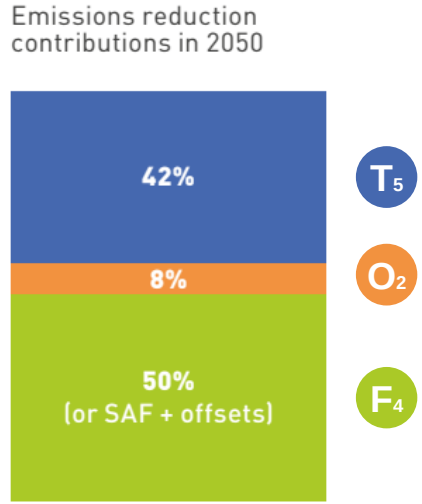


New airframe configurations such as blended wing body. Mid-range operational improvements. 350-450 Mt of SAF by 2050.

Scenario 3

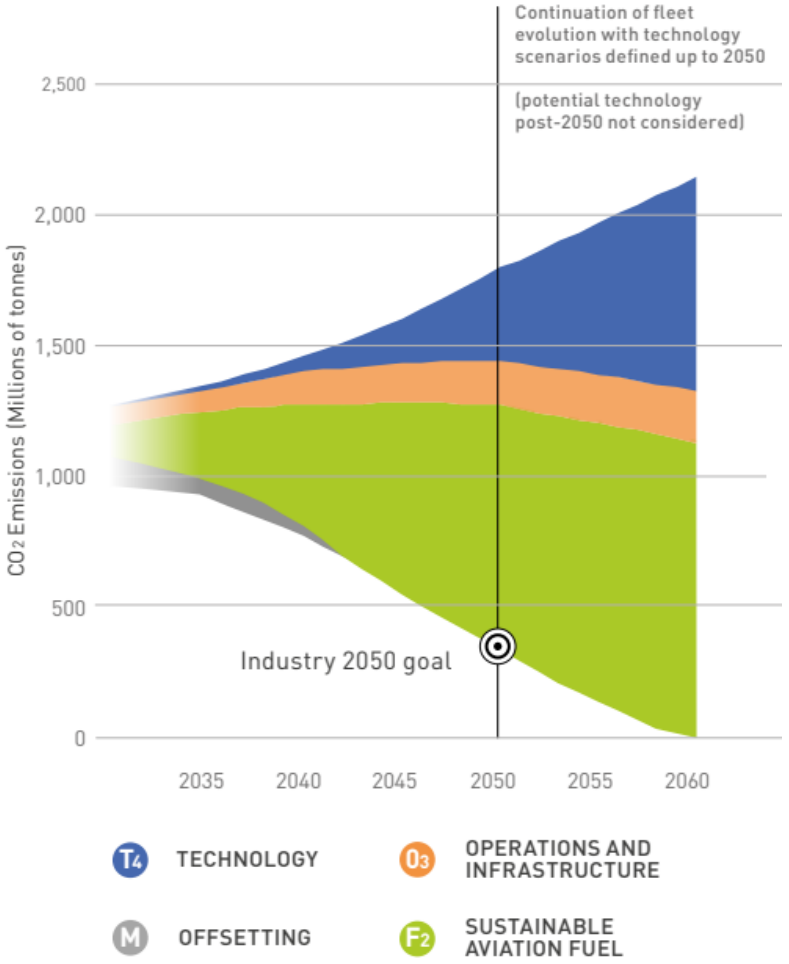
Aspirational and aggressive technology perspective

Highly ambitious technology developments: electric and/or hydrogen for up to 200 seat aircraft before 2035



Very aggressive zero emissions aircraft (electric, hydrogen) by 2035-2040. Mid-range operational improvements. 235-340 Mt of SAF by 2050.

Plotting a path to net-zero emissions

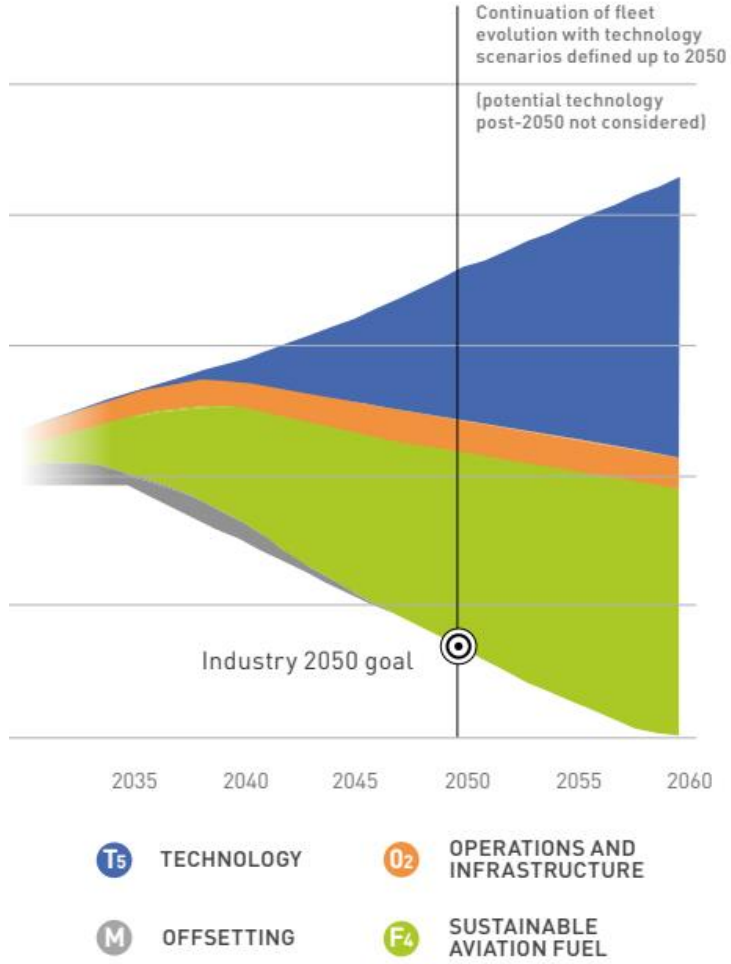


The contribution from hybridisation, electrification and hydrogen becomes substantial in 2050-2060 timeframe.

With emissions reduction factor from SAF reaching 100% by 2060, net zero emissions could be achieved by that date in the absence of offsets.

However, offsets (in whatever form they may take in the 2040+ timeframe) could be used to bridge any gap and support a net-zero goal, either in 2050 or beyond.

Plotted using consolidated scenario 1 (left) and 3 (right).



Key conclusions of Waypoint 2050 research

1

Industry long-term goal of -50% net CO_2 from aviation globally by 2050 **is very challenging, but achievable.**

(there are several pathways to meeting the goal)

2

With the right policy support and advances in technology, **net-zero aviation** can be achieved **globally** by around 2060/65.

(in some regions earlier than this point)

3

We will need a **significant scale-up of sustainable aviation fuel**: to around 450-500 million tonnes a year by 2050.

(long-haul routes will rely on SAF)

4

New technology such as electric and hydrogen aircraft, **need accelerated research & development**

(could enter service around 2035 on short-haul routes)

5

Operations and infrastructure efficiencies are **vital for early action** and to maintain capacity efficiency in the future.

(mainly relates to air traffic management)

6

Offsetting important in the mid-term. Long-term goals should be achievable without offsetting playing a central role.

(by 2050, offsetting will mainly be in carbon removal opportunities)

Discussion / Q&A

WAYPOINT 2050

AN AIR TRANSPORT ACTION GROUP PROJECT

www.aviationbenefits.org/W2050