Alaska Airlines' Aviation Biofuel Goal-

The Challenges of Turning Goals into Reality

May 4, 2016

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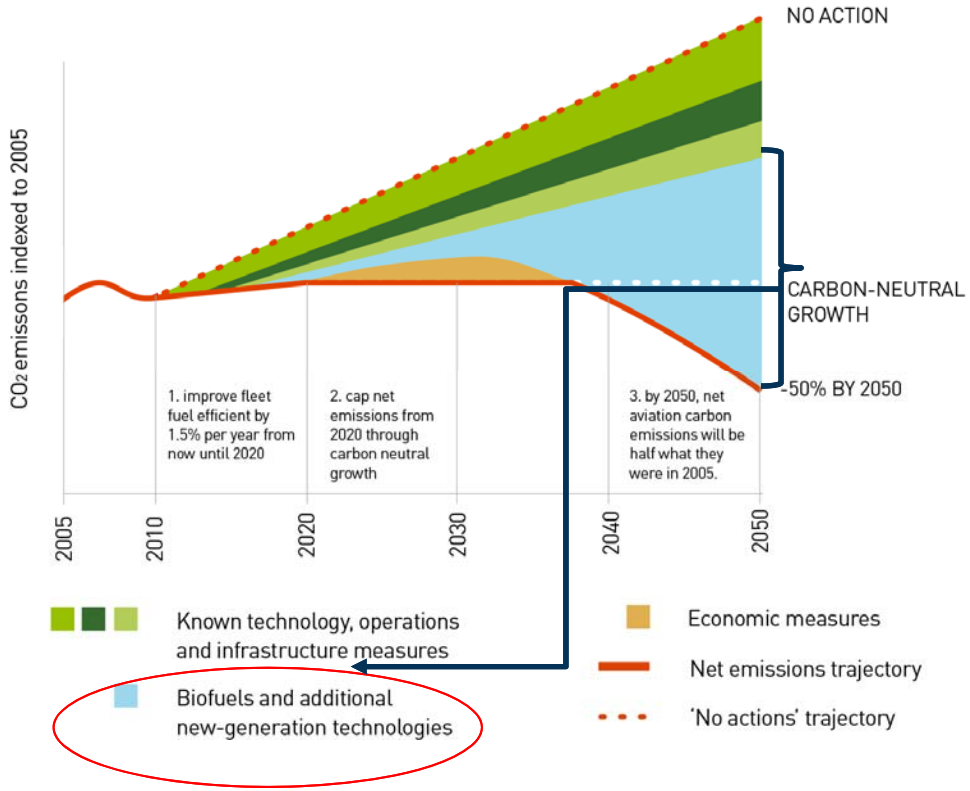
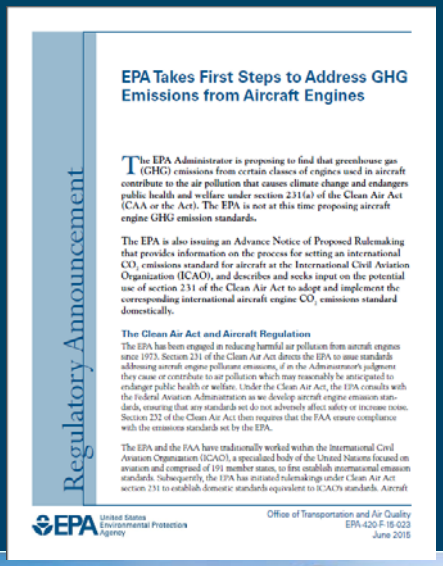
Alaska AIRLINES

IATA CO_2 Emission Reduction Roadmap



Source: IATA

Global Aviation Emission Focus



Regulatory Announcement

EPA Takes First Steps to Address GHG Emissions from Aircraft Engines

The EPA Administrator is proposing to find that greenhouse gas (GHG) emissions from certain classes of engines used in aircraft contribute to the air pollution that causes climate change and endangers public health and welfare under section 231(a) of the Clean Air Act (CAA or the Act). The EPA is not at this time proposing aircraft engine GHG emission standards.

The EPA is also issuing an Advance Notice of Proposed Rulemaking that provides information on the process for setting an international CO_2 emissions standard for aircraft at the International Civil Aviation Organization (ICAO), and describes and seeks input on the potential use of section 231 of the Clean Air Act to adopt and implement the corresponding international aircraft engine CO_2 emissions standard domestically.

The Clean Air Act and Aircraft Regulation

The EPA has been engaged in reducing harmful air pollution from aircraft engines since 1973. Section 231 of the Clean Air Act directs the EPA to issue standards addressing aircraft engine pollutant emissions, if in the Administrator's judgment they cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. Under the Clean Air Act, the EPA consults with the Federal Aviation Administration as we develop aircraft engine emission standards, ensuring that any standards set do not adversely affect safety or increase noise. Section 232 of the Clean Air Act then requires that the FAA ensure compliance with the emissions standards set by the EPA.

The EPA and the FAA have traditionally worked within the International Civil Aviation Organization (ICAO), a specialized body of the United Nations focused on aviation and comprised of 191 member states, to first establish international emission standards. Subsequently, the EPA has initiated rulemakings under Clean Air Act section 231 to establish domestic standards equivalent to ICAO's standards. Aircraft

EPA United States Environmental Protection Agency

Office of Transportation and Air Quality
EPA-420-F-15-023
June 2015

Alaska Airlines-Reducing Aircraft Emissions

20%

2020 Goal: Decrease fuel consumption and associated emissions for mainline operations by 20%, over 2012.

The Fuel We Use

2020 Goal: Use sustainable aviation biofuel at one ore more of our airport locations by 2020.

Involvement in Biofuel Development

- SAFUG- 1st domestic carrier
- SAFN- founding member
- 75 biofuel flights in 2011
- Offtake agreement with HBE in 2013
- WA Aviation Biofuel Work Group
- FAA ASCENT
- Gevo and NARA flights in 2016

Alaska Airlines' Biofuel Goal

2016 Biofuel Goals

- Reaffirm our commitment to the development of biofuel by operating demonstration flights for Gevo and NARA
- In partnership with the Port of Seattle and The Boeing Company, conduct an infrastructure feasibility study to bring commercial supplies of sustainable aviation fuel to the Port of Seattle

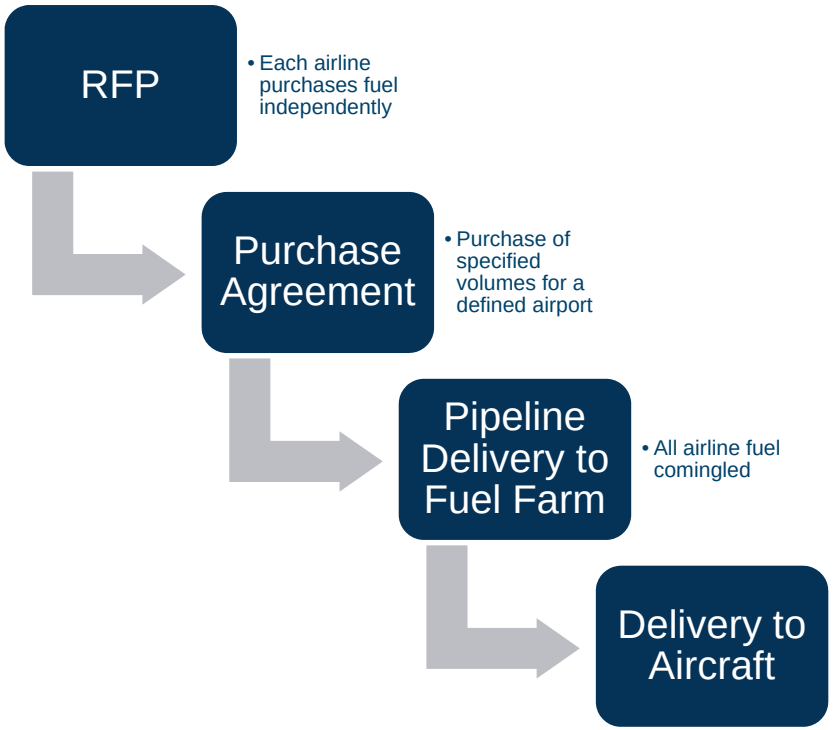
Why NARA?

- Alaska Airlines is officially “feedstock agnostic”
- SAFN identified four regional feedstocks that include woody biomass
- NARA project validates conversion of local feedstocks to aviation biofuel
- In addition to environmental benefits of biofuel, Alaska supports economic development and job growth in the Pacific Northwest, including siting of local biorefinery

Challenges

- Biofuel conformance to ASTM standards and timeline for approval
  - 2011 HEFA Approval
  - 2016 ATJ-SPK
  - Next?
- Fuel Availability- Demonstration scale to commercialization
- Cost
- Delivery Infrastructure

Petroleum Jet Procurement



Biofuel Procurement and Delivery

- Fuel producer must prove technology and obtain ASTM approval
- Propose refinery and secure funding–DOE grants, private investors, etc.
- Fuel offtake agreement by individual airlines
- Production
- Delivery to separate storage at airport fuel farm
- Blending remotely or at fuel farm
- Post blending certification to show conformance to fuel standard
- Delivery to wing via truck vs hydrant system

Biofuel Costs

$4-8 /gallon neat biofuel fuel compared to $1.50/gallon for petroleum

$0.2-0.6/ gallon transportation/delivery into wing

Cost differential for 1 million gallons= increase cost of $2,700,000-$7,100,000

Impact to Alaska Airlines of a $0.01 increase in fuel cost= approximately $5,000,000

When do costs make sense?

- Airport offset incremental fuel cost
- Airport helps with infrastructure cost
- Offset costs associated with GMBM and other costs of carbon
- Strategic position to manage costs