The Aviation Industry & Innovation in Sustainable Transport: Sustainable Alternative Aviation Fuel – Progress, Challenges and Ongoing Opportunities

Transforming Transportation: ATAG and ICAO Event, Innovation in Aviation – Value Added for New Mobility

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Overview

» Aviation Global Climate Action

» The Role of Sustainable Alternative Aviation Fuels (SAF) in Sustainable Aviation

» Innovations and Progress

» Overcoming Challenges and The Road Ahead …
Aviation Has a Strong Fuel Efficiency/GHG Record
A Critical Element in Our Global Climate Commitment

» Aviation Is a Relatively Small Contributor . . .
  • Worldwide aviation = 2% man-made CO₂ (source: IPCC)

» And We Have a Strong Record . . .e.g., U.S. Airlines:
  • Improved fuel efficiency over 125% between 1978 and 2017
  • Moved 34% more passengers & cargo in 2017 v. 2000, with no increase in CO₂

» But There Are Concerns (e.g., Emissions Growth) . . .

» ATAG (which includes A4A) and the Global Aviation Industry Are Addressing These Concerns
ATAG/ICAO Global Aviation Climate Action
Action & Innovation Supported by International Government Agreements

1. Aviation-Specific Emissions Targets
2. Key Focus on Technology, Sustainable Alternative Fuels (SAF), Operations & Infrastructure Measures
   • ICAO CO₂ certification standard for future aircraft
   • ICAO global market-based measure, the “Carbon Offsetting & Reduction Scheme for International Aviation” (CORSIA), emissions monitoring in 2019, offsetting 2021+
   • Framework support for SAF and crediting of emissions reductions for SAF relative to CORSIA under agreed environmental and sustainability criteria
ATAG and ICAO Goals Are Aggressive ….
And Critical to Aviation’s “License to Operate and Grow …”

1.5% improvement in fuel efficiency per year

ICAO MEMBER STATES HAVE A 2% ANNUAL FUEL EFFICIENCY GOAL

Stabilise net CO₂ emissions from the sector at 2020 levels through carbon-neutral growth

ICAO MEMBER STATES HAVE ADOPTED AS AN ICAO GOAL

-50% CO₂ emissions from aviation by 2050 (2005 baseline)

ICAO MEMBER STATES ARE ASSESSING THE POTENTIAL FOR A LONG-TERM GOAL
Innovation in Technology, Operations, Infrastructure, Sustainable Alternative Fuels, With ICAO CORSIA to Fill the “Gap”

The Role for SAF Is Significant!
What Is Needed for SAF Deployment

1) Safety
   – This is addressed through
     (a) The jet fuel specification, ASTM D7566; &
     (b) Application of procedures to assure fuel quality is maintained

2) Environmental Benefit
   – This is being addressed through
     (a) Lifecycle greenhouse gas emissions assessment (LCA), benefits up to 80%;
     (b) Sustainability review and certification;
     (c) Agreeing international methodologies and requirements through ICAO for CORSIA crediting

3) Commercial Viability
   – Need cost competitiveness &
   – Supply reliability

Protocols complete

We know how to do it; working on full suite of agreed international protocols

Significant progress, but this remains the biggest challenge
The Aviation Industry Had Led the Pathway to SAF, as Part of Our Commitment to Sustainable Aviation

  • Forged the ASTM process and certifications; framework for sustainability and lifecycle GHG certifications; policy support for commercialization; worldwide membership and outreach

» ATAG and ATAG Members Coordination and Advocacy
  • IATA, A4A and airline investment, research and tools
  • Aircraft manufacturers investment, research, testing, etc.

» Sustainable Aviation Fuel Users Group (SAFUG)

» ICAO Global Framework for Aviation Alternative Fuels
### Five Approved SAF “Pathways” Under ASTM D7566 (and more in the approval pipeline)

<table>
<thead>
<tr>
<th>PATHWAYS/PROCESS</th>
<th>FEEDSTOCK EXAMPLES</th>
<th>DATE OF APPROVAL</th>
<th>BLENDING LIMIT</th>
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<tbody>
<tr>
<td>Fischer-Tropsch Synthetic Paraffinic Kerosene (FT-SPK)</td>
<td>Biomass (forestry residues, grasses, municipal solid waste)</td>
<td>2009</td>
<td>Up to 50%</td>
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<td>Hydroprocessed Esters and Fatty Acids (HEFA-SPK)</td>
<td>Oil-bearing biomass (e.g., algae, jatropha, camelina, carinata)</td>
<td>2011</td>
<td>Up to 50%</td>
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<tr>
<td>Hydroprocessed Fermented Sugars to Synthetic Isoparaffins (HFS-SIP)</td>
<td>Microbial conversion of sugars to hydrocarbon</td>
<td>2014</td>
<td>Up to 10%</td>
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<tr>
<td>FT-SPK with aromatics (FT-SPK/A)</td>
<td>Renewable biomass such as municipal solid waste, agricultural wastes and forestry residues, wood and energy crops</td>
<td>2015</td>
<td>Up to 50%</td>
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<tr>
<td>Alcohol-to-Jet Synthetic Paraffinic Kerosene (ATJ-SPK)</td>
<td>Agricultural wastes products (stover, grasses, forestry slash, crop straws)</td>
<td>2016 (plus added feedstocks 2018)</td>
<td>Up to 30%</td>
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ICAO CORSIA and the Role of SAF
Approach to “Crediting” “CORSIA Eligible Fuels” (CEF)

» Lifecycle GHG Emissions Savings from CEF/SAF Reduces Individual Operator Offset Obligation

» ICAO CORSIA “Standards” Package Include:
- Lifecycle GHG emissions analysis (LCA) methodology
- Sustainability requirements: (1) >10% relative LCA benefit; (2) protection for high carbon stock land
- Sustainability certification
- SAF purchase monitoring, reporting & verification

» ICAO to Consider Additional Sustainability Criteria Before 2021 Implementation of Offsetting Requirements
Progress: Commercial Flights and Supply Agreements

Represent >250 M gallons per year; 100,000+ Commercial Flights; Increasing Scale-Up

Fuel Providers

Aviation Entities with Supply Agreements

Source: Steve Csonka (Nov. 2018)
Examples of Other Significant Agreements

- MOU Brisbane Supply Demonstration
- MSW FT-SPK (London)
- MOUs for HFP-HEFA collaboration
- Carinata supply development in Australia
- Full production-slate offtakes; Xx M gpy
- Development project

REPORTEDLY THREE ENTITIES, TBA

Source: Steve Csonka
Policy Progress …And Challenges …
We Continue to Work Together To Achieve Our Goals

» Progress:
  • Strong progress toward full agreement on sustainability criteria at ICAO
  • Several countries have supporting policies (e.g., U.S. Renewable Fuel Standard; EU crediting under the EU ETS and Renewable Energy Directive, etc.)
  • Continue to assess and approve new pathways under ASTM jet fuel spec
  • Supply is on the increase as are SAF purchase agreements

» Significant Challenges – Mechanisms to Scale Up and Enhance Cost-Competitiveness Are Still Lacking
  • SAF still significantly disincentivized relative to ground-based alternative fuels
  • Most governments lack stable supporting policies
  • Positive support is good – mandates are premature
The Sky Ahead . . .
The Aviation Industry Is Committed – Ongoing Collaboration Is Vital

» While Carbon Offsetting Can Help Fill the Gap, SAF Scale Up Is Critical to Meeting the Industry’s Climate Goals

» Need to Preserve and Enhance Supportive Policy Initiatives

» Public-Private Partnerships Remain Key
  • e.g., CAAFI; ASTM; work through ATAG partners, ICAO, etc.

» Environmental Benefit & Sustainability Can and Must Be Assured

» Airlines Are Committed to Increasing SAF Deployment
If You Want to Feel Good About the Future, Look Up!

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