Renewable Energy and Energy Efficiency: Opportunities for Oregon's Agricultural Producers

RENEWABLE ENERGY

Major opportunities exist for Oregon agriculture in the fields of renewable energy and energy efficiency. Oregon farms and ranches create many potential feedstocks to generate energy and fuels, and can also develop energy facilities such as solar-powered systems, wind turbines, small hydropower facilities, and geothermal systems. A variety of tools and practices are available to producers to reduce energy use and costs. Technologies and incentives for renewable energy and energy conservation are improving.

This brochure provides an overview of some of the types of renewable energy sources, energy efficiency opportunities, and incentive programs available to Oregon's agricultural producers.

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In compliance with the Americans with Disabilities Act, this publication will be made available in alternate format upon request.

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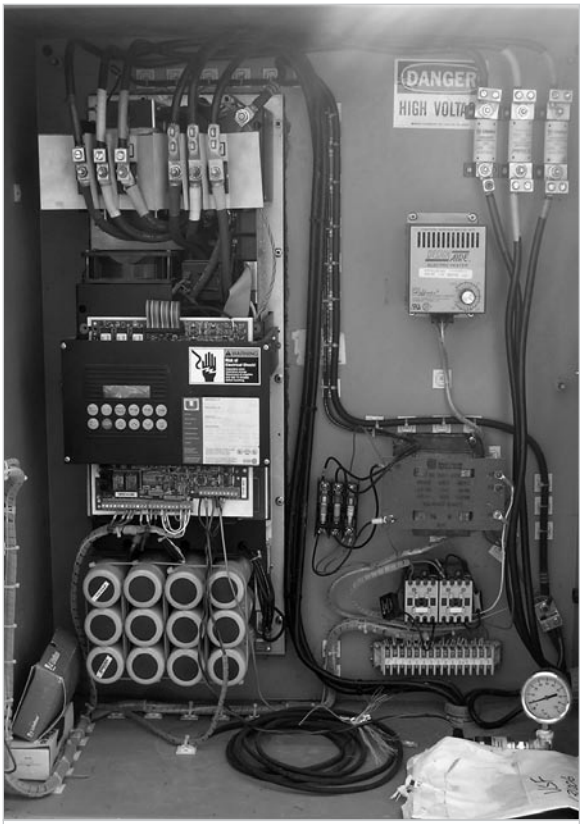
Energy Efficiency

Double polyethylene coverings and caulking air gaps help this greenhouse save energy.

As fuel and power costs rise, most growers are exploring opportunities to save energy. A variety of programs and technologies are available to reduce energy use for different components of agricultural operations. No-till or reduced tillage offers fuel savings in addition to benefits to soil quality. Precision farming equipment can reduce both fuel and fertilizer use. In addition to changing to more efficient irrigation equipment, minor management strategies such as frequent nozzle inspection and replacement can help reduce energy use from irrigation. Livestock buildings, agricultural processing facilities, and greenhouses can save significantly by replacing lighting, switching to more efficient heating and cooling systems, and other strategies.

The following Web sites can help you estimate and reduce your energy use.

http://energytools.sc.egov.usda.gov
http://attra.ncat.org/energy_calculators.html
http://energyexperts.org



This variable frequency drive ensures the irrigation pump will operate at the right speed for the size of the job, saving energy.

Incentives for Energy Efficiency Projects

Oregon's Business Energy Tax Credit provides a 35 percent credit for energy and fuel conservation projects. You must apply in advance for this credit and receive pre-certification by the Oregon Department of Energy. The application is available at http://oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Energy Trust of Oregon provides cash incentives and support to help businesses install qualified energy efficient equipment. Oregon customers of Pacific Power, Portland General Electric, NW Natural, and Cascade Natural Gas are eligible. Typical projects include energy efficiency upgrades to irrigation systems, motors, pumps, air compressors, fans and lighting, and installation of variable frequency/speed drives. More information on this program is available online at http://energytrust.org/pe or by calling toll-free 1-866-368-7878.

The USDA Rural Development Agency's Renewable Energy and Energy Efficiency Program offers competitive grants for up to 25 percent of the costs of energy efficiency projects. Prior to applying, you must have an energy audit completed by a certified assessor. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Farmers Save Energy in Grande Ronde Valley with Management, Technologies, Incentives

Electricity and fuel are significant expenses for growers in the Grande Ronde Valley, where irrigation is necessary to grow crops such as grass seed, mint, alfalfa, wheat, and sugar beets. However, growers are using a variety of management practices and technologies to mitigate these costs, reduce energy use, and provide other natural resource benefits.

A variable frequency drive controls the speed of this efficient pump in Malheur County, saving electricity.

After a professional energy audit, local grower Phil Hassinger learned that conventional irrigation pumps are sized for the grower's maximum water needs, and operate at that horsepower regardless of the size of the irrigation job. "With a regular pump, you use almost as much energy to run one wheel line as you would need to run four wheel lines," Hassinger explains.

Hassinger added a smaller pump at one site to lower his energy use for smaller irrigation jobs, and is currently installing a more efficient pump motor and a variable frequency drive (VFD).

Hassinger's neighbor, John Cuthbert, has also upgraded to an efficient motor and VFD. The variable frequency drive is a computer that runs the pump at the horsepower needed to do the job—and no more. This arrangement more closely matches the cost of electricity to the amount of water applied.

A variable frequency drive controls the speed of this irrigation pump in Union County, saving electricity.

"With the variable speed drive, you enter the pressure you need for the type of equipment you're using," Phil explains. "The drive starts the pump at an idling speed, and gradually builds the water pressure needed. When I start the old pump, it starts at a very high speed to force the water pressure up. Not only will the new system reduce energy use by about a third, it will eliminate problems with water hammering and burst pipes from that first burst of pressure the constant speed pump created."

The cost of the pump and drive was much greater than a conventional pump, but several incentives helped make the project possible for the Hassingers. They received a grant from the US Department of Agriculture Rural Development agency for about 25 percent of the pump cost and also received a Business Energy Tax Credit from the state of Oregon.

Hassinger is also very complimentary of the incentives available from the local power company, Oregon Trail Electric Cooperative. "They have cost-shared energy audits and offer rebates for maintenance activities that save energy, like replacing

This variable frequency drive ensures the irrigation pump will operate at the right speed for the size of the job, saving energy.

nozzles and couplers on pivots." These simple management practices save electricity and also help ensure that growers apply the correct amount of water to their crops.

Fuel-saving management practices have also translated to other natural resource benefits on the Hassingers' fields. "Over the last five years, I've seen diesel prices increase from 63 cents to $3.50 per gallon," says Phil Hassinger. "At that price, farmers are aware of the cost of every pass they make over the field. I'm willing to leave the seed bed more course than I used to." The Hassingers have reduced tillage of the soil, enhancing soil organic matter and quality while lowering their fuel use.

To save fertilizer, which requires significant energy resources to produce, the Hassingers test their soil for major nutrients and apply fertilizer according to soil test results. They are also using a variety of integrated pest management practices such as scouting, predatory mites and wasps for crop pests, which reduces the number of trips across the field needed with a sprayer.

The Hassingers' careful management of soil tilth, nutrient applications, and pesticide applications, as well as other management practices, allowed them to enroll in the Conservation Security Program, a USDA program which rewards growers for a high level of natural resources stewardship.

Hassinger, who enjoys birding and fishing, appreciates the benefits to fish and wildlife as well as the cost savings of his energy efficiency projects.

Biomass and Biofuels

A variety of agricultural crops and byproducts can generate heat, electricity, and fuel. Oilseed crops can be crushed and converted to biodiesel, and corn can be processed to produce ethanol. Several biofuel companies and researchers are refining technologies to produce cellulosic ethanol from materials such as grass straw, poplar, and biosolids. Livestock manure and food processing byproducts can be used in methane digesters. Wood waste from nursery clippings, poplar, juniper, and forest slash materials can power boilers to generate heat and electricity.

Agricultural operations can produce and use biomass and biofuels in a variety of ways. Many operations use wood waste for heat and/or electricity generation. Some producers are purchasing or manufacturing biodiesel for their farm equipment. Others are selling oil to biodiesel manufacturers. Growers are also participating in trials to investigate appropriate crops for biodiesel and cellulosic ethanol production in the Pacific Northwest.

The costs and benefits of using and/or producing biomass for energy production or crops for biofuels vary greatly with the type of technology. For more complex projects, a feasibility study and/or business plan is valuable to evaluate whether the project will work for your operation.

Permitting

Permit requirements for biofuel or bioenergy production vary depending on the type of project. Generally, fuel and energy generation facilities on agricultural lands require a land use permit from your county planning department. If a component of the energy generation facility, such as a motor, will produce emissions, you may also need a permit from the Oregon Department of Environmental Quality.

If you are interested in growing canola (rapeseed) for biofuels, consult the Oregon Department of Agriculture Web site to find out if you are in a rapeseed control area. http://oregon.gov/ODA/PLANT/canola_rapeseed.shtml#Rapeseed_Control_Areas_

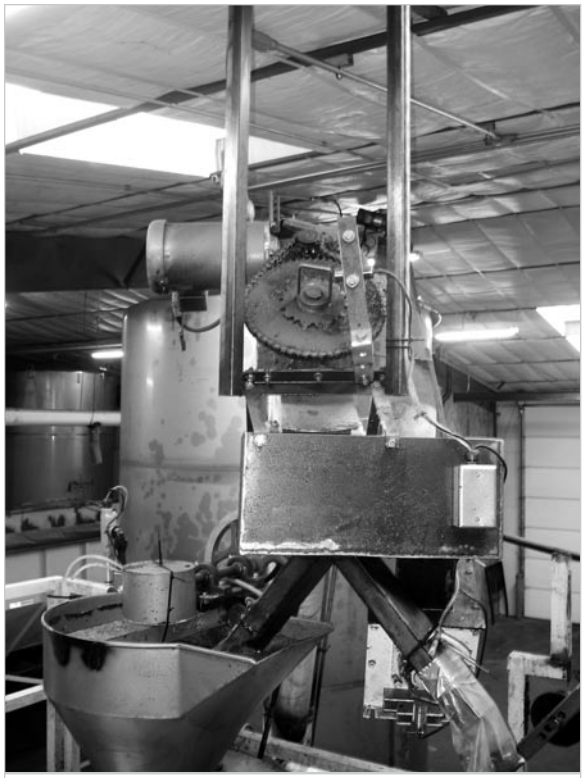
If your growing site is within one of these areas, you may only grow canola for oil with a special permit from the Oregon Department of Agriculture.

Some additional permits are necessary for anaerobic digesters. If a digester is installed on a Confined Animal Feeding Operation (CAFO) permitted by the Oregon Department of Agriculture, the digester design must be submitted to ODA for approval prior to construction. If products produced from the digester will be marketed as having nutrient value, ODA fertilizer license may be required. If other material is brought in from offsite to be added to the digester, a solid waste permit may be required from the Oregon Department of Environmental Quality or solid waste issues must be addressed in the CAFO permit.

Madison Farms, City of Portland, SeQuential Biofuels Partnership Powers City's Water Bureau Fleet

Kent Madison's canola crushing operation made big headlines in the Portland metro area in 2007, when he collaborated with SeQuential Biofuels to supply biodiesel to the City of Portland Water Bureau's fleet.

"The City's commitment to buying renewable fuel from an Oregon source helped make this project work," says Madison. The City and a variety of leaders in the renewable energy field have also been quick to praise Madison



This crusher processes canola seed at Kent Madison's farm in Echo, Oregon. Oil is sold for biodiesel production, and the meal is sold for livestock feed.

Kent Madison stands next to a canola seed storage tank in his biodiesel processing warehouse.

for identifying a unique opportunity for a crop he has grown as part of his rotation for several years.

Madison first began growing canola several years ago in rotation with wheat, potatoes, and other crops. All new crops come with a learning curve, and the challenge with canola was figuring out how to harvest the seed without losing large amounts to shattering, and without having to swath the canola plants first.

"The best way is to push it over before combining it," Madison explains. "Once it's pushed over, it's protected from the wind and less prone to shatter."

The harvested canola seed is brought into the processing room and fed into a crusher to extract the oil. The resulting oil is purified, and the leftover material, canola meal, is sold to local livestock producers for feed.

Once the canola is harvested and crushed, the oil is shipped to SeQuential, which manufactures the biodiesel. Although Madison owns biodiesel processing equipment and had originally planned to manufacture the diesel himself and generate enough diesel on-farm to supply fuel for his own equipment, "it's cheaper for me right now to buy conventional diesel for my own equipment and sell the canola oil," he explains. But the rapidly changing price of petroleum fuels may change this in the near future.

In addition to the SeQuential and the City of Portland, several other partners have contributed to the success of the operation. In 2006, Madison worked with the US Department of Agriculture Rural Development agency and a grantwriter to submit a proposal to purchase inventory for the canola crushing and biodiesel processing operation.

Madison also reports that the Oregon Business Energy Tax Credit (BETC) has been an excellent incentive for the biofuels project. At the time Madison's facility was built, he received a 35 percent tax credit for the eligible costs of growing and processing the canola seed. The credit has since been raised to 50 percent.

"The BETC has been by far the easiest source of funding," he explains. "I had a little trouble finding pass-through partners at first, but then I developed a great relationship with Umpqua Bank." He is referring to the pass-through option on the tax credit that is available for renewable energy developers with no tax liability. With approval from the Oregon Department of Energy, the project developer can sell the credit to a "pass-through partner" at a rate of approximately 33 percent.

Madison has contracted with several neighbors to produce enough canola to supply the City of Portland Water Bureau's fleet for next year.

Digester helps dairy with odor, nutrient management

Bernie Faber began operating Oregon's first methane digester in cooperation with Portland General Electric in 2001. His West Salem operation, Cal-Gon Dairy, is now a popular stop for other dairy operators, organizations, and agencies wanting to learn about the technology and Faber's first-hand experience.

Methane captured in this digester at Cal-gon Dairy in West Salem, Oregon, provides fuel to an engine that generates electricity.

Faber explains that the system was designed to process manure from 500 cows. "PGE was looking for a medium-sized dairy to develop a digester as a demonstration project," he says. "We're currently milking about 300 animals." The digester's current output is between 30 to 40 kilowatts.

To begin the digestion process, manure is scraped from the barns into a concrete tank, then pumped into the digester. Bacteria digest the manure, producing methane that collects in a tank. The methane is piped to a powerhouse, where it fuels a motor that generates electricity, and the electricity is fed into the power grid. A recapturing system takes the heat produced by the engine and transports it back into the digester, helping to maintain high temperatures to support the digestion process.

After manure leaves the digester, liquids are separated and piped into a manure lagoon. Solids are stored for a few days, then collected by a company that composts them along with yard waste. "Solids come out of the digester at about 90 to 100 degrees," Bernie Faber explains. "So they help speed up the composting of the yard materials."

Faber reports that he used to get a lot of questions from other dairy operators about the payback time frame on the methane digester at his dairy, or whether he would still build a digester if he could do it all over again.

"People don't ask me that anymore," he says. "Now they ask, 'How does this help with odor?' or 'How does this help with environmental issues?'"

Odor from dairy manure is an issue in West Salem, with a mixture of agricultural and rural residential neighbors nearby. Faber reports the digester has successfully reduced odor and has also helped the dairy achieve more balanced nutrient applications to their cropland. Before the digester was installed, both solid manure, which contains most of the phosphorus, and liquid manure were spread onto cropland. Excess phosphorus, which can accumulate in the soil when manure is applied to provide enough nitrogen for crop needs, had been a concern for the Fabers.

With the digestion, separation, and export system the dairy now has in place, the phosphorus content in the manure applied to cropland is now greatly reduced. Now, most

Digested solids are exported from Cal-gon Dairy and used to make compost.

of the solids are separated out after the digestion process and exported to the composting company.

The digester was a significant investment for both Faber and PGE, and maintenance costs are also considerable. "If you're not interested in digesters, or if you want a payback of five to seven years, they're probably not for you," Bernie Faber explains. "But it's helped with the challenges we were facing with odor and the land base for manure application. If we weren't able to export the solids from the digester, we would be faced with purchasing at least another 100 acres to accommodate the phosphorus in the manure."

Faber encourages other dairy operators considering digesters to make sure they get assistance from qualified engineers, and to do extensive research and evaluation to make sure a digester is right for them. He recently had some dairy operators visit from New York who also operate in a mixed-use area and are facing some of the same challenges with land base. "I told them, 'You're doing the right thing by visiting other operations. Do your homework and figure out if a digester is a good fit for your operation,'" he says.

In addition to the Web sites listed on the back of this brochure, the following Web sites provide more information about digesters.

http://oregon.gov/ODA/energy_methane.shtml
http://www.epa.gov/agstar
http://www.mrec.org/anaerobicdigestion.html
http://www.mnproject.org/e-newdigesterops.html

Biomass Incentives

There are a number of primary tax credit and incentive opportunities in Oregon for agricultural producers:

1. **Oregon's Business Energy Tax Credit** provides a 50 percent credit for the purchase of equipment (i.e., capital costs) of growing biofuel feedstocks, and processing them on the farm. For biomass harvesting projects, the credit applies to the equipment costs to harvest and transport the feedstock, in addition to processing facilities. You must apply in advance to the Oregon Department of Energy and receive approval prior to starting your project to receive this credit.

2. **Oregon's biomass credit** offers per-unit incentives for biopower and biofuel feedstocks. To claim the credit, you must collect and retain documentation that proves the material was delivered to a biofuel or biomass processing facility in Oregon. The following table lists the incentives by material. You do not need to apply in advance for the biomass credit. This credit is taken directly against taxes owed when filing. However, documentation and records are necessary. For more information, contact the ODA renewable energy specialist at 503-986-4565.

Material	Credit	Amount
Oilseed crops	$.05	per pound
Grain crops (excluding corn, and wheat is eligible after 1/1/09)	$.90	per bushel
Woody biomass collected from nursery, orchard, agricultural, forest or rangeland property in Oregon, including but not limited to prunings, thinning, plantation rotations, log landing or slash resulting from harvest or forest health stewardship	$10.00	per green ton
Grass straw, wheat straw, or other vegetative biomass from agricultural crops	$10.00	per green ton
Animal manure or rendering offal	$5.00	per wet ton
Virgin oil or alcohol processed from Oregon-based feedstock	$.10	per gallon

3. **Energy Trust of Oregon** provides financial incentives to help support development of biopower projects that use organic waste to generate electricity. In some cases, Energy Trust provides funding to share the cost of feasibility studies for projects. Applications are taken on an ongoing basis. Projects must in most cases deliver power to Portland General Electric or Pacific Power in Oregon. More information is available at http://energytrust.org/RR/bio/index.html or by calling toll-free 1-866-368-7878.

4. **The US Department of Agriculture Rural Development Agency** offers competitive grants and loans for capital construction costs associated with renewable energy projects through the Renewable Energy and Energy Efficiency Program (Section 9006). Grants can range from $2,500 to $500,000, and must not exceed 25 percent of the eligible project costs. This program requires that you first have a viable feasibility study and business plan developed. Another USDA-Rural Development Program, the Value Added Producer Grant Program, offers competitive grants for renewable energy projects. These grants can cover up to 50 percent of the eligible project costs, and can be used for planning (feasibility studies, business planning, marketing planning, etc) with a maximum of $100,000 per project, or working capital projects (purchase inventory, marketing campaigns, etc) at a maximum of $300,000 per project. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Solar Energy

Solar systems work well across Oregon, which receives as much sun as the national average. Photovoltaic (PV) systems generate electricity for a variety of home and business uses. In agriculture, growers may be able to use PV systems to power pumps for irrigation and livestock watering, supply electricity to buildings, and charge electric fencing, among other uses. "Passive solar" buildings can also be designed to maximize heating with solar energy. Solar water heating, which uses the sun's energy to preheat water, can reduce energy costs associated with heating water for any purpose from home water supply to sterilization.

The costs and benefits of solar energy systems are highly variable depending on your location. In certain situations, installing a solar electric system can be cheaper than installing new utility lines out to a site.

If utility power is already available at your site, a solar energy system may still make sense. With current tax benefits, cash incentives, and possible third party ownership and financing, solar photovoltaic and water heating may provide energy at similar cost to utility power. Investing in your own power generation will provide energy independence and stabilize your energy costs for the future. In addition to these financial benefits, solar is a visible symbol of your environmental stewardship and commitment to clean energy. This may offer marketing advantages. A careful evaluation of costs and incentives is necessary to make these determinations.

Permitting

On agricultural lands, solar electric projects may require a building permit, in addition to an electrical permit. Solar water heating may also require a building permit in addition to a plumbing permit.

Solar Incentives

Oregon's Business Energy Tax Credit provides a 50 percent credit for all eligible costs of photovoltaic and solar thermal systems. Incremental costs of passive solar systems are also eligible for the credit. You must apply for this credit before beginning your project and receive pre-certification from the Oregon Department of Energy. Applications are available on the Oregon Department of Energy Web site at http://www.oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Energy Trust of Oregon offers cash incentives for eligible commercial solar electric systems installed in Oregon in Pacific Power or Portland General Electric service territory, as well as for solar water heating systems offsetting gas or electricity in Portland General Electric, Pacific Power, NW Natural, and Cascade Natural Gas. PV incentives are based on the rated power capacity of the solar array in $watts_{DC}$. The per-watt and maximum incentive amounts are listed below. Solar water heating incentives are based on the calculated annual energy savings. More information, including solar water heating incentives, are available online at http://www.energytrust.org/solaror by calling toll-free 1-866-368-7878.

	Systems under 30,000 watts	Systems over 30,000 watts	Maximum incentive (100,000 watts)
Pacific Power	$1.25/watt	Varies from $1.00 to $1.25/watt	$100,000
PGE	$1.50/watt	Varies from $1.25 to $1.50/watt	$125,000

The US Department of Agriculture Rural Development Agency offers competitive grants and loans for capital construction costs associated with renewable energy projects through the Renewable Energy and Energy Efficiency Program (Section 9006). Grants can range from $2,500 to $500,000, and must not exceed 25 percent of the eligible project costs. This program requires that you first have a viable feasibility study and business plan developed. Another USDA-Rural Development Program, the Value Added Producer Grant Program, offers competitive grants for renewable energy projects. These grants can cover up to 50 percent of the eligible project costs, and can be used for planning (feasibility studies, business planning, marketing planning, etc) with a maximum of $100,000 per project, or working capital projects (purchase inventory, marketing campaigns, etc) at a maximum of $300,000 per project. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Solar Panels, Efficiency Measures Earn Green Building Certification for Winery

The solar panels on Stoller Vineyards' Dayton, Oregon winery blend in well with the rest of the building, appearing as just another part of the roof. The panels are just one of many features built into the building that fit the Stollers' philosophy of low inputs and high efficiency.

"I'm interested in creating products with the lowest inputs possible," explains Bill Stoller. "And I was excited about the idea of harnessing power from the sun."

In 2006, Stoller Vineyards became the first winery in the United States to be certified as a green building through the Leadership in Energy and Environmental Design (LEED) rating system. The solar photovoltaic system, use of recycled materials, and energy-efficiency measures all helped the winery achieve the benchmarks in the certification system.

Solar panels on the roof of Stoller Winery in Dayton, Oregon helped the winery attain certification as a green building. Photo courtesy of Mike Haverkate, Stoller Vineyards.

Stoller Vineyards received a tax credit from the Oregon Department of Energy for 35 percent of the costs of the photovoltaic system and several of the efficiency measures (this credit was raised in 2007 to 50 percent for renewable energy projects). They also received incentives from the Energy Trust of Oregon.

"They predicted a payback period of about 12 years for our system," explains Bill Stoller. "It was estimated to produce about fifty percent of the electricity the winery consumes. So far, it has exceeded our expectations."

The system was expected to produce about 42,000 kilowatt hours per year, but produced 57,000 last year. Based on the monthly reports so far, Bill Stoller expects it will produce about 50,000 kWh this year.

He navigates to a Web site that provides monthly reports of the system's power production. The Web site also displays the amount of carbon dioxide reductions because of the solar panel system. For the month of October, reductions were estimated at 70 percent.

Energy efficiency measures at the winery include processing facilities designed to maximize gravity flow of juice, lessening the energy needed to move product around. The building has an automated lighting system, insulation levels that are 70 percent above code requirements, and skylights in the fermentation room. Much of the timber used in beams, stairs, and floors inside and outside the building is recycled material.

Stoller Vineyard's energy accomplishments have even received attention from local media, the Sundance Channel, and wine magazines. "I'm not sure if [the media attention] drives people to seek out our wine in the store," Bill Stoller says, "But once people come here and see how we operate, I think they remember us."

This pond on Crown Hill Farm in McMinnville, Oregon supplies water for a hydroelectric facility on the farm.

Hydropower

Small hydroelectric or micro-hydro systems may be installed in irrigation ditches as well as streams. Water may be diverted by pipe (called a penstock) or channel to a turbine, generating electricity.

To determine if a micro- or small-scale hydropower system is appropriate for your farm, ranch, or irrigation district, the first step is to determine how much power the system can generate based on the amount of water flow and head. Based on this information, most turbine manufacturers can tell you how much electricity output you may expect. To determine flow, you may be able to consult flow records from the US Geological Survey or other agencies, or you may have to survey the site if no records are available. You can roughly estimate head, or water pressure, by the vertical distance the water must travel between the top of the penstock and the point where water discharges from the turbine.

Costs of a hydroelectric system vary greatly depending on the type of facility. Potential costs include the penstock, turbine(s), generator, powerhouse construction, and any earthmoving for water storage ponds.

Permits

You will need to secure several permits prior to installing a small hydropower facility. The Oregon Water Resources Department, the Federal Energy Regulatory Commission, Oregon Department of Fish and Wildlife, and the Oregon Department of State Lands are some of the main permitting agencies you may interact with. You should also contact your county planning department to determine whether you need a land use permit.

Hydropower Incentives

Oregon's Business Energy Tax Credit provides a 50 percent credit for all eligible costs of small hydropower systems. You must apply for this credit before beginning your project and receive pre-certification from the Oregon Department of Energy. Applications are available on the Oregon Department of Energy Web site at http://oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Energy Trust of Oregon's Open Solicitation program provides incentives and support for renewable energy projects not eligible for other Energy Trust renewable energy programs, including hydropower. Eligible projects must either be located in or deliver power to the Oregon service territories of Portland General Electric or Pacific Power. Off-grid projects are not eligible for Energy Trust support. Projects must also be located outside of state or federally protected areas to receive Energy Trust funding. More information is available online at http://energytrust.org/RR/os or by calling toll-free 1-866-368-7878.

The US Department of Agriculture Rural Development Agency offers competitive grants and loans for capital construction costs associated with renewable energy projects through the Renewable Energy and Energy Efficiency Program (Section 9006). Grants can range from $2,500 to $500,000, and must not exceed 25 percent of the eligible project costs. This program requires that you first have a viable feasibility study and business plan developed. Another USDA-Rural Development Program, the Value Added Producer Grant Program, offers competitive grants for renewable energy projects. These grants can cover up to 50 percent of the eligible project costs, and can be used for planning (feasibility studies, business planning, marketing planning, etc) with a maximum of $100,000 per project, or working capital projects (purchase inventory, marketing campaigns, etc) at a maximum of $300,000 per project. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Lucien Gunderman stands behind two turbines in the main hydroelectric facility. The turbines have a combined capacity of 30 kilowatts.

Hydropower Example: Crown Hill Farm, McMinnville, Oregon

In 2001, Lucien and Juliette Gunderman became pioneers in the micro-hydroelectric field when they developed and began operating Oregon's first new licensed hydroelectric facility in 20 years. The Gundermans operate Crown Hill Farm, an 800-acre operation that includes sheep, cattle, hay, and timber near McMinnville, Oregon.

For the original project, Lucien took advantage of two existing ponds that store irrigation and livestock water from several small streams and springs on the property. He installed piping from the ponds to deliver water to two turbines in a powerhouse next to Baker Creek.

"The turbines have a total capacity of 30 kilowatts," explains Lucien. "Several people told me not to skimp on turbine capacity."

In 2005, Lucien constructed an additional storage pond on the west side of the property and piped the pond water to a new powerhouse. A small turbine in the west powerhouse develops enough power to run a pump which pumps water to the main storage reservoir, supplementing the volume of water available for power generation by the original project. The second system is self-sufficient, using only water power to run the turbine, pump, and a small generator that supplies power for the control system.

Lucien reports that the permitting process was challenging, with 21 agencies being able to comment on his project, but hopes that his experience will make inroads for other producers interested in small hydropower developments. He worked with several state and federal agencies, as well as the local utility, McMinnville Water and Light. The power generated by the facility feeds into the community power grid, and the Gundermans receive credit from McMinnville Water and Light for each kilowatt hour of electricity produced.

"They've told us that our facility has improved the quality and consistency of electricity delivered to the local area, and especially our neighbors," Lucien reports. "In our agreement with McMinnville Water and Light, all power produced onsite is fed back into the grid, and metered in the process. A credit is issued for the generated power, which offsets our usage. If there is more generation than usage during the month, the excess is rolled forward, and credited as needed when generation is not possible, or there is not enough generation to cover the usage. As utility rates for power go up, it helps the project pay for itself more quickly."

The Gundermans received a tax credit for 35 percent of the eligible costs of the hydropower projects from the Oregon Department of Energy (note: this credit was raised to 50 percent in 2007). "The Oregon Department of Energy was very helpful and willing to incorporate as many of our costs as possible into the credit," Lucien reports. The credit is based on the percent of the project costs that can be recovered in a 15-year period. From that amount, producers now receive a 50 percent credit.

The Gundermans are looking at the feasibility of bringing in other sources of water from other areas on the farm. If feasible and cost effective, they plan to build an additional storage pond and pipe that water to the main powerhouse as well. Lucien continues to work on improvements to the system to refine and improve overall efficiency.

Wind

Oregon farms and ranches host large-scale wind power developments, and can also use smaller wind turbines to supply power to their own operations. Producers can also work with their local community to develop a community wind power supply. The present challenge is finding turbines appropriate to scale at economic costs. Wind power in the US, and worldwide, is on such a building curve that finding towers for purchase can be difficult at the present.

Turbine output depends heavily on wind speeds, both at your site and at the specific height of the turbine. Wind power is generally economical only if your site has an average wind speed of 10 miles per hour or more. Several Web sites can help you determine if wind power may be an option at your operation:

- 3 Tier Group http://firstlook.3tiergroup.com
- The National Renewable Energy Laboratory has wind speed maps at http://nrel.gov/wind/resource_assessment.html
- AWS True Wind http://awstruewind.com/maps/united-states.cfm/region/46702

Permitting and Infrastructure Issues

Like other electricity generation projects, a wind turbine will require a land use permit from your county planning department. You will also need to work with your local utility to hook your system into the power grid, if you plan to be tied to the grid. Assess the site carefully for the ability to tie to the grid as the cost of installing new line for any significant distance to a wind site can be more than the beneficial cost of the project.

Wind Incentives

Oregon's Business Energy Tax Credit provides a 50 percent credit for all eligible costs of wind power project. You must apply for this credit before beginning your project and receive pre-certification from the Oregon Department of Energy. Applications are available on the Oregon Department of Energy Web site at http://oregon.gov/ENERGY/CONS/BUS/BETC.shtml

In 2007, Energy Trust of Oregon launched a small wind program that provides resources and cash incentives up to $60,000 to help customers of Portland General Electric and Pacific Power install turbines up to 50 kilowatts. Projects greater than 50 kilowatts may be eligible for funding through Energy Trust's Community Wind Program. More information is available online at http://energytrust.org/smallwind or by calling toll-free 1-866-368-7878.

The US Department of Agriculture Rural Development Agency offers competitive grants and loans for capital construction costs associated with renewable energy projects through the Renewable Energy and Energy Efficiency Program (Section 9006). Grants can range from $2,500 to $500,000, and must not exceed 25 percent of the eligible project costs. This program requires that you first have a viable feasibility study and business plan developed. Another USDA-Rural Development Program, the Value Added Producer Grant Program, offers competitive grants for renewable energy projects. These grants can cover up to 50 percent of the eligible project costs, and can be used for planning (feasibility studies, business planning, marketing planning, etc) with a maximum of $100,000 per project, or working capital projects (purchase inventory, marketing

campaigns, etc) at a maximum of $300,000 per project. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Harnessing Sun and Wind: A Hybrid System Brings Water to a Remote Location

By Joli Munkers, Pine Hollow/Jackknife Watershed Council

With help from the Oregon Watershed Enhancement Board, Sherman County Soil and Water Conservation District, the Natural Resources Conservation Service Environmental Quality Incentives Program, and the Pine Hollow/Jackknife Watershed Council, the Black Rock Grazing Association constructed the first solar/wind hybrid off-stream water development in the watershed. Being the first of its kind, both for the region and for the contractor, Lexington Pump, it has attracted some attention.

This hybrid solar-wind system will power a pump for livestock watering in Sherman County

A "hybrid" system combines both wind and photovoltaic technologies. This offers several advantages over either single system. Many times wind speeds in the summer are low while the sun shines the brightest and the longest. In the winter, when there is less sunlight available, the wind is usually the strongest. A hybrid system takes advantage of the differences in the peak energy operating times for wind and PV, producing power all year long. If the sun is shining and the wind is blowing, there is an override switch to shut down the wind turbine, allowing power from the PV system to support the pump. This not only keeps a consistent supply of power to the pump, but also keeps the wind turbine components from wearing out. While the pasture is not in use, the system can be easily shut off with the flip of a switch. The turbine will continue to turn slowly, but an internal brake system keeps it from spinning out of control when not in use.

Located in a remote area of the Pine Hollow/Jackknife Watershed, the hybrid system was designed to pump enough water to sustain the Association's 300 head of cattle that rotate through this pasture from May 1–November 1 each year. Water is pumped to two 1,200-gallon poly-troughs to ensure ample water supply for the herd. Any overflow from the troughs is channeled outside the watering area to a safe outlet.

For the Black Rock Grazing Association, the hybrid system will be a reliable water source that will also reduce environmental impacts on fragile streamside areas. Strategically placing the watering source in the uplands has also resulted in more efficient use of the pasture.

Geothermal

Some regions of Oregon have sufficient geothermal resources to provide heat and power to a farm or ranch. Geothermal wells deliver steam or hot water to the ground surface, which can be used for heating or electricity generation. Examples of agricultural uses of geothermal energy include heating greenhouses, heating processing water, or heating a fruit or vegetable drying facility.

Steam from geothermal wells heat greenhouses on Tracey Liskey's farm near Klamath Falls.

Geothermal resources exist in parts of central, eastern, and southern Oregon. The Oregon Institute of Technology has a list of known geothermal resources at http://geoheat.oit.edu/oregon.htm.

Permits

You will need to secure several permits prior to drilling a geothermal well. The Oregon Water Resources Department, the Federal Energy Regulatory Commission, and the Oregon Department of Geology and Mineral Industries are some of the main permitting agencies you may interact with. You should also contact your county planning department to determine whether you need a land use permit.

Geothermal Incentives

Oregon's Business Energy Tax Credit provides a 50 percent credit for the costs of geothermal facilities, such as well drilling, piping, and fans. You must apply for the credit before beginning your project and receive pre-certification from the Oregon Department of Energy. Applications are available on the Oregon Department of Energy Web site at http://oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Energy Trust of Oregon's Open Solicitation program provides incentives and support for renewable energy projects not eligible for other Energy Trust renewable energy programs, including geothermal projects that generate electricity. Eligible projects must either be located in or deliver power to the Oregon service territories of Portland General Electric or Pacific Power. Off-grid projects are not eligible for Energy Trust support. More information is available online at http://energytrust.org/RR/os or by calling toll-free 1-866-368-7878.

Steam from geothermal wells heats this greenhouse on Tracey Liskey's farm.

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program requires that you first have a viable feasibility study and business plan developed. Another USDA-Rural Development Program, the Value Added Producer Grant Program, offers competitive grants for renewable energy projects. These grants can cover up to 50 percent of the eligible project costs, and can be used for planning (feasibility studies, business planning, marketing planning, etc) with a maximum of $100,000 per project, or working capital projects (purchase inventory, marketing campaigns, etc) at a maximum of $300,000 per project. For more information, go to http://www.rurdev.usda.gov/or/rbs.htm

Tailwater from the greenhouses on the Liskey farm heats these ponds, which are used to grow tropical fish.

Geothermal resources allow Klamath Falls farm to diversify, produce clean fuel

If Tracey Liskey's grandparents revisited their homestead south of Klamath Falls, they would certainly be surprised at the diversity of agricultural products grown on the property today. Tracey Liskey and his siblings have harnessed the geothermal energy first discovered on the property by his grandparents to create new economic opportunities for their own operation and for the region.

Tracey Liskey believes his grandparents first discovered the property's geothermal resources when they tried to develop a spring or well for drinking water. Today, hot water from the two wells is piped around the property, providing an excellent source of heating for several greenhouses and ponds.

After water comes out of the wells at 185 to 190 degrees, it is cycled into the greenhouses. The tailwater from the greenhouses is used to warm the ponds.

Until recently, the Liskeys grew nursery products in the greenhouses, supplying many of the hanging baskets in the city of Klamath Falls. The greenhouses are now leased for fruit and vegetable production, to a company that grows spider mites, and for growing tropical fish.

"The warm air in the greenhouses warms the fish tanks," Liskey explains. His lessee, Ron Barnes, also raises tropical fish in the ponds warmed with greenhouse tailwater for sale in pet stores.

Recently, the Liskeys and business partner Rick Walsh harnessed geothermal energy for another renewable project—a canola crusher and biodiesel production facility. The first batch of canola oil was recently processed through the facility.

"The fire marshall was very pleased to know we were heating the operation with geothermal energy," Liskey says. "It really increased the safety of the operation."

In the future, Liskey Farms plans to create an agricultural business park featuring other products grown with geothermal energy.

Additional Funding Programs

Tax credits

Federal tax credits are available for a variety of renewable energy and energy efficiency projects. Eligible projects include efficiency improvements to new and existing buildings, fuel cells, solar power, microturbines, and biodiesel and ethanol production. More information is available at http://oregon.gov/ENERGY/CONS/Federal-Bus.shtml

Grants

Two other US Department of Agriculture Programs, the Conservation Security Program and Environmental Quality Incentives Program, provide funding for certain energy conservation and renewable energy projects. To learn more about these programs in your area, contact your local Natural Resources Conservation Service office.

Growers, researchers, and natural resource professionals may apply for Sustainable Agriculture Research and Education Grants for renewable energy or energy efficiency research projects. More information is available at http://sare.org/grants

The Oregon Watershed Enhancement Board offers competitive watershed restoration grants for up to 75 percent of the costs of watershed restoration projects. You may wish to consider these grants for wind or solar-powered projects that also benefit watershed health or water quality, such as solar-powered off-stream livestock watering systems, or improvements to irrigation systems that conserve water as well as energy. For more information and assistance with the application process, contact your local Soil and Water Conservation District or watershed council.

Loans

The Oregon Department of Energy offers loans for renewable energy and energy efficiency projects, as well as use of recycled materials to create products and projects that use alternative fuels. Loan amounts typically range from $20,000 to $20,000,000. More information is available on the Oregon Department of Energy Web site at http://oregon.gov/ENERGY/LOANS/selphm.shtml

The USDA Rural Energy and Energy Efficiency Program offers loans for renewable energy and energy efficiency projects. Loans may cover up to 50 percent of project costs and range from $5,000 to $10,000,000 per project. For more information including current loan rates, contact the USDA Rural Development office at 503-414-3366 in Portland or in Pendleton at 541-278-8049 x129, or go to http://www.rurdev.usda.gov/or/rbs.htm

For More Information

Oregon Department of Agriculture Renewable Energy Specialist
503-986-4565
http://oregon.gov/ODA/energy.shtml

Oregon Department of Energy
503-378-4040 or 800-221-8035
http://oregon.gov/ENERGY

Oregon State University Extension
To find your county Extension office: http://extension.oregonstate.edu/locations.php

Energy Trust of Oregon, Inc.
1-866-368-7878
http://www.energytrust.org

US Department of Agriculture
Rural Development
503-414-3366
http://www.rurdev.usda.gov/or/rbs.htm

Natural Resources Conservation Service
503-273-2400
Oregon state office web page: http://www.or.nrcs.usda.gov
Energy web page: http://www.nrcs.usda.gov/technical/energy
Find your local Soil and Water Conservation District at http://oacd.org
Find your local Watershed Council at
http://oregon.gov/OWEB/WSHEDS/wsheds_councils_list.shtml

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