WASHINGTON STATE UNIVERSITY

Office of
Clean Technology

Informing Regional Projects

Washington Sustainable Aviation Biofuels Work Group

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Alexandria, VA

ASCENT
AVIATION SUSTAINABILITY CENTER

Regional Motivation

Setting the Stage

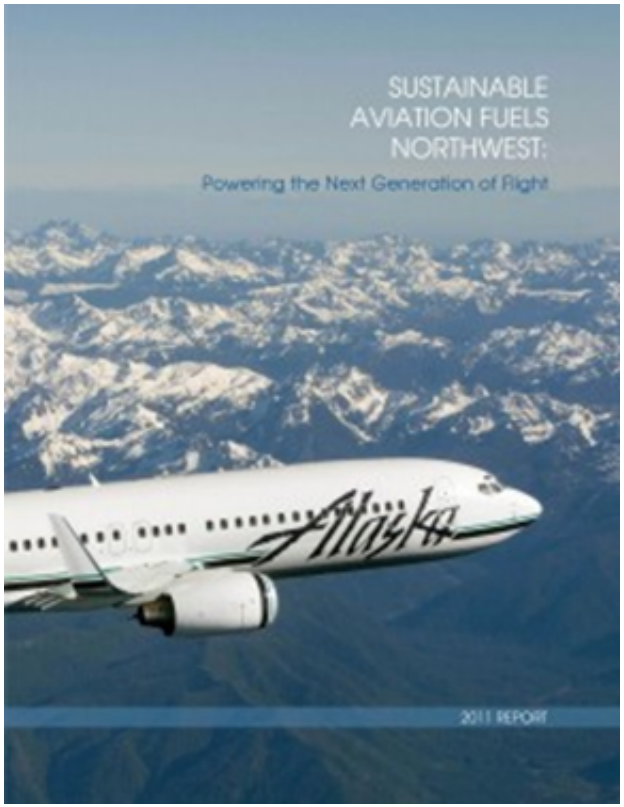
…in July 2010, Boeing Commercial Airplanes President and CEO Jim Albaugh said:

"The Northwest is a global gateway for people, cultures and commerce, and aviation on is a vital contributor to that process. Developing a sustainable aviation fuel supply now is a top priority both to ensure continued economic growth and prosperity at regional levels and to support the broader aim of achieving carbon-neutral growth across the industry by 2020."

Sustainable Aviation Fuels Northwest (SAFN)

2010-2011

- Sponsored by The Boeing Company, Alaska Airlines, Ports of Seattle and Portland, Spokane International Airport & WSU
- Diverse group of 35 stakeholder organizations and 5 elected officials as observers
  - Alternative Fuel Producers
  - Feedstock Suppliers
  - Environmental & Energy Advocates
  - State agencies in Oregon and Washington
  - USDA, DOD, DLA, DOE



https://www.climatesolutions.org/programs/saf/resources/safn

2012 Washington State Energy Strategy

Promote:

- A clean energy economy,
- Competitive energy prices, and
- Lower greenhouse gas emissions.

Strategy highlights Washington's unique opportunity to become a hub for the production and use of sustainable biofuels for aviation.

State Legislative Mandate (HB2422)

https://app.leg.wa.gov/dlr/tld/ViewFileList.aspx

2012- 2015: Convene a Sustainable Aviation Biofuels Work Group to:

- Further development of sustainable aviation fuel as a productive industry in WA, using as a foundation the regional assessment …known as SAFN
- Facilitate communication and coordination among aviation biofuels stakeholders
- Provide a forum for discussion an problem-solving regarding barriers related to technology development, production, distribution, supply chain development and commercialization
- Provide recommendations to the legislature on potential legislation to facilitate technology development, production, distribution, supply chain development and commercialization

State Legislative Mandate

2018- Legislature appropriated funds to continue work group through December 1, 2019 and directed WSU to convene the group.

- First meeting September 17, 2018
  - Four members of the legislature attended
  - Presentations by WSU, CAAFI, USDA, Port of Seattle, Renewable Energy Group (REG)

Engaged Airline

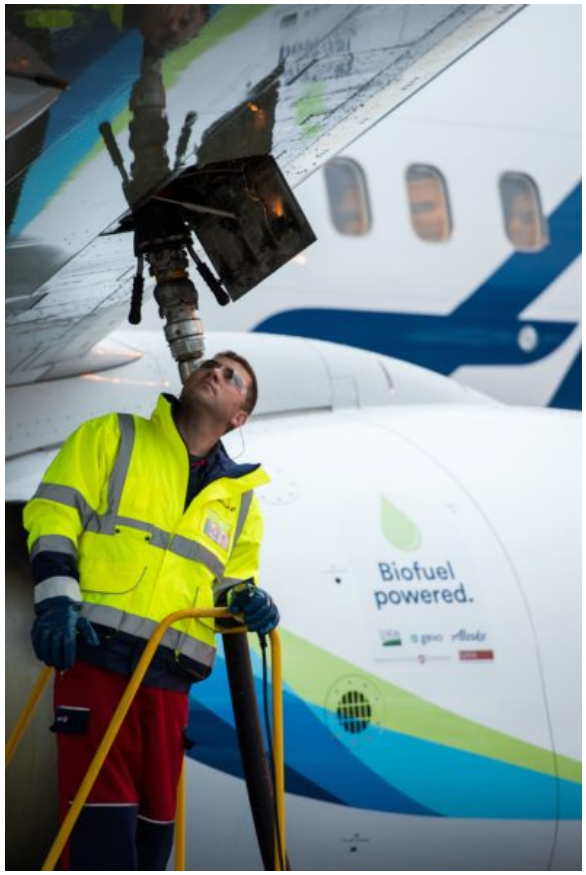
2011

- ASTM approves HEFA conversion process
- Alaska Airlines is the first airline to fly multiple alternative fuel operations on two aircraft types

2016

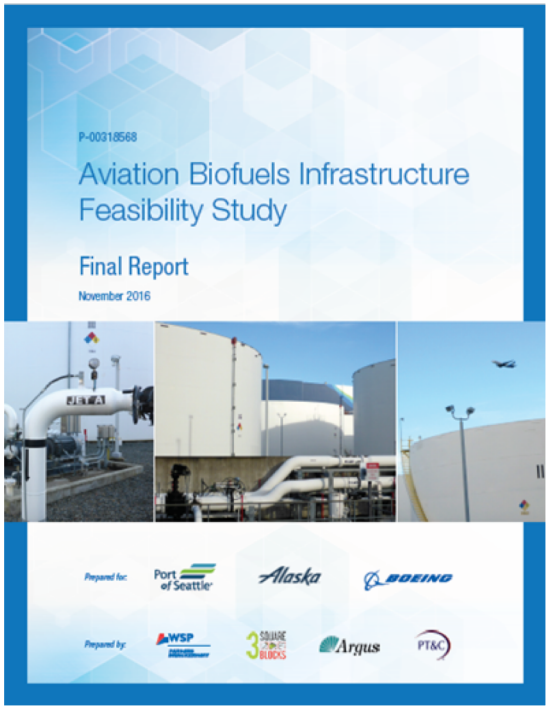
ASTM approves ATJ and Alaska conducts:

- First Alcohol-to-Jet flights using Gevo fuel
- First forest residuals flights with fuel produced from NARA project



Partnerships

- Port of Seattle, Boeing and Alaska Airlines partner on infrastructure feasibility study to deliver 5mgy - 50mgy SAJF to the Seattle-Tacoma International Airport



https://www.portseattle.org/sites/default/files/201803/Aviation_Biofuel_Infrastructure_Report_Condensed.pdf

University Leadership

Washington State University

- ~ $40M USDA NIFA grant
  - Northwest Advanced Renewables Alliance (NARA) using forest residuals as feedstock
- FAA Center of Excellence for Alternative Jet Fuel and the Environment (ASCENT), Co-Director

University of Washington

- ~ $40M USDA NIFA grant
  - Advanced Hardwood Biofuels (AHB) Northwest using plantation grown poplar as feedstock
- ASCENT Partner University

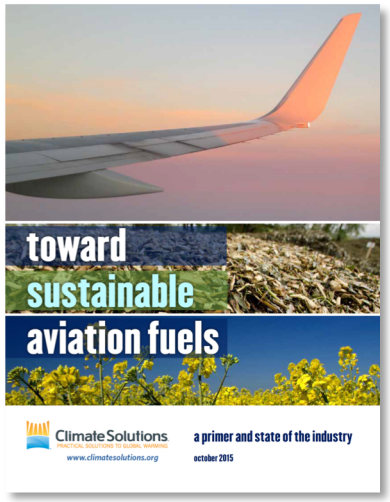
Pacific Northwest National Lab

- DOE BETO Funding
  - PNNL partnered with LanzaTech to produce ethanol from waste gas emissions from industrial sites
    - Ethanol added to ASTM ATJ Annex 5 in 2018
  - Trilateral Biojet Workshop (U.S., Canada & Mexico)
    - Information sharing on alternative fuels research and emission reduction mandates in each country

SABW Initial Recommendations

Align State Tax Policies to Support the Development of Aviation Biofuels

- State tax incentives can reduce risks and increase investment in all parts of the sustainable aviation biofuels supply chain.
- Tax incentives can:
  - Encourage all biofuel production pathways
  - Create synergies with biochemical co-products
  - Not restrict benefits to specific feedstocks
  - Incorporate storage and blending infrastructure
  - Ensure definitions are current and consistent
  - Extend and standardize expiration dates
- Types of taxes that pertain
  - Business and Occupation
  - Sales and Use
  - Property and Leasehold
- Policy Mechanisms
  - SABW found that significant, stable, state-level polices and incentives are vital to the future of the aviation biofuels industry
  - The SABW recommends that the state consider adopting fuel content requirements such as a low-carbon fuel standard to drive adequate market demand. It is obvious that such policies in California have put that state at the forefront of biojet fuel production for commercial airlines



Current Challenges- No Policy Incentives in Washington State

Red Rock

Fulcrum Bioenergy

World Fuels Paramount
(aka Alt Air Fuels)

Location of Biorefinery

Distribution of SAF

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Developing Regional Stakeholder Groups

- It's a long process. Do not expect overnight success.
- Engage Boeing or other aircraft manufacturer
- Invite ASCENT Advisory Committee members (fuel producers, feedstock suppliers, OEMs)
- Solicit airline support from those in the region that are known to support alternative fuels (United, Southwest, FedEx, Jet Blue, Alaska, potentially international carriers)
- Seek State and Federal agency support-highlight rural economic development, job growth and education
  - Find champions in the agencies
- Use CAAFI as a resource (introductions in the region)
- Don't try to replicate SAFN. Do what works in your region.