

Sustainable Jet Fuels: The Pacific Northwest Experience

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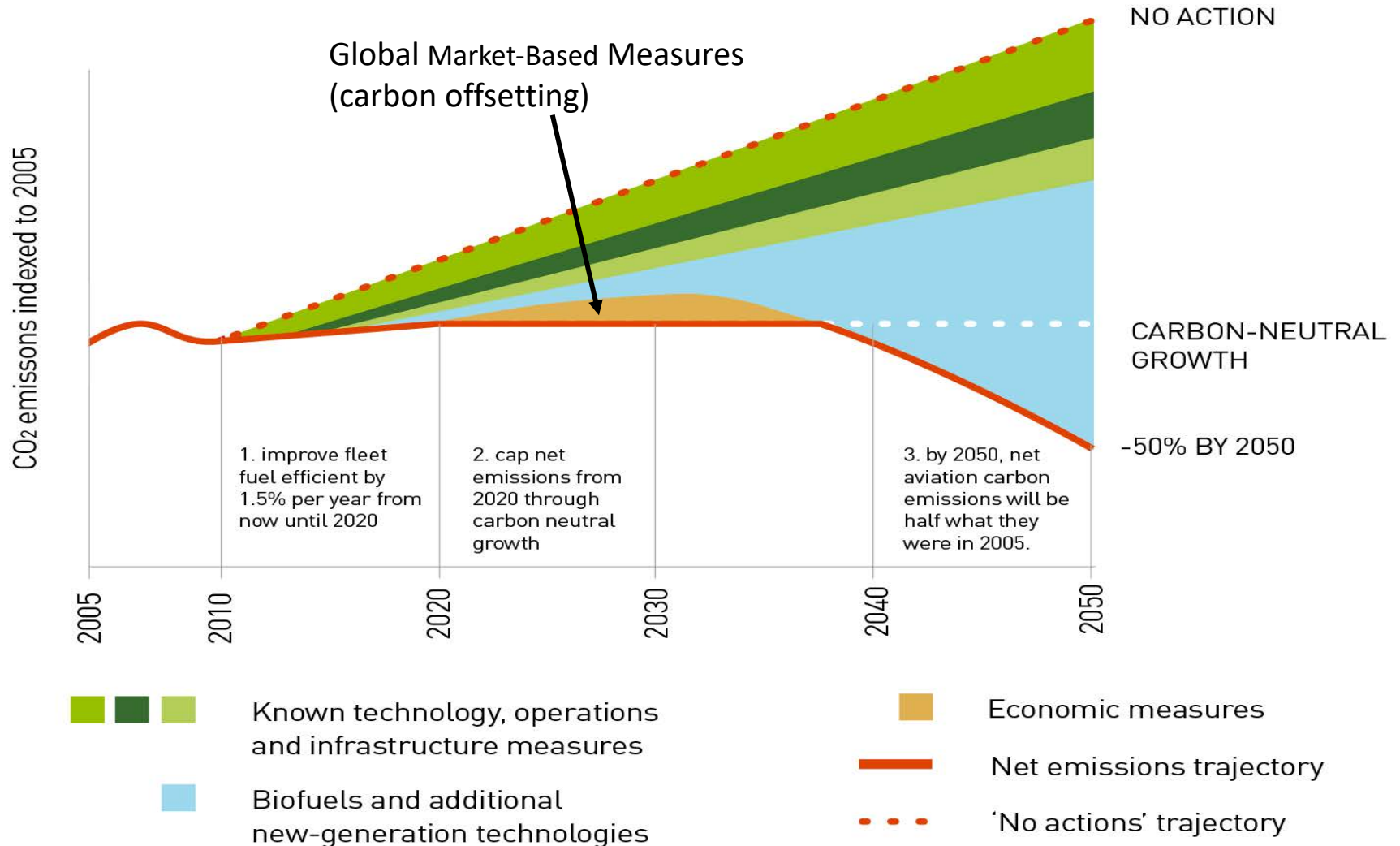
Alternative Aviation Fuels: Developing an Action Plan for the Southeast

April 25, 2019

Knoxville, TN



Aviation Industry Emission Reduction



Local to Global-Global to Local

- Feedstock issues are all local/regional
- Tools for evaluating feedstocks and conversion technologies, such as techno-economic analyses can be applied globally.

Wally Tyner, Purdue

Dept. of Ecology Biomass Inventory

- Extensive inventory of 45 potential feedstock sources in WA
- Agricultural and Industrial Biomass Waste
- Available Mass Estimates
- County Level
- Low Resolution



Biomass Inventory and Bioenergy Assessment

An Evaluation of Organic Material Resources for Bioenergy Production in Washington State

December, 2005



Publication No. 05-07-047
printed on recycled paper



Frear, C., Zhao, B., Fu, G., Richardson, M., Chen, S. and Fuchs, M., 2005. Biomass inventory and bioenergy assessment: an evaluation of organic material resources for bioenergy production in Washington State. Department of Biological Systems Engineering, Washington State University and the Solid Waste and Financial Assistance Program, Department of Ecology, publication, (05-07), p.047.

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



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 and 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

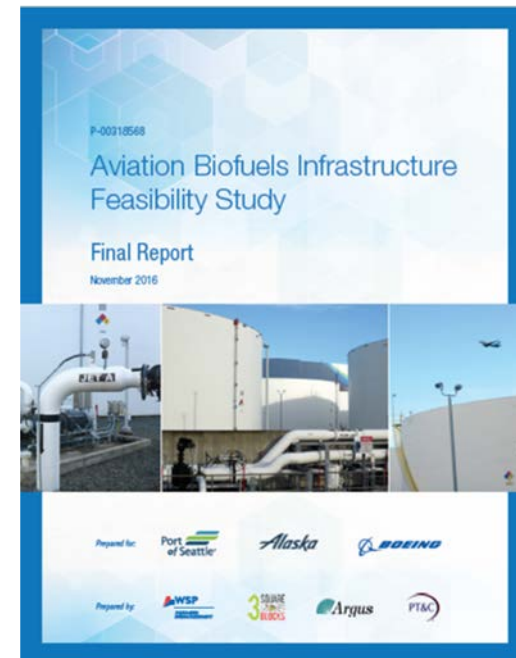
2019

- Alaska Airlines and Boeing announce future deliveries of new aircraft models will be fueled with alternative fuels



Partnerships

- 2016-Port of Seattle, Boeing and Alaska Airlines partner on infrastructure feasibility study to deliver 5mgy - 50mgy SAJF to the Seattle-Tacoma International Airport
- 2018- Port of Seattle Commissioners announce strategic goal to have 10% of all jet fuel from renewable sources by 2028



[https://www.portseattle.org/sites/default/files/201803/Aviation Biofuel Infrastructure Report C
ondensed.pdf](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

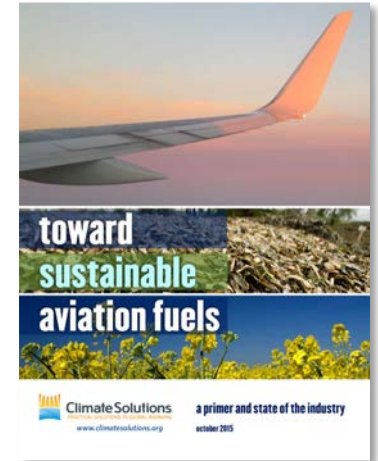
Pacific Northwest National Lab

- 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 policies 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

Developing Regional Stakeholder Groups

- It's a long process. Do not expect overnight success.
- Engage an aircraft manufacturer (Boeing, Airbus and Gulfstream are in the region)
- 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 (FedEx, jetBlue, United, Alaska, potentially international carriers)
- Include members of forestry and agricultural community
- Seek State and Federal agency/legislature support-highlight rural economic development, job growth and education
 - Find champions in the agencies and legislature
 - Policy mechanisms are essential to keep fuel in the region.
- Use CAAFI as a resource (introductions in the region)
- Don't try to replicate SAFN. Do what works in your region.

Stakeholder Group in the Southeast

- You're already ahead of the game!
 - UTK and the UT AgResearch Institute are key researchers in the FAA ASCENT Sustainable Aviation Fuel Supply Chain Analysis
 - Feedstock assessments
 - Techno-economic assessments
 - Interested fuel producers
 - LanzaTech, Velosys, REG
 - Airlines
 - FedEx, Southwest, jetBlue, General Aviation, Boeing Delivery Flights

Barrier	Southeast	WA/PNW	UK/ASCENT
Policy	X	X	X
Feedstock Supply Risk	X	X	X
Feedstock Development	X		X
Supply Chain	X	X	
Market Risks	X	X	
Distribution Infrastructure	X	X	
Requirements for Commercialization Arrangements	X		X (Fuel Requirements)
Sustainability	X	X	
Outreach & Education	X	X	
Need for TEAs	X		
Partnerships		X	