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# Opening



*ICAO Environmental Regional Seminars*

*13 April – 8 May 2023*



- **Raise awareness on the outcomes of the 41st ICAO Assembly**
- **Focus on the implementation of the LTAG, including recent developments on the ACT-SAF programme, financing cleaner energy, implementation challenges and policies, role of State Action Plans and other means for monitoring the LTAG progress**
- **Exchange States' initial views on the expectations for the Third Conference on Aviation Alternative Fuels (CAAF/3)**



Dates	ICAO Regions	Venue
13 and 14 April 2023	European and North Atlantic (EUR/NAT)	Rotterdam, Netherlands
18 and 19 April 2023	Eastern and Southern African (ESAF); Western and Central African (WACAF)	Nairobi, Kenya
24 and 25 April 2023	North American, Central American and Caribbean (NACC); South American (SAM)	Santo Domingo, Dominican Republic
3 and 4 May 2023	Asia and Pacific (APAC)	Bangkok, Thailand
7 and 8 May 2023	Middle East (MID)	Cairo, Egypt



## Day 1

### Setting the Scene (Day 1 AM)

**Overview on the 41st Assembly results, including the long-term global aspirational goal (LTAG) agreement, and the importance of cleaner energy**

**Secretariat presentation, to be followed by clarification Q&A:**

- Milestones toward A41 and its outcomes (e.g. LTAG Report, GLADs, HLM-LTAG, A41-21)
- How fuels contribute to the LTAG
- Opportunities for States to benefit along supply chain and associated challenges
- Activities toward CAAF/3



## Day 1

### Session 1 (Day 1 AM/PM)

#### Supporting policies to promote the development and deployment of cleaner energy for aviation – Opportunities and challenges

#### Secretariat presentation, to be followed by clarification Q&A:

- Potential policies and coordinated approaches
- ICAO State Action Plans initiative
- Estimates related to SAF costs, investment needs and production capacity of facilities
- ICAO Stocktaking and Tracker Tools
- Monitoring and reporting of cleaner energy

#### Dialogue Session 1



## Day 1

### Session 2 (Day 1 PM)

**Assistance, capacity-building and training for cleaner energy, including ICAO ACT-SAF programme**

**Secretariat presentation, to be followed by clarification Q&A:**

- Assembly request on means of implementation and updates on ACT-SAF (e.g. objectives and scope, status of State/Organization partners, ACT-SAF training series)
- Other activities including SAF feasibility studies
- Upcoming assistance and capacity-building activities

**Dialogue Session 2**



## Day 2

### Session 3 (Day 2 AM)

#### Financing cleaner energy

#### **Secretariat presentation, to be followed by clarification Q&A:**

- Assembly request on financing (e.g. consideration of ICAO climate finance initiative or funding mechanism under ICAO)
- ICAO outreach activities with financial institutions
- Next steps on financing and ACT-SAF

#### **Dialogue Session 3**



## Day 2

### Session 4 (Day 2 PM)

#### Exchange of views on the expectations for CAAF/3

#### Secretariat presentation, to be followed by clarification Q&A:

- Background on previous CAAF/1 and CAAF/2 meetings, and Recommendations and Declaration from CAAF/2 including 2050 ICAO Vision for Sustainable Aviation Fuels
- A41 decisions and process for CAAF/3

#### Dialogue Session 4



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# Setting the scene

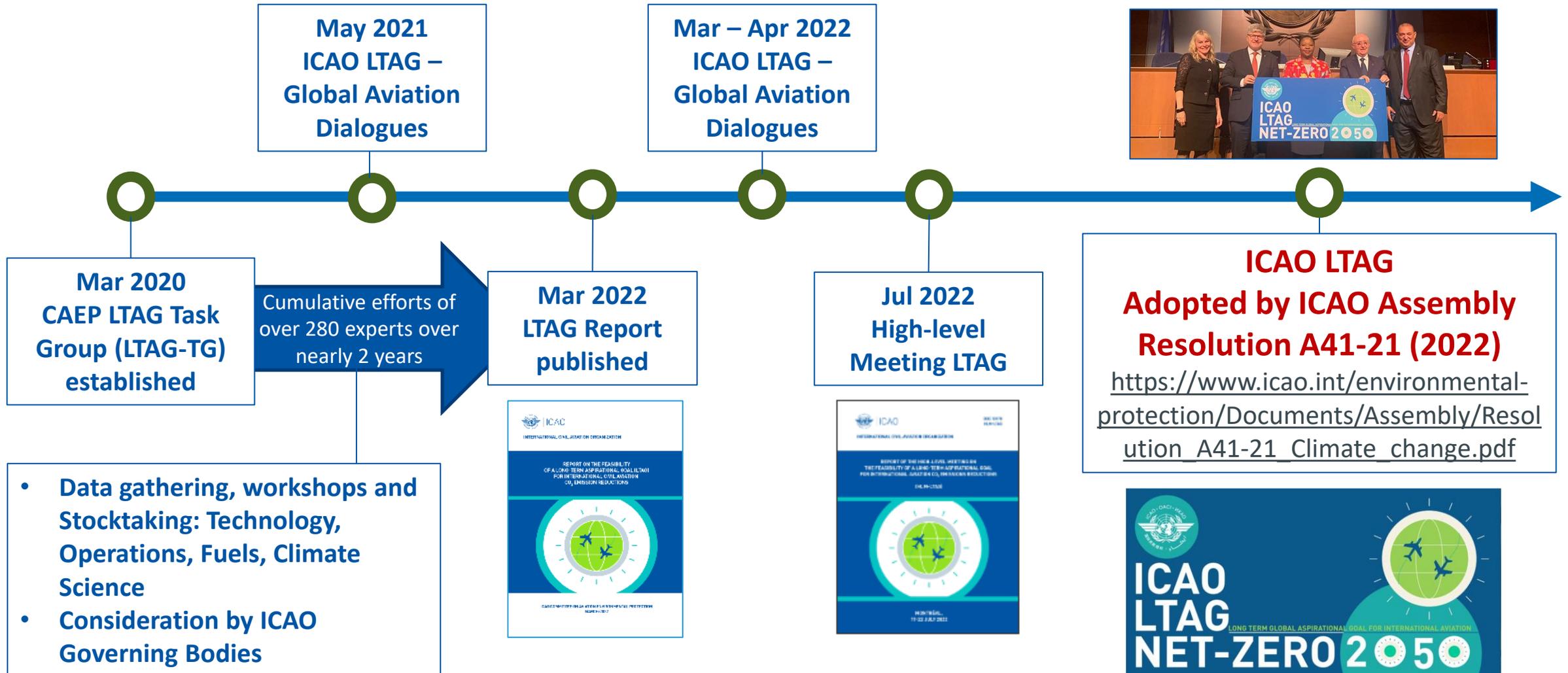


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- **Milestones towards A41 and its outcomes**
- **How fuels contribute to the LTAG**
- **Opportunities for States to benefit along supply chain and associated challenges**
- **Activities toward CAAF/3**
- **Q&A**





The Assembly agreed to a collective long-term global aspirational goal (LTAG) of **net-zero carbon emissions from international aviation by 2050** (Resolution A41-21 Para 7)

- In support of Paris Agreement's temperature goal (A41-21 Para 7)
- Collective global aspirational goal, and does not attribute specific obligations or commitments in the form of emissions reduction goals to individual States (A41-21 Para 8)





# Key outcomes from 41st Session of ICAO Assembly (Oct 2022)

- The Assembly recognized that **means of implementation** commensurate to the level of ambition, including financing, will promote the achievement of the LTAG. (Resolution A41-21 Para 17 & 18)
- The Assembly requested the Council to **regularly monitor progress** on the implementation of all elements of the basket of measures towards achievement of the LTAG...
- ... consider necessary methodologies for the **monitoring of progress**, and report to a future Session of the ICAO Assembly (Resolution A41-21 Para 9)





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# How fuels contribute to the LTAG



The ICAO Committee on Aviation Environmental Protection (CAEP) developed a robust analysis on feasibility of an LTAG



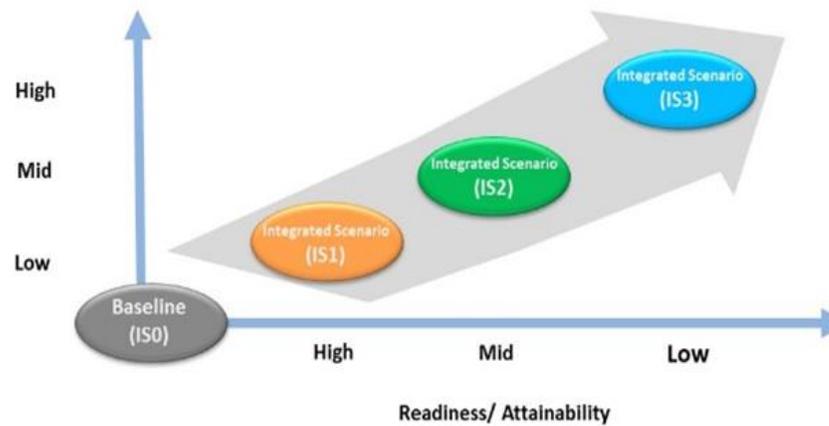
It developed integrated scenarios representing level of aspiration needed, with the degree of readiness and attainability



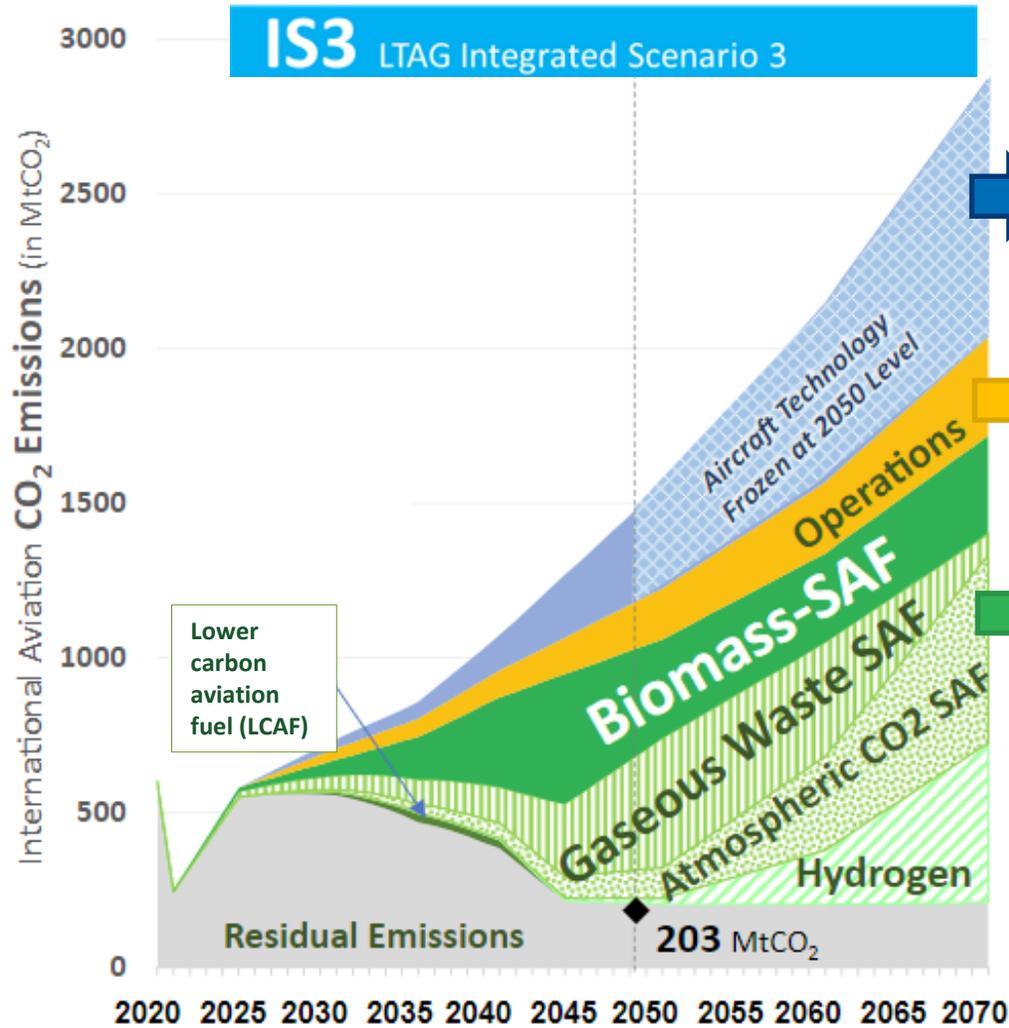
The LTAG Report, published in March 2022, underpinned the LTAG decision at Assembly in October 2022

ICAO WORK ON LONG-TERM ASPIRATIONAL GOAL <sup>1</sup>			
Operations	Technology	Fuel	
 Air operations   Ground operations	 Alternative energy sources  Airframe   Propulsion   Advanced Concepts	<b>Fuels</b>  Drop-in fuels?   Cryogenic fuels (Hydrogen and Methane)   Electricity	<b>Sources of energy</b>  Wind  Solar  Nuclear   Biomass  Solid & liquid wastes  Fossil resources  Industrial waste gases
<b>Transport &amp; Storage</b>			
Identify combined in-sector scenarios of technology, fuels, and operations, and evaluate:			
Timing                         Readiness                         Attainability                         CO <sub>2</sub> reduction			

Aspiration (Enabled by Policy/ Effort)



# LTAG Report – Contributions from technology, operations, and fuels

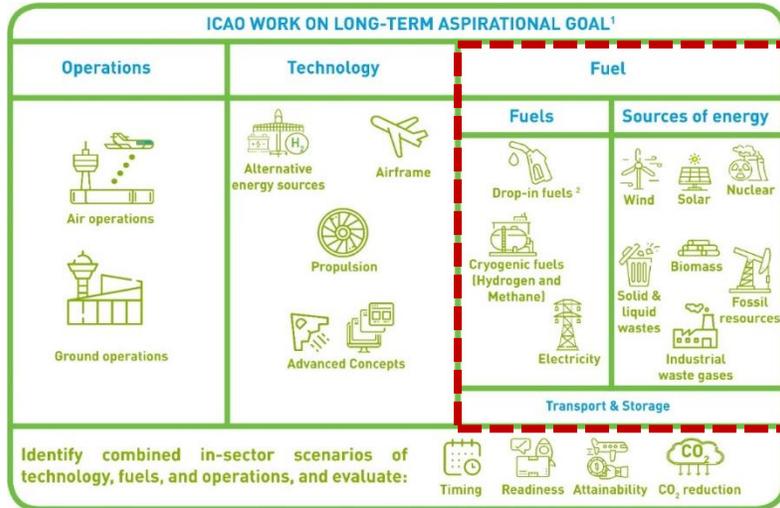


Advanced tube and wing, unconventional airframe/propulsion concept aircraft, non-drop-in fuels such as battery electric etc.

Improvements in the performance of flights across all phases

Sustainable aviation fuels (SAF) and other cleaner energy have the largest impact on residual CO<sub>2</sub> emissions, driving overall reductions by 2050

Contributions from hydrogen may increase in the 2050s and 2060s if technically feasible and commercially viable



Fuel Category	Fuel Name	Carbon sources in fuel feedstock
<b>1. LTAG Sustainable Aviation Fuels (LTAG-SAF)</b>	Biomass-based fuel	Primary biomass products and co-products
	Solid/liquid waste-based fuels	By-products, residues, and wastes
	Gaseous waste-based fuels	Waste CO/CO <sub>2</sub>
	Atmospheric CO <sub>2</sub> -based fuels	Atmospheric CO <sub>2</sub>
<b>2. LTAG Lower Carbon Aviation Fuels (LTAG-LCAF)</b>	Lower carbon petroleum fuels	Petroleum
<b>3. Non-drop-in fuels</b>	Cryogenic hydrogen (LH <sub>2</sub> )	Natural gas, by-products, non-carbon sources
	Liquefied gas aviation fuels (ASKT)	Petroleum gas, 'fat' natural gas, flare gas, and propane-butane gases
	Electricity	Not applicable

**Not part of LTAG fuels analyses – Electrification of aircraft, including hybrid + fully electric airframes considered under LTAG – Tech analysis. ASKT was analyzed as part of case study for applicability in remote areas with stranded hydrogen resources, excluded from subsequent analyses**

# LTAG Report - Financing costs and investments across stakeholders

## Projected cumulative (2020-2050) costs and investments associated with highest-ambition LTAG scenario, across each stakeholder group

Stakeholders	Costs/investments
States	\$160b
Air Navigation Service Providers	\$20b
Aircraft manufacturers	\$350b
<b>Fuel suppliers</b>	<b>\$3,200b</b>
Airports	\$125b

Breakdown of fuel suppliers	Costs/investments
SAF biomass-based fuels	\$950b
SAF from gaseous waste	\$1,700b
SAF from atmospheric CO <sub>2</sub>	\$460b
LCAF	\$60b
Hydrogen	\$55b

**Note: Some investments from upstream stakeholders are passed on downstream (e.g. operators) in the form of incremental price of products**

# Incremental costs – per flight, per seat

Flight Distance		Incremental Cost* per Flight	
Illustrative Origin & Destination		(Incremental Cost* per Seat**)	
		in 2030	in 2050
<b>Short</b> Haul Flight 630 km <i>(=10<sup>th</sup> percentile of int. aviation flights)</i> Zurich → Amsterdam Switzerland → Netherlands (LSZH) → (EHAM)	IS1	\$ 130 (\$0.8)	\$ 780 (\$4.4)
	IS2	\$ 520 (\$3.3)	\$ 1600 (\$9.2)
	IS3	\$ 660 (\$4.3)	\$ 2200 (\$13)
<b>Average</b> Haul Flight 2700 km <i>(average for international aviation)</i> Montreal → Denver Canada → U.S. (CYUL) → (KDEN)	IS1	\$ 650 (\$3)	\$ 3500 (\$15)
	IS2	\$ 2600 (\$12)	\$ 7200 (\$31)
	IS3	\$ 3300 (\$15)	\$ 10,000 (\$43)
<b>Long</b> Haul Flight 5800 km <i>(=90<sup>th</sup> percentile of int. aviation flights)</i> Singapore → Dubai Singapore → UAE (WSSS) → (OMDB)	IS1	\$ 1600 (\$5)	\$ 8000 (\$25)
	IS2	\$ 6600 (\$20)	\$ 17,000 (\$53)
	IS3	\$ 8300 (\$26)	\$ 23,000 (\$73)

\* Costs in \$ 2020 (adjusted for inflation).  
\*\* Seat equivalent including available seats for passenger, equivalent seats for freighters and 13 seats (default) for business jets.

**Under highest ambition scenario, incremental costs from Fuels may represent:**

- Additional \$3,300 in 2030
- Additional \$10,000 in 2050

(Average haul flight – 2,700km)

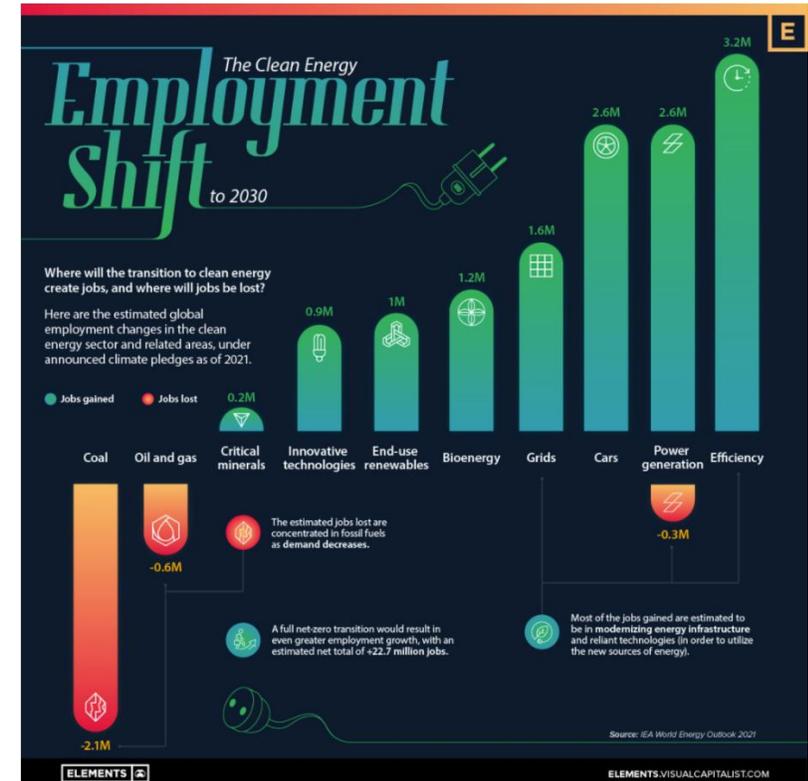
**This represents about \$15 - \$43 on a per seat basis**



# Opportunities for States to benefit along supply chain, and associated challenges



- **Significant employment shifts towards the green energy sector expected in the future**
  - IEA World Energy Outlook estimated global employment shifts (job loss in coal, oil and gas, gains in **end-use renewables**, bioenergy, efficiency)
  - Manufacturers committed to delivering commercial aircraft certified to operate on **100% SAF by 2030** to realize maximum potential of drop-in fuel use
- **Expansion of research and development**
  - Non-CO<sub>2</sub> benefits from SAF use (e.g. improved air quality)
  - New feedstock and conversion pathways
  - Non drop-in fuels



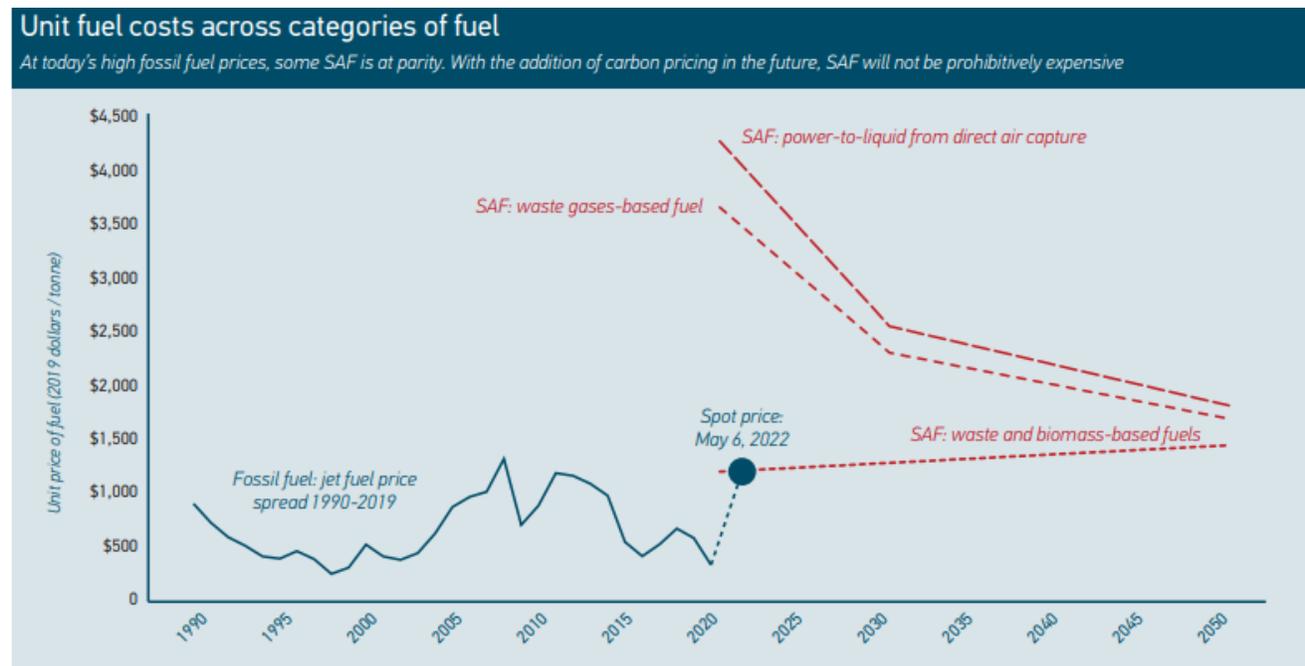
Source: <https://elements.visualcapitalist.com/the-clean-energy-employment-shift-by-2030/>



- **Competition for feedstock**
  - Renewable diesel (for land transport) also takes up huge volumes of feedstock
- **Financing**
  - **Access to capital**, in particular for SAF technology providers may be very limited, impacting opportunities for any scaling up of production
  - Insufficient funding to enable technologies to attain sufficient competitiveness to compete in the market
  - Council held a **high-level exchange with financial institutions** on 28 March 2023, to discuss aviation decarbonization's challenges and opportunities

- **Existing price gap**

- With the right levels of investment and increased SAF volumes, current price differences between SAF and conventional jet fuel are expected to converge in the future



Source: Waypoint 2050 Factsheet #15 / Jun 2022. Based on ICAO/CAEP data



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# ICAO preparatory process and activities towards CAAF/3



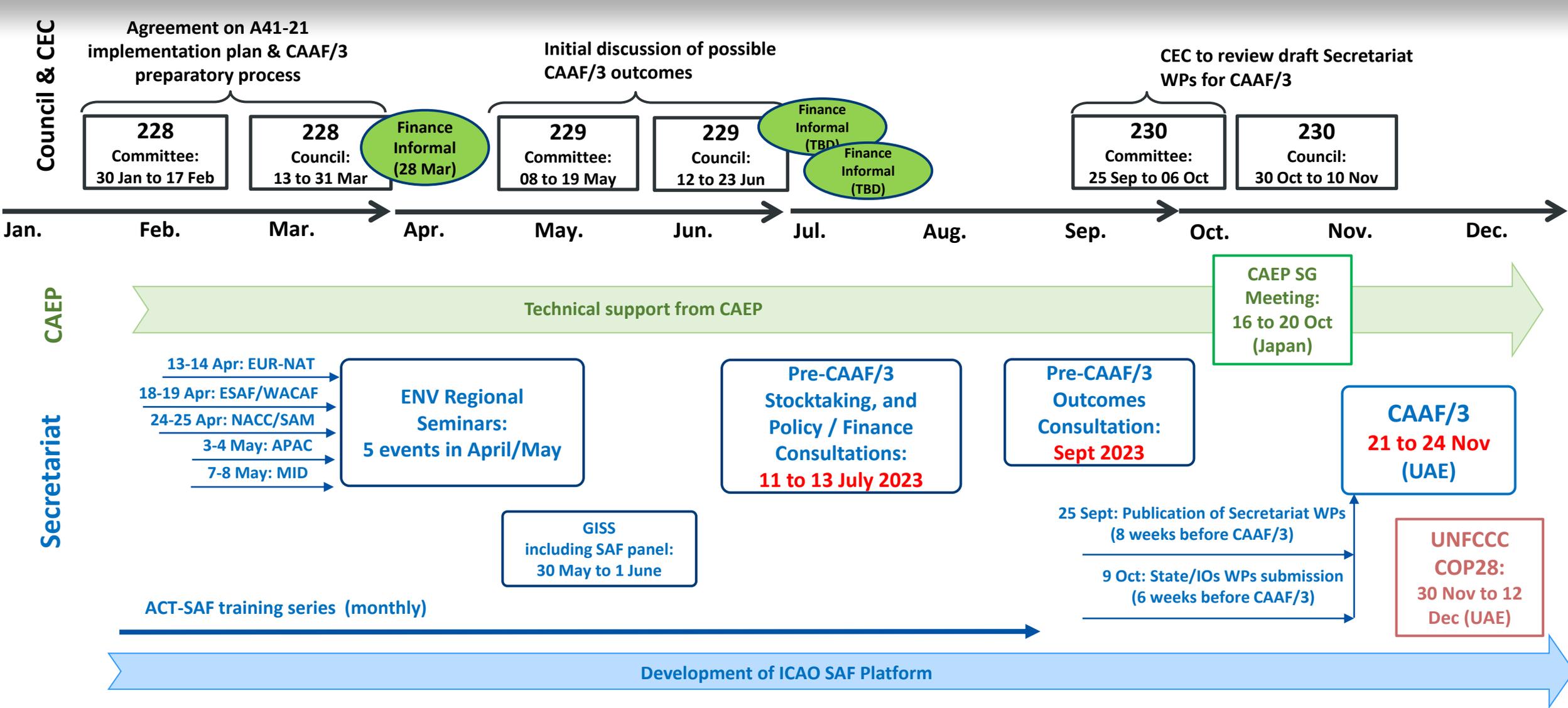


# Third Conference on Aviation and Alternative Fuels (CAAF/3)



The Assembly requested the convening of:

... **the CAAF/3 in 2023 for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, in order to define a global framework** in line with the No Country Left Behind (NCLB) initiative and **taking into account national circumstances and capabilities (A41-21 Para 28f)**





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THANK YOU