Homegrown Prosperity
From the Bottom Up

Western Organization of Resource Councils

Homegrown Prosperity from the Bottom Up

A Report on Small and Community-scale Biodiesel

Wilbur and Elizabeth Wood
Western Organization of Resource Councils

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WORC, the Western Organization of Resource Councils, is a regional network of seven grassroots organizations with 10,000 members and 45 local chapters. WORC helps its member groups succeed by providing training and coordinating multi-state issue campaigns.

WORC's mission is to advance the vision of a democratic, sustainable, and just society through community action. WORC is committed to building sustainable environmental and economic communities that balance economic growth with the health of people and stewardship of their land, water, and air resources.

WORC's member groups are: Dakota Resource Council (North Dakota), Dakota Rural Action (South Dakota), Idaho Rural Council, Northern Plains Resource Council (Montana), Oregon Rural Action, Powder River Basin Resource Council (Wyoming), and Western Colorado Congress.

The Report

Homegrown Prosperity from the Bottom Up is the second report on biodiesel production published by WORC. In 2007, WORC published *Biodiesel Benefits for Cattle Producers: Feeding Byproducts of Biodiesel Production* by Greg Lardy. It lays the foundation for this report, and provides useful and practical information on the compatibility of small scale biodiesel production with the range fed beef cattle industry in Western states. For copies of that report, contact WORC, or download it at www.worc.org.

Elizabeth Hughes Wood and Wilbur Wood conducted the research and interviews that form the case studies, side bars, and background materials for this report. Elizabeth and Wilbur are writers and renewable energy activists from Roundup, Montana. Wilbur writes on energy, agriculture and the environment for a variety of regional and national publications. Elizabeth aided Anne Charter in writing and editing her memoir, *Cowboys Don't Walk*, and has produced energy scripts for children's shows on public radio.

Margaret MacDonald, WORC's Regional Field Organizer, edited the report.

Kerri Nelson, WORC's Development Director, edited, designed and published the report.

An online version of this report is available for download at *www.worc.org*.

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Preface

The Northern Great Plains and Intermountain states of Montana, Wyoming, Idaho, Colorado, Eastern Oregon, South Dakota and North Dakota are significant producers of beef cattle and of small grains and other crops. With the increasing costs of petroleum fuels, and concerns for energy self sufficiency, many farmers, ranchers and rural communities in the region are examining the possibilities of producing oilseeds and making biodiesel.

Up until now, much of the research and analysis on biodiesel production has been directed toward fairly large-scale plants (over 15 million gallons per year), requiring large amounts of contracted oilseed feedstock. On the other end of the spectrum, innovative and entrepreneurial agricultural producers are exploring ways to crush seeds and transesterify vegetable oil to make biodiesel in on-farm settings. While this scale of biodiesel development has received some attention, much uncertainty persists and obstacles remain in place in a system geared for the large refineries. A third way to develop biodiesel from oilseed feedstocks, and incorporate the co-products into existing livestock production systems is a small cooperative or privately-owned plant, no larger than 5 million gallons per year, often less than 1 million gallons.

Smaller scale production models—community and farm-scale—offer some distinct opportunities and advantages for the adoption and utilization of biodiesel in rural areas. They enable farmers and ranchers to direct most of their energies toward production of crops and livestock, while pooling their resources—financial, technical, and managerial—to produce their own fuel, market any spare fuel, and add value to the livestock produced in the region. It also ensures that the development of biofuels will benefit rural communities and restore some prosperity to areas much in need of income. Small-scale biodiesel production spreads the wealth potential from biofuels around much further than one very large plant that requires most of the oilseed production from an entire region.

Traditional thinking about economies of scale, which directs public policy and resources toward larger plants, may not make the best sense for this region, the vast majority of small rural communities nor for individual producers. This purpose of this report is to provide policy-makers and interested producers with information on the production of micro-scale and small community biodiesel, with case studies to discuss economic potential, legal and systemic issues, technical assistance and financial resources available, and sustainability. It provides guidance to prospective developers, local economic development agencies, and policy makers on what steps need to occur to foster community-scale biodiesel.

Introduction

Can farmers grow their own fuel, create "second crops" for themselves, and help revive rural communities? Can localized production and distribution of biodiesel, over large portions of the semi-arid West, disengage family farmers and ranchers from volatile and insecure global fossil fuel markets, enhance fuel and food security, create jobs, and keep money circulating in local economies? To these questions, this report answers a qualified "yes."

It is qualified not due to technological barriers to producing diesel fuel from oilseed crops, used vegetable oil or animal fats. No such barriers exist, and the scale at which biodiesel can be produced varies from a few gallons in one's garage to many millions of gallons in large facilities. The barriers are political and economic: How much is it worth to a state or the nation for agriculture to move toward energy self-reliance and sustainability?

This report takes the measure of the biodiesel industry in its infancy, as it is emerging in the local rural economies across the WORC-state region of North Dakota, South Dakota, Wyoming, Montana, Idaho, Colorado and Oregon. It looks at the experiences of farmers and local entrepreneurs and their public and private partnerships to analyze and assess the potential contributions of this new economic engine for rural income and jobs. This report spans biodiesel on a "micro-processing" scale, on up to community and small commercial-scale with a capacity to produce up to 8 million gallons per year.

As we were researching this report, the commodities markets took an unprecedented roller coaster ride which put the nascent biodiesel industry through a severe test. As 2008 drew to a close, however, there remained reasons for optimism that a locally owned and operated biodiesel sector might work well in this region.

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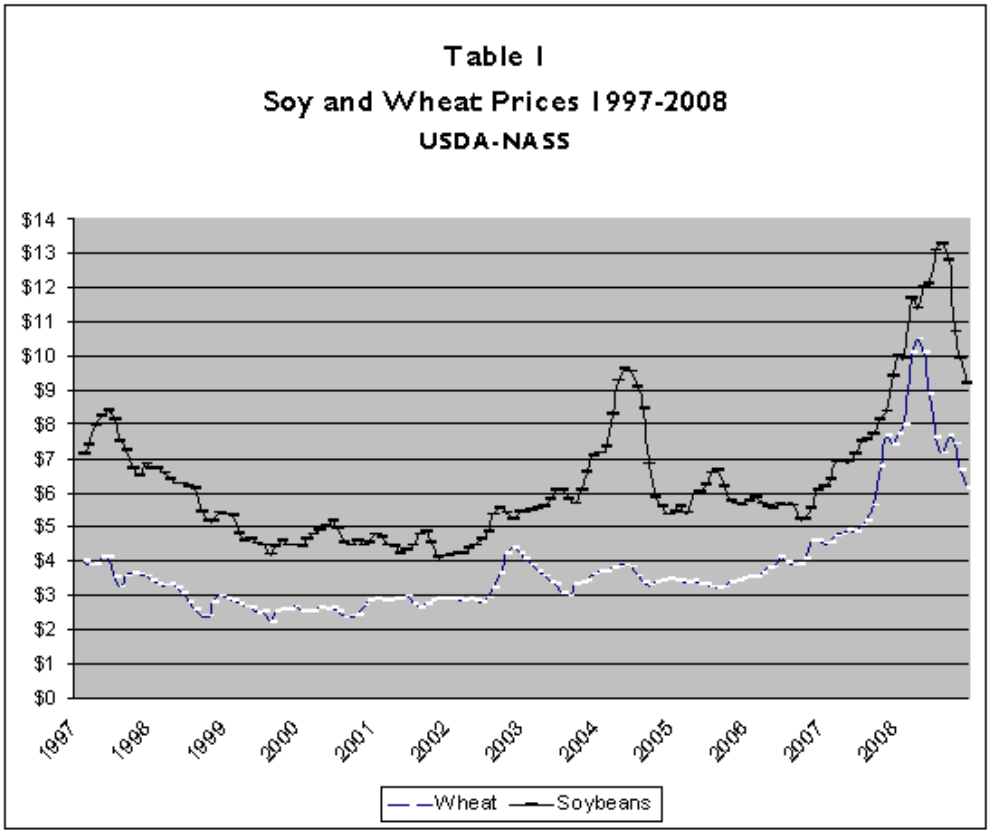
A Market Roller Coaster Ride in 2008

In 2006, there was plenty of reason for optimism. Biodiesel plants of various sizes were either up and running or on the drawing boards. The press reviews were glowing. Farmers were enthusiastic about diversifying their operations by growing oilseeds, which can work well in rotation with grain crops, yielding food-grade oil and feedstock for fuel, and providing high quality meal to feed livestock. Biodiesel production credits from the federal government, along with incentives and renewable fuels standards (RFS) in certain states, lured investors. (Renewable fuels standards are a legally adopted blending ratio for alternative fuels, such as biodiesel.)

By June 2008, when research began on this report, the picture was less rosy. Green Fuels of Oregon, based in Klamath Falls, is one example. Owner Rick Walsh said he had been producing 4,000 gallons a month and was aiming to go higher, but the lack of locally available feedstock had forced him to curtail his operation.

The immediate reason for this was a rapid rise in the cost of feedstock, primarily oil from soybeans, canola, safflower, sunflower, flax, mustard and other crops. Steadily escalating prices for conventional petroleum—rising by July 2008 to a high of $147 per barrel—were accompanied by escalating prices for agricultural commodities. A bushel of soybeans selling for $6 in 2006 was going for $14.50 in summer 2008 (soy tends to set the price for all vegetable oils), but was back down to $7.96 by late December. In 2008, farmers were being offered contracts to grow their traditional crops (wheat, barley or corn) that allowed them to sell at a profit (even with higher priced petroleum fuel and petroleum-based fertilizers, herbicides and pesticides).



Thus, many farmers turned away from devoting acreage to oilseeds. And those who did grow oilseeds aimed to sell them for higher value uses—cooking or salad oils, pharmaceuticals and cosmetics, higher value lubricants—but not as lower value sources for fuel. The difficulty in obtaining feedstock was explained succinctly by Brett Earl of Earl Fisher Biofuels in Chester, Montana, (see Case Study 1) when he remarked ruefully, "We in the biodiesel business are the bottom feeders."

By late summer 2008, petroleum prices were falling from their earlier highs, and agricultural commodity prices were following them rapidly downward. Canola seed, which in 2006 had sold for about 8 cents per pound, then inflated to 28 cents per pound by mid-2008, was back below 14 cents by mid-December 2008. Lee Dirkzwager, a producer who was bringing a biodiesel operation online in York, North Dakota, was pleasantly surprised at this "softening" of prices, adding that seed crushers now were "wanting to sell soy and canola oil at margins that work for biodiesel." Despite fluctuating prices for oilseeds and the falling price of petroleum diesel, he was optimistic that there would be plenty of demand for biodiesel and that feedstock would be available.

In Montana, SunBio Systems, a California company which manufactures and sets up small,

farm-scale micro-processors around the U.S., installed one of them in Sidney at Montana State University's (MSU) Eastern Agricultural Research Center. The goal was to find groups of farmers who would pool resources and set up a refinery, grow and crush their own oilseeds and make enough fuel to run their farm operations.

"We spend a lot of money for oil. If we can make our own, why not?"

"We spend a lot of money for oil. If we can make our own, why not?" said MSU research chemist Chuck Flynn, who has brewed several batches of biodiesel from both oilseeds and used cooking oil.

Local Ownership Offers Resilience and Food Security

The case studies conducted for this report demonstrate the compatibility of biodiesel technology and economics on a local scale. Brett Earl's partner in this operation, Logan Fisher, commented. "Ideally, every farmer around here ought to be growing 100 acres of oilseeds." Fisher and Earl are both farmers, as well as biodiesel producers, and they see locally produced feedstock as the starting point for building local self-reliance in fuel. Feedstock amounts to between 75 and 85 percent of the cost of producing most biodiesel, so the nearer the source the better—oilseeds in rural agricultural areas, used cooking oil in more urban settings, animal fats near meat processing facilities—because of lower transportation costs. The same thing is true at the other end. The nearer the markets, the lower the cost to transport fuel, meal and other co-products. This could provide the margin needed for a positive balance sheet, as well as allowing a portion of these savings to be passed on to the consumer, and keeping those dollars as local as possible.

Part of the challenge for this localization strategy to work, is that local people must buy in, figuratively and literally. Paul T. Miller runs Sustainable Systems of Missoula, Montana, which operates an oilseed crushing plant in Culbertson, Montana, on the other side of the state.

"Biodiesel could work if a town decides: We want to buy biodiesel and are willing to pay more," Miller said. His experience, though, is that "farmers will use petroleum diesel to grow wheat, as long as it is cheaper than biodiesel." So a different perspective is required before farmers or policy makers decide that their long term self interest, and the well being of their communities, is to grow, manufacture and use their own fuel. If farmers own the equipment and are making fuel and feed for their own use, their perspective can shift. Then the benefits to themselves and their communities begin to outweigh disadvantages, including at times a slightly higher price for biodiesel compared to petrodiesel.

"Ideally, every farmer around here ought to be growing 100 acres of oilseeds."

Farmers in North Dakota, Montana, and Ontario all noted the benefits of securing a fuel supply in the volatile energy markets of recent years. Ontario farmer Bill Wilson told a local journalist that "at least then I will have fuel security. Back in the 1976 energy crisis, it wasn't a guaranteed thing that you could pick up the phone, make a call and get fuel delivered." Farmers in North Dakota and Montana reported being told they would have to wait a few days when they called to order fuel deliveries in time for harvest during the summer of 2007.

In terms of feedstock, for many farmers in the region fuel self sufficiency would mean devoting from 5 to 8 percent of their acreage to "fuel crops." There is an important community economic bonus for this kind of energy self sufficiency, because out of every dollar paid for imported

petroleum diesel, approximately 75 cents is exported out of the community, most of it going to corporate headquarters in places like Houston or Los Angeles. By contrast, almost all of every dollar paid for locally produced biodiesel stays at home.

Cliff Bradley, a microbiologist, biofuels entrepreneur and sustainable agriculture consultant based in Missoula, Montana, argues for localization because "that's independence. I want to avoid transferring wealth out of local communities to subsidize petroleum." And Bradley asks, "What happens when the supply of petroleum is cut off?" Homegrown fuels mean that farmers can still get out into their fields to plow or harvest. He points to a barley growers' cooperative in Fairfield, Montana, which also owns gasoline stations in the area out of which it sells fuel and farm chemicals. Why not, he asks, produce biodiesel and ethanol and in the same way—vertically integrated "from tractor to train"—sell homegrown fuel as well?

"What happens when the supply of petroleum is cut off?"

This perspective was articulated, to a greater or lesser degree, by all 50 people interviewed for this report during five months of research. These are farmers and ranchers, oilseed crushers and used oil collectors, producers of biodiesel along with advocates of burning straight vegetable oil (SVO) as fuel. They include chemists, microbiologists, engineers, farmers, mechanics, truck drivers, and renewable energy activists. A few had worked for large corporations, including energy companies, but eventually had quit. Brett Earl, for example, had worked as a chemical engineer for a major oil company, but as he said, "I got tired of selling products I didn't believe in." They live in North Dakota, South Dakota, Montana, Wyoming, Colorado, Idaho, Oregon, Minnesota, Missouri, Washington, and the Canadian province of Ontario. All are committed to figuring out ways to make homegrown fuels a viable form of community economic development. Many have devised unique ways to make this happen.

Continuing Economic Uncertainty

Although a more optimistic tone about biodiesel was arising by fall 2008, one huge uncertainty spun out of the nationwide—and global—financial crisis that descended at that time. Would it constrict access to credit and thus hamper investments in both new and ongoing biodiesel operations?

Further compounding this uncertainty was the price of crude petroleum, which in October, began to slide toward a cliff over which it abruptly plummeted. A badly slumping economy, worldwide, meant drastically reduced demand for petroleum products, driving prices down. From a high of $147 a barrel in July, it fell into the $40 range by December, and this translated into gasoline prices at the pump near $1.50 a gallon—the lowest in several years—compared to the $4.25 per gallon prices that many were paying in July. While diesel prices did not fall that far that fast, they reached the mid-$2 range in December 2008.

This dramatic price fluctuation paralleled previous cycles in the 1970s and early 1980s when petroleum prices rose (and industry profits with them) until ethanol and biodiesel became price-competitive. Then gasoline and petrodiesel prices crashed, cutting the bottom out of a budding renewable fuels sector.

In fall 2008, this market situation was tempered, for biodiesel producers, by the fact that as petroleum prices fell, so did the prices of other basic commodities including wheat, corn, soybeans and other vegetable oils. This could open the door for cheaper feedstocks for renewable fuels, which had been the big problem for producers only a few months earlier. But in the current economic climate, nothing seems certain.

Congress has taken two major steps to establish and cushion the blossoming renewable fuels industry. It passed the Energy Security and Independence Act in late 2007 creating an ambitious standard for inclusion of 36 billion gallons of sustainable renewable fuels by 2022, with low carbon footprints.

Then, in October 2008, both houses of Congress approved and the President signed a one year extension of tax incentives for renewable energy, including biodiesel, that was tacked onto the first so-called "financial bailout" bill. These incentives will expire after only one year, however, unless Congress acts to extend them.

What follows are case studies of a handful of biodiesel operations, mostly in the Western U.S., enjoying a measure of success in spite of the conditions outlined above. They range in scale from farm to microprocessors to community and small commercial plants. They illustrate some of the lessons and policies on pages 6 and 7, suggesting what works and does not work, what helps or does not help. The studies spotlight issues, and do not comprehensively report on the business plan, the profit margins, or the struggles and hopes of these pioneers in biodiesel. They do indicate that despite the dramatic markets that whipsawed both the feedstock and the fuel product, in 2008, these operators were by and large still optimistic, and still creating jobs and income in rural communities.

WORC is grateful for their candor and cooperation.

Lessons and Policies

The case studies and interviews conducted for this report reveal several important lessons for micro-processing and community-scale biodiesel:

(1) Uncertainty for producers remains on many fronts and is likely to continue. This includes volatility in commodity markets; shifts in federal and state regulations, fuel standards and incentives; and fluctuating access to investment capital. For the nation or region to commit to clean, renewable, locally produced fuels for agriculture, public policy needs to establish a firm commitment to this scale of production. Volatile markets can swiftly demolish a fledgling biofuels producer. This would be the second or third cycle in which high oil prices helped engender a new, homegrown fuel sector, which was then destroyed when the price of oil dropped. These repeated industry wash-outs should underscore the need for public policies that are dependably consistent and committed to long term establishment of a renewable fuels capacity.

(2) For prospective producers and investors, the market reality suggests that it is best to reduce risks by building an operation gradually, avoiding large initial outlays of money for facilities and technologies.

(3) Scale matters and local investors and farmer-ownership provide added resilience and flexibility as commodity markets fluctuate. A large industrial facility depending on feedstock from farmers who have the option of selling their commodities into a skyrocketing food market is more vulnerable than a plant that the farmers own and use to fuel their own operations. Farmer-owners have a stake in their energy security and the long term viability of the production facilities. Smaller plants leave less of an investment in jeopardy when volatile markets eat away at profits.

(4) Public policy needs to be redirected to create appropriate incentives for farmers to grow and manufacture their own fuel. Excise tax credits and other subsidies now flow mainly to blenders, fuel producers, and oilseed crushers. In general, tax credits are not strong incentives for farmers, without sufficient income to utilize tax credits. Local biodiesel entrepreneurs and cooperatives should have access to appropriately structured incentives so they can compete on a level playing field with larger industrial plants.

(5) Research and agricultural extension funding should be directed to support microprocessors and community-scale production. This includes helping find productive, safe uses of byproduct glycerin; devising appropriate, readily accessible, and affordable fuel tests for small processors making the product for self use; and partnering with rural economic development agencies to support entrepreneurs and small cooperatives interested in making biodiesel.

(6) Successful biodiesel community projects can minimize transportation costs by localizing acquisition of feedstocks and delivery of products to markets as much as possible. Definitions of "local" can vary greatly according to the region and the size of an operation. But when paying $4/gallon to haul around bulky commodities (seeds or feed), growing the feedstock and using the fuel and byproducts close to the plant significantly enhance the bottom line.

(7) Public policy incentives need to reward biodiesel production that is integrated

into sustainable agricultural practices and stewardship of soils and water. Small entrepreneurial businesses or cooperatives that can grow and produce fuel while enhancing the production of primarily range-fed beef cattle, and that encourage crop rotations on dryland grain farms in the region, promote conservation and stewardship as well as economic resilience and energy independence.

(8) Renewable Fuels Standards (RFS) for sustainably produced low-carbon biodiesel are a keystone public policy platform from which to establish biodiesel production capacity from the growers, to the oilseed crushers, to the processors. (See 'Forward Thinking' Oregon, page 21.) States and municipalities can jumpstart and help sustain a viable renewable fuels industry and strengthen their local economies by adopting standards requiring the use of renewable fuels in their jurisdictions. Renewable Fuels Standards provide the essential ingredient for producers to make investments and step out onto new business platforms.

Case Study 1: Earl Fisher Biofuels, LLP

Commercial plant weathers gas and commodity rollercoaster

Chester, Montana (pop. 880)
Owned and operated by Brett Earl and Logan Fisher

- **Biodiesel Production:** Earl Fisher began making biodiesel early in 2008, with fuel sales beginning in April. Initially, the feedstock was a mixture of virgin vegtable oil, used cooking oil and animal fats. The first-year target was 100,000 gallons. Actual capacity of the plant operating 24 hours/day, 350 days/year is 275,000 gallons/year. The present facility is designed to expand to a top capacity of 1 million gallons/year. At that level, if oilseeds from this region were the sole feedstock, this would require about 20,000 planted acres.
- **Oilseed crushing:** Crushing began in late summer/early fall 2008, with locally grown camelina. Canola and safflower seeds are also being crushed. Seven 1.5 to 2-ton capacity Komet crushers (made in Germany) are operational, with plans soon to increase this to fifteen. (On the plant's current schedule, 9:00 A.M. to 6:00 P.M., 15 crushers would allow processing of up to 30 tons of oilseeds per day.) Along with producing feedstock for fuel, food-grade vegetable oil could also be produced and marketed. The capacity to produce both fuel and food grade oil could make small community plants less vulnerable to fluctuating commodity prices beyond their control.
- **Distribution:** Fuel is sold at retail, with the focus on local buyers. Oilseed meal has a ready market in the area. For glycerin there is no local market outside of the plant, where it is used as a heating fuel.
- **Financing:** The plant is privately financed by the two owner-partners. Government assistance has included a $50,000 loan from the Montana Department of Agriculture, a WIRED (Workforce Innovation in Regional Economic Development) grant to help train plant workers, and an NRCS (Natural Resources Conservation Service) grant for a pilot project "to convince farmers to grow oilseeds." According to Jon VanGerpen of the University of Idaho, a 1.5 million gallon/year facility costs $1.50/gallon of capacity to develop, and beyond that level of capacity, $1.00/gallon.
- **Employment:** The plant employs five workers, plus the two owners. A sixth employee would be added as production reaches capacity.

Montana's only commercial-scale biodiesel plant

In 2008, Earl Fisher Biofuels was the only commercial-scale biodiesel plant operating in Montana. The town of Chester is county seat of Liberty County. It is surrounded by mixed dryland wheat and livestock country along northern Montana's "Hi-Line" and is served by U.S. Highway 2 and the Burlington Northern Railroad.

Acquiring feedstock was the chief problem in their first year, Logan Fisher and Brett Earl agreed. The plant can process "any kind of oil seed, and lard and animal fats are also okay—if we can get it," Fisher said. "But we've had to go way too far to get it." Since at first they were crushing no oilseeds, they were buying non-food-grade oil "from far and wide." In the summer of 2008, they did not reach full-time production.

In the beginning, when the two partners—who are both farmers as well as biodiesel entrepreneurs—devised their business plan, they tried to anticipate the worst case scenario; for example, petroleum diesel falling as low at $1.25 per gallon or wheat rising to its historic high, about $8 per bushel. In Summer 2008, petroleum diesel prices hit historic highs, but Fisher and Earl did not anticipate wheat rocketing into the $15 to $20 per bushel range. Farmers in the area who had indicated an intention to plant oilseed crops—canola, safflowers, mustard, camelina—instead planted wheat. In 2008, Montana canola acres were down by one half, Fisher said, and safflower acres were down 25%.

By early fall 2008, with wheat prices plummeting, along with petroleum and other commodities, the price of feedstock was getting more competitive, and there were signs that farmers might return to a more diversified mix of crops, Fisher said. "I can't imagine a situation where the new Administration in Washington says we're not going to do homegrown fuel," he noted. "The future looks good, as far as this business is concerned."

Ideally, Fisher said, farmers in this region would all each plant about 100 acres of oilseeds. Canola, safflower, mustard and camelina are crops that grow well here, he continued, and they also work well in rotation with grain crops, breaking disease cycles. After crushing, they yield a high quality livestock feed and the oil could provide some measure of fuel security. He estimated that in a normal year 100 acres could provide 4,000 to 5,000 gallons of fuel, which would handle from one-third to half of the fuel needs of many farms in north central Montana.

"The future looks good, as far as this business is concerned."

Decentralized crushing operations

Both partners are committed to moving toward local self-reliance in fuel, and would like to see most of their feedstock come from a radius of approximately 90 miles, because they see transportation costs staying high and cutting into profits for both the grower and the refiner. For this reason, they foresee smaller crushing facilities eventually spread around the region, either set up by Earl Fisher or by groups of farmers: "It makes sense to keep the crusher close to the source," Fisher said. The farmers would retain the meal and feed it to their own livestock or sell it to neighboring ranchers, then send the oil to Earl Fisher. Hauling oil minus the meal would cut two-thirds of the weight. While the Chester plant now is set up to crush seeds and market both the meal and the oil, Fisher said they would be happy simply to charge a processing fee and return the biodiesel to the farmer.

Demand, Supply and Price

There is demand for biodiesel, Fisher said, but "a lot of people say they are 'green' until the checkbook hurts too much"—that is, they'll go back to petrodiesel if the price falls far enough. Biodiesel at times is competitive with petrodiesel, but with petroleum prices fluctuating so much, Fisher believes people committed to homegrown fuels and local economies need to be prepared to pay more for biodiesel than for petrodiesel.

This can work both ways. That is, local supply must exist to meet local demand. In order to build a loyal clientele, Fisher and Earl told their customers that they would meet the "dyed diesel" price (for off-road, on-farm petrodiesel). At one point in 2008 they had an opportunity to sell their biodiesel out of the local area for $5.60 per gallon, which at the time would have brought them more than a dollar over the dyed diesel price. "We thought hard for three days," Earl said, but they decided to turn down this short term financial benefit to their start-up business in order to maintain enough stock on hand, keep local trust, and build a longer term local market.

Rural Jobs

Fisher and Earl's commitment to their local economy also has resulted in the creation of five local jobs—not counting an intern during summer 2008. The five workers aren't always in the plant. When things get slow, they work on Fisher and Earl's farms. But in a town the size of Chester, in a declining rural economy, "five local jobs," as Fisher points out, "is huge." Ramping up production to the plant's current capacity of 275,000 gallons/year would mean running three 8-hour shifts per day, two workers per shift, and require hiring a sixth worker.

Those jobs do not count the owners' own work: Fisher handles much of the paperwork and the contacts with revenue and regulatory agencies on state and federal levels; Earl, a chemical engineer, tests feedstock and devises "recipes" for each batch and after the transesterification process, tests the fuel itself. In the plant's laboratory he can run nine of the eighteen American Society for Testing and Materials (ASTM) quality tests for biodiesel: "we can duplicate in miniature everything that goes on in the plant itself" (see Quality and Testing, page 11).

Even though "we pretty much know if a batch will be okay," Fisher said, "we need the certification." So for commercial operations, regular testing by a labratory is necessary, and is also a way to maintain quality control.

The bigger the batch, the better for the bottom line. "If it costs $1,000 to test a batch, then a 5,000 gallon batch costs 20 cents per gallon," said Fisher. "For a 10,000 gallon batch, that goes down to 10 cents a gallon."

Fisher and Earl sent their first samples out of state, but now use the recently established Montana State University-Northern Bio-Energy Innovation and Testing Center in Havre, a larger Hi-Line city 57 miles east of Chester.

Quality and Testing

The American Society for Testing and Materials (ASTM) defines biodiesel as monoalkyl esters of long chain fatty acids derived from vegetable oils or animal fats for use in diesel engines. Technically, a sample that does not meet ASTM standards for undiluted biodiesel is not considered biodiesel. The standard specifies the methodology as well as the limits for biodiesel fuel properties. Each property is important in assessing the performance of biodiesel, whether as a neat (undiluted) fuel or used as a blend (with petroleum diesel).

Jessica Alcorn-Windy Boy, director of Montana State University-Northern's Bio-Energy Innovation and Testing Center in Havre, confirmed a starting price of $1,600 for the full range of tests to verify that a batch of fuel meets ASTM 6751 standards. She qualified that by noting that since an important role of this non-profit institution is to promote Montana economic development, enterprises like small community producers could end up paying half that amount, "especially with repeat business." For hobbyists or small-scale producers, a more limited series of tests would cost about $200, and if a batch failed the very first test, which costs $75, no additional tests would be run, she went on to explain. Here are the ASTM 6751 battery of measurements.

ASTM D 6751
SPECIFICATION FOR NEAT BIODIESEL (B100)
AMERICAN SOCIETY FOR TESTING AND MATERIALS

- *calcium & magnesium*
- *flash point (closed cup)*
- *alcohol control (either a methanol content or flash point standard must be met)*
- *water & sediment*
- *kinematic viscosity (40 degrees Centigrade)*
- *sulfated ash*
- *sulfur—S15 grade/S500 grade*
- *copper strip corrosion*
- *cetane*
- *cloud point*
- *carbon residue (100% samples)*
- *acid number*
- *free glycerin*
- *total glycerin*
- *phosphorous content*
- *distillation, T90 AET*
- *sodium/potassium combined*
- *oxidation stability*
- *cold filter soak point (added Oct. 13, 2008; important for cold climate use)*

The staff at the MSU-Northern Testing Center, the partners at Earl Fisher (Case Study 1), and other commercial biodiesel producers interviewed for this report, emphasized the necessity of "quality, quality, quality" in producing biodiesel. Testing, particularly for those selling biodiesel, is an essential part of quality control. Moreover, it is in the self interest of anyone making biodiesel for self use to know that fuel going into expensive diesel engines will not cause harm, and that requires a level of testing.

Case Study 2: Costilla County Biodiesel Project

Costilla County shows feasibility of community-scale plant

Mesita, San Luis Valley, Colorado

County-owned and operated. Ben Doon, Co-Manager

- **Biodiesel production:** Production began in spring 2007, in batches of 100 gallons. The plant has been producing approximately 200 gallons per week, but is upgrading to raise capacity to 400 gallons/day or about 100,000 gallons/year.
- **Oilseed crushing:** Crushing began in 2007 also, using locally grown canola, generally non-food-grade, as the feedstock. Four Chinese-made presses have the capacity to crush up to a total of five tons of seeds per day, and equipment recently acquired from India will enhance the process (heating, stirring, filtering) and improve performance.
- **Markets:** All fuel is used by Costilla County's fleet of vehicles, although selling to local farmers is a possibility in the future. Meal is sold to local farmers. Some glycerin is sold to local soap makers, but primarily it will be used for space heating of county buildings and perhaps as process heat for the biodiesel operation.
- **Financing:** The plant is publicly funded by county, state and federal government agencies. The county supplied the building and labor, and federal grants covered much of the equipment and research and development costs.
- **Employment:** Five people are employed in this project, and although some of the work is seasonal (as with the seed crop), this is a significant boost in a county with high unemployment. When the plant raises production to 100,000 gallons per year, because of automated systems five people still should be able to handle the work.

Historic Mountain Valley

The San Luis Valley sits at an altitude of 8,000 feet. There are 425,000 harvested acres in the valley. Rainfall is sparse, but mountain streams provide water for irrigation. Costilla County, one of six counties in the valley, had a population of 3,663 in 2000; 67% was Hispanic, many descended from long-ago settlers from Mexico. San Luis, the county seat, is the oldest town in Colorado. In 2000, median household income in the county was less than $20,000 a year, and 20% of the county's families fell below the poverty level. Small family farmers raise cattle, horses, pigs, goats and other livestock, and grow hay, alfalfa and barley. Larger farmers raise cash crops like potatoes and malting barley.

Community Development Through Biodiesel

In 2001, Costilla County convened a public forum, with the help of the Rural Community Assistance Corporation (RCAC), to set priorities for its needs. Biodiesel emerged as one of the top 12 priorities, in part due to the high use of diesel in the valley and the viability of oilseed crops. County Commissioner Joe Gallegos, who had a background in mechanical engineering, and a retired chemist, Dan Quintana, researched and designed the biodiesel project. After a visit to Iowa State University's biodiesel demonstration plant confirmed the viability of this proposal, the County took on the cost of constructing a building in the small town of Mesita and installing electronic and other infrastructure, while federal grants covered other expenses. One motive was to create a successful community-scale biodiesel plant to demonstrate its feasibility to the private sector.

Some residents questioned county government involvement, however, in this "cash-strapped" place, Ben Doon, co-manager of the county biodiesel project, said county government is the only entity with any money to launch such a venture.

Other residents questioned whether biodiesel could compete in price with petroleum diesel—then still selling for about $1.35/gallon—never foreseeing that in three years, during summer 2008, petrodiesel would climb to more than three times that price.

The Costilla County biodiesel initiative was aided immensely by Dan Quintana's chemical engineering expertise, Doon noted. Hiring outside professionals with Quintana's skills would have been costly and would have slowed down the project. A $25,000 grant from the Governor's Energy Office and two grants from a private family foundation, amounting to $4,500, helped pay for computer software and various services, but it is Costilla County and various federal agencies that have made this happen. The county has endeavored to match federal grants on a 1 to 1 basis, and its investment since 2004 in the building, electrical infrastructure, labor and other expenses is about $400,000.

Federal grants began in 2003 with $50,000 for research and development. In 2004 a rural development grant of $150,000 from the U.S. Department of Agriculture (USDA) paid for biodiesel equipment, while $50,000 from the Environmental Protection Agency (EPA) to support this innovative pilot program also helped. In 2007 a congressionally directed (earmarked) grant of $270,000 from the Department of Energy arrived, and a USDA Natural Resources Conservation Service grant of $35,000 arrived in 2008 to fund work with a growers' cooperative for furnishing feedstock.

San Luis Agriculture

Canola has been planted in the San Luis Valley for 15 years, since a hybrid seed program was started in the valley. Canola (the word is derived from "Canadian oil, low acid") is an improved variety of rapeseed, low in erucic acid, and can be processed into a high quality cooking oil as well as feedstock for biodiesel. By weight, one can normally count on one-third oil and two-thirds meal from crushing oilseeds, but Doon said the oil content of San Luis Valley canola runs as high as 45 percent. Canola, he said, makes "better quality fuels" that work "better in machines"; it grows well in cold climates, and its relatively low gelling point is an advantage in this valley, where temperatures can fall as low as minus 30 degrees F.

Feedstock for the project comes entirely from a radius of 100 miles. Seven hundred to 1,000 acres provide sufficient canola for the Costilla plant at its present level of production. There are no contracts with growers to provide feedstock; the plant counts on purchasing non-food-grade seeds. Growers in the valley can earn premium prices for canola that meets buyers' specifications. "If we

offer 18 cents a pound for 'off-spec' seed, buyers of food-grade canola are offering 28 cents," Doon said. There is talk of growing more canola in the valley. It is viewed as excellent planted in rotation with other crops, helping to control diseases and pests, but one drawback is the cost of transporting seeds or oil from this remote region to distant markets.

Seed cleaning goes smoothly, Doon said, because canola seeds are rounder and more consistent in shape than certain other oilseed crops such as sunflowers. Hwever, obtaining equipment for a small-scale facility like this has been a challenge. The Chinese seed crushers instruct users to pre-heat the seed, but provide no way to do that. The equipment recently acquired from India includes a seed kettle with heat elements and a mixer paddle (to stir the seed). Seeds have been fed to the crushers by hand, but automated systems will replace that labor-intensive process.

After seed crushing, a batch can be brewed in about an hour, then has to settle before undergoing further refining. There are two reactors and two settling tanks in the facility. The B100 fuel created was stored initially in 50 gallon drums inside the shop, but bulk fuel tanks are now in place. Cleaning is not done with water, but with a filter and centrifuge system, thanks to relatively new ion exchange technology and appropriately sized centrifuges.

Marketing the Products

Distribution of fuel and meal is all local. County vehicles burn 100 percent biodiesel (B100) during the warm months, and in colder times the plant does a "splash blending" of B100 and petrodiesel, usually to B50. Eventually, upgraded equipment will enable workers at the county plant to do more precise blending.

The meal, high in protein and fat (energy), is pressed into "cakes" and packaged in 100-pound sacks—another labor-intensive process that with upgrading may become more automated. In this form, the meal is sold directly to local farmers at about 14 cents per pound. That is a better price than they would pay for commercial livestock feed imported from outside the valley, yet it still allows the biodiesel plant to get a return on investment and labor. Selling the meal, Doon said, is absolutely crucial to this project's financial viability.

Glycerin is a co-product with a variety of uses, but markets for it are distant. Some glycerin goes to local cottage industries that make soap, but this market is very limited. The County plans to blend most of it with fuel to help heat the building housing the biodiesel facility, replacing waste oil (petroleum), which is in high demand, said Doon. No natural gas is available in the valley, and the price of propane for space heating is prohibitively high.

Methanol is costly, especially when purchased in 55 gallon drums; however, one of the upgrades of this plant is a 500-gallon tank that allows this key ingredient in biodiesel to be purchased in bulk. Additional savings will result from recovering the methanol during the process; part of a recent Department of Energy grant is projected to pay for installing that technology.

The future of the Costilla County Biodiesel Project could involve offering biodiesel to local farmers and other consumers. Doon said that demand is certainly there, especially for on-farm use, but for now supplying biodiesel to the County and selling meal to local farmers and ranchers remains the priority.

Case Study 3: Oregon

Renewable Fuels Standard spurs Oregon private-public venture

This case study features a private-public partnership, a business relationship between canola growers in northeastern Oregon and a biodiesel producer in the Willamette Valley which works because there is a third party involved—a buyer. The City of Portland Water Bureau contracts with Madison Farms to grow, or obtain from other growers, feedstock for the biodiesel that the bureau uses in its fleet of vehicles. This provides the farmers a secure market. Madison Farms, through an affiliated business, K & S Madison, Inc., crushes the seeds, and SeQuential/Pacifc Biofuels (SQPB) sends trucks to haul the canola oil back to its plant in Salem for processing. The Portland Water Bureau's purchase of biodiesel from SQBP provides another guaranteed market, this time for fuel producers.

Whereas Earl Fisher Biofuels in Montana is primarily a private operation and Costilla County in Colorado is almost totally a public project, in Case Study 3, Madison Farms, SeQuential Pacific Biofuels (SQPB), and the City of Portland mingle the private and the public in a unique way that highlights the value of Renewable Fuels Standards as a keystone public policy in establishing biodiesel production capacity.

Madison Farms

Echo, Oregon (pop. 650)

Kent Madison, owner

- **Feedstock for Biodiesel:** Kent Madison and other farmers in northeastern Oregon are growing canola and crushing the seeds as feedstock for biodiesel. In 2007 approximately 100,000 gallons were sold for biodiesel and in 2008, as much as 200,000 gallons were projected.
- **Private financing:** While oilseed growing and crushing operations are financed by the farmers, their market is secured by a contract to supply feedstock for biodiesel used by a public entity, the Portland, Oregon, Water Bureau. Meal is sold locally.
- **Employment:** The crushing plant employs 6-7 workers, and harvesting crops for fuel as well as food has stablized existing jobs on area farms.

Developing a Market

"Developing a market is the first step," Kent Madison said. The uniqueness of his canola growing and seed pressing operation begins with his contract to provide feedstock for the biodiesel which powers the Portland Water Bureau's fleet of vehicles. The contract guarantees a price that essentially removes Madison and his group of northeastern Oregon canola growers from the vagaries of the global commodities market.

At the end of the growing season in 2008, nine farms were in the program, growing canola for fuel on 1,200 dryland acres and 1,500 irrigated acres. K&S Madison, Inc, buys the canola seeds, extracts canola oil and de-gums it ("decant, centrifuge, settle out" is how Madison described the process) before sending it to Salem for conversion into biodiesel. There is plenty of demand for the meal as a high quality livestock feed, and all of it is sold locally.

The contract with Portland is flexible. Madison gets paid for "all costs associated with the entire process," but this works both ways: Adding value to the canola meal by "pelletizing" it, Madison was able to sell this product, in a more convenient form, for a higher price. This higher price for meal resulted in Portland's paying a lower price for oil.

Madison said the arrangement linking the end user (City of Portland) to the growers adds an element that helps reduce carbon. SeQuential-Pacific Biofuels tanker trucks haul the oil 250 miles from Echo to the bio-refinery in Salem, then the biodiesel is transported 50 miles north to Portland. In turn, the Portland Water Bureau ships biosolids from its sewage treatment plant 200 miles to Madison Farms, where they are applied to fertilize the ground that grows the canola for fuel.

In 2006, SQPB's Salem plant converted 20,000 gallons of canola oil into biodiesel. In 2007, the yield at K&S Madison rose to approximately 100,000 gallons, and some of those 2007 seeds were still being crushed in summer 2008. Madison sees "a growing group of growers" harvesting crops for fuel as well as food in his area, and says "the local farm economy is healthier because of this." In October 2008 Madison was anticipating that this year's canola crop could produce between 150,000 to 200,000 gallons of canola oil.

"We truly have oilfields in Oregon—finally. And you don't have to drill for it," Madison said.

The high yields of canola oil—up to 45%—reported from Colorado's high, cool San Luis Valley (see Case Study 2) line up well with estimates of 43% oil from canola grown in North Dakota and 40% from Montana. Compared to these, Kent Madison's estimate for the oil content in eastern Oregon canola is quite conservative—24% oil and 76% meal.

In the summer of 2008 K&S Madison was pressing 8-10 tons of seed per day. This equates to between 6 and 7 million pounds per year. Madison said that one job could be added for every 1 million pounds of seed processed; so this means six or seven new jobs in the community. He indicated that he had added several jobs within his own operation. He was not sure that other farms had added any new jobs, but by harvesting crops for fuel as well as food they've made the existing jobs more stable and have strengthened the entire local economy.

Madison sees benefits to the local ecosystem as well. Like many farmers and biodiesel producers, he cited the benefits of canola or other oilseed crops grown in rotation with wheat: disease cycles are broken, and farmers often report 10-20% increases in yields of wheat grown on ground that the previous year had grown canola. Madison mentioned one farmer who claimed his yield had increased by 30%.

Madison is capable of producing biodiesel for use on his own farm and did so in 2006. "That was when canola was 8 cents a pound and petroleum diesel was selling for $4.00 per gallon." Since then he has been running his trucks and tractors on petroleum diesel, although he plans to produce biodiesel for his own use "when the economics are there."

Nonetheless, Kent Madison believes that biodiesel is worth far more than petrodiesel because biodiesel burns cleanly, can prolong engine life, and is a renewable resource. These advantages are not rolled into the price any more than the disadvantages of petroleum—finite, polluting, heavily subsidized—are rolled into its price. Ideally, Madison said, consumers should be willing to pay "never less than 50 cents per gallon" more for biodiesel than for petrodiesel.

SeQuential-Pacific Biodiesel, LLC (SQPB)

Salem, Oregon (pop. 143,000)

Tyson Keever, General Manager

- **Biodiesel Production:** SeQuential has been producing biodiesel since August 2005. This is the first commercial biodiesel production facility in Oregon and the second such facility in the Pacific Northwest. In September 2008, production capacity was expanded to 5 million gallons/year, although actual production at that time was approximately 1 million gal/year. Storage capacity was recently expanded, from 10,000 gallons to 200,000 gallons.
- **Financing:** Financing is largely private, although Renewable Fuel Standards adopted in both Portland and the State of Oregon secure a critical market for biodiesel. (See 'Forward Thinking' Oregon" page 19.)
- **Multiple feedstocks:** SQPB processes used cooking oil; oilseeds including canola, camelina, sunflower, safflower; and (outside the region) non-food-grade peanut and olive oils. SQPB does not crush oilseeds, but works with six seed crushers (including K&S Madison, Willamette Biomass Producers, three others in Oregon, and one in Washington) and these supply 30-40% of SQPB's feedstock.
- **Distribution:** SeQuential-Pacific's Salem plant supplies the Portland Water Bureau with more than 100,000 gallons of biodiesel per year, but also maintains a network of 35 fuel distribution sites from Vancouver, Washington, in the north to the California border in the south, through which the company sells gasoline, biodiesel (B5, B20 and B99) and ethanol (E10 and E85).
- **Employment:** There are 30 jobs, including workers at the Salem refinery, drivers, station attendants, and management level personnel.

Used Cooking Oil

Tyson Keever helped start SeQuential Biofuels in Oregon and values the joint venture formed with Pacific Biodiesel, which started on Maui, Hawaii, in 1996 as the first commercial biodiesel producer in the U.S. using recovered cooking oil and has, Keever says, "great technology."

Between 60% and 70% of SQPB's feedstock comes from used cooking oil collected from restaurants and food processing operations, Keever said. However, used cooking oil is "a limited resource," Keever said. A "ballpark" estimate of cooking oil available for refining into fuel is one gallon per person per year. For Oregon that adds up to 3.5 million gallons. Since the state of Oregon uses 720 million gallons of (predominantly petroleum) diesel per year, "the real opportunity for growth," said Keever, "is with oilseed sources—and secondarily with animal fats, tallow." Asked about the price of used cooking oil, Keever pointed to a Fall 2008 Chicago Board of Trade (CBOT) price of $2.75/gallon.

However, it is doubtful that SeQuential-Pacific is paying that much for used cooking oil. Rogue Biofuels—self-described "grease collectors" in the Medford-Ashland, Oregon, area, who produce and sell biodiesel in that same area—offers restaurant sources 50 cents per gallon. Gabe Rowland of Rogue Biofuels says that his company essentially "has no competitors" for used cooking oil in its region and sometimes still pays nothing.

That is the case with smaller scale biodiesel producers in places like Montana. Sam Hoffman, who runs a microbrewery in Red Lodge and brews biodiesel in his garage, and Scott Brown, whose operation in Belgrade is larger, pay nothing for the cooking oil they collect. Restaurants in their respective areas are glad to avoid paying for disposal of what is still, in this region, considered a waste product, not a resource.

The Chicago Board of Trade price likely reflects the value of waste cooking oil used as an additive to livestock feed. The price has a lot to do with distance between food processors and livestock feeding operations, located primarily in the Midwestern United States.

Defining Local

For canola oil, "local" can mean 50 or 60 miles around the Costilla County, Colorado plant or—in Oregon—hauling it 250 miles from Echo to Salem. SQPB has imported camelina seeds from as far away as Montana.

The main vegetable oils which SeQuential-Pacific uses (whatever the source or distance) are canola and camelina, which Keever considers great to work with. The plant also processes sunflower, safflower, and non-food grade peanut and olive oils.

Keever acknowledged that the slowness of the U.S. Food and Drug Administration in approving camelina meal for livestock feed is a big problem. FDA approval is expected to come through in 2009, according to Montana State University Extension officials. (See Using Camelina in Livestock Feed on page 30.)

The single commercial-scale biodiesel producer located in Idaho, Rob Black's Blue Sky Biodiesel, is very near its feedstock: food processing oils from a nearby plant run by the huge Simplot corporation.

Whatever the size of the operation, the nearer the feedstock the better, since feedstocks constitute about 80% of the production cost.

Incentives and Renewable Fuel Standards

The $1.00 per gallon federal excise tax credit has been a "huge boost" to the industry and drives prices down for consumers, Keever said. Keever believes that the federal incentive allows fuel producers to pay farmers a higher price for their seeds and crushers a higher price for their oil. He

expressed frustration that the federal tax credit is only 50 cents/gallon for collectors of used cooking oil. He praised Oregon's 10 cent per gallon tax credit for waste oil collectors who produce biodiesel, along with the 5 cent per pound state tax credit for farmers growing oilseeds for fuel. But perhaps the largest government incentive for his company, at the moment, comes from the biodiesel Renewable Fuel Standards adopted by the City of Portland and the State of Oregon. This public commitment to buy clean, renewable fuel has laid the groundwork for several private sector businesses, including the two in this case study, and cushioned them through the wild markets of 2008. The Portland RFS specifies that 50% of the biodiesel used come from Oregon feedstocks. It also prohibits imported palm oil as a feedstock.

Portland Water Bureau

Portland, Oregon (pop. 568,000)

A City's Transition to a Renewable Fuel

- **Biodiesel consumers:** The Portland Water Bureau was projected to consume 90,000 gallons of biodiesel in 2008, using B100 in the summer and B50 in cooler months. The Water Bureau manages a rainwater-driven, gravity-fed, unfiltered system that serves 800,000 people in the region. It has 640 employees, a $122 million annual budget, and a host of backhoes, dump trucks, graders, excavators, water service trucks, welding and crane trucks, pickups, forklifts, tractors, mowers, work vans, passenger vehicles, generators and compressors. More and more, the engines powering this equipment are running on biodiesel. The Water Bureau is leading the way for a transition by Portland's city government to use renewable fuels in all of its fleets. Since 2004, the Water Bureau has steadily and rapidly increased its biodiesel consumption relative to petroleum diesel.

Reasons for Municipal Biodiesel Use

"Why Use Biodiesel?" asks a slide in a Water Bureau power point presentation. The answers are that biodiesel: (1) can run in most diesel equipment with few or no modifications, (2) adds lubricity to fuel, (3) reduces global warming and particulate emissions, (4) is non-toxic and biodegradable; (5) is renewable, (6) can be made in the U.S., thus reducing dependence on foreign sources of fuel; and (7) offers economic development opportunities, especially in rural Oregon where farmers can grow the feedstock.

In 1993, Portland became the first local government in the U.S. to adopt a plan to address global climate change. In 2001, the city adopted a local action plan on global warming and set a goal of reducing greenhouse gas emissions to 10% below 1990 levels. In August 2004, the entire Portland City fleet, including the Water Bureau, switched to 20% biodiesel (B20). The Water Bureau noticed no measurable increase in maintenance, no reported power reduction and negligible operational change. In 2005, the first full year of this program, the city—including the Water Bureau—used 120,000 gallons of biodiesel and 480,000 gallons of petroleum diesel, a total of 600,000 gallons.

Increasing Biodiesel Consumption

In 2006, the Water Bureau moved to using greater percentages of biodiesel in its fleet while the remainder of the city fleet stayed at B20. This move by the Bureau increased research and direct involvement by staff personnel in order for them to 'buy in" to the program. Overall diesel consumption by the City of Portland remained at 600,000 gallons in 2006, but biodiesel use rose to 150,000 gallons and petrodiesel fell to 450,000 gallons. While other city departments continued running B20 year round, and used 100,000 gallons of biodiesel and 400,000 of petrodiesel, the Water Bureau moved to B50 in the cooler months, November to March, and B100 from March to November, in most of its vehicles. In 2006, the Water Bureau ended up using half biodiesel and half petrodiesel— 50,000 gallons of each.

In summarizing its experience at the end of 2006, the Bureau noted the following changes: (1) frequent fuel filter changes—which began declining as biodiesel began to clean out the engines; (2) some power loss, especially in heavily loaded vehicles—but this was partly due to clogged fuel filters and actually was less than expected; (3) some reduction in fuel efficiency; (4) cleaner emissions; and (5) "employees wanting to make a difference."

In 2007, biodiesel consumption increased in both city and Water Bureau vehicles. City vehicles moved to the B20-B50 range, while Water Bureau vehicles remained in the B50-B100 range. The Water Bureau used 80,000 gallons of biodiesel and only 35,000 gallons of petroleum diesel.

For 2008, projections were that biodiesel consumption by Portland City fleets would exceed consumption of petroleum diesel. Running everything on B50, the city fleet, not including the Water Bureau, would use 250,000 gallons of biodiesel and 250,000 gallons of petrodiesel. The Water Bureau was expected to increase consumption of biodiesel to 90,000 gallons and reduce consumption of petroleum diesel to 25,000 gallons.

Even a villange can support biodiesel

It doesn't take a city to guarantee a market for biodiesel; a villiage can do it as well. Sparsely populated Costilla County, in rural Colorado, runs its county fleet on biodiesel (see Case Study 2). Another possiblity; school districts could begin running their buses on biodiesel.

Every year, around the United States, some 450,000 public school buses travel an estimated 4.3 billion miles to transport 23.5 million children to and from school and school-related activities.

Here is a scenario based on a hypothetical rural school district in the West.

Suppose our school district has five buses, with an average route of 13.5 miles. If each bus runs out and in twice each day, it will travel 54 miles per day. All five buses will travel 270 miles per day. Over 180 school days, the buses will go 48,600 miles. Add 10% for trips to music or sports or other events, and the total is 53,460 miles per year for this school district.

School buses get 5-8 miles per gallon of diesel. At 8mpg, that comes to 427,680 gallons of diesel per year. If the buses start out using B20, that would create a market for 85,536 gallons of biodiesel per year.

In warmer months, the biodiesel blend could increase to B50 or more, and this—along with potential sales to local farmers or truckers—could provide enough demand to support local farmers growing feedstocks, and four or five workers running a modest-sized plant—and most of the money would stay in the local economy.

'Forward Thinking' Oregon

Tyson Keever of SeQuential Pacific Biofuels praised the state of Oregon as "forward thinking". The results of Oregon's public policies on renewable fuels are impressive, according to Keever, who pointed out that between 2006 and 2008 private industry in Oregon invested $300 million in biofuels (biodiesel and ethanol).

The State of Oregon has taken several steps to ensure the development of a strong in-state renewable fuels production sector.

Oregon's House Bill 2210, adopted in 2007, includes a number of biodiesel incentives, which benefit people all along the chain of production: farmers producing feedstock, producers and distributors of biodiesel, and consumers and buyers of alternative fuel vehicles (AFV).

All diesel fuel sold in the state must be blended with 2% biodiesel within three months after biodiesel production in the state has reached at least five million gallons. Feedstocks must come from sources in the Pacific Northwest, which includes Oregon, Washington, Idaho, and Montana. The biodiesel renewable fuels standard will increase to 5% when production reaches at least 15 million gallons, on an annualized basis, for at least three months.

Oregon offers a loan program on alternative fuel projects such as fuel production facilities, including dedicated feedstock production, fueling stations, and fleet vehicles. Growers of oilseed crops in Oregon receive a tax credit of $0.05 per pound for oil to be turned into fuel.

Oregon's state tax credit for farmers who grow oilseed crops for fuel is a real advantage, Kent Madison said. For example, when commodity prices rose precipitously in 2008, a farmer could get 3 cents more per pound for food grade canola than the amount guaranteed by the contract with the Portland Water Bureau (the figures cited by Madison were 32.5 versus 29.5 cents per pound). The 5 cents per pound tax credit more than makes up this difference. One problem for farmers is whether they are making enough income to utilize tax credits. Many do not – at least not every year.

Oregon offers a property tax exemption on property used to produce biofuels, a business energy tax credit of 50% on the cost of constructing an alternative fuel facility, and a 25% tax credit on constructing or installing alternative fuel vehicle fueling infrastructure.

State law requires that all state agencies and transit districts purchase AFVs and use alternative fuels in these vehicles to the maximum extent possible, except when it is not economically or logistically possible to purchase or fuel an AFV. Oregon residents who purchase gasoline blended with 85% ethanol (E85) or biodiesel blends of at least 99% (B99) for their AFVs qualify for an income tax credit of $0.50 per gallon, up to $200 for each AFV that is registered in Oregon. The state also offers both individuals and business owners an income tax credit on the purchase of qualified alternative fuel vehicles.

The City of Portland is phasing in a city-wide biodiesel fleet standard, as well as a commitment to use a 20% blend in its city-owned vehicles in 2004. In July 2006, Portland became the first U.S. city to adopt a local renewable fuel standard, with a goal of B5 by July 2007 and growing to B10 in July, 2010. The Portland Water Bureau ran its equipment and diesel engines on 99% biodiesel during the Summer of 2006, the largest B99 fleet in the U.S. It negotiated an agreement with farmers in Northeast Oregon to provide 250,000 gallons of canola oil annually.

Case Study 4: Midwest Biodiesel Producers, LLC

Small town home to South Dakota's only biodiesel plant

Alexandria, South Dakota (pop. 500)

Brian Stork, part owner and operator

- **Biodiesel production:** In 2008 Midwest was "the only biodiesel plant in South Dakota," according to Brian Stork. It can produce 2 million gallons per year. Upgrades are in process to raise this to the originally designed capacity of 7 million. The patented transesterification technology in this plant was developed by University of Idaho-based biodiesel expert Jon Van Gerpen, one of the investors in this plant. It uses no water for washing; however, water must be on hand because South Dakota requires a sprinkler system in any building containing at least 10,000 gallons of fuel. The process is also versatile enough to convert vegetable oils, used cooking oils or animal fats to fuel. Due to the higher energy costs required to process animal fats, Midwest tends not to use them.
- **Feedstock:** Corn oil is the primary feedstock, due to the proximity of eight corn ethanol plants within 100 miles. Two of these are in Sioux Falls, 50 miles away. Soybean oil is also available in this region. Since the cost of feedstock is a huge factor, diversifying sources of feedstock is important, so Stork said that part of the upgrade involves installing a seed crushing operation.
- **Private financing:** Four initial investors started Midwest Biodiesel, Stork said. Nine investors now own the plant. To help finance the upgrading, 25 more investors, at $25,000 apiece, are being added. As far as public incentives, Stork stated that the dollar-per-gallon federal blenders tax credit "built this industry." If it is allowed to expire, Stork said, "there would be a six month wash-out."
- **Distribution:** Midwest has a retail blender's license and sells directly to the end user. Once the seed crushing is operational, there will be meal to sell to livestock feeders in the area, and Stork mentioned no problem in finding markets, or local uses, for glycerin.
- **Employment:** The plant currently employs 10-11 people and the workforce will grow to 24 when the plant is upgraded to the full capacity of 7 million gallons/year.

Why is "the only biodiesel plant in South Dakota" in this small town?

A native of the South Dakota, Brian Stork left the state 25 years ago, worked in the Texas petroleum industry, was a Red Wing Shoe distributor handling 482 retail outlets all over the West, and was involved in building a 30 million gallon per year biodiesel plant in Iowa. He came back to South Dakota to work on a smaller, more localized level.

"The public does not understand the benefits that farming communities bring to the U.S. Reviving rural America is important," Brian Stork told interviewers.

He bought some land, helped start the Alexandria Economic Development organization, then stepped aside once it was going. He told the local banker that he would not finance his house with that bank unless it guaranteed not to sell the mortgage to another financial institution. The banker agreed. Stork made certain that the local school officials understood that a biodiesel plant would mean more jobs, and that could mean up to "two and a half kids per worker" for the school system to accommodate.

Stork and the other investors who built Midwest Biodiesel Producers brought wide-ranging expertise to the project, including college degrees in electrical engineering, business administration and agronomy; experience in processing industries, grain trading and state government; leadership roles in the military, ownership of an ethanol plant, management of a soybean crushing facility, and training in diesel mechanics. All this helped reduce the costs of hiring expertise from outside. And the fact that most of the investors were involved in farming inclined them to scavenge for equipment instead of buying new.

"The plant from eBay" is what one of the initial investors, farmer Paul Shubeck, has called it. "Instead of a grandiose 20-million gallon plant," Shubeck said, "we built a 7-million gallon plant with used dairy tanks, heat exchangers, nitrogen purifier and boiler. But our junk works."

When the upgrading currently in process is completed, Stork expects there to be 24 jobs associated with the plant, he said. "10 or 11" work there now, and the remainder will be added as needed to work in the expanded plant or the oilseed crushing operation. Twenty-four workers, Stork said, could translate into as many as 56 more students in the school system—assuming those workers all live in or move to the community. Resident workers and their families also will be supporting local businesses. Thus, biodiesel production can foster local economic development on a number of levels.

In the case of the Alexandria plant, Stork said, local means maximum distances from the plant of 50 miles for those in the labor force (preferably closer); 100 miles for obtaining feedstock (though 50 would be better); and 100 miles for marketing fuel and other products.

Vision of Community-scale Plants

Stork has a vision of many decentralized biodiesel plants in rural towns. Midwest Biodiesel, with its 2-7 million gallon/year capacity, is a larger facility than Stork envisions for other towns the size of Alexandria. What he has in mind for them are plants producing from 500,000 to 1 million gallons. "So many towns of 500 are decaying," he said, and he believes that plants of that size could help reverse that decline in South Dakota and the rural West. "The smaller the scale, the less risk," Stork said. "Twenty small plants are better than one big one."

Stork foresees establishing a management team to work with "hardship communities" in areas where sufficient feedstock could be produced within a reasonable distance from the plant. Two key people are needed, he said, to set up biodiesel plants: "a process engineer and a finance guy—and it's too expensive for a small town to put them on a payroll." But a management team such as Stork envisions could hire them, and put their expertise to work in creating a number of community-size plants.

Stork advocates considering a non-profit model for such community enterprises. Why? More funding would be available, he said, and many expenses could be written off. He emphasized the importances of producing quality fuel: "One bad batch, and you can't sell anymore for six or eight months."

Gallons Per Acre and Fuel and Food Security

When times get tough, Stork said, farmers will be thinking not only in terms of bushels per acre but also gallons per acre. So if farmers in his region typically use 5 to 7 gallons of fuel per acre to produce their crops, then a 500,000 gallon per year biodiesel facility would supply enough fuel to cultivate and harvest approximately 83,000 acres.

How many of those 83,000 acres would be needed to grow oilseed crops as the feedstock for that much fuel? The answer varies with the crop, with the location, and with rainfall and temperatures during the growing season. However, taking a fairly conservative estimate of oilseed crops yielding an average of 50 gallons per acre, then 10,000 acres could produce 500,000 gallons; 10,000 out of 83,000 acres is about 12 percent. As yields go up, the percentage of acres devoted to growing fuel would go down.

Stork estimates one could figure on taking 60 acres out of a section (640 acres) to grow the fuel to farm that section, a little over 9%. But this would vary with specific oilseed crops: Forty acres of mustard, he said, could produce enough fuel to farm 1000 acres, or 4%; 60 acres of camelina could do the same or 6%. These latter percentages are in keeping with estimates from other farmers around the semi-arid West. Among them is Bob Quinn of Big Sandy, Montana, who estimates that 5% to 7% of his land can produce enough fuel to run his entire farm.

Quinn and others like to point out that when plowing, harvesting and hauling were done by horses (or other livestock), as much as 40% of a farmer's acres were required to grow feed to "fuel" the horses. So a range of 5-10% to grow fuel looks reasonable.

Whatever the percentage may be of acres to grow fuel compared with acres to grow food and fiber, the fact is that farmers all over the country could grow their own fuel. In the event of a shortage of petroleum diesel, this has obvious appeal.

The Case for Straight Vegetable Oil

Bob Quinn is an innovative and prosperous organic farmer and renewable energy entrepreneur who believes that farmers should grow their own fuel. But Quinn aims to burn not biodiesel but straight vegetable oil—SVO—at least during the warm months of the year.

He is not alone. Compiling this report, the authors spoke directly with, or heard reliable reports of, farmers in Montana, North Dakota, Minnesota, Colorado and elsewhere who are doing just that. SVO's advantages include its simplicity: no need for methanol (or ethanol) and lye; hence, no need to deal with the byproducts of transesterfication. And since SVO contains the glycerin that biodiesel eliminates, it actually has a higher energy value.

However, the engine has to burn hot enough, long enough, to fully combust the glycerin. Otherwise, fuel lines and engines can quickly clog; hence, the advantage of biodiesel. "It's more versatile," Quinn concedes, and thus far, more suited to commercial distribution.

There are two paths: modify vegetable oil to get biodiesel or modify the diesel engine and fuel delivery system to use straight vegetable oil. Bob Quinn believes that a combination of both paths can point American farmers toward energy self-reliance.

Case Study 5: Inland Empire Oilseeds

$13 Million Plant is Key to Rural Economic Development in Eastern Washington

Odessa, Washington (pop. 1,000)

Pearson Burke, Marketing and Logistics

Keith Bailey, Odessa Public Development Authority

- **Biodiesel production:** Once fully installed, the seed crushing line capacity will be 4 million gallons per year, which will supply half of the plant's 8 million gallon per year capacity. This plant is a continuous feed, not a batch processing system, which means that it is a more highly industrialized and engineered scale of production typical of larger volume processing.

- **Feedstock**: The plant is starting with canola, but the developers are looking at using other feedstocks, including soy oil and tallow. The owners had initially hoped to focus on canola-based biodiesel and sell it at a premium. In the volatile commodities markets of 2008, however, the opportunity to market canola-based fuel for a premium did not materialize. Camelina has also been mentioned as a possible feedstock.

- **Ownership and financing:** Two local grain co-ops, a seed company and an individual investor build the $13 million plant. Inland Empire Oilseeds is seen as an important rural economic development project in the dryland grain farming country of Eastern Washington, and about $4 million in public assistance has been funneled to it through the Odessa Public Development Authority. This includes an Energy Freedom Loan of $1 million and $3 million more in other grants and programs from the State of Washington.

Getting Started

Inland Empire produced its first batch of biodiesel (approximately 35,000 gallons) in mid-November, 2008, according to Pearson Burke. "We sent out our samples for ASTM testing and the results came back very good. We then sent the test results to EPA to get our final permit. We received that but we were also notified by the State of Washington that we needed a Fuel Distributors License. We are in the process of obtaining that."

Four years in development, the plant cost $13 million to build. Two local grain cooperatives, Odessa Union Warehouse Cooperative and Reardon Grain Growers, along with Reardon Seed Company, and Michael Dunlap, are the owners of this plant. In August 2007, Green Star Products, which provides the plant's totally enclosed transesterification technology, also became a partner. Green Star, based in Chula Vista, California, is involved in developing advanced biofuels such as algae biodiesel and cellulosic ethanol and other products, as well as lubricants, additives and devices to reduce emissions and improve fuel economy in vehicles, machinery and power plants.

When everything is up and running, this will be a full cycle, continuous process plant that crushes seeds, produces fuel and meal, and sells both. In 2008, however, the "market for biodiesel has not been great," Burke stated. "There appears to be a number of factors for this, both in the U.S. and globally. Hopefully the market will turn around. In the meantime, we continue to move forward with our crush line, with the permitting process and some of the electrical work." Plant operators are still fine tuning the equipment, Burke reports, as they prepare to go into production.

Washington State Biodiesel Standards Stimulate Markets

Washington State has in place a B10 Renewable Fuels Standard for its state-owned vehicles. Starting in November 2008, a B2 standard takes effect for all diesel sales in the state. While nearby Spokane could become a significant market, Burke expects initial demand to be "west of the mountains."

Mobile Crushing & Biodiesel Operations

Taking the technology on the road is one way to facilitate farmers growing their own fuel. The precedents for mobile technology are custom combiners who travel the country with state of the art equipment and experienced crews bringing in the grain harvest every summer and fall, or sheep shearing operations moving from ranch to ranch each spring. In the same way, seed crushers and biodiesel reactors could be hauled from farm to farm, or community to community.

Brian Stork of Midwest Biodiesel (See Case Study 4) envisions a portable operation consisting of three separate skid-built units (equipment mounted on a metal framework that can sit on a flatbed or other foundation):

(1) a seed crusher

(2) a reactor

(3) an energy unit

A single large farmer or a group of smaller farmers could host this operation, keep the meal, pay for the fuel, and either sell the glycerin (if there is a regional market) or use it for process heating.

There are several examples of mobile oilseed crushing and biodiesel processing. Paul R. Miller, a diesel mechanic and the fleet manager for a trucking company that hauls sugar beets to a refinery in Billings, Montana, has been assembling his own mobile crushing and fuel producing operation, which he anticipates taking on the road in 2009.

Already demonstration mobile units are touring in at least two states. In Montana, John Munsell takes his show on the road out of Miles Community College in Miles City. In Colorado, there are two portable units, Little SID and Big SID (SID stands for Seeds Into Diesel). Little SID was put together in 2007 through a venture capital grant from Colorado State University Extension to demonstrate the feasibility of a mobile seed crushing operation. It was part of a larger CSU rural development initiative studying five oilseed crops—soybean, safflower, sunflower, canola, and camelina—at nine locations with differing conditions: dryland, limited irrigation, and full irrigation. In 2008 a cooperative effort among CSU Extension, engineering students, and the International Center for Appropriate and Sustainable Technology (iCAST) led to the creation of Big SID.

According to "Bringing New Technologies to the Farm" in the Fall 2008 issue of CSU's Ag Family, *Big SID is mounted on a donated flatbed military truck and its five-ton-per-day oilseed press can expel 16 to 20 gallons of vegetable oil per hour, depending on the oil content in the seeds.*

"Big SID drives up to a farm," announces the story in Ag Family, *"loads the farm's oil seed crop, produces the month's biodiesel needs, sets the meal by-product aside for farm livestock, and travels on to the next farm."*

Case Study 6: Full Circle

'Closed carbon loop' is goal of Japanese-Canadian project

Shimane, Japan, and Hillsburgh, Ontario, Canada

The vision for this model is to create a "closed carbon loop" by growing oilseed crops, crushing seeds into vegetable oils for cooking, collecting the used oil, and then producing biodiesel to grow more oilseed crops.

Shimane, Japan

Montana chemist Nestor Soriano, who works at the Montana State University-Northern Biodiesel Testing Laboratory, encountered this full circle approach to biodiesel while in the small village of Shimane (pronounced Shee-MAH-nay), Japan. Originally from the Philippines, Soriano did graduate work in Japan, where he visited Shimane. There farmers grow sunflowers; sunflower oil is used in local food processing and then recycled into biodiesel. It is a very local, fairly small scale model, but as Soriano explained, "Shimane uses no fossil fuels."

Hillsburgh, Ontario (Erin Township, pop. 11,000)

Everpure Biodiesel Cooperative

- **Ownership:** The Everpure Biodiesel Cooperative is a joint venture between the Everdale Environmental Learning Centre, Power Up! Renewable Energy Co-op (PURE), and a local farmer, Jay Mowat.
- **Feedstock:** Locally grown oilseeds, including canola and soy, will be crushed into vegetable oil, which will in turn be "rented" to local restaurants and food processors, and then this used vegetable oil will be collected and processed into biodiesel. The biodiesel will fuel canola and soy farming operations and will also be sold at retail to members of the cooperative.

Starting By Developing the Market

Hillsburgh is home of a local non-profit organic farm and learning center called the Everdale Environmental Learning Center. In 2005 a local farmer and board member of Everdale, Jay Mowatt,

began looking into clean renewable fuels that could benefit farmers and the local community, financially and environmentally. The Everpure Co-op is starting with the end-user by selling biodiesel made elsewhere.

"I believe that diesel fuel and biodiesel should be decentralized, so instead of having some huge plant that pays a bunch of fancy engineers all the money, everybody should be able to produce fuel, keep the money local and not have such an impact hauling tractor trailer loads of fuel around."

During the Fall of 2008, the co-op was not yet producing fuel to sell, although trial batches had been produced. It had grown to 54 members, both farmers and consumers, with 30-40 members filling up on a regular basis. Two farmer-members were growing soybeans with an eye toward devoting them to this project, but, according to Garrett Wright, representative of the Co-op, the first step was to develop a market because people in the area were "not familiar with biodiesel" and questioned how it would work in their machines, especially in winter. For that reason, the co-op decided to start by selling biodiesel to its members.

The Co-op found a supplier, Greg Lougheed, a small-scale producer in Owen Sound, Ontario, about 125 miles away. Owner of a fish plant, Lougheed had become proficient in making quality biodiesel from a variety of used feedstocks. Lougheed's Biodiesel has a retail pump and delivers B100 to homes in the area for heating. In the summer of 2008, he began deliveries to the Everpure Co-op. He is happy to see another source for biodiesel become available, as he cannot keep up with demand.

Lougheed told a local journalist, "I believe that diesel fuel and biodiesel should be decentralized, so instead of having some huge plant that pays a bunch of fancy engineers all the money, everybody should be able to produce fuel, keep the money local and not have such an impact hauling tractor trailer loads of fuel around."[1]

Everpure is hoping to build its clientele to hundreds of biodiesel users. One edge it has in competing with regular diesel is that in Canada, biodiesel is not taxed.

One of the co-op steering committee members, Bill Wilson, a farmer, told a local magazine, "If we can make this thing work, at least then I would have fuel security. If you think back to the 1976 energy crisis, it wasn't a guaranteed thing that you could pick up a phone, make a call, and get fuel delivered." Farmers in the Northern Great Plains expressed similar concerns for reliability of fuel supplies during critical planting and harvest seasons.

The next step, after building the biodiesel market locally, is collecting used vegetable oil and increasing the volume of biodiesel being produced until the co-op can generate enough to meet members' demands. Within about 20 minutes of Hillsburgh, to the northeast, is Guelph, a university town of 200,000; to the southwest is Orangeville, population 100,000; and to the west is Georgetown, population 100,000. Plenty of used cooking oil ought to be available in these cities.

In addition to farmers and other biodiesel users, owners and managers of restaurants will be invited to join the co-operative.

The third and final step is closing the circle. Local farmer-members will grow and supply oilseed for crushing into virgin oil, which will be "rented" to local restaurants, then picked up again after their use to make into biodiesel which the farmers will use to fuel their operations.

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[1] Local Farm to Local Food to Local Fuel, *In the Hills*. Summer 2008.

Using Camelina in Livestock Feed

Camelina sativa *is a member of the mustard family. It is a short-season, fast-growing crop. Camelina can be planted in February, March or the fall and harvested in early to mid-summer most years, even in Northern climates, similar to winter wheat. It produces seed on less moisture than other crops and is a good rotation crop for fields that might otherwise lie fallow. Camelina water requirements are minimal and it takes less fertilizer than many other crops.*

Camelina typically contains 35-38% oil, which is high in omega-3 fatty acids. This makes the oil fit for biodiesel, and the meal is a protein-rich feed for cattle, swine and chickens. A yield of 1,200 pounds of camelina per acre will produce 420 pounds of oil (35% by weight). At a 75% oil recovery rate, this amounts to 315 pounds of oil. That leaves 885 pounds of oil-rich camelina meal.

A key sticking point to wider utilization of camelina as a biodiesel feedstock right now is that the Food and Drug Administration (FDA) has not approved the unrestricted use of camelina as a commercial feed ingredient for livestock. It has approved some specific trials and allowed some limited feeding of camelina meal up to 2% of the weight of the total ration for some case-specific users. More extensive use of camelina in feeding is pending approval, which may come as early as the first half of 2009.

"Livestock can tolerate only so much camelina meal because it contains glucosinolate, so only a percentage of the meal can be included in the animals' diet," according to Dr. Alice Pilgeram of Montana State University. MSU is conducting feeding studies to help inform the FDA and livestock producers on the amount of camelina recommended for safely feeding beef cattle, dairy cattle, poultry, swine and other livestock species.

Beef feeding trials currently underway at MSU show feedlot daily rates of gain were higher with a ration containing 3.5% camelina meal than with rations containing 3.5% and 7% soybean meal, according to a report in the Farm & Ranch Guide *in August, 2008.*

Researchers have fed camelina to chickens, goats and beef cattle with promising results in meat and milk products. Milk and meat show increased omega-3 content, which makes them a healthier product and worth more on the market, Pilgeram noted. MSU and Wheat Montana, a company producing and marketing breads, flour and other products using Montana wheat, are also testing camelina oil in bread recipes.

The U.S. Egg and Poultry Association provided supplemental funding to analyze camelina meal as an ingredient for production of omega-3 rich eggs. Poultry readily consumed feeds containing up to 15% camelina meal with no adverse effects on chicken health or egg production. The fatty acid profile of yolks from eggs from chickens fed different levels of camelina (0%, 5%, 10%, 15%) were analyzed for omega-3 content, and showed increases with increasing camelina content in the feed.

Camelina meal, within recommended ranges, presents some advantages as a livestock feed, according to Jason Willis, CEO at Fritz Farm in Montana's Flathead Valley. "We are positioning ourselves for the future," Willis explained, with plans to crush locally grown camelina and market the meal to area dairy operations that need reasonably priced feed. "We'll make biodiesel as a side product," Willis said, once the FDA approval for camelina meal is achieved.

Central Montana farmer and energy innovator Bob Quinn noted that "Camelina is a good crop in Montana. It requires low input, is drought and cold tolerant, has allelopathic properties (it inhibits growth of competing weeds and grasses), and it matures fast. You can plant it in February or March, if your winter wheat gets droughted out."

Appendix A:
Federal Biodiesel Laws and Incentives

A summary of the Federal tax laws and incentives that apply to biodiesel. (For more in-depth information go to: www.afdc.energy.gov/afdc/fuels/biodiesel_laws.html.)

1. Value-Added Producer Grants (VAPG) through the U.S. Department of Agriculture Office of Rural Development

Working capital available for rural development through individual state offices of rural development. (Reference 7 U.S. Code 1621)

Point of Contact
Office of Rural Development
U.S. Department of Agriculture
Phone (202) 690-4730
www.rurdev.usda.gov/rd/energy

2. Small Agri-Biodiesel Producer Tax Credit

A tax credit of $0.10 per gallon of agri-biodiesel is available to qualified small producers. A small producer is one that produces up to 60 million gallons of agri-biodiesel per year. The credit applies only to the first 15 million gallons of agri-biodiesel produced in a tax year and expires December 31, 2009. (Reference House Resolution 1424, 2008, and 26 U.S. Code 40A)

Point of Contact
U.S. Internal Revenue Service
Phone (800) 829-1040
www.irs.gov

3. Biodiesel Mixture Excise Tax Credit

Available for fuel registered with the US Environmental Protection Agency by the biodiesel producer confirming it is biodiesel or agri-biodiesel, and that it meets the requirements of American Society for Testing and Materials (ASTM) specification D6751. Only entities that have produced, sold or used the qualified biodiesel mixture as a fuel in their trade or business are eligible for the credit.

Biodiesel blenders registered with the Internal Revenue Service (IRS) are eligible for a volumetric excise tax credit in the amount of $1.00 per gallon of pure agri-biodiesel blended with petroleum diesel. (Reference 26 U.S. Code 6426)

The forms associated with the volumetric biodiesel credit are available on the Forms and Publications page of the IRS website, www.irs.gov.

Point of Contact : See IRS phone & website above.

4. Biodiesel Income Tax Credit

An entity that delivers pure, unblended biodiesel (B100) into the tank of a vehicle or uses B100 as an on-road fuel in their trade or business may be eligible for a nonrefundable income tax credit in the amount of $1.00 per gallon of agri-biodiesel (such as biodiesel made from soybean oil), or $0.50 per gallon of pure biodiesel made from other sources (such as waste grease). (Reference 26 U.S. Code 40A)

Point of Contact : See IRS phone & website on previous page.

5. Alternative Fuel Infrastructure Tax Credit

A tax credit is available for up to 30% of the cost of installing alternative fueling equipment, not to exceed $30,000. Qualifying alternative fuels include diesel fuel blends containing a minimum of 20% biodiesel. Fueling station owners who install qualified equipment at multiple sites are allowed to use the credit towards each location. Consumers who purchase residential fueling equipment may receive a tax credit of $1,000. (Reference 26 U.S. Code 30C)

Point of Contact : See IRS phone & website on previous page.

6. Clean School Bus USA

Clean School Bus USA, part of the U.S. Environmental Protection Agency's National Clean Diesel Campaign, is a public-private partnership that focuses on reducing children's exposure to harmful diesel exhaust by limiting school bus idling, implementing pollution reduction technologies, improving route logistics, and switching to clean fuels. Clean School Bus USA provides funding for projects designed to retrofit and/or replace older diesel school buses. Eligible applicants are school districts, state and local government programs, federally recognized Indian tribes, and non-profit organizations.

Point of Contact
Jennifer Keller
National Clean Diesel Campaign
U.S. Environmental Protection Agency
Phone (202) 343-9541
keller.jennifer@epa.gov
http://www.epa.gov/cleandiesel/

Appendix B:
State Biodiesel Incentives

Incentives and laws for biodiesel development in each state, as well as tax laws can be found at: www.afdc.energy.gov/afdc/fuels/biodiesel_laws.html

There are a number of state incentives and laws for increasing the use of biodiesel in the WORC region of Colorado, Idaho, Oregon, Montana, North and South Dakota, and Wyoming[1].

Idaho

Idaho has a 6% corporate tax credit for building "fueling infrastructure"; a tax deduction for distributors of biofuels; and a Rural Idaho Economic Development Biofuel Infrastructure Matching Grant Fund to provide funds for up to 50% of the cost of installing new fueling infrastructure dedicated to the retail selling of biofuels.

For the consumer, an Idaho motor fuel tax of $0.25 per gallon does not apply to special fuels such as biodiesel, although a state excise tax does apply.

North Dakota

North Dakota has a Biofuels Loan Program that pays down 5% on the interest on biodiesel or ethanol production facilities, livestock operations feeding byproducts from biodiesel or ethanol facilities, biofuels retailers who install refueling infrastructure, or grain handling facilities which provide storage for grain used in biofuels production.

North Dakota has a tax credit of 10% per year for five years to adapt or add equipment to retrofit facilities for producing or blending diesel fuel containing at least 2% biodiesel; a corporate income tax credit on equipment that makes a facility able to sell 2% biodiesel, a blending income tax credit of $0.05 per gallon of B5 biodiesel, and a Biodiesel Equipment Sales Tax Exemption for facilities that sell diesel fuel containing at least 2% biodiesel. Recently North Dakota imposed a $0.04 a gallon tax on biodiesel and other 'special fuels".

North Dakota state policy encourages the North Dakota Board of Education to establish biomass energy centers at institutions, to conduct research and to provide education and technical assistance related to biomass production, harvesting, transportation, and conversion.

North Dakota and South Dakota have joined Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, and Wisconsin in adopting a cooperative initiative under the Energy Security and Climate Stewardship Plan for a regional biofuels corridor that directs state transportation, agriculture, and regulatory officials to develop a system of coordinated signage across the Midwest for biofuels and advanced transportation fuels.

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[1]Wyoming has no laws pertaining to biodiesel. Wyoming does have a tax credit of $0.40 per gallon for producers of ethanol and tax credits available for building ethanol facilities.

South Dakota

South Dakota offers a tax refund to contractors on excise and sales taxes paid during the construction of new agricultural processing facilities, or expansion of existing facilities for the production of biodiesel. Project costs must exceed $4.5 million in order to qualify for the refund.

The South Dakota Legislature has resolved to invest in the development of perennial biomass crops, to support long-term research and development of crops and cropping systems, to promote the development of vehicles that operate on biofuels, to expand the government purchase of biofuels, and to offer incentives for fueling stations offering blends of biofuels such as E85 and B20.

The South Dakota Department of Transportation and state employees using state diesel vehicles are directed to stock and use a minimum of 2% biodiesel when it is available and financially prudent.

South Dakota offers a graduated reduction in the Biodiesel Tax, which taxes biodiesel and biodiesel blends at $0.22 per gallon. When South Dakota biodiesel production reaches 10 million gallons of biodiesel per year year, this tax will be reduced to $0.20 per gallon, and the tax will be eliminated once sales of taxed biodiesel and biodiesel blended fuels reach 35 million gallons.

Colorado

Colorado promotes biodiesel as part of its economic development strategy. A State Research Grant applies to institutions doing biofuels research. The Colorado Clean Energy Development Authority can issue bonds to finance projects that involve the production, transportation, and storage of clean energy, including biodiesel. Colorado requires that all state-owned diesel vehicles be fueled with a blend of 20% biodiesel and 80% petroleum diesel (B20), subject to the availability of the fuel and so long as the price is no greater than $0.10 more per gallon than the price of conventional diesel.

Retailers can get an income tax credit for the cost of construction, reconstruction, or acquisition of an alternative fueling facility that stores, compresses, charges, or dispenses alternative fuels to motor vehicles.

Colorado consumers get an income tax credit for the purchase of an Alternate Fuel Vehicle (AFV) or the conversion of a vehicle to operate using an alternative fuel. Also, a rebate is available for the purchase of an AFV or for the conversion of a vehicle to operate using an alternative fuel if the vehicle is owned by the State of Colorado or a tax-exempt organization.

By law, the Governor's Office of Energy Management and Conservation sets a high priority on funding projects for Alternative Fuel Feedstock Production.

Montana

Montana encourages the use of alternative fuels though it does not require it, as do South Dakota, Colorado, and Oregon. Montana offers property tax relief of 3% on new investments in facilities that manufacture, research, or develop products relating to biodiesel and other alternative fuels, renewable energy manufacturing plants, and research and development equipment for renewable energy; a Production Facility Tax Credit of 15% of the cost of constructing and equipping a facility to be used for biodiesel or bio-lubricant production; a tax incentive of $0.10 a gallon payable for every gallon increase in production over the year before, during the first

three years of business; and a tax credit on property used to crush oilseed crops for purposes of biodiesel production.

Retailers can get a 15% tax credit for the cost of storing and blending biodiesel, and a licensed distributor who pays the special fuel tax can get $0.02 a gallon back, if all the components of biodiesel are produced in Montana.

Oregon

Oregon requires diesel fuel sold in the state to be blended with 2% biodiesel within three months after biodiesel production in state has reached at least five million gallons; biodiesel feedstocks must come from sources in the Pacific Northwest (Oregon, Washington, Idaho, and Montana). This biodiesel blending mandate increases to 5% when production reaches at least 15 million gallons, on an annualized basis, for at least three months. Oregon has a loan program for alternative fuel projects such as fuel production facilities, dedicated feedstock production, fueling stations, and fleet vehicles. Growers of oilseed crops in Oregon receive a tax credit of $0.05 per pound.

Oregon offers a property tax exemption on property used to produce biofuels, a business energy tax credit of 50% on the cost of constructing an alternative fuel facility, and a 25% tax credit on constructing or installing alternative fuel vehicle fueling infrastructure.

State law requires that all state agencies and transit districts purchase AFVs and use alternative fuels in these vehicles to the maximum extent possible, except when it is not economically or logistically possible to purchase or fuel an AFV.

Oregon residents who purchase gasoline blended with 85% ethanol (E85) or biodiesel blends of 99% (B99) for their alternative fuel vehicles (AFVs) qualify for an income tax credit of $0.50 per gallon, up to $200 for each AFV registered in Oregon. The state offers both individuals and business owners an income tax credit on the purchase of qualified alternative fuel vehicles.

Other States

Washington has generous loan programs for start-up biofuel facilities and authorizes conservation districts, public development authorities, municipal utilities and public utility districts to enter into contracts to grow crops and produce and distribute biofuels. Iowa offers a “value-added” financial assistance program for agricultural biomass businesses that utilize commodity crops in the production of alternate energy which includes ethanol, biodiesel, and biomass. Oklahoma exempts farmers who produce their own biofuels from the state fuel tax.