

Washington

Washington obtains more than 75% of its electricity from renewable resources and is a national leader in energy conservation and energy efficiency. The Bioenergy Technologies Office (BETO) enables the development of novel technologies that can be used to support state energy priorities.

Drop-in biofuels produced from state biomass resources could use the existing infrastructure and distribution networks to reduce dependence on petroleum-based transportation fuels, stimulate economic development, and reduce carbon emissions.



Economy

Washington spent **\$16.3 billion** on petroleum-based transportation fuels in 2013. The state produced more than **120 million gallons** of biodiesel in 2013. Expanding biofuel production using its abundant biomass resources can add to the state's **101,500+ jobs** in green goods and services.



Energy

Several large U.S. Air Force and U.S. Navy installations help place Washington among the **top 10 jet fuel-consuming states** in the nation. **Drop-in biofuels** are the only practical, non-petroleum fuel option compatible with the U.S. military and commercial aviation infrastructure.



Environment

In 2011, petroleum use in Washington's transportation sector released **39.3 million metric tonnes of carbon dioxide**. On a life-cycle basis, advanced biofuels can **reduce greenhouse gas emissions by > 50%** compared to petroleum—helping to reduce environmental impacts.



Feedstocks

Estimates indicate over **6.5 million metric tonnes of woody biomass residues** and nearly **2 million metric tonnes of agricultural residues** are available in Washington each year. The state can leverage these and other **renewable resources** to sustainably produce **advanced biofuels**.

Strategic policies and investments help *bridge the gap* between promising research and large-scale production of advanced biofuels.

Pacific Northwest National Laboratory (PNNL) in Richland, Washington, is a key partner in many BETO-supported efforts to develop clean fuels from biomass.

The U.S. Department of Energy (DOE) has awarded more than **\$107 million** to university, national laboratory, and industrial partners in Washington to research, develop, and deploy sustainable bio-based fuels and products since 2005. Of this total, PNNL received 90% of the funding.

PNNL projects include **\$14.8 million** for fungal genomics (develop and utilize modern fungal genetics, genomics, and bioprocess technology capabilities to produce robust, efficient biocatalysts and bioprocesses for biofuels and bioproducts); **\$10 million** for upgrading of syngas intermediates for liquid fuels production; and **\$3.5 million** for microalgae production and analysis.

PNNL research and development (R&D) is helping drive the shift from petroleum to bio-based renewable fuels and products.

Bio-based fuels

Developing the scientific and engineering foundations for converting biomass to biofuels that are compatible with today's infrastructure.

Bio-based chemicals

Chemical products offer another way to reduce U.S. dependence on imported oil and improve the economics of U.S. biorefineries.

Marine Sciences Laboratory (MSL)

The principles of biotechnology are being applied in the quest for renewable energy resources and in the development of biologically inspired technological innovation.

Why Washington?



Abundant forests and wood products industry could provide 6.6 million metric tonnes of wood waste annually for biofuel production.



Robust agricultural industry could provide 1.7 million metric tonnes of excess cellulosic crop residues annually for advanced biofuels.



Developing in-state resources reduces dependence on imported petroleum products.



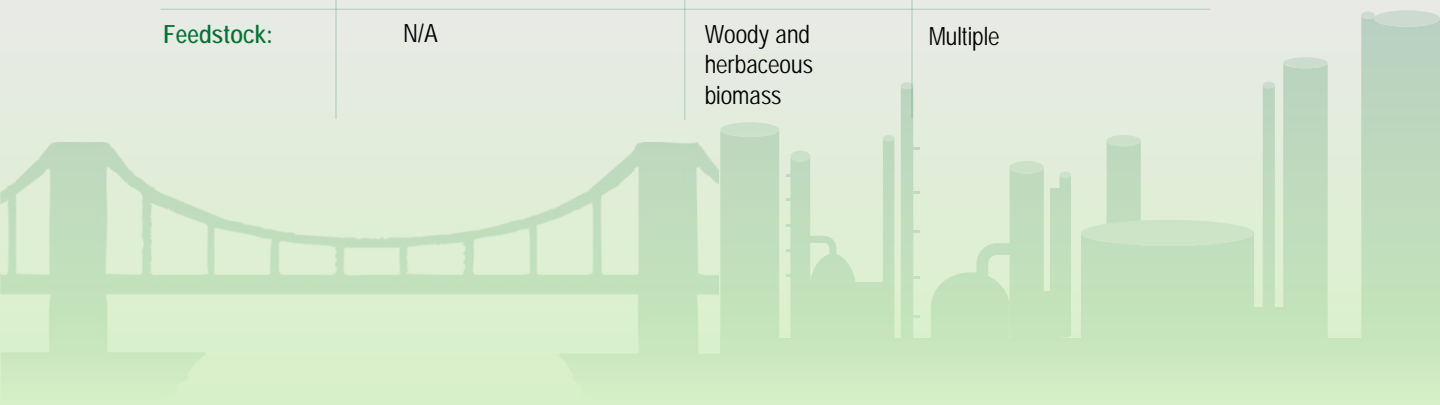
Biomass resources could supply aviation in Washington with sustainable alternatives to petroleum.



DOE has supported **basic R&D at Washington universities**. This basic research improves the productivity of bioenergy feedstocks and maximizes the benefits of biofuels and bioproducts while minimizing negative impacts. DOE seeks to promote promising biofuel and biotechnologies research with the greatest chance of impact on commercial biofuel and bioproducts production.

BETO Projects with Universities

Participant:	Washington State University	University of Washington	
Research area:	Research and develop an algal culture system for the production of algal biomass feedstock	Design a cookstove for woody and herbaceous biomass fuels	Build a bioconversion steam explosion reactor and ancillary equipment to support bioconversion process research.
Stage:	R&D	R&D, commercialization	R&D
Primary product:	Algal biomass feedstock	Cookstove	N/A
Feedstock:	N/A	Woody and herbaceous biomass	Multiple



For more information on the economic benefits of biofuels for Washington, visit:
eia.gov/state/analysis.cfm?sid=WA
energy.gov/eere/bioenergy/about-bioenergy-technologies-office-growing-americas-energy-future-replacing-whole-acre.org/images/documents/Western_Region_Report_2014.pdf
 For more information on biomass resources and the environmental benefits of biofuels, visit:
epa.gov/otaq/fuels/renewablefuels/documents/42of12078.pdf
eia.gov/environment/emissions/state/state_emissions.cfm
eere.energy.gov/bioenergy/pdfs/billion_ton_update.pdf, maps.nrel.gov/biofuels-atlas

For more information on Washington clean energy initiatives, research, and partnerships, visit:
afdc.energy.gov
navy.mil/submit/display.asp?story_id=83417
energyenvironment.pnnl.gov/eere/
pnnl.gov/biobased/capabilities.stm
energy.gov/eere/bioenergy/articles/energy-department-announces-10-million-develop-innovative-bioenergy
energy.gov/eere/bioenergy/financial-opportunities