

ATIP Foundation Regional Bioeconomy Forums:
“Addressing the Challenges & Opportunities of Advancing the Billion Ton Bioeconomy”

**A Report to Participants in the PNW Regional Bioeconomy Forum
Sea-Tac Conference Center (Washington State University, co-hosts)
Seattle, WA**

October 3, 2016

Wes Jurey, Foundation CEO and R.J. Brenner, Director, ATIP Foundation

Background

In late 2013, the seven agencies and the Office of the President that constitute the Biomass Research and Development Board,¹ (BR&DB) began development of a vision to promote the expansion of the bioeconomy. With the projection that this nation, by 2020, will sustainably produce a billion tons of biomass annually, the “Vision” was published as the *“Federal Activities Report on the Bioeconomy,”* (known as FARB) released by USDA Under Secretary Cathie Woteki at the 2016 Advanced Bioeconomy Leadership Conference in Washington, D.C. (February). “The goal of the Billion Ton Bioeconomy Vision is to develop and implement innovative approaches to remove barriers to expanding the sustainable use of America’s abundant biomass resources, while maximizing economic, social, and environmental outcomes.” BR&DB engaged the ATIP Foundation in September 2015 to arrange and convene several regional listening sessions.

Separately, during the month of April, 2016 USDA and DOE co-led some informal “listening sessions” at three major conferences: 2016 International Biomass Conference and Expo in Charlotte, NC (April 11-14); World Congress on Industrial Biotechnology in San Diego, CA (April 17-20); and the Symposium on Biotechnology for Fuels and Chemicals in Baltimore, MD (April 25-28). In addition, a webinar on the Vision was conducted jointly by USDA and DOE on May 5, 2016. Input garnered from these events helped shape a subsequent document, tentatively titled *“The Billion Ton Bioeconomy Initiative: Challenges and Opportunities,”* released in November 2017 by the BR&D Board (for a copy, go to http://www.biomassboard.gov/pdfs/the_bioeconomy_initiative.pdf).

The rationale and strategy for these reports, and purpose for the public gatherings was published in a USDA a blog, including the Vision and the scope of the listening sessions designed to “... gather information and engage stakeholders on how to build and grow the “Billion Ton Bioeconomy.”

(<http://blogs.usda.gov/2016/04/27/growing-and-building-the-billion-ton-bioeconomy/>)

¹ The Biomass R&D Board consists of representatives from the U.S. Department of Energy, U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Transportation, the National Science Foundation, the Environmental Protection Agency, and the Executive Office of the President of the United States.

Regional Bioeconomy Stakeholder Forums

The federal agencies contracted with the ATIP Foundation --- a non-profit consortium of State Economic Development organizations --- to develop and co-host with a coordinating entity, a series of regional Bioeconomy Forums to garner input from a broad range of stakeholders on the Challenges & Opportunities to help shape a “multiyear implementation plan,” expected to be prepared by the Biomass R&D Board during the second quarter of the fiscal year 2017, submitted to the Office of Science and Technology Policy (OSTP).

Forums were convened in the SE U.S with Georgia Tech as co-host (**September 16, Renewable Bioproducts Institute, Atlanta, GA**), in the SW. U.S with the Mineral Wells Chamber of Commerce, Mineral Wells, TX, (**September 29, Holiday Hills Country Club, 4801 Highway 180 East, Mineral Wells, TX**), in PNW with Washington State University as co-host (**October 3, Sea-Tac Conference center, Sea-Tac airport**), in NE U.S. co-hosted by The University of Maine, Orono (**October 18**), and in the MW U.S. , **co-hosted by The Ohio State University (Schisler Conference Center, Wooster, OH, November 15)**. Co-hosts arranged for the meeting room, a modest noon meal, and a dedicated note taker with real-time display so the participants could verify their remarks.

The goal of each Bioeconomy Forum was to bring together a mix of stakeholders (about 40-60 participants) from six sectors to seek their input, relative to the initiative’s vision, strategies, and implementation. These sectors are (1) industry; (2) state and local government; (3) economic and workforce development; (4) investment & finance; (5) academia; and (6) agricultural and environmental organizations. Co-hosts, with the assistance of BR&D Operations Committee, derived the list of by invitation participants.

Forum Structure and Role of the Foundation and Co-hosts

The PNW U.S. Bioeconomy Forum was moderated by Wes Jurey, CEO of the ATIP Foundation, who was assisted by a team from Washington State University (WSU) including John Gardner, CEO of the WSU Foundation. Members of the BR&DB Operations Staff made presentations that reviewed the FARB and posed questions related to advancing the bioeconomy. Real-time notes were taken by Alyssa Patrick

Demographics by sector: Table 1 describes the demographics of invitees by sector, and the actual number able to participate on October 3, 2016

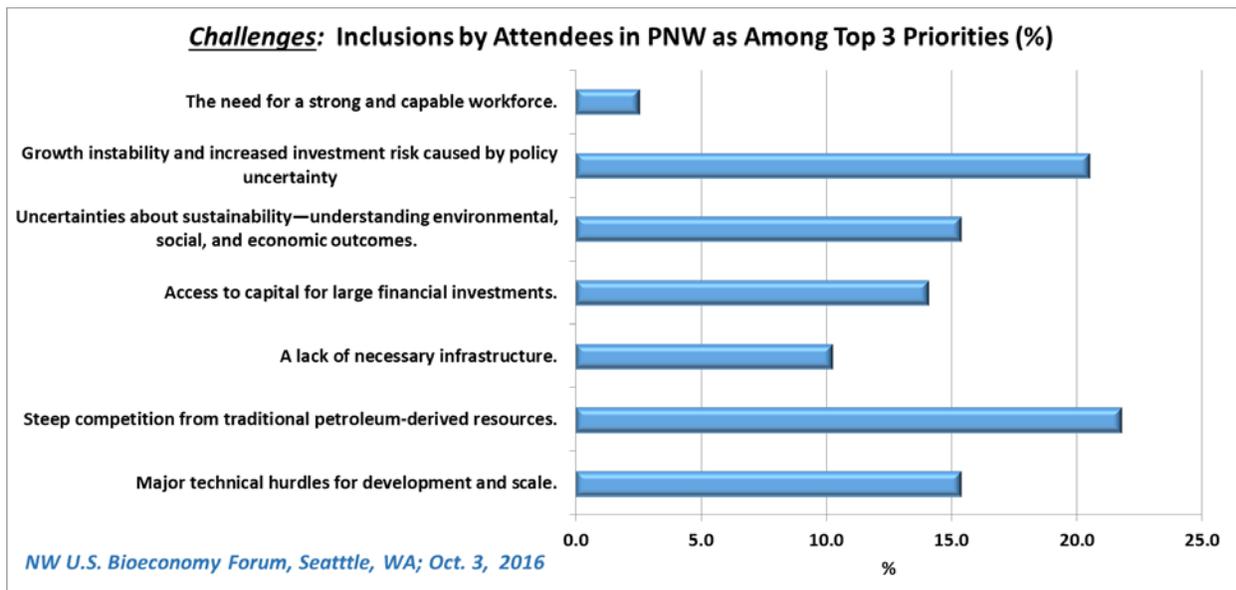
Table 1. Demographics (by sector) of invitees and participants, convened by ATIP Foundation co-host Washington State University for NW Regional Bioeconomy Forum, October 3, 2016.						
Sector Designation	Invited	% of invited	No. Participated	%RSVP to Attend	% of Attendees	
Industry	25	23	3	12	7	
State and local government	11	10	4	36	9	
Economic and workforce development	17	15	11	65	25	
Investment & finance	9	8	4	44	9	
Academia	28	25	14	50	32	
Agricultural and environmental organizations	21	19	8	38	18	
Total	111	100	44	40	100	

The agenda (Attachment 1) included welcoming comments by the ATIP Foundation, BR&DB representatives, and Beth Osborne, Deputy State Director for US Senator Patty Murray. Slide set presentations (Attachment 2) were

made by the ATIP Foundation followed by Todd Campbell (USDA) with assistance from Valerie Reed, Deputy Director, Bioenergy Technologies Office, Department of Energy. In addition, a “discussion document” was provided to the participants (Attachment 3). The remainder of the day consisted exclusively of stakeholder attendees from the six sectors participating in discussions on these “discussion document” questions. Notes were taken (attributed to the commenter) on the fly by Alyssa Patrick who projected these so all participants could review and correct as needed. The audio was also recorded from a laptop in case it was needed later to clarify comments.

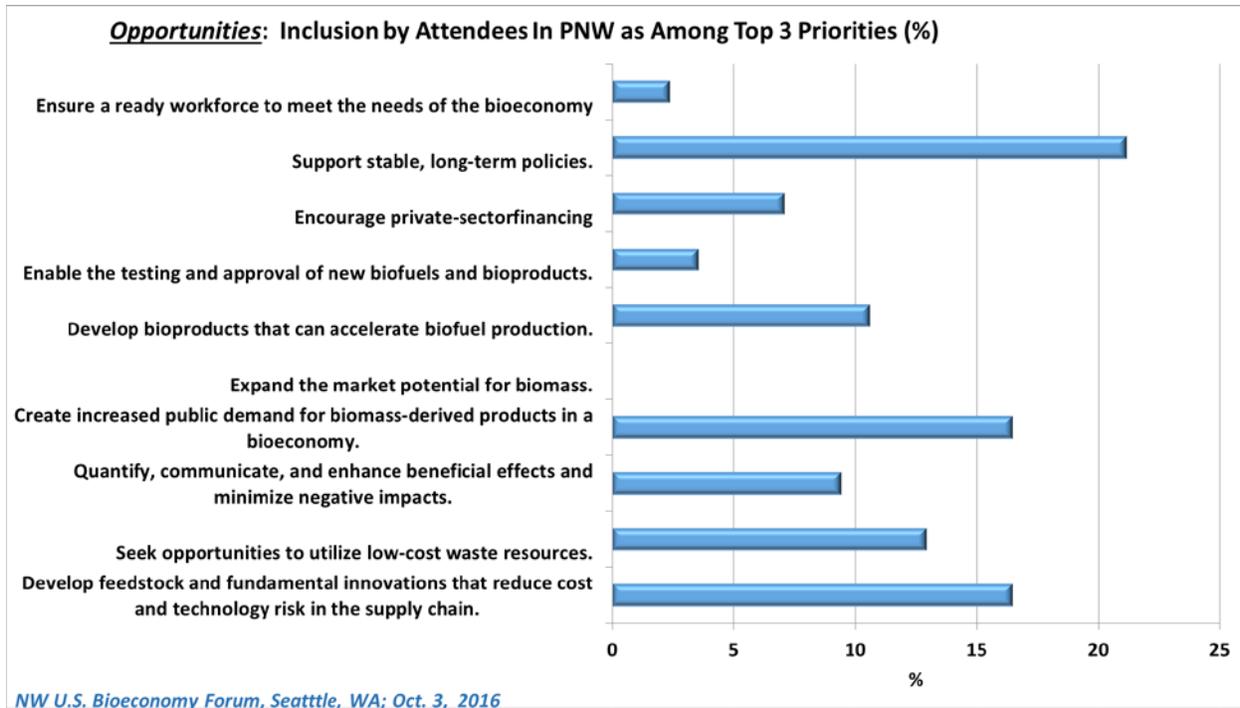
Participants of the forum received a link to a Google Document and a two week window of opportunity to edit their specific comments, or add additional comment. Thereafter, the document was closed by Washington State University, and ownership was transferred to Dr. Rick Brenner, ATIP Foundation, who reviewed comments, clarified with authors as needed, redacted all names of comment contributors, and annotated with ATIP Foundation comments (designated in margins as Comment [RJB#]). The document is presented (Attachment 4) as a record of the forum and it includes participant prioritizations of each “challenge” and “opportunity” --- from their perspective --- to determine whether each was considered to be in the top 3 priorities for the Pacific Northwest U.S. region.

Figure 1a (below) reflects their perspective on these “Challenges”.



The top two issues for PNW participants were “steep competition from traditional petroleum-derived resources” (21.8%) and “Growth instability and increased investment risk caused by policy uncertainty” (20.5%). “Uncertainties about sustainability—understanding environmental, social, and economic outcomes,” and “major technical hurdles for development and scale” were tied for the 3rd top priority at 15.4% of respondents.

Figure 1b (below) reflects their priorities on “Opportunities.”



Participants clearly identified “support stable, long-term policies” as the most important opportunity for advancing the bioeconomy (21%), followed by “create increased public demand for biomass-derived products in a bioeconomy” and “develop feedstock and fundamental innovations that reduce cost and technology risk in the supply chain” (16% each). “Seek opportunities to utilize low-cost waste resources” was just behind at 13% of respondents suggesting that it was among the top 3 opportunities.

Reporting of Participant Comments

There were a number of comments from the PNW region that characterized regional issues, but also a number of comments that were fairly common issues across the 5 regional forums. Below, are non-attribute comments from participants, as well as notations by the ATIP Foundation. Regarding the latter, these are preceded by “[NOTE:...],” and are also reflected in Attachment 4 as “Comment[RJB#].”

Regarding comments to the “challenges” list:

- “A lack of necessary infrastructure” ---
 - Commenter [1]: I would say: Need of new infrastructure and identification of synergistic opportunities with existing infrastructure!
 - [other commenter] is not certain this is correct for many cellulosic sources in the PNW - particularly woody biomass. In fact there are a number of “stranded assets” in the form of pulp

and paper mills, lumber mills, transportation assets (trucks and rail), log depots, chipping and densification equipment, etc.

- “The need for a strong and capable workforce.”
 - It seems that the farm digester company Regenis (www.Regenis.net) might offer models for building a trained, functional and profit-focused workforce in/for the bioeconomy.
 - It is important to highlight the experience of the Walla Walla Community college and their AAAS degree in plant operations

Additional challenges offered by participants:

- Insufficient incentives to drive investment and markets [**Note: this has been a theme heard in most forums**]

General notes on “Challenges”

- In reviewing the Federal Activities Report on the BioEconomy (FARB), I would like to see what the funding levels are -- in terms of authorizations and appropriations for each program and agency described in the report. It would also be very useful to present the total federal funding directed towards BioEconomy developments over the past few years. *This would provide insight into how big is the federal government effort in funding programs for the bioeconomy initiative.* Although it might be controversial, providing high-level comparative funding levels for BioEconomy initiatives relative to aggregate federal funding for fossil fuel and nuclear energy resource and technology programs would contribute to a clearer policy assessment of federal government funding priorities across all major energy options.
- [another commenter] ... would also recommend that the FARB include a section that highlights the BioEconomy related research being conducted at our National Laboratories (e.g. NREL, Argonne, Lawrence Livermore, Idaho, etc.). It would be useful to describe the national labs’ major programmatic leadership assignments and funding levels. This could help the private sector identify sources of technology innovation and potential public/private partnerships for further research and development. [**Note: the Foundation would suggest we provide funding levels for both intramural and extramural research from the various BR&D member agencies that relate to the Bioeconomy. An obvious follow up would be an annual research report highlighting outcomes to date, available technologies, and a request for partnerships to address specific issues (e.g., CRADA or cooperative agreement. This idea is further supported by [RJB7] comment in Attachment 4, and provided attached to comment below.**]
- Should we revise FARB and put numbers behind programs to show size of federal funding? [RJB7] **I think an annual report on bioeconomy-related R&D outcomes would be a great idea. Currently federal agencies are required to publish an annual report on Technology Transfer that covers all innovations arising from intramural R&D in all agencies. Extramural R&D funded outcomes are published by AUTM (Association of University Technology Managers) but only addresses IP licensing.**
- [research] ... The ability to continue to research transportation logistics is important, any region with raw material is going to need this work. Infrastructure and transportation logistics of biomass are crucial elements. Most recent cellulosic plants are in Iowa. Raw materials are found within 50 miles, but the big issue is how to transport that efficiently? How to transport with a minimal amount of costs and distance. Iowa State University and private companies doing work on this.
- We should be working with the tribes as well. Lots of opportunity as well as mutual interests. **Note: Sounds like an opportunity for a Pilot Project Consortium to better utilize lands of Native Americans for creating new opportunities.**
- Distance - we are very far north and we do not have volume produced here in the Pacific Northwest. We need to see a combination of infrastructure and incentives to help improve. **Note: this has been a common theme among regional forums.**
- Much of the inland PNW is dry with less than 14” of precipitation per year. Dryland biomass yields are too low under the dry growing conditions to contribute significantly to the Billion Ton goal. Those crop

residues are needed to protect soil from wind erosion and maintain soil organic carbon. We will need to balance between biomass production and environmental stewardship. This is an important issue; as crop residues (e.g. Wheat straw, corn stover, etc.) are viewed as significant feedstocks for advanced cellulosic biofuels and bioproducts. Sustainable production of these feedstocks will require location specific and crop rotation specific residue management and allocation practices to protect against soil erosion; improve soil moisture retention and add Soil Organic Carbon. **Note: These are formidable problems in PNW. Dedicated biofuel crops help wheat production, but the money crop is still the wheat. This region may want to explore other biomass feedstocks for developing biorefineries (e.g., tallow, ocean / seafood residues, etc.).**

- State and local economic incentives helped spur the development of the biofuels industry in Iowa. State and local economic incentives helped spur the development of the biofuels industry in Iowa. **Note: perhaps the process should be replicated in PNW.**
 - Don't have the same kind of support in Washington, need more business and policy engagement and support

Responses to the “opportunities” list

- “Seek opportunities to utilize low-cost waste resources.” -- We should make opportunities for local communities to benefit from the bioeconomy, rather than strictly adapting a model that’s scaled up to a refinery miles away.
 - Other commenter: We still need to be aware of the differing definitions of some common terms related to development of a bioeconomy. The term biorefinery may look very different depending on the source of biomass and the intended products. A dairy farm by itself can be reclassified to be called a biorefinery. Offsite organics and woody biomass can be brought on to the farm to be anaerobically digested or thermochemically converted; however, the radius from which to derive this biomass is relatively small and serves as an economic boost rather than a critical pillar of the process. This is as contrasted with a biodiesel biorefinery which might need to draw feedstock from a 50+ mile radius or not be viable.
- “Create increased public demand for biomass-derived products in a bioeconomy.”
 - We’ve done prototypes, but public isn’t seeing those - we need to increase awareness and understanding; **social cost of carbon**, other ecological services and environmental benefits.
 - **Would suggest that highlighting clean air, water, and improved soil while gaining the benefit of renewable biofuels and bioproducts is a message that would be more universally accepted.**
 - Bluntly, highlighting climate change/global warming as a reason to change and then insisting on individual acknowledgement of a need to change to support society just will not work for nearly 50% of the US population. Instead of confrontationally dragging this group in, publicize and highlight the local benefits of these projects.

Additional opportunities suggested:

- At regional level, it is challenging to bring infrastructure together; if there isn’t money going to the region to collectively solve a problem, we shouldn’t be surprised it is not getting coordinated. How can the federal government coordinate regional efforts? Need to put at least millions into the region to coordinate the efforts
 - The regional biomass economy programs were in place for decade or more, stood up by DOE, but managed by governor offices. Not big dollar, but were for meetings, convening partnerships. These are the kind of actions we can put to your observations and recommendations. **Note: This comment suggests that a regional pilot project may be a recommendation from PNW attendees.**
- Leveraging public entities for long term energy purchase agreements or market stability - merchant generation not possible for biofuels... EX: RNG producer needs a gas purchase agreement in order to

capitalize a new facility, not many entities have the planning horizon to purchase energy on a long term agreement, except traditional energy companies which fail to value the “green” attributes.

- Other Commenter: Look at King County (WA) separate sale of environmental attributes of landfill gas, along with "merchant gas" from their Cedar Hills landfill to Puget Sound Energy. This is a model for monetizing RNG added value.

General notes on opportunities

- The crops that qualify as specialty crops are specially designated. You have to go through a process to get that designation. **Note:** <https://www.ams.usda.gov/about-ams/programs-offices/specialty-crops-program>
- When considering purposely grown crops, competition with food production (in terms of land, water and input requirements) becomes a much more sensitive issue. It entangles the price of biomass feedstocks with the larger and often volatile agricultural commodity markets. It also has the difficult challenge of convincing US farmers that they should change their farming practices in order to cultivate new types of crops (e.g. camelina, switchgrass, etc.). Unless there are long term public policies that provide incentives and reduce risks, major changes in farming systems are unlikely to be quickly adopted. As we develop opportunities and action items, we need to apply different techniques/resources to each.
 - **Note: Recurring theme among regional forums; however, in this region, crop rotation should be considered to get both a biofuel crop as well as improved wheat production in rotation.**
- I want to make a comparison to the information revolution - in beginning they were not developing computers to do what they do today. Bill Gates and other visionaries turned the informatics revolution into what it is today. With the biomass economy we are in a similar starting phase - how it evolves depends on the “genius” that will help it take shape. We may need to produce a fuel that doesn’t look like petroleum. Right now we are looking to replace existing molecules, but since we are working with new feedstock, there may be a possibility for fuel that we haven’t seen yet.
 - Other commenter: There may be opportunities for fuels and chemicals that we haven't seen yet. The technologies and knowledge that we are developing for the biomass economy could catalyze a revolution in other areas (for example in the way we handle and use our urban wastes!)

What sets the NW / PNW Bioeconomy apart from other regions of the country? What inherent advantages do you have? What regulatory issues constrain success? What incentives would help advance business opportunities to advance the bioeconomy?

- We are a gateway to the Pacific Rim; export options open towards Asia.
- Demand from the aviation industry; track record working with Port of Seattle, SeaTac, WSU, Port of Spokane, and more; all have said they would like to use aviation biofuels. We have relationships with Alaska and Horizon Airlines who are saying if you build it we will come, which says a lot about partnerships in the state.
 - This is an important issue. Similar to the incentives provided to early stage photovoltaic and wind power generation through grid utility power purchase agreements with substantially higher than market prices per kwhr; initial biofuel purchase price premiums could be offered to biofuel producers, where the final blended fuel cost/price could be more competitive with conventional petroleum derived fuels. **Note: government incentives**
 - The better we can quantify the environmental services, the better we can reflect true value of fuel provided. Offtake agreements, the small percent of blended fuel being used, if you can space that over a lot of gallons, it is a small cost to companies. Airlines are currently using 30-40% of budgets on fuel. Let’s create an alternative now while companies have money to invest. USDA Rural Development is willing to share some of the risk with standing up plants/biorefineries. We should share risk to get the first plants off the ground. Doesn’t have to be the most profitable,

just need to reduce the risk so we can move on to more developed options. **Note: Start with this URL <http://www.usda.gov/wps/portal/usda/usdahome>**

- I'm surprised the conversation hasn't focused on **bioproducts** more. If we want to focus on fuel, I don't think we will get there if we don't talk about the high value products that will be needed to make it successful.
 - Commenter: Agriculture systems did not play a large roll in this meeting; however, the focus on anaerobic digestion of animal wastes is now less on how to produce electricity from the biogas and more on how to extract usable and potentially valuable co-products. While the digester is the central component of the facility, it is the nutrient recovery and water upgrading components that are going to drive future adoption. The challenge is now to monetize those co-products for the local bioeconomy--we don't want to be shipping biofertilizers across the country unless there is some other critical need.
- On the East Coast of NE Florida, there are two major manufacturing plants that receive about 400 log trucks a day. Six months ago Rainier Advanced Materials entered into a joint agreement with Borregard in Norway related to lignin. This joint venture called Lignotech LLC, received tax credits from the county, and a new plant is getting built there, on Amelia Island where the existing plants are. Essentially, this makes better use of a biomass (lignin) that was previously burned for energy at the plant. Once the new plant is in operation (2017), the lignin will be used to create high value products --- and the local economy benefits with more job creation, and higher value products on the market.
 - **Note: Example of turning low value biomass waste into high value products because of research, IP, and new partnerships that provides industry with a 20 year advantage of establishing new markets and products.**
- NARA is the Northwest Advanced Renewables Alliance of which Mike Walcott of Washington State University is an integral member. I thought I said that you can't get RINs from federal lands, as is the case. The federal government owns 53% of the state of Oregon and almost 29% of Washington. I was trying to make the point that environmentalism and its inherent love of national forests is very strong in the Pacific Northwest, unlike the southeast section of the U.S. Thus, those who work in the PNW forests, especially in the public sector, generally refer to the jet fuel made from trees as a bioproducts instead of feedstock since feedstock carries with it the emotional baggage associated with clearcutting and commodity production using wood. Thanks for your opportunity to attend this interesting and valuable meeting. PNW is different because of federal land ownership. Example: we were not included in the NARA analysis because you can't use renewable identification numbers on rural land. Here there is a deep attachment to forests, environmentalists don't want to see activity. We refer to it as a bioproduct rather than feedstock because of sensitivity towards national forests.
 - **Note: Uniqueness of land ownership would suggest that a partnership of feds, state lands, and industry / key private sector players should be considered to formulate a unique pilot project for PNW.**
- Policy has focused on replacement of certain molecules; instead of fixing molecule, we are going to have opportunity to develop molecules that react to the biofuel. Nature of molecule we are working on is different than petroleum molecules. We are going to find molecules that perform better than petroleum based molecules.
 - Commenter: The idea here is that by focusing on petroleum replacements we may be missing opportunities in other areas where biomass derived molecules could have competitive advantages.
- We've been focused on large scale plans, but the smaller scale plans haven't been provided. We have so many options, we don't have enough resources to know where to start. How do you do one thing at a time, get it done, and move to the next thing? The process is so distributed at the moment, how can we focus?

- **Note: Appropriate for a public private partnership to garner federal, multi-state, and local resources to optimize novel traits of the PNW region.**
- Haven't talked about municipal solid waste, or water resources. Thinking about public perception; we need to address amount of waste, how it can be used in urban core - need to communicate that better to public.
- Other commenter: Related: Progressive companies and municipalities (SF, Portland, Seattle, Google, Microsoft...) are now moving aggressively to zero-waste strategies. These strategies involve collecting and separating large amount of materials, notably including valuable biologically-sourced types [food waste, etc.]. This is currently a burden, as was collection of quality recyclables such as glass and metal when recycling programs were initiated. But as with high-value recyclables, using digestion and other sophisticated reclaim processes, these "wastes" will be valued when and where they are produced. Again, digestion and other biologically-based waste management systems are highly amenable to down-scaling, reducing need for interconnecting infrastructures to transport these wastes to central plants, as is now the practice. This change of mode will require more trained service workers (to maintain the distributed bio-processors), which creates jobs.
- Cannot sell bioeconomy as if it is same for the whole country. Every region resonates with something different. For Iowa it's about corn, for Washington it is about aviation industry. In years to come, resource limitation is going to be the problem that drives to technology. We can start answering that question with development we are doing today.
 - Other commenter: Our bio-economy marketing efforts have to be regional and have to be well integrated with the economic needs of the region!
- USDA has business services to provide access to capital in rural areas in a myriad of ways. Water quality - recent study shows that there are 66 million dead trees in Nevada, contributes to wildfires, and our waters are filtered through our forests. The recent environmental developments from insect infestations to wildfires - which cost money and environmental health - are why a bioeconomy makes sense here. These should be drivers of why we need to make use of biowaste, and look to new options in bio-feedstocks. Job creation, economic development, environmental services - all have a benefit. How do we quantify those benefits?
 - **Note: This argues for local / regional "biomass accumulators" and a coop structure to produce bioproducts for both regional use (e.g., biochar for soil / water enhancement), or energy-dense pellets for markets elsewhere.**
- Regional innovation centers - put out a proposal for this so region can decide what makes most sense for them to develop. Let them propose the deliverable. That combines research with the market infrastructure.
 - **Note: Back a proposal with a PPP with others at the table for greater likelihood of success.**
- We should also note that a major study (Proceedings of the National Academy of Sciences, "Impact of anthropogenic climate change on wildfire across western US forests") has just been published that finds that more than half of all recent western US forest wildfires are directly attributable to climate change that has increased forest aridity. There was discussion in the Forum of how US Forest Service fire prevention programs should be significantly increased with funding for forest thinning operations that use smaller scale systems for harvesting and converting such thinnings into biochar.
 - **Note: <http://www.pnas.org/content/113/42/11770.full.pdf>**
- We need to be less concerned about the relatively higher capital cost per unit of production of smaller bioproducts operations. This is especially relevant in our current period of exceptionally low interest rates and cost of capital. This perspective would encourage smaller scale production facilities that could be distributed throughout the region; and could benefit many rural communities with increased jobs and incomes from a new, localized BioEconomy. The lead time required for such distributed development of different bioproduct production enterprises may also be shorter than for much higher capacity facilities.

- There's not a conversation about biochar as an application of biomass. It offers opportunity of collocation of feedstock and end use. You gasify biomass, produce biochar, dispose of biomass in low cost way. Then you produce biochar that can help fertilize crops and remediate soil. It is an elegant use of biomass. There is incredible complexity of performance of biochar based on feedstock and way it has been processed - it has created a whole area of science about which much remains unknown. Our local universities are developing knowledge of biochar feedstock characteristics; production technologies; and field applications. However, our universities need much greater financial support for continued research and development of biochar materials in order to become centers of excellence that would help industry and the forestry and farming sectors to make sense of its value and open up new opportunities for economic growth.
 - **Note: These last two comments put forth good arguments for regional PPP that includes federal partners. Sounds like a good topic for a separate meeting on next steps in PNW.**

Follow Up Question: Should we keep collaboration among this group moving forward after this meeting? If so, how?"

- What partnerships do we need to form in this region? Can we do same thing next year with 150 people from many different aspects of this topic?
 - **Note: Group wanted to expand and bring more players into it.**
- We've had two regional projects for 5 years; they have filled a void in conversation across these regions. Both projects are sun setting. They have provided tremendous synergy across the states (WA, OR, MT). There are two different areas here - west and east - that span multiple states and offer different things to this conversation. Maintaining the regional collaboration will be key.
- Our PNW region has also greatly benefitted from the knowledge and capacity building that was accomplished by the major USDA-NIFA five year grant to Washington State University, Oregon State University and the University of Idaho for "Regional Approaches to Climate Change - Pacific Northwest Agriculture" (REACCH). Although the REACCH program focused on wheat farming systems, the comprehensive knowledge gained regarding crop rotation strategies; soil and water impacts of different practices; and the impact of forecast climate changes on the region's farming sector will contribute to our understanding of sustainable agricultural strategies for both food and other biomass products.
- We have tried to address needs for aviation industry through several collaborative forums and initiatives. ATiP would be able to bring all of those things together, bring this into a forum on the larger bioeconomy conversation.
- Yes, we should follow up. Grid modernization, built environment, and biofuels are all on the radar for the state, but biofuels have fallen off the radar a bit. We can bring that back by reconvening this group. These conversations are happening all the time, some larger force to bring us all together is helpful.
- The bioeconomy initiative has been in development for several years. We have gotten to this point and our goal is an action plan that will motivate the new administration. There is another umbrella - Mission Innovation. It is a global initiative, Obama has suggested support of. All countries that came together in Paris proposed doubling spending in R&D for next five years for clean energy technologies. Working on how USDA, EPA, others will play under that umbrella. No guarantees because of admin change. The EU is part of Mission Innovation, and have finalized \$320B - this could still play a role for U.S. too.
- \$1B leaves country every 3 days for petroleum. Would like to keep that circulating here in rural economies.

Summary Statement from ATIP Foundation

PNW Regional Bioeconomy Forum Summary Wes Jurey, CEO, ATIP Foundation

The ATIP Foundation was established in 2011 at the request of the US Department of Agriculture (USDA), Agricultural Research Service (ARS), to serve as a third-party intermediary, engaging a variety of stakeholders with ARS research, programs, and initiatives. The initial goal of the Foundation was to enable a more collective, collaborative approach on behalf of the private sector, with each member representing one of the eight agricultural research regions in the USDA ARS infrastructure.

The fundamental premise behind this approach was the need to create greater awareness of the breadth and scope of USDA intramural research activity (and that of their federal and state partners such as Department of Energy, Department of the Interior, National Science Foundation), and possibly other collaborative agencies of USDA (e.g., Rural Development, Natural Resource Conservation Services, National Institute of Food and Agriculture), conducted in collaboration with 90 + ARS labs throughout the United States, and to foster an understanding that the federal research outcomes are available for use by business and industry, ultimately resulting in economic growth and development, in the agribusiness sector.

The Foundation was incorporated by eight state and regional technology-based economic development organizations, each individually serving as a federal partnership intermediary to USDA's ARS, with many members also having facilitation agreements with other federal agencies, as well as their own network of in-state / regional non-federal stakeholders on many aspects of federal / private sector partnerships.

The Foundation's approach to establishing the five "Advancing the Bioeconomy" forums was premised on identifying regions within the United States whose stakeholders were receptive to the idea that each forum would serve as a springboard to launch one or more demonstration projects within the region. These projects would utilize the scope of research and related outcomes resulting from the massive amount of federal research coordination overseen by the seven federal agencies comprising the Biomass Research & Development Board, formed by statute in 1999.

The ultimate purpose of the regional projects is to demonstrate that the federal research outcomes--- combined with other federal / state / local agencies whose scope is in "implementation" of research outcomes, can result in economic growth and development, particularly in rural areas of the country, creating new businesses and enabling existing businesses to expand, resulting in job creation.

From the Foundation's perspective, based on the response from forum participants, we believe our premise is sound. At the conclusion of the Pacific Northwest forum, participants were unanimous in support of reconvening in a year, and working to formulate a specific demonstration project tailored to their region in the interim.

It is noteworthy to the foundation that, while each of the five regional forums offered some unique perspectives, relative to their region, six common themes resonated throughout all five forums, relative to each region's ability to make use of the federal research to enhance the growth of regional economies.

First, the need for public awareness is considered a major challenge. At the beginning of the forum, there was significant discussion on what the bioeconomy actually was, beyond biofuel.

Second, the lack of knowledge of and about the federal resources within the seven agencies was cited. Throughout the discussion it became apparent that most attendees knew little, if anything, about the scope of research conducted; the number of federal labs that existed; or the significant number of research scientists employed. Additionally, there was little knowledge in terms of how to access the federal resources available, even if one were aware of them.

Third, the need to develop a talent pipeline for current and future workers was a strong concern. It was noted that although seven federal agencies were members of the BR&D Board, the Departments of Education & Labor were not engaged at the federal level. At the Pacific Northwest Regional forum, there was discussion on the need to include them in subsequent forums and pilot projects; none participated in this regional forum.

Fourth, development of the type of supply chain necessary to sustain the bio economy was expressed as a critical priority. It was noted that moving agricultural by products and waste more than 100 miles was a significant inhibitor of the growth of this industry.

Fifth, the need to finance the growth of demonstration projects, establish new businesses, and expand existing businesses, by seeking federal, state, and private sector financial assistance is a critical concern. It was further noted that the financial community was the least represented in the forum.

Sixth, it was noted that federal policy is one of the most critical issues, and is an underlying issue to the first five cited. Policy uncertainty means high risk to institutions that provide financial assistance. It determines the allocation of federal resources, the priorities of the public workforce system, discourages the establishment of a supply chain uncertain of the sectors future, and makes articulating a vision for the bio economy more challenging.

In our report to the BR&D Technical Advisory Committee in November 2016, and the BR&D Board in December, our findings, and particularly the six commonalities, were well received.

In conclusion, the Foundation looks forward to working with the Washington State University and the participants in the initial forum, to expand the stakeholder base, in order to begin the development of a regional demonstration project.

We look forward to doing so in partnership with the seven member agencies of the BR&D board, optimistic that the vision of a billion ton bio economy can become a reality.

Summary Statement from Co-Host

Pacific Northwest Regional / ATIP Bioeconomy Forum Summary

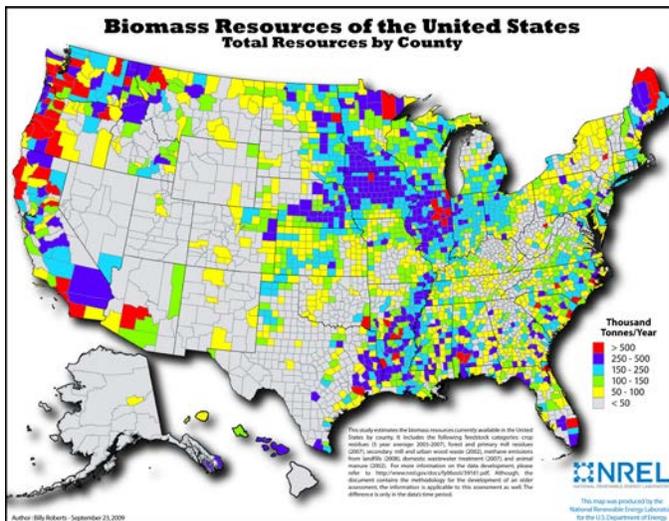
John Gardner
Regional Host

CEO Washington State University Foundation
Professor, Crop and Soil Science, Washington State University

This meeting was co-sponsored by Washington State University under the leadership of the team including Jim Moyer, Associate Dean/Director Agricultural Research Center, College of Agriculture, Human and Natural Resources, Mike Wolcott, Regents Professor, Civil and Environmental Engineering and Director for Institute of Sustainable Design, and Ralph Cavalieri, Associate Vice President for Alternative Energy.

The Seattle meeting represented an attempt at sampling the thought leaders in the bioeconomy from mostly the state of Washington, but also Oregon, Idaho and western Montana. This ATIP regional forum brought together representatives from academia (14), economic and workforce development (11), environmental/agricultural NGOs (8), active investors (4), state and local government (4) and industry broadly (3).

The Pacific Northwest region is among the highest in biomass production capability in the US, and has both public and private forests, grazing land as well as dryland and a substantial amount of irrigated vineyards, orchards and cropland dedicated to high value products.



The production potential of biomass in the region is great (NREL, 2009), but also is tightly linked to public policy (such as the forests) and food/consumer markets (high value crops). Forest/wood waste by-products, energy crops (including perennial and annual, woody and herbaceous), industrial and food wastes thus comprise the major categories of biomass potential.

Challenges

Given Washington's geography in the US and the presence of five petroleum refineries on the Pacific coast built for Alaskan crude (now also from Bakken) – these are among the contributors to the challenge expressed related to the competition from petroleum as a major barrier to further developing the bioeconomy in the Pacific Northwest. The region assumes a technological breakthrough in efficiency and pricing might be necessary to increase use of biomass, thus the emphasis on research/development and participation of the research universities and national laboratory.

Sustainability is another major challenge in further developing the bioeconomy in the northwest. Given public lands, forest management history, the sophistication of water use/allocation, the wide-spread development of renewable sources of energy from hydro, wind and solar, and the environmental mindset – there is a high bar to achieve an acceptable use of biomass. While it could also be considered an asset, one can't deny the importance of federal policy, be it land and water use or forest management in this region. Thoughtful, stable, long-term federal, state and local policy was deemed a requirement at this forum.

Another challenge expressed at the forum was the importance of place related to workforce and development of the bioeconomy. From the Pacific coast, to forests, to mountains, to desert and plains, the diversity of landscapes, ecosystems and opportunities are often closely tied to education and workforce capability. While a favorable attribute if the workforce stays in place, working across locales has revealed a real vulnerability with regard to the transferability of training and experience. Much of the northwest workforce is not capable of mobility.

Opportunities

Thoughtful, stable policy change could have a large impact on the bioeconomy of the northwest. With forest management policy the single biggest example, participants at the forum suggested both environmental and economic benefits were entirely possible given the land, water and bio productivity of the region. The region has relatively large reserves of untapped and under-utilized waste streams from forests, marine and urban communities that have potential for conversion and utilization for energy, products and co-products. Biochar is but one example.

Accompanying policy change, it was suggested a ready market for sustainable products and services could come from a developing bioeconomy. The environmental ethos of the region could provide a market pull if a sustainable supply chain was put in place. The most notable example is that of the aerospace manufacturing and the commercial aviation sector. The northwest is home to national, if not international, thought leaders of research and policy to lower the environmental impact of flight. Development of a sustainable bio-based jet fuel has been among their objectives for nearly a decade, which has demonstrated considerable progress with several alternative fuels now qualified, global policy among 191 countries agreed to, and daily commercial flights on biofuel originating from Los Angeles and Oslo, Norway.

The northwest region holds a strong belief that technological progress and disruptive innovations are possible, and could enable a growing northwest, national and global bioeconomy. This no doubt comes from the region's history but also the public and private research/development capability and a sophisticated investor community. Though most regional investors are used to shorter term, lower capitalization, and faster growth opportunities than found in most of the bioeconomy, there is a community of knowledgeable, committed investors in clean technology native to the northwest.

---- End of report ----

Attachment 1: agenda

Attachment 2: slide presentations

Attachment 3: "discussion document"

Attachment 4: non-attribute notes w/ comments (RJB annotated)

Northwest Regional Bioeconomy Forum Seattle, WA

“Garnering stakeholder perspectives and input to help shape the vision, strategic planning, and implementation to promote and expand the bioeconomy”

Date: October 3, 2016 Time: 9:30 AM – 4:30 PM (local time)

Location: Conference Center at Sea-Tac Airport, 17801 International Blvd, Rm 6012M (inside Sea-Tac Airport), Seattle, WA

Meeting Purpose: To introduce the “Federal Activities Report on the Bioeconomy,” and the subsequent “Bioeconomy Challenges and Opportunities for the Billion Ton Vision” report and to hear from stakeholders in (1) industry; (2) state and local government; (3) economic and workforce development; (4) investment & finance; (5) academia; and (6) agricultural and environmental organizations in order to accelerate the development of the bioeconomy.

8:30 AM – Registration / Check in

9:30 AM Welcome and introductory remarks

- Fred Jarrett, Senior Deputy Executive, King County
- Wes Jurey, Chairman, ATIP Foundation
- Valerie Reed, Deputy Director, Bioenergy Technologies Office
- Todd Campbell, BR&D Board, Operations Committee (Senior Energy Adviser, US Department of Agriculture)

10:00 AM – 11:00 AM Overview of “Federal Activities Report on the Bioeconomy”, and the “Billion Ton Bioeconomy Initiative: Challenges and Opportunities” Report

- Presentation by Todd Campbell, BR&D Board, Operations Committee (Senior Energy Adviser, U.S. Department of Agriculture)
 - Establishes issues from the federal agencies and frames the topics for discussion

11:00 AM–3:45 PM—Stakeholder Comments and Discussion

- 12:30 PM—Working Lunch

4:00 PM–4:30 PM—Facilitator Report Out and Next Steps

- Key comments, findings, and recommendations of the 6 sectors
- Includes next steps (timeline to review, prepare, and disseminate report) and feedback on session format

4:30 PM–5:00 PM—Closing Remarks / Adjournment

¹ The Biomass R&D Board consists of representatives from the U.S. Department of Energy, U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Transportation, the National Science Foundation, the Environmental Protection Agency, and the Executive Office of the President of the United States.

11/5/2016

ATIP FOUNDATION
Agricultural Technology Innovation Partnership

**ATIP Foundation Regional Bioeconomy Forums:
Addressing the Challenges & Opportunities of
Advancing the Billion Ton Bioeconomy**

NEW HOLLAND AGRICULTURE | **POET** | **DSM**
National Sponsors | Advanced Biofuels

Leveraging Assets: Partnership Intermediaries of USDA ARS

The Agricultural Technology Innovation Partnership (ATIP) Network

ATIP FOUNDATION
Established June 2011

ATIP FOUNDATION
Agricultural Technology Innovation Partnership

**ATIP Foundation Regional Bioeconomy Forums:
"Addressing the Challenges & Opportunities of
Advancing the Billion Ton Bioeconomy"**

Venues and Regional Co-hosts

- September 16, Atlanta, GA (Georgia Institute of Technology)
- September 29, Mineral Wells, TX (Chamber of Commerce)
- October 3, Seattle-Tacoma, WA (Washington State University)
- October 18, Orono, ME (University of Maine)
- November 15, Wooster, OH (The Ohio State University)

National Sponsors

NEW HOLLAND AGRICULTURE | **POET** | **DSM**
Advanced Biofuels

BRDB
BIOMASS RESEARCH & DEVELOPMENT BOARD

**The Bioeconomy Initiative:
A National Strategy for the Billion Ton Vision**

ATIP Foundation Regional Forum

Todd Campbell, Senior Advisor for
Energy and the Biobased Economy
USDA Rural Development

October 3, 2016

**Perspectives on the Growth of the U.S. Bioeconomy
Background**

- Executive Order 13134 issued in August 1999, President Clinton launched a national Bioenergy Initiative, "a national partnership...to produce power, fuels and chemicals from crops, trees and wastes." The Executive Order established a goal: to "triple the U.S. use of biobased products and bioenergy by 2010."
- The Biomass Research and Development Act of 2000, later amended by Section 9001 of the Food Conservation and Energy Act of 2008 (FCEA) and most recently reauthorized in the Agricultural Act of 2014, established the Biomass Research and Development Board (BRD). The BRD is co-chaired by the USDA and DOE with 6 other agencies servicing on the BRD. The Biomass Research and Development Board (Board) coordinates research and development activities concerning biobased fuels, products, and power across federal agencies.

Bioeconomy Definition

The BIOECONOMY is defined as:
The global industrial transition of sustainably utilizing renewable aquatic and terrestrial biomass resources in energy, intermediate, and final products for economic, environmental, social, and national security benefits.

--From 2014 Report commissioned by USDA BioPreferred:
[Why Biobased? Opportunities in the Emerging Bioeconomy](#)

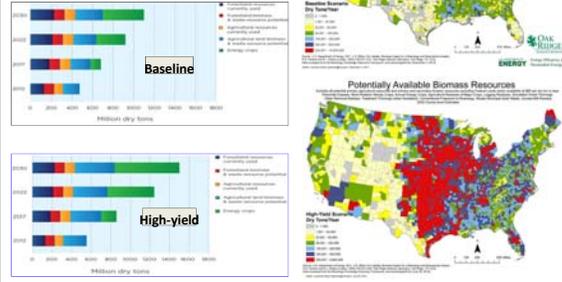
Vision and Goal of the Billion Ton Bioeconomy

The **vision** for the Billion Ton Bioeconomy is to sustainably reach the full potential of biomass-derived products as a way of expanding our nation's economy. In doing so, the bioeconomy will provide multiple economic, environmental, and social benefits to the Nation.

The **goal** of the Billion Ton Bioeconomy is to develop and provide innovative ways to remove barriers to expanding the sustainable use of Nation's abundant biomass resources for biofuels, bioproducts, and biopower, while maximizing economic, social, and environmental outcomes.

Need Biomass – Sustainably Produced

- Baseline scenario
- \$60 dry ton⁻¹
- 2012 & 2030



Billion Ton Studies History and Accomplishments

Billion-Ton Study (BTS), 2005

- Technical assessment of agricultural and forestry systems to supply low-valued biomass for new markets
- Identified adequate supply to displace 30% of petroleum consumption; i.e. physical availability



Billion-Ton Update (BT2), 2011

- Quantified potential economic availability of feedstocks for 20-year projection
- Publicly released county-level supply curves for 23 candidate biomass feedstocks through Bioenergy Knowledge Discovery Framework.



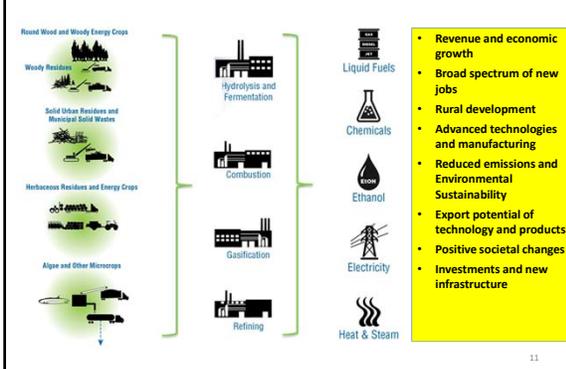
2016 Billion-Ton Report (BT16), 2016

- Expansion of resource assessment to include additional feedstocks and delivered supply
- Two-volume approach

Federal Alternative Jet Fuels Research and Development Strategy



Simplified Bioeconomy Concept



Federal Activities Report on the Bioeconomy

- In February, the Biomass R&D Board released the [Federal Activities Report on the Bioeconomy \(FARB\)](#).
- This report aims to educate the public on the wide-ranging, federally funded activities that are helping to bolster the bioeconomy.
- The **vision** for the Billion Ton Bioeconomy is to sustainably reach the full potential of biomass-derived products as a way of expanding our nation's economy. In doing so, the bioeconomy will provide multiple economic, environmental, and social benefits to the Nation.
- The **goal** of the Billion Ton Bioeconomy is to develop and provide innovative ways to remove barriers to expanding the sustainable use of Nation's abundant biomass resources for biofuels, bioproducts, and biopower, while maximizing economic, social, and environmental outcomes.



Overview of Agency Activities

Agency	Feedstock Supply	Biomass Conversion	Bioenergy Distribution	Bioenergy End Use
DOE	●●●●●	●●●●●	●●●●●	●●●●●
USDA	●●●●●	●●●●●	●●●●●	●●●●●
DOT	●●●●●	●●●●●	●●●●●	●●●●●
EPA	●●●●●	●●●●●	●●●●●	●●●●●
DOI	●●●●●	●●●●●	●●●●●	●●●●●
NSF	●●●●●	●●●●●	●●●●●	●●●●●
DoD	●●●●●	●●●●●	●●●●●	●●●●●

● Use an integrated systems approach
 ● Provide the science and the technology
 ● Public and private collaboration to overcome barriers and accelerate deployment
 ● Develop a workforce for the future bioeconomy
 ● Understand and inform policy

Bioeconomy Initiative Reports Plan

The Bioeconomy Initiative: Action Plan
Target completion date: Dec., 2016

- Three reports in the series: FARB – released in February, 2016
- Stakeholder engagement
 - Over 400 participants involved in 5 sessions.
 - 4 in-person Listening Sessions were held in conjunction with major bioenergy industry events.
 - 1 public webinar (May 5th).
- This report will be the second part of a staggered release of the Initiative
 - An ‘Action Plan’ to follow

Report Outline

- Introduction
 - Purpose of the report
 - Background of the Bioeconomy Effort
- The Bioeconomy Initiative
 - Path to building the Initiative
 - Overview of the Bioeconomy Vision as stated in the FARB
 - Highlights and Learnings from the FARB
 - Expected benefits for 2030 as defined by Analysis IWG
- Challenge Areas (as identified by Stakeholders)
- Ongoing Interagency Areas of Importance and Growth for the Initiative
- Next Steps/Path Forward
 - How to move from the Strategy Report to an Action/Implementation Plan
 - Additional Stakeholder Involvement
 - Call for partners from industry/research community to ‘Join the Initiative’
- Conclusion

Key Challenges Identified

This report discusses seven of the high-priority challenges recognized by the bioeconomy stakeholder community, identified below:

- Major technical hurdles for development and scale.
- Steep competition from traditional petroleum-derived resources.
- A lack of necessary infrastructure.
- Access to capital for large financial investments.
- Uncertainties about sustainability—understanding environmental, social, and economic outcomes.
- Growth instability and increased investment risk caused by policy uncertainty
- The need for a strong and capable workforce.

Key Opportunities

Specific opportunities within each challenge as potential growth areas for the future of the Initiative are detailed below:

- Develop feedstock and fundamental innovations that reduce cost and technology risk in the supply chain.
- Seek opportunities to utilize low-cost waste resources.
- Quantify, communicate, and enhance beneficial effects and minimize negative impacts.
- Create increased public demand for biomass-derived products in a bioeconomy.

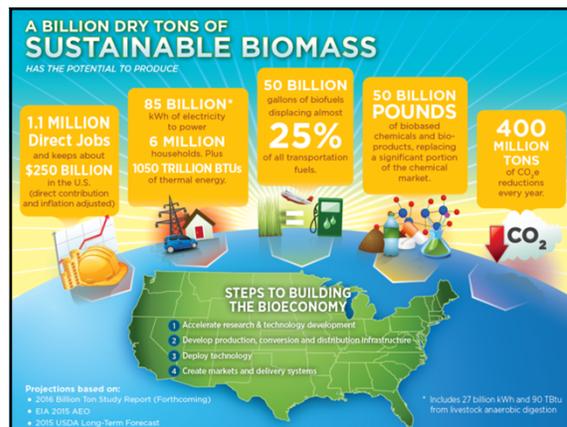
Key Opportunities Continued

- Develop bioproducts that can accelerate biofuel production.
- Enable the testing and approval of new biofuels and bioproducts.
- Expand the market potential for biomass.
- Encourage private-sector financing
- Support stable, long-term policies.
- Ensure a ready workforce to meet the needs of the bioeconomy

Purpose for this meeting:

- This workshop series is intended to focus on regional issues and their specific bioeconomy-related industries through the various state partnerships.
- The feedback gathered from these formal workshops will be used to solidify and support the Action Plan that is planned for release in FY2017.

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Critical Discussion Points

- What are state/local/regional challenges to the bioeconomy?
- How can the federal agencies help address these regional challenges?
- What are state/local/regional opportunities to the bioeconomy?
- How can the federal agencies help leverage these regional opportunities?
- What is the value proposition of a bioeconomy?
- How can you contribute to the Billion Ton Bioeconomy?

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The Billion Ton Bioeconomy Initiative: Challenges and Opportunities

Overview and Outline of Topics

Purpose of the Billion Ton Bioeconomy Initiative: Challenges and Opportunities Report:

In February 2016, the Board released the *Federal Activities Report on the Bioeconomy* (FARB) to highlight the potential for a stronger U.S. bioeconomy, specifically some of the impacts of increasing biomass utilization three-fold by 2030.¹ The goal of the Billion Ton Bioeconomy Initiative (Bioeconomy Initiative) is to develop and coordinate innovative approaches to expanding the sustainable use of America's abundant biomass resources, while maximizing economic, social, and environmental benefits.

Since the release of the FARB, the Board has engaged with the bioenergy stakeholder community to further develop the Bioeconomy Initiative. The new report, *The Billion Ton Bioeconomy Initiative: Challenges and Opportunities*, is the second in a three-part series intended to lay the foundation and serve as the public communication of the Bioeconomy. This report is foundational to the Board's objective to strengthen the commitment and coordination between the U.S. Government and the bioeconomy community. Early feedback from stakeholders has underscored the importance of biofuels, bioproducts, and biopower. This report details several challenges and opportunities that stakeholders have identified as critical to the success of the Bioeconomy Initiative.

Summary of Challenges and Opportunities:

This report discusses seven of the high-priority **challenges** recognized by the bioeconomy stakeholder community, identified below:

- Major technical hurdles for development and scale.
- Steep competition from traditional petroleum-derived resources.
- A lack of necessary infrastructure.
- Access to capital for large financial investments.
- Uncertainties about sustainability—understanding environmental, social, and economic outcomes.
- Growth instability and increased investment risk caused by policy uncertainty
- The need for a strong and capable workforce.

Specific **opportunities** within each challenge as potential growth areas for the future of the Initiative are detailed below:

- Create increased public demand for biomass-derived products in a bioeconomy.
- Quantify, communicate, and enhance beneficial effects and minimize negative impacts of an enhanced bioeconomy.
- Enable the testing and approval of new biofuels and bioproducts
- Encourage expansion of the market potential for biomass.
- Develop feedstock to meet market demands and potential
- Develop bioproducts that can accelerate biofuel production.

- Support fundamental innovations that reduce cost and technology risk in the supply chain.
- Seek opportunities to utilize low-cost waste resources.
- Develop pathways for:
 - private-sector financing.
 - Support stable, long-term policies.
 - Ensure a ready workforce to meet the needs of the bioeconomy.

Disclaimer:

The Billion Ton Bioeconomy Initiative: Challenges and Opportunities is a product of interagency collaboration under the Biomass Research and Development Board and does not establish any new or explicitly reflect United States Government policy. Some information is based on activities conducted by the Executive Agencies as of May 2016. However, some of the views expressed in this document reflect stakeholder perspectives and do not represent United States Government policy. This report is not a policy or budget document nor an action plan, and it does not commit the federal government to any new activities or funding.

¹ http://www.biomassboard.gov/pdfs/farb_2_18_16.pdf

**Critical Discussion Points
(from Biomass R&D Board representatives)**

1. What are state/local/regional challenges to the bioeconomy?
2. How can the federal agencies help address these regional challenges?
3. What are state/local/regional opportunities to the bioeconomy?
4. How can the federal agencies help leverage these regional opportunities?
5. What is the value proposition of a bioeconomy?
6. How can you contribute to the Billion Ton Bioeconomy?

**Additional Regional Discussion Points for Consideration
(from ATIP Foundation)**

- a) From the “Challenges” section of the above document, what would you list as the 3 highest priorities to discuss and address from the PNW region?
 - a) From that same list, what SHOULD be added to that list from our regional perspective? Does it change your prioritization scheme? (1=most important)
- b) From the “Opportunities” section of the above document, is anything missing from the list, and how would you prioritize these issues? (1=most important)
- c) What sets the NW / PNW Bioeconomy apart from other regions of the country? What inherent advantages do you have? What regulatory issues constrain success? What incentives would help advance business opportunities to advance the bioeconomy?
- d) What other biomass would you like to consider in the discussion of advancing the bioeconomy? Animal wastes / carcasses / concentrated animal feeding operations? Municipal landfill biorefineries? Others?
- e) As a region, how can you enhance your bioeconomy through new partnerships in the region, or on a more global basis?

Pacific Northwest Regional Bioeconomy Forum
SEA-TAC Conference Center
October 3, 2016
Listening session notes

Welcome remarks from Beth Osborne, on behalf of U.S. Senator Patty Murray:

Senator Murray regrets that she is unable to attend today's forum on the bioeconomy but asked that I share a few words on her behalf. My name is Beth Osborne and I am her Deputy State Director and Director of State Outreach.

Our nation is faced with a growing global demand for energy, a severe reliance on fossil fuels, and environmental concerns around many of our current energy supplies. Senator Murray believes it will take American innovation and smart policies that encourage conservation, energy efficiency, and increased renewable energy research, development, and deployment to address the critical issue of climate change and create a comprehensive national energy policy.

Your work in renewable energy – biofuels in particular – is a critical part of the solution. And Washington State has long been at the forefront of biofuels production, research and development, and feedstock cultivation. From Boeing, Alaska Airlines, the three largest airports in the region, and Washington State University establishing the nation's first stakeholder effort in 2010 to tackle the challenges and opportunities associated with the production of sustainable alternative aviation fuels... ..to USDA awarding the Washington State University and the University of Washington two multi-year grants to research and demonstrate the use of Pacific Northwest woody biomass in biofuels.

These examples provide only a snapshot of the private and public investments being made in the State of Washington. Our premier research universities and the Pacific Northwest National Laboratory have made great strides in the development of feedstock from regionally available forestry and agriculture products.

The combination of this expertise with leaders in the manufacturing, airport, airline, engineering, and environmental fields and the abundance of agriculture and forestry resources make the Pacific Northwest a key player in the bioeconomy. Continued investment and innovation will create jobs and economic growth, improve our nation's energy security, and promote environmental stability.

Senator Murray is proud to be your partner in Washington, D.C. as you continue your work that does so much for Washington state and our country.

Responses to the “challenges” list

This report discusses seven of the high-priority challenges recognized by the bioeconomy stakeholder community, identified below:

1. Major technical hurdles for development and scale. (12)
2. Steep competition from traditional petroleum-derived resources. (17)
3. A lack of necessary infrastructure. (8)

[commenter] is not certain this is correct for many cellulosic sources in the PNW - particularly woody biomass. In fact there are a number of “stranded assets” in the form of pulp and paper mills, lumber mills, transportation assets (trucks and rail), log depots, chipping and densification equipment, etc.
4. Access to capital for large financial investments. (11)
5. Uncertainties about sustainability—understanding environmental, social, and economic outcomes. (12)
 1. --- Water is a big deal in the west. Climate change will impact water availability, which will impact biomass available
 2. ---- I want to add nuance to this point; there is a lot of utility in recovering nutrients and organic carbon from biomass residues and post-harvest wastes that are returned to the soil to ensure sustainable cultivation of biomass feedstocks from fields and forests. The long term sustainability of chosen feedstocks is dependent upon properly managed nutrient cycles at landscape scale.
6. Growth instability and increased investment risk caused by policy uncertainty (16)
7. The need for a strong and capable workforce. (2)

Additional challenges added by the group:

- --- Market for the products (1)
- --- High proportion of federal land ownership in the west, different treatment of federal biomass sources based on definitions of “renewable” (1)
- --- State economic development programs - what is the hand off to federal programs
- --- Political polarization
- --- Distance to processing - infrastructure and scaling up
- Insufficient incentives to drive investment and markets

General notes on challenges

---- In reviewing the Federal Activities Report on the BioEconomy (FARB), I would like to see what the funding levels are -- in terms of authorizations and appropriations for each program and agency described in the report. It would also be very useful to present the total federal funding directed towards BioEconomy developments over the past few years. This would provide insight into how big is the federal government effort in funding programs for the bioeconomy initiative. Although it might be controversial, providing high-level comparative funding levels for BioEconomy initiatives relative to aggregate federal funding for fossil fuel and nuclear energy resource and technology programs would contribute to a clearer policy assessment of federal government funding priorities across all major energy options.

Comment [1]: I would say: Need of new infrastructure and identification of synergistic opportunities with existing infrastructure!

Comment [2]: It seems that the farm digester company Regenis (www.Regenis.net) might offer models for building a trained, functional and profit-focused workforce in/for the bioeconomy.

Comment [3]: It is important to highlight the experience of the Walla Walla Community college and their AAAS degree in plant operations

Comment [RJB4]: This has been a theme we've heard in most forums.

Comment [RJB5]: I would suggest we provide funding levels for both intramural and extramural research from the various BR&D member agencies that relate to the Bioeconomy. An obvious follow up would be an annual research report highlighting outcomes to date, available technologies, and a request for partnerships to address specific issues (e.g., CRADA or cooperative agreement). This idea is further supported by the anonymous commenter below, and by [RJB7] comment further below.

I would also recommend that the FARB include a section that highlights the BioEconomy related research being conducted at our National Laboratories (e.g. NREL, Argonne, Lawrence Livermore, Idaho, etc.). It would be useful to describe the national labs' major programmatic leadership assignments and funding levels. This could help the private sector identify sources of technology innovation and potential public/private partnerships for further research and development.

Comment [RJB6]: Anonymous commenter.

---- There was a consolidation of public funding information in 2012, when cellulosic fuel was determined to be viable. At that point in time it was \$1B across agencies; USDA feedstocks, DOE's investment, NSF, others – decided to make cellulosic feedstock economically competitive.

---- Should we revise FARB and put numbers behind programs to show size of federal funding?

Comment [RJB7]: I think an annual report on bioeconomy-related R&D outcomes would be a great idea. Currently federal agencies are required to publish an annual report on Technology Transfer that covers all innovations arising from intramural R&D in all agencies. Extramural R&D outcomes are published by AUTM (Association of University Technology Managers) but only addresses IP licensing.

--- The ability to continue to research transportation logistics is important, any region with raw material is going to need this work. Infrastructure and transportation logistics of biomass are crucial elements. Most recent cellulosic plants are in Iowa. Raw materials are found within 50 miles, but the big issue is how to transport that efficiently? How to transport with a minimal amount of costs and distance. Iowa State University and private companies doing work on this.

---- The BioEconomy Vision should also be looking at the potential for biomass conversion and application options in terms of their carbon sequestration values. It is clear that even if all countries were to achieve their voluntary GHG emission targets submitted under the auspices of the COP21 Paris Agreement; global warming will exceed the 2 degree C temperature 'tipping point' well before 2100. We are going to have to increase our investments in 'Negative Emission Technologies' that can draw carbon out of the atmosphere and sequester it for lengthy periods of time (e.g. 100 years or more). There are different carbon sequestration values for different bioenergy and bioproduct processes. There is growing recognition that returning organic carbon to soils (e.g. Composts and crop residue retention) and producing "Biochar" carbon for use as soil amendments and other applications offer the most cost effective and feasible methods of sequestering large amounts of carbon that can mitigate the increasing levels of CO2 in our atmosphere. As governments (e.g. California, EU, China, Alberta and others) establish GHG emission reduction 'Carbon markets'; verifiable carbon sequestration offset values of selected BioEconomy developments will become an important economic factor that will improve the return on investment in BioEconomy initiatives.

Comment [8]: Fully agree! If the biomass economy is a tool to fight global warming, we need to invest more heavily and be more active in carbon sequestration technologies.

Comment [RJB9]: Politically difficult to pull off, but seemingly important. Secretary Vilsack has supported this idea for years.

---- In NW we can irrigate our crops, and that causes competition for growing biomass

Comment [RJB10]: Increasingly important to have minimal inputs required to grow biobased crops for fuel, even better if it can be done on marginal lands. It is for these reasons that a NIFA 5-year grant is looking at impact of crop rotation of dedicated biofuel crops (minimal input) with other high value commodities (e.g., wheat). Turns out, having grown a crop of canola for jet fuel increases wheat yields the following year.

---- There are currently two main tracts for developing a strong, capable workforce. First, we [in higher education] are doing a good job of training scientists and engineers to go into industry and start contributing to this bioeconomy immediately. However, second, the community colleges and other two year vocational/tech schools seem to be arranged into distinct regions within the state with specific bio-related projects driving curriculum development (i.e., different courses are taught in the northwest vs. southwest), which limits

ability to train technicians and other operators for jobs outside their immediate location. In order to best address the needs of these students (who are often anchored by location for education but then have the ability to mobilize for job opportunities), we need to develop training programs and certificates that could be obtained from any location across the entire region.

---- We should be working with the tribes as well. Lots of opportunity as well as mutual interests.

Comment [RJB11]: Sounds like an opportunity for a Pilot Project Consortium to better utilize lands of Native Americans for creating new opportunities

---- We should make sure that the workforce opportunities are diversified. We want everyone to be able to join in the success of solutions to these major challenges.

---- Distance - we are very far north and we do not have volume produced here in the Pacific Northwest. We need to see a combination of infrastructure and incentives to help improve rural development.

Comment [RJB12]: Common theme

---- Much of the inland PNW is dry with less than 14" of precipitation per year. Dryland biomass yields are too low under the dry growing conditions to contribute significantly to the Billion Ton goal. Those crop residues are needed to protect soil from wind erosion and maintain soil organic carbon. We will need to balance between biomass production and environmental stewardship. This is an important issue; as crop residues (e.g. Wheat straw, corn stover, etc.) are viewed as significant feedstocks for advanced cellulosic biofuels and bioproducts. Sustainable production of these feedstocks will require location specific and crop rotation specific residue management and allocation practices to protect against soil erosion; improve soil moisture retention and add Soil Organic Carbon.

Comment [RJB13]: These are formidable problems in PNW. Dedicated biofuel crops help wheat production, but the money crop is still the wheat. This region may want to explore other biomass feedstocks for developing biorefineries. (tallow, ocean / seafood residues, etc.)

---- Five years ago there were three or four technologies in this area, now there are more than we can keep up with in terms of performing needed R&D, formalizing processes and discoveries that are made, etc. The growing research has overwhelmed the resources available, we can't keep up. For example, DOE has a lot of focus on pyrolysis, but there are new areas that need just as many concentrated resources, but they don't exist.

---- State and local economic incentives helped spur the development of the biofuels industry in Iowa. Iowa has provided early stage assistance to companies to establish commercial biofuels production. Production tax credits, specifically for biodiesel now, exist but are targeted and limited in time horizon. Iowa has a brand new production credit for renewable chemicals. We have supported production of higher blend ethanol, that is now gone. We are currently supporting the retail establishment as a state through certain tax credits for higher blend fuels and some support for new blender pump infrastructure. We've found they are beneficial to consumers and the commercial biofuel-producing companies.

Comment [RJB14]: Process should be replicated in PNW.

---- Don't have the same kind of support in Washington, need more business and policy engagement and support

Comment [RJB15]: Policy support; see above RJB14comment.

---- We need policy parity for renewable energy - if we compare the Production Tax Credit (PTC) available for wind and solar (~\$0.02/Kwhr) an equivalent PTC for cellulosic ethanol would be the equivalent of \$0.75/gal.

--- Something unique to our region is how state agencies work together to support bioeconomy. It is important to look at how these agencies integrate. I know this is a problem in other states, but it is actually an opportunity for our region.

Responses to the “opportunities” list

Specific **opportunities** within each challenge as potential growth areas for the future of the Initiative are detailed below:

1. Develop feedstock and fundamental innovations that reduce cost and technology risk in the supply chain. (14)
2. Seek opportunities to utilize low-cost waste resources. (11)
 - a. --- We should make opportunities for local communities to benefit from the bioeconomy, rather than strictly adapting a model that’s scaled up to a refinery miles away. Specifically, also consider local, on-farm conversion methods as a way to allay transportation costs and handle low density, high volume residues that are low in value.
3. Quantify, communicate, and enhance beneficial effects and minimize negative impacts (8)
4. Create increased public demand for biomass-derived products in a bioeconomy. (14)
 - a. --- We’ve done prototypes, but public isn’t seeing those - we need to increase awareness and understanding; social cost of carbon, other ecological services and environmental benefits.
5. Expand the market potential for biomass.
6. Develop bioproducts that can accelerate biofuel production. (9)
7. Enable the testing and approval of new biofuels and bioproducts. (3)
8. Encourage private-sector financing (6)
9. Support stable, long-term policies. (18)
10. Ensure a ready workforce to meet the needs of the bioeconomy (2)

Additional opportunities suggested:

- --- Conversion technologies to upgrade biomass to usable feedstock; a commoditization of biomass to usable feedstock; Need to develop technologies for the process; conversion technologies
- --- At regional level, it is challenging to bring infrastructure together; if there isn’t money going to the region to collectively solve a problem, we shouldn’t be surprised it is not getting coordinated. How can the federal government coordinate regional efforts? Need to put at least millions into the region to coordinate the efforts
 - --- The regional biomass economy programs were in place for decade or more, stood up by DOE, but managed by governor offices. Not big dollar, but were for meetings, convening partnerships. These are the kind of actions we can put to your observations and recommendations.
- --- Leveraging public entities for long term energy purchase agreements or market stability - merchant generation not possible for biofuels... EX: RNG producer needs a gas purchase agreement in order to capitalize a new facility, not many entities have the

Comment [16]: We still need to be aware of the differing definitions of some common terms related to development of a bioeconomy. The term biorefinery may look very different depending on the source of biomass and the intended products. A dairy farm by itself can be reclassified to be called a biorefinery. Offsite organics and woody biomass can be brought on to the farm to be anaerobically digested or thermochemically converted; however, the radius from which to derive this biomass is relatively small and serves as an economic boost rather than a critical pillar of the process.

This is as contrasted with a biodiesel biorefinery which might need to draw feedstock from a 50+ mile radius or not be viable.

Comment [17]: Water/wastewater and nutrient recovery & recycling can increasingly be down-sized. Small communities suffering from years of depletion of these through large-scale extraction can benefit.

Comment [18]: Would suggest that highlighting clean air, water, and improved soil while gaining the benefit of renewable biofuels and bioproducts is a message that would be more universally accepted.

Bluntly, highlighting climate change/global warming as a reason to change and then insisting on individual acknowledgement of a need to change to support society just will not work for nearly 50% of the US population. Instead of confrontationally dragging this group in, publicize and highlight the local benefits of these projects.

Comment [RJB19]: This comment suggests that a regional pilot project may be a recommendation from PNW attendees.

planning horizon to purchase energy on a long term agreement, except traditional energy companies which fail to value the “green” attributes.

- ---- Bio-Preferred program; good way to work with government. Gives advantage in purchasing with the federal government – See link below more information about what the opportunities are related to this program (<http://www.usda.gov/wps/portal/usda/usdahome?contentid=2016/02/0047.xml>)
- ---- Federal land management agencies are critically important to resource supply in short and medium term; they are interested in engaging in this process

Comment [20]: Look at King County (WA) separate sale of environmental attributes of landfill gas, along with “merchant gas” from their Cedar Hills landfill to Puget Sound Energy. This is a model for monetizing RNG added value.

General notes on opportunities

---- There are a lot of ideas in the federal labs, but each agency makes those accessible in different ways and through different processes. We need to increase the opportunity for federal labs to start with “yes” as we work with external entities. In addition, specialty crops allow opportunities for federal funding; some of the money available for this doesn’t get used - people going biofuels crops should pay attention to and use this opportunity.

---- The crops that qualify as specialty crops are specially designated. You have to go through a process to get that designation.

Comment [RJB21]: <https://www.ams.usda.gov/about-ams/programs-offices/specialty-crops-program>

---- It is important to remember biomass feedstocks are acquired from two sources: residues from existing post-harvest and food/fiber/feed/fuel production processes; and feedstocks from purposefully grown crops of all types. Each feedstock category represents distinct attributes to work with and different challenges to overcome.

Biomass residues and wastes are especially significant resources as they tend to be available as already aggregated material that have marginal market value (i.e. low cost to acquire). Many biomass wastes often have negative impacts in terms of air and water pollution that have disposal or remediation costs; these disposal costs can be avoided when the material is used for bioproduct feedstocks.

When considering purposely grown crops, competition with food production (in terms of land, water and input requirements) becomes a much more sensitive issue. It entangles the price of biomass feedstocks with the larger and often volatile agricultural commodity markets. It also has the difficult challenge of convincing US farmers that they should change their farming practices in order to cultivate new types of crops (e.g. camelina, switchgrass, etc.). Unless there are long term public policies that provide incentives and reduce risks, major changes in farming systems are unlikely to be quickly adopted. As we develop opportunities and action items, we need to apply different techniques/resources to each.

Comment [RJB22]: Recurring theme; however, crop rotation should be considered to get both a biofuel crop as well as improved wheat production in rotation.

--- What can we do with all of this agriculture biomass and waste to make something better, to improve economies/health/etc in U.S.? Only through innovation will we stay a global leader.

Comment [RJB23]: Solid argument for funding research.

---- Our experience is that biorefineries need to make a suite of aggregates products; does the biopreferred program include purchase of fuel, plastic-based materials? It’s not clear if that program will directly impact the standing up of a biorefinery.

---- The program covers more of consumer products, doesn't cover renewable energy, biofuels; different federal agencies are handling procurements for those areas. The mechanisms are there, but right now the biopreferred program isn't in fuels.

Comment [RJB24]: Good suggestion for expanding biopreferred program to include more than products.

---- I want to make a comparison to the information revolution - in beginning they were not developing computers to do what they do today. Bill Gates and other visionaries turned the informatics revolution into what it is today. With the biomass economy we are in a similar starting phase - how it evolves depends on the "genius" that will help it take shape. We may need to produce a fuel that doesn't look like petroleum. Right now we are looking to replace existing molecules, but since we are working with new feedstock, there may be a possibility for fuel that we haven't seen yet.

Comment [25]: There may be opportunities for fuels and chemicals that we haven't seen yet. The technologies and knowledge that we are developing for the biomass economy could catalyze a revolution in other areas (for example in the way we handle and use our urban wastes!)

---- Improving supply chain increases market potential. It is important to address this - federal agencies - DOT ? - should be brought into conversation for supporting transportation research needs.

Comment [RJB26]: A new suggestion from the forums. Although DOT is part of BR&D Board, they have not been noticeably active.

Follow up questions

What sets the NW / PNW Bioeconomy apart from other regions of the country? What inherent advantages do you have? What regulatory issues constrain success? What incentives would help advance business opportunities to advance the bioeconomy?

---- Climate

---- We play well together here

---- We have strong research institutes, getting support and incentives for capital investment

---- We are a gateway to the Pacific Rim; export options open towards Asia

Comment [RJB27]: Good point

---- Second largest refinery complex is on the west coast; oil and gas.

---- Two major railroads serve the PNW and there are two major river systems for transportation and hydroelectric power generation. The Grand Coulee Dam provides an extensive system of canals for irrigating the Columbia Basin in eastern Washington. Water can be drawn from the Columbia River and its tributaries to recharge the deep basalt aquifers in the Umatilla Basin.

---- We have Weyerhaeuser, Green Diamond, Roseburg, private and well-managed timber lands. Beyond harvesting timber? It is not as production-oriented as it used to be. Roseburg is distinct from the others. They are eager to sell wood products in a variety of forms

---- I believe those comments refer more to manufacturing than production.

---- We tell different stories around the carbon impacts of woody biomass. Right now answer is "it depends." Can people in this room get clarity around that so policy on national level is less fluid?

Comment [28]: Strongly agree and expand: All bio-products need "seed-to-endues" GHG statistics consistent with IPCC guidelines. This will be among the key metrics for products in the future.

---- Demand from the aviation industry; track record working with Port of Seattle, SeaTac, WSU, Port of Spokane, and more; all have said they would like to use aviation biofuels. We have

Comment [29]: correction/clarification: "Seed-to-endues" = full lifecycle accounting of GHG release per average unit of biomass as currently produced.

relationships with Alaska and Horizon Airlines who are saying if you build it we will come, which says a lot about partnerships in the state.

---- There is a market for biojetfuel - but at what price? It is difficult for DOD to procure biofuel if it is not comparably priced to compete with petroleum options. The aviation industry has same problem. At this time, it does not appear that the 'private market' for most biofuels (e.g. Biojet, etc.) is willing to pay a price that would match current and near-term biofuel production technologies from 'commercial scale' biofuel production facilities.

---- We are seeing developments in the market for aviation biofuels. R&D shows prices are competitive with petroleum fuels. Jet Blue is adopting biofuels at a price that is competitive; we're seeing companies throughout the world saying they will make biofuel at competitive prices. There is still a long way to go, but we are seeing the scale we need to bring prices down, especially in biodiesel.

---- We are seeing a maturity in how we look at biofuels. The alternative jet/green diesel contracts made last year are at a percent blend. Biodiesel can start moving into production when it is blended with petroleum fuel. That gets production going, provides learning opportunities that can lead to wider adoption. Goal is to get the supply chain moving.

This is an important issue. Similar to the incentives provided to early stage photovoltaic and wind power generation through grid utility power purchase agreements with substantially higher than market prices per kw/hr; initial biofuel purchase price premiums could be offered to biofuel producers, where the final blended fuel cost/price could be more competitive with conventional petroleum derived fuels.

Comment [RJB30]: Government incentives...

---- The better we can quantify the environmental services, the better we can reflect true value of fuel provided. Offtake agreements, the small percent of blended fuel being used, if you can space that over a lot of gallons, it is a small cost to companies. Airlines are currently using 30-40% of budgets on fuel. Let's create an alternative now while companies have money to invest. USDA Rural Development is willing to share some of the risk with standing up plants/biorefineries. We should share risk to get the first plants off the ground. Doesn't have to be the most profitable, just need to reduce the risk so we can move on to more developed options.

Comment [RJB31]: Start with this URL <http://www.usda.gov/wps/portal/usda/usdahome>

---- We have the cheapest electric in the country, great hydroelectric power, we have one of the largest biorefineries in Grays Harbor. It did not become as prominent as we thought it might when started it in 2005. We haven't been supporting very basic policy; getting stable policy seems nearly impossible.

----- We need to decide how to best sell bioeconomy? The benefits are different state to state. In Washington, we want to be the best in biofuels, preserve jobs here, so we need to invest in this.

---- I'm surprised the conversation hasn't focused on bioproducts more. If we want to focus on fuel, I don't think we will get there if we don't talk about the high value products that will be needed to make it successful.

Comment [32]: Agriculture systems did not play a large roll in this meeting; however, the focus on anaerobic digestion of animal wastes is now less on how to produce electricity from the biogas and more on how to extract usable and potentially valuable co-products. While the digester is the central component of the facility, it is the nutrient recovery and water upgrading components that are going to drive future adoption. The challenge is now to monetize those co-products for the local bioeconomy--we don't want to be shipping biofertilizers across the country unless there is some other critical need.

---- Half of the revenue has to come from coproducts. Cannot get there if you are only making the fuel.

---- If biofuel solutions are approaching **cost performance parity with petroleum**, that's new to me, which means you have a problem. People think if there is a subsidy available, that will make up for the economics, but it does not. I don't want to be in it for the first one, I want to be in for the longterm. This is primarily a biofuels audience, and biomass is a much, much broader undertaking. I needed to understand the difference between residues and dedicated feedstocks. I wouldn't seek to produce more residues, but **purposely grown crop** feedstocks are a different story.

---- Communication to those that don't have the technical background is crucial. We need capital, if it is off the table because of perception, that's a problem.

---- I'm a lawyer/investor, I want bioeconomy to be similar to software. Looks simple on the surface, but has large capital cost. Cellulosic > biogas - too focused (example). Biojet, the deal is a help and a problem. Hawaii wants biojet produced there, but will want concessions on price. There has to be rationality in how policies play out - DLA (Defense Logistics Agency) is finally realizing that.

---- DOE had first pioneering facilities, we learned that the smaller companies with good technologies could not get backing from private sector to build facilities. So those small companies failed and did not end up working. The companies that could build had deep pockets, got loans later on. Plant (rounds) 2 & 3 are looking to Europe, China, India, etc, because they're not getting investment here.

---- On the East Coast of NE Florida, there are two major manufacturing plants, which get about 400 log trucks a day. Six months ago Rainier Advanced Materials entered joint agreement with Borregard in Norway related to lignin. Joint venture called Lignotech LLC, tax credits approved, and a new plant is getting built there, on the island where the existing plants are. Essentially, this makes better use of a biomass (lignin) that was previously burned for energy at the plant. Once the new plant is in operation, the lignin will be used to create high value products --- and the local economy benefits with more job creation, and higher value products on the market.

---- If an investment is profitable for one player, and then increases funders, that will ruin profitability. **First movers have risk.**

---- NARA is the Northwest Advanced Renewables Alliance of which Mike Walcott of Washington State University is an integral member. I thought I said that you can't get RINs from federal lands, as is the case. The federal government owns 53% of the state of Oregon and almost 29% of Washington. I was trying to make the point that environmentalism and its inherent love of national forests is very strong in the Pacific Northwest, unlike the southeast section of the U.S. Thus, those who work in the PNW forests, especially in the public sector, generally refer to the jet fuel made from trees as a bioproducts instead of feedstock since feedstock carries with it the emotional baggage associated with clearcutting and commodity production using wood. Thanks for your opportunity to attend this interesting and valuable meeting. **PNW is different because of federal land ownership. Example: we were not included**

Comment [RJB33]: Example of turning low value biomass waste into high value products because of research and IP that provides industry with a 20 year advantage of establishing new markets and products.

Comment [RJB34]: That may be true, but although increasing investors doesn't ruin profitability (expect for very short term), it expands opportunity!!

in the NARA analysis because you can't use renewable identification numbers on rural land. Here there is a deep attachment to forests, environmentalists don't want to see activity. We refer to it as a bioproduct rather than feedstock because of sensitivity towards national forests.

---- How do we articulate this so the voter says that's good for Washington?

---- Early on, it was about developing technology that goes through process to biorefinery. Now there is another hurdle, which is getting through regulations. Scale up activity of getting to market is another investment need. The needs of capital are not the same all along the process. There is a big need for patient capital.

---- Biomass and biofuels are two sides of same coin. USDA looks at it as job and wealth creation for rural areas that comes along with feedstock. Whether it's fuels or renewable, biobased products - making transition to renewable energy/products industry - what does this look like? It is a wholesale transition from fossil fuel based economy to biobased economy. How do we get there? Low cost will dictate what is used by first adopters.

---- Chemicals that make a lot of things can come from bioproducts.

---- Policy has focused on replacement of certain molecules; instead of fixing molecule, we are going to have opportunity to develop molecules that react to the biofuel. Nature of molecule we are working on is different than petroleum molecules. We are going to find molecules that perform better than petroleum based molecules.

--- I don't know that PNW will become chemical production hub; but we could look at a more distributed energy resources approach in PNW. If you visit a farmer with a digester, they'll say I'm a farmer first, but transported this here so I need to use it. We need aggregators who engage with these technologies on the farm to have highest value impact.

--- How do you build the infrastructure of an industry? Need to get answers to that for USDA, DOE, etc to see what their role is in the answers.

--- The infrastructure piece is essential. National lab can look across infrastructure, assess it and publish a study on it, which private sector won't do. We are trying to green field a new industry, without really looking at the assets. A lot of the national studies focus on aggregate numbers across country, but that doesn't get you to how you make this a reality at the regional level, to see what the assets are and how they can be used, create a business plan.

--- We've been focused on large scale plans, but the smaller scale plans haven't been provided. We have so many options, we don't have enough resources to know where to start. How do you do one thing at a time, get it done, and move to the next thing? The process is so distributed at the moment, how can we focus?

---- Haven't talked about municipal solid waste, or water resources. Thinking about public perception; we need to address amount of waste, how it can be used in urban core - need to communicate that better to public.

Comment [RJB35]: Uniqueness of land ownership would suggest that a partnership of feds, state lands, and industry / key private sector players should be considered to formulate a unique pilot project for PNW.

Comment [36]: The idea here is that by focusing on petroleum replacements we may be missing opportunities in other areas where biomass derived molecules could have competitive advantages.

Comment [RJB37]: Appropriate for a public private partnership to garner federal, multi-state, and local resources to optimize novel traits of the PNW region.

Comment [38]: Related: Progressive companies and municipalities (SF, Portland, Seattle, Google, Microsoft...) are now moving aggressively to zero-waste strategies. These strategies involve collecting and separating large amount of materials, notably including valuable biologically-sourced types [food waste, etc.]. This is currently a burden, as was collection of quality recyclables such as glass and metal when recycling programs were initiated. But as with high-value recyclables, using digestion and other sophisticated reclaim processes, these "wastes" will be valued when and where they are produced. Again, digestion and other biologically-based waste management systems are highly amenable to down-scaling, reducing need for interconnecting infrastructures to transport these wastes to central plants, as is now the practice. This change of mode will require more trained service workers (to maintain the distributed bio-processors), which creates jobs.

However, although municipal solid wastes may currently represent a large feedstock resource for bioproducts; the carbon content of these wastes may be subject to significant reductions as municipalities adopt comprehensive 'source separation and recycling' regulations and practices. Biorefineries that require large volumes of municipal waste may find it difficult to acquire long term waste purchase agreements with local or regional waste management operations.

---- We have a couple biorefineries in the area. I've been thinking about these ideas for 15 years in NW. The reason capital hasn't entered space is because of economic risk and unstable policy. Trying to stand up biorefinery that is competing with advanced, large, heavily-subsidized petroleum economy. Need to reduce some of the incentives for that industry, or do other things to pull it back so biofuels can grow. If we don't have stable policy framework that drives the market, we're going to keep talking about the pieces but not actually get there. Absent of carbon tax, etc, don't have big push towards biofuels. More effective to tax what you don't like to incentivize what you do.

Comment [RJB39]: Likelihood of a new policy to tax carbon?

It is important to recognize the enormous fiscal incentives that are in place on behalf of the entrenched fossil fuel industry; and that there has yet to be legislated any significant 'policy parity' with biofuels and bioproducts developers. The basic depletion allowance tax benefits for oil, natural gas and coal enable fossil fuel producers to enjoy much larger net-of-taxes revenues that reduce their total costs of capital and reduce their marginal costs of producing fuels. The BioEconomy producers require comparable tax incentives that would improve their competitiveness with fossil fuels.

---- Old saying - necessity is the mother of invention. What is the why? Absent the answer to this question it will be based on financial performance, which is why it's not happening right now. Hydraulic fracturing, a new source of energy, has taken away \$100/barrel in oil. The 'why' can no longer be getting away from Middle East oil. If it's because of climate change - there are discussions we can have there. But we need to define the criteria. Otherwise we will continue to talk in circles.

Comment [RJB40]: Solid points for why biobased innovations get the fuzzy end of the lollipop. The attitude of past politicians "...drill, baby, drill!" is profoundly short sighted. Let alone the new problems of water injection and apparent enhanced local seismic activity.

---- What you're getting to is assigning a value to these things that are economic. Investment community needs that.

The reason ethanol made it into market was because we eliminated MTEV. If we need to pursue putting holes in someone else's tech, we can. Petroleum is going to go away, that's inevitable. It will be too late to start development if we start at that point.

BILLION TON BIOECONOMY CREATES OPPORTUNITIES (from Valerie/Todd's PPT I believe)

Jobs

Heat and power generation

Biofuels (including jet)

Renewable Chemicals and Biobased Products

GHG emissions reductions (82 million cars)

---- Capitalism requires this. You have two choices. You can either mandate or provide a subsidy for replacement, or you can regulate - the life cycle emissions, the waste, and leave it to industry to find lowest possible cost to meet the regulations. Or make a superior product.

---- Corn ethanol economy - the govt didn't mandate MTEV, oil industry came up with it because they owned all the assets to do it and could make money. Then when there was a different problem, had to go to ethanol. At the same time, we reached tech advantage - immediately following was RFS 1 & 2 which were environmental mandate for oxygenates, there was tech advantage that industry could get behind, and there was policy to stand on. So successful, petroleum industry started suing EPA. Need tech to move it forward, need economics for private capital, and need stable and sound policy to provide policy that industry can make profit out of.

Comment [RJB41]: Another solid statement supporting clarity and vision in policy

---- Cannot sell bioeconomy as if it is same for the whole country. Every region resonates with something different. For Iowa it's about corn, for Washington it is about aviation industry. In years to come, resource limitation is going to be the problem that drives to technology. We can start answering that question with development we are doing today.

Comment [RJB42]: Leaders on West Coast

Comment [43]: Our bio-economy marketing efforts have to be regional and have to be well integrated with the economic needs of the region!

---- Additional variables - in ethanol it was corn vs oil states. This debate has to get that simple for bioeconomy. You bring costs down by doing projects in lower end cost points. Investing in it overseas can bring cost down. Have to decide which way we want to go, do we have the economic backing in the US, or do we have ability to send overseas?

---- of factors mentioned are related to driving a cost. There is a portion of the market that will buy things because it is the right thing to do, but it is not the majority. If we can create policy that drives better costs, we will get there. We need to make an impact in China and India to make an impact here.

---- Need to have flexibility in what we will allow to be used for biowaste power. We work with impact funds who want to drive innovation - they won't invest in anything if they don't think there is a path to profitability. They need to see policy stability. If they know what the time frame is to getting a profit on something, they'll be willing to invest. That time frame isn't clear at this point.

Comment [RJB44]: Only if the ROI is 3 years or less. A strong policy that favors elements of a bioeconomy --- with either regulatory actions or economic incentives that support the policy that can sunset at a defined time.

---- Stability of oil policy and instability of bioeconomy policy aspects are part of the reason it is not fully adopted.

---- Why are we pursuing this? If not for energy independence, in which we are going to have to achieve a cost competitive renewable fuel source - then the 'why' is if you believe in climate science and the central role played by the continued and expanding use of fossil fuels and fossil-fuel derived chemicals (e.g. petrochemicals, Haber-Bosch nitrogen fertilizers from natural gas, etc.).

I believe that the primary motivation for building a BioEconomy should be to avoid climate threats. I'm an advocate of looking at biochars, where you have produced them as value-add materials (e.g. biochars blended with biofertilizers as soil amendments; as remediation media for polluted soil and water; etc.); and that also provide verifiable carbon sequestration offsets. These multiple values of biochar products should be an important factor to consider as we develop the BioEconomy. We need to identify what is driving us. We need to keep more carbon out of the atmosphere for the benefit of future generations.

---- Biomass can do more for water quality. There is soil quality of feed and food costs by developing landscapes that maximize energy and food products, and beefing up rural economies.

Comment [RJB45]: Climate remediation, and use of biochar to improve environmental quality.

---- USDA has business services to provide access to capital in rural areas in a myriad of ways. Water quality - recent study shows that there are 66 million dead trees in Nevada, contributes to wildfires, and our waters are filtered through our forests. The recent environmental developments from insect infestations to wildfires - which cost money and environmental health - are why a bioeconomy makes sense here. These should be a drivers of why we need to make use of biowaste, and look to new options in bio-feedstocks. Job creation, economic development, environmental services - all have a benefit. How do we quantify those benefits?

Comment [RJB46]: This argues for local / regional "biomass accumulators" and a coop structure to produce bioproducts for both regional use (e.g., biochar for soil / water enhancement), or energy-dense pellets for markets elsewhere.

---- Methane is worse than CO2 as greenhouse gas. We should take methane and convert it into something else because it is harmful.

---- People in Oregon became disenfranchised with academic, government activity. Bringing the people who worked in forest, related industries back into the conversation.

---- There is only cleaner energy, not perfect clean energy. Bioenergy has unique opportunities in economic development, especially in rural areas. The challenge for bioenergy is sustainability concerns, properly sourcing things, highly efficient process you are using, ignorance about the improvements that have been made in process technologies. The moral argument can move markets because it moves policy. But it needs to be founded in sound technological development/facts. Without a clear message and aggregated front, we won't move the needle. I'd argue bringing together state level organizations to understand and untangle these things to provide recommendations is the way to go. If there is potential from the federal government to support that convening on the state level, that'd be great.

---- If you leave forest residual, livestock waste, garbage out, it is going to turn into methane, which is worse than CO2. Creating bioeconomy will take care of those methane sources, which is a goal policy can help make happen.

Comment [RJB47]: Reinforces comment above.

---- People don't care about global warming - some people that do, but it is not changing government or economic conversation. That is not going to drive transition to the bioeconomy. Here in NW our environmentalists will be against policies because it isn't perfect, not the most sustainable option.

Comment [RJB48]: A pilot project could also include education as to well-documented global warming, but also creation of opportunity to capitalize on a local/regional basis.

---- Federal initiatives (e.g. DOE and USDA) to develop a BioEconomy should build much closer relationships with the EPA. As has been discussed at this Forum, public policy incentives for bio-based products should be complemented by policy disincentives that discourage inefficient use and environmentally adverse applications of fossil fuel based resources. If the non-subsidized embedded and externality costs of fossil fuels were reflected in their market price; bioproducts would have a 'more level playing field' to compete.

It is also necessary to work with the EPA in building the evidence base for determining the ecosystem service values of properly conducted biomass production and conversion

operations. We are beginning to realize the financial benefits that are commonly gained with proper watershed management practices; with retaining and enriching our soils for continued productivity; with providing habitats for biodiversity that provide pollinator and pest control services; etc.). The accompanying environmental benefits of a sustainable BioEconomy need to be factored into a more inclusive 'business case' that would justify both public and private investments.

---- In order to make existing RFS policy effective, federal agencies should consider some form of RIN market participation. (renewable identification number). For example, a guaranteed RIN purchase agreement, would help establish a price floor for RINs on a new project which would allow the developer to include RIN revenue in their pro-forma. Would likely be structured such that they would rarely exercise their contract with government agency, and if they did, the agency would likely have the patience to retain the RINs long enough to profit from their sale, making the project effective to capitalize.

---- There needs to be more research done on environmental services that can be provided by this industry; specifically what can be offered regionally.

---- We need to frame this around something that can get national, bipartisan support. I think we should frame it around infrastructure. Congress looking at public investments in transportation, energy, water modernization. I think people might listen to these issues if framed around infrastructure as stimulus for now, and even better if forward thinking for future.

Comment [RJB49]: We did get a fair amount of interest from lawmakers for these forums. Perhaps if we have an infrastructure program ...

---- Encourage federal govt to continue investment in Community Land Trusts (CLT). Way to connect urban and rural populations. I think it has potential to make that connection, allows for deeper understanding of benefits.

---- Regional innovation centers - put out a proposal for this so region can decide what makes most sense for them to develop. Let them propose the deliverable. That combines research with the market infrastructure.

Comment [RJB50]: Back a proposal with a PPP with others at the table for greater likelihood of success.

---- Ask that the federal agencies - USDA & DOE - keep providing the financial and technical resources they've already started - for feedstock, biorefinery, co-location projects. Have had a positive impact to accelerate commercialization, would like to see those efforts continue. The supply chain and infrastructure are important, maybe more focus on these front end, harvest, storage, and transportation issues addressed.

---- Follow through on Methane Opportunities Roadmap. It is a solid document with partnerships among fed agencies to bring more methane to market, with less emissions.

---- Methane road maps are essential. In WA, our feedstock and land management needs are in the forests. We are facing serious fire hazards, so there is renewed support for forestry support, forestry collaboratives. Enable forest practices on federal lands that have otherwise been held up.

We should also note that a major study (Proceedings of the National Academy of Sciences, “Impact of anthropogenic climate change on wildfire across western US forests”) has just been published that finds that more than half of all recent western US forest wildfires are directly attributable to climate change that has increased forest aridity. There was discussion in the Forum of how US Forest Service fire prevention programs should be significantly increased with funding for forest thinning operations that use smaller scale systems for harvesting and converting such thinnings into biochar.

Comment [RJB51]: <http://www.pnas.org/content/113/42/11770.full.pdf>

Comment [RJB52]: Consistent with earlier comments in this document.

---- Need to continue support for R&D, we have seen a decline recently. There is a lot of research going on, need to start thinking more carefully about needs of the industry. How can we best invest the R&D money, rather than reducing.

---- Flood small to medium business market, and then let the private sector come in to see what to scale up, pick what worked best. At the regional level, maybe we can get teams that help parts of process need more development and focus on that

---- We need to be less concerned about the relatively higher capital cost per unit of production of smaller bioproducts operations. This is especially relevant in our current period of exceptionally low interest rates and cost of capital. This perspective would encourage smaller scale production facilities that could be distributed throughout the region; and could benefit many rural communities with increased jobs and incomes from a new, localized BioEconomy. The lead time required for such distributed development of different bioproduct production enterprises may also be shorter than for much higher capacity facilities.

---- There's not a conversation about biochar as an application of biomass. It offers opportunity of collocation of feedstock and end use. You gasify biomass, produce biochar, disposes of biomass in low cost way. Then you produce biochar that can help fertilize crops and remediate soil. It is an elegant use of biomass. There is incredible complexity of performance of biochar based on feedstock and way it has been processed - it has created a whole area of science about which much remains unknown. Our local universities are developing knowledge of biochar feedstock characteristics; production technologies; and field applications. However, our universities need much greater financial support for continued research and development of biochar materials in order to become centers of excellence that would help industry and the forestry and farming sectors to make sense of its value and open up new opportunities for economic growth.

Comment [RJB53]: These comments put forth good arguments for regional PPP that includes federal partners. Sounds like a good topic for a separate meeting on next steps in PNW.

Follow Up Question 2: Should we keep collaboration among this group moving forward after this meeting? If so, how?

---- With NARA, etc here, we have a lot of information

---- There is a lot of information here to take forward. The food processing industry also has a lot of waste. Biochar and food processing waste are a great marriage. We have a lot of synergies here around disparate issues, makes a lot of opportunity.

---- What partnerships do we need to form in this region?

---- Can we do same thing next year with 150 people from many different aspects of this topic?

Comment [RJB54]: Group wanted to expand and bring more players into it.

---- Biomass industry is not new. The question is, as it grows, what are additional needs? Need to define what are the problems in our region, what our capabilities are, so we can address them. Pursue inventory of industry, need of industry, capabilities, to see how we can work together moving forward.

---- We have tried to address needs for aviation industry through several collaborative forums and initiatives. ATIP would be able to bring all of those things together, bring this into a forum on the larger bioeconomy conversation.

In Georgia I had conversation about how to communicate from industry to federal government about the work that's been done - how can we bring together several stakeholder conversations to take action?

---- Yes we should do something else with this group. There may be possible DOE money on the way to the region...bringing national labs together. CleanTech Alliance is talking to people in other states about potential coming projects that will be relevant to this conversation as well.

---- We've had two regional projects for 5 years, they have filled a void in conversation across these regions. Both projects are sunseting. They have provided tremendous synergy across the states (WA, OR, MT). There are two different areas here - west and east - that span multiple states and offer different things to this conversation. Maintaining the regional collaboration will be key.

Our PNW region has also greatly benefitted from the knowledge and capacity building that was accomplished by the major USDA-NIFA five year grant to Washington State University, Oregon State University and the University of Idaho for "Regional Approaches to Climate Change - Pacific Northwest Agriculture" (REACCH). Although the REACCH program focused on wheat farming systems, the comprehensive knowledge gained regarding crop rotation strategies; soil and water impacts of different practices; and the impact of forecast climate changes on the region's farming sector will contribute to our understanding of sustainable agricultural strategies for both food and other biomass products.

---- Yes, we should follow up. Grid modernization, built environment, and biofuels are all on the radar for the state, but biofuels have fallen off the radar a bit. We can bring that back by reconvening this group. These conversations are happening all the time, some larger force to bring us all together is helpful.

---- The bioeconomy initiative has been in development for several years. We have gotten to this point and our goal is an action plan that will motivate the new administration. There is another umbrella - Mission Innovation. It is a global initiative, Obama has suggested support of. All countries that came together in Paris proposed doubling spending in R&D for next five years for clean energy technologies. Working on how USDA, EPA, others will play under that umbrella. No guarantees because of admin change. The EU is part of Mission Innovation, and have finalized \$320B - this could still play a role for U.S. too.

--- \$1B leaves country every 3 days for petroleum. Would like to keep that circulating here in rural economies.