1. Introduction

To provide a better high-level understanding of where and how existing policies are shaping the development and implementation of agricultural symbiosis, this appendix summarizes and contextualizes some key elements of the policy landscape. The goal of this review was not to dig into the details of particular regulations, grant programs, or other support. Instead, the goal was to identify major areas in which existing policy related to different technologies are relevant to industrial symbiosis in the agricultural sector.

1.2 Sources of Information

This appendix summarizes a number of different sources. Whether they use the words “industrial symbiosis” or not (and in most cases they did not), stakeholders across Washington have important place-based experience trying to bring industrial symbiosis projects to fruition within the agricultural sector in Washington. While other aspects of their experience relating to opportunities and barriers are summarized in the main report, within this appendix we took a more detailed look at observations and opinions relating to existing and future policy that were expressed during the CSI interviews.

We also drew on several additional, relatively recent (within the 5-7 years) roadmaps and workgroups for Washington and the Pacific Northwest for technologies that are relevant for industrial symbiosis in the agricultural sector, including for renewable natural gas [1], biochar [2], and sustainable aviation fuels [3]. Each of these documents focuses on a specific industrial symbiosis opportunity that may include other sectors of the economy, but each also has an important intersection with the agricultural sector. Given that these efforts incorporated the views of a diverse set of industry, community, and academic experts, these roadmaps were examined to understand the views of a broader group of individuals who have been active in this area over time. Based on these observations, we also reviewed state-level policy in areas that are relevant for agricultural symbiosis projects.

Finally, the academic literature relating more generally to industrial symbiosis and policy has been reviewed, with an eye towards how this literature may confirm regional experiences, or bring in new ideas.

1.3 The Economic Context for Industrial Symbiosis

Economic benefits and the ability to meet regulatory requirements are considered to be major motivations sustaining successful industrial symbiosis projects and relationships [4], [5], [6] [7] [8]. At their heart, industrial symbiosis relationships are economic arrangements that can provide services and products. As an example, an on-farm dairy digester with nutrient recovery technologies added may provide specific products such as renewable natural gas or energy, fiber that can be used for animal bedding, and perhaps nutrient-rich amendment products (Figure B-1.1). Products may be utilized on-farm (as replacements for costs that would otherwise be incurred), or sold to other entities. However, they may also provide services, for example water treatment, or (if they accept pre-consumer food wastes from nearby food processors) organic waste treatment.

For both products and services, the farm may realize economic benefits in two forms. The first of these is revenues for products or services sold for others. Thus, in the example above, revenues can come in the form of tipping fees from food processors who are leaving organic wastes to be digested, carbon credits from reducing greenhouse gas emissions, sales of renewable energy, fiber that can be sold to the horticultural industry for inclusion in potting mixes - or a number of other possible products. The mix of products will depend on the capacity of the dairy and the needs of existing markets (which may vary across time or in different locations). The other form of economic benefits is avoided costs. Thus, for example, fiber from a dairy digester can be used as animal bedding,
thus reducing the dairy’s bedding purchases. Nutrient recovery systems may reduce the costs that would otherwise be incurred from trucking manure to far-flung fields to ensure that nutrients are applied consistent with plant needs. There may also be benefits which are not directly monetized, for example, reductions in odors and the generation of sustainable jobs that add to the economic base.

Not all industrial symbiosis projects need to be this complex. But stakeholder experience and research both suggest that economics for larger projects usually depend on a combination of revenue sources from energy and non-energy products and services (including in many cases incentives, such as carbon credits or incentives for renewable energy production) to remain viable [1], [10]. There is often the potential to generate both products with lower value but broader markets, and the potential to generate higher value products, which may have smaller overall markets and/or require more specialized knowledge, facilities, and financial and human resources to produce. Neither of these approaches is a “silver bullet” for ensuring the economic viability of industrial symbiosis, and both may require support for market development.

The other important feature of these systems is that many of them are industrial-scale installations, with relatively high capital costs for equipment that has a long lifetime (one or often multiple decades). As such, stability of economic arrangements may be an important consideration, both for the installing company and for investors and financiers.

The other important implication of the fact that as industrial-scale installations, most will require siting and permitting. Air, water, and solid waste permitting, and other regulatory requirements exist to protect the environment and public health. As such, compliance with existing regulations is an important part of ensuring that these installations are good neighbors to the

Figure B-1.1: Generalized figure of an on-farm dairy digester that accepts off-farm pre-consumer food wastes and generates several different end-products, including renewable natural gas, recycled water that can be used within the digester, organic fertilizers, and a peat moss replacement. Reproduced with permission from [9].
communities in which they are located - and achieve their desired benefits without creating negative environmental impacts. And yet, siting and compliance with existing permitting requirements may also form an important barrier to industrial symbiosis development, especially for newer technologies that may not be “business as usual” operations [2], [3].

Given this broader economic context, there is potentially a role for policy to play, and it may be most effective when it takes a holistic approach to the barriers faced by these types of operations. The sustainable aviation fuel workgroup update notes from a World Bank report that: “a comprehensive public policy and regulatory framework should define production incentives needed to increase supply and lower costs, while incentivizing sustainable aviation fuel usage [3]. To be effective, high level policy commitments must be accompanied by the development of financing schemes (including guarantees instruments), easement of environmental licensing, and promotion of exports to meet the growing demand.”

1.4 Lessons Learned: the economic and other hurdles facing Industrial Symbiosis ventures

Industrial symbiosis ventures are not always successful. The failure rate for new businesses is high. To some extent, this may be merely a reflection of the fact that success is challenging for all new businesses, whatever the type. It also may be because industrial symbiosis ventures run the entire range of size and sophistication: from a few individuals with a great idea working with limited capital, to business ventures by some of the world’s largest energy companies.

Therefore, as a counterpoint to the many successful and ongoing agriculture symbiosis projects that were profiled throughout the main report, we also reviewed the gray literature for existing descriptions for agriculture and forestry symbiosis projects that ceased operations over the past few years. This review indicates that economic pressures are among the most commonly cited reasons for abandonment of industrial symbiosis ventures, and given that many symbiosis projects rely on a number of different revenue streams (and sometimes input streams) to achieve economic viability, these economic pressures can come from a number of different sources. A lack of markets (impacting revenues), especially for those that produce new products, can be important (e.g. Columbia Pulp, Starbuck, WA, [11]). Changes in subsidies that impact revenues can also be important, as can rising input or construction costs (e.g. Parkland Corporation, Burnaby, BC, [12]). For dairy digesters, at least one closure of a Washington dairy digester is attributable to the closure of the underlying dairy operation, likely due to ongoing economic pressures and consolidation within the industry [13].

Even for those symbiosis projects that survive, challenges can include navigating substantial volatility in various markets. For example, in the 2010s, on-farm anaerobic digesters in Washington State and elsewhere in the U.S. experienced substantial challenges, with only one of four products having stable prices. Volatility was substantial for carbon credits and renewable energy credits due to regulatory uncertainty, and prices for electricity dropped in the Pacific Northwest and elsewhere in the U.S. as natural gas prices fell [14], [15].

Uncertainty relating to permitting is another important barrier and may result in loss of investment capital, and projects may ultimately either move to more favorable jurisdictions or ultimately collapse. The Sustainable Aviation Biofuels Workgroup [3] highlights increasing national recognition that federal, state, regional, and local permitting processes may delay construction of clean energy projects for several years. On the ground, Washington experienced this when REG and Phillips 66 withdrew their permit application for the Green Apple Renewable, LLC project in Ferndale, WA and REG invested the money by expanding an existing facility in Louisiana [3]. Permitting processes may include opportunities for public engagement, and at times, these public processes can prove challenging (e.g. [16])
Beyond these economic and regulatory reasons projects may fail due to issues with proposed technologies or processes not performing as desired (e.g. Upward Farms, Brooklyn, NY and Wilkes-Barre, PA, [17]; Red Rock Bioenergy, Lakeview, OR, [18]). There have also been at least a few cases over the last decade where failed waste conversion technologies left behind hazardous materials that needed to be cleaned up and required governmental intervention (e.g. Onalaska Wood Energy, Chehalis, WA, [19]).

It may be helpful to think of industrial symbiosis projects as encompassing several distinct steps, or links in a chain between the point where excess heat, water, or biomass is considered "waste," and its successful recapture and reuse. The focus may sometimes be on one step of the process, but there are often several steps that are needed to achieve successful symbiosis. For biomass recovery, for example, that could include acquiring feedstocks and ensuring it meets minimum quality and purity requirements, a main waste-conversion technology such as a digester, and one or more additional processing technologies that are used to achieve saleable products and services, as well as market-development for each of those products or services. Each of these links needs to be successful for industrial symbiosis projects to experience sustained success.

From a broader perspective, it may also be helpful to see each individual agriculture symbiosis entity existing within an ecosystem of other players. As industrial symbiosis becomes more common, more robust ecosystems may evolve, when there are more players, and thus more opportunities for a particular industrial symbiosis technology to remain economically viable over a longer timeframe. Less robust ecosystems (which may be more frequently the case for emerging technologies) may make it more likely that any given company will not be able to sustain economic viability over the long run.

2. Identified Policy Needs

Detailed analysis of potential policy changes was outside the scope of this proviso, yet the stakeholder engagement process did elicit some general recommendations. Stakeholders interviewed by CSI generally expressed their preference for incentive based policies over additional regulatory policies. However, there was quite a bit of diversity in terms of what types of incentive-based policy were recommended, with suggestions including:

- Continuing and/or expanding existing grant programs that support agricultural symbiosis projects.
- Bolstering offtake markets. In the case, a stakeholder was discussing the particular example of helping create a market for recovery of nutrients like nitrogen and phosphorous in addition to carbon and energy for anaerobic digesters,
- Helping businesses and or local governments engage in research and development and/or the necessary feasibility studies to get agriculture symbiosis started,
- Providing cost share for start up costs for agriculture symbiosis projects, such as purchasing equipment.

It is important to note that there was not necessarily stakeholder agreement about which of these pathways were desirable, nor about the details of how such incentives might be implemented. In reviewing roadmaps and workgroup processes, it was noted that the sustainable aviation biofuels workgroup also had a diversity of opinions regarding specific incentives [3].
Other themes that emerged from the stakeholder interviews included the observation that incentives may not always "tip the balance", depending on the amount of financial help they provide. One interviewee specifically noted that grant programs requiring a one-to-one match for grant funds can still result in high capital costs for large agricultural symbiosis projects. Several interviewees also noted that creating a program specifically focused on agriculture symbiosis at the state level would help ensure that some portion of funds specifically support symbiosis in the agriculture sector.

Academic literature relating to incentives and technology adoption suggests that a key characteristic of effective incentive-based policy is reducing risk and uncertainty [20], [21], for example by reducing the amount of money that the adopter must invest into a new practice or technology. Offering incentives over time frames that match the technology or practice adoption can be an important aspect of reducing uncertainty. If adoption of technology will require many years to make back the money spent to acquire it, then incentives will be more beneficial if they are spread out over a similar amount of years [21], [22], [23]. Similarly, for industrial symbiosis opportunities that take a number of years to plan and bring to fruition, ensuring that the incentive environment is stable over more than a few years can be helpful to reducing risk [3]. This can lessen the risk that adopters may feel regarding the long-term economic success of a technology they have invested in. One - but certainly not the only - example of these types of longer-term incentives from the bio-energy sector is feed-in-tariffs. These tariffs provide a guaranteed above market price to renewable energy providers, usually with a long-term contract over 15-20 years [20], [23]. Feed-in tariffs were first used in the U.S., but have been used widely around the globe over the last decade, including in Germany, Japan, and China. In the U.S., they may be more commonly used in combination with other policy tools, including rebates for purchasing renewable generation equipment, renewable portfolio standards, net metering, or production- or investment-based tax incentives [24].

Flexibility in incentives can be another important feature, as lack of flexibility has been directly linked to lower adoption levels [21]. Examples include allowing for adoption of various practices or technology which will lead to the same desired benefit [21], or allowing transferability of incentives so that more than just one individual or business could benefit from the incentive [22]. Finally, tailoring incentives to different localities can improve adoption levels [21], [22], by responding to the specific needs of a community and providing more relevant benefits for adopters.

2.1 Support for Development of Emerging Markets

Market development is critical when new products are being developed, and the potential for support for market development was expressed throughout interviews and roadmaps. For example, CSI interviewees noted the need to bolster markets for non-energy products from agricultural symbiosis projects. Meanwhile, recommendations from the RNG road mapping process included “fund[ing] research and development of technological innovations that ...build markets for value-added co-products [1].” And the biochar roadmap indicated a need for “near-term research focused on market-development activities [3].” This included, for example, efforts to develop protocols and specifications to ensure product consistency and facilitate appropriate use of biochar. It also included a focus on near-term research and pilot- or larger-scale demonstrations of biochar technology, showing how biochar can generate direct economic value when used to address specific problems (e.g., soil acidity, low water-holding capacity, fire-hazard reduction, mined land reclamation, composting odors and efficiencies, and storm-water filtration) as well as the development of new high-value C-based products and materials (e.g., catalysts, battery electrodes, and reductants for specialty metallurgical operations).

Successful industrial symbiosis projects are sometimes also referred to as “biorefineries”. Similar to oil refineries, these biorefineries integrate a core processing technology with multiple additional downstream processes to generate a number of
value-added products including fuels, power, and chemicals. As mentioned above, many projects depend on a combination of revenue sources to remain economically viable. If new, each of these products may benefit from market development. This can include both lower and higher value products (e.g. understanding how biochar applied to soils impacts soil microbial activity over time versus testing of new bioplastics) or services (e.g. working across the American biogas industry to develop a new carbon accounting methodology to measure the carbon intensity of all biogas projects and ensure consistency [25]).

2.2 Institutional support

Alongside this diversity of products, a diversity of types of actions are needed to support market development. In some cases, policy creates, or vastly expands, particular markets (e.g. carbon policy that creates a more robust market for carbon sequestration in the case of biochar, renewable fuel standards or low carbon fuel standards support renewable energy generation). In other cases, applied research is needed to help potential buyers understand and use new biologically-based products that are similar to (but sometimes not the same as) current standard products. In yet other cases, coordinated actions by industry, researchers, and others can help create industry standards that support consumer knowledge about new products they are purchasing For example, research has shown that purchasers of manure-derived nutrient products from dairies value these products differently than the chemical fertilizers they replace, and that information relating to nitrogen release may be one important factor supporting more widespread use [26].

Many longer-standing industrial symbiosis projects in the region - both those in the agricultural sector, and those in other sectors - have evolved over time to generate different end products. This flexibility has helped projects to remain economically viable by responding to changes in incentives and changes in market-driven prices over time. For example, the King County’s Cedar Hills Landfill, the first Washington landfill to develop an RNG project in 2009, originally cleaned their landfill gas and sold it for electricity production [1].

Likewise, some of Washington’s dairy digesters - some of the oldest agricultural symbiosis projects in the state - show a similar evolution from electricity production sold to the local grid, to other products: either RNG production (most viable at larger scales), or electricity that can be wheeled to California and can receive additional subsidies for producing renewable electricity specifically for charging electric vehicles. These projects have proven viable over time due to state and federal grant programs, PSE’s willingness to provide supportive power purchase agreements, value added co-products (e.g., fiber and nutrients), tipping fees for accepting food processing waste, and beneficial tax incentives (e.g., deferred property tax and sales tax exemption).

2.3 Support to Overcome Regulatory Hurdles

As industrial facilities, industrial symbiosis project sites may require permits for air, storm water, waste discharge, solid waste, and conditional use as well as other environmental review. As new facilities engage in processes outside the "business as usual" for which regulation is designed, they often have additional regulatory hurdles that add time and expense to project establishment.

In some cases, state government and other collaborators have come together to reduce regulatory hurdles while ensuring that environmental and public health are adequately protected. One successful strategy implemented for industrial symbiosis in the dairy sector, was the adoption in Washington of a solid waste permit exemption for digesters that are accepting pre-consumer food waste at less than 30% by volume and follow other guidelines to ensure that nutrients are handled appropriately and other potential concerns are addressed [27]. This exemption was established through Legislation passed in 2009 and greatly eased the regulatory burden for on-farm dairy digesters that were digesting mostly manure and wanted to add pre-consumer food wastes. In these digesters, food wastes act synergistically with the manure and can greatly enhance biogas production.
(and hence project economics), due to the higher energy content of food wastes. In many cases, the project also earns a tipping fee for accepting organic wastes, an added revenue stream that can be an important aspect of project viability [10].

Other regulatory challenges remain to be addressed. For biochar, air quality permitting can be a major barrier, and a variety of potential pollutants should be considered, as air pollutant emissions from biochar production units can vary widely depending on biomass feedstock composition and biochar production system design, operation, and use of add-on control devices [28]. Those who are exploring the use of biochar production systems to replace open burns in forestry and agriculture will generally find that despite a clear air quality benefit, the applicable regulatory process is substantially more complex, costly, and time consuming than the permitting process for open biomass burning [28]. Many, if not most, biochar production systems (even those that are very small scale) will fail to qualify for an exemption from air quality permitting and thus will require a permit from the appropriate agency. Biochar production systems that have the capacity to discharge emissions exceeding a specified threshold may be subject to Title V or New Source Review/Prevention of Significant Deterioration permitting requirements, a more costly and time-consuming process. Meanwhile, data relating to emissions from various commercially available technologies (which are important for guiding decisions throughout the air permitting process) are few [28]. This hampers the process and can greatly increase the cost, because in evaluating emissions rates for new sources, permitting agencies prefer source test performance data from similar units to the one being proposed [28].

Reducing the size of this barrier will likely take sustained action on several fronts, including collection of emissions data for a variety of potential pollutants from a number of the more common technologies. The situation may also benefit from conversations between scientists, industry, and regulators to develop more efficient permitting pathways where this is possible without compromising public health [2], [3], [28].

2.4 Facilitating the Development of Group Knowledge and Experience

The CSI stakeholder interviews indicated substantial interest in bringing people in the field together to exchange ideas and discuss synergies that could lead to successful agriculture symbiosis projects. Improved coordination mechanisms and social networks can benefit industrial symbiosis projects [4], [29], and because industrial symbiosis as a whole often involves partners from different economic sectors, there is an important potential impact of helping potential partners in diverse sectors find each other and explore partnerships via such groups. In addition, bringing together individuals working on similar projects, such as symbiosis projects within agriculture, can be an important strategy to build knowledge and capacity, and thereby reducing risk in a new endeavor. Increasing the awareness and knowledge of incentives is also crucially important. Potential adopters can be ignorant of incentives, both of their existence and the detailed information which are vital to precipitate adoption [21], [22].

Groups of individuals, especially if they bring together relevant individuals from nascent industries, academia, and relevant government agencies, can also act strategically to address some of the regulatory and market barriers previously discussed. As examples, the RNG roadmap identifies an opportunity for state agencies to work to “coordinate development of a voluntary RNG quality standard with natural gas utilities to enhance access to the natural gas pipeline grid [1].” A recent review of successful and unsuccessful eco-industrial parks in the United States suggests that stakeholder involvement and dedication, community involvement, and regulatory system/agency support are all critical factors for success [8]. This is consistent with others who have discussed the necessity of intentionally nurturing collaborative and information-sharing relationships [30], [31]. And while government backing is not sufficient on its own when firms do not desire to collaborate, direct and indirect government support in a variety of forms can be important and build interest in, and capacity for, industrial symbiosis [7], [8], [32], [33].
Evaluation of whether or not perceived benefits are being achieved is also important and may involve collaboration between industry and non-industry actors, including academic or agency. These efforts can showcase successes, point to areas for improvement, build evidence for monetization of benefits such as carbon, and ensure consistency [1], [2]. Data gaps in terms of impacts are numerous across worldwide industrial symbiosis efforts, and in some cases positive outcomes are assumed to occur. There is an ongoing need for study of whether or not industrial symbiosis is achieving its desired economic, environmental, and social impacts [6], [29], [34].

3. Overview of Relevant Washington Regulatory Policies

Multiple CSI interviewees acknowledged benefits of current policies in place in Washington, at the federal level, and in other states. Specifically, organic waste diversion laws in both California and Washington were cited as creating early progress in reducing the amounts of organic waste being hauled to the landfill and creating opportunities for synergies between businesses. Similarly, state-level clean fuels standards and the federal renewable fuel standard were praised as providing impetus to develop or use renewable natural gas and other fuels with a lower carbon intensity. A number of existing agriculture symbiosis ventures in the state have benefitted from matching funds or other support provided by the Department of Commerce, including via the Clean Energy Fund Programs. Many interviewees also pointed out that incentive based policies such as the existing that leverage tax credits or programs like the Sustainable Farms and Fields grant program that provide financial assistance to farmers and other businesses are easy to navigate and are already helping make agricultural operations more sustainable, as well as supporting markets for soil amendments and other products from agriculture symbiosis projects.

While there were many positive sentiments around current policy, interviewees also noted that it can be very difficult to navigate some existing opportunities, especially those within current federal policy. Both the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Bill were acknowledged as having potential to support agriculture symbiosis but many, though not all, indicated great uncertainty in how businesses or individuals could take advantage of these pieces of legislation. (See also resources such as the Inflation Reduction Act Guidebook [35], and a website that includes guidance and a sortable list of Inflation Reduction Act programs [36].)

Ensuring alignment between state- and local- level policies may also be important, as indicated by some CSI stakeholder interviewees. For example, geographic proximity can be encouraged through local land use planning - though it is important to note that co-location does not on its own necessarily lead to industrial symbiosis, even when this has been identified as a goal [37]. Opportunities to share “waste” biomass (especially for lower value products, and the wet wastes common within agriculture), heat, and water may necessarily rely on partners who are physically near each other to support economic viability [34]. However, other aspects of industrial symbiosis, including recent efforts to decarbonize supply chains, provide a potential opportunity to “de-couple” industrial symbiosis from physical co-location.

A comprehensive review of all areas of state policy that could potentially impact all types of agriculture symbiosis was outside of the scope of this policy scan. However, in this section, we capture recent and major areas of policy that are likely to be relevant. Agriculture symbiosis, and other types of industrial symbiosis, can support the substantial action and commitments that the state has made in these other spaces. These areas of policy also represent opportunities for leveraging impact across state agencies.
3.1 Climate

The Climate Commitment Act. The Climate Commitment Act caps and reduces greenhouse gas (GHG) emissions from Washington’s largest emitting sources and industries, with mechanisms that allow businesses to find the most efficient path to lower carbon emissions. This program aims to ensure that Washington achieves a 95% reduction in GHG emissions by 2050.

The Climate Commitment Act works by setting an emissions limit, or cap, and then lowering that cap over time in line with the state’s climate goals. Businesses in the state that emit more than 25,000 MT CO2e (metric tons carbon dioxide equivalents) annually are covered under the regulation, and must either 1) reduce their emissions, 2) purchase allowances, which are offered for sale in the quantities allowed by the cap and/or 3) purchase greenhouse gas offsets in regulatory markets. Offsets can account for up to 5% of needed emissions reductions in the first compliance period and 4% in the second period.

While the Climate Commitment Act is often thought of as being primarily regulatory in nature, the implications of this act for agriculture symbiosis, at least in the near term, are largely indirect. Due to provisions in the law, farm and ranch operations will remain largely untouched by the regulatory portions of the Climate Commitment Act. Moreover, food products and food manufacturing will initially be offered “allowances” for their greenhouse gas production at no cost, due to their status as emissions-intensive, trade-exposed industries. The rationale for this is that these industries that release large amounts of greenhouse gas emissions also face significant national or global competition for their products; thus if faced with sudden, substantial changes to their operations, they could limit operations, close, or transfer production elsewhere - thus failing to achieve worldwide emissions reductions and causing harm to the state’s economy.

In effect, what this means is that the regulatory portions of the Climate Commitment Act will likely have less direct impact on the food and agriculture sector in the near term with the primary impact being the potential to voluntarily offer offsets to entities in other sectors which are regulated. Among the four types of offset projects currently adopted under the Climate Commitment Act, Livestock Projects offer an opportunity for agricultural industrial symbiosis. Under this protocol, dairy cattle and swine operations can develop carbon offset projects by installing biogas control systems in the manure management process. Producers can be paid for destroying, using, or selling the methane captured by digesters.

Meanwhile, a second potential opportunity relating to the climate commitment act may come as a result of the revenue generated in the state’s cap-and-invest program. Through this program, the revenues generated when regulated entities purchase allowances will be invested in climate projects in the state and will be used to increase climate resiliency, fund alternative-transportation grant programs, and help Washington transition to a low-carbon economy. There are three primary accounts which revenue will fund. 1) The Carbon Emissions Reduction Account is set for projects that reduce emissions from the transportation industry and increase access to public and alternative transportation; 2) The Climate Investment Account will support projects that focus on transitioning to clean energy, ecosystem resilience, and carbon sequestration; and 3) The Air Quality & Health Disparities Improvement Account will support projects that help identify and reduce criteria pollutants and health disparities in overburdened communities highly impacted by air pollution.

3.2 Fuels

Washington Clean Fuel Standard. The Washington Clean Fuel Standard (CFS) was launched on January 1, 2023 after the Washington State legislature initially passed the CFS into law in 2021. The CFS requires the transportation industry (Washington’s largest source of greenhouse gas emissions) to reduce the carbon intensity of their fuels or invest in the production of cleaner fuels (such as electricity and low-carbon fuels). The CFS stipulates that the carbon intensity of transportation fuels is reduced by 20% below 2017 levels by 2034. Credits will be
given to fleets of vehicles and equipment that use clean fuels, and these credits are traded on an open market. Meanwhile, regulated entities who produce or import high emission fuels like petroleum will be required to purchase credits from this market if they do not sufficiently reduce emissions. The policy aims to support rural economic development and could create opportunities for those within the agricultural sector as demand for biofuels will increase. This policy is modeled after similar programs in California and Oregon and will be compatible with those same programs so that fuels can be traded across state lines and essentially create a regional market for low-carbon fuels.

The Clean Fuel Standard has an advisory panel for agriculture and forestry carbon capture and sequestration. This group offers ideas about how to provide incentives and allocate credits to sequester greenhouse gases related to the Clean Fuel Standard through activities on agricultural and forest lands in Washington.

3.2 Renewable/Clean Energy

Clean Energy Transformation Act (CETA). Enacted in 2019, CETA sets goals for transitioning the state to a carbon-neutral economy by 2030 and achieving 100% clean electricity by 2045. The act includes both regulations and incentives that will create opportunities in the areas of renewable energy generation (installation of wind and solar and production of biogas from anaerobic digestion) and promoting more sustainable agricultural practices (e.g., carbon sequestration).

Washington Renewable Portfolio Standard (RPS) for Electricity. Established by passage of the Energy Independence Act (I-937) in 2006, the Act requires the state’s largest utilities to acquire both cost-effective energy efficiency and new renewable energy sources. These sources include wind, solar, and geothermal energy; biogas from landfills, sewage treatment, and animal manure; wave, ocean, or tidal power; biodiesel; and some forms of hydro and biomass energy. Certain technologies that fall under agricultural symbiosis, such as anaerobic digesters, are specifically mentioned as the Act underscores the benefit of small-scale distribution generation systems (five megawatts or less) and provides a double credit toward a utility’s renewable energy obligations for using such systems. This Act helped drive development of digesters during the early years of compliance, but more recently RPS compliance requirements have been met by most electrical utilities and thus the interest in anaerobic digesters for power generation has plateaued.

3.3 Organics Management

2022 Organics Management Law. In 2022, Washington’s Legislature passed House Bill 1799 (HB 1799) requiring diversion of organic materials away from landfill disposal and towards food rescue programs (preferred for edible food) and organics management facilities. Many aspects of this law focus on post-consumer aspects of the food system (and thus is beyond the scope of agriculture symbiosis as defined for purposes of this report). However, the business requirements and non-residential aspects of the law have the potential to impact agriculture symbiosis directly. And beyond this, the changes induced by the Organics Management Law may also to create opportunities for partnership with agriculture symbiosis projects. Though the bill is complex, some major portions include a study of the adequacy of funding for local government solid waste management, a phased approach to collecting source-separated organics from businesses, the establishment of a Food Center to coordinate statewide food waste reduction, development of a system for voluntary tracking of food donations, model ordinances that address solid waste collection and disposal and discourage disposal of organic materials in landfills, a future requirement that new and updated local comprehensive solid waste management plans must address a new requirement to provide organic materials collection and management to residential and nonresidential customers, and requirements for larger cities and counties to adopt compost procurement ordinances and report tons of organic materials diverted from the landfill.
As local jurisdictions and businesses begin recovering additional post-consumer wastes, an opportunity may exist to partner with facilities that accept agricultural or food processing wastes. This may include opportunities to create low-carbon energy such as renewable natural gas or liquid fuels. Local jurisdictions could consider collaborating with nearby industrial facilities to promote symbiosis opportunities. These collaborations can ensure these renewable energy facilities can obtain the feedstock necessary to create low-carbon fuels.

3.4 Water

Reclaimed Water Rule. Passed in 2018, the State provided guidance for how reclaimed water can be used for irrigation, industrial, augmentation, and other beneficial uses. This rule outlines a framework for permitting and distribution and gives specific guidelines for areas where reclaimed water may be included in the agricultural symbiosis process. (Chapter 173-219 WAC).

WA Stormwater Permitting. Washington issues permits under federal and state laws to control surface and groundwater pollution from runoff. The most-populated cities and counties, as well as industrial sites, construction sites, and many businesses (including many agricultural businesses) have stormwater permits. Additional clarity on policies related to stormwater management and water reuse and where they intersect to support or create barriers against agricultural symbiosis could provide valuable information for reducing policy-based barriers in the water sector.

Voluntary Clean Water Guidance for Agriculture. WA established the Voluntary Clean Water Guidance for Agriculture Advisory Group to advise Ecology on the identification and implementation of practices that support healthy farms and help farmers to meet clean water standards. The guidance resulting from this process generates technical resources to help the agricultural community implement practices in a way that ensures protection of water quality. Including groups that understand the variety of water uses and water-related issues could be beneficial towards supporting improved communication and collaboration across sectors towards new symbiosis projects.

4. Overview of Relevant Washington State Incentive Programs

4.1 Climate

Climate Commitment Act. The incentive-based portions of the Climate Commitment Act (including the climate investment funds and the opportunity to voluntarily offer climate offsets) are described above.

4.2 Soil Health / Climate

Sustainable Farms and Fields Grant Program. The Sustainable Farms and Fields program was created in 2020 by the Washington State Legislature to make it easier and more affordable for farmers and ranchers to implement climate-smart practices and projects that increase carbon sequestration and reduce GHG emissions. Funding is open to conservation districts and other public entities (state agencies, universities, tribes, counties, municipalities, special purpose districts) that possess expertise and can provide technical assistance and capacity to implement climate-smart practices. Examples of potential grant-eligible activities include: developing climate-smart farm plans, cost sharing of climate-smart practices (e.g., tree planting, manure management and storage, planting cover crops, composting, purchasing precision agriculture equipment/technology, etc.), purchasing seed, spores, animal feed, and soil amendments, and purchasing shared-use equipment that will be made available through local entities such as conservation districts or farm co-ops.

4.3 Fuels

Alternative Fuel Commercial Vehicle Tax Credit. This tax credit, which was first signed into law in 2015, has been extended through December 31, 2026, and provides a credit to businesses and individuals who purchase or lease new vehicles that use alternative fuels. The credit is available for up to 50% of the incremental cost of a qualifying vehicle, with a maximum credit of $32,000 per vehicle. It is also available to cover the cost of converting a conventional vehicle to run on alternative fuel, up to a maximum of $16,000 per vehicle. The alternative fuels that are eligible for the credit include
compressed natural gas, liquefied natural gas, liquefied petroleum gas, hydrogen, electricity, and biodiesel. This policy could have important indirect impacts on agricultural symbiosis by improving markets for alternative fuels, some of which may be produced through agricultural symbiosis projects.

**Alternative Fuel Vehicle Retail Sales and Use Tax Exemption.** Sale or lease of new or used passenger vehicles, medium-duty passenger vehicles, and light-duty trucks alternative fuel vehicles (AFVs) is exempt from state retail sales and use tax. Eligible AFVs include those powered by natural gas, propane, hydrogen, or electricity. New vehicles cannot be valued over $45,000 and used vehicles over $30,000 to be eligible.

### 4.4 Renewable/Clean Energy

**Retail Tax Deferral Program for Some Clean Technology Investment Projects.** HB 1988 created a retail tax deferral program for some clean technology investment projects, including the manufacturing of such, production of alternative fuels and renewable energy storage. This is meant to provide businesses with the ability to delay their use and sales taxes. They still have to pay them, but if they comply with the requirements they can postpone them. Although some deferral programs can be repaid partially. The bill also includes a pause in sales tax for installing, constructing, repairing or improving electric vehicles, until July 1, 2025.

**Renewable Energy System Incentive Program.** Originally began in 2005 for homeowners, businesses, and local governments that installed solar, wind, and anaerobic digester systems and was updated in 2019. As of 2021, all funds have been appropriated but it is still technically an active program. Specifically relating to agricultural symbiosis opportunities, as of 2021, the REISP program offers a biogas production incentive of $0.12 and $0.02 per kilowatt-hour (kWh) of electricity generated from biogas produced by an anaerobic digester for residential and commercial scale systems, respectively. The incentive is capped at $5,000 and $25,000 per year for residential and commercial scale systems, respectively.

**The Clean Energy Fund Programs.** The Clean Energy Fund (CEF) program has funded the development, demonstration and deployment of clean energy technology since 2013. Since its founding, over $144 million has been invested in capital programs to advance projects. Aspects of this fund that are particularly relevant to agricultural industrial symbiosis include the Rural Clean Energy Innovation Fund ($4.6 million in early 2023) and the Research, Development, and Demonstration Program ($8.5 million in 2022). The Forest Products Financial Assistance Program, which requires a match, is a distinct program that may also be of interest to agricultural symbiosis efforts, including biochar:

- **Rural Clean Energy Fund:** $1.8 million is available for projects “that enhance the viability of dairy digesters;” $1.8 million is available to support rural communities in advancing innovative clean energy projects; a minimum of $921,500 is available for tribal projects that advance dairy digester or rural clean energy innovation projects. Applications are due March 23, 2023

- **Research, Development, and Demonstration Program:** “The Research Development and Demonstration program supports projects that engage in strategic research and development for new and emerging clean energy technologies that will help achieve state, national and international climate goals. Grants will be used to match federal or other non-state funds."

- **Forest Products Financial Assistance Program:** “This program supports the development and expansion of forestry and agroforestry product industries in the State of Washington. This program has an emphasis on use of woody biomass, including by-products of forestry management activities and wood products manufacturing. Proposed projects may utilize biomass to provide thermal energy, electrical energy, or engineered fuel products, or result in energy efficiency improvements. Additional program goals include enhancing forest ecosystem function, reducing forest fire hazards, and supporting resiliency of rural, timber-dependent communities.”
4.5 Water

Water Quality Combined Funding Program. This is an integrated funding program through the Department of Ecology for projects that improve and protect water quality throughout the state. The program combines grants and loans from state and federal funding sources, such as the Infrastructure Act to create high-priority clean water projects across the state. Projects that address standing wastewater, stormwater, and non-point source pollution issues in waterways across Washington State are sought in particular. The extent to which this program is leveraged by existing agricultural symbiosis projects, or could be articulated to explicitly support such, could be valuable.

Stormwater Facility Credits. Properties that have a fully functioning, well-maintained stormwater system are eligible to save money on annual drainage fees. For example, Seattle Public Utilities (SPU) developed the Stormwater Facility Credit Program “to recognize privately-owned systems that reduce stormwater flow and/or provide water quality treatment, which help lessen the impact to the City’s stormwater system, creeks, lakes, or Puget Sound.” Working with organizations that have already been leveraging these incentives to understand how credits to achieve novel or symbiotic management goals could benefit towards better aligning water reuse policies for reduced barriers to agricultural symbiosis.
References


