

Biofuel Economics and Policy For Washington State

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Executive Summary

In April 2007, the Washington State Legislature passed [E2SHB 1303](#), an “act relating to providing for the means to encourage the use of cleaner energy”. This omnibus bill contains four chapters. The fourth contains a number of research and planning initiatives for energy markets and climate change. Chapter 4, Section 402

directs Washington State University to provide recommendations for market incentives and research and development grants as follows:

Washington State University is directed to analyze the availability of biofuels in the state and to make best estimates to indicate, by

percentage, the types and geographic origins of biofuel feedstock sources that contribute to biofuel production and use in the state, and to recommend models for possible implementation by the legislature or the executive office for at least the following potential biofuels incentive programs:

(a) Market incentives to encourage in-state production of brassica-based biodiesel, and cellulosic ethanol, including such market methods as direct grants, production tax credits, contracting preferences, and the issuance by the state of advance guaranteed purchase contracts;

(b) Possible preferred research programs, grants, or other forms of assistance for accelerating the development of in-state production of cellulosic ethanol and in-state biodiesel crops and their coproducts; and

(c) The following should be considered when evaluating potential biofuel incentive programs:

(i) Assisting Washington farmers and businesses in the development of economically viable, environmentally sustainable in-state biofuel and biofuel feedstock production;

(ii) Leveraging and encouraging private investment in biofuel production and distribution and biofuel feedstock production; and

(iii) Assisting in the development of biofuel feedstocks and production techniques that deliver the greatest net reductions in petroleum dependence and carbon emissions.

In response to this legislation, this report provides estimates of feedstock availability

by region in the state of Washington based on economic feasibility, wherever possible (Chapter 4). The report includes a comparative analysis of policy alternatives in terms of their efficacy for meeting the stated goals above, and provides recommendations for market incentives for the development of biofuel and feedstock markets in the State of Washington (Chapter 5). The report also provides recommendations for public investment in research and technology development, promotion of new technology adoption, and infrastructure investment to support Washington State biofuel market development (Chapter 6). We also include supporting material on current market conditions (Chapter 2), a description of policy approaches being pursued at the national and state level in the Pacific region (chapter 3), and a conclusion (Chapter 7).

Market conditions for Washington biofuels and feedstocks

Washington's farmers and ranchers and the agricultural industry produce many profitable and high value crops including apples, potatoes, livestock products, hops, wheat, and wine. These crops provide high quality food for the state's six million consumers and profitable exports to the rest of the country and the world. Currently, Washington does have a high value ethanol feedstock production industry -- but it is in the form of wine grapes --- a high-value alternative crop indeed. In contrast, corn, sugar beets, soybeans, canola and other biofuel feedstocks for today's markets are

grown more competitively in Midwestern states, Canada and elsewhere.

The implication is that in order for State policy to induce biofuel market competitiveness and the provision of significant quantities of fuel crops in today's markets, it would likely come at significant cost to either biofuel consumers or the taxpayers of Washington. Our analysis of feedstocks and the results from our market model for Washington's energy economy are consistent with this conclusion.

In the longer run, our analysis indicates that Washington State shows promise as a potential producer in biomass-based fuels and second generation biofuels markets. Indeed, Washington ranks 4th among 19 western states (after California, Texas, and Oregon) for estimated available biomass. Biomass-based fuels may, within a well-designed policy environment, be able to supply energy with reduced net carbon emissions, and compete less with food crops for agricultural land. In general then, the state has limited short term prospects for a state-based biofuel industry, but it has stronger long term prospects. There are several implications of this situation:

- If the State chooses to promote in-state production of biofuels, the most cost-effective approach would likely be to implement policy actions now to set the stage for advanced biofuels industry in the longer run.
- However, the shortage of regionally-produced feedstocks in the short run does not prevent the State from adopting

policies to meet the other goals in this legislation -- reduction of dependence on petroleum and mitigation of greenhouse gas (GHG) emissions – now and in the immediate in the future.

There are policy options that would have both an immediate effect on reducing petroleum dependence and GHG emissions and that would set the stage for a developing bioenergy industry. On the other hand, some policies that would have the effect of promoting biofuel consumption in the short run would also impose costly short-run requirements. For example, suppose the State required that biofuels consumed in the state also be produced in the state. If so, our analysis shows that the State would have to either accept low levels of biofuel adoption, or adopt costly subsidies or “pass it on to the consumer” mandates for in-state feedstock use. Suppose tax credits are provided for in-state production of feedstocks or fuels to compete in today's biofuel markets. These tax credits would almost certainly cost the state more than the economic benefits that the tax credit would generate for in-state producers and consumers in the biofuel industry. In the short run, in-state production requirements or subsidies will lead to more costly biofuels for consumers or the taxpayers of the State. In general, policies that might seem to promote one goal can turn out to have negative impacts on other goals. Moreover, the short-run (immediate) and long-run impacts of policies can easily conflict.

Hence, it is important that the goals of this legislation be considered together, and in

conjunction with the goals and mandates of other related Washington State legislation, as they are evaluated. Also, it is important that the policies integrate effectively into broader state and federal energy policy as it develops. For example, the State can take advantage of an infrastructure for tracking biofuel and or biofuel characteristics that has already been developed as part of the Federal Renewable fuel standard. Furthermore, many states, as well as the Federal government, are currently developing policies to promote biofuels and reduce carbon emissions and energy dependence. Coordinating with these other policy efforts would make Washington policies more effective.

Washington State can be among the leaders in biofuel market and policy development by focusing public policy on long-run industry development rather than incurring significant net costs by taking a short-run follower role in today's first-generation biofuel market. Our analysis suggests that Washington has relatively strong long run potential in biofuels, but weak short run prospects. However, this does not suggest waiting to put policies in place. In fact, Washington has the opportunity to 'get ahead of the curve' by adopting balanced and carefully targeted policies now to better position the State for biofuel markets of the future.

Market incentives

If the State decides to implement a market incentive policy approach to pursue the objectives state in E2SSHB 1303 §402, we recommend following a price incentives

approach based on a carbon intensity tax, which is a tax that is progressively higher the greater are the "life-cycle" green house gas (GHG) emissions from the fuel. Such a tax could be implemented in a number of ways to make it revenue neutral and non-regressive - depending on how it interacts with existing fuel excise taxes. For instance, it could generate a "renewable fuels fund" that would be available to fund tax credits for fuels with low carbon intensities as the foundation policy.

It is important to make three points clear immediately. First, taxes are never popular, but a carbon emissions tax¹ can be designed to alleviate concerns. In principle, the tax structure could be revenue and even final fuel price neutral in the long run by coupling the carbon tax on high carbon fuels with tax credits on low-carbon fuels. The tax revenues could also be used for biofuel investment incentives or to provide reduction in other preexisting regressive or burdensome taxes such as sales taxes or Business and Occupation taxes. Further, other policy alternatives such as renewable fuel standards or low carbon fuel standards may not entail explicit taxes, but they do impose a penalty which amounts to an

¹ We will refer to the proposed tax by a number of terms: carbon emissions tax, carbon intensity tax, or, sometimes, just carbon tax. The idea of a "carbon tax" includes a family of related taxes (just as a sales tax may be implemented in a number of ways). The idea put forward in this report is for a kind of tax related to life-cycle emissions and measured in carbon-equivalents. Often the unmodified term "carbon tax" is used to refer to a basic tax on fossil fuel carbon emissions. An example of the latter is the carbon tax recently implemented in British Columbia.

implicit tax due to their effects on fuel supply and demand.

Second, a greenhouse gas based approach may appear at first to be a climate change policy rather than a biofuels policy. However, our analysis shows that the most streamlined and direct way to approach all of the goals noted in our enabling legislation given Washington State's comparative advantages is through a policy linked to greenhouse gas emissions. Pursuing multiple goals is inherently complicated, because no one policy instrument can address all goals perfectly. However, the carbon emissions based policy that we recommend simultaneously addresses biofuels market development and petroleum dependence, as well as reductions in greenhouse gas emissions.

Third, we recommend the use of carbon emissions taxes over quantity-based fuel taxes for a three important reasons. First, while volume-based taxes, subsidies, or standards can be used to (more or less) effectively reduce petroleum dependence and promote biofuel and feedstock markets in Washington, they do not provide direct incentives to produce and consume low-carbon fuels. We argue that a carbon-based policy can better target all three primary policy goals outlined in the legislation. The second reason is that quantity-based fuel taxes actually can penalize some biofuels. In particular, ethanol has a low energy content (hence a reduced number of miles-per-gallon) so that the effective quantity-based tax is higher for ethanol (for example) than for other liquid fuels.

Our analysis favors taxes over subsidies due to the difficulty in targeting subsidies to the goals -- and to the larger state costs of subsidies. Our analysis shows that subsidies are costly, both in terms of taxes to the citizens and in terms of burden on the Washington economy. Also, we recommend against a Washington-specific renewable fuel standard. Our analysis suggests that an effective (in economist's jargon, binding) standard would not be as effective for providing incentives for carbon emissions reduction, and it entails up-side cost risk. We also recommend against a carbon-based renewable fuel standard such as that under development for California for similar reasons. Based on our analysis, we recommend a price based (tax and tax credit) system over a carbon cap and trade program, but given the inertia behind this approach under the Western Climate Initiative we provide recommendations for pursuing this approach as well..

If policymakers choose to implement subsidies (tax credits) for renewable fuels produced in-state, we recommend using tax credits based on carbon emission intensity, and to fund them only with carbon emissions tax revenues, not by general revenue funds. Similarly, we recommend against feedstock subsidies, except perhaps for specific feedstocks where there are additional benefits garnered by the subsidy. Examples of such include municipal solid wastes (which reduce public waste disposal costs) and forest thinning (where wildfire risk is reduced and for public land, where forest productivity is improved). Some incentive measures will be required to meet the biofuel

feedstock and production objectives of the legislation. However, we recommend that these be cautious and oriented towards long term measures.

Research, new technology adoption, and infrastructure

Our analysis identifies market conditions that can justify public investment in such activities as research and development (R&D), late stage market development, and market infrastructure. We discuss a set of management principles to guide public investments when they are justified. We then discuss the implications of our proposals and provide specific recommendations for near-term investment. A few examples of our recommendations for research include:

- Invest in research to improve productivity and reduce costs of production of dryland (including forest) biomass and waste-based feedstocks.
- Invest in agricultural crop development, including new forage grass feedstocks, if these show substantial potential for improvement in productivity and economic viability.
- Invest in research on distributed and multi-stage biofuel production processes to reduce feedstock and co-product distribution costs.
- Invest in research on accounting for Life Cycle Analysis of fuel carbon.
- Invest in research on environmental impacts of biomass production and utilization, especially on water use quantity, water quality, and long-run impacts on soil characteristics.
- Invest in infrastructure, including rail and transportation, which can adapt to, and

promote a flexible, progressive energy program.

Notice that we have not listed explicit State investment in biofuel production. Currently there are large private and national government efforts in developing the technology for advanced biofuels and other forms of bio-mass energy production. It would seem prudent for the State to focus any research investments it makes to roles that support the State's infrastructure or economic sectors in which the state has obvious existing or potential comparative advantage.

Investment in late-stage development should focus on projects that provide significant potential for market-wide benefits from new technology that lend themselves to Washington's specific comparative advantages. We believe the state can facilitate private-sector initiation of cost-sharing arrangements, with a significant portion of risk borne by the private sector, and with substantive information sharing requirements. Our analysis provides some recommendations for future use of the Energy Freedom program in this regard.

As with public R&D investments, identifying appropriate targets for state biofuel infrastructure investment is especially difficult because fuel markets are currently in a state of flux. This uncertain state creates a substantial risk of investing in infrastructure that is not subsequently utilized effectively by the industry. The risk is higher, the more specific-purpose the investment is; it is lower, the more general-purpose the investment program is.

We therefore recommend that the State should pay particular attention to maintaining rail infrastructure. The state should exercise caution when deciding to invest in specific biofuel plant or distribution-logistic projects. Where possible, it should strive to help facilitate market-based outcomes through public/private partnerships from all vested parties.

Biofuels in evolving energy markets

Our legislative mandate calls for us to focus our analysis primarily on the biofuel market. Biofuel policy to date across the United States has developed with a degree of isolation from most other energy policy developments. To reach our energy goals in a cost-effective and sustainable way, it is important to balance the economics of biofuel markets and their environmental consequences with the other important energy sectors.

Washington State policy and investment in biofuel markets should be approached with integration into the larger energy markets in

mind, and with a deliberate intent to allow for adaptation to technological change.

At the risk of prognostication, consider, for example, the current level of investment by automakers in electrical hybrid vehicles. From a transportation cost and carbon impact framework, greater utilization of the electrical grid to provide power to passenger vehicles may prove more environmentally and economically viable in the future. The movement toward electric vehicles could reduce many network inefficiencies associated with moving, heavy, bulky products such as feedstocks long distances and instead create electricity from local resources such as forestry residues and distribute via the available electrical grid. On the other hand, if electricity depends on large centralized fossil fuel plants, a transportation network built on electric vehicles could run counter to local pollution and global climate change concerns. While it is likely that biofuels will play a part in fulfilling Washington's energy needs in the foreseeable future, these broader developments should be kept in mind as the State develops its biofuel policies.