



Aviation Industry briefing pre-CAAF/3

Friday 22 September 2022

Montreal, Canada

WiFi: **CDPQ_PUBLIC**
No password required



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Welcome remarks

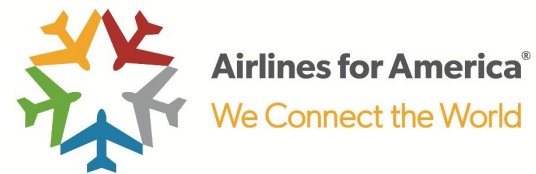
Aviation industry briefing pre-CAAF/3

Haldane Dodd

Executive Director, Air Transport Action Group



Briefing
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Agenda for the briefing

1

State of SAF

2

Exploring
implementation

3

Finance

Refreshment break

4

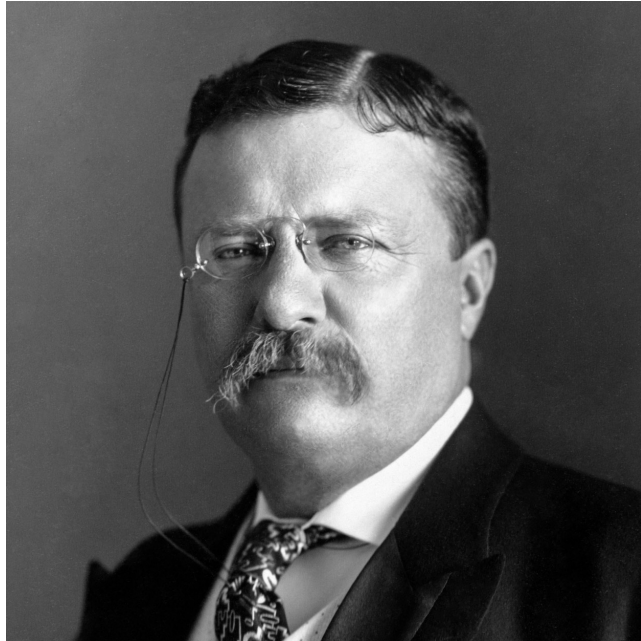
Preferred
CAAF/3
outcomes panel

5

Exchanges with
representatives

Welcome

Theodore Roosevelt



“Nothing in the world is worth having or worth doing unless it means effort, pain, difficulty... I have never in my life envied a human being who led an easy life. I have envied a great many people who led difficult lives and led them well.”

Whilst we can be proud of our achievement in 2022...

EURACTIV

UN aviation body agrees on 'net zero' target

 **United Nations**

Historic net-zero international flight goal agreed at UN conference

 **CLIMATE HOME NEWS**

International air travel set for 'aspirational' 2050 net zero goal

 **REUTERS**

UN nations reach long-term aviation climate goal

 **Environmental Defense Fund**

EDF Welcomes ICAO Assembly's 2050 Goal and CORSIA decisions

FLYING

Net-Zero Emissions Target Set By ICAO for 2050

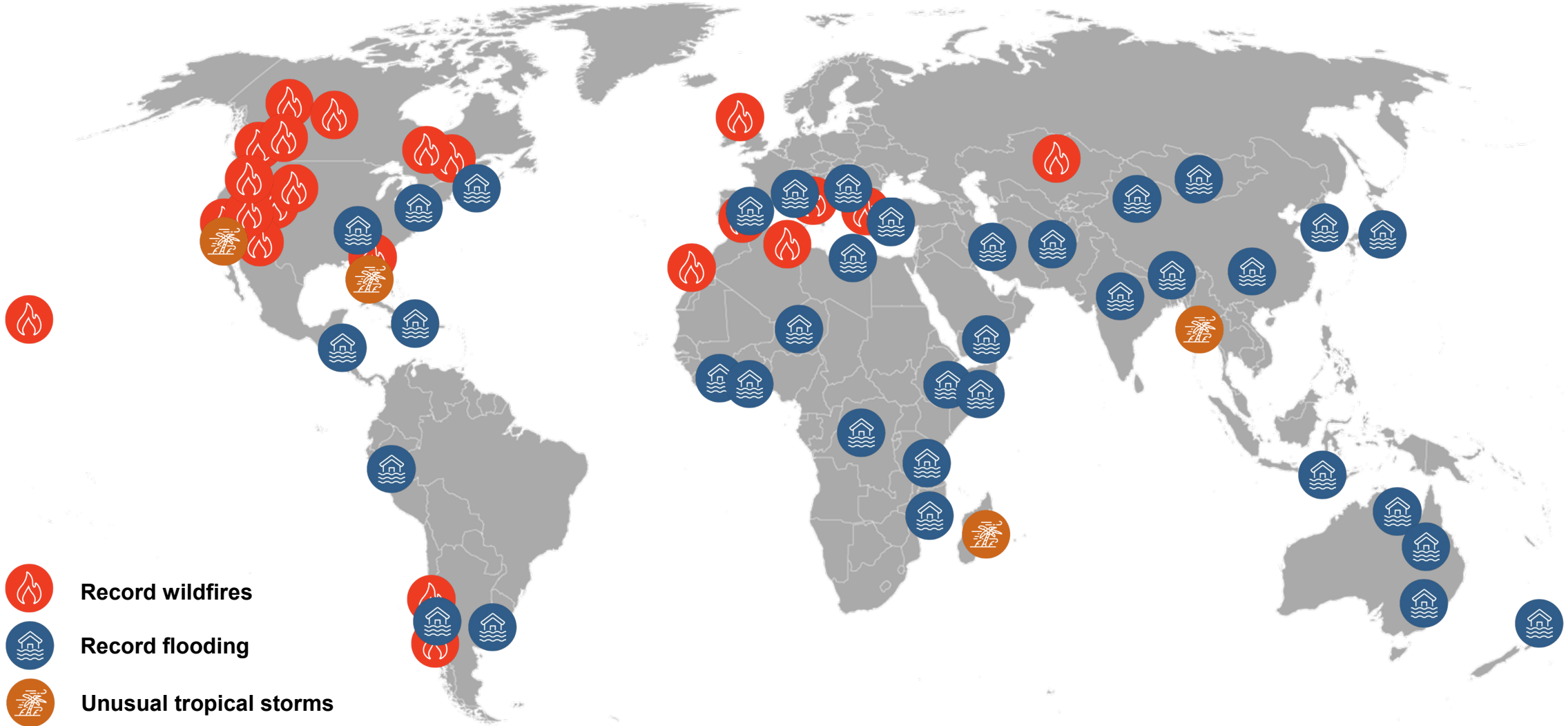
 **FRANCE 24**

Civil aviation to aim for net-zero carbon emissions in air travel by 2050

BTN

Countries agree goal of achieving net zero for aviation by 2050

... 2023 has been a stark reminder of our purpose.



Welcome remarks

These events impact us too...

11:55	Dubai		
12:15	Plymouth via: Newquay	2653	Cancelled
12:55	Salzburg	Y892	Cancelled
12:55	Faro	Y860	Cancelled
13:15	Malaga	2905	Cancelled
13:20	Manchester	Y897	Cancelled
13:35	Sofia	2691	Cancelled
13:45	Innsbruck	2607	Cancelled
13:45	Naples	S847	Cancelled

Welcome remarks

Hard to abate, but...

Sector used to
tackling big
challenges on a
global level

Hard to abate, but...

Industry aware of
its obligations:



Sector used to
tackling big
challenges on a
global level

Hard to abate, but...

Global, unifying
organization:



| ICAO

Industry aware of
its obligations:



Sector used to
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Hard to abate, but...



Global, unifying
organization:

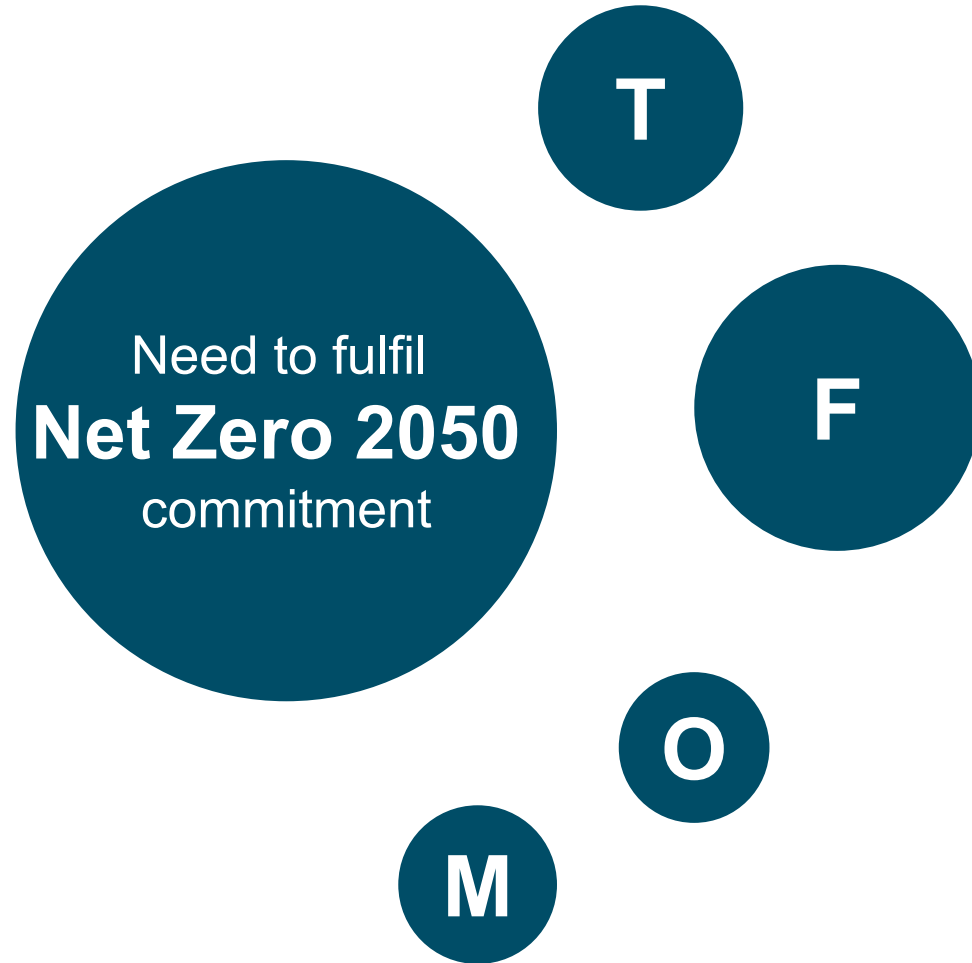


Industry aware of
its obligations:

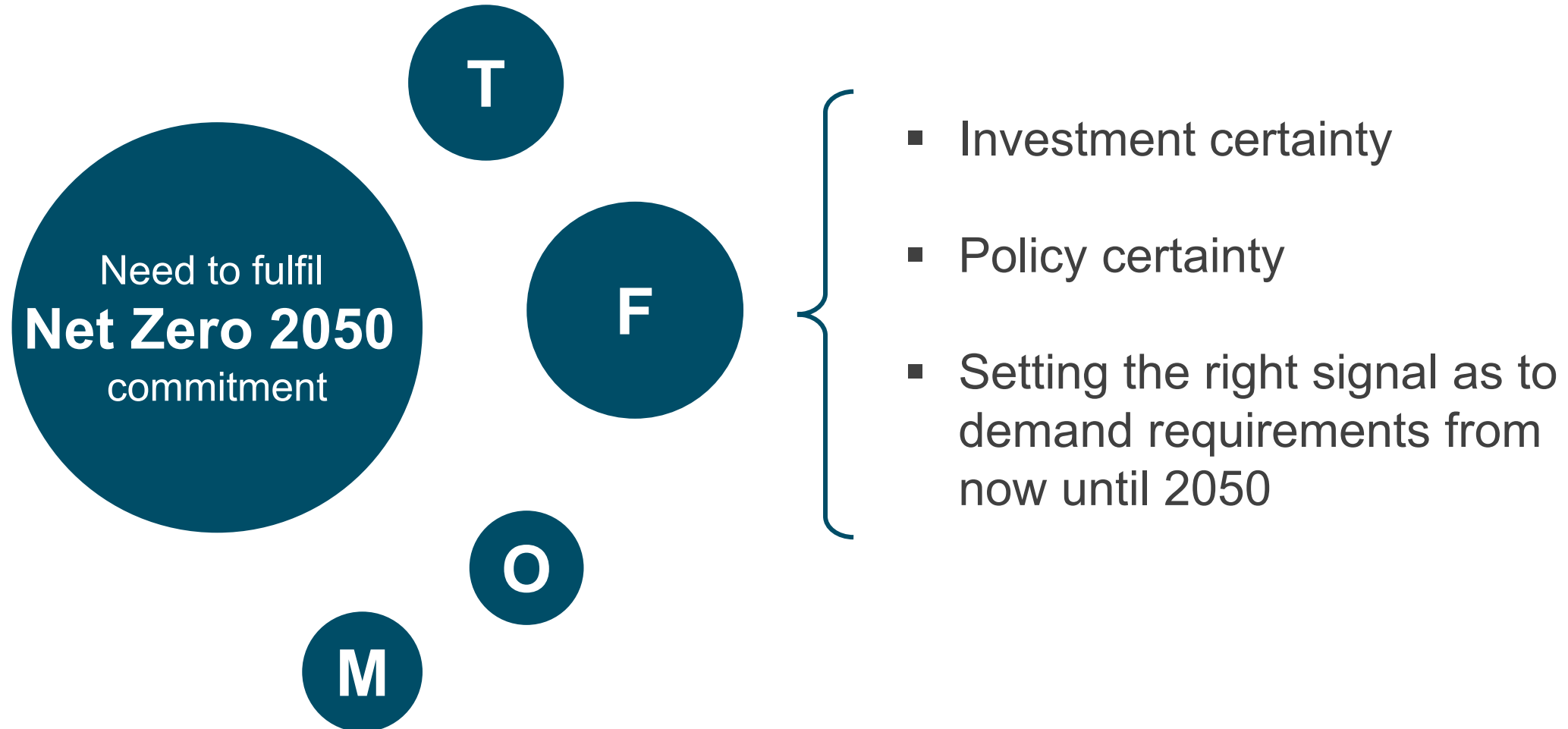


Sector used to
tackling big
challenges on a
global level

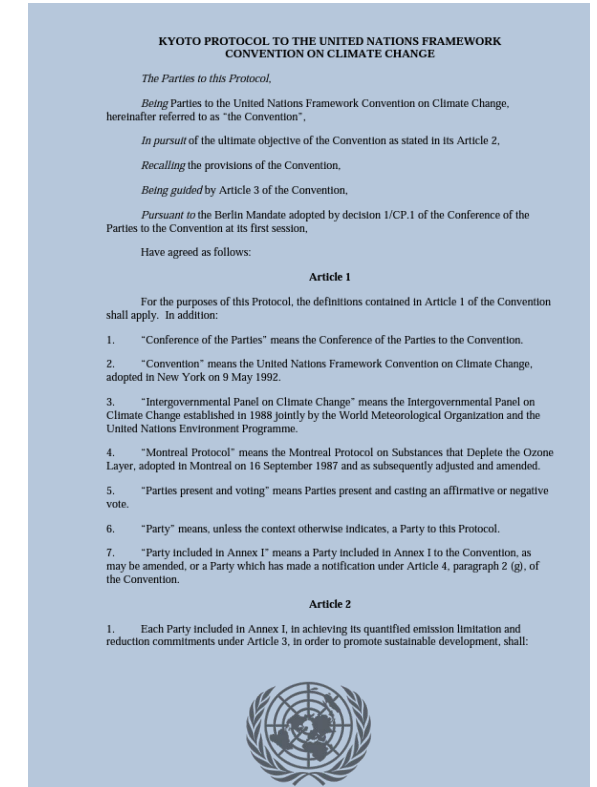
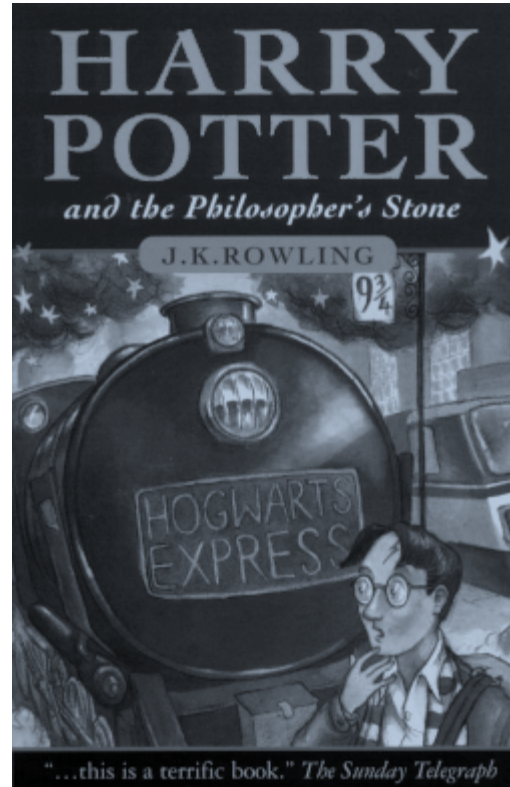
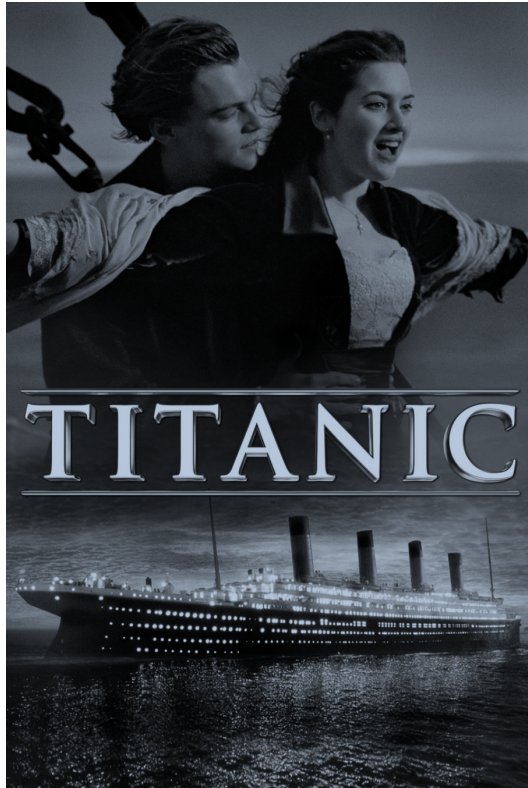
Hard to abate, but...



What is the benefit of a good outcome at CAAF/3?



2050 is not so far away... 26 years back...



Outcomes at CAAF/3

~80% reduction
in the carbon intensity of the fuel used
in 2050 through the use of SAF

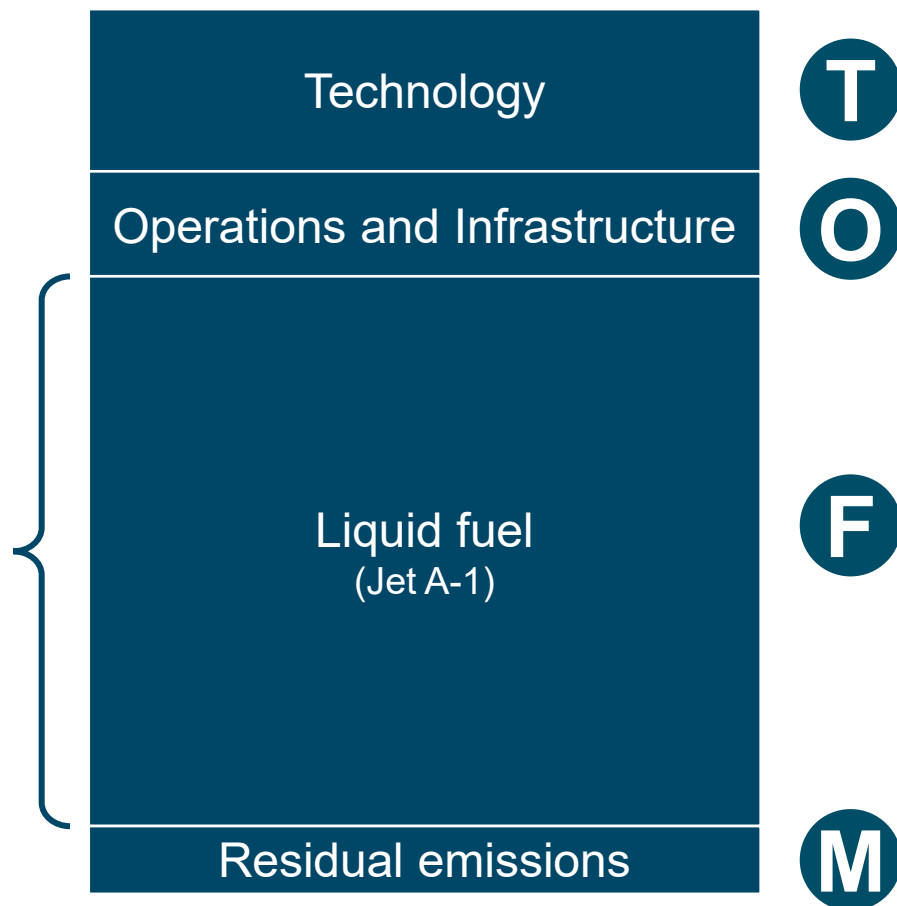
Global framework

- Capacity building
- Financing
- Enabling mechanisms

ICAO
Vision

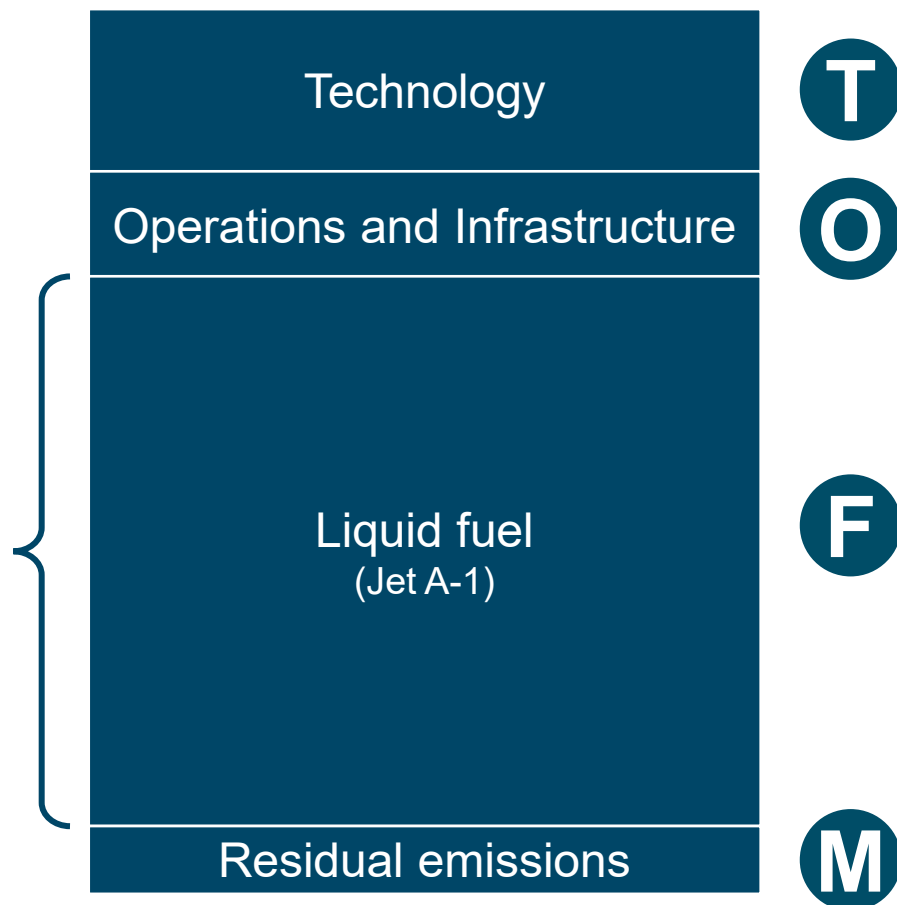
How SAF fits in to the overall decarbonisation roadmap

~80% reduction
in the carbon intensity of the fuel used
in 2050 through the use of SAF



How SAF fits in to the overall decarbonisation roadmap

380Mt – 490Mt+
of SAF per year in 2050 (depending
on the lifecycle carbon and other
demand factors)





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Session One

State of SAF

Robert Boyd

Chair of the ATAG CAAF/3 industry working group

What data can inform future SAF expectations?

Demand intentions

- Airlines have signed numerous off-take agreements or made SAF use commitments

Supply side announcements

- More than 100 SAF compatible projects have been announced so far

Government policy or regulation

- Around 65% of the world by jet fuel uplift has a SAF policy in place or being considered.

Roadmaps / studies and other initiatives

- A lot of information projecting theoretical SAF potential
- Several initiatives aimed to enable SAF

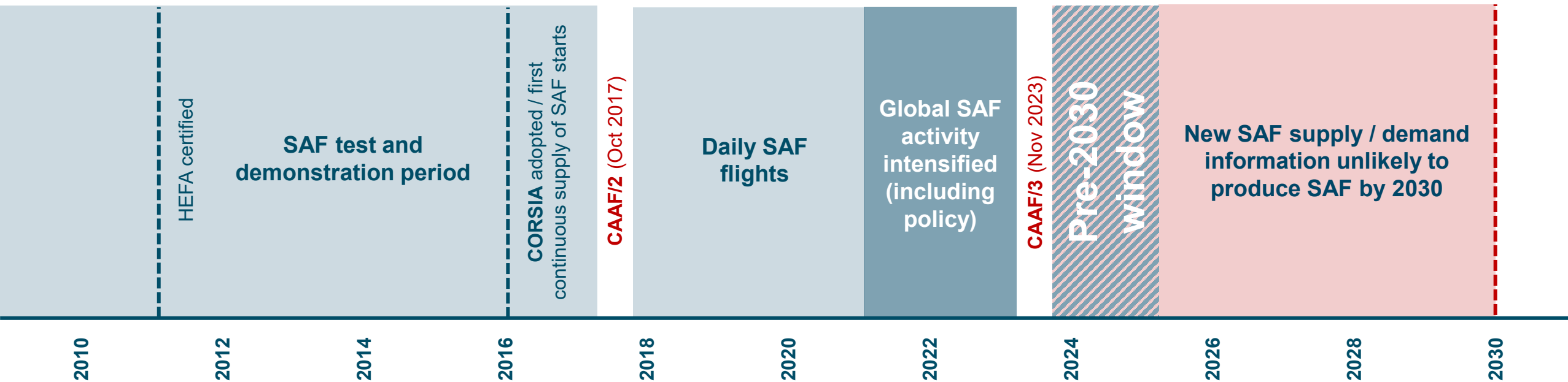
**This helps inform a direction for SAF development, independent of the CAAF/3
Reliability weighting – this is a judgement call**

Phases of SAF momentum

- 2021: Industry – net zero 2050
- 2022: States – net zero 2050 at ICAO A/41

12 offtakes at the time of CAAF/2, worth ~\$6bn

80 out of 107 offtakes announced ↑ \$39bn



Some airlines are making longer-term SAF commitments: 10% by 2030



RYANAIR
12.5% commitment

SAS
25% "in the 2030s"
norwegian
28% commitment

DHL
30% commitment

ups 30%
commitment

FedEx
30% commitment

40+
airlines

35%
Global
passengers

39%
Global
RTKs

Demand intentions:

Significant growth in offtakes since CAAF/2

- Aegean Airlines
- Air Canada
- Air France
- Air Greenland
- Air Transat
- Alaska Airlines
- All Nippon Airways
- Amazon Air
- **American Airlines**
- Asiana
- Austrian Airlines
- British Airways
- Cathay Pacific
- Cebu Pacific
- **Delta**
- DHL Express
- EasyJet
- FedEx
- Finnair
- Hawaiian Airlines
- IAG
- IAG Cargo
- Iberia Airlines
- Icelandair
- ITA Airways
- Japan Airlines
- **JetBlue**
- **KLM**
- Korean Air
- LOT Polish Airlines
- **Lufthansa Group**
- Netjets
- Qantas
- Qatar Airways
- **Ryanair**
- SAS
- Scoot
- Singapore Airlines
- Southwest Airlines
- Sunclass Airlines
- **United Airlines**
- Verijet
- Virgin Atlantic
- VistaJet
- Wizz Air

Some airlines with several offtakes (portfolio approach)

7 airlines with 4 or more offtakes

Weighted average offtake term: ~10 years

Predominantly voluntary SAF procurement

45 airlines with offtake agreements for SAF totalling over **37 Mt / (\$45bn)** so far...

Supply-side announcements

CAEP Fuels Task Group:
Short term SAF projection model

- 108 distinct facilities inform the FTG SAF production projection model
- 36 considered too uncertain to contribute to results
- Uses a scenario based approach, Probability assigned based on the type of company, the maturity of the production plans, product slate assumptions, and assumptions regarding the success rate of announced production plans
- The model is sensitive to different levels of policy support for SAF
- The data base was frozen as at 31 January 2023

ICAO forecast for production:

- **16.9 Mt in 2030 (high+)**

NB: this analysis was based only on announced capacity in Jan 2023.

Total facilities required (using ICAO rule of thumb assumptions)

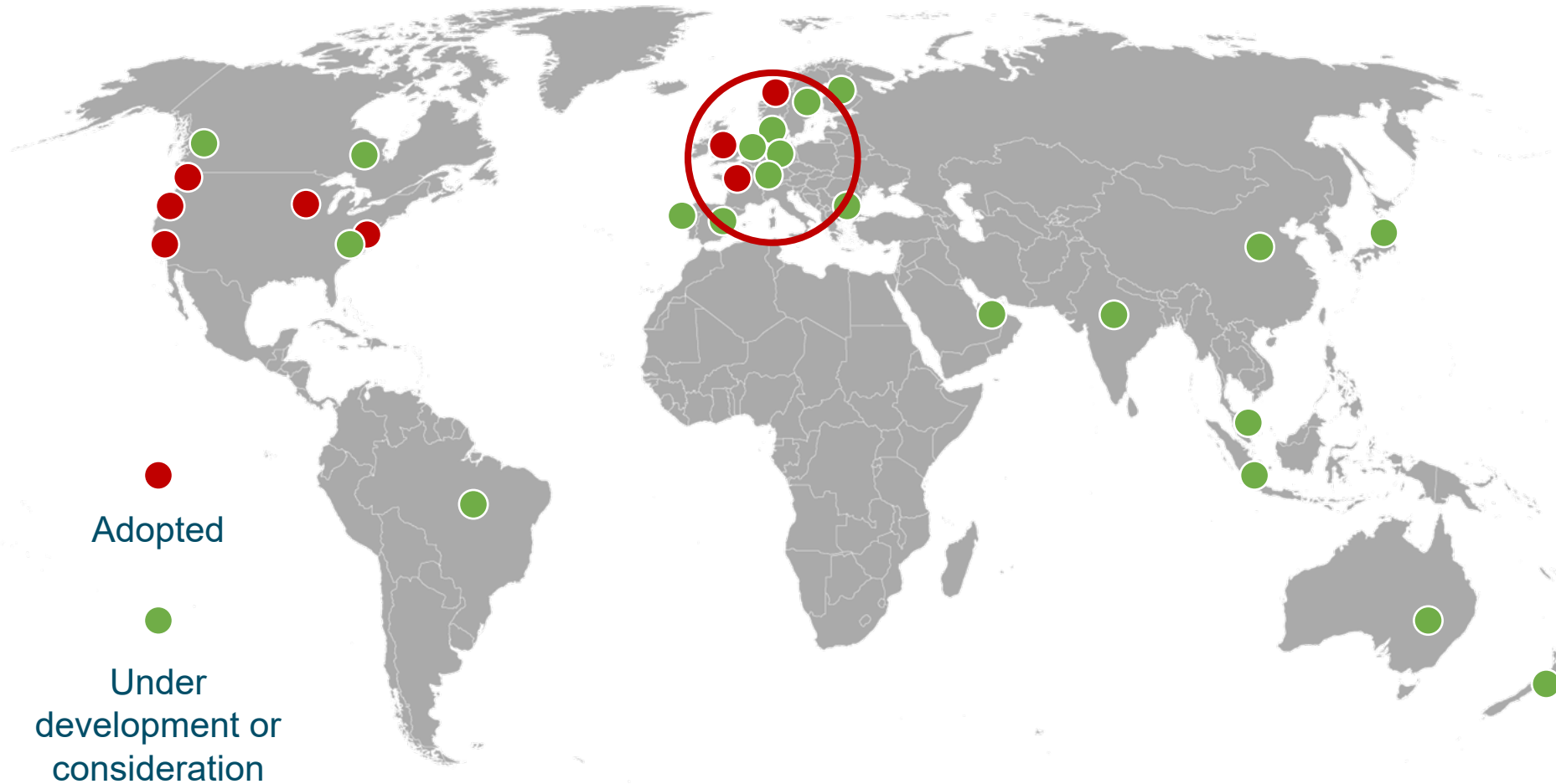
- **23 @ ~800,000 tonnes output per annum by 2030**

Cost:
~\$14 bn capital for plant construction
(\$196m / month)

Product slate assumption:

- HEFA: 84%
- AtJ: 7%
- FT: 7%
- PtL: 2%

Government policy to add demand: **global picture**



Around 40 countries covering about 65% of global jet fuel use are implementing or considering SAF policy options.

From those with detailed policy measures, around **20Mt of SAF** would likely be required in 2030.

Other initiatives, studies and roadmaps

By individual passengers

(as part of a ticket or separately through the booking process)



By corporate customers

(large purchasers of tickets or air services)



Separate to airline

(direct purchase of SAF into the system)



Global roadmaps

(Global roadmaps that provide SAF guidance)



Approved technical pathways

	Process / pathway	Feedstock	Blending limit
1	FT-SPK	Biomass (e.g. trash/rubbish, forestry residues, grasses)	up to 50%
2	HEFA-SPK	Oil-bearing biomass (e.g. UCO, algae, jatropha, camelina)	up to 50%
3	HFS-SIP	Sugars to hydrocarbon (e.g. molasses, sugar beet, corn dextrose)	up to 10%
4	FT-SPK / A	Same feedstock as Annex A1, but slightly different process	up to 50%
5	ATJ-SPK	Agricultural waste (e.g. forestry slash, crop straws)	up to 50%
6	CH-HK	Plant and animal fats, oils and greases (FOGs)	up to 50%
7	HC-HEFA-SPK	Bio-derived hydrocarbons, fatty acid esters	up to 10%
8	ITJ	Industrial Sugars	up to 50%

	Co-processing	Feedstock	Blending limit
9	FOG-CP	Waste fats, oils, greases (FOGs) from vegetable and animal sources	up to 5% (could inc. to 30%)
10	FT-CP	Fischer-Tropsch biocrude	up to 5% (could inc. to 30%)
11	CP-HB	Co-processing of hydroprocessed biomass	up to 5% (could inc. to 30%)

Technical pathways in the process of ASTM approval

	Process / pathway	Feedstock	Blending limit	Timeline
11	SAK	synthesized aromatic kerosene (Virent)	tbc	2-5 years
12	IH2	Integrated hydropyrolysis and hydroconversion (Shell)	tbc	2-5 years
13	ATJ-BI	ATJ derivative biochemical production of isobutene (Global Bioenergies)	tbc	2-5 years
14	ATJ-MA	ATJ derivative starting with the mixed alcohols (Swedish Biofuels)	tbc	2-5 years
15	DILSAAF	Single reactor HEFA (Indian CSIR-IIP)	tbc	2-5 years
16	ReOIL	Pyrolysis of non-recyclable plastics (OMV)	tbc	2-5 years
17	MtJ	Methanol to Jet (Honeywell, Topsoe and Nacero)	tbc	2-5 years
18	CP-UT	Co-processing of pyrolysis oil from used tires	up to 5%	2-5 years
19	CP-HB	Co-processing of hydroprocessed biomass	up to 5%	2-5 years

Leading manufacturers have committed that commercial aircraft will be capable to fly on 100% SAF by 2030



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Session One

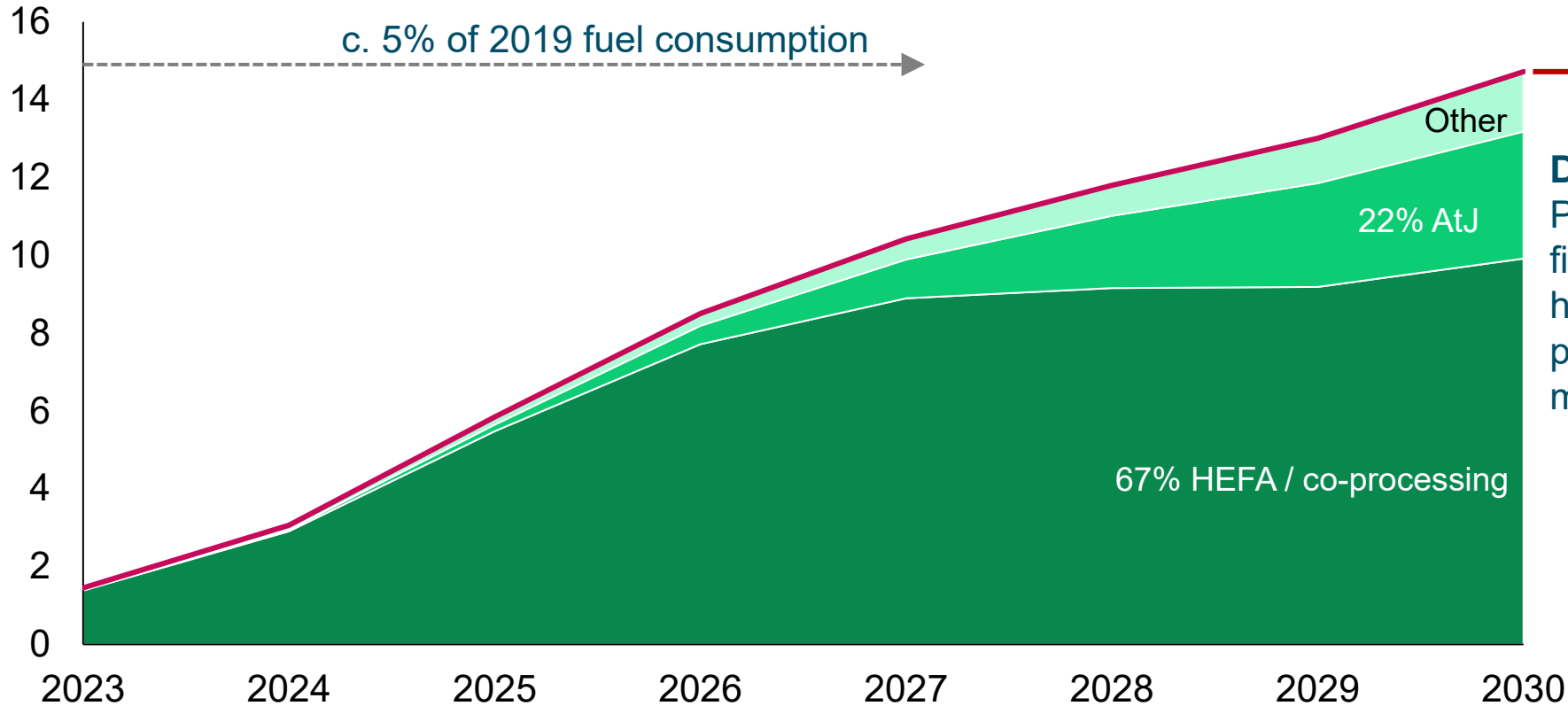
State of SAF

Alastair Blanshard

Director Sustainable Aviation, ICF

ICF analysis of current supply intentions suggests 12-20Mt by 2030

Million tonnes neat SAF



Upside:

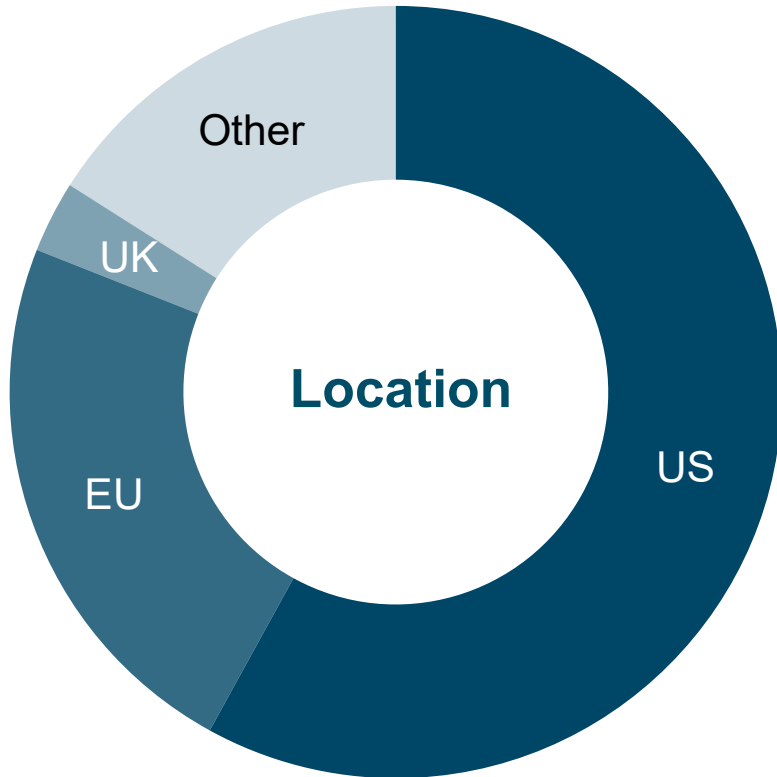
Additional policies and project starts



Downside:

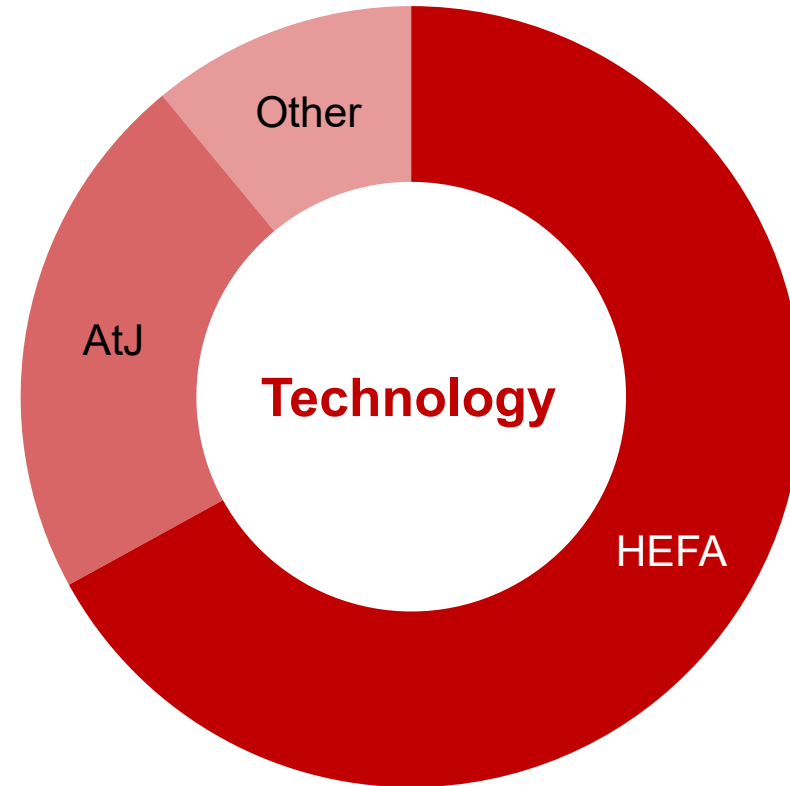
Projects slow to raise finance, find a market, or hit technical challenges – policy decisions can help mitigate these challenges

2030 snapshot: locations and technology



Location: Led by regions with:

- Supportive policy
- Existing road biofuel use

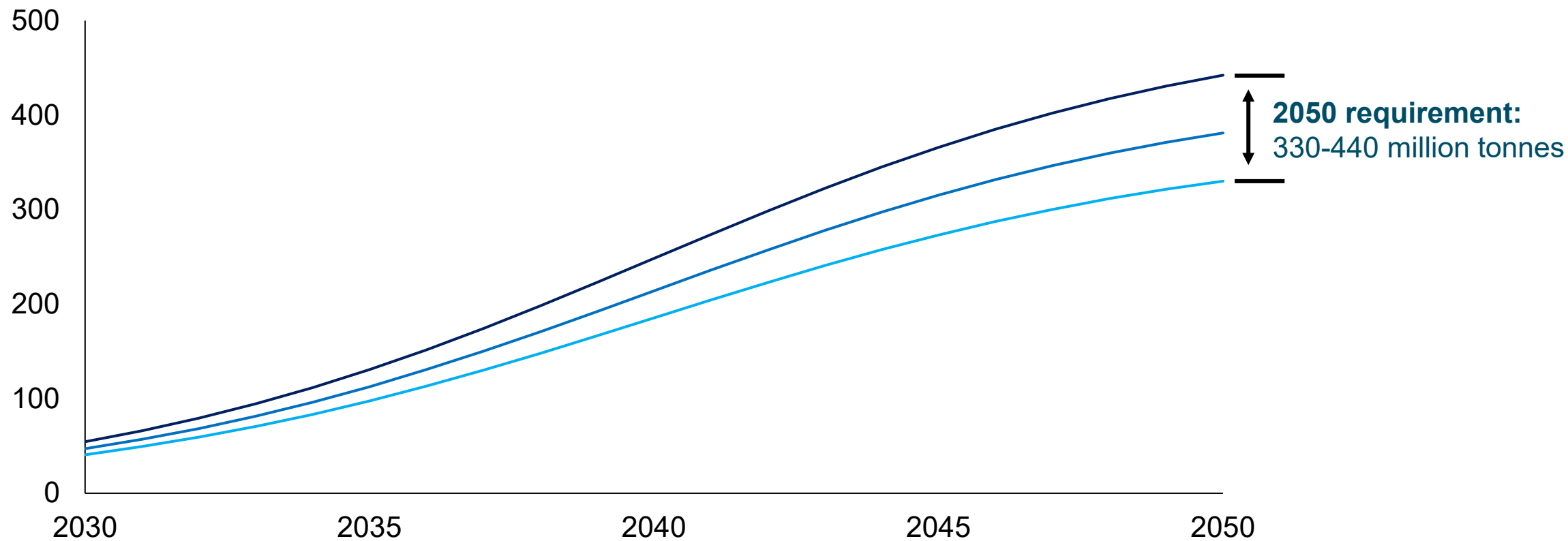


Technology:

- Significant HEFA volumes
- Followed by Alcohol to Jet (corn/sugarcane)
- All others just 10%

Long term outlook: Building on the 2030 foundation for rapid growth

Million tonnes neat SAF



Aviation energy transition will create global opportunities

Building:

**Thousands of
production
facilities**

Improving energy security and
resilience

Creating opportunities in all countries
– 90% of current oil production is in
22 countries

**Assumes small-scale production
close to feedstocks and airports –
likely opportunities for some
consolidation**

Investment of:

\$1.0-1.45 trillion

~6% of annual fossil and gas
investment

Aviation currently uses ~7% of liquid
fuels

However, aviation will be a sector
more important to the energy industry
in the future as other transport shifts
to electric.

And will create:

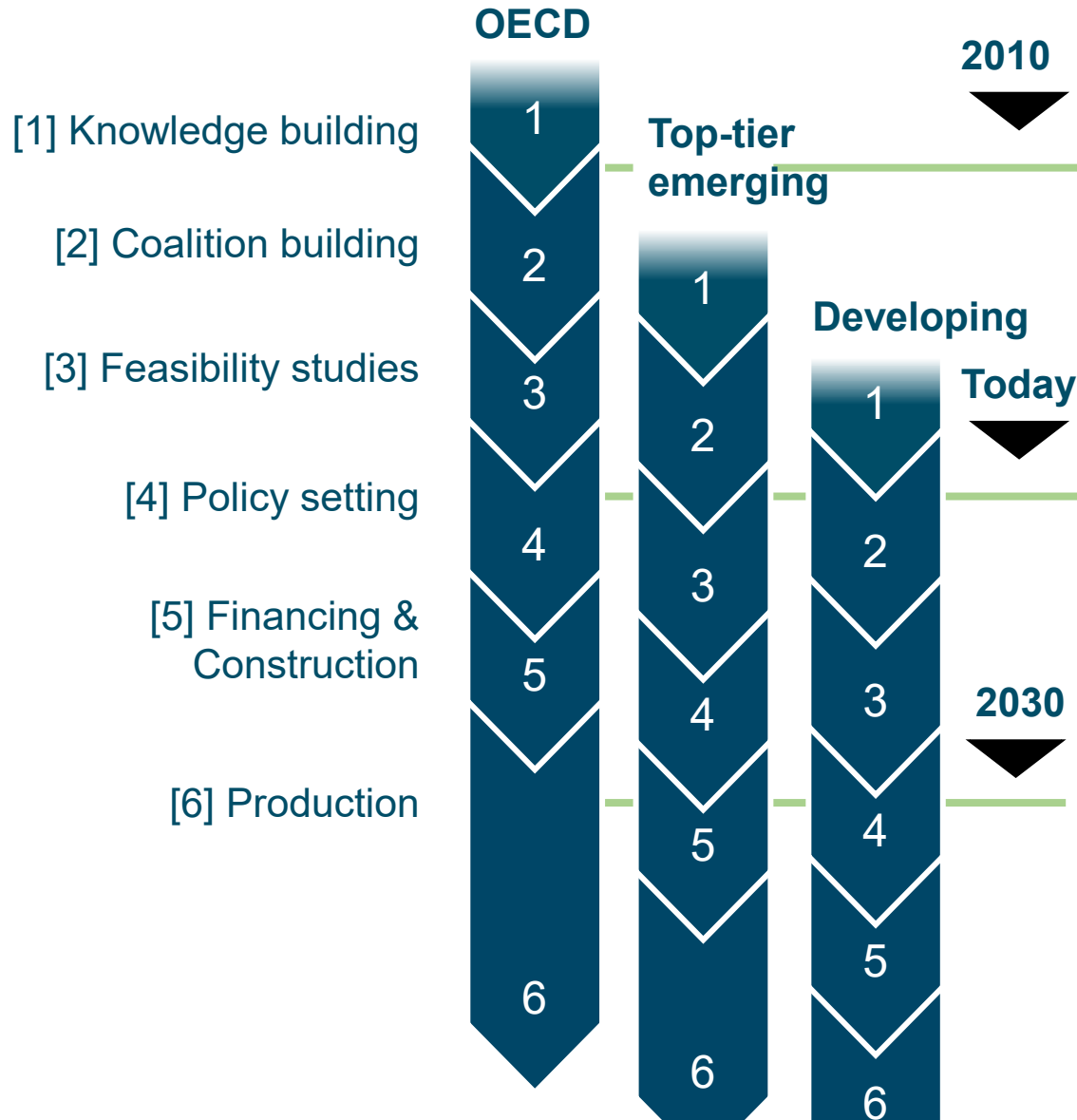
**Up to 14 million
jobs**

With 90% across the supply chain

Supporting collection of feedstock
and construction of facilities

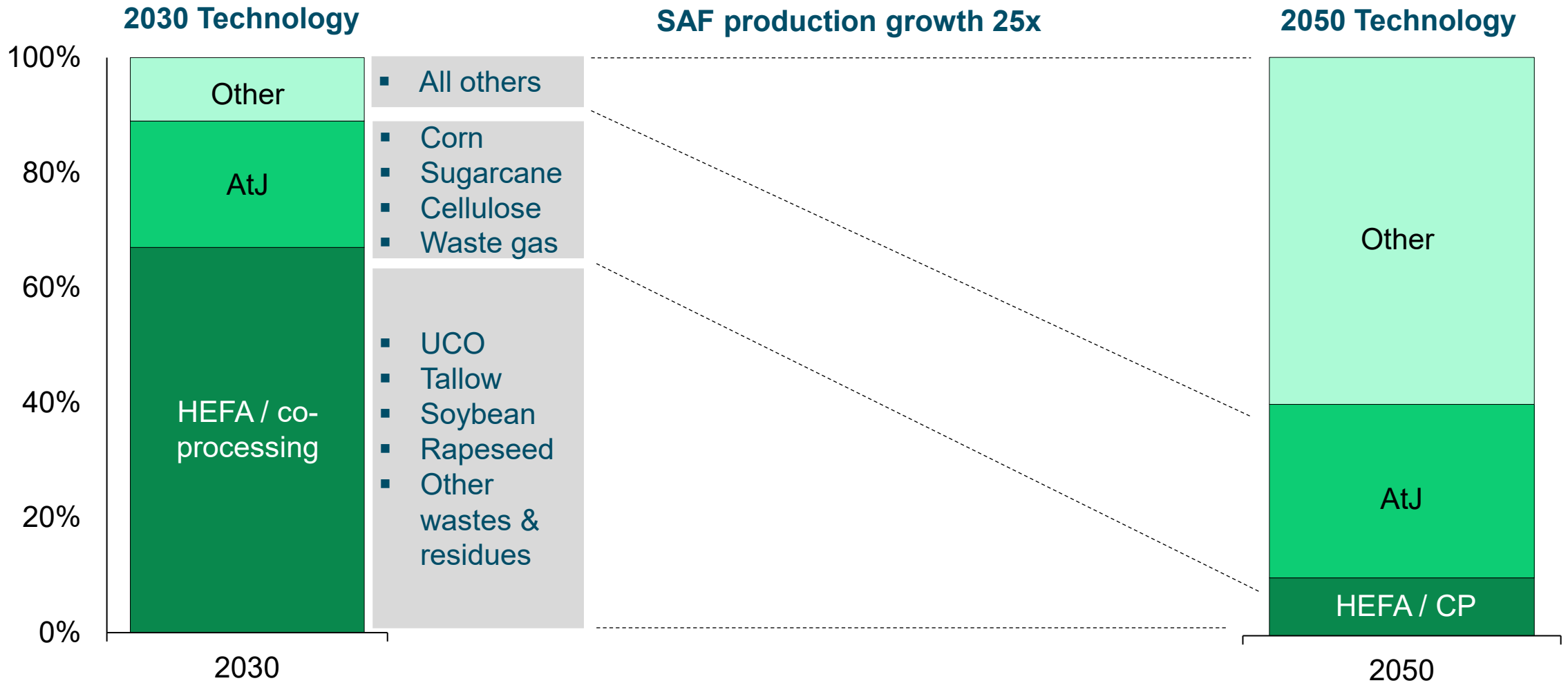
Helping to support a just transition
from fossil fuel jobs to clean energy

Long term outlook: Cascade through industry stages



- Longer-term there will also be a need to push for policy responses in countries outside the traditional OECD members
- Organisations such as WEF will be undertaking outreach in the 'big' emerging economies (China, India, Brazil), but we need movement in every country

Long term outlook drivers: technology



Summary: **time to act**

The foundation is being built:

- Supportive regulation
- Pathways certified
- Technologies going through de-risking

Production will rapidly accelerate over coming years.

However, there is still a gap between ambitions, targets, and supply.

Consistent, widespread policy must be developed and refined to close the gap: CAAF/3 can help enable this.



Panel Three

Exploring the implementation building blocks

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Graham Webb

Chief Sustainability Officer, Pratt & Whitney

Sean Newsum

Managing Director Environmental Affairs, A4A

Daniel Chereau

Fuel Team Lead, IATA

Why is SAF policy necessary?

Reduce cost

Increase supply

Close cost gap with conventional kerosene and reduce the cost of SAF production

Stimulate long-term, enduring supply and demand for cost-effective, sustainable SAF feedstocks and production infrastructure

Reduce investment risk

Provide investors with signals needed to trigger financing of SAF production infrastructure needed to meet growing demand

Reduce resource competition

Ensure sustainable growth by reducing competition for resources with other sectors (e.g., road transport, renewable power)

**Avert
market
failure**

ICAO building global SAF aspirations

2016

CORSIA

Structured to ensure emissions reductions achieved through use of SAF is accounted for

2022

Long-term Aspirational Goal

Collective goal of net-zero carbon emissions by 2050 backed by analysis that confirmed SAF must play critical role

Ongoing

ACT-SAF

Assistance, Capacity-building and Training for SAF

Supports development and deployment of SAF, including establishment of partnerships among States and key stakeholders

2023

CAAF/3

Opportunity for a global goal for SAF deployment

Will provide significant market signal

Will catalyze policy development in countries all over the world



Q&A



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Panel Two

Financing our SAF pathway



Cost of the transition: getting to net-zero

Item	Total 2020-2050	Annual average		Comparison
Cost to aircraft operators	\$5.3 trillion	\$170bn	Mainly incremental costs of SAF	Airlines have spent \$4.3 trillion on fuel in the last 30 years
SAF investment	\$1.45 trillion	\$48bn	Capital expenditure on SAF production facilities	Oil and gas company capex was \$499 billion in 2022
Manufacturer R&D investment	\$180-350 billion	\$6-11bn	Research and development of novel aircraft (hydrogen and electric, etc)	Current average efficiency-related R&D is around \$15 billion a year



LTAG report
\$3.2 trillion
for fuel suppliers



Net zero roadmaps
\$5.3 trillion



Aviation roadmap
\$175 billion/year

Outreach to the finance community

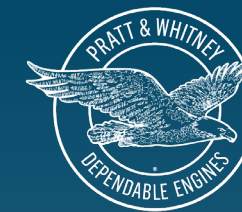
- ATAG has started reaching out to the finance sector this year



- In addition, a number of other initiatives will do the same thing in coming years.
- Finance community is highly interested in SAF, needing some core reassurances before making it part of their investment strategy.



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Panel Two

Financing our SAF pathway

Marc-André Blanchard

Executive Vice-President and Public Affairs, CDPQ

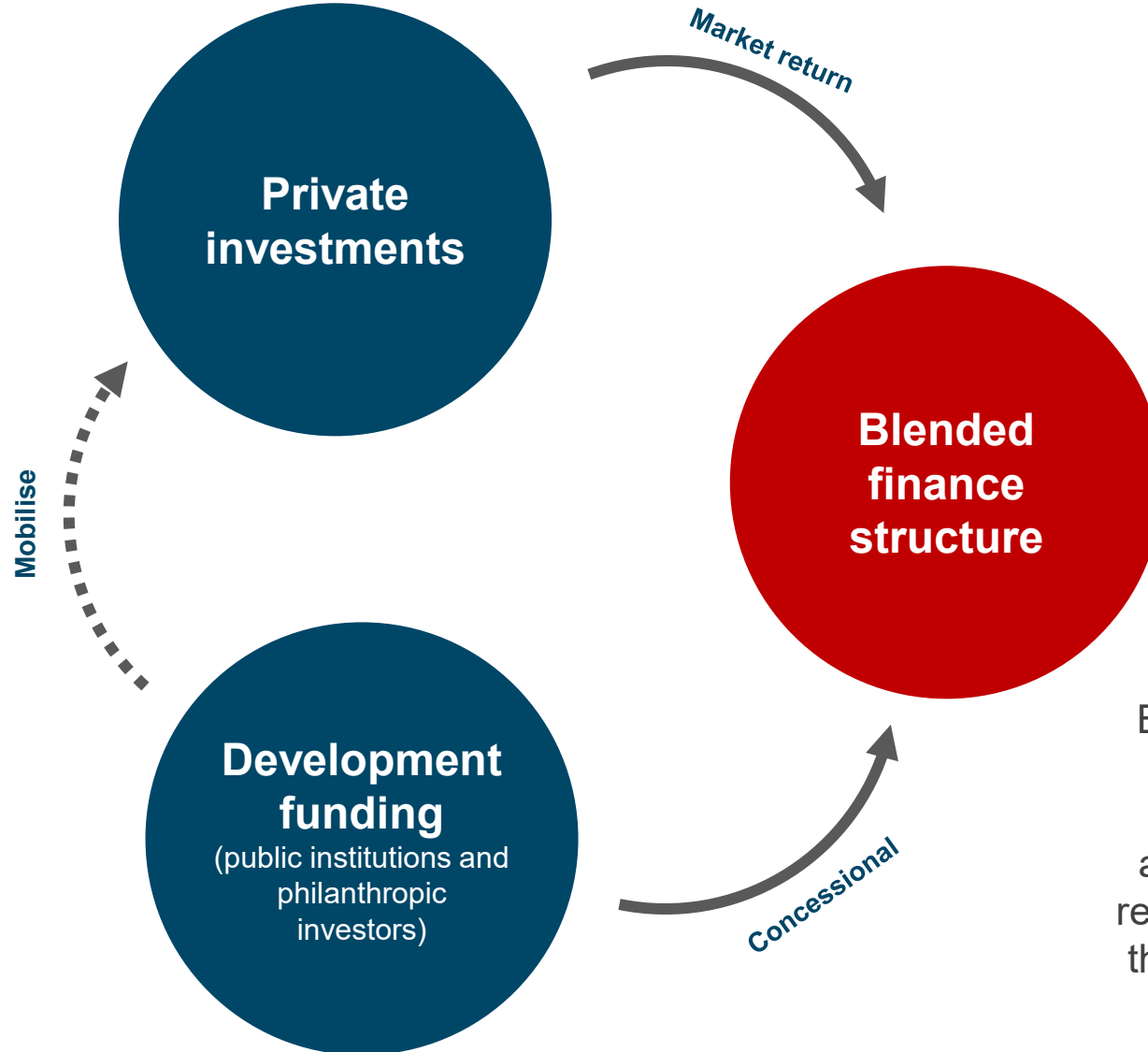
Jimmy Samartzis

CEO, LanzaJet

Nancy Young

Chief Sustainability Officer, Gevo

The mechanism: blended finance



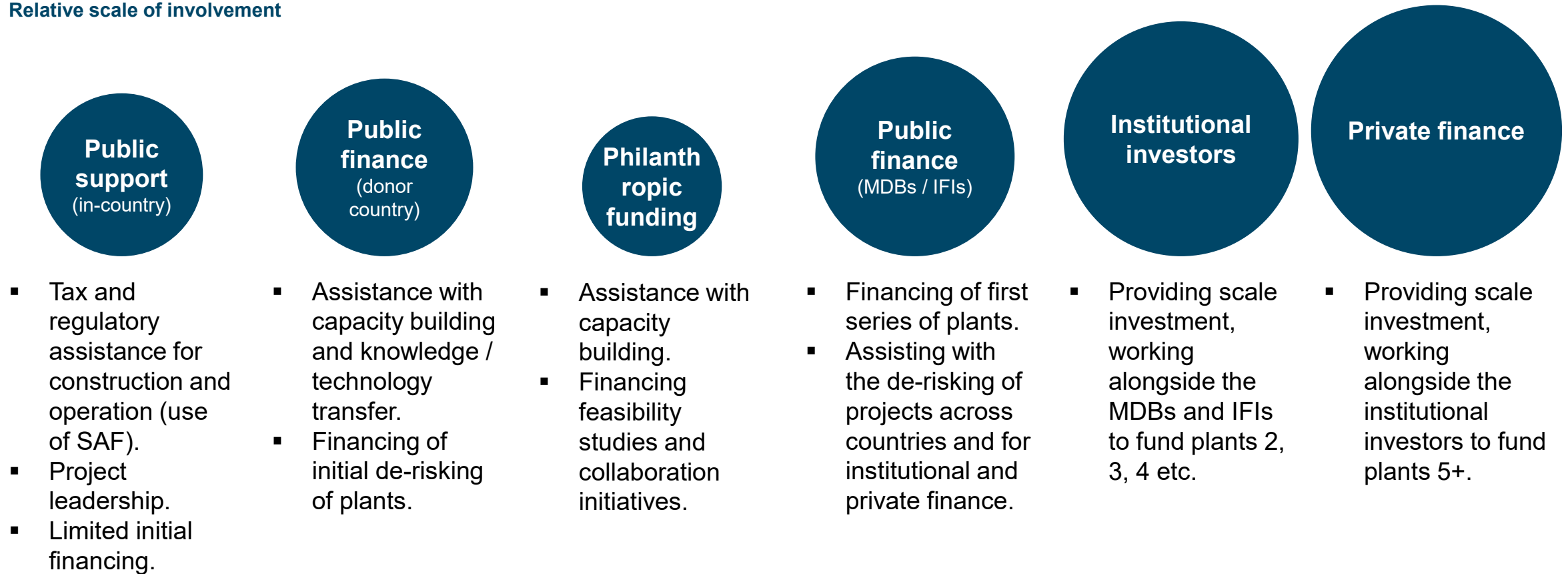
Public and private institutions should all play a critical role for the blended finance ecosystem to function efficiently and in proper synergy.

Private investors (e.g. private equity and venture capital firms, institutional investors, commercial investors) have the capacity to participate in blended finance transactions as arrangers and distributors, with the ability to provide commercial capital and leverage expertise from various divisions as well as global networks.

By offering catalytic capital (such as concessional capital), public institutions (MDBs, DFIs, etc.) can accept higher risk and concessional returns to enable private investments that otherwise would not be possible and help bridging financing gaps.

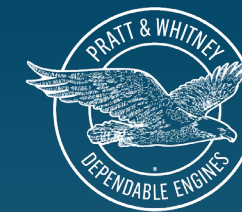
The role of blended finance

Relative scale of involvement





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Panel Two

Financing our SAF pathway

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Executive Vice-President and Public Affairs, CDPQ

Jimmy Samartzis

CEO, LanzaJet

Nancy Young

Chief Sustainability Officer, Gevo



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Refreshment break



Speed panel

Preferred outcomes of CAAF/3 and ICAO's role in SAF

Michael Rossell

Deputy Director General, ACI World

Kurt Edwards

Director General, IBAC

Marie Owens Thomsen

SVP Sustainability and Chief Economist, IATA

Marc Hamy

Vice President Corporate Affairs, Airbus

Brian Moran

VP Global Sustainability Policy and Partnerships,
Boeing



Why is CAAF/3 important to the sector's climate strategy?

What do you hope to for a **global framework** from CAAF/3?

What do you hope to for an **ICAO Vision** from CAAF/3?

What practical role do you see for ICAO in SAF deployment?



Speed panel

Preferred outcomes of CAAF/3 and ICAO's role in SAF

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VP Global Sustainability Policy and Partnerships,
Boeing



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Dialogue

Exchanges with State Representatives

Michelle Bishop

CANSO

Interventions from ICAO Council
Members and States



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Closing

Closing remarks

Michael Gill

Director, Legal Affairs and External Relations, ICAO



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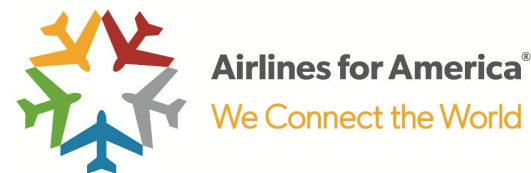
Closing
Wrap-up

Haldane Dodd
ATAG





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Informal reception at Humaniti Hotel until 19:00