
Pilot Project Report: OSU Agricultural Assessments



Energy | Efficiency Center

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Pilot Project Report: OSU Agricultural Assessments:

This is a summary of the results of a pilot project to perform agricultural assessments of four (4) Oregon State University (OSU) facilities.

Background: The OSU Energy | Efficiency Center

This Pilot project is part of an effort to leverage the 20+ years of OSU Industrial Assessment Center (IAC) experience. The center is growing into the OSU Energy | Efficiency Center (EEC) with a goal of providing the Northwest a laboratory to develop a knowledge base of new & common efficiency opportunities in a range of sectors, currently including industry, agriculture, and institutional facilities.

The center is built on student management with faculty mentorship. Since 1986 the core EEC project, the IAC has: Served over 500 manufacturers (545 to date), recommended over \$86 million in annual savings with an average 1.0 year payback, and helped industry achieve implemented savings of over \$9,700,000 in energy, \$4,600,000 in Waste Minimization/Pollution Prevention, and \$11,800,000 in Productivity Improvements.

The mission of the EEC is to “help partners and the region, reduce energy consumption and waste generation, conserve natural resources, and improve profitability and sustainability.” The intended impacts include: direct partner results, influencing and providing learning opportunities for our graduates, and developing resources as well as a wide knowledge-base from EEC activity.

Students develop professionally as they collect data on site, learn to rapidly visualize new systems, brainstorm and problem solve, quickly estimate potential with available data, work professionally with clients and colleagues, analyze opportunities and prepare reports, act as subject mentors and leaders. Partners and the region benefit from student time, energy, creativity, technical capability, and willingness to ask the “dumb question” that can surface unexamined assumptions.

Students offer a special advantage for providing farm assessments, as the relatively low cost to support a student assessment team can make it cost effective to visit farms, a sector that is poorly served currently as agricultural operations are often hard pressed to foot the cost of professional consultants.

Farm Assessment Project Phase 1: Assessments of OSU facilities

This summer in a cross campus agreement, four OSU operations were assessed: The OSU Dairy, Hyslop Farm, Greenhouse, and Vegetable Farm. Four reports were prepared. Following is a brief summary of the results. (The four individual project reports are attached as separate files.)

<h3>OSU Hyslop Farm</h3> <p>Opportunities Quantified</p> <ul style="list-style-type: none">• Lighting• Dryer Fan Controls• Turn of Dryer• Boiler Tune <p>Other Measures Considered</p> <ul style="list-style-type: none">• Boiler & Dryer Economizer• Chemical Hood Filter• Blower Sizing• Tractor Operation• Fuel Tank Cover• Low Pressure Irrigation• Swamp Cooler Control <h3>OSU Dairy</h3> <p>Opportunities Quantified</p> <ul style="list-style-type: none">• Milk Tank Insulation• Parlor Heating Interlock• Safety Lighting Control• Barn Lighting Upgrade• Vacuum Pump VSD• Roofing• Electric Waste Water Pump <p>Other Measures Considered</p> <ul style="list-style-type: none">• Field Moisture Sensors	<h3>OSU Vegetable Farm</h3> <p>Opportunities Quantified</p> <ul style="list-style-type: none">• Electric Tractor Conversion• Electric People Movers• Composting: Vegetable Plots• Composting: Hazelnut Plots• Photovoltaic Array <p>Other Measures Considered</p> <ul style="list-style-type: none">• Fuel Tank Cover• Tractor Operation• Low Pressure Irrigation• Ecosystem Services• Double Pane Windows <h3>OSU Greenhouse</h3> <p>Opportunities Quantified</p> <ul style="list-style-type: none">• Insulate Steam Pipes• Drip Irrigation• Lighting• Air Compressor <p>Other Measures Considered</p> <ul style="list-style-type: none">• Angle Fans• Steam Heating Units
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Project Phase 2: Web Resource and Analysis Tool

in order to extend the reach of the assessment effort, the center also initiated work on a draft Web Resource and Analysis Tool to begin capturing the information, understandings, and analysis approaches gathered and developed in preparation for and through farm assessment and report preparation. The long term goal is to provide links/resources for a wide range of agricultural related topics. To date one of our talented students has developed the basic layout of the site and is tackling it section by section as time permits. Currently the focus is on an Energy Estimators section which we believe will be most useful for website viewers. It is not yet ready for public viewing but we can grant access to interested parties and collaborators to view and provide input on the current state of the site.

Following are a few screen shots from the site.

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Welcome

to our agricultural site

The **Oregon State University Energy Efficiency Center** is here to help inform managers of a wide range of agricultural operations about potential energy saving opportunities. In this website you will find information about us, our experiences, our resources, industry specific opportunities, energy saving estimators and example recommendations.



Energy Estimators:

We have developed energy estimators designed to increase energy awareness and to help agricultural managers identify where there is potential for reduced energy costs. This page will help you estimate potential savings based off your current operational conditions.



Our Experiences:

We have been to a wide range of agriculture operations including dairies, grass seed farms, vegetable farms, nurseries, and wineries. This page will help you become better acquainted with us, our past, and what we do.



Resources:

We have done extensive research to help further our knowledge. This page contains some industry specific opportunities that may not show up else where on the site.

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Energy Estimators

helping you save energy

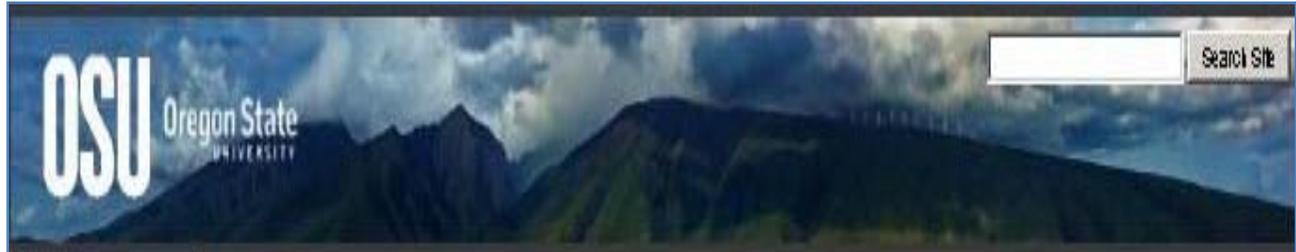
The Oregon State University Energy Efficiency Center has developed energy savings estimators designed to increase energy awareness and to help agricultural managers identify where there is potential for reduced energy costs. All results generated are estimates based off models from our experiences and past assessments.

Conserving Fuel

- Tractor Governor Estimator:**
The Tractor Governor Estimator is designed to help you estimate fuel savings associated with using tractor governors during field use. By shifting up and idling down significant fuel can be saved during operation.
- Tractor Maintenance Schedule Estimator:**
The Tractor Maintenance Schedule Estimator is designed to help you estimate fuel savings associated with keeping maintenance schedule. Maintaining tire pressure, filters, and ballasting can reduce tire slip during work intensive tasks and reduce fuel consumption.
- Fuel Tank Estimator:**
The Fuel Tank Estimator is designed to help you estimate fuel savings associated with covering and protecting fuel tanks. Painting and/or covering fuel tank will reduce direct sunlight exposure thus reducing the amount of fuel evaporating to atmosphere.
- Fuel Tank Tips:**
Tips on how to improve fuel tank storage systems.

Conserving Electricity

- Low Pressure Irrigation Estimator:**
The Low Pressure Irrigation Estimator is designed to help you estimate energy savings associated with converting a linear or central pivot system to low pressure. This will reduce the load on the pump thus reducing energy consumption
- Tractor Heater Timer Estimator:**
The Tractor Heater Timer Estimator is designed to help you estimate energy savings from installing a timer on tractor engine block heaters. Installing a timer will reduce heater operating hours thus reducing energy consumption.



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Fuel Tank Tips

helping you save energy

Storage tanks can lose a considerable amount of fuel due to evaporation and leaks. In extreme cases, up to 40 percent of a tank's capacity can be lost per year through evaporation. This can be reduced to around 0.5 percent by following these tips:

- Keep fuel tanks well sealed.
- Tanks should be aluminum or white to reflect the sun's heat and reduce evaporation.
- Use pressure-relief vacuum caps instead of conventional caps.
- Lock and attend fuel tanks.
- Regularly inspect tanks for leaks. During inspections, tighten all fittings.

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Energy Estimator Page



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Low Pressure Irrigation Estimator *helping you save energy*

Background:

The Low Pressure Irrigation Estimator is designed to help you estimate energy savings associated with installing a variable frequency drive and converting your linear / central pivot irrigation system to low pressure. Operating a system at low pressure is more efficient than a high pressure system resulting in reduced load on the pump and reduced energy costs.

Savings:

Most linear / central pivot irrigation systems utilize a high pressure sprinkler system to deliver water to the field. These system typically operate anywhere from 70 - 100 psi. This is a very inefficient method for delivering water to a field. A more energy efficient system uses low pressure drop down nozzles that require less pressure to operate at the same flow rate as conventional sprinklers. These low pressure systems can operate at pressures as low as 15 - 20 psi without a reduction in flow rate. This puts less load on the pump, by installing a variable frequency drive (VFD), the pump is then able to change how it operates depending on its current load and pressure.

Demand savings will occur because the VFD will "soft start" the pump reducing peak demand. A VFD "soft start" works by slowly ramping up the motor instead of trying to do it instantaneously. This will ensure the peak demand is never more than the motors full load operating amps. A "soft start" will also reduce motor wear and damage caused by hard starting as well as maintenance cost associated with water surge/hammer, sprinkler head damage and flexible coupling damage.

Costs:

Replacing a high pressure irrigation system with a low pressure one requires installing a VFD on the pump and replacing all of the sprinkler nozzles with drop down low pressure spray nozzles. The VFD cost will depend on the size of the motor it will be installed on. As a general rule of thumb you can estimate the cost of a VFD by taking the horsepower and multiplying it by 75 and then add 1,000. This is just a general rule of thumb and cost may vary depending on quality and location.

It will require a professional electrician to install and wire the VFD. Labor costs will vary depending on many variables, but generally they should be around \$600 to \$2,000 for motors of size 10 - 250 hp.

Replacing the sprinkler nozzles will cost approximately \$10 per sprinkler head. This includes the cost of the goose neck elbow, drop down tube, and low pressure spray nozzle.

Assumptions:

For this analysis we assume that the current irrigation system comprises of linears and central pivots as low pressure irrigation will not work with hand lines or wheel lines.

Low Pressure Irrigation Estimator	
Horsepower of Pump :	<input type="text"/> hp
Hours of Operation :	<input type="text"/> hrs/yr
System Pressure :	<input type="text"/> psi
Energy Cost :	<input type="text"/> \$/MWh
Demand Rate :	<input type="text"/> \$/MW

Estimated Energy Savings :	<input type="text"/> 0 MWh
Estimated Demand Savings :	<input type="text"/> 0 MW
Estimated Annual Savings :	<input type="text"/> 0 dollars

* You will need your energy bill to find your energy and demand rates.
* If you do not have a demand charge leave it blank.

Project Follow-on: Commercial Farms and Row crop agriculture Assessment Proposal

As follow-on to this project the OSU EEC will visit at least two commercial facilities, perhaps a dairy, grass seed operation (growing and/or cleaning), and/or a nursery operation with greenhouses on site. The OSU EEC has also made a proposal to the Oregon Processed Vegetable Commission through the Agricultural Research Foundation. It is proposed to assess four processed vegetable growers, analyze their energy and resource use patterns and identify opportunities to reduce electrical, fertilizer, & fuel energy use and improve resource use and production efficiency. The goal will be to offer immediate value to assessed facilities, to hone a long term strategy to serve the agricultural sector and to develop experience based tools to identify and evaluate energy and efficiency opportunities in agricultural operations.

Assessment elements might typically include evaluation of irrigation, fuel use and fertilizer application as well as an open ended review of other opportunities to reduce energy, consumption and waste generation, conserve natural resources and improve profitability and sustainability. Assessment teams will typically include one graduate student, several undergraduate students and an optional faculty member.

The assessment process will follow the OSU Agricultural Assessment approach. They will start with pre-assessment data collection of annual month by month energy use and cost, significant energy users, equipment specifications and site visit preparation details. A site visit will follow and include a tour, brainstorm session, preliminary opportunity prioritization, data collection and a wrap up meeting. Follow-on report preparation work will include an email to the grower with a list of initial calculation results, request for additional data that would be helpful, and additional communication as needed. A report will be prepared with a summary of brainstorm ideas and recommendations, detailed presentations of calculation methodologies, and an energy use breakdown. Dissemination of the project results will include electronic and hard copies of the report to the facility, availability of results to OSU faculty and other interested parties, and continuing to share the report, findings, and methodologies via a web interface.