



Policy Panel Discussion: Updates on International, US Federal, and State approaches

CAAFI Biennial General Meeting
Washington 4th December 2018

Robert Boyd

To represent, lead and serve the airline industry



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 CO₂
EMISSIONS AT
2020 LEVELS
WITH CARBON-
NEUTRAL
GROWTH.**

T O I + M

GOAL 3

ON THE 2°C PATHWAY

**REDUCE
AVIATION'S NET
CO₂ EMISSIONS
TO 50% OF WHAT
THEY WERE IN
2005, BY 2050.**

T O I

Aviation's global market-based measure has been agreed

CORSIA
CARBON OFFSETTING AND
REDUCTION SCHEME FOR
INTERNATIONAL AVIATION



Historic decision at ICAO Assembly

Nearly all 191 ICAO States supported 'CORSIA'

Ten years since industry set goals and started pushing for a global MBM

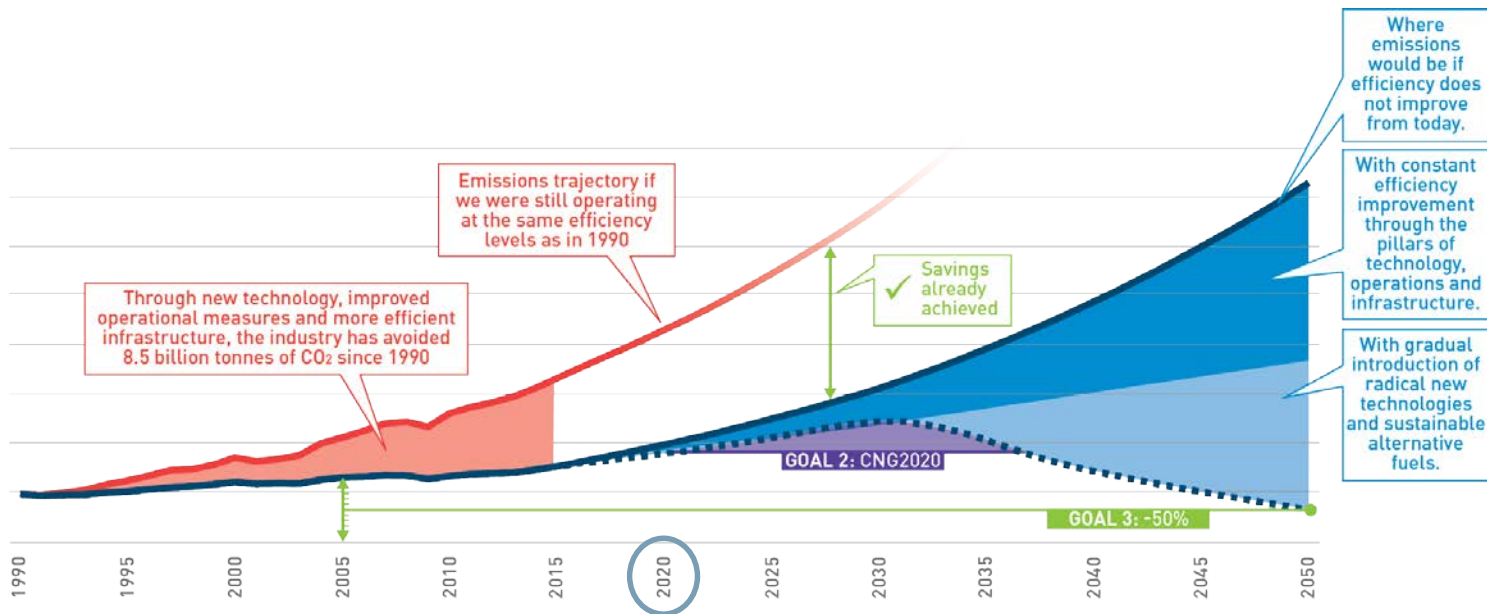
CORSIA represents a significant policy change for aviation

GOAL 2

IN LINE WITH THE NEXT UNFCCC COMMITMENT PERIOD

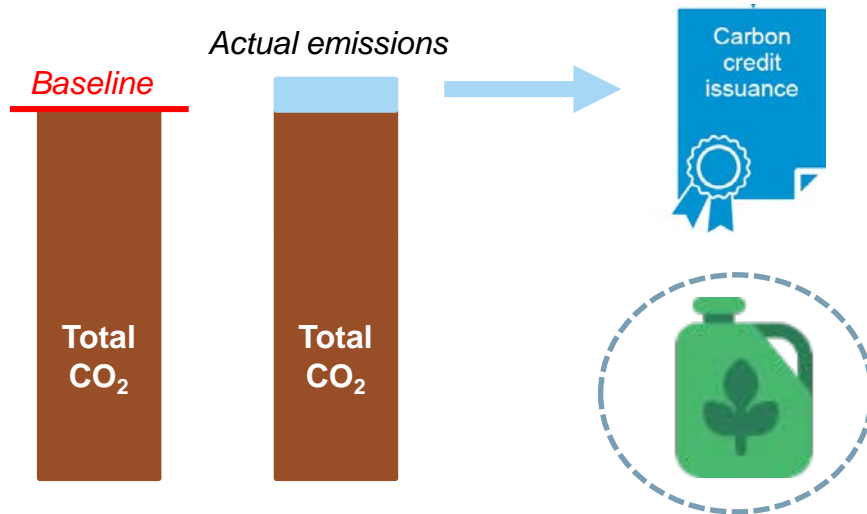
STABILISE NET AVIATION CO₂ EMISSIONS AT 2020 LEVELS WITH CARBON-NEUTRAL GROWTH.

TOI+M





An offsetting scheme...including SAF



Each company must compensate for emissions above its baseline with emission reductions achieved elsewhere or with sustainable aviation fuel

CORSIA Eligible Fuels

Presented to: CAAFI Biennial General Meeting
By: Dr. Jim Hileman
Chief Scientific & Technical Advisor for
Environment and Energy
Office of Environment and Energy
Federal Aviation Administration
Date: December 4, 2018



Federal Aviation
Administration



CORSIA Eligible Fuels (CEF)

CEF provide a secondary means to comply with CORSIA Offsetting Requirements

1. Emissions Units
2. Claiming Emissions Reductions from CORSIA Eligible Fuels (CEF)

$$Emissions\ Reduction = 3.16 * \left[\sum Neat\ Fuel\ Mass * \left(1 - \frac{Life\ Cycle\ Emissions}{89\ g\ CO2/MJ} \right) \right]$$

To be eligible for CORSIA, a fuel needs to meet the CORSIA Sustainability Criteria as certified by a CORSIA Approved Sustainability Certification Scheme (SCS)

- CEF shall achieve net greenhouse gas emissions reductions of at least 10% compared to the baseline life cycle emissions values for aviation fuel on a life cycle basis.
- CEF shall not be made from biomass obtained from land converted after 1 January 2008 that was primary forest, wetlands, or peat lands and/or contributes to degradation of the carbon stock in primary forests, wetlands, or peat lands as these lands all have high carbon stocks.
- Work is ongoing on additional criteria within ICAO CAEP.



Potential CORSIA Sustainability Criteria

Work is ongoing on additional criteria within ICAO CAEP

Sustainable = environmental + greenhouse gas (1) +
social + carbon in the land (2) +
economic water quality (?) +
soil quality (?) +
air quality (?) +
conservation (?) +
waste / chemicals (?) +
human and labor rights (?) +
land use rights (?) +
water use rights (?) +
local and social development (?) +
food security (?)



Life Cycle Emissions for CORSIA Eligible Fuels

Induced Land Use Change (ILUC):
included for fuels not derived from wastes, residues, or by-products

Core LCA

Stage #1: Production at source
 (feedstock cultivation)

Stage #2: Conditioning at source
 (harvest, collection, recovery)

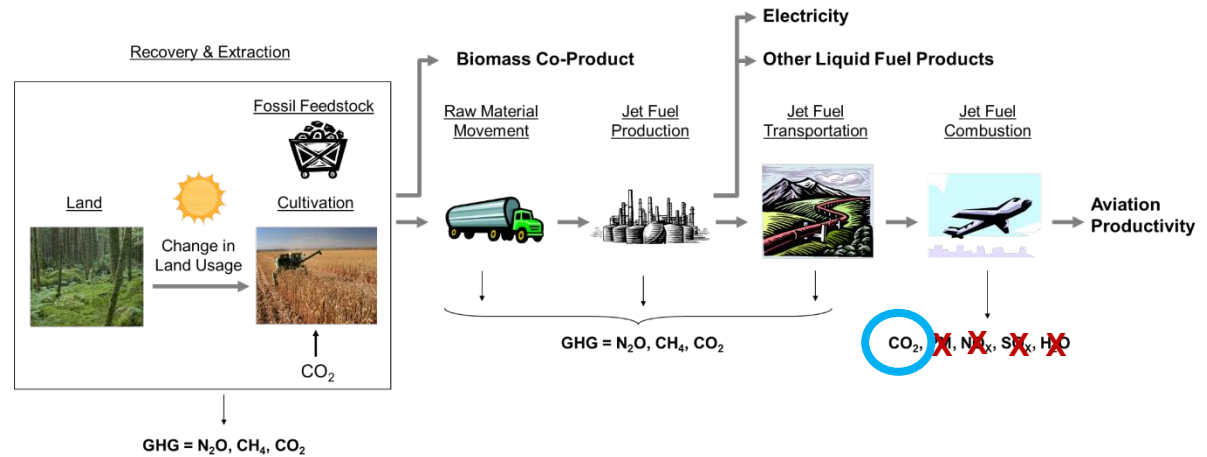
Stage #3: Feedstock processing
 and extraction

Stage #4: Feedstock transportation
 to processing and fuel production
 facilities

Stage #5: Feedstock-to-fuel
 conversion process

Stage #6: Fuel transportation and
 distribution to the blend point

Stage #7: Fuel combustion in
 aircraft engine



Life cycle values calculated by international team of experts:

Default Core LCA Values:

- DOE Argonne National Laboratory
- Massachusetts Institute of Technology
- E.U. Joint Research Centre
- University of Toronto
- Brazilian Bioethanol Science and Technology Laboratory (CTBE)
- Universidade Estadual de Campinas

Default ILUC Values:

- Purdue University (GTAP-Bio)
- International Institute for Applied Systems Analysis (GLOBIOM)



Federal Aviation
 Administration

Life Cycle Emissions for CORSIA Eligible Fuels

Two methods to determine life cycle emissions value for CORSIA Eligible Fuels

1. CORSIA default life cycle emissions values
2. CORSIA methodology for calculating actual life cycle emissions values

Default LCA values

- Values in CORSIA SARP Package calculated by team of international experts and approved by ICAO Council

Actual LCA values using CORSIA Methodology

- Airline operator / fuel producer can work with an eligible SCS to seek a core LCA value representative of their specific fuel production pathway
- SCS will need to prepare a technical report justifying actual LCA value
- Methodology uses attributional process with energy allocation of emissions among co-products to determine core LCA value
- Methodology potentially provides a means to get an ILUC value of zero for using land use change-risk mitigation practices (this aspect is still under development)
- Methodology potentially provides credits for MSW Landfill and Recycling Emissions (this aspect is still under development)



Adding New Default Life Cycle Values

CORSIA SARP Package contains default life cycle emissions values for a number of fuel pathways.

Adding default life cycle values for a new fuel pathway

- Working out final details on process and expect it to be completed in 2019. The following points are likely to be requirements.
- Key question - is the feedstock of interest a waste, residue, or by-product?
 - Yes – then no ILUC value is needed and you can use the CORSIA methodology for calculating an actual LCA value.
 - No – then a default ILUC value needs to be calculated and approved by ICAO.
 - Final definitions of main product, by-product, residue, and waste are expected in 2019.
- Key information required for adding a new fuel pathway
 - Pathway uses ASTM certified conversion process, or conversion process with Phase 2 ASTM Research Report that was reviewed and approved by OEMs.
 - Conversion process has been validated at sufficient scale to establish a basis for facility design and operating parameters at commercial scale.
 - There is sufficient data on conversion process, feedstock, and region of interest to perform life cycle modelling.





Dr. Jim Hileman

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Office of Environment and Energy**

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CORSIA Monitoring, Reporting and Verification

Kerri Henry
Transport Canada
December 4, 2018





PHASED APPROACH TO IMPLEMENTATION

- January 1 2019: Start of Monitoring, Reporting and Verification (MRV)
 - Operators in all states with at least 10,000 tonnes of in scope emissions

- January 1 2021: Start of Compliance phase
 - All operators continue to undertake MRV on all in scope routes
 - A subset will also need to meet offsetting compliance obligations



COVERED OPERATIONS

- Scheme targets operators on international flights that emit more than 10 000 tonnes of CO₂ emissions annually
- New entrants are exempted from the application of the offsetting portion of CORSIA for the first 3 years or until its annual emissions exceed 0.1% of total 2020 emissions, whichever comes first (still have to do MRV)
- MRV not required for (out of scope emissions):
 - Domestic aviation
 - Aircraft with less than 5,700 kg Maximum Take Off Mass
 - Humanitarian, medical or firefighting operations
 - Helicopter operations
 - State/military aircraft



MONITORING

- **Starting January 1, 2019**
- **Monitoring** of fuel use on each flight and calculation of CO₂ emissions (1 tonne fuel burn = 3.16 tonnes CO₂ emissions) based on approved eligible method
 - All operators have access to 5 direct monitoring methods
 - Small operators also have access to a tool from ICAO that estimates emissions based on flights (<https://www.icao.int/environmental-protection/CORSIA/Pages/Agreement.aspx>)
- All operators must develop an Emissions Monitoring Plan to explain their proposed approach
 - Approved by state only once, unless material changes



OPERATOR REPORTS

- On annual basis, submit Emissions Report
 - Baseline period (2019-2020):
 - Due by May 31 of subsequent year
 - Includes identification, fuel, airplane, flight, emissions information
 - Starting in 2021
 - Due by April 30
 - Also include CORSIA eligible fuels information
- Every 3 years starting in 2025, submit Emissions Unit Cancellation Report
 - Due by April 30
 - Includes detailed information on units cancelled
 - Preceded by public communication of offset cancellations by Feb 7

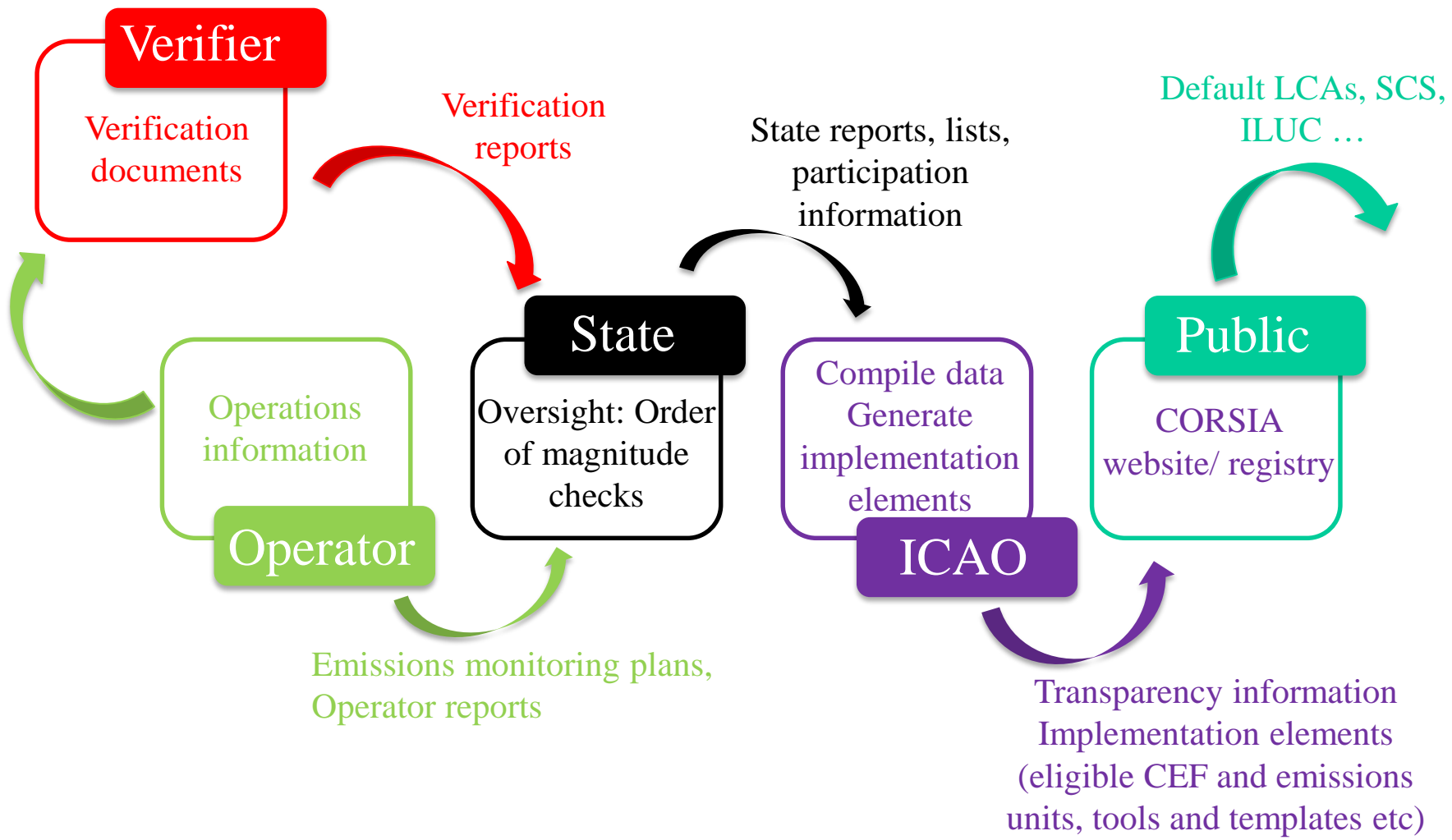


VERIFICATION

- Verification of reported information to ensure completeness and to avoid misstatements.
 - Voluntary pre-verification modules for industry
 - Third party verification according to ISO 14064.3 required for all in scope operators
 - Order of magnitude verification by states
- Third party verification of emissions reports and emissions units report
- Verification bodies accredited to ISO 14065 and CORSIA and carry out verifications in accordance with ISO 14064.3 and CORSIA
- Verification reports also due to state by May 31 in 2020, 2021 then by April 30



INFORMATION FLOW EXAMPLE





ANNUAL CEF REPORT CONTENT

Contact info, neat fuel producer
Production location
Production date
Purchase date of neat fuel
Proportion of neat batch purchased,
total mass of each neat batch
Name and contact information of
intermediate producer, party shipping to
blender and blender
Location of blender
Date the fuel received by blender
Blend ratio
Documentation of blend to aviation fuel
Evidence that meet sustainability criteria
LCA and ILUC values

(Aggregated by
state)
Mass of neat
CORSA eligible
fuel blended
Reduction claim

Production year
Name of producer of
neat fuel
Batch number
Mass of each batch of
neat fuel
Type of fuel
Feedstock
Conversion process

State

ICAO

Public



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Overview of CORSIA and the Role of Alternative Jet Fuel (Meeting Certain Criteria ...)

CAAFI Biennial Meeting – Panel Policy Discussion: Updates on International, US Federal, and State approaches

Nancy N. Young, Vice President, Environmental Affairs

December 4, 2018

ICAO's "Carbon Offsetting & Reduction Scheme for International Aviation" (CORSIA)

» Global Carbon Offsetting Scheme

- Not a carbon tax or emissions trading scheme

» Applies to Aircraft Operators, International Only

- Exemptions for aircraft $\leq 5,700$ kg, operators with $\leq 10,000$ metric tons CO₂, and humanitarian, medical, firefighting flights

» Offsetting to Help Meet the Carbon Neutral Growth from 2020 Goal

- Offset the increase in CO₂ emissions of international flights between participating countries after 2020, from averaged 2019-2020 baseline

ICAO CORSIA (cont.)

- » **Timeframe for Offset Requirement: 2021-2035**
 - » **But, Operators' Emissions Monitoring, Reporting & Verification (MRV) Begins in 2019 and Is Annual**
 - Alternative fuel is NOT included in the 2019-2020 period; only becomes relevant in 2021 when the offsetting obligation begins
 - » **Demonstration of Compliance with Offset Requirement Every 3 Years**
 - » **Country-by-Country Implementation, with Certain Reporting to and Determinations by ICAO**
-

ICAO CORSIA (cont.)

» Emissions Savings from an Operator's Purchase of "CORSIA Eligible Fuels" (CEF) Reduces Individual Operator Offset Obligations

- Emissions savings from CEF are NOT separately accounted for during the 2019-2020 period; they become relevant in 2021 when the offsetting obligation begins

» CORSIA Is In Lieu of Other Measures Imposed by States on International Aviation

“Determines that the CORSIA or any other scheme decided by the Assembly is to be the market-based measure applying to CO₂ emissions from international aviation”

How/When the Offsetting Obligation Applies

- **2021-2026, Voluntary “Phase In” for Countries**
- **2027-2035, Mandatory Other than Exempt Countries and Routes to/from Those Countries**
 - Exemptions for certain least developed countries (unless volunteer)
- **No Offsetting Obligation for Flights to/from Exempt Countries (but All Countries Must Do Emissions Monitoring)**
- **76 Countries, Representing 76% of International Aviation Activity, Have Volunteered So Far**

List of Countries on ICAO Website:

<https://www.icao.int/environmental-protection/CORSIA/Pages/state-pairs.aspx>

What Is CEF as Defined by CORSIA?

Note: What Is Typically Considered “Alternative” Fuel Is a Subset

Defined in the “Standards & Recommended Practices” (SARPs) Package that Establishes the “Rules” for Implementing CORSIA, in Volume 4, Annex 16, to the Chicago Convention

» A “CORSIA Sustainable Aviation Fuel” or a “CORSIA Lower Carbon Aviation Fuel”

- “CORSIA Sustainable Aviation Fuel”: renewable or waste-derived aviation fuel that meets the CORSIA Sustainability Criteria
- “CORSIA Lower Carbon Aviation Fuel”: fossil-based aviation fuel that meets the CORSIA Sustainability Criteria



ICAO CORSIA and the Role of CEF

Approach to “Crediting” CEF

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

» **ICAO CORSIA SARPs Package includes:**

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

» **ICAO to Consider Additional Sustainability Criteria Before 2021 Implementation**



If You Want to Feel Good About the Future, Look Up!



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RFS2 and U.S. Federal Alternative Fuels Regulation

Michael McAdams
Advanced Biofuels Association

December 4, 2018

Who We Are





RVO Mandates, 2015-2020

	2015	2016	2017	2018	2019	2020
Cellulosic biofuel (D3) (million gallons)	123	230	311	288	418	
Biomass-based diesel (D4) (billion gallons)	1.73	1.90	2.00	2.1	2.1	2.43
Advanced biofuel (D5) (billion gallons)	2.88	3.61	4.280	4.29	4.92	
Renewable fuel (D6) (billion gallons)	16.93	18.11	19.28	19.29	19.92	

2019 Regulatory Priorities

- 2019 RVO
- E-15/ Transparency Rule
- Set vs. Reset and 2020 RVO
- Biointermediates
 - Segregation vs. aggregation
 - Mass balance vs. C-14 dating
- Pathways
- Small Refinery Exemptions (SREs)



Alternative Jet Fuel Policies

2018 Expansion and 2019 Plans



Commercial Aviation Alternative Fuels Initiative

Biennial Meeting, Washington D.C.

December 4, 2018



Alternative Jet Fuel Policy Goals



Consumers are increasingly aware of aviation carbon impact,
and want to participate in real change



Now is the time to drive policies to enable alternative jet fuel commercialization,
to build positive perceptions of the aviation industry and its brands

Low Carbon Fuel Standard Initiative

Joint Effort



Airlines for America[®]
We Connect the World

Airlines

particularly United Airlines



Airports

particularly San Francisco International Airport



Alternative Jet Fuel Producer Group

AJF Producer Group



NESTE



VELOCYS



California's Low Carbon Fuel Standard (LCFS)



- Authorized by AB 32 and SB 32 and supported by Executive Order
- Developed by California Air Resources Board (CARB)
- Regulated parties must obtain LCFS Credits by blending low carbon fuels or buying credits to meet annual standard for their transportation fuel volume
- Annual standard is a carbon intensity measurement:
GHG Performance Efficiency
- Declines 1.25% per year through 2030



LCFS Rulemaking



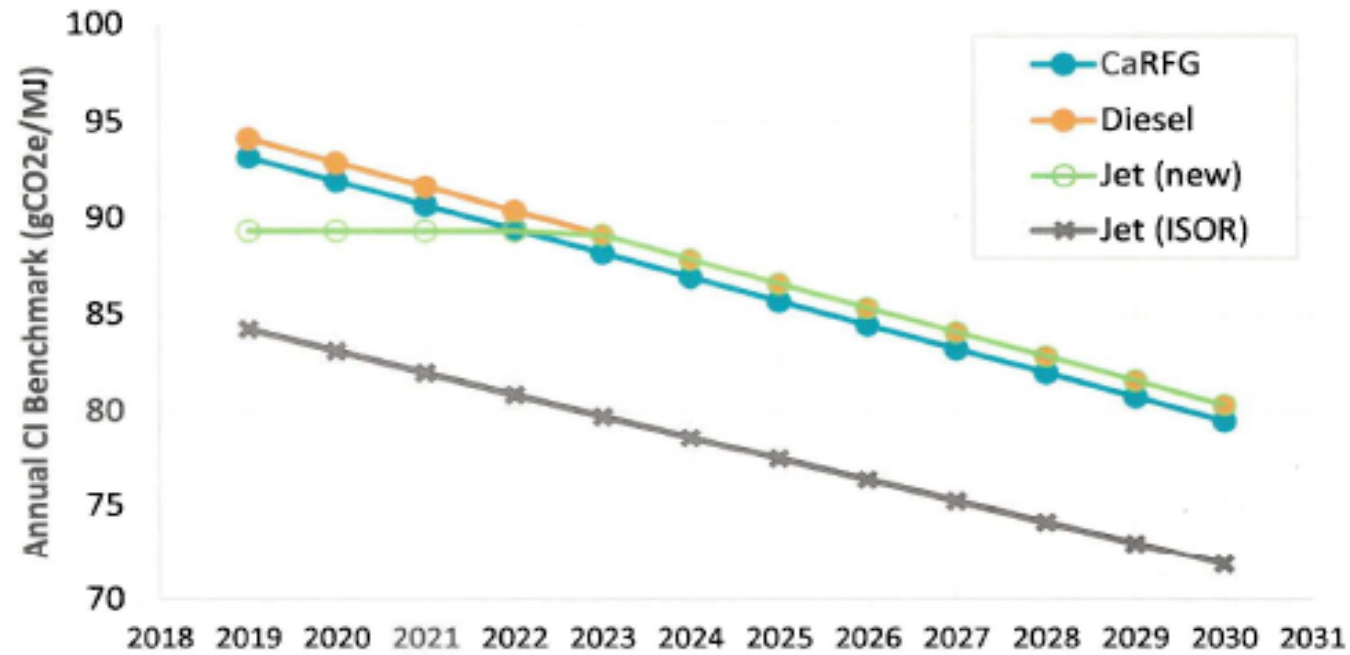
- 2 ½ year process
- Extensive engagement with CARB
- Informal meetings
- Workshops
- Formal rulemaking process
- Succeeded in bringing AJF into LCFS on opt-in basis
- Effective January 1, 2019



Generate Credits for Carbon Intensity Below Annual CI Benchmark for Jet



Figure 1. Proposed Annual CI Benchmarks





Clean Fuels Program (CFP) Rulemaking



- Comparable program
- Oregon Department of Environmental Quality (DEQ)
- Began five years later
- Leverages California program
- Pathways are similar
- Approved by EQC to bring AJF into CFP on opt-in basis
- Effective January 1, 2019



LOW CARBON
FUELS COALITION

Value of LCFS Credit per MT

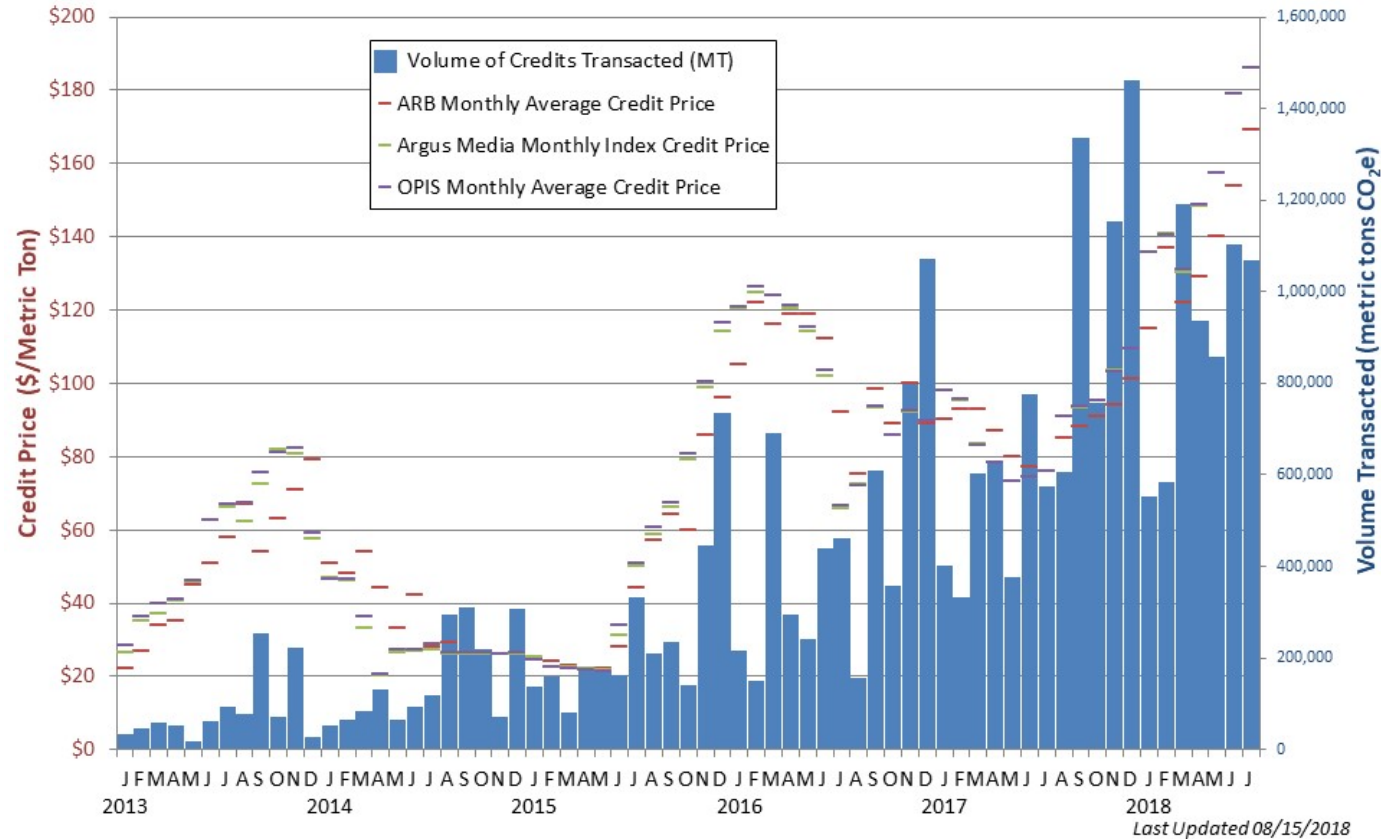
Carbon Impact (CI)
for AJF is variable

Feedstock

Process

Other Factors

Monthly LCFS Credit Price and Transaction Volume



This chart tracks credit prices and transaction volumes over time. Monthly average credit prices reported by Argus Media and OPIS [used with permission] are shown along with ARB monthly average price.

[Click to download the Excel spreadsheet of this graph.](#)

Recent Value

Per CA Gallon

MT = \$186

CI = 40 = \$1.19

CI = 10 = \$1.83

Per OR Gallon

MT = \$102

CI = 40 = \$.65

CI = 10 = \$1.00



LCFS Cost Impact on Diesel Fuel



OPIS California Low Carbon Fuel Standard

Product	Low	High	Mean	Change
Carbon Credit (\$/MT)	140.000	145.000	142.5000	1.0000
CI Pts Ethanol (\$/CI)	0.01141	0.01182	0.011615	0.000080
CI Pts Biodiesel (\$/CI)	0.01766	0.01829	0.017975	0.000125
Carbon CPG Diesel (cts/gal)	6.72	6.96	6.840	0.050
Carbon CPG Dsl 95% (cts/gal)	6.38	6.61	6.495	0.045
Carbon CPG Gasoline (cts/gal)	10.43	10.80	10.615	0.075
Carbon CPG Gas 90% (cts/gal)	9.38	9.72	9.550	0.070

LCFS addresses the toughest GHG sector: value of 10x plus over cap-and-trade



Cap & Trade Costs



Prompt Calif. Cap-at-the-Rack Prices (cts/gal)

Product	Price	Wk Avg	30-Day Avg
Summer CARB RFG-R	11.83	11.848	11.881
Summer CARB RFG-M	11.80	11.818	11.852
Summer CARB RFG-P	11.79	11.808	11.842
Winter CARB RFG-R	11.80	11.818	11.858
Winter CARB RFG-M	11.80	11.818	11.858
Winter CARB RFG-P	11.82	11.834	11.871
CARB No.2	15.03	15.052	15.099
B5 Biodiesel	14.28	14.302	14.347
Propane	8.25	8.262	8.288
LNG (cts/DGE)	10.75	10.762	10.796

Cap-and-trade remains inapplicable to jet fuel and AJF

2019 US Opportunities

Washington State



Midwestern States



Regional Greenhouse Gas Initiative (RGGI) States



- Develop optimal policy structure for airlines
- Need public support from aviation industry to keep succeeding



Essentials for 2019



- Continued leadership from A4A, CAAFI
- Sustained support for federal agencies and U.S. military
- Public and vocal support from aviation industry in Washington state and potentially other states
- Optimal Policy Structure for decarbonizing aviation
- Cannot win policy battles from the sidelines

Contact Information



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