Integrated Design Experience (IDX): Wood-based Aviation Biofuels Supply Chains in the Pacific Northwest

Dr. Tammi Laninga, AICP
Western Washington University

Dr. Karl Olsen
Washington State University
• **RELEVANT:** Real-world problems with sustainable solutions in the built environment.

• **INTERDISCIPLINARY:** Students and faculty from engineering, design, and community planning disciplines

• **PARTNERSHIPS:** Collaboration with industry, governmental, and professional practice stakeholders
Sustainable BioJet
Valuable Lignin Co-Products
Rural Economic Development
Supply Chain Coalitions
Energy Literacy

NATIONAL MODEL
Total Jet Fuel Consumption in 2010
743-million gallons
Aviation Fuel Demand Centers

Combined Seattle Market
(656.5 MGY)

Combined Spokane Market
(40.9 MGY)

Combined Portland Market
(316.3 MGY)
By the Numbers …

- Boeing 747 uses 1 gallon/fuel every second
- 4 hour flight (60 sec x 60 min = 3,600 gal x 4 hours) = **14,550 gallons**
- **313 BDT** woody biomass (or 636,000 lbs) for 4 hour flight
- Standard chip van carries 12.5 BDT; **25 chip vans to fuel 4 hour flight**
State forest residue volumes are approximated using Timber Product Output (TPO) datasets from the University of Montana Bureau of Business and Economic Research (BBER). They sample Oregon, Montana and Idaho on a bi-decadal basis. Washington is sampled by the Washington State Department of Natural Resources, and the numbers are reported to the BBER.

Dates Used for State Forest Harvest Volume Averaging:
Oregon -- 2003, 2008
Washington -- 2002, 2010
Montana -- 2004, 2009
Idaho -- 2001, 2006
Estimated Overall Impact in WMC

$110 million Economic impact*

736 new jobs created

60% Reduction in global warming potential

*Economic impact and jobs directly and indirectly generated from annual forest residual feedstock purchases by a hypothetical biojet fuel refinery in the WMC.
## Asset Mapping

### NODES
- State Databases
- Active Primary Wood Processing Facilities
- Road and Rail Access

### LINKAGES
- Google Maps Travel time
- ArcGIS
- BNSF Rail distance calculations

### AREAS
- ArcGIS Network Analyst
- One-way travel time
- Biomass
- 0.5, 1, 1.5, 2 HR radius
NARA Facility Types

Solids Depot

Liquids Depot

Integrated Bio-refinery (IBR)
Nodes – Mills

- Depot Locations
- Counties
- MC2P Boundary
Areas - Available Forest Coverage (Ownership)
Relationship of Transportation and Depot Size

- Same distance, more efficient mode = larger radius
- More distance, same mode = smaller radius

DEPOT

CONVERSION PLANT

Depot co-located with conversion plant = largest possible forest road radius

WASHINGTON

MONTANA

OREGON

WYOMING

HIGHWAY

RAIL

HARVEST AREA

USDA
NIFA

NARA
Depot – Direct Drive Time - 30 Minutes
Depot – Direct Drive Time - 60 Minutes

- Depot Locations
- Counties
- Forest Coverage
- 1.0 hr Drivetime
- MC2P Boundary
Depot – Direct Drive Time - 90 Minutes

- Depot Locations
- Counties
- Forest Coverage
- 1.5 hr Drivetime
- MC2P Boundary
Biorefinery/Depot Model

- **Depot Locations**
- **Counties**
- **Forest Coverage**
- **1.0 hr Drivetime**
- **1.5 hr Drivetime**
- **Bio-refinery**
- **MC2P Boundary**

**Transportation Cost**
$38/BDT

**Biomass Available**
880,000 BDT
Supply Chain Analyses

Olympic Peninsula (OP)
Supply Chain Analysis
This site provides supply chain data and analysis generated by NARA research for the region identified as the Olympic Peninsula, located in Western Washington.

Pacific Northwest (PNW)
Supply Chain Analysis
This site provides supply chain data and analysis generated by NARA research for the region identified as the Pacific Northwest, which includes Montana, Idaho, Washington, and Oregon.

Mid-Cascades to Pacific (MC2P)
Supply Chain Analysis
This site provides supply chain data and analysis generated by NARA research for the region identified as Mid-Cascades to Pacific, which includes the western sections of Washington and Oregon.

Western Montana Corridor (WMC)
Supply Chain Analysis
This site provides supply chain data and analysis generated by NARA research for the region identified as the Western Montana Corridor, which includes the western section of Montana, Northern Idaho and northeast Washington.

Clearwater Basin
Supply Chain Analysis
This site provides supply chain data and analysis generated by NARA research for the region identified as the Clearwater Basin, located in central Idaho.
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