

Renewable Energy Project Development

A GUIDE FOR AGRICULTURAL PRODUCERS | CLACKAMAS COUNTY, OREGON

DEVELOPED BY NORTHWEST SEED | WWW.NWSEED.ORG

ABOUT THIS GUIDE

This *Renewable Energy Project Development* guide was developed by Northwest SEED. Northwest SEED works to establish a clean, diverse, and affordable Northwest energy system based on efficient use of renewable resources, with maximum local control and ownership of energy assets. As a nonprofit organization, we empower communities to develop their own clean energy solutions that provide real local benefits.

Northwest SEED would like to thank Oregon Department of Energy and Energy Trust of Oregon for their contributions to this guide, and USDA Natural Resources Conservation Service for funding this effort.

This *Renewable Energy Project Development* guide provides county-specific information regarding renewable energy technologies, incentives, financing, and resources. The objective of this guide is to stimulate development of on-farm energy projects, allowing agricultural producers to offset their energy use, displace fossil fuels, address the future uncertainty of energy costs, and reduce their environmental impact.

Renewable Energy Project Development guides are available for Lane, Lincoln, Benton, Linn, Polk, Marion, Yamhill, Clackamas, Washington, and Multnomah Counties. To obtain a guide specific to your county, please contact Northwest SEED:

- info@nwseed.org
- (206) 328-2441

If you would like assistance with identifying next steps for your renewable energy project, please visit the Oregon Rural Renewable Energy Tool at <http://energytool.odoe.state.or.us/>.

TABLE OF CONTENTS

Introduction	2
Renewable Energy Technologies	4
Financial Incentives	8
Project Cost Examples	11
Solar Energy Development Checklist	13
Wind Energy Development Checklist	14

INTRODUCTION

Oregon's agricultural producers are stewards of the land, employing innovative conservation techniques to help preserve Oregon's valuable natural resources for generations to come. However, energy price volatility and the rising costs of energy inputs are making it increasingly challenging for Oregon's producers to balance land stewardship with productivity and profitability. At the same time, Oregon is committed to developing clean energy resources and prepared a *10-Year Energy Action Plan* to accomplish just that. These two driving forces are creating a climate in which on-farm energy projects make sense. Clean energy projects can help lower energy costs and provide a more predictable business environment for agricultural producers while helping Oregon meet its energy goals.

ENERGY PRICE VOLATILITY

Oregon's producers rely heavily on energy inputs to maintain agricultural operations, ranging from crop planting to crop management, harvesting, and distribution. More than a decade of volatile energy prices has had an impact on the stability of Oregon's agricultural landscape. This volatility has presented across the board, affecting the cost of electricity, fuel, and fertilizer—all of which are central to continued agricultural operations.

Electricity, in particular, is central to modern agricultural operations, providing power for irrigation, lighting, processing, cooling and ventilation, and more. Due to an abundance of hydropower, Oregon has been fortunate to have some of the lowest electricity prices in the United States. However, over the past several years the region has witnessed both rising electricity costs and an increased reliance on electricity to power agricultural operations. As a result, producers face significantly higher utility expenses. With ongoing efforts to decommission hydropower plants in the Pacific Northwest and the general trend of rising utility rates, continued increases in electricity prices are imminent.

RISING COST OF ENERGY INPUTS

The price volatility of energy inputs has contributed to an overall rise in energy costs as a percentage of total farm expenses. Oregon's producers have had to devote ever-growing resources towards covering the energy costs necessary for agricultural operations (relative to ongoing labor, maintenance, and other operational costs). Between 2002 and 2007, utility, fuel, and fertilizer expenses jumped 62% for Oregon's farmers and ranchers, as compared to overall farm expenses which rose just 34%.

The general trend of increasing energy costs has made it difficult for Oregon's farmers and ranchers to accurately forecast expenses and profits. While this poses risks to fundamental farm operations, it also complicates the deployment of on-farm energy projects. To consider this type of long-term investment, Oregon's agricultural producers would benefit from a more predictable trajectory of energy expenses.

FOSTERING STABILITY THROUGH ON-FARM ENERGY

On-farm energy renewable energy projects can help lower energy costs and provide a more stable business environment for Oregon's farmers and ranchers. Despite the challenges posed by the current agricultural landscape, these projects have the potential to re-establish stability and achieve cost savings in day-to-day agricultural operations. Energy efficiency improvements have consistently proven to be one of the most cost-effective means to reduce energy expenses. Given the large energy appetite typical of agricultural operations, energy efficiency measures can achieve sweeping reductions in utility bills. Cost savings can be further amplified by deploying renewable energy systems on agricultural land, allowing Oregon's farmers and ranchers to produce energy for farm use on-site. Moreover, via mechanisms such as Oregon's feed-in tariff, farmers and ranchers can ensure a steady, predictable income for many years by selling power generated on the farm to utilities.

ENVIRONMENTAL IMPLICATIONS

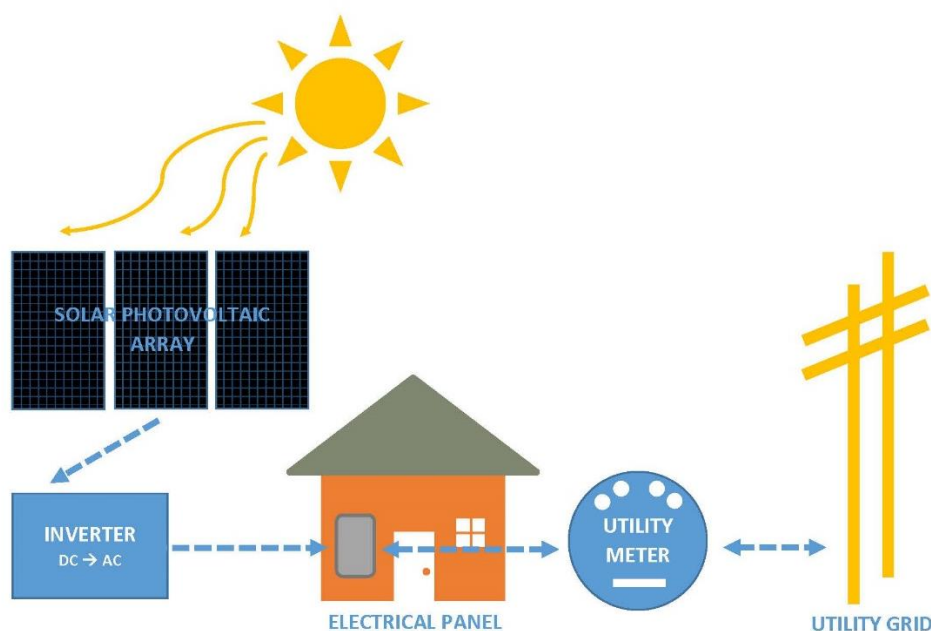
Increased deployment of on-farm energy projects by Oregon's producers results in tangible progress towards mitigating climate change impacts. Oregon's *10-Year Energy Action Plan* identifies reducing greenhouse gas emissions as the state's "most difficult energy challenge," while the state legislature has established significant greenhouse gas reduction targets to be met by 2020 and 2050. As historic stewards of the land, Oregon's producers hold a vested interest in conserving resources and maintaining healthy ecosystems to ensure environmental stability. Distributed on-farm energy projects provide homegrown energy for the state's producers, displacing fossil fuel emissions and reducing the environmental impacts of agricultural businesses. This represents a step in the right direction, towards achieving Oregon's efforts to maintain economic and environmental stability into the future.

RENEWABLE ENERGY TECHNOLOGIES

The pages that follow detail three renewable energy technologies: solar photovoltaics, solar hot water, and small wind. The accompanying descriptions are meant to provide readers with an understanding of each technology's functions and potential applications.

Please keep in mind that this is not an all-inclusive list. For further information on these and other renewable energy technologies, please visit the Oregon Department of Energy website's renewable energy resources: <http://www.oregon.gov/energy/renew>.

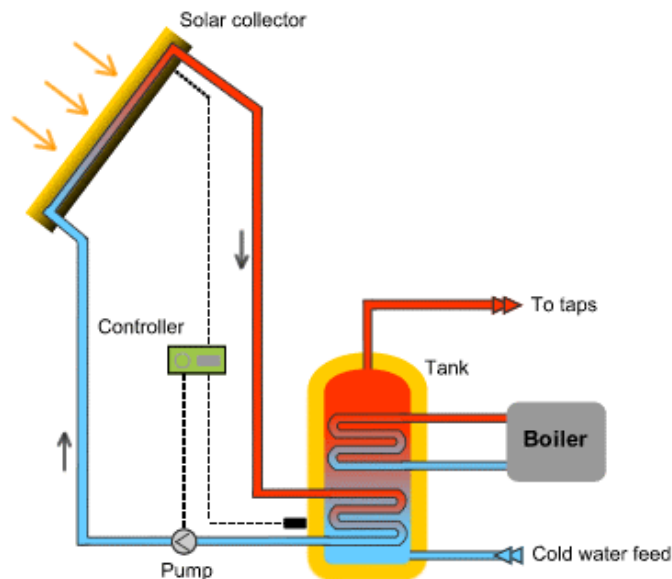
SOLAR PHOTOVOLTAICS (PV)



Solar photovoltaics (PV) convert sunlight into electricity to power your home or business. When the sun shines on a solar PV array, it produces direct current (DC) electricity. This DC electricity flows through an inverter, which “translates” the power to the alternating current (AC) electricity that is used in your home or business. The electricity then flows through your breaker box and goes to power your home’s current energy load.

If your solar system is producing more energy than is being used in your home, the excess will flow to the grid through the utility billing meter, which measures your home’s energy usage. When you install a solar PV system, your current billing meter will be swapped out with a bi-directional net meter, which allows you to have a push/pull relationship with the utility grid. A net meter credits your account when you push energy into the grid, and deducts from your account when you pull energy from the grid. Net excess generation is either purchased at the utility's avoided-cost rate or credited to the customer's next monthly bill as a kilowatt-hour credit. At the end of an annual period, any unused net excess generation credit is granted to the electric utility.

SOLAR HOT WATER

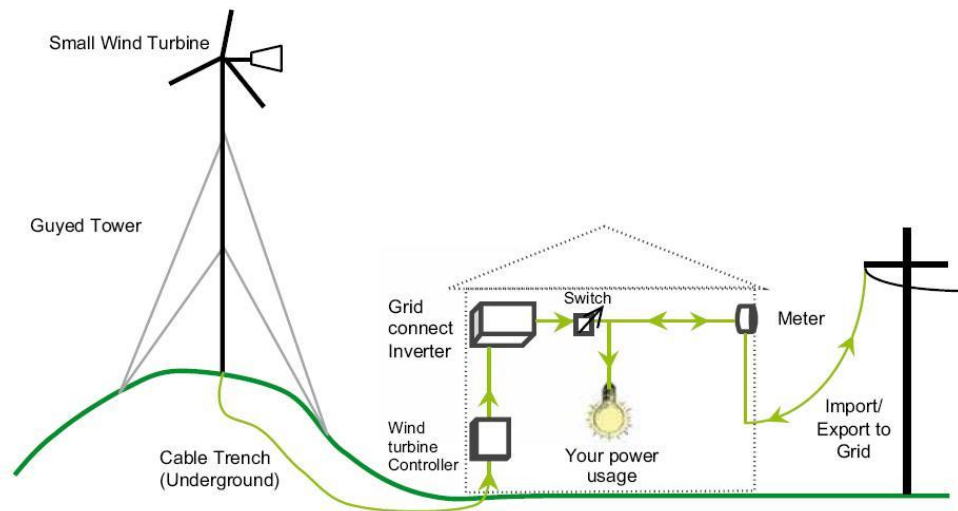


Using the sun's energy to heat water can be as simple as putting a container of water outside on a sunny day. Heating large quantities of water to high temperatures requires some additional equipment. The standard solar hot water system in use today takes advantage of new technologies to maximize efficiency and avoid problems like freezing and the potential for leaks.

- Just as with photovoltaic systems, solar hot water requires a solar collector. The **collector** is mounted to make the most of a site's solar resource. It can be mounted on a roof or on another structure in proximity to the water storage tank. The collector may consist of a number of flat plates or tubes.
- The hot fluid coming from the solar collector goes into pipes inside your hot water tank where they heat the cold water coming from the utility. If this **heat exchange system** does not heat the water to the desired temperature, an additional energy source such as gas or electricity is used to provide the final heat boost before the hot water leaves the tank and heads for the tap.
- The solar hot water system is **closed loop** filled with a fluid that will not freeze and is better at transferring heat than water. After this fluid runs through the pipes in your water tank it is pumped back up to the solar collector to complete the loop.

Solar hot water can be integrated into practically any hot water system. The heat exchanger that interacts with your water supply can be housed in a separate tank or the same tank as your current system. In the case of a separate tank, the solar water heater acts as a preheater and the traditional hot water system raises the temperature of the water as needed. Solar hot water systems require less capital investment than PV panels, but may not be eligible for the same incentives. Just as with PV, regular maintenance will keep the system running smoothly for years.

SMALL WIND



Just as airplanes use the wind rushing over their wings to lift them into the air, wind turbines use the wind rushing past their blades to spin a generator which in turn produces electricity. This electricity runs from the generator through an inverter, which matches the electricity from the turbine to the electricity in the utility grid, and then into the building or utility grid, depending on the building's load.

There are several factors that play key roles in how much energy a wind turbine will produce:

- The **swept area** of the wind turbine refers to the circle drawn by the spinning blades. The swept area determines how much energy can be collected. The larger the swept area, the more wind the turbine encounters, which translates into more energy collected. Wind turbines with shorter blades have smaller swept areas and cannot collect as much energy as turbines with longer blades.
- There is not much benefit to installing a wind turbine at a site with a low **wind speed**. Low wind speeds have low energy, which translates to small amounts of electricity. A doubling of wind speed increases wind power by a factor of 8. This has huge implications for energy production, and is why people installing wind turbines pay so much attention to the average wind speed at the proposed installation height. Wind speed can also vary due to local topography, so siting of a wind turbine is a complicated business. Since wind speed increases with height, a taller tower means more energy production. Towers are expensive, so when designing a system the extra cost of a tall tower is weighed against the increased wind speed at a taller turbine height. Wind installers typically start by looking at computer models, visit the site to look for additional indications of a good wind resource, and when possible, install a measurement system to collect data at the proposed turbine location. Commercial wind farms collect data for up to two years before committing to a site. In the case of small wind turbines, less data can be considered adequate for decision-making.

- Increased tower height not only puts the turbine in a zone of stronger winds; it also puts the turbine farther away from zones of potential **turbulence**. Air flowing around buildings, trees, or other structures does not flow smoothly, but eddies and whirls. The quality of the wind—its turbulence—also has an effect on how much energy a turbine can extract. Nearby buildings, trees, and mountains make ground-level wind flow quite turbulent, and consequently turbines will not produce much energy. Farther away from the ground and other obstacles, the wind smooths out and is better for energy production.

Designing any renewable energy system to take best advantage of the resource and location is difficult, but it is especially difficult in the case of wind energy. Siting a wind turbine appropriately without collecting years of data with expensive monitoring equipment is challenging, to say the least. While wind energy can be a fantastic resource when conditions are right, the development of this resource on a small-scale should be undertaken with extreme caution.

ENERGY STORAGE AND OFF-GRID LIVING

Solar energy is not available at night, and wind energy is only available on windy days. As such, electricity production is intermittent. Most electricity generating systems—solar PV and wind—are interconnected to the utility grid to ensure access to power when the sun is not shining and the wind is not blowing. In turn, interconnected utility customers can receive net metering benefits by feeding excess power production into the grid. As a safety measure, grid-interconnected systems cease to produce power when the electric grid goes down—meaning system owners do not have power during a blackout.

Some system owners opt for certain modifications, such as incorporating batteries for backup power or going completely off-grid. Adding batteries gives grid-interconnected system owners access to backup power when the grid goes down, but adds significant cost and maintenance time in addition to lowering overall system efficiency. However, some solar and wind owners decide that these costs are worthwhile to safeguard against power outage. Off-grid system owners go one step further, using batteries as their sole energy storage mechanism and never interconnecting to the utility electric grid.

FINANCIAL INCENTIVES

Incentives and financing may help agricultural producers overcome financial hurdles associated with installing a renewable energy system. Further information can be found at the Database of State Incentives for Renewables and Efficiency: <http://dsireusa.org>.

FEDERAL INCENTIVES

RESIDENTIAL RENEWABLE ENERGY TAX CREDIT: The federal government provides taxpayers a tax credit equivalent to 30% of total qualified expenditures for a renewable energy system that serves a dwelling unit owned and used as a residence by the taxpayer. Expenditures include equipment, labor costs for on-site preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year. Qualifying technologies include solar PV, solar hot water, wind, and more. *Incentive expires 12/31/2016.* <http://energy.gov/savings/residential-renewable-energy-tax-credit>

BUSINESS ENERGY INVESTMENT TAX CREDIT: The federal government provides businesses in the commercial, industrial, utility, and agricultural sectors a tax credit equivalent to 30% of total qualified expenditures for a renewable energy system. Expenditures include equipment, labor costs for on-site preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. Qualifying technologies include solar PV, solar hot water, wind, and more. *Incentive expires 12/31/2016.* <http://energy.gov/savings/business-energy-investment-tax-credit-itc>

MODIFIED ACCELERATED COST RECOVERY SYSTEM: The federal government allows business to recover investments in certain energy property through depreciation deductions. Most renewable energy property has a 6 year depreciation schedule. Qualifying technologies include solar PV, solar hot water, wind, and more. Property placed in service by December 31, 2013 qualifies for a 50% first-year bonus depreciation. <http://energy.gov/savings/modified-accelerated-cost-recovery-system-macrs-bonus-depreciation-2008-2012>

STATE INCENTIVES

RESIDENTIAL ENERGY TAX CREDIT: Homeowners, renters and third-party owners who pay Oregon income taxes are eligible for the Residential Energy Tax Credit.

- Solar PV systems are eligible for \$2.10/watt with a maximum limit of \$6,000, up to 50% of the net cost. The net cost is calculated after taking any state incentives. The amount claimed in any one tax year may not exceed \$1,500 or the taxpayer's tax liability, whichever is less. Unused credits may be carried forward for five years.
- Solar hot water systems are eligible for a credit of \$0.60/kWh saved during the first year, up to \$1,500.

- Wind turbine systems are eligible for a credit equal to the lesser of \$2.00/kWh produced during the first year, or \$6,000. The incentive is based on actual system production. Wind systems must meet specific requirements for minimum production, tower height, and wind speed, among other requirements.

Qualifying technologies include solar PV, solar hot water, wind, and more. *Incentive expires 01/01/2018.* http://oregon.gov/ENERGY/RESIDENTIAL/residential_energy_tax_credits.shtml

RENEWABLE ENERGY DEVELOPMENT GRANT PROGRAM: The Oregon Department of Energy offers competitive grants to commercial renewable energy projects as part of the Energy Incentives Program. Qualifying technologies include solar photovoltaics, wind, and a variety of other renewable energy technologies. ODOE awards grants up to a maximum of \$250,000 per project, not to exceed 35% of eligible project costs. Grant opportunity announcements are periodically released. <http://www.oregon.gov/ENERGY/BUSINESS/Incentives/Pages/index.aspx>

PILOT SOLAR VOLUMETRIC INCENTIVE RATES & PAYMENTS PROGRAM: Under this incentive program, solar systems installed in Pacific Power, Portland General Electric, and Idaho Power territories are paid for the kilowatt-hours generated over a 15 year period, at a rate set at the time a system is initially enrolled in the program. As of November 2013, rates are as follows:

- Small-scale systems (>10 kW) = \$0.39/kWh
- Medium-scale systems (>10 kW and ≤100 kW) = \$0.23/kWh

These rates are not the actual rates paid to the customer-generator; the actual rate paid is the volumetric incentive rate minus the retail rate. The volumetric incentive rates will be re-evaluated every six months and may be adjusted if necessary. Small- and medium-scale systems reserve capacity via a lottery-based method. Participating systems must be grid-tied, metered and meet all applicable codes and regulations. *Incentive expires 03/31/2016.*

<http://www.puc.state.or.us/PUC/solar/SolarIncentivePilotProgram20712.pdf?ga=t>

COMMUNITY RENEWABLE ENERGY FEASIBILITY FUND PROGRAM: Under this program, the Oregon Department of Energy provides grants for feasibility studies for renewable energy, heat, and fuel projects. Non-residential electric generation projects sized 25 kilowatts to 10 megawatts will be considered. CREFF is designed to be a revolving fund; projects that are ultimately constructed and are profitable are required to pay the state back for the initial grant amount. *Program is currently fully subscribed, but will reopen when funds are repaid back into the revolving loan fund.* <http://www.oregon.gov/energy/RENEW/Pages/CREFF.aspx>

SMALL-SCALE ENERGY LOAN PROGRAM: The Oregon Department of Energy offers low-interest loans for projects that save energy, produce energy from renewable resources, use recycled materials to create products, and use alternative fuels. Loans are available to individuals, businesses, schools, cities, counties, special districts, state and federal agencies, public corporations, cooperatives, tribes, and non-profits. Loan amounts generally range from \$20,000 to \$20 million. Terms vary; loan terms may not exceed project life.

<http://www.oregon.gov/ENERGY/LOANS/Pages/selphm.aspx>

UTILITY INCENTIVES

The following table explains incentives offered by Clackamas County utilities at the time of publication. Utility incentives are subject to change. Please visit your utility's website for the most up to date information on incentive rates.

Solar PV	Solar Hot Water	Small Wind
Portland General Electric www.energytrust.org		
<u>Residential:</u> \$0.75/watt rebate; \$5,000 maximum incentive. <u>Commercial:</u> \$1.20/watt rebate for systems 0-35 kW; \$1.20-0.60/watt rebate for systems 35-200 kW; \$0.60/watt rebate for systems 201-500 kW owned by homeowner or 3 rd party; \$300,000 maximum incentive.	<u>Residential:</u> \$1,000 incentive, applied upfront. <u>Commercial:</u> \$0.40 per first-year kWh savings, maximum incentive 35% of total system cost.	<u>Residential + Commercial:</u> \$5.00/kWh for projects with an estimated average energy output of 9,500 kWh or less; \$47,500 plus \$1.75/kWh per kWh over 9,500 for projects with an estimated average energy output of more than 9,500 kWh
Canby Utility www.canbyutility.org		
<i>No residential or commercial incentive available at time of publication.</i>	<i>No residential or commercial incentive available at time of publication.</i>	<i>No residential or commercial incentive available at time of publication.</i>

PROJECT COST EXAMPLES

The examples provided below demonstrate the costs associated with installing on-farm solar PV and small wind systems, respectively. They should be used as a guideline for producers interested in using clean energy technology to power farm operations. Incentives will vary based on project location and utility affiliation (see previous section on Financial Incentives). *PLEASE NOTE: these pricing examples are intended as explanatory examples only—producers should work with a renewable energy contractor to determine costs specific to their site.*

SAMPLE SOLAR PV PROJECT

Project Name: Steenson Farms

Developer: Advanced Energy Systems

Location: Salem, OR

Project Type: Solar

Project Size: 8 kilowatt solar PV system, estimated production 9,146 kWh per year

Project Cost: \$48,000

PROJECT ORIGINS

David Steenson, owner of Steenson Farms, saw solar as a smart investment for his hazelnut farm. With the financial incentives available, it made sense. The system is in full sun on his shop roof.

PROJECT FINANCING

The project received funding through the Federal tax credit, the Oregon Department of Energy tax credit (which is now a competitive grant), and a rebate from the Energy Trust of Oregon. The remaining cost was self-financed.

PUTTING THE PIECES TOGETHER

Federal tax credit	\$14,500
ODOE tax credit	\$10,000
Energy Trust of Oregon	\$10,100
<u>Private Financing</u>	<u>\$13,400</u>
Total Cost	\$48,000

IS IT WORKING?

According to Mr. Steenson, the project is producing the quantity of electricity predicted—more than 9,000 kilowatt-hours per year. He is pleased with the system's performance.

SAMPLE SMALL WIND PROJECT

Project Name: Buchholz-Schmitz Farms

Developer: Kardon Construction

Location: Mount Angel, Oregon

Project Type: Wind Turbine

Project Size: 20 kilowatt wind turbine, expected production 16,000 kWh per year

Project Cost: \$117,500

PROJECT ORIGINS

Tom and Barbara Buchholz became interested in wind after seeing other turbines installed in their area. They are interested in reducing their electric bill and they see the turbine as a means of achieving that goal.

PROJECT FINANCING

The farm received funding through the federal tax credit, a USDA REAP grant, and incentives from the Energy Trust of Oregon. The remaining cost was financed through an increase in the farm's line of credit.

PUTTING THE PIECES TOGETHER

Federal ITC	\$34,950
USDA REAP Grant	\$20,000
Energy Trust of Oregon	\$42,300
<u>Private Financing</u>	<u>\$20,250</u>
Total Cost	\$117,500

OBSTACLES AND LESSONS LEARNED

Wind projects are sizable construction projects that require know-how. Make sure to hire a knowledgeable contractor who can handle permitting, grant-writing, agency coordination, and the multiple pieces of the installation and construction process.

IS IT WORKING?

So far, so good. The project is still relatively new and thus far its production has met expectations. The family says the jury is still out, however. If the system requires major repairs in coming years, payback will be severely impacted.

SOLAR ENERGY DEVELOPMENT CHECKLIST

PRIOR TO CONTACTING INSTALLERS:

- ☐ Maximize the energy efficiency of your home or business by conserving energy, weatherizing, and installing energy efficient appliances.
- ☐ Research the technology, investment, incentives, and best practices associated with a solar installation. Some good resources include:
 - Residential: <http://solaroregon.org/residential-solar>
 - Commercial: <http://solaroregon.org/commercial-solar>
- ☐ Consider your goals, budget, roof life, and solar exposure. These details will help your installer design a system that works for you!

COMPARE PROJECT PROPOSALS:

- ☐ Contact solar installers in your area to set up a site assessment. It is recommended that you solicit bids from at least three installers. Some good resources include:
 - Find a contractor: <http://solaroregon.org/find-a-professional>
 - List of state-certified contractors:
<http://www.oregon.gov/energy/RENEW/Pages/solar/Support.aspx>
- ☐ Compare bids based on costs, production estimates, services included, warranties, etc.
- ☐ Determine whether you qualify for any rebate or grant opportunities, such as an ETO rebate, an ODOE RED grant, or a USDA REAP grant. Many of these programs require that project construction starts after the rebate or grant application is received or approved.
- ☐ Secure financing, if necessary.
- ☐ Select a solar contractor and sign a contract.

ONCE YOU ARE A SOLAR SYSTEM OWNER:

- ☐ Keep your system maintained and monitor production.
- ☐ Apply for your federal tax credit.

WIND ENERGY DEVELOPMENT CHECKLIST

PRIOR TO CONTACTING INSTALLERS:

- ☐ Maximize the energy efficiency of your home or business by conserving energy, weatherizing, and installing energy efficient appliances.
- ☐ Research the technology, investment, incentives, and best practices associated with a wind installation. Some good resources include:
 - Oregon Department of Energy:
<http://www.oregon.gov/energy/renew/pages/wind/windhome.aspx>
 - Small Wind Certification Council:
<http://www.smallwindcertification.org/for-consumer/>
- ☐ Use a wind map to determine whether your site is a potential candidate for a small wind system. This packet includes a wind map specific to your county—see final page.
- ☐ Investigate permitting and/or zoning requirements pertinent to your site.

COMPARE PROJECT PROPOSALS:

- ☐ Contact wind installers in your area to set up a site assessment. It is recommended that you solicit bids from at least three installers. Some good resources include:
 - Energy Trust small wind trade allies:
<http://energytrust.org/residential/find-a-contractor/small-wind/>
 - Small Wind Certification Council certified turbines:
<http://www.smallwindcertification.org/certified-turbines/>
- ☐ Compare bids based on costs, production estimates, services included, warranties, etc.
- ☐ Determine whether you qualify for any rebate or grant opportunities, such as an ETO rebate, an ODOE RED grant, or a USDA REAP grant. Many of these programs require that project construction starts after the rebate or grant application is received or approved.
- ☐ Secure financing, if necessary.
- ☐ Select a wind contractor and sign a contract.

ONCE YOU ARE A WIND TURBINE OWNER:

- ☐ Keep your system maintained and monitor production
- ☐ Apply for your federal tax credit

Clackamas County Wind Resource - Modeled Data

