Aviation's Market Pull for SAF (Sustainable Aviation Fuel)

First flight from continuous commercial production of SAF
UAL 0708, 10 March 2016, LAX-SFO

Fuel from World Energy - Paramount (HEFA-SPK 30/70 Blend).

Only U.S. facility offering continuous production of SAF at present.
Other batch production & tolling occurring due to extreme customer interest.

Steve Csonka
Executive Director, CAAFI

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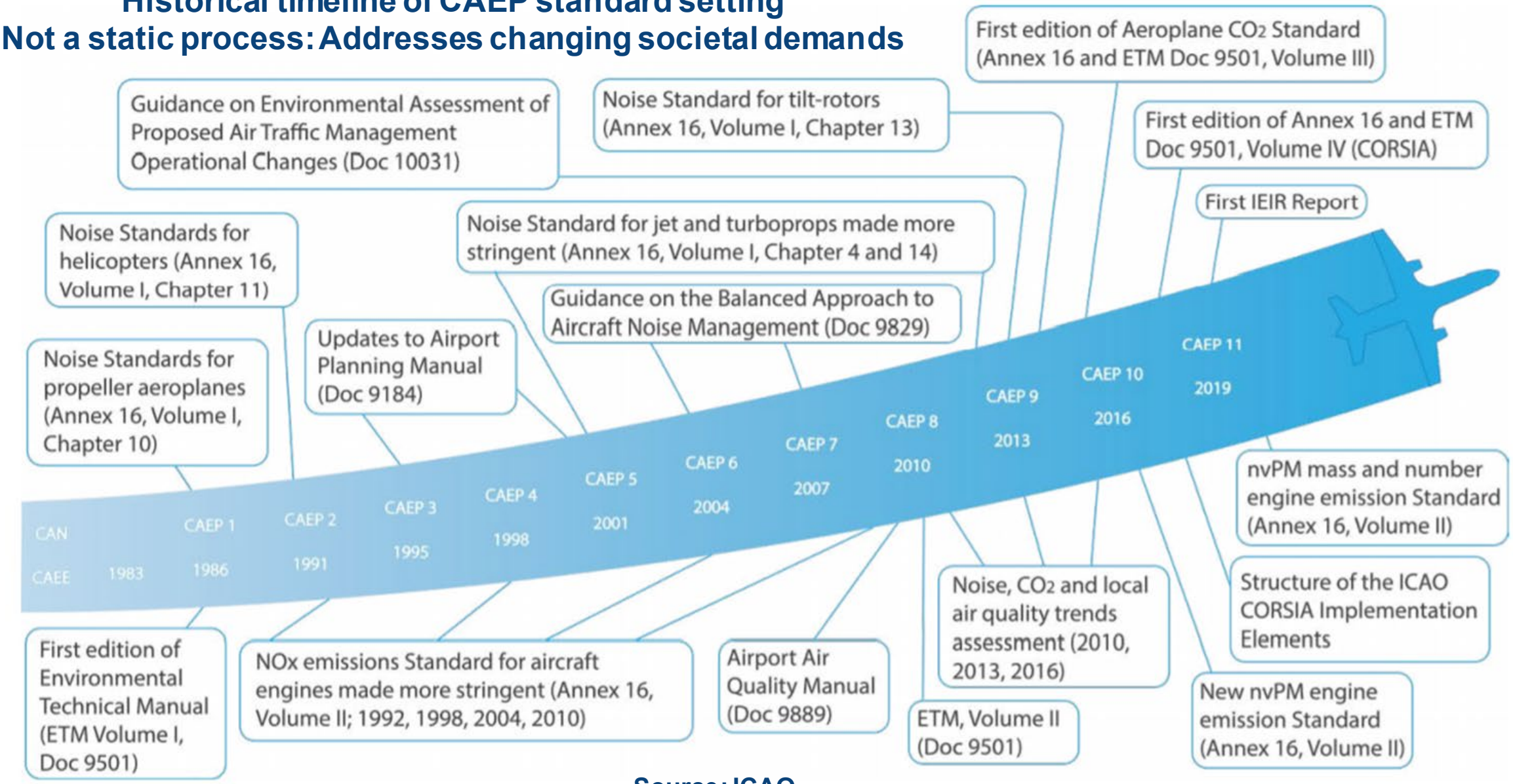
20Sep'21

www.caafi.org

Aviation takes its environmental responsibility seriously

Historical timeline of CAEP standard setting
Not a static process: Addresses changing societal demands



Source: ICAO

Aviation takes its environmental responsibility seriously … on GHGs too

Industry commitments in 2008, 2012, 2015, 2019

The business aviation community has long been committed to reducing the environmental impact of its products and operations. Indeed, we have improved the fuel efficiency of our products 40% over the past 40 years.

PETER J. BUNCE
PRESIDENT AND CEO
GENERAL AVIATION MANUFACTURERS ASSOCIATION

DONALD SPRUSTON
DIRECTOR GENERAL
INTERNATIONAL BUSINESS AVIATION COUNCIL

Our manufacturers and operators continually seek new ways of increasing an airplane's performance and range while reducing fuel consumption. Nonetheless, our community recognizes that we must do our part to reduce aviation emissions further even as we grow to meet rising demand for transportation.

The General Aviation Manufacturers Association (GAMA) and the International Business Aviation Council (IBAC), on behalf of the manufacturers and operators of business aviation worldwide, have therefore developed an aggressive strategy for CO_2 emissions reductions to 2050. We also join with the commercial aviation sector in endorsing the International Civil Aviation Organization's (ICAO) proposal for a global sectoral approach for aviation emissions in a post-Kyoto Agreement on climate change.

Our commitments parallel those made by the commercial aviation sector and depend equally on efficiency improvements that are projected from infrastructure modernization, operations and alternative fuels. Our community pledges an average of 2% improvement in fuel efficiency per year from now until 2020 on a fleet-wide basis. We acknowledge the need for appropriately structured market-based measures, so long as any revenues collected are reinvested into the sector. Such measures, along with advances in the areas mentioned above should help business aviation achieve carbon neutral growth by 2020 and an absolute reduction of 50% of CO_2 emissions by 2050 relative to 2005.

Business aviation is a vital tool for businesses and economic development and is an integral part of the international transportation system. It facilitates commerce and investment, connects people and communities around the globe, helps relieve famine, and delivers vital relief to those in need or afflicted by natural or man-made disasters. Business aviation also represents a dynamic and critical engine for economic growth that brings jobs and prosperity to millions of people worldwide.

While business aviation manufacturers and operators are engaged in a sustained effort to meet these targets, a strong partnership between industry and government is also absolutely necessary to achieve these goals. We can only meet these targets if all stakeholders work together on comprehensive, ambitious and fair worldwide action to mitigate emissions.

In this document, we describe our strategy and ambitious goals to meet this critical global challenge of emissions reduction while continuing to deliver vital economic, business and social benefits.

enviro.aero

Aviation Industry Commitment to Action on Climate Change

As leaders of the aviation industry, we recognise our environmental responsibilities and agree on the need to:

- build on the strong track record of technological progress and innovation that has made our industry the safest and most efficient transport mode; and
- accelerate action to mitigate our environmental impact, especially in respect to climate change while preserving our driving role in the sustainable development of our global society.

Therefore, we, the undersigned aviation industry companies and organisations declare that we are committed to a pathway to carbon-neutral growth and aspire to a carbon-free future.

To this end, in line with the four-pillar strategy unanimously endorsed at the 2007 ICAO Assembly, we will:

1. push forward the development and implementation of new technologies, including cleaner fuels;
2. further optimise the fuel efficiency of our fleet and the way we fly aircraft and manage ground operations;
3. improve air routes, air traffic management and airport infrastructure; and
4. implement positive economic instruments to achieve greenhouse gas reductions wherever they are cost-effective.

We urge all governments to participate in these efforts by:

1. supporting and co-financing appropriate research and development in the pursuit of greener technological breakthroughs;
2. taking urgent measures to improve airspace design including civil/military allocation, air traffic management infrastructure and procedures for approving needed airport development; and
3. developing and implementing a global, equitable and stable emissions management framework for aviation through ICAO, in line with the United Nations roadmap agreed in Bali in December 2007.

Our efforts and commitment to work in partnership with governments, other industries and representatives of civil society will provide meaningful benefits on tackling climate change and other environmental challenges.

We strongly encourage others to join us in this endeavour.

Airports Council International — Robert J. Aaronson, Director General; Jim C. Cherry, Chairman
IATA — Giovanni Bisignani, Director General & CEO; Fernando Pinto, Chairman
Airbus — Thomas Enders, President & CEO
Boeing — Scott Carson, President & CEO
Bombardier — Steve Ridolfi, President Regional Aircraft
CFM — Eric Bachelet, CEO
Embraer — Frederico Fleury Curado, President & CEO
Pratt & Whitney — Stephen Finger, President
Rolls-Royce — Mark King, President Civil Aerospace
GE Aviation — Scott C. Donnelly, President & CEO
CANSO — Alexander ter Kuile, Secretary General; Ashley Smout, Chairman
Marion C. Blakey, Chair; Sawtosh Hosiye, Vice-Chair
ATA — Philippe Rochat, Executive Director

3rd Aviation & Environment Summit, 22nd April 2008, Geneva, Switzerland

Becoming the first industrial sector to commit to an agreed carbon reduction approach

Aviation Industry Commitment to Climate Change Action: 3 Goal Approach

GOAL 1

PRE-2020 AMBITION

1.5% ANNUAL AVERAGE FUEL EFFICIENCY IMPROVEMENT FROM 2009 TO 2020.

T O I

GOAL 2

IN LINE WITH THE NEXT UNFCCC COMMITMENT PERIOD

STABILISE NET AVIATION CO_2 EMISSIONS AT 2020 LEVELS WITH CARBON-NEUTRAL GROWTH.

T O I + M

GOAL 3

ON THE 2°C PATHWAY

REDUCE AVIATION'S NET CO_2 EMISSIONS TO 50% OF WHAT THEY WERE IN 2005, BY 2050.

T O I

Four Pillar Commitment:

Technology
- Includes the development and commercialization of Sustainable Aviation Fuels (SAF)

Operations

Infrastructure

Market-Based Measures

Source: Boyd, Robert (IATA). 2018 CBGM. Policy Panel Discussion. Available at: http://caafi.org/resources/pdf/1.9_Policy_Discussion.pdf

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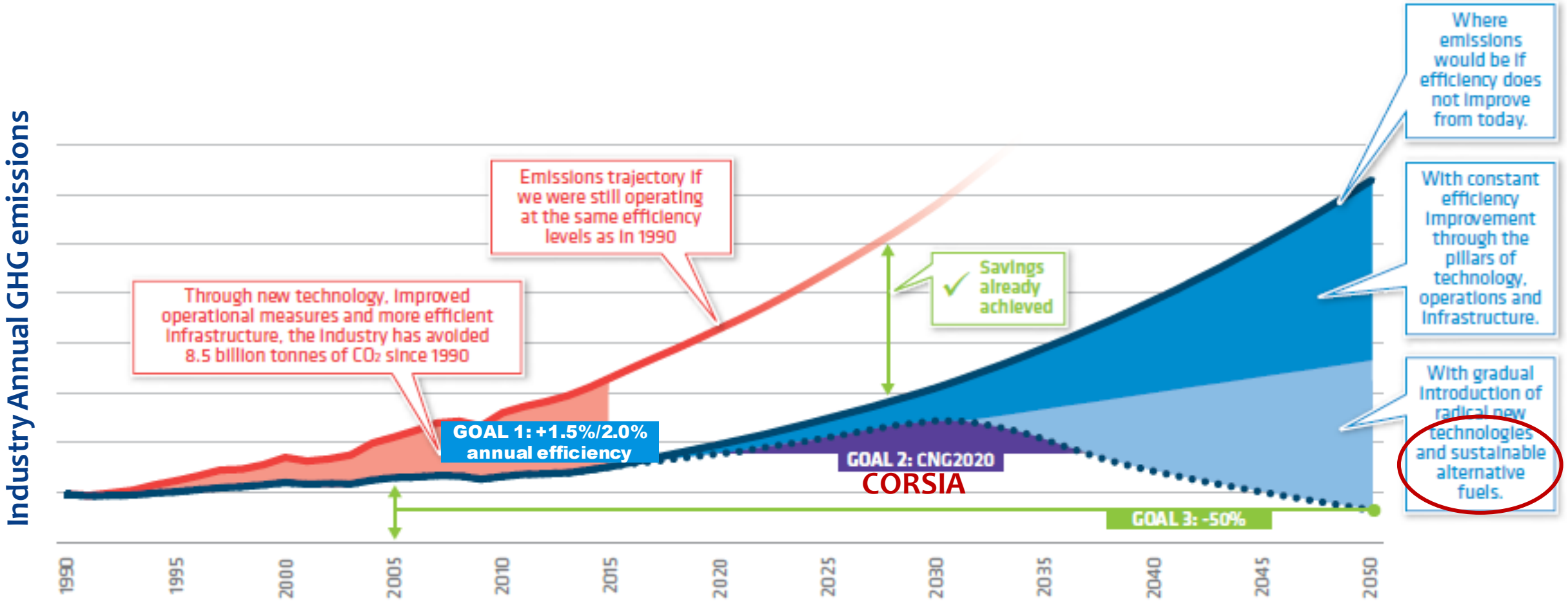
SAF a key component of the Technology Pillar; enabler for GHG containment strategy



Courtesy of ATAG: www.atag.org/our-publications/latest-publications.html
Beginner's Guide to Sustainable Aviation Fuel
Business Aviation made similar commitments

SAF (Sustainable Aviation Fuel)
a.k.a. aviation biofuel, biojet, alternative aviation fuel

Aviation Fuel: Maintains the certification basis of today's aircraft and jet (gas turbine) engines by delivering the properties of ASTM D1655 – Aviation Turbine Fuel – enables drop-in approach – no changes to infrastructure or equipment, obviating incremental billions of dollars of investment

Sustainable: Doing so while taking Social, Economic, and Environmental progress into account, especially addressing GHG reduction

How: Creating synthetic jet fuel with biochemical and thermochemical processes by starting with a different set of carbon molecules than petroleum … a synthetic comprised of molecules essentially identical to petroleum-based jet (in whole or in part)

Unabashedly - Lowest societal-impact way to decarbonize civil aviation!!

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SAF progress - Technical

* SAF are becoming increasingly technically viable
  * Aviation now knows we can utilize numerous production pathways
    (7 approved, 6 in-process, >15 in pipeline)
  * Enabling use of all major sustainable feedstocks
    (lipids, sugars, lignocellulose, hydrogen & carbon sources, circular-economy byproduct streams)
  * Utilizing thermo-chemical and bio-chemical conversion processes to produce pure hydrocarbons, followed by standard refinery processes
  * Following blending with petro-jet, SAF is drop-in, indistinguishable from petro-jet
  * Some future pathways expected to produce SAF blending components that will need less, or zero, blending
  * Expanding exploration of renewable crude co-processing with refineries
  * Continuing streamlining of qualification – time, $, methods

Sourced from CAAFI (Commercial Aviation Alternative Fuels Initiative - see www.caafi.org), 14Mar2021.
Information herein originates from the definitions in ASTM D7566 as well as industrial knowledge emanating from the work of CAAFI and industry practitioners.

ASTM D7566 Annex	Technology Type	Process Feedstock	Process Feedstock Sources	Blend Requirement	Certification Date	Technology Developer*/ Licensor	Commercialization Entities
A1	Fischer-Tropsch Synthetic Paraffinic Kerosene (**FT-SPK**)	Syngas (CO and H_2 at approximately a 1:2 ratio)	Gasified sources of carbon and hydrogen: Biomass such as municipal solid waste (MSW), agricultural and forestry residues, wood and energy crops; Industrial off-gases; Non-renewable feedstocks such as coal and natural gas.	Yes, 50% max	2009	****Sasol**, Shell, Velocys, Johson Mathey/BP, …	Sasol, Shell, Fulcrum, Red Rock, Velocys, Loring, Clean Planet Energy, …
A2	Hydroprocessed Esters and Fatty Acids Synthetic Paraffinic Kerosene (**HEFA-SPK**)	Fatty Acids and Fatty Acid Esters	Various lipids that come from plant and animal fats, oils, and greases (FOGs): chicken fat, white grease, tallow, yellow grease, brown grease, purpose grown plant oils, algal oils, microbial oils.	Yes, 50% max	2011	**UOP/ENI,** Axens IFP, Neste, Haldor-Topsoe, UPM, Shell, REG …	World Energy, Neste, Total, SkyNRG, SGPreston, Preem, …, many entities using technology for renewable diesel too
A3	Hydroprocessed Fermented Sugars to Synthetic Isoparaffins (**HFS-SIP**)	Sugars	Sugars from direct (cane, sweet sorghum, sugar beets, tubers, field corn) and indirect sources (C5 and C6 sugars hydrolyzed from cellulose);	Yes, 10% max	2014	**Amyris**	Amyris / Total
A4	Fischer-Tropsch Synthetic Paraffinic Kerosene with Aromatics (**FT-SPK/A**)	Syngas	Same as A1, with the addition of some aromatics derived from non-petroleum sources	Yes, 50% max	2015	**Sasol**	none yet announced
A5	Alcohol to Jet Synthetic Paraffinic Kerosene (**ATJ-SPK**)	C2-C5 alcohols (limited to ethanol and iso-butanol at present)	C2-C5 alcohols derived from direct and indirect sources of sugar (see A3), or those produced from microbial conversion of syngas	Yes, 50% max	2016	**Gevo, Lanzatech,** (others pending including Swedish Biofuels, Byogy, ...)	Gevo, Lanzatech
A6	Catalytic Hydrothermolysis Synthesized Kerosene (**CH-SK, or CHJ**)	Fats, Oils, Greases	Same as A2	Yes, 50% max	2020	**Applied Research Associates** (ARA) / CLG	ARA, Wellington, UrbanX, Euglena, ...
A7	Hydroprocessed Hydrocarbons, Esters and Fatty Acids Synthetic Paraffinic Kerosene (**HHC-SPK**, or **HC-HEFA**)	Algal Oils	Specifically, bio-derived hydrocarbons, fatty acid esters, and free fatty acids. Recognized sources at present only include the tri-terpenes produced by the Botryococcus braunii species of algae.	Yes, 10% max	2020	**IHI Corporation**	IHI

* The entity who was primarily responsible for pushing the technology through aviation's D4054 qualification is shown in bold.

** There are 3 major systems associated with FT conversion: Gasification, Gas Clean-up, and Fischer-Tropsch Reactor. This column focuses on the FT reactor only. There are over a hundred gasification entities in the world, and several of the major oil companies own and utilize gas clean-up technology. Further, up to the current time, FT reactors were only produced at very large scale. The unique technology brought to the market by Velocys *et al.* is a scaled-down, micro-channel reactor appropriately sized for processing of modest quantities of syngas as might be associated with a biorefinery.

Industry qualification process progress

Vertimass, OMV Re-Oil, Forge, REVO, SBI Prometheus, Alder, Brightmark, Others

Also now a UK Clearinghouse activity

Virent SAK

Tier 1

Specification Properties

Tier 2

Fit-For-Purpose Properties

OEM Review & Tier 3 & 4 Requirements

Tier 3

Component/Rig Testing

Tier 4

Engine/APU Testing

OEM Review & Approval

FAA Review

ASTM Balloting Process

ASTM Specification

D4054 Testing Initiated

Global Bioenergies Isobutene to jet

Indian CSIR-IIP

ATJ-SKA (Swed Biofuels)

HFP-HEFA (Renewable Diesel as blending agent)

Shell IH²

Annex A7 "HHC-SPK"

Annex A6 CHJ

Annex A5 ATJ-SPK (Isobutanol & ethanol)

Annex A4 FT-SKA

Annex A3 HFS-SIP

Annex A2 HEFA-SPK

Annex A1 FT-SPK

D1655 Feedstock Expansion

FT Biocrude Co-processing (D1655)

FOG Co-processing (D1655)

Other Co-processing
- Expansion of %
- 50% HDRD

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Overall outlook for SAF:

* Making progress, but still significant challenges – only modest production: focus on enabling commercial viability <u>for which lipids will play an early / significant role</u>
* Potential for acceleration a function of engagement, first facilities' success replication, additional technologies and feedstocks that continue to lower production cost or improve Carbon Index
* Enabling/forcing policy continues to advance:
  - Renewable & Low Carbon fuel standards
  - Tax Treatment
  - International policy (ICAO CORSIA)
  - Usage mandates

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Worldwide SAF production capacity forecast

Announced intentions*

Year-end Production Capacity (M gpy)

By YE '21	2022	2023	2024	2025	2026
world energy Paramount	Lakeview 6	REPSOL Cartagena 20	gevo Net Zero 1 22.5	gevo Speyer 22.5	
NESTE Porvoo	Delfzijl 33	ReadiFuels two locations 24	PHILLIPS 66 Rodeo 290	VELOCYS Altalto Immingham 16	
gevo Silsbee	NESTE Singapore 330	NESTE Rotterdam 130	TOTAL Grandpuits 56	REPSOL Spain all 405	VELOCYS Bayou Natchez, MS 33
TOTAL La Mede	LanzaJet Freedom Pines 10	Fulcrum BIOENERGY Gary, IN 21	preem Go'burg 70	LanzaJet 7 Int'l locations 210 -> 1,000 by 2030	
eni Gela	world energy Paramount+ 150		LanzaJet EU - FLITE 13		
air bp Castellon			Rotterdam 135	+523 by 2025; 10% of all Jet by 2030	
Fulcrum BIOENERGY Sierra					
~70+ M	~600+ M	~800+ M	~1,385 M	~1.83 B +	~2.62 B +

* Not comprehensive; CAAFI estimates (based on technology used & public reports) where production slates are not specified. Does not include various small batches produced for testing technology and markets.

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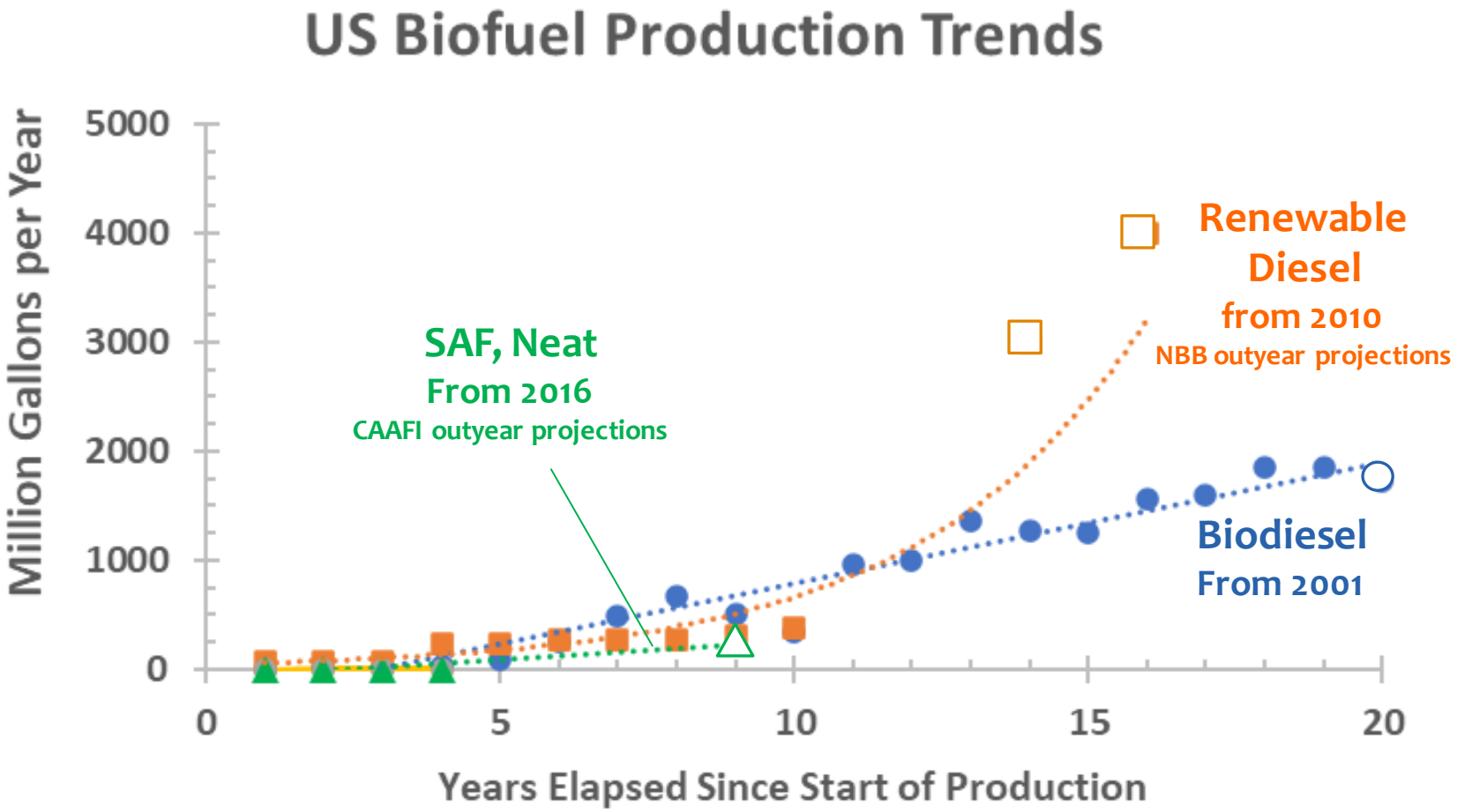
Industry focus on enabling SAF affordability



* We know what impact policy had on the ramp-up of ethanol and bio-diesel / renewable diesel – it can be replicated for SAF

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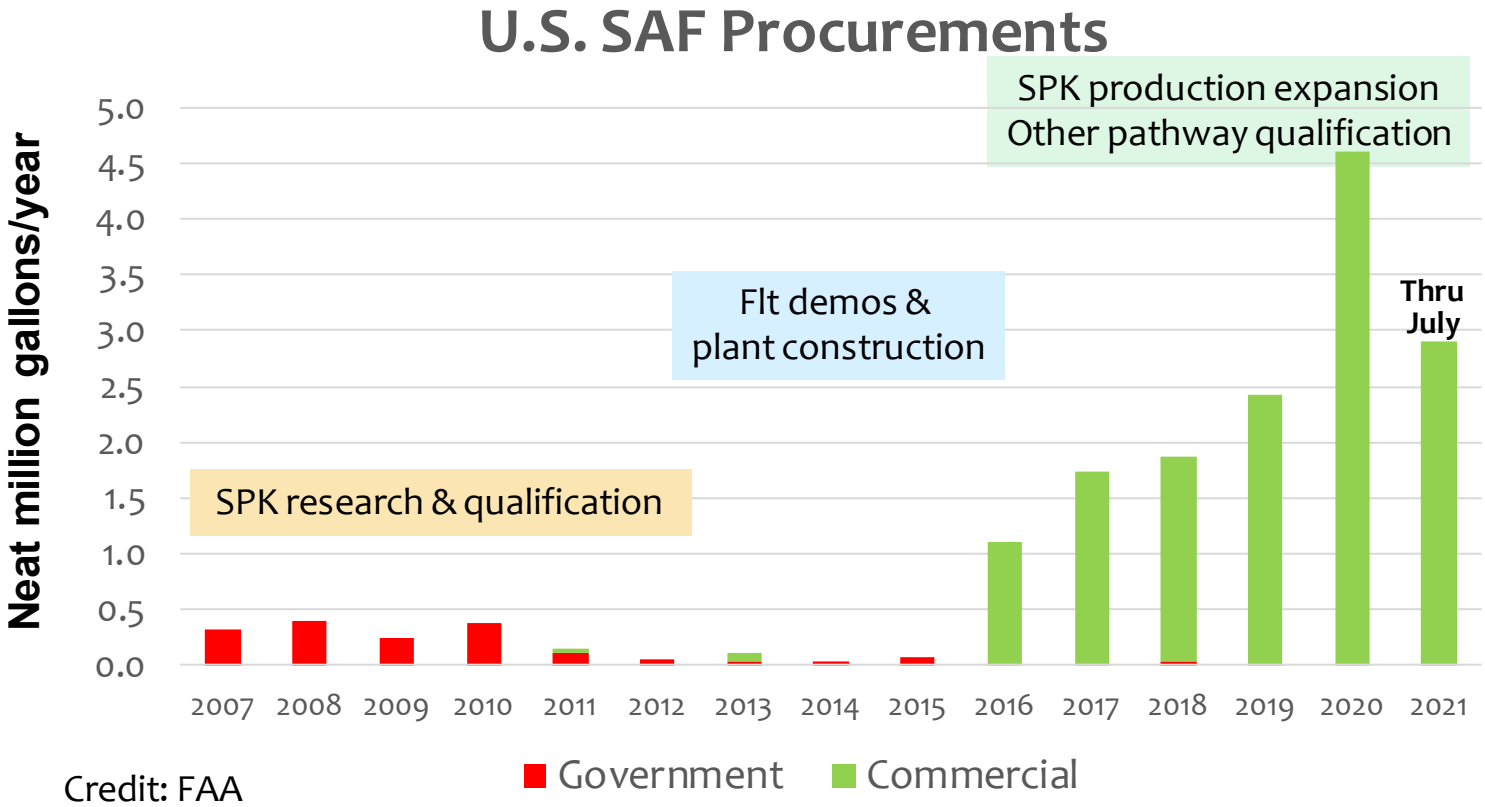
Where we stand on U.S. SAF consumption
Initiation underway, still early

- Five years of sustained commercial use
- Commercial & General Aviation engaged
- Two facilities in operation
- Two facilities under construction, others in development
- Cost delta still a challenge, with policies favoring renewable diesel
- In spite of that … we still have $6.5 B in airline offtake commitments for >350M gpy … with more in development



Credit: FAA
*Reflects voluntarily reported data on use by U.S. airlines, U.S. government, manufacturers, other fuel users, and foreign carriers uplifting at U.S. airports.
^2017-2021 calculation includes reported EPA RFS2 RINs for jet fuel.
2021 data as of Feb 2021

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A4A airlines' individual carbon / SAF commitments

Beyond NZC by 2050, and building to 2B gpy SAF by 2030 (commitments of Mar'21)

Alaska Airlines	NZC by 2040; Deal with Microsoft for SAF from SkyNRG/World Energy; SAF supply at SFO from Neste; SAF R&D investments with WSU-PNNL; Work with Carbon Direct
American Airlines	Allocation with Kuehne+Nagel and Deloitte ; 9 M usg SAF supply at SFO from Neste; Science based target by 2035 with SBTi; 10 M offtake from Prometheus
Atlas Air Worldwide	SAF demo work with Exolum/Avikor on Spain – Mexico flight;
Delta	Commits to be first global carbon-neutral airline; Collaboration with corporate customers (Deloitte, Takeda); targeting 10% SAF by 2030; SAF test purchase from Chevron (El Segundo)
FedEx Express	Achieve NZC by 2040; $2B investment target; $100M on Yale Center for Natural Carbon Capture
Hawaiian Airlines	
jetBlue	NZC by 2040; 10% SAF penetration by 2030; World Energy SAF supply; offtakes with SGPreston
Southwest	Collaboration with NREL on new pathways; MOUs with Marathon & P66 – focus on CA refinery retrofits
United	UA First U.S. Airline to Pledge to Reduce Own Emissions by 50% (vs. 2005) by 2050; 13Sep'18. $40M SAF Investment Fund; 27Oct'19; SAF usage at LAX since 2016
UPS	30% SAF usage by global air fleet by 2035
Air Canada	Midterm goal, -20% from 2019 air ops by 2030. $40M investments in SAF and carbon reductions and removals. [14Mar'21, Leaveless(aircanada.com)]

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SAF offtake agreements – pg 1

Beyond numerous demonstration programs

Paramount*

- Initial 40M gpy nameplate facility
  With 25M gpy SAF capacity

	neat quantities
UNITED	Up to 5 M gpy from 2016 (LAX)
World Fuel Services, Gulfstream	Second 5-year agreement from 2020, 30/70 blend
Shell, amazon Prime Air	1.8M g over 12 months
SkyNRG NORDIC, AIRFRANCE, FINNAIR, KLM	Misc Flights, e.g. SFO
air bp, SAS, OSLO AIRPORT, Shell, Lufthansa Group, VISTAJET	Bioports on demand, et al. — Halmstad, Arlanda, Bromma, Goteborg, Leeuwarden
jetBlue	450,000 gpy for 3 years to LAX from Sep'21

* 24Oct'18: Moving forward with $350M Paramount expansion to enable 306M gpy total capacity & jet capacity of 150M gpy; Fuel production expected by YE'22

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SAF offtake agreements – pg 2

Beyond numerous demonstration programs

NESTE

Porvoo *

- Initial 34M gpy capacity
- Moving forward with significant expansion at Singapore and other locations to enable ~480M gpy by 2023
- New Rotterdam facility possibly next, similar size to Singapore expansion, FID by early 2022.

+ air bp

SAS AIRBUS Lufthansa KLM ZURICH AIRPORT FINNAIR Emirates Alaska American Airlines jetBlue

= neat quantities not announced, except as noted

Porvoo SAF Q4'18 restart supplied to:

Swedish Airports - SAS;

Mobile, Hamburg – Airbus;

Frankfort – Lufthansa;

Amsterdam – KLM;

Zurich – WEF;

Helsinki – Finnair;

Stockholm – Emirates, Swedavia;

SFO – American (9 M over 3 years), Alaska, and JetBlue

+ AVFUEL

= Sustained supply to U.S. targeting BizAv: KMRY - Monterey Jet Center

+ Signature FLIGHT SUPPORT NETJETS

= SFO, London – Signature FBO

✈ Neste establishes concrete milestone to reach carbon neutral production by 2035 (Oct 07, 2020).

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SAF offtake agreements – pg 3

Beyond numerous demonstration programs

gevo *

* 3-4 facilities, utilizing ethanol conversion bolt-on approach

		neat quantities
+	AVFUEL / AIR TOTAL	= Up to 1M gpy, 5 yrs+ / France & EU supply;
+	AVFUEL ATLANTIC ACIJET	= Various Business Aviation airports FBOs
+	SAS	= 5M gpy, >$100M over tbd term
+	VIVA Energy Australia, Queensland Government	= HOA on SAF development in Australia, engagement with Brisbane
+	DELTA	= 10M gpy, from 2022/2023 term/blend unspecified
+	TRAFIGURA	= Unspecified SAF distribution rights
+	H·C·S GROUP	= Speyer, Germany facility, 22 M gpy TLP

- 11Jan'21: Gevo announces Net-Zero Projects to produce zero carbon index fuels, with first project targeted for Lake Preston, SD: $700M, "Net-Zero 1" with 45 M gpy hydrocarbon capacity.
- Older agreements with Virgin Australia and Lufthansa

CAAFI® COMMERCIAL AVIATION ALTERNATIVE FUELS INITIATIVE

SAF offtake agreements – pg 4

Beyond numerous demonstration programs

Fulcrum BIOENERGY

#1 Sierra*

- Initial 11M gpy nameplate facility, remainder at 2-3X in size;
- Biocrude delivered to Marathon Anacortes for finishing & blending

		neat quantities
+	CATHAY PACIFIC	= 37.5M gpy
+	UNITED	= 90-180 M gpy
+	air bp	= 50 M gpy
+	JAPAN AIRLINES, JOIN, Marubeni	= Project Development, License, and Offtake
+	ESSAR OIL UK; Fulcrum Northpoint, Stanlow, UK	= Project Development, License, and Offtake 26M gpy facility

10 yr agreements

* Per statements made at ABLC 2020

#2 Gary, IN @ 3x capacity

Then replication in Houston, UK, WA state, CA state, Australia

Additional sites aligned with investor airlines' US focal cities previously discussed

CAAFI® COMMERCIAL AVIATION ALTERNATIVE FUELS INITIATIVE

SAF offtake agreements – pg 5

Beyond numerous demonstration programs

		neat quantities
RED ROCK BIOFUELS	Southwest, FedEx	3 M gpy each, 7 yrs (Bay Area, CA)
SG Preston	jetBlue	10M gpy, 10 yrs (JFK)
	QANTAS	4M gpy, 10 yrs (LAX)
SkyNRG Americas	Alaska	West Coast U.S. supply MOU
SkyNRG NORDIC	KLM, Shell	KLM - 24M gpy, 10 yrs / Shell - SAF Supply collaboration
	FLITE Consortium Project in [illegible]J	30k tpy ATJ-SPK from 2024
LanzaTech * capturing carbon fueling growth	ANA, Suncor, Mitsui & Co.	Freedom Pines, supply from 2022, 10M gpy nameplate
LanzaJet	British Airways, Shell, Virgin Atlantic	UK DfT F4C Funding: ATJ Development

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* 100M gpy by 2024 from 4 facilities

SAF offtake agreements – pg 6

Beyond numerous demonstration programs

						neat quantities
preem	Gothenburg Refinery	+	SAS	=	Long-term supply negotiation (from 2023). Fueling all domestic flights by 2030.
SAF+ CONSORTIUM		+	Air transat	=	Detail tbd; Montreal East pilot facility approaching completion

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Other recent announcements

effort

Multiple Producers, TBA + World Fuel Services, AVFUEL = Full production slate offtakes

Multiple Producers, TBA + Cathay Pacific, Alaska, jetBlue, Delta, ANA, China Airlines, Emirates = New aircraft deliveries from Airbus, Boeing, …

Multiple Producers & Suppliers + Airports and Airline Tenants (Port of Seattle, Seattle-Tacoma International Airport, SFO) = Exploration of greater ambition

Northwest Advanced Biofuels + Delta = Grays Harbor, WA feasibility study, and offtake agreement, tbd

CAAFI® Commercial Aviation Alternative Fuels Initiative

Other recent announcements

				effort
VELOCYS	+	BRITISH AIRWAYS, Department for Transport	=	Altalto, Immingham, UK 20M gpy TLP
	+	TOYO ENGINEERING	=	Demo-plant follow on: Development activity in Japan
	+	KLM	=	500 liter P-t-L SAF from STCA; 22Jan'21 demo flight AMS-MAD
PROMETHEUS	+	BOOM	=	To support flight test
Carbon Engineering, LanzaTech (capturing carbon fueling growth)	+	BRITISH AIRWAYS, virgin atlantic	=	AtmosFUEL Project: DAC, ATJ

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Paradigm changing announcements

Intent to help close price premiums via traveler/shipper involvement

Rocky Mountain Institute + World Economic Forum

The Good Traveler — Leaves No Trace

Resilient and Sustainable Aviation Fuel (RSAF) credit

Clean Skies for Tomorrow Program

Use of Scope 3 (SAFc) credits, SABA program

SkyNRG Nordic

Fly Green Fund → Board Now — coalition for sustainable flying

Microsoft, Air France KLM, Delta

Purchase of SAF for US-Netherlands flights (beyond offsetting employee travel)

United

Eco-Skies Alliance Program – 11 Customers

Launch 13Apr'21; targeting 3.4M usg usage in 2021

CAAFI® Commercial Aviation Alternative Fuels Initiative

Overall industry summary on SAF:

SAF are key for meeting industry's commitments on carbon reductions

- Aviation enterprise aligned, representing a 26B gpy US & 97B gpy worldwide opt'y
- Jet fuel demand expected to increase for foreseeable future … 3 - 5% per year (following COVID rebound)
- SAF delivers net GHG reductions of 65-100+%, other enviro services
- Segment knows how to make it; Activities from FRL 1 to 9, with many in "pipeline"
- CAAFI and others are working to foster, catalyze, enable, facilitate, …
- First 6 facilities on-line (5 from lipids), increasing run-rates, multiple offtakers
- Commercial agreements being pursued, fostered by policy and other unique approaches
- Pathways identified for fully synthetic SAF (50% max blend today), enhancing SAF value proposition by enabling deeper net-carbon reductions
- Additional work needed on "appropriate conversion process for targeted feedstocks" enabling affordability

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