
Sustainable Aviation Fuel Opportunities for Washington



Sustainable Aviation Biofuels Work Group
November 2020 Final Report

Prepared for: The Washington State Governor and the Washington State Legislature

DISCLAIMER

This report was prepared by the Washington State University (WSU), Office of Clean Technology and the William D. Ruckelshaus Center on behalf of the Sustainable Aviation Biofuels Work Group. The information and policy recommendations contained in this report are intended to reflect the statements, opinions, and decisions of the Work Group. This information and policy recommendations do not represent the views of the universities, the Ruckelshaus Advisory Board members, or the facilitation team.

The Ruckelshaus Center's mission is to help parties involved in complex public policy challenges in the State of Washington and Pacific Northwest tap university expertise to develop collaborative, durable, and effective solutions. The Center is a joint effort of the University of Washington and Washington State University.

The WSU Office of Clean Technology's mission is to build a better future for Washington State communities through innovative research and new technology by developing advanced materials, improving air and water quality, creating sustainable building designs, developing biofuels and bioproducts, advancing small grid technologies, and advancing precision agriculture.

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I. EXECUTIVE SUMMARY

Washington State University (WSU), Office of Clean Technology, at the direction of the Washington State Legislature, convened the Sustainable Aviation Biofuels Work Group to further the development of sustainable aviation fuel (SAF) as a productive industry in the state. The work group's mandate is to provide policy recommendations that will advance technology development, production, distribution, supply chain development, and commercialization of SAF. This report is required by the 2019 Supplemental Operating Budget (ESHB 1109, §607(17)) provided in Appendix 1. Members of the work group represent airports, airlines, an aircraft manufacturer, academia, state and federal agencies, a national laboratory, public-private partnerships, SAF producers and suppliers, feedstock suppliers, petroleum industry, environmental groups, trade organizations, and members of the Legislature. Meeting attendance included other interested parties from various industries.

The COVID-19 pandemic has had an unprecedented impact on the aviation industry. Passenger volume in the United States decreased 95% year over year (YOY) in April 2020 and as of early November 2020 domestic air travel is still 60% below pre-COVID-19 numbers YOY. Passenger volume is not forecasted to recover to pre-COVID-19 levels until late 2023 or early 2024.¹ The Seattle-Tacoma International Airport (SEA) projects the same timeline for passenger load recovery. Despite the impacts of COVID-19, the global aviation industry recommitted to meeting its environmental targets at an International Air Transport Association (IATA) Board of Governors meeting in June 2020.² Likewise, in Washington, the Sustainable Aviation Biofuels Work Group remains committed to the work of furthering the development of SAF as a productive industry in Washington.

SAF is the only available near- to mid-term technology option for reducing aviation's carbon emissions. Numerous conversion pathways have been approved and there are multiple SAF production facilities in operation, under construction or planned in the United States. The work group identified ten areas of opportunity for legislative policy support to accelerate SAF development in Washington. These opportunities and supporting policy recommendations are detailed in Section III and include:

- Alignment with State Energy Strategy & Aviation's Carbon Emission Reduction Goals
- Financial Incentives
- Supply Chain-Feedstock
- Supply Chain-Fuel Distribution Infrastructure
- Permitting
- Economic Development
- Environmental Sustainability & Carbon Reduction
- Public Awareness & Understanding
- Research & Information Gathering
- Regional Coordination & Collaboration

¹ Airlines for America, <https://www.airlines.org/dataset/impact-of-covid19-data-updates/>

² IATA-International Air Transport Association Board of Governors is comprised of 25 global airlines, including U.S. passenger and cargo carriers, <https://www.iata.org/en/about/priorities/>

II. INTRODUCTION

Opportunity for Collaboration

Washington is a global leader in the aviation and aerospace sectors. Both industries make significant contributions to the economic vitality of the state and the Pacific Northwest region. Statewide, Washington's 134 public-use airports support 407,042 jobs and generate \$26.8 billion in labor income and \$107 billion in business revenues.³ Washington's aerospace industry employs 136,000 highly skilled workers and is home to 1,400 aerospace-related companies.⁴ In 2017 (latest available numbers), direct aerospace wages totaled \$3.4 billion and business revenues totaled \$66.8 billion.⁵ Aviation and aerospace consider aggressive carbon emission reduction as vital to their continued growth. Washington has a unique opportunity to support these important industry sectors in achieving their emission reduction goals by creating policies that promote production and use of sustainable aviation fuel.

Why Sustainable Aviation Fuel (SAF)?

Industry Commitments

In 2009, the global aviation industry committed to three aggressive carbon emission reduction targets: a 1.5% improvement in fuel efficiency per year until 2020; carbon neutral growth from 2020 forward; and a 50% reduction in emissions by 2050 compared to a 2005 baseline. Achieving these commitments will require integration of commercial scale volumes of SAF, the adoption of radical new aircraft technologies, improved operational efficiencies and significant infrastructure enhancements. SAF is viewed as an essential component for the industry to meet its commitments.

Seven SAF conversion technologies are approved by ASTM International (formerly American Society of Testing and Materials) and more are in the approval pipeline. SAF producers are eager to build production capacity but lack stable, long-term policies that incentivize production and that are equitable with incentives for other fuel types.

A September 2020 report published by the Air Transport Action Group indicates "the re-start of aviation is an opportunity to build back the {domestic and international} connectivity and the economic benefits air transport provides in a way that sets the industry on a course for decarbonization. The next decade will be crucial for government support of the rapid scaling up of new types of fuel so aviation can make an energy transition away from fossil fuels..."⁶

Washington Goals

Washington has set aggressive carbon emission reduction goals to reduce overall emissions to 45% below 1990 levels by 2030, 70% by 2040 and 95% by 2050 and net zero GHG emission. Meeting these goals will require adoption of new technologies throughout the energy sector. Some transportation sectors, such as cars and light duty trucks, may easily transition to electric or hydrogen power in the short-to-midterm. **Aviation is one of the most difficult sectors to decarbonize and it will require energy-dense liquid fuels for decades to come, particularly for long-haul and cargo operations.**⁸ Low-carbon sustainable aviation fuels are the only near- to mid-term option for reducing aviation's carbon emissions.

³ Washington Aviation Economic Impact Study, Washington Department of Transportation, April 2020, <https://wsdot.wa.gov/aviation/Planning/WAEconomicStudy.htm>

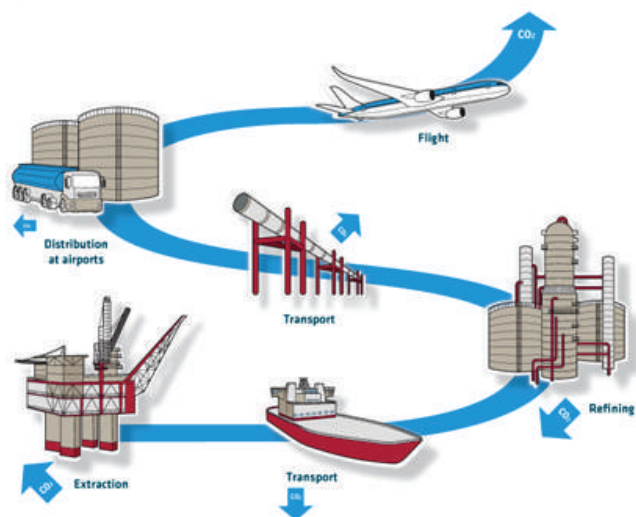
⁴ Washington Department of Commerce, www.commerce.wa.gov/news-releases/growing-the-economy/washington-delegation-soaring-at-paris-air-show-2019

⁵ Washington Aerospace Economic Impacts 2018 Update, Community Attributes, nma.choosewashingtonstate.com/wp-content/uploads/2018/12/CAI-AFA-2018-Aerospace-Update.pdf

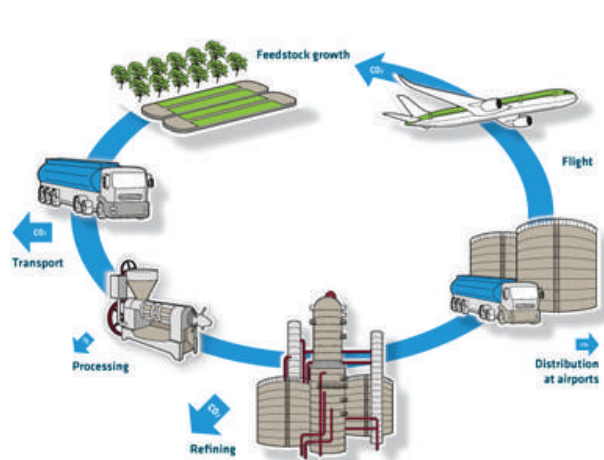
⁶ Blueprint for a Green Recovery, Air Transport Action Group, September 2020, www.atag.org/our-publications/latest-publications.html

⁷ apps.leg.wa.gov/rcw/default.aspx?cite=70A.45.020

⁸ Waypoint 2050: Balancing growth in connectivity with comprehensive global air transport response to the climate emergency, Air Transport Action Group, September 2020, https://aviationbenefits.org/media/167187/w2050_full.pdf



At each stage in the distribution chain, carbon dioxide is emitted through energy use by extraction, transport, etc.



Carbon dioxide will be reabsorbed as the next generation of biofuel feedstock is grown.

Figure 1: Lifecycle Emissions of Fossil Fuels Compared to Biofuels, Air Transport Action Group (ATAG)

SAF produced from the seven approved conversion pathways decrease emissions by 50% to 80% on a lifecycle basis. Figure 1 illustrates the lifecycle emissions of biomass-based SAF and petroleum fuel. In addition, SAF is a “drop-in” fuel that can be used in existing aircraft engines and fuel delivery and storage infrastructure systems. Washington has a deep and robust liquid fuel manufacturing and distribution history and could adapt its current capacity or build new capacity for creating sustainable aviation fuel in the state.

Washington is the fifth largest consumer of aviation fuel in the United States. SEA has been one of the fastest growing hubs for international arrivals on the West Coast in the last three years⁹ and has had jet fuel consumption grow to over 600 million gallons per year.¹⁰ In 2019, jet fuel and aviation gasoline made up 7.8% of Washington’s total carbon emissions, significantly more than the national average of 2.7%.^{11,12} Washington has volume demand for SAF and its integration into the fuel supply will help the state meets its carbon reduction goals. The Port

of Seattle signaled additional market demand by setting a goal to power every flight fueled at the Seattle-Tacoma International Airport with at least a 10% blend of SAF by 2028.¹³ Although the state has adequate demand to support a SAF production facility, it lacks the policy incentives to attract large SAF development projects.

The aviation and aerospace industries recognize that integration of electric, hydro-electric, and hydro-gen-powered aircraft into the statewide and national fleets will be important for carbon reduction in the long-term. Such new technologies and their supporting infrastructure likely will not be available at scale until 2035 and beyond. Currently, battery technology limits such aircraft to short distances with only a few passengers. Displacing conventional regional aircraft with electric aircraft will not have a significant impact in reducing aviation emissions in the state. Although there are a larger number of regional flights in the state, they burn significantly less fuel than single aisle and wide-body aircraft and, therefore, have comparatively minimal contribution to the state’s overall

⁹ The 2010s in Review, Aviation Weekly, Issue 749, Jan. 06, 2020. <https://airlineweekly.com/issues/2020/01/the-2010s-in-review-jan-6-2020/>

¹⁰ SEA personal communication, 2020

¹¹ State of Washington Department of Ecology, 2019. Washington State Greenhouse Gas Emissions Inventory: 1990-2015. <https://fortress.wa.gov/ecy/publications/documents/1802043.pdf> Accessed December 27, 2019.

¹² ICAO. 2019. U.S. Efforts to Address Aviation’s Climate Impacts. Working Paper A40-WP/531. 40th ICAO Assembly. Accessed 16 October 2019. https://www.icao.int/Meetings/a40/Documents/WP/wp_531_en.pdf

¹³ www.portseattle.org/sites/default/files/2019-05/POS_SAF_1Pgr_181009.pdf

aviation carbon emissions.¹⁴ In contrast to sustainable aviation fuels, the transition to small aircraft with new energy sources, including electricity and hydrogen, will require significant infrastructure investments for energy delivery and storage at airports. Because wide-scale adoption of these new technologies is decades off, the Legislature has the opportunity to focus on SAF policy in the near term and adopt multiple strategies to reduce aviation's emissions in the future.

Sustainable Aviation Biofuels Work Group, 2018-2020

The Sustainable Aviation Biofuels Work Group seeks to further the development of sustainable aviation as a productive industry in Washington and to provide recommendations to the Governor and appropriate committees of the Legislature. In 2018, the State Legislature reinstituted and directed Washington State University's Office of Clean Technology to convene the Sustainable Aviation Biofuels Work Group. The Office asked the William D. Ruckelshaus Center to help facilitate meetings and to support the development of consensus-based recommendations that are due by December 1, 2020.

Building on previous statewide and regional partnerships,¹⁵ the facilitation team convened the Work Group to share information and updates, identify opportunities, and develop consensus recommendations. The Work Group met in September 2018, June 2019, June 2020. Meeting minutes are provided in Appendix 2.

Work Group Decision-Making Process

At its first meeting in September 2018, all members reached consensus and adopted a Work Group Structure (see Appendix 3). That structure includes the following definition of and process for seeking consensus-based decision-making:

"The work group will practice consensus-based decision-making and operate under the following definition of consensus:

The group will have reached consensus on an issue when it agrees upon a single alternative and each participant can say:

- I believe that other participants understand my point of view;
- I believe that I understand others' point of view; and
- Whether or not I prefer this alternative, I support it because it was arrived at openly and fairly, based on good information, and it is the best decision for us at this time.

This consensus can be conveyed via thumbs up (I fully support this option), thumbs sideways (I can live with the option for the good of the group and the process), or thumbs down (I cannot live with this option). If anyone is thumbs down, the group will seek solutions that allows those thumbs to move up or sideways. If there are instances where consensus cannot be reached, the different alternatives can be presented in a succinct report.

The work group's decisions are advisory only and may inform future policy, programmatic, and administrative choices of the State of Washington. The work group itself has no other decision-making authority."

The remainder of this report will focus on the regional and national context for SAF, provide an overview of the emerging and ongoing challenges in developing a productive SAF industry, highlight opportunities to move the industry forward and the policy recommendations developed by the Work Group.

¹⁴ Graver, B., Rutherford, D., Zheng S., CO2 Emissions from Commercial Aviation: 2013, 2018 and 2019, International Council on Clean Transportation, October 2020, theicct.org/sites/default/files/publications/CO2-commercial-aviation-oct2020.pdf

¹⁵ Sustainable Aviation Fuels Northwest, www.climatesolutions.org/sites/default/files/uploads/safn_2011report.pdf; Northwest Advanced Renewables Alliance, [nararenewables.org](https://www.nararenewables.org); and Aviation Biofuels Work Group, www.climatesolutions.org/sites/default/files/uploads/pdf/aviation_biofuels_work_group_2012_update_1.pdf

III. REGIONAL AND NATIONAL CONTEXT

Washington: SAF Development

The 2012 State Energy Strategy stated that “Washington has a unique opportunity to become a hub for the production and use of sustainable biofuels for aviation – the state has a strong tradition of market innovation, a concentrated demand for sustainable aviation fuels, leading expertise and research capacity, and significant sustainable non-food biomass resources from agriculture and forest residuals.” Although not specifically mentioned in the strategy, municipal solid waste is also a large and viable feedstock in the region. The report also highlighted that, “SAF production and use has the potential to reduce dependence on foreign sources of fossil fuels, reduce greenhouse gases and foster economic growth and jobs in Washington.”¹⁶

Two renewable fuel projects, with potential SAF production capability, have been proposed since the Work Group reconvened in 2018. Both are described below.

In 2018, Green Apple Renewable Fuels, LLC, a joint venture between Renewable Energy Group (REG) and Phillips 66, proposed the construction of a renewable diesel plant adjacent to an existing Phillips 66 facility in Ferndale, Washington. The Green Apple Renewables, LLC fact sheet, provided in Appendix 4, states that the proposed plant would have had the capacity to produce 250 million gallons per year of renewable fuels using regionally-sourced and imported waste animal fat, used cooking oil, and vegetable oil feedstocks and would have created an estimated 100 family-wage jobs and 650 construction jobs. The project was cancelled in January 2020 due to concerns regarding the permitting application and review process and associated financial risk due to permitting uncertainty.¹⁷ REG and Phillips 66 worked collaboratively with Whatcom County

and the Washington Department of Ecology on potential pathways for moving the Green Apple project forward through the permitting process but ultimately the companies remained uncomfortable with the permitting uncertainties. In October 2020, REG announced that it would instead expand its existing Geismar, Louisiana renewable diesel plant by 250 million gallons per year, for a total of 340 million gallons per year of production capacity. Although the proposed Green Apple project was cancelled, REG remains committed to increasing its renewable diesel production to serve the West Coast, including Washington State. REG continues to operate its biodiesel plant in Grays Harbor and is evaluating growth opportunities at that location, including the potential for a renewable diesel plant similar to what was proposed for Green Apple.¹⁸ It is also noteworthy that after the Ferndale project was cancelled, Phillips 66 announced it was closing its refinery in Northern California and converting it to the largest renewable fuels production facility on the west coast.¹⁹

In September 2019, Northwest Advanced Bio-Fuels, LLC (NWABF) partnered with Delta Air Lines to conduct a \$2 million feasibility study on the potential for a 64 million gallon per year biorefinery using forest residuals as feedstock. NWABF is evaluating locations in the Grays Harbor area and feedstock supplies encompassing the western side of the state.

U.S. SAF Development

Figure 2, prepared by the Commercial Aviation Alternative Fuels Initiative, shows renewable fuel projects across the U.S that have potential to produce SAF. The total production capacity for projects that are operating, under construction, or planned is approximately 200 million gallons per year. Renewable fuel facilities typically produce multiple fuel types which may include various combinations of biodiesel, renewable diesel, SAF, ethanol, isobutanol or others. Table 1 presents the feedstock type used in

¹⁶ 2012 Washington State Energy Strategy, Section 3.5.3, www.commerce.wa.gov/wp-content/uploads/2016/06/Commerce-State-energy-strategy-2012.pdf

¹⁷ REG press release, Jan. 21, 2020, <https://www.regi.com/blogs/blog-details/resource-library/2020/01/21/phillips-66-and-renewable-energy-group-withdraw-renewable-diesel-project-in-washington-state>

¹⁸ Personal communication with REG.

¹⁹ www.biomassmagazine.com/articles/17275/phillips-66-to-convert-san-francisco-refinery-to-renewable-fuels

Sustainable Aviation Fuel Production Facilities

* as of July 2020

Note: The specific fraction of the total capacity dedicated to SAF will likely be based on market conditions.

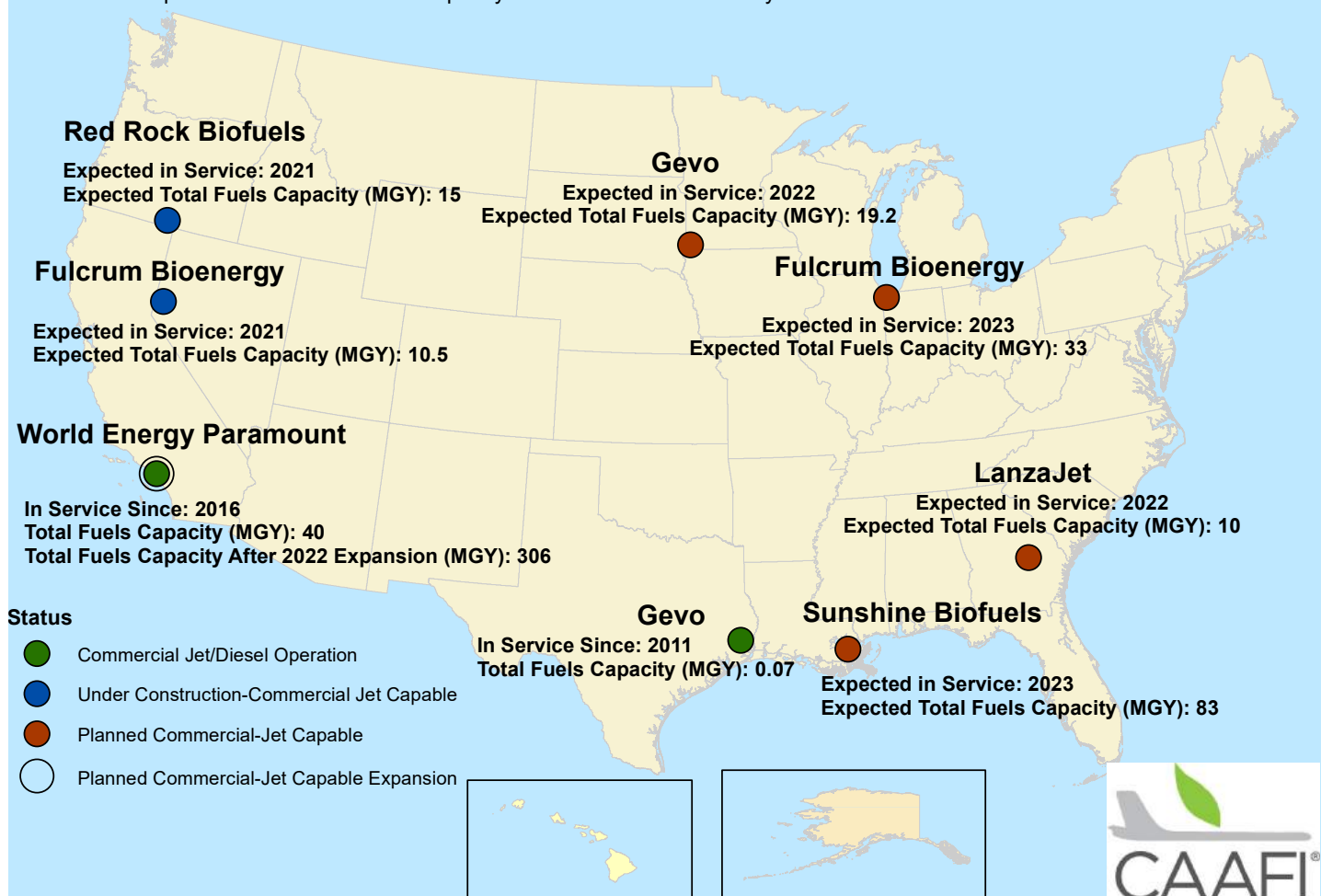


Figure 2: SAF Production Facilities in the U.S.

each of the production facilities shown in Figure 2. The fraction of SAF produced, in relation to other fuel types, will likely be based adoption of new policy incentives that create favorable market conditions for SAF. In April 2020, the Atlantic Council published, *Sustainable Aviation Fuel Policy in the United States: A Pragmatic Way Forward*, which details how SAF is at a market disadvantage compared to other transportation fuels.²⁰

Emerging & Ongoing Challenges

The COVID-19 pandemic has had an unprecedented impact on the aviation industry. Passenger volume in the United States decreased 95% year over year (YOY)

in April 2020 and, as of early November 2020, domestic air travel is still 60% below pre-COVID-19 numbers YOY. Passenger volume is not forecasted to recover to pre-COVID-19 levels until late 2023 or early 2024.¹ The Seattle-Tacoma International Airport (SEA) projects the same timeline for passenger load recovery. Despite the impacts of COVID-19, the global aviation industry recommitted to meeting its environmental targets in an International Air Transport Association (IATA) Board of Governors meeting in June 2020.² Likewise, in Washington, the Sustainable Aviation Biofuels Work Group remains committed to the work of furthering the development of SAF as a productive industry in Washington.

²⁰ www.atlanticcouncil.org/in-depth-research-reports/report/sustainable-aviation-fuel-policy-united-states/

Table 1: Feedstock type used for each operating, under construction and planned production facility

SAF Producer	Feedstock
Red Rock Biofuels	Wood derived biomass
Fulcrum BioEnergy	Municipal Solid Waste
World Energy Paramount	Waste vegetable and animal fats, oils and greases
Gevo	Isobutanol derived from sustainable corn
LanzaJet	Ethanol derived from various sources
Sunshine Biofuels	Waste vegetable and animal fats, oils and greases

Commercialization remains one of the largest hurdles to bring SAF to market. Substantial research and private investment have demonstrated that SAF is viable. Seven sustainable aviation fuel conversion pathways are now ASTM-approved and there are several more in the certification and qualification pipeline. SAF has powered 250,000 flights in numerous countries since 2008, production capacity has continued to grow since 2016, and there are forward offtake agreements between airlines and fuel producers worth over \$6.5 billion.²¹ SAF also has been continuously delivered to the fuel hydrant system at the Los Angeles International Airport since 2016 and to San Francisco International Airport since summer 2020. However, the cost of SAF in comparison to conventional aviation fuel remains a significant challenge. To move the industry forward in Washington, the Legislature needs to adopt policies that account for the value of carbon emission reductions and support long-term capital investments of several hundred million dollars.

Numerous fuel producers have indicated that Washington is an attractive location for new renewable fuel facilities because of its proximity to other states and provinces that have enacted low carbon fuel standards (LCFS) or clean fuel standards (CFS) (e.g., California, Oregon and British Columbia). These standards generate \$1-\$2 per gallon credits, depending on the fuel type, which provide significant financial value to the fuel producer or supplier.

Producers have also indicated that even if a facility is built in Washington, until a similar policy mechanism is adopted, most renewable fuel produced in Washington will continue to be shipped to other jurisdictions with favorable economic incentives.

Investors will be looking for a clear and defined roadmap through the permitting process before committing to capital investments for SAF production and delivery in Washington. Permitting should be rigorous and protective of the environment and should be a guide to building the best projects. Permitting should not be an obstacle to SAF projects which provide overall environmental and economic benefits for the state. Current permitting uncertainty around large industrial projects makes Washington less attractive for investment.

²¹ Boyd, Robert, International Air Transport Association, State of the Airlines and Sustainable Aviation Fuel Beyond COVID-19, SAFI-UAE Webinar, August 2020

IV. OPPORTUNITIES AND RECOMMENDATIONS

The Legislature’s 2019 budget proviso directed the Sustainable Aviation Biofuels Work Group to develop policy recommendations to “further the development of sustainable aviation fuel as a productive industry in Washington.” Figure 3, prepared by WSU and the Pacific Northwest National Laboratory, illustrates many of the critical components required for commercial SAF production. This section presents the opportunities identified and final policy recommendations for consideration by the Governor and appropriate committees of the Legislature.

Unless otherwise noted, the group reached consensus on recommendations as defined in the decision-making section of the Work Group Structure.

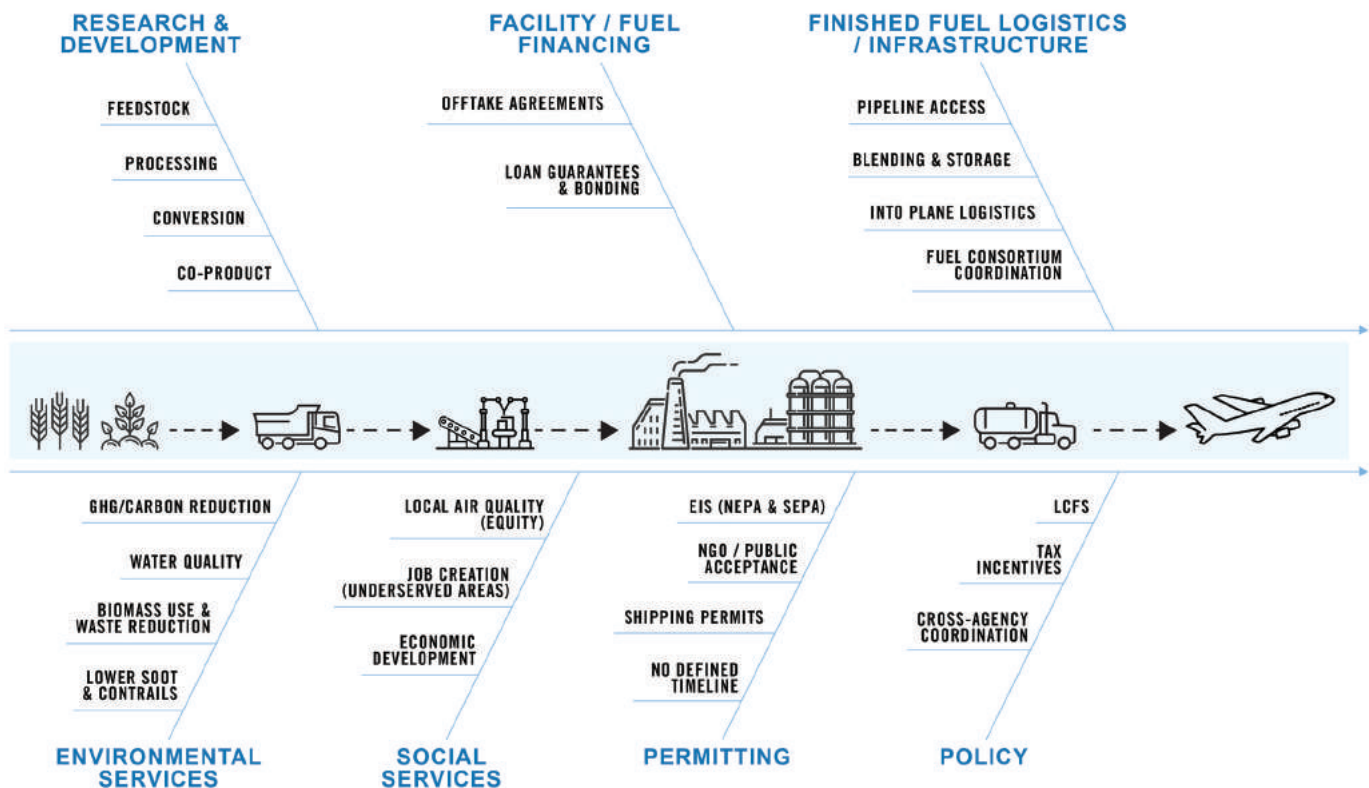


Figure 3: Illustration of complex process for converting bio-based feedstocks to SAF, WSU and PNNL.

Alignment in State Energy Strategy and Aviation's CO2 Reduction Goals

The global aviation industry has set a target of 50% reduction in global aviation carbon emissions by 2050 (compared to a 2005 baseline) and identified a multi-pillared approach for meeting that target. Although electrification of commercial flight is not expected in this timeframe, the approach does include incremental fuel efficiency improvements through modifications to existing technologies, modernization of operations and infrastructure, the gradual introduction of radical new airframe and engine technologies, and a commercial supply of SAF.

The industry's targets support Washington's carbon emission reduction goals. At the request of the Legislature and Governor, the Washington Department of Commerce convened an advisory committee and technical teams to update the State Energy Strategy (SES) to reflect state goals of climate and consumer protection and promotion of a green economy. The SES update is scheduled to be complete by December 2020. While SAF will not be a focus of the update, it will be included as an opportunity to reduce aviation's contributions to the state's total emissions.

Implementation of SES advisory committee recommendations will require federal, state, and local policy alignment and coordination to support a multi-faceted, multi-scale approach to carbon emission reduction across industry sectors, including aviation. Coordination between the Sustainable Aviation Biofuels Work Group and the State Energy Strategy team will help to ensure alignment in the policy recommendations developed by each respective entity.

Recommendation: Support policies that advance both the development and commercialization of SAF and new aircraft technologies. Efforts should focus on the early-action pathways to decarbonize the energy sector and should not prioritize any particular feedstocks, process technologies, or fuel type over others.

In the near-term, policy should focus both on development of both low carbon fuels, and supporting infrastructure, for the sectors that will continue to rely on liquid and gaseous fuels (e.g., aviation, heavy-duty trucking, marine, rail) and focus on clean electricity for sectors that can readily electrify (e.g., cars and light to medium duty trucks).

Financial Incentives

Low Carbon Fuel Standard (LCFS)

Almost all of the work group members continue to support adoption of a Low Carbon Fuel Standard (also known as a Clean Fuel Standard) as a policy tool to stabilize market volatility, attract investment, and help ensure that a portion of the SAF developed in the state is used in Washington – and not just exported to other states.

A LCFS does not prescribe specific feedstocks, conversion technologies, or type of renewable fuel production but rather places limits on the carbon intensity (CI) per unit of each fuel. This type of policy encourages the use of lower carbon fuels by obligating fossil fuel providers to gradually lower the CI of fuels provided to the market. By rewarding technologies that create the lowest cost emission reductions, LCFS-type regulations are considered technology-neutral.²² Such a policy intervention would also align Washington State with neighboring states and provinces on the West Coast.

Note: Although almost all work group members support the following recommendation, one member disagrees. Their statement is included in Appendix 5.

Recommendation: Enact a low-carbon fuel standard policy that aligns with efforts in California, Oregon and British Columbia and provides credits for SAF on an opt-in basis.

An LCFS opt-in approach is a way for a state to speed the adoption of SAF without violating federal law. The state does not set carbon intensity limits on conventional jet fuel but does provide LCFS credits (and revenues) for jet fuel that is lower than the applicable CI standard. Note that the federal government has preemption authority in certain areas, such as those involving interstate commerce. If the federal government exercises its authority, states are preempted from passing conflicting legislation. The goal is to avoid a patchwork of state laws when there is an

overriding federal law. Due to the nature of air travel, the federal government has exercised its preemption authority and the states are prevented from passing legislation.

Recommendation: Adopt a framework for determining carbon intensity (CI) scores for renewable fuel production from various feedstocks and production pathways that use already established values. The framework should allow for adjustments to the CI score if certain production steps have lower carbon emissions than the established baseline.

Bond Financing

Low carbon fuel production facilities, including those producing sustainable aviation fuels, require a capital investment of several hundred million dollars per facility. Exempt Facilities bonds offer one of the best financing tools for advanced biorefining based on waste feedstocks. Under the state's Bond Cap Allocation Program,²³ exempt facilities are initially limited to 20% of the total allocation in any given year, and any one project can only receive up to 30% of that allocation. After July 1 of each year, unspent bonding cap authority can be reallocated from one category to another, though 50% is prioritized for housing. At the end of the year, any unused cap authority can be carried forward to the next year for either housing or exempt facility projects.²⁴ In 2020, the initial bond cap allocation for exempt facilities was \$158.25 million and the maximum amount an individual project could receive was \$47.97 million.

Modifications to exempt facility allocations could allow bond financing to become a more viable mechanism for financing new SAF facilities. Increasing the total amount of funds allocated to the program on a federal level, increasing individual project limitations under the state exempt facility allocation, and allowing for multi-year allocations would help project developers secure sufficient outside capital investment. Such changes to the bonding program would make Washington an attractive location for investment in new or repurposed facilities.

²² Sustainable Aviation Fuel Policy in the United States: A Pragmatic Way Forward, Atlantic Council, April 2020, atlanticcouncil.org/wp-content/uploads/2020/04/AC_SAF_0420_v8.pdf

²³ Washington Department of Commerce, Bond Cap Allocation Program, www.commerce.wa.gov/about-us/research-services/bond-cap-allocation-program

²⁴ app.leg.wa.gov/RCW/default.aspx?cite=39.86&full=true

Exempt Facilities bonds have been used successfully to promote the construction of new, environmentally beneficial projects in the state. For example, in 2017, the Washington Economic Development Finance Authority (WEDFA) issued \$133.6 million in Exempt Facilities bonds to Columbia Pulp, LLC, a greenfield pulp mill located in Dayton, Washington. The project has substantial environmental benefits, including pulp produced from renewable non-wood fibers such as wheat and alfalfa straw, which are waste products in the region and are typically burned or tilled. Compared to traditional kraft pulp processes, the mill requires substantially less energy, generates far fewer emissions, and uses a much more environmentally benign chemical mix to breakdown the fibers. WEDFA worked with Columbia Pulp and its investment bank to structure the bonds as a tax-exempt eligible issuance using the solid waste exemption.²⁵

Recommendation: Increase the initial bond cap allocation limit in RCW 39.86.120 for Exempt Facilities to 28%. Consider increasing the individual project limit under the Exempt Facility bond cap allocation from 30% to 50% for projects that support key state strategies such as decarbonization and clean energy. Allow for multiple-year allocations under the bond cap allocation for Exempt Facilities bonds.

Tax Incentives

Tax incentives can reduce risks and attract investment in all parts of the aviation biofuels supply chain. Appropriate incentives should have parity with other sectors and provide short-term assistance with the expectation that the industry will be self-sustaining after it is more established. A tax incentive environment that encourages capital investment in aviation biofuels should encourage all biofuel production pathways, create synergies with biochemical co-products, not restrict benefits to specific feedstocks, incorporate storage and blending infrastructure, and ensure bioenergy definitions are current and consistent.

Between 2003 and 2007, the Legislature adopted a number of tax incentives targeting the production of specific biofuels and feedstocks, and associated distribution and retail infrastructure. These incentives

supported the initial establishment of biodiesel refineries in the state but preceded the commercial development of more advanced biorefining technologies targeting the aviation biofuels market and they had little impact during the subsequent economic downturn. Nearly all of these incentives have now expired.

Recommendation: Reinstate a comprehensive suite of tax incentives for biofuels produced from non-fossil feedstocks. Given the rapid evolution of biorefining and other low-carbon fuel technologies, these incentives should not be limited by specifying type of feedstocks or products. Associated definitions of biofuels and feedstocks, elsewhere in state code, should also be reinstated or updated as necessary to ensure an effective incentive program.

²⁵ Goldman Sachs Investment Banking Division, Columbia Pulp Project Information Sheet and www.seattletimes.com/business/new-mill-will-turn-e-washington-wheat-straw-from-waste-to-resource/

Supply Chain- Feedstock

Washington has an abundance of feedstocks that can be converted to sustainable aviation fuels including municipal solid waste, forest residuals, wood mill residues, agricultural waste, purpose-grown crops, and other resources. While recognizing that renewable feedstocks are a global commodity, the competitive sourcing of SAF from Washington could create economic growth and investment in sectors producing the feedstocks. The development of these feedstocks often affords additional environmental benefits as well, such as improved water quality and quantity, enhanced soil health, reduced smoke exposure from prescribed burning, and waste reduction.

Recommendation: Incentivize the use of residual feedstocks, including municipal solid waste, forest and wood mill residuals, and agricultural wastes for liquid renewable fuel production. This mechanism could be similar to the USDA Biomass Crop Assistance Program.

Recommendation: Develop policy to recognize and monetize the environmental and social services that result from utilizing various feedstocks.

Recommendation: Direct Washington State University, or other public institution, to conduct a comprehensive study on potential feedstock cover crops that could fit into surrounding geographic crop rotations and support SAF development.²⁶

Supply Chain- Fuel Transportation Infrastructure

When evaluating SAF projects, investors consider both the viability of a proposed production facility and the ability to transport fuel from the facility to airports. Stand-alone SAF facilities tend to be located close to feedstock supplies and at a distance from fuel distribution infrastructure such as pipelines, deep water ports or rail lines. This creates an infrastructure challenge for the “last mile” of fuel delivery. An additional challenge is that, per fuel specifications, pure (known as neat) SAF is required to be blended with traditional fossil jet before it is supplied to an airport, which may require additional tankage, piping, etc. Capital investments will be required to build new blending facilities or upgrade existing facilities to accommodate blending. The Port of Seattle’s Aviation Biofuels Infrastructure Feasibility Study from 2016 summarizes various infrastructure investments necessary to supply SAF to SEA.²⁷

Recommendation: Develop tax incentives that encourage capital investment in sustainable fuel infrastructure projects.

Recommendation: Consider development of sustainable fuel infrastructure as part of transportation infrastructure funding packages.

²⁶ USDA Biomass Crop Assistance Program, www.fsa.usda.gov/FSA/webapp?area=home&subject=agri&topic=bcap

²⁷ www.portseattle.org/sites/default/files/2018-03/Aviation_Biofuel_Infrastructure_Report_Condensed.pdf

Permitting

As noted in the Washington SAF Development and Ongoing Challenges, Sections III (a) and (c) above, the lack of certainty or defined timelines for obtaining necessary permits to construct and operate a commercial scale SAF facility detract from capital investment in the state. Permitting was added to the work group's list of opportunities for policy change in the June 2020 meeting. Concern regarding permitting was identified after REG and Phillips 66 withdrew the permit application for the Green Apple Renewable facility in Ferndale, WA in January 2020. The work group has determined that further evaluation is necessary before meaningful recommendations on regulatory language can be provided. Due to the complex nature of permitting, the group wants to ensure that additional key stakeholders are engaged to further define beneficial recommendations that do not have the unintended consequence of adding uncertainty and cost to the permitting process.

Recommendation: Continue the Sustainable Aviation Biofuels Work Group for the next biennium and form a subcommittee of agency representatives, SAF fuel producers, and community groups to identify and mitigate the challenges to facilitate new SAF production opportunities in the state.

Economic Development

As noted in the introduction, aviation is a powerful economic engine in the state, contributing billions of dollars and tens of thousands of jobs to the economy. The development of a productive SAF industry will support growth in the aviation sector and opportunities for SAF-related jobs and economic development, especially in rural areas.

In 2017, the Northwest Advanced Renewables Alliance, led by WSU, published a case study on the economic benefits of building a wood waste biorefinery in Longview, Washington. The study found a biorefinery would have projected revenues of \$327 million and would add jobs in many different regions of western Washington and Oregon. The study estimated the facility would add 10,000 construction jobs over three years and 2,170 permanent jobs related to the operation of biorefinery and the needs of biorefinery employees, their families, and suppliers.²⁸

Another example of regional benefits is provided in an economic analysis for the recently proposed Fulcrum BioEnergy renewable fuel facility in Gary, Indiana. It is anticipated the proposed facility will bring \$600 million in capital investment, 900 construction jobs, and over 160 permanent jobs to the region. It will have a production capacity of 33 million gallons per year and will divert 700,000 tons of municipal solid waste from area landfills.²⁹

Recommendation: Support current and ongoing efforts to facilitate community partnerships and increase public awareness of the economic development opportunities provided by SAF production projects.

Recommendation: Develop policies and educational programs that incentivize workforce development in the SAF industry, from feedstock supply to finished fuels, especially in rural and agricultural communities.

²⁸ Wood to Wing, Northwest Advanced Renewables Alliance, 2017, research.wsulibs.wsu.edu:8443/xmlui/bitstream/handle/2376/12179/WoodToWing_Economics_2.pdf

²⁹ <http://fulcrum-bioenergy.com/wp-content/uploads/2018/12/2018-12-13-Fulcrum-Centerpoint-Announcement-FINAL.pdf>

Environmental Sustainability & Carbon Reduction

It is imperative that all SAF projects meet recognized sustainability criteria and demonstrate meaningful carbon reduction, on a lifecycle basis, when compared to petroleum fuels. SAF fuel producers are aware that they must meet sustainability criteria and typically work with credible third-party verification bodies to ensure conformance.

The FAA, through its Center of Excellence for Alternative Jet Fuel and Environment (ASCENT), has conducted extensive lifecycle analyses (LCAs) and documented carbon reductions for numerous feedstocks and conversion pathways. These LCAs have informed FAA decision-making and its positions in the International Civil Aviation Organization (ICAO)'s Committee on Environmental Protection (CAEP) forum. In addition, the LCAs will be used in determining how SAF emission reductions are credited for compliance with the Carbon Offsetting and Reduction Scheme for International Aviation. ICAO CAEP has also established a Sustainability Certification Schemes Task Group to develop international environmental, social and economic sustainability criteria for SAF.

Recommendation: In any rulemaking regarding carbon reduction and environmental sustainability criteria for SAF, the state should adopt already accepted domestic and international lifecycle emission reduction values. Adoption of any state-specific values that deviate from national or international values may make Washington a less desirable location for SAF investment.

Public Awareness & Understanding

Advancing the SAF industry will require common understanding and increased awareness across all stakeholders – governmental entities, agencies, local communities, businesses, nonprofits, and other interested entities and individuals – about the challenges of reducing carbon emissions in the aviation sector. A first step is articulation of the aviation industry's commitment to reducing emissions and the essential role that SAF plays in meeting those commitments. Stakeholder education regarding the environmental and economic benefits of SAF, from feedstock supply to distribution of finished fuel, is essential. Benefits include job creation, funding for schools, productive use of waste products, reduced forest fire risk, reduced fuel source volatility, increased public health and safety, and environmental sustainability, in addition to carbon emission reduction.

Recommendation: Continue to support the Sustainable Aviation Biofuels Work Group and expand its mandate to serve as a neutral forum for exchanging information and building understanding of sustainable aviation fuel. Create a formal mechanism for the Work Group to disseminate information through university outreach programs.

Recommendation: Support development of a dedicated, robust website that highlights the work of the Sustainable Aviation Biofuels Work Group, provides educational resources on SAF for Washington stakeholders, and serves as a central location to direct interested parties.

Research & Information Gathering

Significant resources have been invested in SAF research on both the regional and national level. Work Group members have conducted studies on feedstock availability, techno-economic analyses of different feedstock conversion technologies, and SAF fuel infrastructure needs. However, many Work Group members noted that data gaps remain, notably in regard to the full range of effective SAF financing and policy mechanisms. They also noted the need for disseminating lessons learned from research and policy efforts in other regions and how these might apply at the state and local level in Washington, and the need to coordinate existing and future research efforts to avoid duplication.

Recommendation: Support policies and programs that disseminate information and/or coordinate research efforts.

In the 2021 biennial operating budget, the Legislature could provide matching funds to researchers in the academic sectors. This could expand regional research efforts by WSU in the FAA Center of Excellence for Alternative Jet Fuel and the Environment (ASCENT), the Bioproducts, Sciences and Engineering Laboratory, and the SAF work of the Bioproducts Institute, co-directed by WSU and the Pacific Northwest National Lab.

Recommendation: Support and invest in efforts that identify research, demonstration and pilot project priorities, foster research into effective financing and policy mechanisms, connect researchers and potential partners, and increase awareness of funding opportunities.

Regional Coordination & Collaboration

Continuation of Sustainable Aviation Biofuels Work Group

Renewable fuel, including SAF, is a value proposition for a diverse group of regional stakeholders, including commercial aviation, business aviation, aviation equipment manufacturers, shipping, renewable fuel producers, military, forestry, agriculture, transportation and infrastructure systems (pipelines, rail, etc.), corporate partners, and local governments. There is an ongoing need to incentivize and foster relationships with new potential partners. With support and direction from the Legislature, the Office of Clean Energy at WSU could continue to convene the Work Group and provide a forum for exchanging information, building relationships, and disseminating technical information.

Recommendation: Continue the Sustainable Aviation Biofuels Work Group through the next biennium. The Work Group has grown from 15-20 participants to about 50 active participants. Broader participation keeps more people informed, maintains synergy and relationships, and provides formal processes for exchanging information and developing public/private partnerships.

Recommendation: Direct the Work Group to inform Washington's federal congressional delegation about the need to support and align federal and state policies that promote SAF development in the state.

Coordination among Clean Fuels Work Groups and Commissions

Decarbonizing the aviation industry is difficult and will require multiple efforts with many partners. Several statewide clean energy and clean fuel forums, including this Work Group, are focusing on aviation decarbonization strategies. These include:

*2021 State Energy Strategy*³⁰ is being prepared by the Washington Department of Commerce, in partnership with an advisory committee and technical teams, to support the state's goals of climate and consumer protection and promotion of a green economy. The strategy is scheduled to be completed by December 2020.

*Commercial Aviation Coordination Commission (CACC)*³¹ is focused on accommodating commercial aviation growth (passenger and cargo) in the state with a focus on the Puget Sound area. The Legislature specifically directed the CACC to develop recommendations by January 2022 to meet critical aviation system capacity needs, identify new primary commercial aviation facilities and explore other ways to accommodate capacity needs. CACC is convened by the Washington Department of Transportation Aviation Division, which has reached out to the SABWG facilitation team about partnership opportunities and to exchange information.

*Electric Aircraft Work Group*³² was convened by Washington Department of Transportation Aviation Division at the request of the Legislature. This work group explored "the electric aircraft industry and how electric aircraft technology could be used to expand regional air transportation in the state of Washington."

Recommendation: Align the efforts of multi-disciplinary work groups and advisory committees in order to develop consistent and unified policy recommendations that support pathways toward a lower carbon footprint for aviation. Clearly defined roles, responsibilities, and processes for sharing information will be essential to avoid duplication, efficiently use time and resources, and coordinate diverse efforts with common goals.

³⁰ www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy

³¹ wsdot.wa.gov/aviation/commission

³² wsdot.wa.gov/sites/default/files/2019/07/15/ElectricAircraftWorkingGroupReport-June2019.pdf

APPENDIX 1 - EXCERPT FROM 2019 SUPPLEMENTAL OPERATING BUDGET

(14) General fund—state appropriations in this section are reduced to reflect a reduction in state-supported tuition waivers for graduate students. When reducing tuition waivers, the university will not change its practices and procedures for providing eligible veterans with tuition waivers.

(15) \$1,119,000 of the general fund—state appropriation for fiscal year 2020 and \$1,154,000 of the general fund—state appropriation for fiscal year 2021 are provided solely for implementation of chapter 36, Laws of 2017 3rd sp. sess. (renewable energy, tax incentives).

(16) \$500,000 of the general fund—state appropriation for fiscal year 2020 and \$500,000 of the general fund—state appropriation for fiscal year 2021 are provided solely for the joint center for deployment and research in earth abundant materials.

(17) \$20,000 of the general fund—state appropriation for fiscal year 2020 and \$20,000 of the general fund—state appropriation for fiscal year 2021 are provided solely for the office of clean technology at Washington State University to convene a sustainable aviation biofuels work group to further the development of sustainable aviation fuel as a productive industry in Washington. The work group must include members from the legislature and sectors involved in sustainable aviation biofuels research, development, production, and utilization. The work group must provide recommendations to the governor and the appropriate committees of the legislature by December 1, 2020.

(18) \$113,000 of the general fund—state appropriation for fiscal year 2020 and \$60,000 of the general fund—state appropriation for fiscal year 2021 are provided solely for implementation of Engrossed Second Substitute House Bill No. 1517 (domestic violence). If the bill is not enacted by June 30, 2019, the amounts provided in this subsection shall lapse.

(19) \$100,000 of the general fund—state appropriation for fiscal year 2020 and \$75,000 of the general fund—state appropriation for fiscal year 2021 is provided solely for the William D. Ruckelshaus center to partner with the University of Washington and the Washington State University to provide staff support and facilitation services to the task force established in section 9 of this act.

(20) \$264,000 of the general fund—state appropriation for fiscal year 2021 is provided solely for implementation of Second Substitute

APPENDIX 2 - WORK GROUP MEETING SUMMARIES

Sustainable Aviation Biofuels Work Group

September 17, 2018
Seattle-Tacoma International Airport Conference
Center Meeting Summary

Attendees:

- | | | |
|--|--|---------------------------------------|
| • Andy Billig, WA Senate | • Chris Cassidy, USDA | • Dan Siemann, WA DNR |
| • Mark Schoesler, WA Senate | • Lance Lyttle, Port of Seattle | • MaryCatherine McAleer, Weyerhaeuser |
| • Mark Hargrove, WA House of Representatives | • Stephanie Meyn, SeaTac | • Johnway Gao, International Paper |
| • Vandana Slatter, WA House of Representatives | • Elizabeth Leavitt, Port of Seattle | • Candace Kessel, BP |
| • Carol Sim, WSU | • Kent Hartwig, REG | • Morgan John, King County |
| • Michael Wolcott, WSU | • Bill Clarke, REG | • Brian Young, WA Dept. of Commerce |
| • Molly Stenovec, Ruckelshaus Center | • Elsa Brown, Legislative Assistant | • Ross Macfarlane, Climate Solutions |
| • Ralph Cavalieri, WSU | • Noelle Connolly, Legislative Assistant | • Joe Ellsworth, Boeing |
| • Alex Pietsch, WSU | • Marianne Csaky, Alaska Airlines | |
| • Chris Mulick, WSU | • Dean Williams, Alaska Airlines | |
| • John Hollady, PNNL | • Scott Richards, National Biodiesel Board | |
| • Rick Gustafson, UW | • Bart Lynam, ReNuFuel | |
| • Steve Csonka, CAAFI | | |

Phone:

- Sarah Richardson, Hawaiian Airlines
- Sigurdur Hardarson, Iceland Air Group

Welcome & Introductions

Senator Andy Billig welcomed participants and provided a brief overview of the formation of the work group. Lance Lyttle, Managing Director of Aviation at the Port of Seattle, welcomed attendees to the Port of Seattle, briefly discussed the Port's sustainable alternative jet fuel goals and the synergy between the Port's goals and the work group.

Actions

- Approved the proposed work group structure and discussion and decision-making ground rules
 - Nominated and confirmed Senator Billig to serve as work group Chairperson
-

Guiding Values/Goals and Anticipated Outcomes

Participants shared their perspectives and ideal outcomes for the group, which include:

- Achieve more than low-carbon fuel standards.
- Bring in members of the public to build broader community understanding regarding the importance of biofuels and hurdles the region faces in developing a productive biofuels industry.
- Advance the biofuel work done in the state in a unified voice and harness the collective energy of so many different stakeholders.
- Seize the opportunity to lead and take advantage of economic development opportunities, especially around clean technology. Be the world leader both in producing and using clean jet fuel.
- Identify incentives for supply chain and feedstock.
- Understand the value proposition beyond low greenhouse gas (GHG) fuel.
- Clarify the value of aviation biofuels across sectors, particularly environmental.
- Leverage the military's interest in renewable aviation fuel and the large military presence in the State.
- Ensure adequate outreach and education to communicate the industry's needs for alternative fuels and address public perception around "biofuels".

Review of Work & Recommendations by Previous Work Group (2012-2016)

Ralph Cavalieri, WSU (retired), coordinator of the prior Sustainable Aviation Biofuels Work Group, provided an overview of the work group milestones and challenges, as well as previous policy recommendations and current status, which are outlined below (refer to presentation, *Cavalieri-Historical SABWG Recommendations*)

Recommendations

- Aligning state tax policies to support development of aviation biofuel, reduce risk and increase investment
 - Encourage all production pathways, create synergies with bioproducts, do not restrict to certain feedstocks, incorporate storage and blending infrastructure, extend and standardize expiration dates
 - Types of taxes (business and occupation, sales)
- Stabilizing demand for aviation biofuels in Washington by creating a
 - Renewable fuel standard, or
 - Clean fuel standard
- Supporting the research and development to build the aviation biofuels industry
 - University led consortia (NARA and AHB); PNNL/BSEL
 - FAA Center of Excellence for Alternative Aviation Fuel and Environment (ASCENT) co-directed by WSU- state provides some of the matching funds
 - Green Chemistry Lab - Green Energy Institute at UW
- Clarifying policy framework for aviation biofuels
 - Preferential purchasing policies to meet offtake markets
 - Solid waste policy document (biofuel resource)
- Creating public-private partnerships
 - Enable attractive financing

- Exempt facility bonds
- Industrial revenue bonds (\$10 m)
- SHB 2422 in 2012 issue bonds for aviation biofuels facilities

The Sustainable Aviation Biofuel Work Group facilitated discussion among the various interested parties in Washington and found that **significant, stable, state-level policies and incentives are vital to the future of the aviation biofuels industry.**

Current State: Supply Chain & Fuel Production Challenges and Opportunities Unique to Washington

Steve Csonka, Executive Director, Commercial Aviation Alternative Fuels Initiative (CAAFI), provided an overview of the sustainable aviation jet fuel industry, with a focus on Washington. Three key areas were discussed: progress to-date, challenges and the path forward. A summary is provided below. Refer to Csonka presentation for specifics.

Progress

- **Commercialization activity is expanding**
 - U.S. airline engagement continues to be strong with key fuel development entities resulting in numerous off-take agreements
 - Other stakeholder convening activities - **fuel suppliers** are looking for new business opportunities, **refiners** are interested in maintaining markets while meeting policy obligations for renewable fuels, **NGOs** are attempting to assist in demand aggregation, **airports** (SFO, TX all following suit of SeaTac) are starting to evaluate infrastructure needs, **feedstock development** and flight demonstrations continue to whet investor interest, **SAJF producers** continue to explore development pathways.
 - Market drivers- Airlines have made commitments through the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to decouple carbon growth from business growth (i.e., increased passenger and cargo operations)
 - With risk on global warming, the international aviation industry **self-committed** to emission improvements. Commitments were made through the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA)
 - 3 goals (see slides for details)
 - 1.5% / year efficiency gain from 2010-2020
 - Carbon neutral growth from 2020
 - Achieve 50% reduction in emissions by 2050 compared to a 2005 baseline. Reductions will be achieved through a basket of measures including operational improvements and technology advancements such as alternative fuels
 - **A commercial supply of SAJF is critical for the industry to meet its 2050 goal**
 - Airline specific goals:
 - United Airlines has adopted CORSIA commitments as corporate goals and are working to reduce their own emissions by half by 2050

- FedEx has adopted a goal to obtain 30% jet fuel from alternative sources by 2030
- **Sustainable Alternative Jet Fuels (SAJF) are becoming increasingly technically viable**
 - ASTM is the alternative jet fuel certification/qualification body
 - There are 5 approved conversion pathways with many more at various stages in the certification/qualification pipeline
 - The approval process is expensive and lengthy. Work is being done to streamline the process.
- A full range of activities are underway to bring down the cost, reduce risk, incentivize production, and develop feedstocks;
- Journey to scale has commenced-in production, in construction, in final design, in conceptualization. Some concepts will be readily replicable may be able to leverage refineries.

Challenges

- **Although SAJF are technically viable, impediments continue to be cost delta and the lack of policy framework**
- Low-priced petroleum
- Having to stand-up a new industrial sectors simultaneously
- Capital's aversion to risk and low reward exacerbated by uncertainties due to changing state of technology, players, etc.
- Fragmented policy creates an uneven playing field

Path Forward

- Consistent long-term policy
- Cost reduction
- Integrated project development

USDA: Role, Updates, Progress, Projects, & the Farm Bill

Chris Cassidy, National Renewable Energy Advisor, US Department of Agriculture, provided an update and overview of the USDA Rural Business-Cooperative Services program activities and the Bioeconomy Roadmap, including programs to support aviation biofuels. The goals of the program are to: do right and feed everyone; increase economic opportunity and improve quality of life; innovation, partnerships and infrastructure.

Technology strategy is in public-private partnerships and buying down the risk in scaling and construction. Challenges include: preprocessing technologies; feedstock delivery systems; performance guarantees; and equity. USDA offers loan guarantees – credit enhancement, grants, and payment programs to support public-private partnerships in aviation biofuels and rural development.

Note that Mr. Cassidy's presentation included two tables on projects that USDA has funded including the project name, location, feedstock type, conversion technology, final product (diesel, jet, etc.) and funding amounts. Due to the small font size, this information has been deleted from the attached copy of Mr. Cassidy's presentation. This information is available upon request.

Port of Seattle Sustainable Aviation Fuel Goals – Alignment with Work Group Goals

Stephanie Meyn, Climate Protection Program Manager at the Seattle Tacoma International Airport (SeaTac), provided an overview of SeaTac and Port of Seattle strategies and opportunities for collaboration and alignment with the goals of the work group. Key strategies include:

- Airline-Airport Cooperative Model: developing a memorandum of understanding among an airport, airlines, and other parties to aggregate funds and/or demand. This approach is similar to agreements in the Netherlands and elsewhere in Europe. Similar models are challenging in the U.S. due to federal restrictions on how airport revenues are spent.
- Policy Support: the Port supports policy instruments similar to California's low carbon fuel standard that would help build a SAF market in Washington. Washington is currently at a competitive disadvantage because most renewable fuels are being sold in California or other locations with effective policy instruments.
- Approval for SAF co-benefit: SeaTac is assembling research and hopes to petition FAA to use federal funds for the purchase of SAF. Preliminary data show that the use of 10% SAF would reduce emissions equivalent to the reductions the airport has achieved through installation of pre-conditioned air (PCA) units. PCA units qualify for federal funding targeted toward airport emission reduction.
- Education & Advocacy: the Port views community support for production facilities as critical as political support. The Port is working to help communities understand the benefits biofuels facilities by developing education materials.

Renewable Energy Group Industries

Kent Hartwig, Renewable Energy Group (REG) Industries, provided an overview of REG and its renewable fuel production in the U.S., with a focus on Washington.

REG views logistics and market potential to expand renewable jet (RJ) facilities in Washington. It owns one facility in the state with potential to build others. **Washington is viewed as a favorable location due to favorable logistics to and from LCFS markets in other states and other countries, not because of market demand for fuel.**

Current federal and state policies do not support renewable jet economics because:

- Renewable jet generates less RIN value than renewable diesel due to lower energy density
- Renewable jet does not currently qualify in LCFS markets
 - When renewable jet does qualify under LCFS it will have a lower carbon index versus ultra-low sulfur diesel (ULSD) and will generate a lower LCFS value
- Renewable diesel sells at a premium to ULSD in California and Jet Fuel sells at a discount
- Supply chain costs are significantly higher for renewable jet blending and certification

Break- Out Session Discussion: Priority Issues and Opportunities

During this session, attendees began to identify priority issues and opportunities through small group discussions. Group discussions were captured on sticky notes and are summarized below. Comments were similar between the groups and have been consolidated for brevity. Each group considered

whether a subgroup should be formed to advance a goal/priority and may have recommended subgroup participants. Note that many of the issues identified are the subject of on-going work through various research groups and other entities. Prior to the next work group meeting the Chair and WSU conveners will identify where existing policy and/or research aligns with subgroup recommendations and highlight areas where new policy or research may be appropriate.

Priority Issue/Opportunity:	Markets & Economics: Producing sustainable aviation jet fuel that is economically viable and product is price competitive
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Need policy to provide industry stability for 15-20 years • Develop legislation and incentives to support the retrofit of existing manufacturing facilities to biorefineries • Determine actual consumer demand and market value of biojet • Incentives to lower the cost of SAJF that balance the risk/cost across all partners or method/incentives to cost-parity with traditional jet • Property tax incentives for SAJF • State & local incentives to promote economic development of sustainable aviation fuels industry • What is the role for government? If government funds are invested, what is the return on investment? • Determine who bears the cost of policy incentives and how the cost influences the consumer. • Define the non-carbon benefits. • Can the industry be viable without government policy mechanisms? • Highlight markets and opportunities for co-product development and use in-state (more generally, assist with market development)
Recommended subgroup participants	SAF users, producers

Priority Issue/Opportunity:	Financing: Infrastructure, supply chain
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Funding for facilities • Infrastructure development • Feedstock priority options • Do not repeat the mistakes of the past in renewables • Define supply chain

Priority Issue/Opportunity:	Economic Development & Environmental Sustainability
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Leading state voice on long-term stable policy to put SAJF on equal footing with current alternatives in the state in order to meet state sustainability goals

	<ul style="list-style-type: none"> • Agriculture/rural community development, economic development and job growth • Incentives for “grown here, produced here, and used here” (policy) • WA state should capture the economic benefits of aviation biofuel production (Made in WA) • WA state should benefit from the environmental and public health benefits of aviation biofuel (used in WA) • Need: policy advocacy from key groups/companies • Create a biojet refinery in Washington state and have the product used here in our state • Production facility in Washington supplying to airports in this state using regional feedstocks to the max • Ensuring fuel is sustainable (lower carbon lifecycle) • Plan, build, & incentivize workforce development pathways
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Priority Issue/Opportunity:	Partnerships
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Partnership incentives for state/port/federal/private • Involve military (National Guard?) as partners in future strategy • Support/build public-private partnerships

Priority Issue/Opportunity:	Public Awareness & Support
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Develop a campaign for public acceptance of local processing plants. Increase PR/marketing awareness • Public communication/education on the benefits of sustainable aviation fuels • Communicate multiple benefits of SAJF: use of waste product; funding for schools (constitution); reduced forest fire risk; increased public health and safety • Consumer demand locally • Public acceptance of higher cost of biojet fuel • Wider support and understanding for SAJF across public, politicians, feedstock, industry
Recommended subgroup participants:	Work group, forest2market, Port of Seattle, universities, legislature/elected officials, fuel producers, airlines, environmental groups

Priority Issue/Opportunity:	Research
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Approach toward R&D • Understand new models for what the industry would look like (SeaTac) • Make State a demonstration platform for new technology and ideas

	<ul style="list-style-type: none"> • Define R&D needed for industry • Study: Feedstock co-products – costs offset? • Funding: state government match fund for Federal + private sector + university • Research funding for targeted biofuel projects that could benefit in Washington state • Who else has done this research? (not just in WA)
Recommended subgroup participants	Rick Gufteson @ UW, WSU, BESL, PNNL, USDA, community colleges

Priority Issue/Opportunity:	Policy & Strategic Approach
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Policy credits like California that are of sufficient stability and duration • “Level” or advantaged position • Rewards target behavior • Acknowledge/rewards other environmental services/benefits • Must address cost changes – what are they? • Flexibility in a policy framework to allow multiple co-products and pathways for the industry to develop • Consistent policy focusing on renewable fuel where WA has competitive advantage • Focus on aviation fuels v. policy around universe of carbon intensity (e.g., On-road LCFS) • Identify lessons learned in developing SAFJ and addressing impediments from around US and the world • Develop awareness of infrastructure needs for multiple pathways for reducing carbon in transportation system (for upcoming 20-40 years)
Who:	Associations, legislature, department of commerce, work group, environmental groups, feed & fuel producers, Federal – especially Chris Cassidy & Rick Gufteson, elected beyond WA, industry groups

Priority Issue/Opportunity:	Supply-Chain/Technical
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Review/update SAFN report on impediments, feedstock, & infrastructure • Explore using municipal solid waste (MSW) as feedstock • Feasibility of lighocellulosics – stable product? • Feedstock supply: geographic location; seasonal availability; capable of meeting existing targets • Make WA forest health and timber residuals (wood slash) viable as a feedstock
Recommended subgroup participants	Airports, Railroads, Weyerhaeuser, Boeing, military, Alaska Air, Paramount, REG, canola/wheat growers – farmers, greenwood resources, BP / Fulcrum

Priority Issue/Opportunity:	Fuel Efficiency /Carbon
Sub-tasks/questions to address:	<ul style="list-style-type: none"> • Feedstock(s) to supply ≥ 80 MMGY goals for WA • Mature (or almost) technologies to readily use feedstocks for renewable biojet fuel precursors and final mature or almost ready biojet conversion technologies for precursors to fuel • Reduce emissions • Pass low carbon fuel standard (LCFS) or Clean Fuels Standard (CFS) policy and include sustainable aviation biofuels as opt-in • Aviation priority for sustainable fuels • Recognition of clean air co-benefits • What are the benefits of this effort besides carbon emission reduction?

Sustainable Aviation Biofuels Work Group

June 11, 2019

Seattle-Tacoma International Airport Conference Center

Meeting Summary

Attendees:

- Eleanor Bastion, WEC
Climate & Energy
Policy Manager
- Angela Becker-
Dippman, PNNL
- Senator Andy Billig,
WA Senate
- Mark Bourdeau, Delta
- Kristin Brandt, WSU
- Elsa Brown, Legislative
Assistant to
Representative Slatter
- Chris Cassidy, USDA
- Amira Chowyuk Port
of Seattle
- Marianne Csaky,
Alaska Airlines
- Steve Csonka,
CAAFI
- Kim Cushing WA
State Senate,
House Environment
and Energy
Committee
- Corinne Drennan,
PNNL
- Joanna Ekrem, WA
Department of
Ecology
- Neville Fernandes,
Neste
- Representative Joe
Fitzgibbon, WA
State House
- Johnway Gao,
International Paper
- Nate Green, REG
- Kent Hartwig, REG
Corporate Affairs
and Policy
- Daniel Himebaugh,
Senior Staff Counsel,
Senate Republican
Caucus
- John Holladay, PNNL
- Scott Holub,
Weyerhaeuser
- Morgan John, King
County Solid Waste
- Glenn Johnston,
Agrisoma
- Michael Kern, WSU,
Ruckelshaus Center
- Jacob Lipson, Research
Analyst, House
Environment and
Energy Committee
- Ross MacFarlane,
Climate Solutions,
Retired
- Stephanie Meyn, Port of
Seattle
- Peter Moulton, WA
Department of
Commerce
- Chris Mulick, WSU,
Director of Government
Relations
- Rob Myrben, Alaska
Airlines
- Jesse Nikkel, National
Biodiesel Board
Representative
- John Plaza, Membrion
- Benji Rinehart, WSU,
Ruckelshaus Center
- Dan Siemann, Department
of Natural Resources
- Carol Sim, WSU
- Representative Vandana
Slatter, WA State House
- Ryan Tomasich, Boeing,
Government Affairs
- Lana van Marter, Neste
- Dustin Watson, WA
Department of Ecology
- Chris Whitworth, U.S.
Advance Bio-Fuels
- Michael Wolcott, WSU
- Brian Young, WA
Department of Commerce
- Tim Zenk, Molecule

Welcome & Introductions

Carol Sim welcomed people into the space and provided some basic information regarding administrative items, then she invited Senator Andy Billig to speak. Senator Billig encouraged attendees to briefly introduce themselves to the group, and then delved into a brief background of the Sustainable Aviation Biofuels Workgroup (SABW). Carol reviewed the agenda, noted the Port of Seattle's goal for 10% sustainable fuel usage by 2028, and reminded the group of their due date for a report to the legislature: December 1st 2020.

New Legislation and Funding Impacting Aviation Biofuels

Brian Young presented on behalf of Peter Moulton, discussing a handful of bills in the State Legislature including:

- HB 1109 Budget Proviso (passed)
 - SABW deadline moved from December 1, 2019 to December 1, 2020 with a \$40,000 budget
 - ASCENT match funding of one million dollars for WSU
 - Biorefinery Feasibility Study of \$300,000 for UW
 - Poplar-based cellulosic biorefinery at TransAlta
 - Green Economy Work Group \$150,000 for the WA Department of Commerce
 - Recommendations for investment opportunities, preliminary report due December, 1 2019, final June 30th 2020.
 - Carbon Inventory and Sequestrations:
 - Inventory of carbon stocks conducted by the WA Department of Natural Resources (DNR): flux, trends, emissions, and sequestration, including wood products, wildfire emissions, land management, etc.
 - Sustainable Farms and Field
 - Industrial Symbiosis
 - How to utilize waste: water and heat from on facility to power another
- SB 5116 Clean Electricity Bill (passed)
 - No power generated by coal by 2026
 - Become greenhouse gas emission neutral by 2030
 - No power generated from fossil fuels by 2045
 - Major tax exemptions for green energy equipment and machinery sales through 2030.
 - Sales and use tax exemptions of 50+% on alternative energy depending on labor and procurement standards
- Clean Fuel Standards (not passed)
- ZEV Standards (not passed)
- Carbon Tax (not passed)
- Cap and Trade (not passed)
- Sustainable Farms and Fields (not passed)
- Industrial Symbiosis (not passed)

Airline Panel

Marianne Csasky Alaska Airlines, **Jesse Nickel** Southwest Airlines, and **Mark Bourdeau** Delta, SeaTac Fuel Consortium Chair all provided an overview of airline perspectives on sustainable aviation biofuels, and the challenges to implementing the use thereof on a large scale.

Questions and Answers

- Carol: How do individual airlines feel about sustainable alternative fuels and what are their strategies to integrate them?
 - Jesse (Southwest):
 - Southwest signed an agreement with Redrock Biofuels in 2014. Southwest anticipates receiving fuel in the first quarter of 2020. Fuel will be produced in Lakeview, Oregon and distributed to the California bay area.
 - Southwest's priority is to minimize emissions by employing new aircraft technologies and more efficient operational procedures. Biofuels support emission reduction goals.
 - Southwest's goal is to support the aviation industry goal of 50% reduction of CO2 emissions by 2050, compared to a 2005 baseline (as per the IATA agreement)
 - Marianne (Alaska):
 - Alaska also supports the industry's goal of 50% reduction of CO2 emissions by 2050, compared to a 2005 baseline (as per the IATA agreement)
 - Alaska is looking for ways to use alternative jet fuels for aircraft deliveries and has signed an agreement with Boeing for delivery flights.
 - Mark (Delta):
 - Delta also supports the industry goal emission reduction goals. Delta will use the full basket of measures [*technology advancements, operational efficiencies and alternative fuels*] to achieve emission reductions.
 - The fuel consortium manages fuel on-site at SeaTac including the infrastructure to facilitate fueling. The consortium does *not* purchase or sell fuels, that business is conducted by airlines.
 - The logistical transportation of costs of sustainable aviation fuels must be considered when increasing use of these fuels. Efficiency and cost are important to the consortium and duplication of any activity (e.g., fuel blending) adds costs and reduces efficiency.
 - Blending of fuels locally at airport facilities on site is not a viable option in terms of logistical practicality and safety.
 - Carol: How does your airline prioritize airports when considering use of alternative fuels? Does the SeaTac memorandum of understanding (MOU) impact your strategy or decision-making?
 - Marianne: Fuel should be sourced as geographically close to the airport as possible.
 - Capacity and infrastructure for processing alternative fuels is not strong enough to accommodate rapid conversion to alternative fuels.
 - The airline industry operates on razor-thin profit margins; alternative fuels can only be integrated if they are market competitive.
 - Jesse: Fuel allocation is based on cheapest/most efficient shipping route.
 - Public perception and marketing sometimes justify sending fuels in a less efficient way if it generates more overall profits.
-

- Southwest did not sign the SeaTac MOU, due to short-term market uncertainty, and a lack of faith in the practicality of reaching 10% sustainable fuels by 2028. Southwest has also not done test flights with sustainable fuels.
- Carol: How much is 10% in terms of gallons?
 - Mark: About 61 million gallons currently.
- Carol: How are sustainable biofuels delivered at large scale?
 - Mark: Pipelines are the most efficient, and nearly 100% of all SeaTac fuels are currently delivered via pipeline.
 - We don't want more trucks on the road, which would add more emissions.
- Mike Wolcott: Why is blending fuels on site at the airport not viable?
 - Mark: Because of safety concerns. Blending should be done upstream (in terms of pipeline flow), where it's away from the airport itself.
- Senator Billig: Would a Low Carbon Fuel Standard (LCFS) passed by the State Legislature help with achieving that 10% by 2028?
 - Ken Hartwig: Yes
 - Marianne: It helps, but sustainable fuels production **nationwide** is not yet producing enough fuel to meet SeaTac's 10% goal.
 - Senator Billig: What help is needed to make the goal realistic?
 - Neville Fernandes: Very few renewables would be realistic: they run about \$100 a barrel, whereas crude oil is \$60 a barrel. And even if the renewables were realistic, the incentive structure would funnel them to northern California, without a similar policy mechanism in Washington.
 - Mike Wolcott: How much time would be needed to reach the 10% mark, if appropriate legislation was passed?
 - Peter Moulton: It's impossible to know for certain, a best estimate would be 3-5 years.
 - Mike Wolcott: Pioneer plants often have 5-10-year gestation periods: long term sustainable biofuels infrastructure takes time to build.
- Carol: To what extent does the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) affect airlines decisions?
 - Marianne: Alaska is on track to meet CORSIA requirements. CORSIA works well because of its market-based approach.
 - Jesse: Southwest does not purchase carbon offsets yet, and only about 3% of its flights are international. However, Southwest does plan to grow internationally, and plans to meet its CORSIA offset obligation using alternative fuels. If sustainable fuels become more market competitive, Southwest would use more of them.
- Carol: What are the challenges of updating fuel infrastructure and who pays for it?
 - Mark: Financing is a matter of individual contracts between individual airlines and fuel suppliers. Blending of fuel upstream is most efficient. Blending on sight is time, resource, and logistics costly.
 - Jesse: Logistics and pricing
- Carol: What policies drive the industry forward?
 - Marianne: The opt-in nature of LCFS is critical because only the federal government can pass mandates, and opt-in measures ensure that transitions are done safely.
 - Jesse: Existing regulations make it easier to get carbon credits for non-aviation

sustainable fuels. The nature of jet fuel makes it more difficult to take advantage of existing incentives.

- Representative Slatter: In terms of forecasting, how was the 10% by 2028 number decided upon, and how have fuel needs changed since that number was decided?
 - Marianne: We don't know how the number was determined. When drafted, 10% in 2028 was projected to be about 770 million gallons; now 10% in 2028 is projected to be about 1.6 billion gallons
 - Jesse: 10% by 2028 is just the first threshold of the MOU.
 - Amira Chowyuk: the thresholds increase over time to 25% by 2035 and 50% by 2050.
- Brian Young: Price parity matters, but is there any internal study of publicity and externalities of carbon usage?
 - Jesse: Southwest does not do that
 - Marianne: Alaska does do that, but it is very hard to put a cost to those issues
 - Steve: That is a complex thing to do, and personal bias enters into it: those who are most concerned with climate change attach the highest dollar cost to carbon.
 - Brian: Do companies invest any effort into this because carbon costs are, in actuality, higher than what the market shows right now?
 - Jesse: Those things are discussed
 - Marianne: Alaska's director of sustainability is looking into it, but profit margins are razor thin, it is hard to put a cost on carbon.
 - Steve: Very few businesses have "X dollars per ton of carbon" cost, it is too complex an issue and the impact of announcing such a number would be vast and immediate on the market.
- Eleanor Bastion: Are there carbon intensity improvements outside of feedstock biofuels?
 - Jesse: The transportation cost of where crude oil comes from factors into that: the further a petroleum fuel has to be shipped, the higher its carbon intensity.
 - Steve: More efficiently produced petroleum fuels. Petroleum fuels could be considered CORSIA eligible fuels, if they meet the thresholds for carbon/emission reduction on a lifecycle basis.
- Representative Slatter: Do incentives or mandates work better?
 - Jesse: Incentives. Federal regulations are so strict that states cannot levy many regulations.
 - Marianne: Only the federal government can pass mandates on the airline industry. Federal regulations are so strict already, that there is little that state governments can actually do.

Feedstock Options/Availability

Morgan John, Project Manager King County solid waste, **Dan Siemann**, Washington Dept. of Natural Resources, and **Glenn Johnston** from Agrisoma all gave presentations on sources of sustainable biofuels

Presentations

- Morgan John, King County, Municipal Solid Waste (MSW) Division: *Solid Waste and Aviation Fuel*
 - King County MSW handles ~900k tons of MSW a year
 - King County has one active landfill at Cedar Hills, near Maple Valley. The landfill has a methane capture facility, which refines the landfill gas to pipeline quality gas. The landfill will close when it reaches capacity within 20 years.

- There are also 10 waste transfer stations and nine closed landfills in the County
 - King County is has conducted an updated waste characterization study that is currently being reviewed by cities within the county. The report will be published in early 2020. The most recent study was completed in 2015.
 - King County is reviewing disposal recommendations, to determine how best to handle waste. Preliminary results are either ship it out or turn it into fuels.
 - “Diversion and Recovery Technologies” to reduce and divert waste are being tracked.
 - As a public agency, the county must go through the evaluation processes to determine the best options available. Allocation of resources from King County MSW takes time.
- Dan Siemann, WA Department of Natural Resources (DNR): *Woody Biomass: A Renewable Green Fuel Source*
 - DNR manages forests and other natural resources; DNR engages in forest health and geological surveys.
 - Biofuels offer an opportunity to put the waste from forest management practices to a profitable use, which helps fund forest health maintenance.
 - Wildfires:
 - Wildfires are a huge problem. Wildfire smoke made Puget Sound the worst air quality in the world for a couple days in 2018.
 - In 2018, 40% of wildfires started on the western half of the state.
 - This uptick in wildfires is massive and very recent. The number of fires has tripled in under 5 years.
 - Preventing wildfires, means preemptively removing a lot of tress from high wildfire risk areas and creating a well-spaced and resilient forest, as opposed to stressed, dense forests.
 - The small diameter trees in those dense forests are not market-valuable for lumber, but are for biofuel.
 - Proximity to market (treatment plant and consumer) and overall distance to haul at all stages of the process is critical in determining market viability.
 - DNR created a biomass calculator. 1.5 million bone dry tons (BDT) of biomass is available, AFTER forestry harvest, every year.
 - Small diameter wood BDTs have previously been sold at very low prices to Port Townsend pulp and paper, until 2016 when they converted from wood fuels to gas.
 - The 1.5 million BDT translates to 66 million gallons of jet biofuel based on NARA research.
 - NARA research shows little to no impact on soil creation/productivity.
 - *research conducted on this at long-term sites in Oregon.
 - Triple bottom line: The benefits of removing small diameter wood in high risk wildfire areas include:
 - Ecological- Improves forest health
 - Economic- Increases revenue for the state school construction
 - Governmental- Supports state stewardship of public lands.
 - Carol: how do people buy this wood?
 - Dan: DNR has a draft template supply agreement; DNR is ready for business.
 - Amira: how does mixed feedstock supply affect biofuel production?
 - Mike Wolcott: it depends. For thermal conversion, there is probably little impact. For sugar conversion, there is a high impact, and the mixed feedstock likely slows the process.

- Glenn Johnston, Agrisoma: *Carinata-The Future of Advanced Biofuel Feedstocks*
 - Carinata is an oil seed (mustard seed) similar to canola/rapeseed but has a non-food oil component. Oils (i.e., lipids) are closer to hydrocarbons than other chemicals, which makes them desirable as feedstocks for renewable fuels.
 - Carinata is currently grown as a cover crop that compliments the growing cycle of other plants, so farm land can produce more frequently.
 - The size, shape, and characteristics of Carinata naturally align well with existing farm equipment used for canola and rapeseed (e.g., planters, harvesters, etc). The infrastructure for Carinata is the same as that already widely used, so farmers do not have to purchase new equipment.
 - The same applies for the crushing and separation infrastructure required for converting seeds into meal and oil.
 - Carinata flowers at a time in the season when most crops don't, which helps bees.
 - Facts:
 - The plant is about six feet tall at maturity, making it an effective carbon sink.
 - Seeds are very small and when harvested, leave behind a lot of biomass, which helps control moisture level on farms, and creates a carbon sink
 - Carinata has major root networks, which get left underground at harvest and form a gradually-increasing carbon sink in low to no till operations.
 - Meal is safe in animal feed at an enclosure rate of up to 10%

Questions and Answers for the Feedstock Panel

- John Plaza: Can MSW tipping fees subsidize biofuel production?
 - Morgan: Tipping costs \$140 a ton, between 40 and 60 dollars of that is for landfill cost of operation. If the waste does not go to the landfill, it impedes ability to charge tipping fees. Using tipping fees to subsidize biofuel production is a tentative possibility.
- John Holladay: Are both the oil and meal of Carinata seeds marketable?
 - Glenn: Most oilseeds are grown for the meal, not the oil, but both are marketable.
- Scott Holub: What role does DNR play in promoting feedstock production?
 - Dan: DNR manages land to promote health in Washington's natural resources, as well as honoring a fiduciary responsibility to DNR trust beneficiaries. There is an interest in promoting feedstock production, continuing to lease land to farmers, and promoting feedstock and oilseed production.
- John Holladay: five percent of MSW is animal feces? How much methane is produced and captured?
 - Morgan: Yes five percent is animal waste and cat litter. About 90% of the methane produced is captured. The 10% loss occurs during the transfer of the waste before it is placed in the landfill unit.
- Representative Slatter: MSW and Carinata are predictable, is small diameter wood predictable and long-term as well?
 - Dan: Biomass calculator gives a very precise and accurate number.
 - Michael Wolcott: Most small diameter wood comes from private lands, which respond to market incentives, which makes it predictable based on industry trends.

Renewable Fuel Producers

Neville Fernandes from Neste, **Chris Whitworth** the General Manager at U.S. Advanced Bio-Fuels, and **Steve Csonka** the Executive Director for CAAFI all gave presentations.

Presentations

- Neville Fernandes, Neste: *Decarbonizing Aviation-The Role of Policy*
 - Overview of Neste's business and renewable fuel refining capacity in their facilities in Finland, Singapore, and Rotterdam. Refer to slides for details.
 - Neville called for extensive support for public policy and stakeholders to expand usage of renewable jet fuel
 - Incentives around the world include:
 - US Federal Government
 - Renewable fuel standard
 - Blenders tax credit
 - California
 - Requires carbon intensity reductions in gasoline and diesel, jet fuel not required, but can still benefit from the carbon credits it generates.
 - *in six years, 10% jump in utilization of sustainable fuels due to incentives.
 - Current credit under LCFS is about one dollar per gallon.
 - California is a four billion dollar market.
 - Norway
 - Mandated that 0.5% of the national jet fuel supply be will be comprised renewable jet fuels in 2020 with an increase to 30% by 2030.
 - Finland/Sweden
 - Proposed mandate expected to pass.
 - UK
 - Mandates and incentives for different aspects of aviation industry's carbon footprint. There is currently an incentive of 20 pence/liter for use of renewable jet.
 - Netherlands
 - Mandates for other petroleum fuel sectors, incentives to jet fuels. Dutch Climate Agreement prioritizes the use of sustainable biomass for fuels in heavy road transportation aviation and shipping.
 - Washington State
 - Incentive bill (Clean Fuels Programs) in State Legislature. Passed House, died in Senate committee.
 - Private and public aspects of this industry across the board support the bill.
- Chris Whitworth: US Advanced Bio-Fuels provided a general overview of the company's intent to build a sustainable aviation fuel facility in Hoquiam, Washington.
 - They are working with an EPC firm that has been around for over 100 years, and has operations worldwide.

- Woody biomass is the intended feedstock, coupled with Fischer-tropsch conversion technology.
- Feedstock will be sourced from Port Angeles and points south along the coast.
- The Facility is currently in phase 1. It is anticipated that:
 - Permitting process takes four months
 - The feedstock study takes eight months
 - Construction will take three to four years; anticipate production in 2023-2025.
 - When operational, the company hopes to produce 60 million gallon a year, assuming full supply of adequate feedstock.
- The facility will produce sustainable aviation fuels. US Advanced Bio-Fuels signed an offtake agreement with a “one of the largest airlines in the world” for 100% of the fuel produced.
- Senator Billig: What is the site built on?
 - Chris: The facility will be built on what is basically an empty plot, with a single building. Not previously a refinery.
- Senator Billig: About six or seven years ago, the State Legislature passed a bill to designate biorefineries as “buildings of statewide significance.” Has this helped?
 - Chris: US Advanced Bio-Fuels is too early on in the permitting process to say for certain, but presumably yes.
- Representative Slatter: What proportion of the fuel produced is going to each region?
 - Chris: Our airline partner will dictate where the fuel is used, but it looks like 75% to California and 25% reserved for Washington.
- Steve Csonka: CAAFI
 - Background:
 - CAAFI is a 13-year private-public partnership between the Federal Government and Private Industries.
 - CAAFI acts as an industry advocate, mostly behind the scenes.
 - CAAFI supports the aviation industries goal to reduce emissions by 50% by 2050, compared to a 2005 baseline. A readily-available commercial supply of sustainable aviation fuel is key to achieving these goals.
 - Business aviation (BizAv) worldwide consumes two percent of jet fuel, seven percent in the US.
 - BizAv has made the same emission reduction commitments as commercial aviation, although BizAv is sometimes left out of aviation fuels conversations. The General Aviation Manufacturers Association (GAMA) has stepped up engagement with various association to have a larger voice at the table in SAF policy making.
 - The GAMA Environment Committee drafted and published “Business Aviation Guide to the Use of Sustainable Aviation Fuel.
 - The BizAv industry is typically less price-sensitive than commercial aviation BizAv fuel is typically bought from a fixed-base operator (FBO), and the price is already higher than what commercial airlines are paying.
 - BizAv is a small percentage of aviation, but uses a significant amount of fuel- upwards of 10 million gallons a year.
 - Gulfstream has been conducting certification flights at its facility in Savannah, Georgia, with fuel produced at World Energy Paramount in Los Angeles. Gulfstream will start taking fuel

at its completion/delivery center in Long Beach, CA and has customer commitments for use of SAF.

- Sustainable fuels producers need offtakes from users, to ensure the debt of the facility gets covered.
- GAMA service providers may buy the entire production suite of renewable fuel from a production facility (SAF, propane, naphtha, etc.), and market the products they won't use. The key benefit for the producer is that suppliers may take entire production slate, then handle all logistics, enabling the producer to focus on execution.
- Several SAF events have been held at BizAv airports to increase exposure- Van Nuys, CA: Farnborough, UK; Geneva, SW

Questions and Answers for Renewable Fuel Panel

(note-Chris Whitworth did not participate in the Q & A)

- Ross MacFarlane: are there situations where policy puts sustainable fuel on par with petroleum fuel?
 - Neville: There are two cases: The Renewable Energy Directive (RED) 2 in the European Union has a carbon credit multiplier for sustainable aviation biofuels. Also, in the UK renewable jet fuel is considered developmental and gets four times the renewable energy credits, making it market competitive.
 - Steve: Cap and Trade in California favors biodiesel over sustainable aviation biofuels.
- Senator Billig: What were the reactions from various airlines to the strong mandates in Nordic countries?
 - Neville: Airlines already want to decarbonize. Airlines comply with mandates, but it is a part of a larger discussion. In Sweden there exists a culture of "flight shaming" people because of the large carbon footprint of flying.
 - Marianne: Not all airlines like mandates because of the excessive taxation they bring, and mandates run counter to CORSIA's market approach. CORSIA was agreed upon by all countries to be the one policy-based market mechanism to reduce emissions. The intent was to avoid a patchwork of different policy mechanisms across the globe.
- Carol: Does CAAFI engage in dialogue with PNW BizAv?
 - Steve: Yes, but the focus is not in Washington, but in northern California, where most of the biofuels are expected to be allocated.
- Mike Wolcott: CORSIA is an international agreement. Are European nations also pursuing mandate in concurrence with the Paris Climate Accord?
 - Neville: Yes, mostly through domestic measures to meet Paris Accord requirements.
 - Marianne: Airlines in Europe are usually international and already subject to the European Emission Trading Scheme (EU ETS) constraints.
 - Steve: CAAFI's recommendation needs to be measured, since we are a neutral party. Mandates can be a part of that, but it is important to recognize how much mandates can shake up and harm an industry.
 - Carol: In the United States, mandates can only be established by the federal government.
- Carol: What is happening in British Columbia?
 - Neville: Canada has LCFS credits, but they do not apply to aviation biofuels. An amendment to fix that has been added to current legislation.

- Representative Slatter: How can states effectively work with the federal government to be more green?
 - Neville: It has to be opt-in at the state level.
 - Glenn: CORSIA is a big tool for a lot of people
- Brian: Washington has open pathways with maritime blue work for an MOU to set up biofuels as the backup provider of power, if there is a disruption to the electrical grid.

Structured Facilitated Discussion

Michael Kern, the Director of the Ruckelshaus Center, led the group through a facilitated discussion surrounding the work group's objectives/opportunities, key leveraging options, and recommendations.

The group workshopped some fine tuning of language in the existing recommendation document. Elements discussed during this section of the meeting include the following:

- Opportunity- Promote rural economic development
 - It was agreed to remove the word "rural" from the Opportunity column, and have it be considered under key leveraging actions that promote economic development.
 - Developing sustainable fuels is not solely about mitigating climate change, it also helps combat oil price volatility, and promotes rural job opportunity.
- Opportunity-Increased collaboration, coordination and public private partnerships:
 - The military is not an effective partner under an administration that is only concerned with cost of fuel, not climate change. Consider addition of business aviation, OEMs and existing fuel suppliers.
 - Co-processing (using renewable and fossil fuels in the same process) is an avenue forward. There was a robust conversation regarding co-processing, and it was agreed that further discussion/consideration needs to occur before including as a potential for collaboration.
- Opportunity- Increase public awareness and understanding of SAJF
 - The general public does not understand how jet fuel is produced, shipped, and used. However, we still need to educate the general public on the needs for and benefits of sustainable fuel. For instance, while buses can be electrified, planes cannot, hence the need for liquid sustainable aviation fuels
 - Targeted education to the appropriate audience. There needs to be a broader education in general to the public. Legislature needs education. Some environmental groups oppose SAJF.
 - Add key leveraging action, "Awareness to commercial aviation fuels and context to commercial aviation and how it works." Also, awareness is needed regarding commercial aviation's commitments. We're beyond GHG and climate change.
- Opportunity- Advance production of sustainable aviation jet fuel that is economically viable and price competitive.
 - Agreed to change first key leveraging action to include existing refineries.
 - Agreed to remove "property tax incentive" from key leveraging actions, because it is already included in the first bullet point regarding supportive legislation.
 - Current sustainable fuel incentives push fuel to vehicles on roads, not jets in the air.

- Opportunity- Provide needed research and information
 - Millions of dollars have already been spent on sustainable aviation fuels research, although that research is largely not specific to Washington state. Any additional research should not be duplicative of existing work. The work group needs to better articulate what this opportunity means.
 - Specify that “provide research” also includes dissemination of existing research.
- Opportunity-Help meet Washington’s goals for environmental sustainability and carbon reduction.
 - Connect Washington’s goals and public awareness.
 - Establish policy that prioritizes production and use of SAF.
 - Add increase understanding of and incentives for monetizing environmental services.

Wrap up

Carol Sim mentioned the need to come to the next meeting with specific ideas for recommendations, so that the work group can remain on track to meet the deadline for recommendation to the state legislature on December 1st 2020.

Sustainable Aviation Biofuels Work Group

June 8, 2020

Meeting Notes

Participants

Academia

Ruckelshaus Center

Michael Kern

Molly Stenovec

University of Washington

Rick Gufstason

Washington State University

Kristin Brandt - Researcher

Chris Mulick - State Government Relations

Alex Pietsch - Corporate Relations

Carol Sim - Work Group Facilitator & Assistant Director of ASCENT

Michael Wolcott - Associate VP of Research & Regents Professor

Agencies

Department of Commerce - Peter Moulton & Brian Young

Department of Ecology - Dustin Watson, Joanna Ekrem

Department of Natural Resources - Dan Siemann

King County Solid Waste Division - Morgan John

US Department of Agriculture - Chris Cassidy

Aircraft Manufacturer

Boeing Commercial Airplanes - Joe Ellsworth & Dale Smith

Airlines

Alaska Airlines - Marianne Csaky

Delta Air Lines - Keith Taylor

Southwest Airlines - Jesse Nikkel

United Airlines - Aaron Robinson

Airports

Port of Seattle - Seattle Tacoma International Airport - Stephanie Meyn

Paine Field Fuel FBO - Dean Williams

Environmental/NGOs

Climate Solutions - Leah Missik

Clean Energy Transition Institute - Ross Macfarlane, Board Member

Potential Feedstock Suppliers

International Paper - Johnway Gao

Nuseed - Glenn Johnston

Weyerhaeuser - MaryCatherine McAleer

Fuel Producers/Suppliers

BP - Jennifer Dell & Tom Wolf

Neste - Lana Van Marter & Neville Fernandes

Northwest Advanced Bio-Fuels - Chris Whitworth

Renewable Energy Group (REG) - Bill Clarke, Kent Hartwig & Nate Green

SkyNRG - Darrin Morgan

Legislature

Elected Officials

House Representative - Joe Fitzgibbon, 34th District

House Representative - Vandana Slatter, 48th District

Senator - Andy Billig, 3rd District, Work Group Chair

Senator - Liz Lovelett, 40th District

Staff

House Environment & Energy Committee - Jacob Lipson, Research Analyst

Senate Republican Caucus - Daniel Himebaugh, Senior Attorney

Senate Environment, Energy & Technology Committee - Kim Cushing, Senior Staff
Coordinator/Counsel

Legislative Assistant to Senator Liz Lovelett, Jordan Kronan

National Laboratories

Pacific Northwest National Laboratory- John Holladay

Public-Private Partnerships

Commercial Aviation Alternative Fuels Initiative (CAAFI) - Steve Csonka

Trade Organizations

Low Carbon Fuels Coalition - Graham Noyes

National Biodiesel Board - Scott Richards

Other Interested Parties

Entrepreneur - John Plaza

Microsoft - Julia Fidler

Molecule - Tim Zenk

Perkins Coie - John Pierce

Note that ten participants joined the virtual zoom meeting by phone and were not identifiable.

Welcome & Overview of Virtual Meeting

Carol Sim welcomed everyone to the virtual meeting room and provided an overview of the agenda.

Work Group Chair, Senator Andy Billig provided opening remarks and expressed enthusiasm for this opportunity to share information and encouraged active dialogue from all participants.

Steve Csonka, the Executive Director of the Commercial Aviation Alternative Fuels Initiative (CAAFI) presented on current state of sustainable aviation fuel industry and Dr. Michael Wolcott, WSU Regents Professor & Associate Vice President, discussed Pacific Northwest feedstock viability and supply availability. Slide presentations are included with the meeting notes.

Participants were provided a draft table of contents and proposed outline for the report to the legislature, by December 1, 2020, and were asked to provide feedback on content.

Virtual breakout rooms were used to review and refine the opportunities/leveraging actions/potential policy recommendations document that was developed in the previous meeting of the work group.

Presentations

Sustainable Aviation Fuel (SAF) Update, Steve Csonka, Executive Director of Commercial Aviation Alternative Fuels Initiative (CAAFI)

An update on the state of the sustainable aviation fuel (SAF) industry was provided in context of the impact of COVID-19 on aviation, oil markets and current economic outlook.

Key takeaways:

- The aviation industry remains committed to its long-term sustainability and emission reduction goals and continues to view SAF as essential to realizing its goals.
- New conversion pathways, using various feedstocks, continue to be approved by ASTM (the international standard setting organization) and there are numerous new pathways in the approval pipeline. There are currently seven approved pathways. Blend ratios with conventional jet fuel range from 10 %-50%, depending on the pathway.
- The U.S. has seen four years of sustained commercial use of SAF, in limited quantities. There is currently only one production facility in the country, two are under construction and several in development.
- Worldwide total SAF production forecast, based on announced intentions with specific commitments to SAF production, are approximately 49 million gallons by 2021 and approximately 816 million gallons by 2024.
- Lack of policies and incentives, such as those that facilitated the ramp up of ethanol and bio-diesel/renewable diesel, continue to limit the pathway to prosperity and competitive pricing for SAF.

Potential Northwest Regional Feedstock and Production of Sustainable Aviation Fuel: Port of Seattle, Dr. Michael Wolcott, Washington State University, Regents Professor & Associate VP of Research

The Port of Seattle (Port) contracted WSU to conduct a constrained assessment of feedstock availability and SAF production potential in the Pacific Northwest, using the Sustainable Aviation Fuels Northwest (SAFN) report (2011) as a baseline. Dr. Wolcott reminded participants that the SAFN report included the nation's first regional stakeholder effort, examining the feasibility, challenges, and opportunities for creating a commercially viable, sustainable aviation fuel (SAF) industry in the Northwest. WSU's work for the Port builds upon the original SAFN effort with an updated review of SAF supply chain and economic scenarios for the Northwestern (NW) U.S., defined as Washington, Oregon, Idaho and Montana. Information for British Columbia feedstock was also included where readily available. WSU's research supports the Port's efforts to meet their goal to have a 10 percent SAF jet fuel blend available at Seattle-Tacoma International Airport by 2028. In addition, it provides valuable techno-economic analyses for SAF production pathways to producers, airlines, and policymakers. WSU's analysis quantifies available regional feedstock suitable for ASTM-approved pathways, evaluating lipids, forest residuals and municipal solid waste. The potential quantities converted to SAF were modeled, as well as the minimum selling prices (MSP) for the fuel products for each of the feedstock types.

Key Findings

- There is sufficient volume of available feedstocks in the Pacific Northwest to produce up to 220-290 million gallons of sustainable aviation fuel per year (80-130 from forest residuals and 140-160 from MSW), or about one-third of the fuel dispensed at Seattle-Tacoma International Airport. However, economic models predict the minimum selling prices using these feedstocks in early generation/pioneer plants to be 3-5x higher than cost of conventional jet fuel.
- There is insufficient regional supply of lipids for SAF production. Conversion of waste fats, oils and grease using the HEFA process is currently the lowest-cost scenario for producing sustainable aviation fuel. It is currently believed that this feedstock is fully utilized in the Northwest U.S. by other industries.
- Utilizing purpose-grown oilseeds in the HEFA process will substantially increase the fuel cost and require considerable change in practice by the agricultural community. Even though the region has potential for oilseed production, there is not adequate availability to supply sustainable aviation fuel production. Any lipid feedstock would need to be imported into the region to support this pathway.
- MSW and forest residuals-based fuel production facilities will require large capital investments, and the technology has not been proven at scale.
- Models indicate the best logistical costs for MSW and forest residual conversion in the region are realized when biofuel facilities are located in Oregon.
- When evaluated from a purely logistical standpoint, the lowest-cost delivery market for fuels produced from either MSW or forest residuals is Portland, OR.
- Financial incentives will be necessary to bring sustainable aviation fuel to price parity with petroleum jet fuels. These incentives will likely be a combination of policies such as low carbon fuel standards (LCFS), the federal Renewable Fuel Standard renewable identification numbers (RINs), blender tax credits and green bonds to help incent business investments.
- Given existing incentive programs, the most likely location for the fuel to be sold is California as a result of the Low Carbon Fuel Standard (LCFS) incentive. In addition, Oregon will be a potential market as this state's LCFS is implemented.

Updates on Washington Related Projects

John Holladay, Pacific Northwest National Laboratory (PNNL)

John shared some background information on PNNL, and its industrial partner LanzaTech, and their current efforts. PNNL and LanzaTech have demonstrated through a combination of chemistry, biotechnology, engineering and catalysis that recycled carbon can be used to produce sustainable aviation fuel.

LanzaTech's process includes the biological conversion of carbon-rich industrial gases to ethanol which can then be upgraded to SAF. The process is based on a technology started by John Plaza (a SAF work group member) that starts with small molecules and builds them into larger molecules, including hydrocarbons.

The week prior to the SAF work group meeting, LanzaTech announced a spin-off company **LanzaJet** that will produce SAF from existing low-cost, sustainable ethanol sources. The initial demonstration facility will have a 10 million gallon per year capacity and will be built at LanzaTech's Freedom Pines site in Soperton, Georgia.

Senator Billig asked if Washington would be a good candidate for a future LanzaJet facility and John Holladay indicate there was a possibility.

Nate Green, Renewable Energy Group (REG)

Nate provided an update and discussed the challenges of trying to permit a facility for Green Apple Renewable Fuels, LLC, a joint venture between Renewable Energy Group and Phillips 66. The proposed facility would have constructed a renewable diesel plant adjacent to an existing Phillips 66 facility in Ferndale, WA, with the capacity to produce 250 million gallons per year of renewable fuels by converting waste fats, used cooking oils and vegetable oils. The project was cancelled due to concerns regarding the permitting application and review process and heightened risk due to permitting uncertainty. REG indicated that they were willing to mitigate all concerns documented in an Environmental Impact Statement and asked for reasonable assurances from public stakeholders (e.g., environmental NGOs) that once environmental concerns were mitigated, that stakeholders would not file a law suit upon permit issuance. Such assurances were not provided which furthered the uncertainty about the permitting timeline and ultimately drove uncertainty into the project cost. One of the biggest issues for the stakeholders was transportation of the finished product to California or British Columbia. Because these locations have LCFs, and Washington does not, there is economic incentive to sell the renewable fuels outside of Washington.

After announcing the project cancellation, REG went through a month-long assessment and considered reviving the project, but ultimately, they decided to move forward on a different project. It was noted that the State did significant work to design a more efficient environmental review/permitting process. Nate indicated that all renewable energy projects will have some degree of environmental impact and stated that there is a need for education among stakeholders including the general public, tribes and environment groups, to learn more about SAF, biodiesel, and need for local facilities and how they support GHG reduction and create jobs.

At the conclusion of Nate's remarks, Carol Sim reminded the group that Public Education and Awareness is one of the opportunity areas for potential policy recommendation and that the topic would be discussed during the breakout sessions.

Chris Whitworth, Northwest Advanced Bio-Fuels (NWABF) - In September 2019, NWABF partnered with Delta Air Lines to conduct a \$2 million feasibility study on the potential for a sustainable biofuel refinery in

Washington using forest residuals as feedstock. NWABF is evaluating refinery locations in the Grays Harbor area and feedstock supplies encompassing the west coast of the state. NWABF has selected Black and Veatch as the engineering, procurement, and constructing (EPC) contractor and will be announcing their technology partner later this summer. Chris indicated that they are a year into the project and continue to make progress.

Keith Taylor from Delta added his perspective indicating that they have made significant progress and are looking to have product in 2024-2025 or so.

Report Content -Table of Contents and Outline Review

Participants briefly provided suggestions on the outline and contents for the final report. The table of contents /outline is attached to these meeting notes. **Please forward any additional input to Carol Sim (carol.sim@wsu.edu) or Molly Stenovec (molly.stenovec@wsu.edu) by July 17.**

Comments:

- The report needs mention COVID-19 and its impact on the aviation industry.
- Although COVID has slowed down current air travel, NOW is the time to plan for future air travel. The work group should consider what “new” opportunities COVID has created.
- In developing the policy recommendations, the group should also consider challenges with the permitting process and opportunities for the state to provide additional certainty.
- The regional updates section of the report should include a discussion of low carbon fuel standards in CA and OR and the financial incentives provided for SAF.

Attendees also discussed continuing the working group beyond its current December 2020 deadline. Many described the benefits of somewhat frequent gatherings as opportunities for exchanging information across sectors and developing new partnerships and expressed support for the Working Group to continue.

BREAKOUT SESSIONS

Participants broke into three different groups to discuss opportunities for SAF development in Washington and to refine/provide policy recommendations based on leveraging actions identified in previous meetings. The following sections reflect the suggestions and next steps identified by the participants in the breakout session to develop the leveraging actions into specific policy changes or requests.

Group One discussed: Research and Information Gathering; Public Awareness and Understanding; Regional Coordination and Collaboration.

Group Two discussed: Environmental Sustainability and Carbon Reduction; Supply Chain.

Group Three discussed: Incorporate/Prioritize SAF in the State Energy Strategy Update; Financial Incentives; Promote Economic Development.

BREAKOUT SESSION: GROUP ONE RESEARCH and INFORMATION GATHERING

Leveraging Action: Support policies and programs which provide matching funds to researchers in the federal, private, and academic sectors.

POTENTIAL POLICY RECOMMENDATION:

Next steps:

- Gather more information - during the discussion, individuals identified several questions including:
 - What is the Bioproducts Institute? How does it differ from PNNL/WSU?
- Dale Smith offered to help turn this leveraging action into a policy recommendation; Liz Lovelett can help connect this conversation to the federal delegation.

Leveraging Action: Develop a framework to guide research, inquiries, demonstration/pilot projects, and identify potential funding opportunities. Identify and secure research funding for targeted biofuels projects.

Areas of inquiry/potential projects:

- Identify lessons learned in developing SAF and addressing challenges/barriers from across the country and around the world.
- Explore/develop new models for what the SAF industry could look like in Washington.
- Determine actual consumer demand and market value of SAF.
- Develop sustainable aviation fuel industry models for Washington.

POTENTIAL POLICY RECOMMENDATION:

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Leveraging Action: Make state a demonstration platform for new technology and ideas.

POTENTIAL POLICY RECOMMENDATION:

Next steps:

- Gather more information: What does this look like? What investments need to be made? How does this translate into a policy recommendation?
- Identify working group members who can help develop the policy recommendation.

BREAKOUT SESSION: GROUP ONE **PUBLIC AWARENESS and UNDERSTANDING**

Leveraging Action: Develop strategy to increase awareness and understanding of the need for and multiple benefits of SAF (such as use of waste product, funding for schools, reduced forest fire risk, reduced fuel source volatility, increased public health & safety, economic development, environmental sustainability, and attaining GHG reduction goals).

POTENTIAL POLICY RECOMMENDATION:

Next steps:

- Gather more information - during the discussion, individuals identified several questions including:
 - What are additional state agencies which could have a role (Dept. of Natural Resources, Ecology, Commerce, etc.)?
 - How could the Working Group better serve as venue for exchanging information? What is the potential for establishing a unique online presence?
 - How is the Working Group connecting with the Federal delegation?
- Liz Lovelett offered to help develop this leveraging action into a policy recommendation.

Leveraging Action: Increase understanding of how commercial aviation operates, the role of jet fuels, and the industries' commitments.

POTENTIAL POLICY RECOMMENDATION:

Next Steps:

- Dale Smith & Lana van Marter, with guidance from additional airlines representatives, offered to help develop this leveraging action into a policy recommendation.

BREAKOUT SESSION: GROUP ONE REGIONAL COORDINATION and COLLABORATION

Leveraging Action: Incentivize and foster the development of relationships with new potential partners such as business aviation, equipment manufacturers, maritime, refineries, military, and local government, forestry, agriculture, transportation systems (rail, etc), corporate partners.

POTENTIAL POLICY RECOMMENDATION: The sustainable Aviation Biofuels Working Group should continue to reach out to and serve as a venue for building relationships with new potential partnerships.

Leveraging Action: With support and direction from the Legislature, the Office of Clean Energy at WSU could continue to convene SABW and provide a forum for exchanging information, building relationships and disseminating technical information.

POTENTIAL POLICY RECOMMENDATION: Continue the Sustainable Aviation Biofuels Working Group through the next biennium.

Note: The Sustainable Aviation Biofuels Working Group has grown from 15-20 participants to about 50 active participants. Broader participation keeps more people informed, maintains synergy and relationships and provides formal processes for exchanging information and public/private partnerships.

Discussion: some observed that this recommendation should not be listed first – this summary reflects that guidance.

BREAKOUT SESSION: GROUP TWO ENVIRONMENTAL SUSTAINABILITY AND CARBON REDUCTION

Leveraging Action: Develop awareness of infrastructure needs to produce and distribute SAF for multiple production and feedstock pathways for reducing carbon in transportation system (for upcoming 20-40 years).

POTENTIAL POLICY RECOMMENDATION: Consider including or linking infrastructure needs in the transportation package.

Supplemental Notes: Massive 1/3rd of electricity in state would be needed for Power-to-Liquid (PtL). Need SAF infrastructure decoupled from needs on the pipeline. Linking the sustainable fuels production infrastructure is not traditional but possible.

Leveraging Action: Develop and establish a low carbon fuel standard (LCFS) or Clean Fuels Standard (CFS) policy that aligns with efforts of CA, OR, and BC. Include sustainable aviation biofuels as opt-in.

POTENTIAL POLICY RECOMMENDATIONS: Maintain the course on LCFS, look at policy that reduces costs of SAF production (i.e. feedstock programs, etc.), and consider policy that monetizes carbon.

Supplemental Notes: Policy is needed to provide industry stability and incentives at a state and regional-scale. LCFS is a valuable tool the does not require an expenditure. But, additional revenues (i.e., monetize carbon) will also be important in the upcoming sessions.

Leveraging Action: Increase understanding/awareness of, and of the need to monetize, other environmental services/benefits.

POTENTIAL POLICY RECOMMENDATION:

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Supplemental Notes: Monetize improved water quality, soil health, carbon sequestration in root systems, waste as feedstocks.

BREAKOUT SESSION: GROUP TWO SUPPLY CHAIN

Leveraging Action: Fund and support university-private partnerships in information gathering efforts.

Leveraging Action: Clearly define supply chain which considers geographic location, seasonal availability, alternative feedstock sources, and ability to meet existing targets.

POTENTIAL POLICY RECOMMENDATION: Group Two had a robust discussion Environmental Sustainability and Carbon Reduction and did not have time to evaluate Supply Chain opportunities.

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Supplemental Notes: The Port of Seattle (POS) contracted WSU to evaluate constrained availability of local feedstocks. This report built on the SAFN report and identified viability and availability for different feedstocks. The report has not been formerly released yet.

BREAKOUT SESSION: GROUP THREE **INCORPORATE/PRIORITIZE SAF IN STATE ENERGY STRATEGY (New)**

Leveraging Action: Legislature needs to provide for deep decarbonization of liquid fuels. Efforts should be focused on the fastest pathway to decarbonization based on energy sector and not prioritize one energy type over another. Focus on clean electrons for the energy sector and clean molecules for the liquid fuel sector (aviation, heavy duty trucking, marine, and rail).

POTENTIAL POLICY RECOMMENDATION:
Group needs further discussion on this policy recommendation area.

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Supplemental Notes: Development of an SAF industry requires a fast-track permitting process with clear timelines and expectations for project planning/development. Need to get away from focus just on biomass and should not select/prefer/incentivize one feedstock type over another.

Update: Carol Sim (WSU) and Peter Moulton (Dept. of Commerce) met with team members from the Clean Energy Transition Institute and Evolved Energy who are leading the 2021 State Energy Strategy update. We conveyed our concerns that electrification efforts would overshadow the need for decarbonization of liquid fuels, SAF would not be well represented in the SES update and that policy recommendations between the two groups might conflict. We were assured that SAF work group members would be included in the drafting of the SAF section of the SES update.

BREAKOUT SESSION: GROUP THREE **FINANCIAL INCENTIVES**

Leveraging Action: Convene a Legislative sub-working group to draft new and revise existing legislation and incentives to support new, or the retrofit of existing, manufacturing facilities to biorefineries.

POTENTIAL POLICY RECOMMENDATIONS:

- Develop a carbon pricing mechanism that includes specific incentives for SAF that are feedstock and conversion pathway agnostic. Note that any LCA values used in any carbon pricing mechanism should be values adopted by ICAO.
- Continue efforts toward a Low Carbon Fuel Standard (LCFS). It was noted that a LCFS is a more effective incentive than cap and trade. In California, cap and trade produces a ~\$0.10/gallon credit and the LCFS produces ~\$1.00/gallon credit.
 - LCFS radically changed the approach to production
 - Don't have static carbon intensity (CI) scores- consider carbon reductions throughout the supply chain, not just on the finished product
 - Power to X- can make hydrogen with virtually zero CI
 - Need to look at the synergistic effects
- Added benefit incentives
 - Monetize CI throughout the value chain (e.g., 20% of CI in HEFA process is due to hydrogen. If you have renewable hydrogen the CI of the HEFA should go down.)
- Monetize environmental benefits (e.g., use of forest residues/slash piles can reduce disease, improve soil health and reduce fires. Conduct cost/benefit.
- Review expired and soon to be expired tax incentives that benefit biorefineries and reinstate those with the most benefit.

Leveraging Action: Identify potential funding sources for infrastructure development.

POTENTIAL POLICY RECOMMENDATION: Evaluate State Bond Financing Mechanisms as impactful solutions to attract capital investments in infrastructure projects.

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Update: Peter Moulton is setting up a call, in late July, between State bonding experts and interested breakout group participants to discuss available options.

Leveraging Action: Highlight markets and opportunities for coproduct development and use in-state (more generally, assist with market development).

This item was not discussed during the meeting due to time constraints.

POTENTIAL POLICY RECOMMENDATION:

Next Steps:

- Identify working group members who can help develop the policy recommendation.

BREAKOUT SESSION: GROUP THREE PROMOTE ECONOMIC DEVELOPMENT

Discussion: The breakout group did not discuss specific policy recommendations due to time constraints but noted that when evaluating policies that incentivize SAF, the legislature should consider that aviation is a powerful economic engine in the state that contributes billions of dollars and tens of thousands of jobs to the economy. As SAF is essential for meeting aviation's emission reduction goals and is seen as the industry's license for continued growth, state policies should promote SAF to support industry growth and increase in the number of aviation and SAF related jobs (long term goal 2050).

Leveraging Action: Plan, build, and incentivize workforce development pathways.

Leveraging Action: Increase understanding of economic development/job growth opportunities in agricultural/rural communities.

Next Steps:

- Identify working group members who can help develop the policy recommendation.

Closing Remarks

Senators Billig and Lovelett indicated that the legislature is in the perfect position to make progress, that change is possible with new members of the legislature and that some sort of carbon pricing scheme (i.e., cap and trade, LCFS, etc.) will likely be proposed.

Afterward

Perkins Coie has offered to assist in drafting the report to the legislature at no cost.

Work Group Structure– Sustainable Aviation Biofuels Work Group

1. Purpose & Role of the Work Group

The purpose and role of the Sustainable Aviation Biofuels Work Group is to:

- Further the development of sustainable aviation fuel as a productive industry in Washington;
- Provide recommendations to the Governor and appropriate committees of the Legislature no later than December 1, 2020.

2. Membership

Composition of the work group must include members from the legislature and sectors involved in sustainable aviation biofuels research, development, production, and utilization. The work group may recommend adding members to fill a needed area of expertise. Additional criteria for consideration in membership composition: 1. Individuals who will represent their constituency/interest group/agency (and keeping them informed as needed), who are committed or willing to commit to working toward a consensus solution and willing to share and listen to others' perspectives; 2. Broad range of perspectives and entities who have a role or interest in the future of sustainable aviation biofuels in Washington.

3. Procedural Rules

a. Discussion

In order to ensure that the Work Group's discussions and deliberations are efficient, productive, and civil, the work group and neutral convener agree to abide by the following discussion ground rules. The Work Group grants the neutral convener the permission to remind the group of these ground rules when needed.

- Be respectful, productive, & constructive.
- Keep comments brief so everyone gets a chance to share their thoughts and don't repeat or rephrase what others have already said.
- Silence and refrain from using cellphones and laptops, except for work group business.
- Acknowledge that all participants bring with them legitimate purposes, goals, concerns and interests, whether or not you are in agreement.
- Act in "good faith," seeking to resolve conflicts and identify solutions.
- Ask for clarification when uncertain of what another person is saying.
- Minimize use of jargons and acronyms—define and explain when used.
- Begin and end meetings on time.
- Volunteer for the tasks at hand.
- Bring a sense of humor and have fun.

b. Decision-Making

The work group will practice consensus-based decision-making and operate under the following definition of consensus: *The group will have reached consensus on an issue when it agrees upon a single alternative and each participant can say:*

- *I believe that other participants understand my point of view;*
- *I believe that I understand others' point of view; and*
- *Whether or not I prefer this alternative, I support it because it was arrived at openly and fairly, based on good information, and it is the best decision for us at this time.*

This consensus can be conveyed via thumbs up (I fully support this option), thumbs sideways (I can live with the option for the good of the group and the process), or thumbs down (I cannot live with this option). If anyone is thumbs down, the group will seek solutions that allows those thumbs to move up or sideways. If there are instances where consensus cannot be reached, the different alternatives can be presented in a succinct report.

The work group's decisions are advisory only and may inform future policy, programmatic, and administrative choices of the State of Washington. The work group itself has no other decision making authority.

c. Meetings

Frequency: The work group will meet every six months, with additional correspondence as needed between meetings. Sub-work groups will identify a meeting frequency that meets their needs.

Communication: A draft written summary of discussion and action items from each meeting will be prepared by the Ruckelshaus Center and reviewed by the Leadership Team before being considered final. Scheduling, reminders, logistics, and summaries will be sent out electronically and in a timely manner.



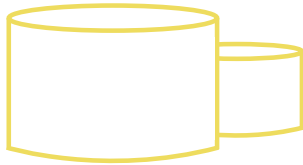
GREEN APPLE RENEWABLE FUELS, LLC

Planned Renewable Diesel Facility

Ferndale, Washington

Renewable Fuels, Green Jobs

➤ PROPOSED PROJECT



250 Million
gallons renewable fuels per
year capacity



Up to 100
full-time
family-wage jobs

Up to 650
construction jobs

➤ EMISSIONS BENEFIT



60% - 80% reduction
in greenhouse gas emissions¹



Offsets emissions equivalent to
over **5X** the vehicles in
Whatcom County²

➤ RENEWABLE DIESEL PLANT ADVANTAGES



High quality,
high fuel efficiency



Drop-in fuel for use in any
diesel engine; blends at
any level with diesel



Potential blendstock
for jet fuel

➤ PROJECT REVIEW

✓ What this project IS:

- Stand-alone renewable fuels facility utilizing state-of-the-art waste conversion technologies
- Joint Venture between Renewable Energy Group and Phillips 66, a renewable energy veteran partnering with a top energy company
- Converts fats, used cooking oil and vegetable oils into renewable fuel

X What this project is NOT:

- It is **NOT** additional petroleum refining capacity
- It is **NOT** processing renewable feedstocks in the petroleum refinery
- It is **NOT** transporting crude oil or unrefined petroleum product

¹.Based on registered California LCFS carbon intensity values for renewable diesel production.

².Whatcom County drivers average 860 million miles driven annually. Green Apple Renewable Fuels could potentially offset approximately 2 million metric tons of CO₂e annually compared to traditional fuels. Values are estimates, using the proposed Facility design and projected feedstock mix.

STATEMENT OF SEN. MARK SCHOESLER

As a matter of first importance, I extend my sincere thanks to the staff at Washington State University and the William D. Ruckelshaus Center who convened the Sustainable Aviation Biofuels Work Group. Their expertise and professionalism were invaluable to ensuring that this group would successfully finish its report.

I also want to commend our state's aerospace leaders for their continued commitment to innovation, including fuels research and development. Aerospace is an anchor industry in Washington, and I have always appreciated the industry's pioneering and problem-solving spirit.

I only write separately to register my disagreement with some of the suggestions and recommendations contained in this final report. I specifically wish to convey my strong opposition to establishing a "clean" fuel standard for Washington. The state legislature has repeatedly rejected bills that would have enacted a new fuel standard as recommended in this report. I hope the legislature will continue to reject those bills. Let me explain why.

1. New fuel standards unfairly increase the price of fuel for drivers

We have seen over and over again how the evidence shows that enacting a new fuel standard will make fuel more expensive for drivers in Washington. Last year, in its now-abandoned effort to adopt a regional fuel standard, the Puget Sound Clean Air Agency estimated that its proposal would have driven up the price of gasoline by as much as 57 cents per gallon.¹ Similarly, California's low carbon fuel standard has already inflated prices at the pump in California by more than 19 cents per gallon.² And state estimates show that the impact on Oregon's gas prices under the Oregon Clean Fuels Program has increased elevenfold over the last three years.³

These increases are equivalent to gas taxes, but they do not build roads or return any economic benefit to taxpayers. In fact, they do the opposite—PSCAA's 2019 analysis showed that a new fuel standard would cause statewide job growth to slow down in seven out of eight modeled scenarios.⁴ Clearly, fuel price increases are not worth the trouble, especially now, as we embark on the path to recovery from the ongoing coronavirus shutdowns. Policymakers should resist policies that will add to the price of fuel during this uncertain time. Keeping fuel affordable for families will help our economy come back from the brink, but hiking up fuel prices will not.

¹ ICF, Puget Sound Regional Transportation Fuels Analysis, Final Report, p.57 (2019).

² Stillwater Associates LLC, CFP and LCFS Updates, p.6 (2020).

³ Oregon Department of Environmental Quality, 2019 Annual Cost of the Clean Fuels Program.

⁴ *Supra* n.1 at 94-101.

2. Rejecting new fuel standards has been key to state transportation policy

Indeed, concerns about the high cost of fuel standards have driven consensus in the legislature in the past and should continue to do so in the future. The 2015 Legislature made rejecting a new fuel standard the linchpin of the Connecting Washington transportation package, which amended several statutes to discourage the future adoption of a new fuel standard.⁵ That decision represents a bipartisan commitment by legislators who worked together to improve transportation infrastructure around the state. It is a commitment that should be honored.

3. Environmental benefits from a new fuel standard would be negligible

Another reason legislators have decided to forgo creating a new fuel standard is because the legislature's own examination of the costs and benefits reveals that a low carbon fuel standard is not cost-effective and would underperform as an emissions reduction policy. This was a key conclusion of the Climate Legislative and Executive Workgroup in its final report, which showed that each metric ton reduced by a low carbon fuel standard would cost up to \$131, an outrageous price tag for a program that aims to curtail emissions by millions of metric tons.⁶

Even in the unlikely event that Washington embraced an expensive new fuel standard, the emissions reduction that might be possible would be quickly eclipsed by growing emissions rates in parts of the world beyond the influence of Olympia. Our state's emissions have dropped since 2000, even as our population has grown. But Washington's share of global emissions has always been so meager—our state accounts for less than one quarter of one percent of global emissions—that even achieving the impossible feat of 100-percent statewide emissions reduction would have no discernable effect on Washington's natural environmental processes.

4. Alternatives to traditional fuels present serious challenges

Furthermore, transitioning to other transportation fuels, such as electricity, would put major stress on the electricity delivery system in Washington. Our West Coast neighbors in California have already suffered blackouts from reckless policies as California has aggressively attempted to shift toward electric vehicles while undermining its ability to provide enough electricity to reliably power homes, businesses, and now cars. Mandating mass electrification while banning traditional sources of baseload power is a dangerous combination that Washington should avoid.

The warnings about overreliance on non-baseload sources of electricity are growing louder, as analysts from groups such as the Northwest Power and Conservation Council have concluded that the regional power supply is likely to become inadequate by 2021.⁷ These concerns are real

⁵ RCW 46.17.365; 46.20.202; 46.25.052, .060, .100.

⁶ Climate Legislative and Executive Workgroup, Evaluation of Approaches to Reduce Greenhouse Gas Emissions in Washington State—Final Report, p.4 (2013).

⁷ Northwest Power and Conservation Council, Pacific Northwest Power Supply Adequacy Assessment for 2024, p.5 (2019).

and recently motivated the 2020 Legislature to pass—and Governor Inslee to sign—Substitute Senate Bill 6135, which requires the Department of Commerce and the Utilities and Transportation Commission to evaluate the adequacy of energy resources necessary to satisfy our state's needs.⁸

5. Federal law prohibits regulating aviation fuels under a state-level fuel standard program

Finally, due to the federal prohibition against state-specific emission standards for aircraft, establishing a new fuel standard in Washington would not directly affect aviation fuels.⁹ The very fuels that this report seeks to promote would not be regulated by the recommended program, which raises serious questions about the fairness of the program for other fuel users, who would be subsidizing new aviation fuels that are not subject to the same regulations.

Conclusion

Fuel price increases, transportation infrastructure disruption, sky-high costs, the risks of using alternative fuels, and federal law, all point against a new fuel standard for Washington.

I once again express my sincere thanks to Washington State University, the Ruckelshaus Center, and our partners in Washington's aerospace industry for their commitment to this work group, and their long and continuing track record of innovation. Thank you for the opportunity to express my specific concerns with certain suggestions and recommendations in this report.

Sincerely,

Sen. Mark Schoesler
9th Legislative District

⁸ RCW 19.280.065.

⁹ 42 U.S.C. § 7573.