

Wood to Energy in Washington: Imperatives, Opportunities, and Obstacles to Progress - Summary Brief of Findings and Recommendations

By C. Larry Mason, Richard Gustafson, John Calhoun, Bruce Lippke, and Natalia Raffaeli

School of Forest Resources, College of the Environment, University of Washington

At the request of the Washington State Legislature, a thorough investigation into the barriers to increasing utilization of woody biomass for energy production in Washington has been conducted by University of Washington scientists. Identifying barriers and recommending solutions required an assessment of how the broader energy policies of the state and nation impact biomass energy opportunities.

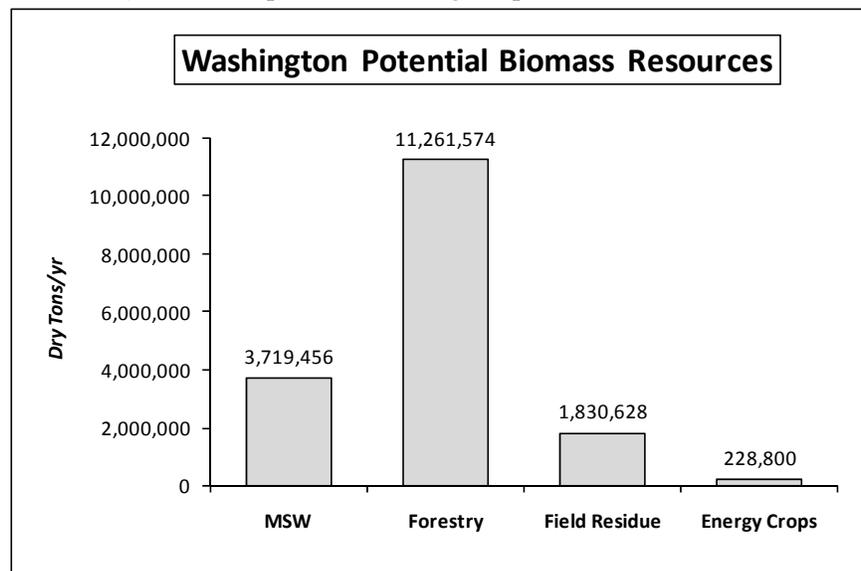
Major Findings:

- Energy policy must be examined in the context of three over-arching imperatives that compel immediate attention: Climate Change Mitigation, Energy Independence, and Sustainability.
- Wood is second only to water as a source of renewable energy for Washington, and, conversions to liquid transportation fuels emerge as the highest priority for maximizing integrated achievement of the imperative objectives.
- Liquid fuels conversions from wood biomass will require large biorefinery capacity designed to utilize dispersed biomass resources for maximized bioenergy outputs. Co-location with State pulp and paper mills represents the greatest opportunity for success.
- While a paradigm shift from fossil fuels to renewable energy will be difficult and expensive, the environmental and economic costs of inaction outweigh needed investment for change.

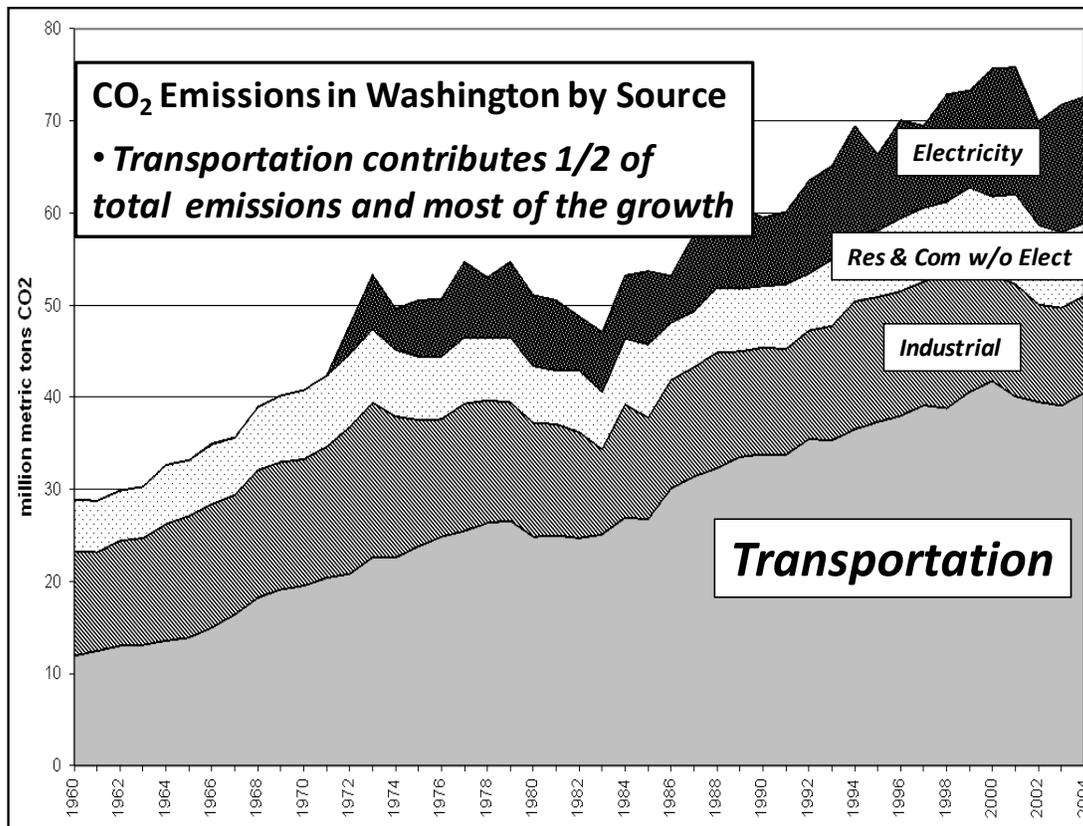
Additional Conclusions:

National Objectives: Energy independence and climate change mitigation are linked as national policy objectives. Sixty percent of the petroleum consumed in the US is imported at high cost to the economy. Climate change mitigation efforts focus on reducing greenhouse gas emissions (primarily carbon dioxide) mainly released from combustion of fossil fuels for electricity and transportation. The Energy Independence and Security Act (EISA 2007) and subsequent EPA rulings require emission reduction targets to be met by replacing fossil fuels with renewable domestic energy alternatives. Woody biomass has been recognized as an attractive US energy source that is both carbon-neutral and renewable. Efforts to identify and remove barriers to increased utilization of woody biomass for energy are critical especially in the West where forests dominate the landscape and thinning can reduce the risk of catastrophic fire.

State Issues: Washington, with abundant forests, ranks at the top of US states in woody biomass availability. Washington State produces clean electricity from



hydro and nuclear power sources and exports electricity surpluses but must import nearly 100% of the petroleum needed for transportation fuels (gasoline and diesel). The transportation sector is the leading State cause of air pollution, contributing more than half of the total greenhouse gases released into the atmosphere in Washington State. In 2006, the second largest source of greenhouse gas emissions was catastrophic wildfires releasing more than twice the emissions of State electricity generation. Plant biomass is stored solar energy that can be converted to biofuels, such as ethanol, to displace gasoline for transportation. Woody biomass represents two-thirds of all potentially available State biomass resources; more than twice all agricultural and municipal waste sources combined. Substantive production of renewable biofuels in Washington will necessarily require wood as a primary feedstock and efforts to reduce State greenhouse gas emissions must fully consider forest health and forest resources.



The Role of the Forest and the Forest Industry: Forests play a unique role in climate change mitigation by absorbing carbon dioxide through photosynthesis, storing carbon in tree biomass and building products, offsetting use of carbon emitting building product alternatives such as steel and concrete and by providing biomass for clean energy. Thinning overly-dense forests will help to avoid carbon dioxide and other emissions from catastrophic wildfires while providing wood resources for green building materials and renewable biofuels creating double greenhouse gas emission reduction benefits while sustaining forest ecosystems. Reducing catastrophic fires will save hundreds of millions of dollars each year by avoiding fire-fighting costs, destruction of forest resources, loss of structures and the risk of fatalities. Yet collected forest residuals may be mistakenly thought to be too costly for use as biofuel feedstocks. This situation would change, however, if and the many public benefits of climate change mitigation, healthy forests, avoided costs of catastrophic fires, and reduced use of imported fossil fuels were included in the cost accounting.

The forest industry represents the State's largest biomass collection system, the largest industrial investment in renewable energy generation, and has potential to significantly improve wood-to-energy recoveries and outputs if policies are developed to support future investment. The forest industry should be regarded as a major provider of green jobs in Washington with considerable potential for new green energy development.

Energy Options: While use of woody biomass for direct heat or electrical energy production may be appropriate in some local areas of the State, but development of renewable clean sources of transportation fuel should be the State's highest energy priority. However, a shift from oil to biofuels will not be easy. Efficient conversions of woody biomass to liquid fuels such as ethanol will require large integrated biorefineries dependent upon regular collection of millions of tons of woody biomass each year. In Washington State, 11 million dry tons of forest biomass annually are potentially available for energy production. Additional biomass from municipal waste and agricultural residues can be recovered to augment wood supplies for mixed feedstock conversions. Co-location of integrated biorefineries with pulp and paper mills represents the greatest potential opportunity to economically maximize energy recovery of liquid fuels, electricity, and process steam from biomass resources in Washington State. Co-location with existing facilities will bring reduced capital costs, access to needed infrastructure, synergies for integrated raw materials and product streams, and an engaged corps of highly-skilled engineers and union workers.

An Energy Strategy for the State is needed: Sustainable development of renewable energy alternatives to fossil fuels will require careful planning, resource conservation, and committed policy support. Washington State could greatly benefit from development of a scientifically-supported comprehensive strategy for renewable energy based upon an inventory of available renewable resources, identification of energy conversion priorities, and full understanding of the cost of inaction.

Challenges to progress: Washington does not have a lead Energy Agency or effective organizational framework for scientific participation in policy considerations such as the interrelated topics of energy, climate and sustainable forest resources. Criteria for comparisons of potential alternative energy and resource applications have not been developed to inform State energy policy priorities. For example, should biomass be used for electricity generation vs. transportation fuels? The public benefits of carbon neutral energy alternatives to fossil fuels are not readily captured by consumer markets and, in lieu of integrated planning, are not adequately characterized in State energy policy. Current State energy policies, such as I-937, inadvertently favor small-scale and inefficient conversions of biomass to electricity, which fail to address energy independence, have poor raw material-to-energy yields and result in unintended consequences such as compromised biofuels development and reduced greenhouse gas emissions. A comprehensive energy plan is needed.

Recommendations:

A lead state agency should be given authority to coordinate policy development for the interrelated energy policy imperatives of climate change mitigation, energy independence and sustainable management of State natural resources. An interdisciplinary team of State scientists should be assembled to recommend energy priorities and strategic opportunities for progress based upon the three imperatives. Progress will be dependent upon effective use of available but finite resources that maximize energy yields from efficient conversions of biomass to biofuels. Large-scale biofuels projects rather than inefficient small-scale power generators are needed. A State commitment to develop a comprehensive energy strategy supported by interdisciplinary research to identify priority objectives will be needed to support investment for Wood to Energy in Washington.

Climate Change: Policy mechanisms, such as a carbon tax, to provide economic value for energy projects that reduce greenhouse gas emissions are needed.

Energy Independence: An assessment of costs and benefits that could derive from reduced reliance upon imported fossil fuels in Washington resulting from development of wood biomass for ethanol should be conducted.

Forest Health: Washington will benefit from a plan to integrate hazardous fuel load reductions for forest health with provision of adequate woody biomass resources for effective climate change mitigation and energy development activities.

Guidelines for Slash Removal: As evidenced by successes in other states, forest biomass collection guidelines should be developed and incorporated into Washington forest practice rules.

Integrated Infrastructure and Product Hierarchies: Biomass energy priorities should favor liquid fuels conversions at biorefineries that can optimize energy yields through integrated recovery of biofuels, heat, electricity, and chemical byproducts. Where available, biorefineries will be best sited to exploit synergies with pulp and paper mills. State investments in support of biorefinery development would be the most effective biomass-to-energy approach for response to the three imperatives of climate change mitigation, energy independence, and sustainability.

Conversion Technology Advancement: Continued research investment to develop superior conversion technologies for liquid fuel production from Washington biomass resources will help to identify advancements that provide maximum energy yields at least costs. Investment in a pilot project towards development and demonstration of a commercial, integrated biorefinery is highly recommended as an important next step.

Social License: Outreach programs that facilitate public education and dialogue towards consensus solutions to contemporary resource and energy challenges are worthy of State support, as demonstrated in many other states.

Green Jobs: State leaders should acknowledge that wood is a preferable green building product and that forest biomass-to-energy can be a cornerstone element of a clean future economy. State agencies should work with universities and community colleges to establish training programs for forestry workers that cover the spectrum of skills from collection through conversion.

Green Building Products: Green building standards should be revised such that product comparisons are based upon rigorous scientifically-supported performance standards such as Life Cycle Assessment and Net Energy Balance.

Interdisciplinary Science Support for Energy Policy Development: Programmatic investment in sustained in-state interdisciplinary research to develop the data and inform policy makers and stakeholders of realistic and effective strategies to address the difficult and complex challenges of renewable energy development and climate change will be essential. The University of Washington has recently organized a new College of the Environment to address such tasks. Important energy research is also being conducted at Washington State University, the Pacific Northwest National Laboratory, and other State institutions of scholarly pursuit but an effective organizational framework for critical review and collaboration between research institutions is needed.

The entire 200+ page full report, [Wood to Energy in Washington: Imperatives, Opportunities, and Obstacles to Progress](http://www.ruraltech.org/pubs/reports/2009/wood_to_energy/index.asp), commissioned by the State Legislature, is available for download.

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*For other information contact Larry Mason, College of the Environment, University of Washington
larrym@u.washington.edu*