HARVESTING NORTHWEST BIOENERGY COOPERATIVES

Mapping the Route to a Cooperatively-Owned Future for Emerging Bioenergy Industries

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1. Introduction

This study examines the past, present and future role of cooperatively-owned businesses in the budding bioenergy industry. It intends to illuminate not only growth opportunities but also to highlight some of the risks and barriers to cooperative business development.

The term "bioenergy" refers to renewable energy made from biological sources, from liquid "biofuels" (i.e. ethanol and biodiesel) to "biopower" derived from numerous biomass sources (i.e. anaerobic digestion generation). As an industry, "bioenergy" can also refer to the social, economic, scientific and technical fields associated with using biological sources for energy.

1.1. Overview

This study is a report on the preliminary findings of a year-long initiative, titled *Harvesting Northwest Bioenergy Cooperatives.* The study was completed with grant support from USDA Rural Development Business and Cooperative Programs and the Bullitt Foundation. This project was a partnership between Northwest Cooperative Development Center and Climate Solutions.

With advisement from Climate Solutions, the Northwest Cooperative Development Center:

- Conducted phone interviews with existing co-ops
- Surveyed emerging groups seeking to form co-ops
- Examined previous case studies
- Reviewed articles on the subject

Particular attention was paid to farmer-owned processing facilities, consumer-owned "brewing" projects, and bioenergy production for on-farm use.

1.2. Executive Summary

Bioenergy presents the Pacific Northwest with tremendous opportunities for cleaner energy and economic development. The opportunity for economic development should not only be viewed within the context of jobs creation and commodity prices, but also the long-term future of potential ownership. Different ownership models are ultimately designed to benefit their stakeholders, i.e. the owners. Local ownership substantially increases economic benefits compared to absentee, investor-owned businesses.

The specific industries perceived as holding the greatest potential for bioenergy development in the Pacific Northwest were:

- Biodiesel
- Ethanol
- Anaerobic digestion
- Combustion of woody biomass

First, it was concluded the biodiesel industry holds the most near-term potential for a regionally-based liquid biofuel industry in the Northwest. Oregon, Washington and Idaho have the potential to grow substantial oilseed crops, primarily canola. Multiple farmer-owned projects are now underway but a great deal of infrastructure capacity has yet to be developed. Currently, there are few regional crushers to separate the meal and the

oil, and more hybrid research is needed to guarantee producers reliable crop yields. Just as with ethanol, oilseed producers (for example, the Pendleton Grain Growers) can engage in a variety of capacities to capture greater value for their agricultural products.

Second, the Midwestern ethanol industry provides a timely case study of how a liquid biofuels industry can be developed from the farm up. Nationally, the ethanol industry is experiencing a rapid transformation into larger investor-owned facilities. Virtually all current ethanol industry development in the Pacific Northwest is investor-owned and relies on low-cost commodities already flowing through the region via rail and barges to Pacific Rim markets. While corn and wheat are grown in the Pacific Northwest, the most abundant biomass feedstocks are forestry and agricultural residues. That said, the future of cellulosic feedstocks for ethanol has yet to be written. Much research and development, and refining of technologies is needed to fully commercialize the industry.

Once commercialized, the long-term potential for cellulosic ethanol is enormous and will likely play a major role in the liquid biofuels industry. Fortunately, scale and ownership of cellulosic ethanol facilities have yet to be predetermined. Just as an investor-driven firm (e.g. Iogen with Goldman Sachs and Royal Dutch/Shell) can explore launching a cellulosic ethanol refinery, a group of agricultural producers could explore economically cooperating to:

- Facilitate marketing of their agricultural residues to such a plant
- Join in a joint venture with the principals of a plant
- Launch a small- to medium-scale facility

Third, anaerobic digestion (or “AD”) promises a niche solution to a distinct set of problems, from energy production to manure management. An established industry in other parts of the world, AD is quickly becoming more feasible in the Pacific Northwest. A group of nearby farmers with large quantities of animal waste could realize economic opportunities by forming a bioenergy cooperative. Furthermore, cooperative ownership is well-suited to address specific project needs, such as the initial high capital costs of digester construction and the need for large quantities of manure. As an industry, AD offers promising opportunities to form synergies between multiple stakeholder groups, i.e. farmers who need improved manure management and communities who want clean waterways.

Finally, the combustion of woody biomass for heat and power is an established industry lead by wood product manufactures. Around the corner, innovation promises new technologies, such as integrated biorefineries. Because bioenergy production utilizes large amounts of feedstock, a cooperative of like-producing individuals could, efficiently support such a facility. Because of the sheer quantity of available resources, woody biomass promises to play an increasing role in the nation’s renewable energy portfolio.

As citizens, we must ask ourselves what we want this industry development to accomplish, and remember there will be costs and benefits no matter the direction. If we seek a bioenergy economy that delivers on its promises to rural America, then we must incorporate rural economic development priorities.

Recommendations for groups exploring cooperative start-up:

- “Normal rules” of business apply to co-ops; create a market-driven enterprise with a well-researched and thought-out business plan, adequate reserve funds, etc.

- Build partnerships; co-ops represent the broader community and, by definition, must appreciate and incorporate community interests
- Identify what differentiates the group, be it feedstock production or marketing, and leverage these strengths to ensure economic success

Co-ops must clearly identify and research their markets, resources and partners to determine if the project justifies the possible risks.

Recommendations for local government, policy makers and the general public:

- Provide guaranteed markets through contracts, such as the relationship the City of Portland has formed with Pendleton Grain Growers and Madison Farms
- Encourage accessible and sizable capitalization, ranging from:
    - Investment equity
    - Grants
    - Debt availability & loan guarantees
- Educate about, and advocate for the benefits of local ownership
- Realize the broader condition of industry development and seek to create what is wanted, be it decentralized, locally-owned or centralized, absentee-owned
- Create ownership-based incentives and/or tax benefits, such as Minnesota's disincentives for selling a farmer-owned facility

1.3. Historical Context

The rapidly expanding bioenergy industry provides new opportunities for cooperatives in the Pacific Northwest. Currently most biofuels co-ops are located in the Midwest because of:

- A long cultural tradition of farmer co-ops
- The proximity to and control of feedstock commodities
- An established agricultural infrastructure based on a surplus of high-volume/low-value commodities

The bioenergy industry is now rapidly expanding from a dynamic confluence of variables, including but not limited to:

- Bipartisan support for policy incentives on both the federal (tax credits and air quality regulations) and state (Renewable Fuel Standards/Renewable Portfolio Standards) levels
- Increasing cost of traditional energy supplies
- Decreasing supplies of energy resources coupled with increasing demands
- Environmental concerns, from carcinogens to climate changing gases
- Foreign policy concerns and desires to reduce "foreign oil" consumption
- Phasing out of gas additives, e.g. MTBE, and ultra low sulfur diesel requirements
- Promise of rural economic development, i.e. jobs, ancillary businesses, etc.

Within this current environment, virtually every state in the Pacific Northwest is seeking to accelerate the development of nascent bioenergy industries. While renewable energy and biofuels are on the minds of farmers, voters, consumers and investors, there is still much development to occur in order to have the vibrant, regionally-based industry people envision.

In 2007 the Northwest is at the dawn of this industry. There are enormous business opportunities in the development of new markets, processing infrastructure and feedstocks, all of which hold the potential for cooperative ownership structures.

Cooperatives are any business that is member-owned, member-controlled and member-benefited. Co-ops are internationally recognized as any "autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise."[1] Co-ops economically empower communities of consumers, workers, agricultural producers or businesses to achieve together what they cannot independently.

The synergies gained by an economy of scale provide ownership, equity, income and economic benefit to communities. These increased benefits would otherwise be unavailable or routed to anonymous, absentee owners.

Cooperative businesses have a long history in the Pacific Northwest, from worker-run plywood mills to large agricultural co-ops like Cenex Harvest States, and from Group Health Cooperative to REI. The Northwest is also home to some of the largest credit unions in the country, like BECU. In recent years, biofuels customers have been proactively developing the market for biodiesel through brewing biodiesel and/or wholesale purchasing. In addition, grain co-ops are exploring the promising market opportunities biofuels offers for new and existing commodities.

1.4. Vision of the Future

While there are particular obstacles to groups of farmers, consumers and workers collaborating in business, there are also unique benefits to gain through economic and social cooperation. Co-ops hold a promise of keeping ownership, control and economic benefits local, all factors which present prospective solutions to modern conundrums. Moreover, local control and ownership is a message which viscerally resonates with many rural and urban Americans regardless of political points of view.

Things are not going well in the rural American economy. Our nation's backyard has been rocked by globalization and de-industrialization, creating a new reality for the parts of the country in which agriculture and resource extraction have been the primary industries. The consolidation of corporate agribusiness and subsequent "leaner" farm operations have led to decreasing profitability of smaller community-based businesses. Additionally, the trend of increasing debt for smaller farms has placed many "family farms" in a decreasing profitability feedback loop of overproduction, low prices and debt.[2]

Through technical assistance, public education, pro-active policy and access to capital, an economy that delivers on its promises can be born out of this industry. This is a rare moment in American economic history: rural America has a yet-to-be tapped asset, environmentalists are pleased, business can turn a healthy profit, and consumers get more for less. While venture capital, angel investors and investment firms have a major

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[1] International Cooperative Alliance. "Statements on Cooperative Identity." Retrieved January 2007 from: www.ica.coop/coop/principles.html

[2] Mullinix, Kent, and Warner Nancy. Institute for Rural Innovation & Stewardship. "Building a Healthy Future for Family Farms." January 1, 2005. Retrieved March, 2007 from: http:/csanr.wsu.edu/InfoSources/Summit05.pdf or http://iris.wvc.edu/Summit05.pdf

role to play, there are unique opportunities for communities in rural America during this genesis of the bioenergy industry.

The media, political pundits, and environmental activists have all promised the nation that *"anybody can do it."* Recently, the American pubic has had an infatuation and exuberance around the idea of regular citizens, farmers and homeowners, or nations like Brazil breaking the "addiction to oil" and becoming energy independent.[3]

It is the Center's opinion that there will be both broad industrial development and "boutique" projects having disproportionately large impacts on the local economies in which they are located. The potential for increased farmer-income through new markets and increased commodity prices promises true and lasting economic development, greater economic activity and increased employment. Nevertheless, as any economist will quickly point out: ownership matters. The depth and breadth of this economic benefit will be determined by who owns, controls and manages these new industries. In any economic shift, there will be new winners and new losers. The country must now ask itself: whom do we seek to satisfy?

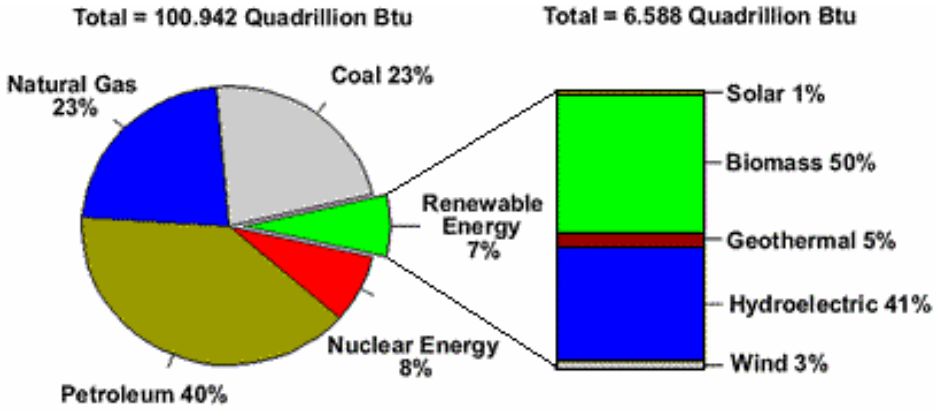
The historical nature of cooperative businesses indicates there will be a host of site-specific situations in which communities of farmers and consumers can organize a bioenergy business. Our research indicates the most fertile opportunities for cooperatives in the Pacific Northwest bioenergy sectors are in the:

- Aggregation of feedstocks to access larger markets or to reduce marketing and handling costs
- Cultivation and support of existing networks of urban consumer co-ops
- Increasing awareness today's agricultural wastes (such as straw or slash) could be tomorrow's desirable cellulosic ethanol feedstocks
- Research and development of small- to medium-scale cellulosic ethanol facilities
- Exploration of economic feasibility for anaerobic digestion facilities
- Production and control of feedstock to add value to oil through biodiesel production for either on-farm use or wholesale distribution

As the following chart, "The Role of Renewable…," indicates, biomass energy contributes the largest proportion of renewable energy portfolio. And yet, there is enormous potential still to be tapped.

[3] Reel, Monte. 2006. "Brazil's Road to Energy Independence; Alternative Fuel Strategy, Rooted in Cane Sugar, Seen As Model." *Washington Post*. www.washingtonpost.com/wp-dyn/content/article/2006/08/19/AR2006081900842.html
In all fairness to the intent of the article, Brazil only replaced 40% of its gasoline consumption with ethanol. While this is an impressive feat, Brazil has aggressively pursued domestic oil exploration and exploitation in order to achieve a state of "energy equilibrium." Nevertheless, the media buzz surrounding the news story was focused on energy "independence" via liquid biofuels.

The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2005[4]



1.5. Assumptions and Limitations

This report was authored with the following assumptions, which while speculative represent possible trends:

- Future regulations on carbon consumption are likely, leading to new markets such as "renewable energy credits"
- Supplies of cheap, accessible energy will continue to decline while energy demands continue to rise
- Continued bipartisan political support for renewable energy will result in favorable governmental policies
- Increasing technological innovation will make renewable energy production more affordable
- Business opportunities exist, specific to rural America, for distributed bioenergy production

It has been theorized these conditions could create a new "Industrial Revolution" of renewable energy. The authors of this paper view this as a possibility and it guided the intentions behind the paper.

Although policy is critical, it was beyond the scope of the study to follow all of the rapidly increasing policy developments in Washington, Oregon, Idaho and Montana.

While the majority of very recent industry developments have involved large agribusiness, the study did not focus on the large national cooperatives such as Cenex Harvest States. In addition, the study paid little attention to electrical co-ops owned by rural electric consumers, some of which have entered into power purchase agreements from biomass plants or explored launching bioenergy projects. The focus of this study was small to mid-size business development for new and existing cooperatives in the Pacific Northwest.

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[4] U.S. Department of Energy, Energy Information Administration. 2005. Retrieved July 2007 from: www.eia.doe.gov/fuelrenewable.html EIA defines "Biomass energy" as the following three sources: "wood, waste, and alcohol fuels. Wood energy is derived from…wood as a fuel and from wood waste streams. The largest source of energy from wood is pulping liquor…from processes of the pulp, paper and paperboard industry. Waste energy is the second-largest source…municipal solid waste (MSW), manufacturing waste, and landfill gas. Biomass alcohol fuel, or ethanol, is derived almost exclusively from corn."

It was beyond the scope of this study to explore the opportunity for co-ops to be an aggregator of environmental attributes; such as "Green Tags," renewable energy credits (RECs) or carbon credits. Further market development is yet to be completed in order to fully realize the benefit from RECs or carbon credits.[5]

Supreme Court attorneys have often quipped that there are three different arguments before the Court: first, the one you prepared; second, the one you presented; and finally, the one you wish you had prepared. This "folk wisdom" could be true of this report. As teams of well-funded state employees began to churn out multiple reports on the ever-changing status of the industry in a single region, it was quickly apparent the industry was moving at the speed of light. Retrospectively, the hope of identifying regional opportunities and challenges for an array of industries was an overly aggressive task.

2. Benefits of Economic Cooperation

The cooperative business model has several unique features both positive and negative. While not currently the predominate model for industry, co-ops hold a host of strengths and weaknesses no other business model allows. Irrelevant of size, co-ops belong to those who utilize its services: *the members*. Groups of consumers, workers and farmers/producers typically organize into a co-op for one reason: *to access services or markets*. Therefore, a co-op's primary purpose is to serve a particular membership's identified needs, most often by increasing income and/or reducing costs for members.

Through the one-member, one-vote principle, co-ops enable people to operate their business in a democratic manner. By pooling human and capital resources, co-ops allow people to achieve more together. Nevertheless, because co-ops are often a response to a lack of access to capital, their very nature can limit outside investment, potentially complicating start-up financing. A defining characteristic of co-ops is that non-members are not allowed to vote and can only be issued preferred stock.[6]

Generally the American economy is geared and structured to reward individual corporate action through return on investment rather than collaborative, mutual problem-solving. It is this fundamental distinction that defines the foundation for advantages for cooperative businesses. Co-ops have a rich history of excelling where investor-owned businesses dared not venture or were deemed unprofitable; such as in organic food in the 1970s or credit unions lending to those with poor credit.

It is the community-origination and service-driven orientations that investor-owned corporations spend millions attempting to imitate through "image branding." National Cooperative Business Associations CEO and President Paul Hazen said:

> *More than 75% of those surveyed agreed that co-ops run their businesses in a trustworthy manner compared to just 53% for investor-owned companies. More than two-thirds agreed that consumer-owned co-ops are ethically governed, while just 45% said the same of investor-owned corporations.*

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[5] For more information on a cooperative business model, the Our Wind Co-op (www.ourwind.org) which is a "cooperative of small-scale wind turbines" which had numerous goals; one of which was to "Link rural, small-wind power producers with urban consumers through aggregated Green Tag sales"

[6] A theoretical example of this situation would be community or industry stakeholders seeking a successful project, such as a pork buyer purchasing stock in a processing co-op. This would enable investors to participate but not govern. Likewise the group of pork processors could form a LLC and sell shares to non-farmers. There are pros and cons in any investing situation that need to be considered.

Even when consumers and business partners only vaguely know what a "co-op" is and isn't, they tend to extend greater "goodwill" towards co-ops. Co-op tendencies toward transparency and innate community accountably encourage trust as a business partner. People like to do business with "the producer." Additionally, this could be a result of co-ops to be most active in sectors of the economy which experience what an economist would call "market failure." By providing electricity or market access for agricultural products when nobody else would, the largest 100 co-ops currently represent $140.9 billion worth of the U.S. economy, and the six largest cooperative sectors (totaling 21,367 co-ops) service 130 million members or 43% of all Americans.[7]

Some benefits of economic cooperation are easily measured, such as retained access to economic surplus, while other less tangible features like "social capital" are harder to quantify. What follows are some of the benefits that co-op members and the broader community receive. For the purposes of this study, farmers, communities and consumers were identified as key stakeholders in bioenergy cooperative development.[8]

2.1. Benefits to Farmers

Cooperatives have been a component of the farming community since the passage of the Capper-Volstead act in 1922 which enabled farmers to legally market on a collective basis.[9] Co-ops democratically increase farmer-control and farmer-ownership of an industry in which their traditional role is that of a supplier. Through economic cooperation, groups of farmers can create an economy of scale to capture more of the value of their products through engaging in processing, marketing and distribution of the goods they provide.[10]

Cooperatives enable farmers to better compete in the marketplace, which translates to increased profits for products and services. By pooling the individual farmers' experience and markets together into the co-op, they are able to leverage more than an individual farmer could. An added benefit of working cooperatively and having an economy of scale is that the co-op may gain lower input prices, and have access to expanded markets. Working cooperatively to achieve an economy of scale has historically benefited our farming communities. When considering the future of bioenergy, the cooperative model can still be a mechanism offering the most value.

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[7] Figure taken from the National Cooperative Bank's "NCB Co-op 100." Retrieved June 2007: www.co-op100.coop; NCB goes on to list the top revenue generating industries in order of magnitude: agriculture, grocery, energy/communications, finance and hardware/ lumber.

[8] Not examined here are the benefits for workers to organize as a cooperative. While rare, there are worker-owned businesses being organized around this new industry. For example, Biofuels Oasis in Berkeley, CA is a women/worker-owned business organized to provide "greater access to biodiesel." For more information see: www.biofueloasis.com. Also Blue Ridge Biofuels in Asheville, NC is a worker co-op which produces and distributes biodiesel, see: www.blueridgebiofuels.com

[9] Volkin, David. 1985. "Understanding Capper-Volstead." US Department of Agriculture. Cooperative Information Report 35. Retrieved June 1997 from: www.rurdev.usda.gov/rbs/pub/cir35.pdf

[10] Brown, Roger B. and Christopher D. Merrett. Volume 11, Issue 7. Spring 2000. "The Limited Liability Company Versus the New Generation Cooperative: Alternative Business Forms for Rural Economic Development." Rural Research Report. Illinois Institute for Rural Affairs. Retrieved November 11 2007: www.iira.org/pubsnew/publications/IVARDC_RRR_44.pdf

2.2. Benefits to Consumers

Cooperatives benefit consumers in two ways: first and primarily, consumer-owned cooperatives provide a business mechanism for consumers to own and control their service providers (such as housing, health care or credit unions); second, as purchasers of goods produced by farmer-owned marketing co-ops.

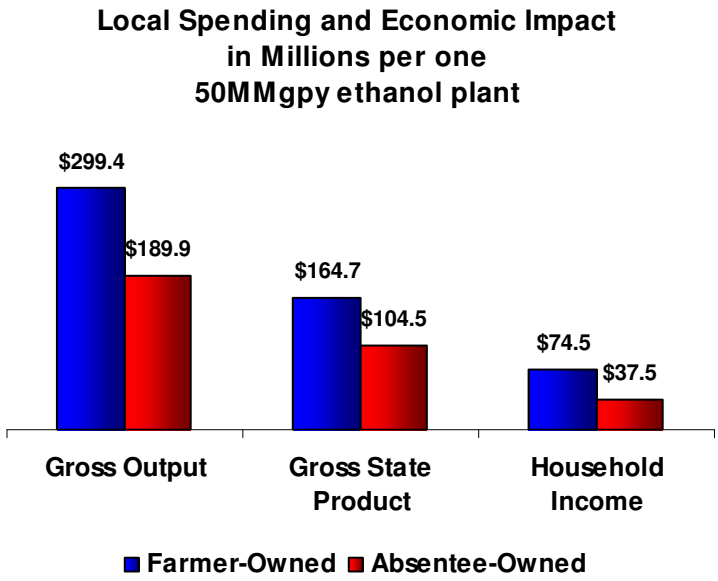
In a consumer-owned cooperative, the leading benefits of membership are that members share in the profits and/or savings of the business. Frequently co-ops have a patronage dividend system in which members receive payments for revenue exceeding profits. Additionally, co-ops tend to have lower costs of goods due to economies of scale. Furthermore, co-ops have a direct incentive for transparency in the broader community because of the ownership model. Transparency is important to co-ops because in theory the customer base consists of voting owners.

For customers of farmer-owned products, the business model contributes value to the overall process and, in so doing, increases income for the farmers. One only needs to examine the recent success of Equal Exchange or Organic Valley to see that a growing portion of consumers are increasingly making ethics-based decisions in the marketplace.

Archer Daniels Midland high fructose corn syrup will never evoke the same positive psychological response in a consumer as locally produced Tillamook cheese. If the $2.2 billion fair trade industry has demonstrated nothing else, it's that socially-minded consumers have demonstrated a willingness to pay more for a product when they know more of the money is reaching the producer. Also noteworthy is the standard fair trade business mechanism for ensuring this: *a producer-owned co-op*.[11]

2.3. Benefits to Communities

In addition to the individual (i.e. farmers and consumers), cooperative businesses support the overall community as a whole. Economic activity begets further economic activity. Cooperatives increase income by retaining economic surplus locally and by paying taxes into local and state economies. Unlike transnational corporations, most money spent at a co-op and by the co-op tends to stay inside the community. Furthermore, co-op members will likely spend money at other businesses in the community. The co-op also spends money on supplies and utilities, and pays local taxes, all which benefit the town where the business is located.



A study by John Urbanchuck describes and quantifies the returns to the community

[11] Fairtrade Labeling Organizations International. 2007. Retrieved on May, 2007 from: www.fairtrade.net

through cooperative ownership.[12] These include:

- The majority share of expenditures will be from local sources, i.e. debt servicing, general accounting, marketing and administration
- Farmers will also receive dividend payments that increase household income and will be circulated through the local economy

Urbanchuck calculates the full contribution to the local economy to be 56% larger than the impact of absentee-owned corporate plant (see chart titled, "Local Spending and Economic Impact…").[13]

David Morris reiterates the benefits of cooperative ownership for the farmer and the local community.[14] He notes the profitability of the industry by citing a study by Iowa State University which concluded, "The 5-year average after-tax return for an ethanol dry mill is 23%. On the other hand, 70% of Iowa's counties averaged returns on farmland of 2.5% or less."

As previously mentioned, co-ops are more loyal to their communities then an absentee-owned business. The British Columbia Cooperative Association has noted, "Co-ops are less vulnerable to takeovers and closures by outside decision-makers. In fact, in many communities, co-ops have stayed to serve their members long after other businesses have fled to more profitable locales."[15]

Loyalty to the broader community is a direct result of where the ownership is physically located and motivations of the firm. If a business owner is an actual constituent of the community, there is a direct disincentive for a co-op's board to give up control to external players in the industry. During this time of mass out-migration from our rural communities co-ops are currently providing means for business retention.

2.4. Conclusion

Cooperative businesses provide meaningful solutions to an assortment of interrelated problems of the economy by providing a business mechanism to:

- Add value to agricultural commodities
- Generate more jobs and greater income
- Empower communities, consumers and producers

While not the only business model, co-ops are a proven tool for real and lasting economic development.

3. Cooperatives, Biofuels and Ownership Trends

In many ways, the ethanol industry provides a microcosm to examine the role of co-ops as early industry leaders in biofuels and how ownership evolves with time. Even though

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[12] Urbanchuk, John M. September 2006. "Economic Impacts of Farm Community of Cooperative Ownership of Ethanol Production." National Corn Growers Association. Retrieved November 11, 2006 from: www.ncga.com/ethanol/pdfs/2006/FarmerOwnedEthanolEconomicImpact.pdf

[13] Urbanchuk, 2006.

[14] Morris, David February 2006. "Ownership Matters: Three Steps to Ensure a Biofuels Industry That Truly Benefits Rural America." Institute for Local Self-Reliance. Retrieved November 11, 2006 from: www.newrules.org/agri/ownershipbiofuels.pdf

[15] British Colombia Cooperative Association. "The Co-op Advantage." Retrieved June 28, 2007 from: www.bcca.coop/pdfs/CoopAdv.pdf

the original Model T was built for ethanol, farmers have been the economic engine that has propelled ethanol into a mainstay pillar of the liquid biofuels industry and the broader American economy.

The Midwest has been the epicenter for biofuels industry development. A combination of factors, including lack of assess to capital combined with a surplus feedstock, led to formation of numerous farmer-owned co-ops. As the industry matures it has caught the attention of investment banks and hedge funds, thus a more diverse ownership landscape is emerging.

3.1. History of Biofuels Ownership

By an enormous margin, biofuels production in the U.S. has focused on the manufacturing of corn-based ethanol in the Midwest. Because feedstock distribution is initially in the hands of farmers and they developed the industry for their purposes, the ethanol industry provides a very relevant case study in how the ownership of the biodiesel industry has and will unfold; and how the ownership of related bioenergy industries could evolve. Sidebar One illustrates the generally accepted evolution of any particular industrial sector.

In the early 1980s, with gas prices hitting new highs and federal 100% loan guarantees available to plants producing less than a million gallons per year, capital poured into the ethanol industry. By 1984 there were 167 plants. This number took a sharp drop by 1990 after oil dropped to $8 a barrel, leaving only 56 plants in operation. David Morris has tracked what he considers the "four major structural upheavals" of the ethanol industry:[16]

- **The Early 1980s:** Between 163-176 very small stills; in 1979 oil price doubled and a Federal 100% loan guarantee for >1 million gallons per year (MMgpy) plants promoted small-scale production
- **In 1985:** almost half of these small plants failed and by 1990 only 56 plants were left, most with a capacity >5 MMgpy; crude oil dropped to $8 a barrel and ethanol fell under negative publicity
- **Late 1980s to early 1990s:** "dominated by" 100-140 MMgpy wet mills serving the high fructose corn syrup (HFCS) market; 75% of ethanol output was ADM, as ADM controls most HFCS production
- **The 1990s:** Most new ethanol plants were farmer-owned, and by 2002 they produced more ethanol then ADM; most new plants between 15 and 30 MMgpy
- **In 2004:** An era of 100 MMgpy dry mill facilities; a doubling in the price of oil

Sidebar One

The 5 Stages of the Industrial Lifecycle*

Caused by product innovation or deregulation, the following stages are common in emerging industries:

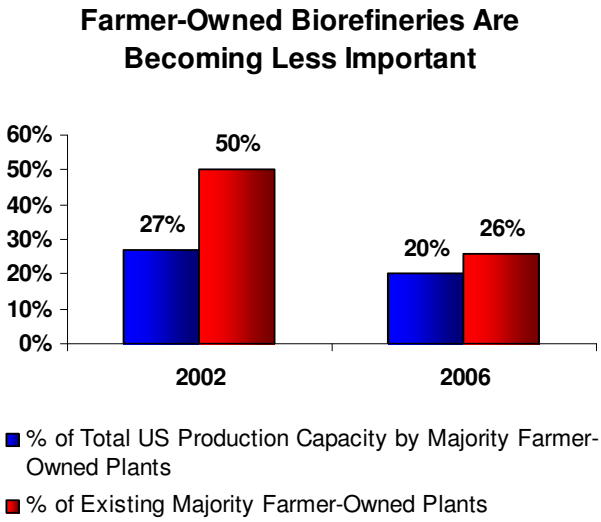
1. ***Dormant:*** low numbers of competitors enjoying high monopoly profits
2. ***Takeoff:*** soaring entry and virtually non-existent exit from the market
3. ***High Turnover:*** many firms entering the market and leaving it
4. ***Shakeout:*** mass exit via mergers, bankruptcies, etc.
5. ***Stabilization:*** a stable oligopoly emerges

* Michael Gort, Steven Klepper. *Time paths in the diffusion of product innovations*. Economic Journal, vol.92, no.367. (September, 1982) Pp.630-653.

[16] Morris, David. 2005. "Do Bigger Ethanol Plants Mean Fewer Farmer Benefits?" USDA. Rural Cooperatives Magazine. November/December 2005 Volume 72, Number 6. Retrieved May 2007 from: http://www.rurdev.usda.gov/rbs/pub/nov05/bigger.htm

In the late 1990s, the perfect storm of high energy costs, favorable policy and low commodity prices hit once again and fresh capital from farmer cooperatives began expanding ethanol production. Farmer-owned plants began to control the market, and by 2002 over 25,000 farmers held stock in ethanol facilities.[17] In the chart, "Farmer-Owned Biorefineries," David Morris illustrates the diminishing importance of farmer-ownership in the industry.[18]

Currently, the industry continues its rapid expansion due to rising oil costs, the phasing out of MTBE, renewable fuel standards, financial incentives and air quality regulations, making it an attractive investment. Venture capital is quickly shifting the magnitude of ethanol production facilities. Several larger producers and outside capital are consolidating ethanol production to an elite few large producers. According to David Morris, "It is likely that in the next 3 years, 75% of new ethanol production will come from large, non-farmer-owned plants."[19] Morris goes on to speculate that no longer is the goal of rural revitalization attached to energy goals as large centralized plants extract profits from local communities.



In many ways, these ownership trends are only a reflection of broader economic trends influencing the American economy. According to the "Farming as Big Business" section of the U.S. Department of State's "Outline of the U.S. Economy":[20]

> *Just as an industrial enterprise might seek to boost profits by becoming bigger and more efficient, many American farms have gotten larger and larger and have consolidated their operations to become leaner as well. In fact, American agriculture increasingly has become an "agribusiness," a term created to reflect the big, corporate nature of many farm enterprises in the modern U.S. economy. Agribusiness includes a variety of farm businesses and structures, from small, one-family corporations to huge conglomerates or multinational firms that own large tracts of land or that produce goods and materials used by farmers.*
>
> *The advent of agribusiness in the late 20th century has meant fewer but much larger farms. Sometimes owned by absentee stockholders, these corporate farms use more machinery and far fewer farm hands. …In 1900, half of the labor force were farmers, but by the end of the century only 2% worked on farms. And*

[17] Ibid
[18] Morris, 2006.
[19] Ibid
[20] Conte, Christopher and Karr, Albert. February 2001. "Outline of the U.S. Economy." U.S. Dept of State. http://usinfo.state.gov/products/pubs/oecon Retrieved July, 2007: http://usinfo.state.gov/products/pubs/oecon/chap8.htm

nearly 60% of the remaining farmers at the end of the century worked only part-time on farms; they held other, non-farm jobs to supplement their farm income.

While the owners of agribusiness are increasingly ramping up in scale, some have noticed an increase in small-scale interest. BBI's Ethanol Producer Magazine (EPM) reported in 2006 the majority of permit holders with the Alcohol Tobacco Tax and Trade Bureau were small-scale, i.e. less then 5,000 gallons of pure alcohol or 10,000-proof gallons per year.[21] EPM goes on to point out that of the 1,247 total active permits for producing ethanol, only 103 were for medium to large facilities. While this is not a return of the "still on every hill" era of the 1970-80s, it does indicate the existence of strong motivating factors encouraging many private citizens to produce ethanol, even if just as a hobby for their own use.

3.2. Case Studies

There are a variety of cooperatively-owned business models emerging in biofuels industries. For example, biodiesel users are forming "purchasing club" co-ops (e.g. the Bend Biofuels Co-op) similar to the natural food buying clubs from the nascent natural food industry of the mid-1970s. At the other end of the spectrum, large vertically integrated cooperatives, such as CHS, are assimilating biodiesel and ethanol production into pre-existing distribution and supply chains. Several case studies on ethanol cooperatives in the Midwest have documented the numerous benefits to consumers, producers, communities and states.

CHS, as "the nation's largest cooperative petroleum refiner, marketer and distributor," is a natural fit for the industry. It is also the third largest US grain company and holds 22% ownership of US BioEnergy, the nation's second largest ethanol manufacturer.[22] CHS recently launched a joint marketing venture with U.S. Bioenergy, Renewable Fuels Wholesale Marketing.[23]

Another major cooperatively-owned player is AGP (Ag Processing, Inc), a joint venture between Land O' Lakes, Farmland Industries and Boone Valley Cooperative Processing Association. AGP has over 250,000 farmer-owners in the Midwest and is a federation of 203 smaller local co-ops engaged in the procurement, processing, marketing, and transportation of grains and grain products.[24] It is worth noting AGP recently built a deep water port in Grays Harbor, Washington near the largest biodiesel processing facility in the country, Imperium Renewables' 100 MMgpy plant.[25]

Farmer-owned co-ops have been the engine behind Midwestern ethanol production. Some examples include Southwest Minnesota Agrifuels Cooperatives (SMAC), which

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[21] McElroy, Anduin Kirkbride. 2006. "Will Backyard Stills Make a Comeback." *Ethanol Producer Magazine*. July 2006. Retrieved from: www.ethanolproducer.com/article-print.jsp?article_id=2154

[22] PRNewswire. 2007. "CHS CEO Calls for Reality-Based Approach to Energy, Renewable Fuels Future." March 1, 2007. Retrieved July 2007 from: http://chsinc.mediaroom.com/index.php?s=43&item=24

[23] BBI International. 2006. "CHS, US Bioenergy Form New Marketing Company." *Biodiesel Magazine.* Retrieved July 2007 from: www.biodieselmagazine.com/article.jsp?article_id=933

[24] Ag Processing, Inc. a cooperative. "A Farmer Owned Company." Retrieved July 2007 from: www.agp.com/about_us.shtml

[25] AGP International. 2007. "The Fastest Route from the West Coast to Your Market." Retrieved July 2007 from: www.agpportofgraysharbor.com

initially formed to add value to its members' corn production.[26] It allowed farmers to buy shares of the plant and receive dividends over the years. SMAC appreciation of stock increased from roughly $4 million at start up in 1997 to $11 million in 2001, returning large dividends to the farmers.

In the case study Golden Triangle Energy Cooperative, the cooperative had a return rate of 25-30% to shareholders and it allowed farmers to hedge against low corn prices.[27] In the case study Sunrise Energy Cooperative, farmers successfully created an integrated system that included an ethanol plant, an anaerobic digester supplying methane, and a beef feedlot consuming distiller grains from ethanol plant.[28] These case studies demonstrate the substantial advantage to farmers of cooperative ownership.

Dave Dietrich of Vera Sun noted, "We are getting $.20 to $.25 more for each bushel we produce. And our land values are increasing."[29] Farmer-owned biorefineries also act as a hedge against low corn prices. When the price of corn drops, production costs of ethanol also drop, returning higher profits to the biorefinery.[30]

In a co-op structure, net savings are also passed on to the farmer-owners. For example, the Chippewa Valley Ethanol Cooperative in Minnesota employs 45 full-time workers with a payroll of more than $2 million. Its 650 farmer-owners have earned, on average, a return of 25% on their investment since the plant opened…"[31]

Co-ops create new business opportunities in local communities. For example, in Brookings, South Dakota, Integrated Business Solutions was created to help manage the information technology needs of the ethanol plants.[32] New business development has also helped in retaining youth and stemming out-migration from rural communities. In a recent article in the *Wall Street Journal*, Bryan Gruley remarks how rural communities in the past have struggled with falling populations, but with the construction of ethanol plants these communities are retaining populations and growing.[33]

For the foreseeable future the largest and highest profile role for cooperatives in the ethanol industry will be for the co-ops who are already major players in their respective industries, i.e. those already producing, marketing and processing grain.

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[26] Lawless, Greg, Powell, Maria, and Thongchua, Nalinee. July 2002. "Southwest Minnesota Agrifuels Cooperative: A case study prepared for North Central Initiative for Small Farm Profitability" by the Wisconsin Center for Cooperatives. Retrieved Nov. 11, 2006 from: www.uwcc.wisc.edu/info/supply/sw_ethanol.pdf

[27] Fink, Rodney. "New Generation Cooperatives: Case Study Golden Triangle Energy Cooperative, Inc. Ethanol Plant." Illinois Institute for Rural Affairs. Retrieved Nov. 11, 2006 from: www.iira.org/pubsnew/publications/IVARDC_CS_184.pdf

[28] Fink, Rodney. January 2001. "New Generation Cooperatives: Case Study Sunrise Energy Cooperative." Illinois Institute for Rural Affairs. Retrieved Nov. 11, 2006 from: www.iira.org/pubsnew/publications/IVARDC_CS_170.pdf

[29] Renewable Fuels Association. February, 200. "Tales from the Heartland: The American Ethanol Scrapbook." Retrieved March 2007 from: http://www.ethanolrfa.org/objects/pdf/scrapbook/RFA_Scrapbook_2007.pdf

[30] Morris, 2006

[31] Morris, 2007

[32] Renewable Fuels Association, 2007

[33] Gruley, Bryan. "Energy Boom Lifts Small-Town Hope On Northern Plains." *The Wall Street Journal.* December 1, 2006.

3.3. Ownership Models and Transitional Trends

Unfortunately, future ownership by communities, consumers and farmers may play a minority role. The markets have been sufficiently developed and now there is too much money at stake for the well-financed firms to neglect developing capacities in these industries. While co-ops have shepherded this industry along, traditional financiers, such as equity funds and venture capital, are now pouring money into the industry and creating innovative business models

Eric Bowen, an energy expert with Sigma Capital in San Francisco and President of the San Francisco Biofuels Cooperative, claimed that among the 100 biodiesel business plans he's reviewed there are the following three types of companies: [34]

> *Agribusiness giants like Archer Daniels Midland with lots of cash and talent; old hippies working on small projects that will mostly fail; and a new breed of "pure-play" venture-backed companies focused on making large volumes of biodiesel.*

All Americans, especially farmers, are aware we live in a dynamic and ever-changing economy. Every sector of the agricultural economy is facing new conditions and operating in a new context. Modern economic realities for many traditional farmer-owned cooperative are requiring increased capital and a transition to more progressive models. According to Doug Sim, the CEO of CoBank:[35]

> *Farmer cooperatives are increasingly turning to value-added activities to bolster their members' farming operations, and many are turning to new business models to raise equity capital from non-producers to minimize tax liabilities and gain added operational flexibility.*

One of the prominent models in the Midwest was the "New Generation Cooperative" (NGC). NGCs differ from standard co-ops in three ways:

1. Requires farmers to invest significant dollars up front by purchasing shares in the business
2. Obligates the producer to deliver a set-quantity of the raw product (e.g. corn)
3. Limits the total quantity of tradable shares which can appreciate or depreciate depending on the market

One benefit of an NGC is they require a capital investment in order to own stock and lock in a secured feedstock for the facility. This relationship avoids a "price war" for feedstock. It is worth noting that many NGCs, as they scale up, are transitioning to Limited Liability Corporations (LLC) in order to entice outside investors.

The advantage of the LLC model is it allows outside capital to finance the project and can quickly raise large sums of capital. The LLC model can also be set up like a cooperative and indeed some are. Unfortunately, one cannot sell a house and continue to live in it without paying rent; once something is sold, it is sold. As David Morris has pointed out: [36]

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[34] Timmerman, Luke. 2007. "Can Biodiesel Compete on Price?" *The Seattle Times*. February, 14 2007. Retrieved February 2007 from: http://seattletimes.nwsource.com/html/businesstechnology/2003470213_biodiesel10.html

[35] Campbell, Dan. 2003. "Congressional hearing focuses on possible need for more flexible co-op business model" USDA. *Rural Cooperatives Magazine*. November/December 2003 Volume 70, Number 6. Retrieved May 2007 from: www.rurdev.usda.gov/rbs/pub/nov03/hearing.html

[36] Morris, 2006

> *In an LLC, the farmer, and most specifically the farm, is less closely tied to the firm. However, if the LLC is majority farmer controlled and owned, it can have a similar impact on the farmer.*

Concern has been expressed that cooperatives are not being represented correctly and that they do have the capability to effectively raise sufficient capital. Also by promoting the LLC or hybrid models, some of the traditional characteristics of a co-op may be sacrificed. For example, the LLC model may not represent farmers' interest and shifts a bulk of the profit out of local communities, thus failing to deliver fully on the promise of economic development.

Vertically-integrated agribusiness see the future, and in that future is domestic energy production in rural America. One only need read the *Wall Street Journal* or view recent television advertisements to notice the tectonic shift in attitude for agribusiness giants like Cargill or ADM. This aggressive positioning is best summarized in the following quote about AMD's new tagline as "the global leader in bioenergy," according to ADM CEO Patricia Woertz:[37]

> *The word 'the' is there for a purpose. It means we will be number one. It means we will be 'the' leader, not amongst the leaders, not a U.S. leader, not a leader where we choose to market or operate. It is 'the global leader in bioenergy.'*

3.4. Conclusion

Midwest farmers were the originators of domestic biofuels industry development, primarily ethanol. While farmer ownership has since dwindled, there are opportunities for increased local ownership. If other bioenergy industries follow the path of the Midwest ethanol producing co-ops, the market development and considerable capital spent on research will be consolidated elsewhere. Farmer invested sweat-equity is being threatened by premature harvesting for the profit by a select few outsiders. Furthermore, with future feedstocks (e.g. switchgrass) and new products (e.g. bio-plastics) around the corner, increased local ownership of the feedstocks could provide co-ops and rural communities with opportunities.

4. Biodiesel in the Northwest

As long as the Pacific Northwest ethanol industry remains primarily dependant on railed in feedstock, the largest impact from biofuels in the rural economy will come in the production of biodiesel feedstocks. Oilseed co-ops are uniquely positioned to provide markets and infrastructure for biodiesel, whether for on-farm use or commercial applications.

The recent volatility in petroleum prices and increasing environmental concerns has lead to amplified public interest and demand for biodiesel in the Northwest. However, to date the majority of biodiesel has been transported into the Northwest from the Midwest where there is more access to feedstocks. This is changing, though, as in-state production ramps up. It is crucial to analyze the ownership models that will be at the helm of this industry.

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[37] BBI International. 2007. "ADM Plots Biofuels Future." *Biodiesel Magazine*. Retrieved July 2007 from: http://www.biodieselmagazine.com/article.jsp?article_id=1349

Communities cannot sell the equity of new manufacturing capacity and receive the entire economic benefit from its existence. Therefore, an influx of private capital into corporate bioenergy plants will conversely decrease the local ownership in our rural economies.

4.1. Industry Overview

Several biodiesel production facilities are under development and will be coming online in the near future. The larger producers will be importing a majority of their vegetable oil from low cost agricultural producers, ranging anywhere from the Midwest to Asia. That said, there has been an aggressive effort to create an in-state oilseed market.

Imperium Renewables recently opened the largest plant in the country located in Hoquiam, WA. Imperium recently negotiated a deal with Natural Selection Farms in Sunnyside, WA, a local canola grower and crusher, to supply up to 1 MMgpy, or roughly up to 1% of their total supply needs. According to the *Capital Press*, "the deal marks the largest purchase agreement for canola grown in Washington State."[38]

A critical limiting factor to building a biodiesel industry based on Northwest feedstocks is crushing capacity. There are several oilseed crushers proposed, and several <1 MMgpy crushers owned by individual farmers, but this remains the greatest immediate infrastructure limitation.

Future deals will depend upon farmers' capacity to profit from cultivating and selling oilseeds. "Oilseed and raw oil imports into the Pacific Northwest will probably occur in the short term, but imports will not have a positive impact on the local agricultural economy or on local growers."[39] The Pacific Northwest will have to compete with established oilseed markets in Canada and the Midwest, which already have developed markets and can offer oilseed and vegetable oil at a very competitive price. Coupled with current high commodity prices, these challenges have inhibited efforts to promote local oilseed production. However, there remains a strong regional interest in biodiesel production and oilseed markets.

Interest in local production is illustrated by several smaller projects currently under development with the help of governmental low-interest loans and grants. For example, the Washington State Bioenergy Team seeks a long-term strategy to create financing options for partner cooperative programs with federal funding resources and private investors.[40] A 2006 report states, "Expansion and sustainability of the biodiesel industry will ultimately depend on the availability of inexpensive, locally grown oilseed crops."[41]

Several grain growing co-ops have also explored options in the industry, including joint ventures. Most visibly, Pendleton Grain Growers (PGG) recently purchased a .5 MMgpy processor and has negotiated sale of the fuel to the City of Portland and Carson Oil.[42]

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[38] Beecher, Cookson. 2007 "Eastern Washington farm to supply canola to Westside biodiesel plant." *Capital Press.* Volume 80, Number 6. February 9, 2007.

[39] Dan O'Brien Associates. June, 2006. "Assessment of Biodiesel Feedstocks in Oregon." Prepared for the Portland Development Commission. Retrieved January 2007 from: www.pdc.us/pubs/inv_detail.asp?id=661&ty=46

[40] Dan O'Brien Associates. January 2007. Washington State Bioenergy Team. "2006 Status Report." Retrieved from: agr.wa.gov/bioenergy/MultiagencyReportFINALJan2007.pdf

[41] Washington State Bioenergy Team, 2006

[42] Schmitz, John. 2007. "Biodiesel Plant About Ready For Delivery." *Capital Press.* June 29, 2007. Retrieved July 2007 from: www.capitalpress.info/SiteImages/FileGallery/2471.pdf

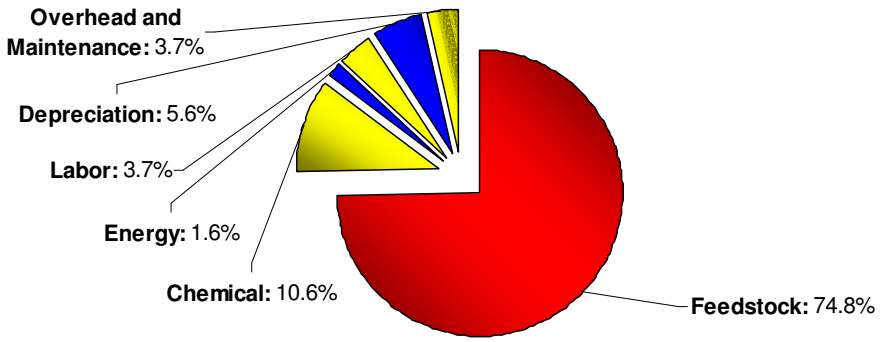
PGG members will grow canola as a rotational crop with wheat and expect to receive $.13 to $.15 per pound for their oilseed.

4.2. Industry Factors

This section outlines several important factors when considering regional biodiesel production. These include, but are not limited to, petroleum diesel fuel prices, feedstock prices, byproduct/co-product markets (i.e. glycerol, seed meal, etc.) and infrastructure costs.

A brief discussion of issues highlights the complexity of establishing an in-state biodiesel and oilseed market. The following chart, "Typical Distribution of Biodiesel Production Costs," quickly identifies the major factors affecting the economics of the industry.[43]

Typical Distribution of Biodiesel Production Costs



4.2.1. Diesel Fuel Prices

Last summer diesel fuel prices hit all time highs of around $3.00 per gallon, quickly making biodiesel an attractive alternative.[44] But as volatile retail prices for petroleum diesel drift lower, biodiesel again struggles to compete. As seen in Table 1, the price of low-level biodiesel is $.13 higher than conventional diesel, while B20 is $.04 higher. The biggest difference is seen with B100 which is retailing for almost $.60 higher than diesel.

[43] Pruszko, Rudy. February 2006. "Rendered Fats and Oils as a Biodiesel Feedstock." *Renderer Magazine.* Retrieved May 2007 from: www.rendermagazine.com/February2006/RenderedFatsandOils.pdf
[44] Energy Information Administration. February 12, 2007. "Diesel Fuel Prices." Retrieved February 2007 from: tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp

Fuel Price Report Comparison, National and on West Coast[45]
(all prices per gallon)

	Price for March 2007 Period	Price for October 2006 Period	Price Change This Report vs. Last
Diesel			
National	$2.63	$2.62	$.01 / 0%
West Coast	$2.96	$2.74	$.22 / 8%
Biodiesel (B2-B5)			
National	$2.60	$2.75	($.15) / (5%)
West Coast	--	$2.90	--
Biodiesel (B20)			
National	$2.53	$2.66	($.13) / (5%)
West Coast	$2.77	$2.78	($.01) / (0%)
Biodiesel (B99-B100)			
National	$3.31	$3.31	$.00 / 0%
West Coast	$3.44	$3.55	($.11) / (3%)

The economics of alternative fuels are becoming more attractive due to the long-term trend for increasing oil prices.[46] It remains to be seen, however, if biodiesel can compete with diesel without subsidizes.

Public support for biodiesel, and more specifically biodiesel from the Northwest, may provide a market regardless of diesel prices. For example, the City of Portland is working towards branding Oregon Fair Trade Biodiesel to provide a niche market for consumers in the Pacific Northwest.[47] Consumer co-ops have emerged primarily in urban areas to promote and facilitate biodiesel use. These initiatives combined with state and federal renewable fuel standards may provide a strong market for biodiesel.

4.2.2. Northwest Feedstocks

The primary indigenous feedstocks for industrial biodiesel production in the Northwest are oilseed crops and waste FOG (fats, oils, grease).

Waste Oils, Grease and Rendering

Waste vegetable oil (or WVO) is primarily the leftover frying grease from commercial restaurants or industrial food production. Almost all WVO is collected and rendered into yellow grease (a more consistent product) and is marketed for animal feed, cosmetics and other uses.

While the total amount of WVO created within the Pacific Northwest is unknown, it can be estimated. According to a 1997 NREL study of 30 random cities, the West Coast

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[45] Alternative Fuels Data Center. *"Clean Cities Alternative Fuel Price Report."* U.S. Department of Energy. Retrieved June 2007 from: www.eere.energy.gov/afdc/resources/pricereport/pdfs/afpr_02_28_06.pdf, www.eere.energy.gov/afdc/resources/pricereport/pdfs/afpr_mar_07.pdf

[46] Energy Information Administration. "Annual Energy Outlook 2007 with projections until 2030." Retrieved from: www.eia.doe.gov/oiaf/aeo/index.html

[47] Brickey, Dean. *The Oregonian*. November 15, 2006. "Canola contract could fuel Portland's pumps." Retrieved June 2007 from: www.portlandonline.com/leonard/index.cfm?a=bdihgh&c=cgefa

samples produced around 6.7 pounds of yellow grease per year per capita.[48] Adding a 7.3 pounds-per-gallon multiplier equates to a conversion rate of .918 gallons per person annually. If Washington has a population ~6.4 million, Oregon ~3.3 million and Idaho ~1.3 million, then the Northwest has a total combined resource of ~10 MMgpy of yellow grease available, the vast majority of which is already being processed and consumed by mature entrenched businesses.

Biodiesel from WVO presents additional issues, primarily increased costs of production stemming from:[49]

- Inconsistency of feedstock sources and varying degrees of free fatty acids
- Greater pre- or post-processing requirements to reach ASTM specifications
- Increased quantities of low quality glycerol byproduct

Despite these challenges, multiple Northwest businesses have explored or launched WVO biodiesel businesses. SeQuential Biofuels is operating a 1 MMgpy facility in Salem, OR. Baker Commodities has publicly considered expanding its Tukwila rendering plant to include biodiesel production.[50] Recently, Standard Biodiesel has announced the opening of an 8 MMgpy facility in Arlington, WA and Olympic Biofuels opened a .5 MMgpy facility on Bainbridge Island, WA, both using WVO and virgin vegetable oils. In addition, WVO is the fuel of choice for the backyard and garage producers who produce small quantities for personal consumption.

Oilseed

Brassica plants (i.e. canola, rapeseed or mustards) are well-adapted for the Pacific Northwest. Canola is grown in cool Northern climates, requires more moisture then wheat, and makes a good winter rotational crop. The U.S. currently has over 1.6 million acres in production. Globally, canola is second only to soy for oil production.[51] Nevertheless, there is need for additional research and technical assistance to identify and promote well-suited oilseed crops in the Northwest.[52]

Crushers under construction or currently operational in the region are all mechanical extraction, or "cold press." Most Canadian canola meal currently offered in the Northwest has gone through a chemical extraction process, typically using hexane. The cold press process provides a higher-value, more desirable feed meal because of higher oil content and lower chemical residues resulting from the mechanical extraction process.

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[48] Wiltsee, G. November, 1998. "Urban Waste Grease Resource Assessment." National Renewable Energy Lab. Retrieved July 2007 from: www.epa.gov/region09/waste/biodiesel/resources/NRELwaste%20grease%20assessment.pdf

[49] For a detailed look at a cooperatively-owned startup, the Olympia Biofuels Cooperative commissioned a feasibility study;.. Bowman, Eric and Gasaway, Diane. Fall 2006. "Feasibility Report for the Olympia Biofuels Cooperative." Northwest Cooperative Development Center. Retrieved August 2007 from: www.nwcdc.coop/Resources/OBCFeasibilityReport.pdf

[50] Lyons, John Kim. May, 2005. "Biodiesel in Washington: A Snapshot." Washington State University Energy Program. Created for: Washington Community Trade and Economic Development Energy Policy Division. Retrieved November 2006 from: www.cted.wa.gov/_CTED/documents/ID_3180_Publications.pdf

[51] Boland, Michael and Brester, Gary. 2005. "Canola Profile." Agricultural Marketing Resource Center. Retrieved August 2007 from: www.agmrc.org/agmrc/commodity/grainsoilseeds/canola/canolaprofile.htm

[52] Painter, Kate. August 9, 2006. "Can We Produce Home-Grown Biodiesel*?"* Center for Sustaining Agriculture & Natural Resources. Washington State University. Retrieved February 2007 from: www.wsu.edu/Publications/Painter biodiesel econ 8 06.pdf.

At present, oilseed crops in the region have been fairly limited, estimated at less than 10,000 acres.[53] By comparison, depending on crops and growing conditions, 133,000 to 400,000 acres of annual canola production would be required to meet Washington's new B2 content requirement.[54]

Several studies have shown the break-even price for canola seed ranges between $.13-.15 per pound.[55] Assuming 40% oil content and a 90% extraction rate, 20 pounds of $.15 a pound seed would produce one gallon of biodiesel for about $3. After adding crushing fees of $.30-.50 per pound, the price of a gallon of biodiesel quickly becomes $3.50, which is above current diesel prices.[56]

Yet if the price of regional canola oil doesn't increase, farmers will have little economic motivation to plant it. Canola must compete with palm, soy and other domestic and foreign sources of vegetable oil.

A primary question is: would higher crude prices eventually balance out the higher costs of canola or would it lead to general inflation of all commodity prices due to increased production costs?

From wheat to corn, most farm commodity prices are currently at all-time highs. An article in the *Seattle Times*, "Palouse Wheat Farmers Lock in High Wheat Prices," notes producers are, "hoping to cash in on higher prices… taking the unprecedented step of contracting their crops two years in advance."[57] Farmers could be hesitant to cultivate new crops when traditional crop markets, i.e. wheat, are so strong. Bill Warren of Pacific AgriEnergy notes, "higher prices mean farmers can make more money on the risk they assume growing wheat."[58] This risk will need to be minimized through state policies or growth in the oilseed industry.

Small to midsize plants will also have to compete with larger plants that can afford higher prices and longer contracts. ADM recently announced "act of god" contracts. This guarantees up to 1,000 pounds per acre of approved canola varieties at close to cash prices, of $13.00 to $13.50 per hundred-pound.[59] This might entice farmers to cultivate canola but it will limit the competitive margin for small- to mid-size biodiesel plants that are competing for feedstock.

Currently the economics of producing oilseed solely for biodiesel production is not enticing many growers. Byproduct market development and increased oilseed crushing capacity are vital in creating a stable an oilseed market in the Northwest.

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[53] Lyons, 2005
[54] Painter, 2006
[55] Ibid.
[56] Lyons, 2005
[57] Associated Press. "Palouse Wheat Farmers lock in high wheat prices." *Seattle Times*. February 14, 2007. Retrieved June 2007 from: seattletimes.nwsource.com/html/businesstechnology/2003570974_wheat14.html?syndication=rss
[58] Interview Bill Warren. Pacific AgriEnergy LLC. January 26, 2007.
[59] Kotrba, Ron. "Counting on Canola." *Biodiesel Magazine*. February 2007.

4.2.3. Byproduct Markets

Seed Meal

Canola meal is a low-value commodity sold for animal feed. Canola is 38% protein and considered a supplement to soy meal. Livestock utilize a soybean/canola blend better than the separate meals individually.[60] According to Kim Lyons of Washington State University's Energy Program, "The development of higher value seed meal markets may be the most significant (industry factor), for without this, farmers are unlikely to invest in oilseed crops."[61]

Canola meal, along with other commodities, has increasing in value. This trend could indicate greater future economic viability for cultivation of canola as a rotational crop. Without sustained high seed meal prices, oilseed cultivation in the Pacific Northwest will struggle to get off the ground.

Importantly, there is an ample market for seed meal in the Pacific Northwest. "Washington is a feedstock deficient state, so meal production will reduce feed imports."[62] A cow-to-meal ratio is 3-5 pounds a day and with over a 4.5 million cattle in Washington, Oregon and Idaho, there is a large regional demand for meal.[63]

Canola meal which originates in the Northwest reduces transportation costs. Currently most meal is shipped in from the Midwest, but with raising fuel costs, locally sourced meal is gaining an increasing advantage.

Alternative uses for meal are currently being researched. For example, the University of Idaho is researching bio-pesticides from mustard meal. "If realized, the value of the remaining mustard oil is projected at $.10 per pound, allowing for biodiesel production costs of $1.00 per gallon."[64] Innovative, higher-tech, higher-value coproducts will help support meal price as regional production expands.

Glycerin

Glycerin (also known as glycerol) is a major byproduct of biodiesel production, representing roughly 10% of a facility's total output. In the past most glycerin has been synthetically produced from petroleum. Biodiesel produces a natural glycerin from fats and oils. This glycerin can be used in a variety of different products and will likely supplant petroleum-based glycerin.

An increase of crude glycerin entering the market will force down prices, most likely to a point where glycerin will need new disposal options. According to Dave Nilles of *Biodiesel Magazine*, "Crude glycerin that once fetched between 20 to 25 cents per pound is now edging closer to 5 cents and lower."[65] These prices are compelling some to refine their glycerin to get a higher market price, but this is an expensive process primarily limited to larger producers who can afford to build a refinery. Smaller producers

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[60] Boland, 2005
[61] Lyons, 2005
[62] Painter, 2006
[63] U.S. Dept. of Agriculture, National Agricultural Statistics Service, Meat Animals-Production, Disposition and Income. Retrieved July 2007 from: www.nass.usda.gov
[64] Lyons, 2005
[65] Nilles, Dave. September 2006. "Combating the Glycerin Glut." *Biodiesel Magazine*.

struggle to produce high-quality crude glycerin and are forced to give it away or even pay for disposal.[66]

New uses for glycerol are being researched. There is a potential for natural glycerin to replace synthetic glycerin derived from petroleum products. In addition, research is being conducted around using it as dairy, beef and poultry feed.

4.2.4. Infrastructure Costs

Utilities/Energy

While not always the largest input, energy costs are always a concern for industry. The typical energy source for biodiesel production has been natural gas, and with rising prices emerging plants may want to creatively consider other options.

There are plants now powering their production from leftover biomass. An example is the Central Minnesota Ethanol Co-op, which installed a biomass gasification system to power the plant. Another option, Corn Plus installed two wind turbines that will produce 45% of the energy needed for the plant.[67]

Transportation

Most soy oil and biodiesel production has taken place in the Midwest, whereas the bulk of consumers are located in the more densely populated coastal regions. Transportation costs associated with procuring feedstocks and shipping biofuels are key factors in the profitability of biofuels. Investing in transportation infrastructure will be vital in accommodating larger volumes of ethanol and biodiesel.

According to Stephen Thomson of *Rural Cooperatives* magazine, "Transport by truck is an economical option for short hauls – up to about 500 miles from the producer."[68] Longer distances make truck transport too expensive. Pipelines are considered the cheapest mode of travel. Over 70% of petroleum is piped through pipelines. With their higher solvent properties, biofuels cannot share existing pipelines for fear of contamination. Currently there are no biofuels pipelines scheduled to be built. Trains offer another option but they are expensive and are currently scrambling to keep up with the growth of the biofuels market.

According to Kim Lyons with the Washington State University Energy Program: [69]

> *(The cost of) importing oil into the state from the Midwest is estimated at about $0.20 per gallon. While Seattle Biodiesel expects to be competitive with out-of-state biodiesel producers, the ability of Seattle Biodiesel and other in-state*

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[66] Ibid.
[67] Renewable Fuels Association. "Ethanol Industry Outlook 2007: Building New Horizons." Retrieved February 2007 from: www.ethanolrfa.org/objects/pdf/outlook/RFA_Outlook_2007.pdf
[68] Thompson, Stephen. September/October 2006. Volume 73 Number 5. "Keep on truckin' ethanol boom creates transportation challenges." *Rural Cooperatives*. Retrieved March 2007 from: www.rurdev.usda.gov/rbs/pub/sep06/keep.htm
[69] Lyons, John Kim. *Biodiesel in Washington: A Snapshot*. Washington State University Energy Program. May 2005. Created for: Washington Community Trade and Economic Development Energy Policy Division. Retrieved March 2007 from: cted.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&ItemID=3180&MId=863&wversion=Staging

producers to source lower cost, in-state oil feedstocks is important to their long-term success.

Seattle Biodiesel's parent corporation, Imperium Renewables, has opened a facility which will utilize a variety of feedstocks including 1 MMgpy of canola oil from Natural Selection Farms in Sunnyside, WA.[70] In addition, SeQuential Pacific has announced deals with Oregon farmers at Pendleton Grain Growers and Madison Farms for 10,000 gallons of canola oil a month.[71] This represents a budding demand in the Northwest for locally-produced feedstock.

General gas price volatility increases the Northwest's comparative advantage to produce fuels closer to the urban markets. New economics could lead to a re-imagining of how and why products are shipped long distances.

4.2.5. Existing Consumer Co-ops

Biodiesel consumer co-ops, as often happened with other cooperatives, filled in where the marketplace was not meeting the needs of the consumers. Before biodiesel became commercially available, the Northwest biodiesel market was primarily served by a loose federation of unincorporated "collectives/co-ops" with small memberships. These semi-social entities existed in urban areas up and down the Interstate 5 corridor. Thanks to a "do it yourself" ethic these groups tended to operate out of a single member's garage, which could be used for "brewing" and/or distribution of bulk purchased biodiesel usually sourced from the Midwest. A boutique fuel wholesale distribution industry was set up and still exists to serves these co-ops.[72]

While some consumer co-ops folded with the arrival of readily available commercial biodiesel, others persisted and continued operations to serve their communities growing desire for democratically-run, community-owned biodiesel businesses. Membership ranges from around 10 to 50, with each co-op requiring different commitments from their membership. Because all of these co-ops are run by their members, all activities necessary for the business to operate are performed by the membership.

Currently there are less than ten incorporated consumer co-ops in the Pacific Northwest. Most are bulk distribution co-ops, and only a few 'brew' their own biodiesel.

As biodiesel has become more readily available, a number of these co-ops disintegrated due to lack of critical need. A sizeable portion of the smaller scale biodiesel purchasing co-ops found they could not compete price-wise with the new commercial scale biodiesel retailers. Several co-ops recognized this and have actively pursued other ventures to keep the co-op a financially viable business. For example, GreaseWorks! in Corvallis, OR once a biodiesel distribution co-op, now operates a biodiesel/straight vegetable oil mechanic shop as their primary business. Alternatively, Bend Biofuels Cooperative still operates and continues to grow in Bend, OR despite recent local availability of product from SeQuential Biofuels.

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[70] Cook, John. 2007. "Biodiesel Company Imperium Gets Huge Infusion – But It Says It Needs More." *Seattle Post-Intelligence*. February 22, 2007. Retrieved August 2007 from: seattlepi.nwsource.com/business/304638_imperium22.html

[71] Libby, Tucker. 2006. "Big Crush for Oregon Farmers to Begin in July." *Daily Journal of Commerce*, Portland, OR. June 26, 2006. FindArticles.com. 29 Aug. 2007. Retrieved August 2007 from: findarticles.com/p/articles/mi_qn4184/is_20060626/ai_n16515548

[72] For example, Dr. Dan's Alternative Fuelwerks in Seattle, WA. www.fuelwerks.com

For these start-ups finances are tight or worse: unsustainable. Many of the biodiesel consumer co-ops which were running strong a few years ago have ceased operations. According to a recent story in the *Denver Post*:[73]

> *Distributing 1,000 gallons per month to a relatively small number of co-op members who were paying only $50 per year for access to discounted fuel soon became financially unsustainable and the co-op found itself without enough money to pay its rent.*

The diminishing importance of these original pioneers and market developers has been unfortunate. A few former co-op business members went on to join an industry that would rather see people leave fuel production to large industrial corporations. Many of the original businesses may have been ill-conceived or suffered from the many challenges that besiege any start-up business.

4.3. Cooperative Advantage in Biodiesel

The challenges of biodiesel will require innovative solutions. The cooperative model, depending upon scale of production, can improve the logistics and economics of biodiesel production.

One option is "closed loop" community-scale biodiesel production on the farm. In a recent case study, State Line Farm in Shaftsbury, VT developed viable small-scale production for on-farm use.[74] With direct use, the farm was able to avoid costly ASTM certification. Fuel taxes were minimized because the fuel was not commercially sold for on-road use. And, it provided small-scale farmers in the area extra income through oilseed cultivation. There is also some discussion from farmers interested in cooperative sharing of harvest, crush and brew equipment.

By growing their own oilseed for on-farm use, farmers avoid fluctuating input prices and reduce transportation costs and the need to find a market. This model offers a potentially viable option for farmers or small communities interested in pursuing biodiesel.

Another study, *Cheaper Biodiesel Through the Reduction in Transaction Costs*, analyzes how Austrian cooperatives and New Generation cooperatives can eliminate transaction costs through a community-based crushing and biodiesel facility.[75] Transaction costs extend from the farm gate of the grower to the livestock feeder and diesel market, including in-loading, storage and aggregation of soybeans, transportation to the processing plant, and out-load of soybean oil and meal.

In this model, the farmers make an up-front investment in the cooperative processing plant and retain ownership of the oilseeds, oil and meal fractions. This model is also a "closed loop" with farmers producing soybeans, delivering them to the processing plant,

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[73] Cronin, Sean. 2007. "Co-op Finds Biodiesel Sales Unsustainable." Retrieved July 2007 from: denver.yourhub.com/DenverNorth/Stories/News/General-News/Story~323400.aspx

[74] Grubinger, Vern. "Case Study: John Williamson, State Line Farm, Shaftsbury, Vermont." University of Wisconsin. Retrieved March 5, 2007 from: www.climateandfarming.org/pdfs/CaseStudies/V.4Closed_Loop.pdf

[75] Blasé, Melvin G, and Van Dyne, Donald L. BioEnergy 98'. "Cheaper Biodiesel Through a Reduction In Transaction Costs." Retrieved March 1, 2007 from: www.biodiesel.org/resources/reportsdatabase/reports/gen/19981001_gen-109.pdf

feeding the meal to livestock and poultry, and using the biodiesel to operate diesel-powered farm equipment, eliminating many of the transaction costs.[76]

In this model the only direct costs incurred by farmers are the costs of hauling soybeans to the processing plant and then hauling the meal back to their farms. The farmers can avoid costs of soybean processing and high meal prices because of the retained ownership throughout the system. It should be noted that the reduction in transaction costs are dependent upon soybean prices. If prices are high the farmer may be financially better off selling the soy oil and buying biodiesel or petroleum diesel from other markets.

A recent article from USDA Rural Development notes cooperative grassroots structures can be the basis for infrastructure critical to biofuels ventures.[77] Co-op members can be a built-in market of biodiesel users and can also provide capital for projects. The article also notes how cooperatives often have an edge in sourcing grain because they are willing to work with small producers and know the product and issues facing the producer.[78] Additionally, farm supply cooperatives provide a possible market of biodiesel users.

Cooperatives can offer an advantage to small- to large-scale decentralized plants by reducing transaction costs. “Closed loop systems” cooperatives may provide cost efficient ways to produce biodiesel. Additionally, cooperatives could have the infrastructure to work with small producers and provide a defined market of biodiesel consumers.

4.4. Conclusion

Biodiesel production faces many of the same problems of market and capital access confronting the regional ethanol industry. It is crucial to understand and incorporate feedstock prices, byproduct markets, and existing infrastructure limitations. Because of strong community connections co-ops usually have a sizeable advantage in addressing these issues.

5. Ethanol in the Northwest

The conversion of starch or sugar-based feedstocks into ethanol or ethyl alcohol has been practiced by humans almost as long as agriculture. Ethanol as fuel follows a similar process as the production of drinking spirits; it has recently been refined into highly efficient process for the sake of fuel production. Grain-based ethanol is brewed using either dry mill facilities which account for 82% of ethanol production or wet mills which account for 18%.[79]

5.1. Industry Overview

Ethanol consumption has risen considerably over the last couple of years. Co-ops have driven the growth of production capacity and feedstock production. According to the

[76] Blasé, Melvin G, 1998
[77] Pittman, Lynn. January/February 2007. “Renewable fuels industry rife with opportunity for co-ops.” *Rural Cooperatives Magazine.* USDA/Rural Development. Retrieved March 2007 from: www.rurdev.usda.gov/rbs/pub/jan07/jan07.pdf
[78] Ibid
[79] RFA, 2007

Renewable Fuel Association, "Much of the growth of the U.S. ethanol industry to date has been supported by farmers and local residents investing their hard-earned dollars together in an ethanol biorefinery."[80] These facilities have predominately been located in the Midwest because of the proximity to corn and the established agricultural infrastructure.

Cooperatives were among the first to develop ethanol processing plants. This was a strategic step for many agricultural cooperatives in producing a value-added product and to hedge against low corn prices. According to Hill and Morris with NCAT, "Many have hailed the growth of farmer-owned ethanol facilities as an encouraging trend that allows farmers to add value to their crop, keep more of the profits, and keep dollars in rural communities."[81] Nationally, ownership is now shifting away from farmer cooperatives as investment capital pours into the industry and large agribusiness corporations begin to acquire and build ethanol plants.

There is also some concern about the rapidly rising cost of corn. As of this writing, corn futures have traded as high as $4 a bushel and with 110 biorefineries coming on-line, smaller producers may struggle to remain profitable. Since ethanol is currently almost exclusively dependent on corn, it has not offered the same competitive advantage for the Northwest as it has in the Midwest. That said, corn is grown in the Northwest and quite a bit is shipped from the region. Most ethanol plants under construction in the Northwest[82] will depend largely on imported corn from the Midwest.

Some projects are searching out alternative feedstock sources, such as wheat and barley. However, these are considerably less competitive than corn. According to Philip Madson of KATZEN International Inc.:

> *You'd need 21% more barley and 8% more wheat to make the same amount of ethanol as corn does. And you'd have 77% more DDGS (Dried Distillers Grain with Solubles) with barley and 26% more with wheat than corn. Barley and wheat DGS is perfectly palatable.* [83]

Potatoes and sugar beets have also been researched but are considerably more expensive to process. According to the Washington State Bioenergy Team, "None of Washington's major agricultural crops (wheat, potatoes, and hay) are promising candidates as feedstocks."[84] Commercial ethanol in the Pacific Northwest will be dependent upon new technologies and on railed corn from the Midwest.

To date there are no cooperatively-owned ethanol operations in the Pacific Northwest, and none in the works. This could change as alternative feedstocks become more economically viable.

5.2. Looking to the Future: Cellulosic Ethanol

Cellulosic ethanol is building momentum and the potential is enormous. Several different corporations are building plants but cellulosic ethanol remains very capital intensive and

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[80] RFA, 2007

[81] Hill, Amanda and Morris, Mike. "Ethanol Opportunities and Questions." NCAT. 2006. Retrieved November 6, 2006 from: http://attra.ncat.org/attra-pub/ethanol.html

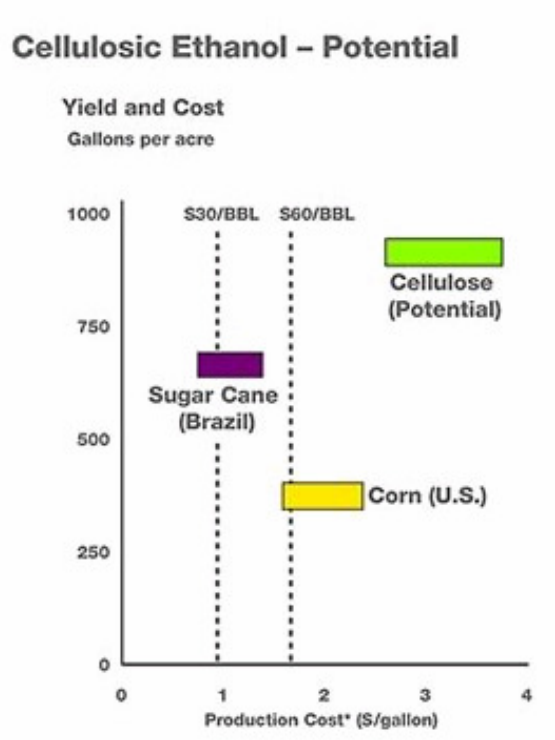
[82] See Appendix V; Biofuel Developments in Washington State

[83] Burkdoll, Shannon. August 8, 2005. "Alternative Feedstock Research Makes Waves in Ethanol Industry." Prairie Star Editor. Retrieved March 7, 2007 from: www.ethanolmt.org/php/julyaug05.php

[84] Washington State Bioenergy Team. January 2007.

additional R&D is needed before it becomes a mainstream technology. Although in a recent podcast by *Inside Renewable Energy*, Arnold Klan of Bluefire Ethanol, a cellulosic ethanol plant utilizing from waste in Southern California, remarked the technology is ready but government must help bridge the gap of financial risk.[85]

In the following chart, "Cellulosic Ethanol – Potential" demonstrates ExxonMobile's estimation of yield per acre as compared to cost.[86]



David Morris of the Institute for Local Self Reliance estimates the cost of cellulosic ethanol at $1.90-2.25 per gallon verses corn ethanol of $1.20-1.50 per gallon. He remarks that in order to make cellulosic competitive there will need to be strong governmental incentives or ethanol incentive cuts.[87] Morris also stresses the Department of Energy, in the development of cellulosic ethanol, should fashion a program that nurtures local ownership and geographic diversity.

Local communities have benefited from corn ethanol in the Midwest and could continue to benefit through the development of cellulosic feedstock. Because of the decentralized nature of feedstock distribution and new crops under development, this industry also holds promise for the Northwest.

State/Federal Policy

Several states are currently in the process of enacting different forms of incentives and regulations to help promote biofuels production. There are only a handful of states that have initiated producer programs to help support in-state biofuels production.

Incentives for Washington, although progressive, do not address ownership issues. The issue of local ownership is important to improve rural economies. The "Minnesota Model" has been touted as one of the most successful policies at encouraging local ownership. Minnesota enacted producer incentives that specifically targeted small producers in the early 1980s. The incentive included $.20 per gallon for the first 15 million gallons of in-state production for 10 years. In 2006, 12 of 14 plants in Minnesota were farmer-owned.[88]

In 2002, after the Minnesota Corn Processors, a larger farmer co-op, voted to sell their shares to ADM, Minnesota further narrowed their producer incentives to only farmer-

[85] Inside Renewable Energy. "The Challenges for Cellulosic Ethanol." Podcast. Sept. 28, 2006.
[86] Exxon Mobile. 2007. "Energy Outlook." Retrieved July 2007 from: www.exxonmobil.com/Corporate/Citizenship/Imports/EnergyOutlook06/slide_16.html
[87] Morris, David. 2006. "Putting the Pieces Together: Commercializing Ethanol from Cellulose." Institute for Local Self Reliance. Retrieved November 6, 2006 from: www.newrules.org/agri/celluloseethanol.pdf
[88] Morris 2006

owned producers and required incentives be repaid if the farm producers chose to sell to a corporation.[89] Other states have followed in similar form, and now 15 states have producer incentive programs ranging from $.05 to $.39 per gallon.

The federal government also provides a $.54 per gallon subsidy for ethanol and a $1 per gallon subsidy for biodiesel.[90] These incentives are not specifically focused on local ownership. However, there is a $.10 per gallon producer incentive for small producers. These federal and state producer incentives have produced positive results. The states with producer incentives have had the most growth within the ethanol industry. Golden Energy Cooperative views state incentives as vital to help manage risk.[91] There is some concern that fiscal constraint will negatively influence the ability of states to continue producer incentives, further increasing the risk of investment in biofuels.

5.3. Present Context of Ownership

Ownership is shifting. In 2004, of the 92 ethanol plants in operation 44 (48%) were owned by farmers. Now, as much as 90% of ethanol capacity expected to come on-line in the next 3 years will be non-farmer owned.[92] Strategies have been suggested to stop this ownership trend towards absentee-ownership:

1. Develop an education campaign to inform the public about the benefits of local ownership
2. Provide technical assistance and outreach to rural communities
3. Establish paths, such as loans or grants, for farmers to gain capital necessary for growth
4. Direct federal and state incentives towards producer payments that promote local ownership

These proposed strategies will necessitate new partnerships, innovative thinking and foresight to recognize local ownership as a priority. Along with the quantitative goal of energy supply, there should be the qualitative goal of supporting rural economic improvement.

5.4. Conclusion

Cooperatives have led the growth of the domestic ethanol industry. However, this industry is still primarily dependent upon imported Midwestern corn. The future scale of ethanol produced in the Pacific Northwest will be dependent upon new technologies. Depending on who owns the intellectual property rights underlying these new technologies, there could be opportunities for community ownership. Most state-level renewable energy policies in the Northwest don't address ownership. If we want to fulfill the promises of renewable energy benefiting rural America we need policies that address ownership.

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[89] Morris, Mike and Hill, Amanda, 2006

[90] MacDonald, Tom. 2004. "Ethanol Fuel Incentives Applied in the U.S. California Energy Commission." January 2004. Retrieved July 2007 from: www.energy.ca.gov/reports/2004-02-03_600-04-001.PDF

[91] Fink, Rodney. "New Generation Cooperatives Case Study: Golden Triangle Energy Cooperative, Inc. Ethanol Plant." Illinois Institute for Rural Affairs. Retrieved June 2007 from: www.iira.org/pubsnew/publications/IVARDC_CS_184.pdf

[92] Morris, 2006.

6. Anaerobic Digestion

Anaerobic digestion (or AD) holds the promise of rural economic expansion, reduced greenhouse gases, environmentally friendly waste disposal, energy production and reduced pathogen levels in manure. For the purposes of examining the potential for cooperatively-owned businesses in the region, this study primarily focuses on models which might be feasible for groups in the Pacific Northwest.

6.1. Industry Overview

Anaerobic digestion is a commercialized biological process to harness the decomposition of wastes to produce biogas. The biogas can then be utilized to power electrical generators, and/or provide heat or liquid fuels. The digestion process also produces soil improving material and other co-products. The biodegradation of organic matter generates primarily methane and carbon dioxide. The biogas can be utilized as heat or to generate electricity by the following methods: [93]

1. Electricity generated on-site by reciprocating engines or gas/steam turbines
2. Injection into an existing natural gas pipeline (biogas must be converted into a higher BTU form of natural gas, which is capital intensive)
3. Utilize the medium BTU gas via an onsite boiler
4. Convert biogas into other chemicals, such as methanol

Typical sources of organic waste are paper, plant material, industrial solid waste, industrial wastewater, animal waste, municipal solid waste, organic leftover food and sewage.

AD can provide farmers with an opportunity to manage their manure efficiently through controlled recycling, and increase income by means of generating electricity for on farm use and sale to the grid (e.g. “net metering”). AD can turn “waste” into an asset for rural and urban communities alike. One aspect of AD which lends itself to economic cooperation is the diversity of potential community stakeholders whom have a vested interest in the success of a project. These groups range from farmers to other rural residents who don’t like the smell of waste or prefer to fish in clean waterways, to governmental agencies that regulate water quality.

Outside of the U.S., AD has been harnessed by people for some time. “Currently, digesters are concentrated in developing countries, with over five million household digesters constructed in China and India alone.”[94] Increasing environmental regulations on waste disposal and enthusiasm around renewable energy has spurred greater interest in the implementation of AD in the U.S. AD provides benefits to the farm, the environment and energy consumers.

Farm benefits include:

- Improved utilization of nutrients
- Reduced costs for transportation
- Slurry pasturisation to remove most germs and weed seeds
- Access to low cost bedding for livestock

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[93] Zhang, Zhiqin. “Anaerobic Digestion.” California Energy Commission. Retrieved April 2007 from: www.energy.ca.gov/pier/renewable/biomass/anaerobic_digestion

[94] Lansing, Stephanie; Botero Botero, Raul; and Martin, Jay. “Small scale digesters in Costa Rica.” BioCycle, February 2007, p.48

Environmental benefits include major reductions of:

- Greenhouse gasses, i.e. reduced methane from manure tanks and offset of fossil fuel consumption
- Odor problems

Energy benefits:

- Generation of quality renewable energy
- Numerous end use applications

There are several different anaerobic digesters, each suited to different circumstances:

Plug Flow reactors are recommended for animal manure is 11-13% solids. Most plug-flow systems have a manure collection apparatus, a mixer, and the digester. Plug flow reactors usually feature long, covered channels in which the manure is moved along as a 'plug.' The reactor is based on several reaction chambers that do not entail moving parts. The digester operates via the insertion of new feedstock into one end of the digester, thus pushing out the older material from the opposite end.[95] This type of digester is incredibly useful for dairy systems that operate with scraped-manure operations.

Covered Lagoons are the oldest and most rudimentary digester. They are usually less expensive then other AD models. A critical issue for covered lagoons is a dependency on temperature, making operations difficult in cold climates, including the Northwest. Currently, covered lagoons have been modified by means of mixing methods to enable faster processing. The complete process takes around 20-40 days.[96]

Complete Mix/Continuous Stir (CSTR) digesters are a form of tank reactors first employed in the 1970s. In the 1980s, *Anaerobic Filters (AF)* were introduced to keep biomass inside the reactor. The digestion tank contains a filter medium which anaerobic bacteria populate. Anaerobic filters are commonly employed in the treatment of waste waters. "AF reactors are gaining in popularity versus more established aerobic waste water treatment systems as they produce less solid residue."[97] The filters usually function in an up-flow digester, or sometimes in a down-flow model. One large advantage to this type of digester is that retention time is usually around one day, making it attractive to small operations with limited space. A disadvantage is the potential for clogging with high-solid feedstocks like manure.

Upflow Anaerobic Sludge Blanket (UASB) digesters combine the mixing components of the CSTR system with a internal biogas separation and clarification mechanism. There are no mechanical mixers; mixing is a result of gassing from the organic matter. Similar

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[95] Oregon State Government. 2007. "Biomass Energy Home Page." Retrieved July 2007 from: www.oregon.gov/ENERGY/RENEW/Biomass/biogas.shtml

[96] Lusk, Philip D. "Associates Methane Recovery from Animal Manures." Retrieved May 2007 from: www.p2pays.org/ref/21/20982.htm

[97] Francisco, O., Garrido, J. M., Arrojo, B. & Mendez, R. 06/2003. "Anaerobic filter reactor performance for the treatment of complex diary waste water at industrial scale, Water Research." *Water Research*. Retrieved April 2007 from: www.usc.es/biogrup/Anaerobic%20filter...Water%20Research.37%20(4099-4108).pdf

to an up/down flow filter digester, UASBs have short retention times but also have difficulty digesting solids.[98]

Hybrid reactors, are combination of UASB and AF technologies, are becoming more popular. Hybrid AD is capital intensive, but has improved solid retention time in the treatment of waste water.

Fluidized Bed digesters were developed in the 1980s and are currently being redesigned. In this process biomass is attached to heavy matter then strong hydraulic pressure is applied. New versions are currently being developed where the biomass is not attached to the heavy particulate matter.[99]

A recent advance in UASB technology is the *Induced Blanket Reactor* (IBR*).* Currently in pre-commercial development: [100]

> *the UASB/IBR system uses above or below ground reactor tanks with the waste (influent) typically heated before it enters the tank to maintain the mesophilic temperature range in the reactor. The influent enters the lower part of the tank and gradually moves upward through the super rich bacteria blanket where digestion and gas production occurs.*

6.2. Ownership Models

Anaerobic digesters are typically found on-farm or in centralized locations. While prevalent, municipal digestion was not a focus of this study. In Europe, a significant portion of the centralized digesters are cooperatively-owned. In the U.S., the vast majority are owned and operated privately or by municipalities. Europe has a history of cooperatively-owned digesters and provides a potential model for farmer ownership.

6.2.1. On-Farm/Sole Proprietor Ownership

In the U.S., privately held AD is the predominate model of operation and ownership, especially sole-proprietorship. There are many alternatives for individually owned on-site AD that are technically considered sole-proprietorships, but this ownership model has its drawbacks. Anaerobic digesters have substantial upfront large capital costs that can be prohibitively expense for many independent farmers. Additionally, operating and maintaining a digester poses another task for farmers with all ready demanding workloads.

While some farmers in the U.S. operate their own digester, it is not suitable for every farm. For existing AD technologies to be economically feasible, there should be, “>300 mature milk cows, <500 sow farrow to finish, <1000 farrow to wean, or <3000 finished.”[101] These figures are generalized and projects need to be evaluated by a case-by-case basis to determine feasibility.

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[98] Seadi, Teodorita. 2000. “Danish Centralised Biogas Plants - Plant Descriptions.” Bioenergy Department, University of Southern Denmark. Retrieved May 2007 from: websrv5.sdu.dk/bio/pdf/rap2.pdf
[99] Francisco, 2003
[100] Andigen. Retrieved May 2007 from: www.andigen.com/pages/ibrsystem.html
[101] Mattocks, Richard P. “Is a digester right for you?” Environomics, LLC. Retrieved May 2007 from: hwaste2profits.com/Is_It_Right.htm

6.2.2. Centralized

As stated above, anaerobic digesters often require significant numbers of animals, considerable capital, and a decent technical knowledge to operate successfully. Having a centralized or cooperatively-owned digester would mitigate these problems by pooling the resources of individuals and diversifying risk. To clarify, there is a large difference between a centralized and a cooperatively run digester. A centralized digester combines feedstocks from a variety of sources in a centralized digester. A cooperatively run operation does this but is owned and governed equally by all of the partners (often the feedstock providers).

To further alleviate these problems, the group or co-op could decide to have a digester manager so farmers do not have to learn how to operate the digester. "A centralized anaerobic digester facility would be beneficial only if farmers were motivated to utilize a facility as part of their manure management plan."[102] For a centralized AD to be feasible there must be consistent commitment by the group to actively participate in the workings. This can be a challenging task for a group of individuals, therefore a cogent organizational structure tasked with managing the centralized AD is often beneficial.

One successful example of a centralized AD is the Port of Tillamook Bay, which has gathered a sizeable group including the Tillamook County Creamery co-op to operate a centralized digester on the central Oregon coast.[103]

Fourteen years in the making, the Tillamook Bay Hooley digester is now processing the manure from around 4,000 of the county's 30,000 dairy cows. The digester pumps an average of 375 gallons of raw manure into its holding cell every minute. The liquid byproducts are then applied back to the farmers' fields. Additionally, the digester produces around 1,000-3,000 yards of fiber per month which is sold to local nurseries and landscape businesses.

The Port of Tillamook Bay, which owns and manages the digesters, estimates that one of the two digesters can annually produce around $180,000 in clean electricity, enough for around 150 homes. One of the latest developments aiding the fiscal solvency of the digester was implementation of a tipping fee. The fee is charged to the party transferring their waste product to the AD facility. Because of the favorable economics of the Hooley AD, the Port of Tillamook Bay plans to build more centralized digesters, which in turn will lead to the development of more digester projects.[104]

6.2.3. Cooperatively-Owned

There are numerous AD facilities in the European Union owned and operated by cooperatives. There are around 20 AD co-ops in Denmark alone.[105] A large portion of these are mesophilic operations that process combinations of pig and cattle slurry (liquid state), organic waste, and small amounts of other waste such as fish, poultry, and sludge (i.e. semi-solid material left from industrial, water treatment, or wastewater

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[102] Kubsch, Kristin. 9/5/03. "Cooperative Anaerobic Digestion." University of Wisconsin Green Bay. Retrieved April 2007from: www.focusonenergy.com/data/common/dmsFiles/W_RW_RPTE_GlacierlandResearchStudy.pdf

[103] Port of Tillamook Bay. "Bio-Gas Methane Facility - Hooley Digester." Retrieved July 2007 from: www.potb.org/methane-energy.htm

[104] Ibid.

[105] Seadi, 2000

treatment processes). The number of farmer-members in these co-ops ranges widely from around five up to 66, as is the case with one of the largest AD co-ops in the world, *Lintrup*. A large portion of these co-ops aim to find environmentally correct and economically viable uses for their slurry. Others are motivated by their desire to "demonstrate the advantages of decentralized energy supply, based on local resources."[106]

Operationally, a large portion of these cooperatively-owned centralized facilities transport slurry from the farms to the AD facility in vehicles owned by the co-op, with the additional feedstock trucked in from outside sources. After the slurry is digested it is placed back in the storage tanks, which are normally owned by the co-op. Some of these facilities have slurry separation equipment that is utilized as a post-treatment process. Biogas from the digestion process is usually cleaned and used to heat the plant, and/or is sold to the power grid. If the centralized plant is cooperatively-owned (and depending on their bylaws), a portion of the yearly profits go back to the members as patronage dividends.

This successful model has worked well for many in the European Union. With some adaptation this model could provide many benefits to American farmers. Many experts argue the reason for the success of digesters in Europe is not cooperation, but a completely different economic context, e.g. much higher prices for energy offsetting operating and management costs. Energy prices in the U.S. are on the rise, and will eventually more closely resemble the current situation in Western Europe.

Bioenergy Cooperative of Perry (BCP), located in New York State, will be the first cooperatively-owned centralized AD plant in the U.S. They anticipate beginning construction in the fall of 2007. The co-op is a collaboration between local farmers, a landfill, and a technology advising company. Frank Wowkowych, Chairman of BCP, said, "We believe that our collaborative approach to better manure management is a solution that addresses many of the problems with manure disposal investment, and that our solution can be replicated throughout the U.S."[107]

BCP is planning to build a digester able to process 34,000 gallons per day of liquid manure. Additional waste from the landfill will be utilized as well. From theses feedstocks BCP expects to produce around 625kW of renewable electricity which will all be sold to the power transmission system.[108]

6.3. Small-Scale AD

Research and development in American anaerobic digestion has primarily concentrated on large-scale projects. This scale tends to be prohibitively expensive and unattainable for small-scale operations. Recently, Ohio State University proved small-scale AD can be feasible and environmentally beneficial. These digesters vary in design and costs, but a large portion of them are concrete stirred or plug flow digesters.

According to the research completed by Ohio State University, very small-scale digesters are often utilized in the developing. Plug flow digesters are simple mechanisms

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[106] Seadi, 2000

[107] Cetti, Bill. "Community Digester Concept: Building a Manure Management Model for US Farms" *Biocycle*, May 2007 59-61.

[108] Ibid.

that allow fluid to flow one direction without any back mixing. They are extremely inexpensive (ranging from $34 in Vietnam to $150 in Costa Rica) and are adaptable to almost any tropical climate.[109]

The Costa Rican example of small-scale AD treats waste for around 30 cows or swine, and utilizes the effluent to make compost. The effluent is transported by gravity to two lagoons and utilized as food for tilapia. Additionally, the biogas produced can supply around 12 hours of cooking fuel per day. This small-scale example proved low-tech plug flow digesters can produce methane and reduce containments in wastewater at rates comparable to high-tech larger scale models here in the U.S.[110]

The study conducted by the Ohio State University researchers identified Taiwanese-model digesters (a simple flow-through reactor made from a double tubular polyethylene bag, PVC piping, and vinyl housing) which could be upgraded for electricity generation. Capital costs for the generator, however, can complicate many small projects.

In summary, the OSU research found:[111]

> *Digesters in this study were effective at producing a sustainable energy source and improving the water quality by providing a more useful organic fertilizer, reducing the impact of the wastewater on the receiving waters, and generating methane to meet the farmers' cooking needs.*

The OSU study presents a viable small-scale, inexpensive model that runs counter to the status quo of large and costly anaerobic digesters. Much can be gained from this atypical AD model, though there are key issues that must be considered, such as applicable climates for this technology. With further research and development, many lessons surrounding scalability can be extrapolated and adapted to other AD projects.

6.4. Cooperatively-Owned AD in the Pacific Northwest

With tightening water quality regulations, successful models for AD implementation, heightened focus on renewable energy, and the constant need to augment earnings, an increasing number of Northwest farms and facilities are considering AD. "The Northwest represents 8% of all U.S. dairy farm receipts." Dairy is the top farm earner in Washington State, and the third biggest earner in Oregon.[112] The Northwest holds enormous potential for anaerobic digestion, especially community-scale, cooperatively-owned operations due to the close geographic proximity of the feedstock producers.[113]

Currently, the predominate ownership model is still sole-proprietorship. However, due to economics of scale and the fundamentals of an AD operation, the cooperative business model is particularly well-suited for AD projects.

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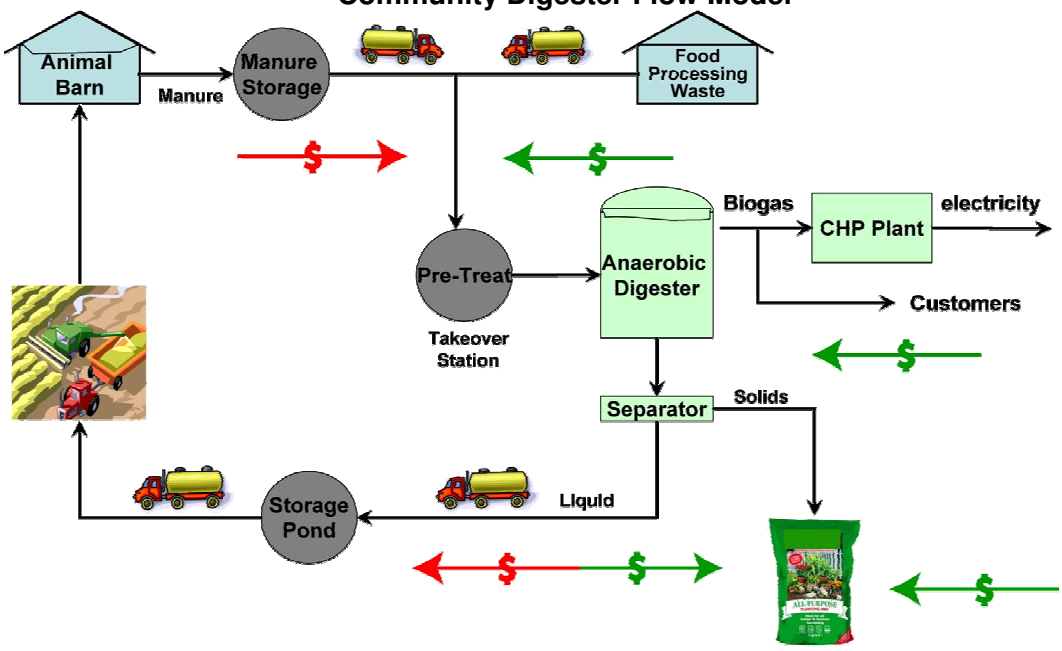
[109] Lansing, 2007
[110] Ibid.
[111] Ibid.
[112] Mazza, Patrick. February, 2002. "Harvesting Clean Energy for Rural Development: Biogas." Harvesting Clean Energy Special Report. Retrieved August 2007 from: www.harvestcleanenergy.org/documents/Biogas_Report.pdf
[113] Washington State Department of Ecology. "Dairy Farms 2003." Retrieved June.2007 from: www.ecy.wa.gov/services/gis/data/ag/dairy.gif

Community Digester Flow Model[114]



There are many forms an AD co-op could take. One of the prevailing models proven to be successful is a cooperative venture of farmers operating an AD facility. Also there could be a cooperative effort between farmers and factories that produce organic wastes to operate a joint anaerobic digestion facility. Operationally, one of the key features of successful digesters is the employment of a General Manager. This position is pivotal in allowing for smooth operations through the specialization of skills.

As described above, cooperative AD pools the resources of a group of individuals and allows the costs and responsibilities of the business to be shared by the entire group. The co-op structure has the ability to maximize farm assets so members can reduce costs and maintain their competitive edge. In addition, the cooperative business model provides distinct tax benefits. By working together to create an economy of scale groups are achieving more than they could alone.

Another plausible model for a cooperative AD facility would feature restaurants seeking a better means of dealing with their food waste. Instead of paying a waste management company to take their food waste, they could join with other restaurants and operate a central digester to turn their waste into revenue. The National Restaurant Association notes, "three out of five restaurants report paying more for wastes management now than just a few years ago." They also report that, "tipping fees have more than doubled since 1982."[115] Tipping fees could play a crucial economic aspect of any AD project.

The possibilities for cooperatively-owned AD are numerous, and the examples listed above are simply some of the more common ones. Some of the essentials components of a successful, cooperatively-owned AD project are listed below.

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[114] Used with permission from ECO Technology Solutions, LLC

[115] Scott, Norman & Ma, Jianguo. January 2004. "Potential of Using Food Wastes In Farm-based Anaerobic Digesters." Retrieved June 2007 From: www.manuremanagement.cornell.edu/Docs/Food%20Waste-4-13-04.pdf

6.5. Recommendations for Viable Cooperative Ownership

In order to greatly increase the opportunity for success, it is suggested groups seeking to form a cooperatively-owned digester:

- Identify farmers willing to utilize a digester as a component of a manure management plan, and as a way to reduce waste removal expenses
- Ensure a committed membership of business owners
- Conduct a comprehensive feasibility study which leads to an informed business plan, paying specific attention to the needed economy of scale. For example, Richard Mattox suggests, "manure from the equivalent of 6000 mature Holsteins in a three to five mile driving range…"[116]
- Network with a friendly municipality that desires more green power and is willing to provide premium rates (~$.06-.08 kWh) for the value-added benefits of digester power
- Seek out other organic feedstock wastes, thus improving the overall project economics

6.6. Conclusion

There is growing interest in anaerobic digestion, and advancements in technology are creating more favorable economics in the Pacific Northwest. As an industry, AD offers promising opportunities to form synergies between multiple stakeholder groups, i.e. farmers who need improved manure management and communities who want cleaner waterways.

There is ongoing research for new models of digesters that would work in the Northwest's cooler climates. Industry dynamics (i.e. large feedstock requirements), operational needs, and ownership interests favor the cooperative business model. The future will likely see increased development of AD projects, and there exists prime potential for farmer ownership and other benefits for our rural communities.

7. Woody Biomass

Currently there is increasing interest in the untapped potential for biomass as a renewable energy source. This industry's development is being closely watched by many stakeholders, both public and private. According to the Northwest non-profit group Climate Solutions:[117]

> *Payments for biomass energy crops would total at least $25 billion by 2020, and could reach $34 billion. The latter would occur if power plants fueled primarily by biomass become economical. The lower figure reflects a market primarily for biomass co-fired in existing fossil power plants*.

Consequently, biomass promises to play a sizeable role in our nation's future renewable energy portfolio.

While all organic plant matter is technically "biomass," the U.S. Department of Energy defines biomass resources as, "agricultural and forestry residues, municipal solid

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[116] Mattocks, Richard. "Self Screening Assessment." August 2003. Retrieved May 2007 from: www.waste2profits.com/Articles/self_screening_form.htm

[117] Mazza, Patrick. Energizing Rural America: How Renewable Electricity Standards Generate Rural Economic Prosperity www.nfu.org/wp-content/res-for-nfu-7-27-2-07-clean.pdf

wastes, industrial wastes, and terrestrial and aquatic crops grown solely for energy purposes."[118] In this study, traditional liquid biofuels (biodiesel and ethanol) and animal manure are elaborated upon separately. This section focuses primarily on the potential for cooperatively-owned businesses to exploit forest residues, wood debris, crop residues, and related biomass feedstocks through thermochemical and biochemical conversion.

"First generation" woody biomass technologies have focused on energy derived from wood industry pulping liquors, traditional wood combustion, pellets, etc. "Second generation" technologies are utilizing advanced approaches to combustion (pyrolysis and gasification) and fermentation (enzymatic and acid-based extraction of cellulosic sugars) to produce energy, biofuels and various co-products. These more complex process are seen as the next phase of innovation for the industry, resulting in the rise of biorefineries.[119] To expedite industry development, the US Department of Agriculture recently funded six biorefineries developing cellulosic ethanol for a combined amount of $385 million.[120]

While "second generation" technologies have yet to mature into commercial production, there is strong momentum behind them. Once on-line, the trend will be to create biorefineries that integrate biomass conversion processes and equipment to produce fuels, power, and value-added chemicals.

Because of the decentralized distribution of biomass resources, biomass energy projects provide opportunities for local ownership. Currently though, this industry is dominated by investor-owned businesses.

Woody biomass energy presents the most promising opportunities in the Northwest with massive potential for a variety of arenas, including:

1. Production of renewable energy
2. Economic development
3. Forest restoration and fire management through the use of slash and debris

While all three of these categories are of great importance, this study is primarily concerned with the intersection of the first two, but is optimistic support can be garnered as a result of the third. This section examines current ownership trends that dominate this emerging industry, and how cooperatives can facilitate industry development while maintaining the benefits of local ownership.

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[118] U.S. Department of Energy, Energy Efficiency and Renewable Energy. 2007. "Biomass FAQs." Retrieved July 2007 from: www1.eere.energy.gov/biomass/biomass_basics_faqs.html

[119] According to the US Department of Energy's Energy Efficient and Renewable Energy Program, an "integrated biorefinery is defined as follows, "Existing industries such as wet-mill corn processing and pulp and paper mills fit the multiple-products-from-biomass definition of a biorefinery, but the goal is to foster new industries converting lignocellulosic biomass into a wide range of products, including ones that would otherwise be made from petrochemicals. As with petrochemical refineries, the vision is that the biorefinery would produce both high-volume liquid transportation fuel (meeting national energy needs) and high-value chemicals or products (enhancing operation economics)." Retrieved July 2007 from: www1.eere.energy.gov/biomass/integrated_biorefineries.html

[120] US Department of Energy. February, 2007. Retrieved July 2007 from: www.energy.gov/news/4827.htm

7.1. Industry Overview

With caution of oversimplifying the diverse biomass industry, what follows is a brief description of current and future technologies.

Cogeneration/Combined Heat and Power (CHP) is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. In the Northwest a large proportion of CHP plants utilize wood waste or wood-related products such as chips or pellets as the energy source, often at an existing timber-based industrial operation.

Biomass-to-Liquid (BTL) processes are a family of complex technologies that generate liquid biofuels from biomass. Currently, BTL is in the research and development stage, though there is vast interest and thus money propelling various technology pathways. From a greenhouse gas emission perspective, the largest advantage of BTL is the utilization of surface carbon. In other words, the carbon dioxide burned in the consumption of the fuel is equal to the carbon dioxide taken out of the environment during the life-cycle of the feedstock. In addition, less land is required to produce these feedstocks compared to biodiesel or ethanol.

The U.S. Department of Energy envisions this materializing via two distinct types of biorefineries:

- **Sugar Platform Biorefineries** would break biomass down into different types of component sugars for conversion via fermentation or other biological processes into various fuels and chemicals.
- **Thermochemical Biorefineries** would convert biomass to synthesis gas (hydrogen and carbon monoxide) or pyrolysis oil, the various components of which could be directly used as fuel or converted to other fuels and chemicals via chemical catalysts.

In Washington State alone there are over twenty biomass plants ranging from wood products to paper and pulp and solid waste.[121] These plants are supplying clean energy to an array of customers ranging from industrial paper mills to Public Utility Districts.

Counter to the vast range of customers served by these biomass plants, the ownership models are primarily industrial corporations and public investors. Large companies, such as Weyerhaeuser, have found it profitable to convert waste products into energy. When analyzing ownership of Northwest biomass plants there were underlying principals that dictated current ownership models, i.e. access to both large quantities of low cost feedstock (e.g. waste) and to sufficient capital to launch the operation

Bill Warren, who spent a year as an Eisenhower Fellow studying next generation biofuels and future policy development in Europe, noted:[122]

> *Second generation BTL facilities will be large in capacity, expensive and centralized, requiring committed acreages within the radius circles around these facilities that allow for acquisition of feedstocks for least costs of delivery. Because of the high establishment costs of these plants, feasibility will be*

[121] Energy and Environmental Analysis, Inc. "Combined Heat and Power Units Located in Washington. Retrieved July 2007 from: www.eea-inc.com/chpdata/States/WA.html

[122] Warren, Bill. 2007. "Observations of the developments of the German, Austrian and European biodiesel and Bioenergy industry." Program Report. Eisenhower Fellowship 2006 Agricultural Fellow.

determined on inexpensive feedstocks. There is open discussion as to whether farmers can profitably deliver feedstock to the facilities for the price that is offered, noting a $15-20 per ton difference between what the farmers are willing to grow it for and what the refining facilities can afford to pay.

Because of the wide distribution of feedstocks, second generation biomass technologies could support more decentralized ownership.

7.2. Cooperative Development Opportunities

Biomass energy presents cooperatives with a variety of opportunities, primarily because current biomass facilities require large amounts of feedstock. Cooperatives can supply these large volumes of feedstock to a biomass facility more easily than a single individual because of their aggregated resources. That said, previous successes in biomass energy have been based on the scale of the forestry industry.

Co-ops have aspects that make them an opportune partner for a biomass project. They are:

1. Producer-member ownership creates a vested interest for the business' success, i.e. resource producers have an economic incentive tying their loyalty to the firm
2. By pooling resources to create an economy of scale, members can aggregate decentralized feedstocks into a single processing facility

There are several types of producers that would benefit from organizing into a cooperative to work with a biomass plant. The first would be a group of forest owners. Not only would forest owners keep their forest healthy and less prone to fires, but they would earn a profit from the slash and brush that was once a disposal problem. According to the Oregon Forest Resources Institute, "Evidence indicates that many of our state's forests are out of balance with natural conditions and therefore more susceptible to insects, disease and wildfire than ever before."[123] Sustainably harvested biomass offers a favorable solution to these above mentioned problems.

Another group of producers who would benefit from organizing into a co-op to supply a biomass facility are straw producers. Again, like the forest owners co-op, a straw producers' co-op could turn wastes from their value-added products into an additional revenue stream. Moreover, individual producers in the co-op could share processing equipment, and thus dramatically decrease their costs.

The three possible models for organizing a cooperative of producers are a:

1. Joint-venture with a processing technology partner
2. Wholly-owned value-added processing facility
3. Marketing cooperative providing inputs to another facility

However, as mentioned above, there are some considerable challenges for a co-op. The major challenges facing a woody biomass cooperative venture are the:

1. Capital intensive nature of an industrial-scale biomass facility, combined with a business model that can constrain outside financing
2. Complex, technical specialization required to operate a biorefinery

[123] Lord, Ehlen, Stewart-Smith, Martin, Kellogg, Davis, Stidham, Penner, Bowyer. June 30 2006. "Biomass Energy and Biofuels from Oregon's Forests." Oregon Forest Resources Institute.

3. Significant research and development yet to be completed for process technologies

Industry is actively positioning itself as a major player in the future of BTL biorefineries. For example, in February 2007 Weyerhaeuser and Chevron announced "a letter of intent to jointly assess the feasibility of commercializing the production of biofuels from cellulose-based sources."[124] These companies have identified the potential for cellulosic technology and the opportunity cost of noninvolvement. With the respective assets of both corporations, the chances for success are improved. Currently they have access to forestland, forestry management expertise, sufficient capital, processing capacity, transportation infrastructure, and established fuel markets.

If rural America is to fully benefit from the development of these new industries, it is imperative farmers, landowners and communities become astutely aware of the difference between playing a passive role as feedstock providers and taking a more active role in ownership.

7.3. Conclusion

Woody biomass provides the Northwest with enormous potential far exceeding current renewable energy production. Future development of a biomass industry has the potential to benefit the Northwest in three significant, frequently cited ways:

- Production of renewable energy
- Increased economic development
- Forest restoration

With new technologies imminent, the biomass industry will continue its rapid evolution. This could lead to more opportunities for rural America. Due to the distribution of biomass resources, collection of feedstocks could be prone to decentralized operations and could lead to cooperatives playing a sizeable role. Because biomass facilities utilize large amounts of feedstock, a co-op of like producing individuals could more efficiently support them. Biomass promises to play an increasing role in the nation's renewable energy portfolio.

8. Regional Survey of Cooperatively-Owned Bioenergy

The Northwest Cooperative Development Center conducted an on-line survey of farmers, consumers and businesses who have sought to create a cooperative bioenergy business in Pacific Northwest.[125] It was a broad survey, and it sought input to identify how cooperatives can play a viable role in emerging bioenergy industries. The information provided in the survey was treated with complete confidentiality. The Center emailed the survey to over 3,000 recipients via a database of biofuels professionals and farmers who had expressed interest in renewable energy, and posted it on multiple mailing lists with the potential to reach hundreds of additional email recipients.

The survey didn't seek to validate a specific hypothesis. Rather it attempted to:

- Identify communities in the Northwest participating in biofuels project development

[124] Chevron Press Releases. 2007. Chevron and Weyerhaeuser Create Biofuels Alliance. Feb 2007. Retrieved July 2007 from: www.chevron.com/news/press/2007/2007-04-12.asp

[125] See Appendix IV for a copy of the online survey.

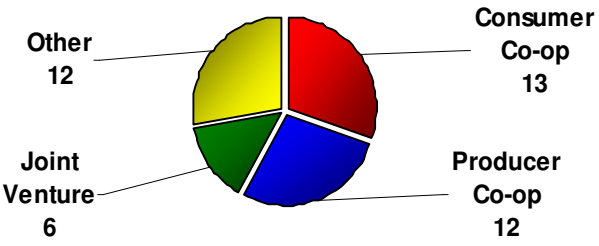
- Better understand the internal and external challenges of the projects
- Gauge the different stages of development
- Determine possible opportunities for starting new cooperatives
- Evaluate how existing biofuels co-ops can overcome some of the challenges

The survey received 48 responses. While this may seem a modest return considering the large number who received the survey, the target audience for the survey is limited to those seeking to cooperatively form a business in the renewable energy industry. There are a limited number of groups, co-ops and communities seeking to engage in the bioenergy industry, so the overall completion rate met expectations. In addition, because its highly competitive and rapidly changing nature, the energy industry has a history of being protective of intellectual property and business plans. Therefore, we never expected start-up businesses to be particularly forthright with information regarding their project.

8.1. Survey Findings

The majority of respondents were from the four-state region of Oregon (63%), Idaho (54%), Washington (52%) and Montana (37%).

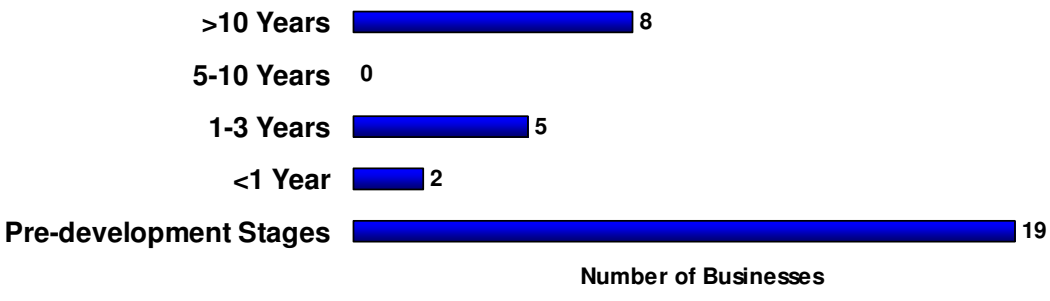
Ownership of Co-op or Business



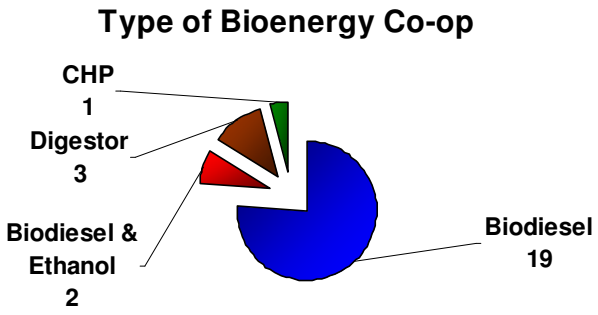
While over 58% of the respondents identified themselves as a "cooperative" or sought to form one, they were almost equally split between consumer and producer cooperatives (see chart titled "Ownership..."). In modern business, ownership can be a complicated thing. For example, it can be argued a project is "farmer-owned" if both farmers and non-farmer investors launch a joint venture with a co-op. Many mature farmer co-ops seek to mitigate risk and may launch a joint venture or LLC to spreading risk between the aggregated members and investors.

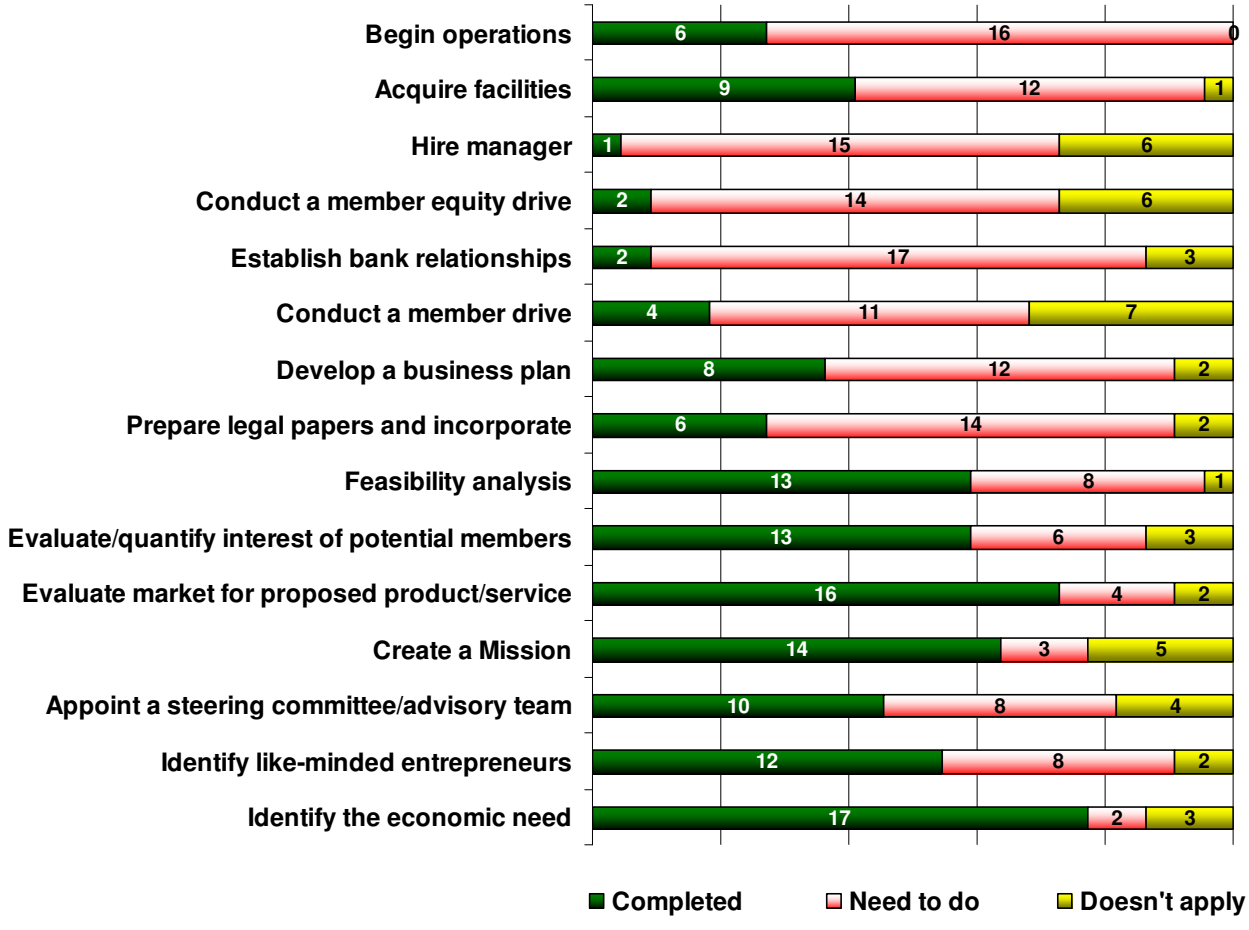
Also noteworthy, several of the respondent co-ops service both the consumer-needs and marketing-needs of their farmer-members, so they are technically both a producer, and a consumer co-op. For example, a farmer supply store that also manages storage and marketing of grain.

Years of Operation for Co-op Business



In the chart “Type of…,” all non-co-op businesses were filtered from the response pool in order to provide a picture of those seeking to form a co-op or expand an existing co-op. Overwhelmingly, the co-ops sought to engage in the production and retail of biodiesel (76%) with the financial scale of the business ranging between $25,000- $1,000,000 (22%). The co-ops primarily had a core focus of either biodiesel distribution and marketing, and/or feedstock propagation.





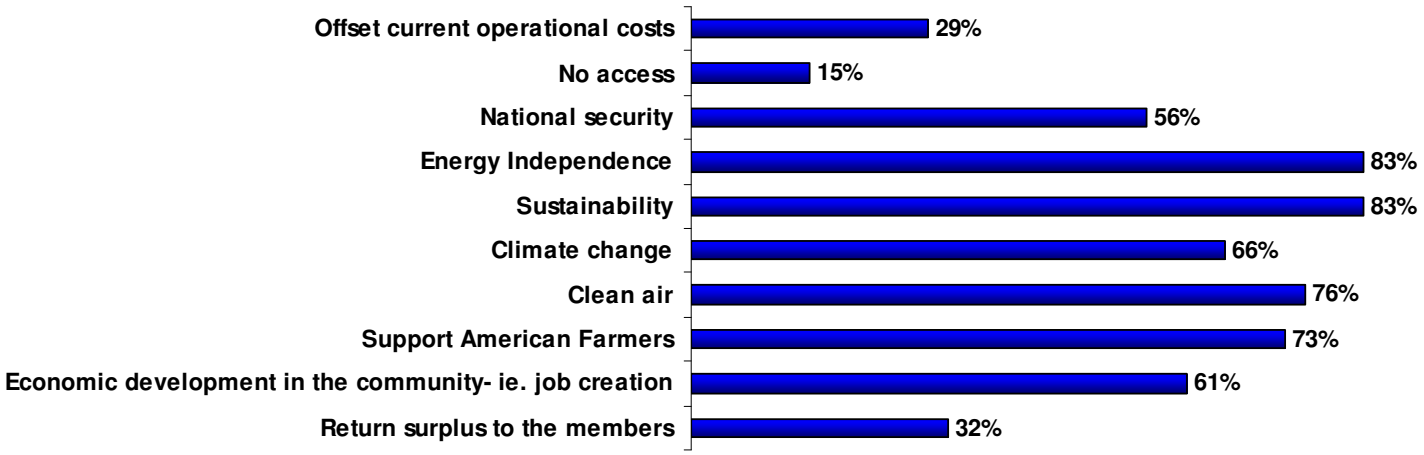
The majority of respondents are in pre-development stages of cooperative development with over half having more than one key partner. Interestingly, several of the “more then 10 years” respondents mentioned being in business for 50-75 years. Most respondents

are still in the beginning stages of cooperative business development and several have only identified a need for a cooperative. Quite a few are in the final stages of development.

The following chart represents respondents identified as a cooperative business who responded to the question, "What follows is a list of the steps to form a co-op; please share what stage your co-op has accomplished."

The main reasons cited for developing a bioenergy business were "energy independence" and "sustainability" closely followed by "supporting American farmers" and "clean air."

Selected Reasons Co-op is in the Bioenergy Business



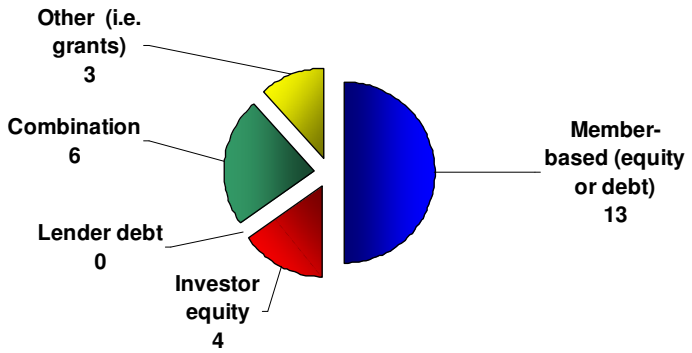
The co-op respondents reported that financing is primarily through member-based equity or debt, but over half have also sought grants, investors or a combination thereof.

8.1.1. Internal Challenges

Not surprisingly the most frequently cited "highly challenging" internal issue was a lack of member financing. The most prominent "slightly challenging" internal issue was a lack of communication between management and board, and between members. Respondents also reported that lack of participation amongst members was also slightly challenging.

The following chart represents the total responses. As an interesting side note, the numbers of both total respondents and just co-op responses were examined and not only did trends remain the same but there was no significant difference in the percentages.

Project Financing



The potential challenges presented in the survey question were based on the following factors:

- The Center's past anecdotal experience working in startup cooperatives

- The National Cooperative Business Association's "Lessons for Success; Why Co-ops Fail & Why Co-ops Thrive"[126]

Rating of the Largest Internal Challenges the Business Faces*

	Highly Challenging	Moderately Challenging	Slightly Challenging
Poor selection of directors	21%	16%	**63%**
Inactive membership	22%	30%	**48%**
Interpersonal conflicts	14%	14%	**73%**
Members who don't attend annual meetings	11%	21%	**68%**
Directors who fail to attend Board Meetings	11%	21%	**68%**
Poor understanding of co-op principles by members	13%	21%	**61%**
Inadequate member financing	**44%**	32%	24%
Communications between the Management and the Board	14%	9%	**77%**
Management errors	14%	27%	**59%**

*Bold denotes greatest respondent rating

8.1.2. External Challenges

Most respondents rated "capitalization/debt financing" of the projects as the greatest external challenge (58%) to starting a cooperative business (see following chart). Respondents also reported access to feedstock and lack of infrastructure as "moderately challenging." Lack of byproduct markets" and "input/output contracts" were "slightly challenging."

Rating of the Largest External Challenges the Business Faces*

	Highly Challenging	Moderately Challenging	Slightly Challenging
Capitalization/difficulty w/ debt	**58%**	24%	18%
Feedstock access/supply	28%	**38%**	35%
Insufficient byproduct markets	16%	28%	**56%**
Lack of infrastructure	33%	**42%**	24%
Input/output contracts	29%	29%	**42%**

*Bold denotes greatest respondent rating

When asked which area of the project could best be helped by the Northwest Cooperative Development Center, the overwhelming response was grant writing (68%), followed by market studies (60%), and business planning (51%).

[126] National Cooperative Business Association. "Lessons for Success." Retrieved July 2007: www.ncba.coop/abcoop_ab_success.cfm

8.2. Conclusion of Survey Results

The respondents overwhelming noted that financing, internal collection and management of member funds, as well as the external challenge of securing capitalization for the project, were the leading challenges to co-op development. Also, most respondents noted financing has primarily been member-based equity and debt. Further evaluation of different financing mechanisms to better utilize all possible financial options is needed.

To reiterate, most of the projects are still in the early stages of development and are seeking help in grant writing and market studies to evaluate project feasibility. These needs are an opportunity to utilize various nonprofit organizations geared to helping cooperative business development. Needless to say, new and existing ventures should seek out all available resources when in the different stages of development.

9. Recommendations and Conclusions

The renewable energy industry is booming, but it is also at a crossroads. At this juncture, cooperative ownership can either be encouraged or left behind for investor ownership. The American economy will experience more, not less, renewable energy in the years to come. Be it 10% by 2010 or 25% by 2025, this nation needs only vision and drive. For better or worse, just like the formative years of childhood, the decisions made today will affect our rural landscape and economy for the coming century. An opportunity is present, an opportunity to either create new winners in marginalized rural communities or to enrich anonymous, distant investors.

Renewable energy development is built on our insatiable demand for energy, and it attempts to address a variety of tangential objectives from environmental concerns to rural economic development. For example, better manure management or a need to consume excess commodities. In the promise of this new industry, investors primarily envision financial returns on investment. Conversely, rural communities hope for a dynamic rural economy to stem out-migration and increase land values.

Biodiesel, ethanol, anaerobic digestion and cellulosic biomass industries represent these hopes, both economic and environmental. Because of resource distribution, there exist unusual opportunities for groups of farmers, landowners, communities and consumers to cooperate in business.

Sidebar Two

Carsey Institute Recommendations*

"At this critical juncture, when the sector's conversion technologies, infrastructure and ownership are being established, policies can be developed… to assure rural communities continue to participate and benefit…"

1. *Prioritize Rural Development Considerations in Biofuel Incentives*
2. *Help with Start-up Capital*
3. *Education and Technical Assistance*
4. *Make Public Research Public*
5. *Make Biofuels a Part of Conservation Programs*
6. *Ensure Biomass Feedstocks are Sustainable Over the Long-term*

* Klienschmit, Jim. "*Biofueling Rural Development: Making the Case for Linking Biofuel Production to Rural Development*." Carsey Institute. Policy Brief No. 5 Winter 2007. Retrieved June 2007 from: www.carseyinstitute.unh.edu/documents/Biofuels_final.pdf

Co-ops, by their very nature, exist in industries which seek to meet the needs of people rather than capital; from housing to the marketing of agricultural products and health and financial services. Rural America has a tradition of developing the "West" through economic cooperation.

As citizens, we must ask ourselves what we want this industry development to accomplish, and remember there will be costs and benefits no matter the direction. If we seek a bioenergy economy that delivers on its promises to rural America, then we must incorporate these priorities, such as those recommended by the Carsey Institute (see Sidebar Two).

Recommendations for groups seeking to explore cooperative start-up:

- Create a market-driven business, as all "normal rules" of business apply to co-ops, such as having a well-researched and well-thought out business plan, adequate reserve funds, etc. (see Sidebar Three, "Steps to Forming…").
- Build partnerships; co-ops represent the broader community, engage and involve it
- Identify and leverage what differentiates the group, be it feedstock production or marketing (see Sidebar Four, "Marketable Advantages…")

Co-ops need to clearly identify and research their markets, resources and partners, and then analyze whether the project justifies the possible risks.

Recommendations for municipalities, general public and or policy makers who seek to promote local, community and co-op ownership:

- Provide guaranteed markets through contracts; such as the City of Portland has done with Pendleton Grain Growers and Madison Farms
- Encourage accessible and sizable capitalization, ranging from:
    - Investment equity
    - Grants
    - Debt availability & loan guarantees
- Educate and advocate about the benefits of local ownership
- Realize the current situation in industry development and seek to create what is wanted, be it decentralized, locally-owned or not
- Favorable policy, such as ownership-based incentives and/or tax benefits, such as Minnesota's disincentives for selling a farmer-owned facility

Bioenergy presents the Pacific Northwest with tremendous opportunities for cleaner energy and economic development. The opportunity for economic development should not only be viewed within the

Sidebar Three

Steps to Forming a Cooperative

Forming any business requires a host of concurrent tasks. It helps to have a shared model and shared vision of the path to be taken by the steering committee or board.

1. **Information Gathering:** Identify needs to be met, who will join, etc.
2. **Get Organized:** assign roles and goals, etc.
3. **Research Feasibility:** sufficiently examine business details
4. **Review Findings:** vote go or no go
5. **Membership Drive:** begin to finance start-up of project
6. **Planning and Financing:** convert feasibility into a business plan
7. **Begin Operations**

Sidebar Four

Marketable Advantages of the Co-op Business Model over Investor-owned Firms

1. **Democratically controlled** by those it serves, and surplus is distributed equitably
2. **Ties to local community** mean more socially conscientious, more accountable and more representative of the broader community
3. **No investors to feed,** so income stays in the community
4. **Permanence:** co-ops live beyond its founders
5. **Self-management,** as co-ops are a self-help tool for people to achieve together what they cannot alone
6. **Trusted business partners,** as most people believe producers to be honest and reliable individuals
7. ***Investor-owned firms focus on the bottom line and co-ops focus on social, individual and community needs in addition to the bottom line***

context of jobs creation and commodity prices, but also in the long-term future of potential ownership. Different ownership models are ultimately designed to benefit their stakeholders, i.e. the owners. Local ownership substantially increases the extent of economic impact compared to an absentee, investor-owned business.

Appendixes

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Appendix II – Qualifications and Disclaimer

Eric L. Bowman has been a Cooperative Development Specialist since joining the Center in the winter of '03/'04. Eric has since managed workshop series focusing on cooperative development, co-authored feasibility studies and provided technical assistance with committees seeking to form co-ops. After graduating the Evergreen State College with a focus in non-profit administration, Eric has attended multiple professional development workshops, including both sessions of the 2005 Cooperative Development Training Program: the Art and the Science of Starting a Cooperative Business. Eric is a Director on the Board the Tulip Credit Union in Olympia, WA. His background includes owning a gardening business and being a farm interpreter (i.e. guiding and designing educational tours and animal husbandry) for a regional park authority at an agro-tourism operation.

Ben Dryfoos-Guss has been a Cooperative Developer and Research Assistant for the Center since 2005. Ben holds a Bachelors of Arts from the Evergreen State College with an emphasis in cooperative development. Ben has provided valuable research support and administration to many NWCDC projects, such as: *Organization of Parent Educating Programs:* preformed a qualitative analysis of 14 diverse bylaws of preschool co-ops, and drafted a bylaw template for all member co-ops. *Last Mile Electric Co-op*: Researched and wrote content for a new community energy website for Northwest SEED. For the *Economic Power Project,* he designed, analyzed and reported on a survey for Washington State financial institutions, and community colleges regarding their financial literacy programs

Haley Sample was a Research Intern on this report. In 2007, she received her Masters degree in Public Administration from the University of Oregon and undergraduate from Western Washington University. She spent a majority of her academic and professional experience focused on sustainable development at both community and global level. She has experience in policy analysis and has researched topics from public participation techniques to management models. She has extensive international experience, ranging from working on an Irish organic farm to volunteering with Guatemalan children. She recently finished a project in Greece, where she worked on sustainable redevelopment plans for the reconstruction of Blue Village on Kefalonia in the Ionian Islands.

The co-authors used their combined experience and knowledge with extensive research to prepare this study and have reached conclusions in an objective and unbiased manner. There is no assurance given, nor should any be inferred by anyone whom reads this study that any projections or forecasts made by this study or implied by it will in fact be realized.

Appendix III – Business Comparison Chart

Business Forms	Advantages	Disadvantage	Notes
Sole Proprietorship	• You're the Boss.	• Unlimited liability.[2]	• Owners often invest in other businesses to acquire goods, services, access to markets, and/or profits they cannot acquire alone.
Partnership	• Pass-through income taxation.[3] • Appreciated assets can be distributed to original owners without recognizing gains.	• At least one partner must shoulder unlimited liability.	• There appears to be few good reasons to choose a partnership over an LLC.
Limited Liability Company (LLC)	• Same advantage as partnership • Limited liability for all members.	• Not so well suited for large (+10) numbers of owners or when ownership continually changes hands.	• Most appropriate for "close-held" joint ventures (involving two to ten owners) with relatively stable ownership (slow turnover)
C Corporation	• Open to any and all investors. • Very flexible to reward capital investment.	• Both individual owners and the corporate entity are taxed (i.e., double taxation).	• Designed to maximize profits for investors. One share, one vote. Best model for securing capital.
S Corporation	• Open to any investors, up to a limit of 75. • Pass-through taxation.	• A limit to one class of stock prevents varied allocations of profits to different investors. • Limit to 75 shareholders.	• Appropriate if: between 10 and 75 owners; regular turnover of ownership; a single class of stock is sufficient; and not all investors "use" the business.
Cooperative Corporation	• Control of the business is kept in the hands of those who "use" its goods and services.[4] • Most profits are returned to members in proportion to their "use" • Pass through taxation for all profits that are distribution to members in proportion to use.	• Investment limited mainly to those who "use" the co-op's goods and services, thereby restricting access to capital.[5] • Decision-making can be slowed by democratic process. • Added costs for communication and member education.	• When numerous individuals or businesses agree on a long-term strategy to meet common need or pursue opportunity can utilize member investments to pursue strategy through marketplace transactions. • Designed to serve members. One person, one vote.
Not-For-Profit Corporation	• Can qualify for grants, donations and other subsidies. • Can avoid income taxation entirely.	• Cannot distribute profits to members.	• Even if profits are not generated, the "control structure" of co-ops may be more appropriate if an organization's mission is to sell goods and services to its own members at cost.

Reference from Chart

[1]The best choice of business structure will vary from situation to situation. Sometimes, a combination of two or more business forms is recommended. This chart is offered only as a basic introduction. It is strongly recommended that individuals consult legal and financial professionals before selecting a business form.
[2]This means that the owner risks not only the money invested in the company, but all personal assets are places at risk.
[3]Sometims referred to as single (v. double) taxation, pass-through taxation means that the individual owners (partners and members) pay income tax on profits, but the joint entity does not. "Double" taxation," when both owners and the joint entity pay income taxes on profits, occurs in C Cooperatives, and in limited circumstances in S and Cooperative Corporations.
[4]There are many ways that member can "use" a cooperative: to acquire goods and services; to produce value-added products for sale; etc. This use is measured (in dollars spent, in hours worked, in bushels processed, etc) and the profits generated by the cooperative are returned to members in an "equitable" fashion -- i.e., in proportion to use.
[5]Acutally, "outsiders' or non-users can invest in a cooperative, but by law their return on investment is limited to 8%. This limit also restricts access to capital.

Appendix IV – Phone Interview Questions

Today's date and time:
Interviewer:
Interviewee:
Interviewee's company/Farm:
Contact Info:

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1. How long has your business been in operation?

   - How long have you worked there?

2. What is the (co-op/farm/biz) core business (feedstock, fuel production, retail/marketing, distribution etc.)?

   - Core biz as it relates to biofuels?

Fuel dist. Fuel generation feedstock grower technology provider
Start up agriculture

3. What is the geographic location of the target market?

4. Does the biz/co-op have key partners? If so, who?

5. How many members/customers does the biz/farm/co-op have?

   - What are the roles of the members
   - What benefits do members have

6. Was the operation financed inside or outside or both?

7. What is the annual financial scale or range of the business?
$25,000-$50,000 $500,000-$1mm $1-5 $5-15 $20-30 $30-50
$50-100 Other

8. What are the biggest challenges?

   - Internal in the co-op
   - External in the market
   - Biggest successes?
   - Do you desire to expand?

9. Where do you see opportunity for future growth?

10. Any lessons learned?

11. Where do you see the operations in 1 to 3 years?

12. If you could change one thing in your business what would it be?

    - Any specific organizational needs - ie. Board training?

13. What other groups do you know that are involved with co-ops and/or biofuels?

(optional)

Why did you select the co-op business model?

Are you interested in being involved in the Centers efforts?

Given your experiences and market where do you think the saturation point is in your location?

Do you have any competition?

Appendix V – List of Interviewees

The questions from Appendix II were formally recorded and used to inform the study from interviewing the following people:

- Lyle Estill with Piedmont Biofuels
- Bill Warren with Pacific Agri Energy LLC
- Fred Fleming with Inland Empire Oilseeds
- Kent Madison with Madison Farms
- Mike Conklin with Palouse Bio
- Peter Stocking with GreaseWorks
- Nikola Davidson with Madrona Biodiesel Co-op
- Glen Brady with Umpqua Bio-Alternatives Co-op
- James Santana with Flower Power Co-op
- David Otto with Mountain West Co-op (Cenex)
- Brennan Morrow with Bend Biodiesel Co-op
- Lance McCardle with LC Biofuels
- Bill Christie with the Grange Co-op
- Jeff Barnhart with the Prairiefire Biofuels Cooperative

Interviewees were selected chosen from by being management, farmers, founders or members of the following groups:

- Farmer-owned farm supply co-op
- Farmer-owned grain grower co-op seeking to engage in value-add production
- Consumer-owned co-ops
- Farmer's seeking to do on-farm production

Whereas the majority of interviewees were in the Northwestern four-state target area (Oregon, Idaho, Washington and Montana), interviewees included businesses in Wisconsin, California and North Carolina.

Appendix VI – Online Survey Reprinted from www.surveymonkey.com

Introduction
The Northwest Cooperative Development Center is researching groups of farmers, consumers and businesses who've sought to create a bioenergy/biofuel cooperative business in Pacific Northwest. This is a broad survey, and we would like your input to help us identify how cooperatives can play a viable role in the emerging bioenergy industry. The survey will only take five to ten minutes. The more responses received, the better the Center can serve cooperative businesses, rural America and bioenergy projects.

The information provided in this survey will be treated with complete confidentiality. Names or contact details will not be shared electronically or manually with any other party.

1. Please provide the following contact information:

First name	
Last name	
Phone number	
Email	
The name of your co-op	
Your role in the co-op/business	
Mailing address: Street	
City	
State	
Zip code	

2. What is the geographic location of the co-ops' target market? (Mark all that apply)

	NW	NE	SW	SE	Central
Washington					
Oregon					
Montana					
Idaho					

3. Does your co-op/business have key partners? If so, who?

4. How long has your cooperative business been in operation?
Currently in the pre-development stages

Less than 1 year
1-3 years
3-5 years
5-10 years
More than 10 years
Other (please specify)

5. What type of business is your co-op? (check all that apply)
Consumer co-op (the consumers are the owners)
Producer co-op (the producers are the owners)
Joint venture
Other (please specify)

6. How does the co-ops' core business relate to bioenergy?
Feedstock grower
Fuel processing
Fuel distribution/marketing
Power generation
Other (please specify)

7. In your opinion, what is currently the single greatest challenge for the cooperative?

8. Why is the co-op in the bioenergy business? (check all that apply)
Return surplus to the members
Economic development in the community- ie. job creation
Support American Farmers
Clean air
Climate change
Sustainability
Energy Independence
National security
No access
Offset current operational costs
Other (please specify)

9. What type of bioenergy is your co-op/business working with?
Biodiesel
Ethanol
Digester
Combined heat and power/co-generation

Other (please specify)

10. What is the estimated annual financial scale of your business?

$25,000-$50,000

$50,000-$1 million

$1-3 million

$3-5 million

$5-15 million

$15-30 milllion

Other (please specify)

11. How many people are involved in the bioenergy project?

One to five

Five to ten

Ten to fifteen

Fifteen to twenty

Twenty and over

How many (please specify)

12. Has your co-op/business:
(please check all that apply)

Identified a need that a co-op could meet

Formed a steering committee

Researched feasibility

Incorporated

Conducted membership drive

Authored a business plan

Sought project financing

Began operations

13. Why did the group decide to organize in a co-op structure?
(if applicable)

14. How was your operation financed?
(Mark all that apply)

Member-based (i.e. equity or debt)

Investor equity

Lender debt

Combination

Other (i.e. grants)

15. Please list the co-op's greatest achievements:

16. What are the biggest internal challenges in the business?

	Highly challenging	Moderately challenging	Slightly challenging
Poor selection of directors			
Inactive membership			
Interpersonal conflicts			
Members who don't attend annual meetings			
Directors who fail to attend board meetings			
Poor understanding of co-op principals by the members			
Inadequate member financing			
Communication between Management and the Board			
Management errors			

17. Please rate the largest external challenges the business faces.

	Highly challenging	Moderately challenging	Slightly challenging
Capitalization/difficulty with debt			
Feedstock access/supply			
Insufficient byproduct markets			
Lack of infrastructure			
Input/output contracts			

18. What follows is a list of the steps to form a co-op. Please share what stage your co-op has accomplished.

	Completed	Need to do	doesn't apply
Identify the economic need			
Identify other like minded entrepreneurs			
Appoint a steering committee and Advisory team			
Create a Mission			
Evaluate the market for the proposed product/service			
Evaluate and quantify the interest of potential members			

Feasibility analysis

Prepare legal papers and incorporate

Develop a business plan

Conduct a member drive

Establish Bank relationships

Conduct a member equity drive

Hire manager

Acquire facilities

Begin operations

19. If your business has any specific organizational needs, please check all that apply:

Board training

Organizational development

Strategic Planning

Grant writing

Feasibility analysis

Market Studies

Business planning

Other (please specify)

20. What other groups do you know that are involved with co-ops and/or biofuels?

WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

June 30, 2007

BIOFUEL DEVELOPMENT IN WASHINGTON

Introduction

This listing provides a brief overview of the status of ethanol and biodiesel production and delivery in the state of Washington. It is a snapshot of known activities and is subject to constant revision due to a rapidly changing environment.

Ethanol

Currently, Washington State has up to 566 million gallons per year (MGY) of potential ethanol production in the permitting/proposal stage. It is not known how much of this proposed capacity will be built. Total motor gasoline consumption in the state is estimated at 2,700 MGY (EIA 2004). Proposed ethanol production is approximately 18 % of the state's motor gasoline consumption. Ethanol consumption in Washington is running about 68 MGY (EIA 2003) or approximately 2.5 % of motor gasoline consumption.

Proposed Ethanol Facilities

Location	Developer	Size	Status
Plymouth	Pacific Ethanol	55 MGY	permitting
Moses Lake	Global Ethanol	40-80 MGY	permitting
Finley	Columbia Renewable Energy	55 MGY	SEPA completed. Construction planned for summer 2007.
Wallula	E85 Inc (tech provider VogelBusch)	100 MGY-corn	proposal to Port of Walla Walla-planning stage
Vancouver	Great Western Malting (tech provider Delta-T)	55 MGY – Barley feedstock	planning
Tokio/Ritzville	Premier Bio Energy/Cillion/Khosla Ventures	55 MGY	Permitting started
Longview	US Ethanol	55 MGY	Construction begun, 2008 startup

Moses Lake	Earth Ethanol/Liquefaction Corporation (20% own)	12 -36 MGY	Air permit completed for 12 MGY
Vancouver	Rappaport Energy Consulting LLC	25 MGY	planning
Bruce	Evergreen Biofuels	50 MGY	concept
St. John	St. John Ethanol	NA	concept
Cowlitz County	Pure Energy	NA- cellulosic	concept
Port of Wilma	Losonoco	NA	concept

Ethanol Fueling

Location	Access
McChord Air Force Base	No public access at this time
Fort Lewis	No public access at this time
Pacific Pride, Richland	Card lock-public access
Richland Hanford	Private access
Vancouver (BPA Ross Complex)	For government vehicles only
Sunnyside Conoco	Public access

Note: Additional information on fueling facilities can be found at the National Ethanol Vehicle Coalition website @ www.e85refueling.com/

Corn Production: In 2006, 140,000 acres of corn were grown in Washington. For 2007, an estimated 190,000 acres of corn will be planted in the state, a 36 % increase. Nationally, 90.5 million acres of corn will be planted in 2007- an increase of 15 % over 2006 acreage.

Biodiesel

Currently, Washington State has as much as 380 million gallons of biodiesel production capacity either on-line or in the permitting/proposal stage. It is not known how much of this proposed capacity will be built. If fully developed, this capacity could offset as much as 30 % of in-state middle distillate demand as derived from EIA 2004 data**.**

Biodiesel Facilities

Location	Developer	Size	Status
Seattle	Seattle Biodiesel (aka Imperium Renewables)	5 MGY	operational – mainly soybean oil
Creston	Columbia BioEnergy, LLC/Air energy LLP	@ 8 MGY- grow to 16 MGY	operational – mainly soybean oil
Ellensburg	Central Washington Biodiesel	3-5 MGY	operational- in ramp up phase using WA canola to start
Arlington	Standard Biodiesel	8 MGY	operational-waste vegetable oil
Poulsbo	Olympic Biofuels	0.5 MGY	operational-waste vegetable oil

Grays Harbor	Imperium Renewables	100 MGY	under construction-startup mid 2007
Mount Vernon	Whole Energy	10 MGY	financing complete/permitting
Burbank/Walla Walla	Gen-X	5 MGY	Startup-up summer 2007 recycled vegetable oils/fats
Odessa	Inland Empire Oilseed-Fred Fleming	5-25 MGY	$848,102 Energy Freedom Program
Port of Sunnyside	Natural Selection Farms-Ted Durfee	0.5 MGY	air permitting complete
West Seattle	Planetary Fuels + Adrian Higgenbotham	6 MGY	Permitting, funded
Port of Warden	Washington Biodiesel	35 MGY	permitting- received $380,780 Energy Freedom Program & CERB funding- may focus near term on oil crushing
Addy	Advanced Biodiesel Systems., Inc	24 MGY	permitting
Spokane	Spokane Conservation District/Palouse Bio	5 MGY	planning-$853,871 Energy Freedom Program
Vancouver	Rappaport Energy Consulting LLC	60 MGY	planning
Bruce	Columbia BioEnergy/Air Energy	25-30 MGY	concept
Tacoma	Baker Commodities	10-15 MGY	concept
Tacoma	Sound Refining	30 MGY	concept
Toppenish	Agri Systems	NA	Tribal location-EPA regulates
Chelan County	Robert Steward	NA	concept
Burbank/Walla Walla	NorthWest BioFuels Inc	closed	Project terminated Spring 2007

Note: At least three smaller biodiesel facilities are also on-line. They are Sound Biodiesel of Port Townsend, Beavercreek Bioproducts of Twisp and Biodiesel Works of Bellingham. They each produce less than 10,000 gallons per year.

Oilseed Acreage: In 2006, approximately 7,500 acres of oilseed (canola) was under production in the region. Oilseed plantings for 2007 are not expected to increase significantly, although there are signs of increased activity. For example, Imperium Renewables contracted for 1 million gallons of canola oil from Natural Selection Farms, located in Sunnyside, Washington.

Crushers

Oilseed crushers can be measured in several ways (tons crushed per day, tons crushed per year or by gallons of oil produced per year). The preferred measure for this report is tons crushed per year. On-line or under development oilseed crushing capacity is 742,455 tons per year.

Location	Developer	Size	Status
Spokane	Spokane County	Range from 25,500 to	Planning-

	Conservation District/Palouse BioEnergy	340,000 tons per year (TPY).	$1,799,000 Energy Freedom Program
Port of Warden	Washington Biodiesel	350,000 TPY	Planning- $2,915,397 Energy Freedom Program
Odessa	PDA/Inland Empire Oilseeds LLC (2 co-ops, Rearden Seed and Fred Fleming)	44,200 TPY	Planning- $3,500,000 Energy Freedom Program
Sunnyside	Port of Sunnyside/Natural Selections (Ted Durfee)	8,000 TPY- contract w/ Imperium for 1 MGY. delivered 6K gallons 1/30/07	Operational- $750,000 Energy Freedom Program
Colfax	NRCS/Whitman Conservation District	255 TPY- portable crusher @3/4 tons per day	Operational

Biodiesel Fueling:

The National Biodiesel Board reports that there are approximately 40 stations selling biodiesel in Washington State. Station information can be viewed at www.biodiesel.org/buyingbiodiesel/retailfuelingsites/showstate.asp?st=WA. The actual number of stations in Washington selling biodiesel is probably higher, according to preliminary sampling being conducted by WSDA. WSDA is currently gathering information on biodiesel outlets in Washington and expect to make this information available in August, 2007.

For more information, additions, corrections, and updates contact:

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Appendix VIII – Biofuels Development in Oregon

This list of plants planned for Oregon was taken from: oregon.gov/ENERGY/SITING/exempt.shtm

"This page lists Oregon energy facilities that are exempt from the site certificate requirement."

According to the Oregon Dept of Energy:

"Before a large energy facility is built in Oregon, the developer must apply for a site certificate from the Energy Facility Siting Council. The types of energy facility subject to Council jurisdiction are defined by statute in ORS 469.300. Some types of energy facilities that would otherwise need a site certificate are exempt from Council jurisdiction under Oregon statutes."

Location	Project / Developer	Size	Status
Morrow County	Altra Biodiesel / Altra Biodiesel of Oregon LLC	Up to 40 MMgpy	Construction has not begun
Morrow County	Altra Ethanol Production Plant / ALTRA Ethanol of Oregon LLC	Up to 50 MMgpy	Construction has not begun
Columbia County	Cascade Grain Products / Cascade Grain Products LLC	Up to 100 MMgpy	Under construction
Morrow County	Morrow Biodiesel / Morrow Bioenergy LLC	Up to 60 MMgpy	Construction has not begun
Morrow County	Oregon Ethanol Facility / Greenstock Resources, Inc.	Up to 30 MMgpy	Construction has not begun
Morrow County	Pacific Ethanol Energy Project / Pacific Ethanol, Inc.	designed to produce 42 MMgpy	Under construction
Malheur County	Treasure Valley Renewable / Treasure Valley Renewable Resources LLC	Up to 30 MMgpy	Construction has not begun