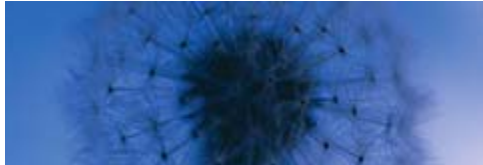




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Carbon Neutral Challenge  
Greenhouse Gas Management Phase 2

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# Carbon Neutral Challenge (CNC) Initiative for Oregon Wineries

## Greenhouse Gas Management Plan Phase 2

### Introduction

#### Overview

The management and reduction of greenhouse gas (GHG) emissions within the Carbon Neutral Challenge is a long-term process with multiple phases. In aggregate, these phases are designed to achieve the strategic objectives of the CNC:

- ▶ to proactively reduce operational GHG emissions
- ▶ to achieve carbon neutrality
- ▶ to enable the participating wineries to be leaders on climate change

Just as Phase 1 represented the beginning of the GHG management effort within the CNC, Phase 2 builds on those efforts and offers additional cost-effective mitigation strategies for wineries to utilize in order to reduce their GHG emissions footprints and save money. As with Phase 1 strategies, all of the recommendations included in this document will not be directly applicable to every participant. It is the hope that by offering an assortment of mitigation strategies, wineries will discover some that will work at their facilities.

#### Phase 2

In conjunction with the Phase 1 recommendations sent earlier in the Carbon Neutral Challenge, the GHG management projects detailed below are recommended steps to continue the long-term process of reducing GHG emissions. In Phase 2, there are six recommendations:

#### *Savings Opportunities*

- ▶ Variable Frequency Drives (VFDs) on Pumps and Fans
- ▶ Temperature Uniformity Measures in Barrel Storage Rooms (Temperature Sensors and High-Volume Low-Speed Fans)
- ▶ On-Demand Hot Water Heaters
- ▶ Free Cooling
- ▶ Solar PV

These recommendations are summarized in the table on the following page.

Solution		Description	Environmental Benefits
<b>Savings Opportunities</b>	<b>Variable Frequency Drives (VFDs)</b>	Ecos recommends that wineries install VFDs on existing pumps and fans. The implementation of VFDs will allow systems to work only at the rate they are required to complete the job they are responsible for.	Impacts will vary based on infrastructure and usage patterns. As an example, the net effect of installing a VFD to a pump that reduces the water flow rate by 20 to 30 percent will save of 50 to 80 percent in system energy consumption.
	<b>Temperature Uniformity Measures</b>	Ecos recommends that wineries install temperature sensors and high-volume low-speed (HVLS) fans in barrel storage areas to ensure that temperatures remain consistent throughout the space being used.	Temperature sensors will not save energy, but will allow wineries to understand the temperature differential occurring throughout the room. HVLS fans will capture energy savings because HVAC fans can be turned off when heating and cooling of the room is not required.
	<b>On-Demand Hot Water</b>	Ecos recommends that wineries replace gas or electric hot water heaters with on-demand water heaters. These systems only heat the amount of water being used and allow for on-hand hot water at any time it is needed.	Traditional hot water heaters waste both energy and water. It is estimated that the implementation of an on-demand system will save 10 to 20 percent of an organization's water heating bill.
	<b>Free Cooling</b>	Ecos recommends that wineries investigate the feasibility of implementing "free cooling" or air-side economizer HVAC systems in warehouses and barrel storage rooms. Free cooling utilizes the outdoor weather conditions to cool buildings rather than using mechanical cooling.	Bringing in outside air at lower temperatures only requires power for the fans to move the air. It has been estimated that companies can capture energy savings of approximately 20 percent of the energy costs related to existing mechanical cooling systems.
	<b>Solar PV</b>	Ecos recommends that wineries look into the potential for installing solar PV at their sites. By installing solar PV, wineries will draw energy from a renewable source, decreasing the amount of energy they are required to purchase from the grid.	The environmental benefit acquired by installing solar PV is dependent on a number of factors, including the type and size of system purchased and the efficiency of the system as a whole.

Please find detailed project descriptions and corresponding environmental benefits below.

## GHG Management: Phase 2

### Variable Frequency Drives (VFDs) on Pumps and Fans

#### Project Description

Pumps and fans are hidden users of energy – quietly using electricity 24 hours per day, 365 days per year. Slightly over-sized systems are usually installed to ensure that they work properly in all situations. This results in higher energy use than process equipment actually requires.

In general, the implementation of variable frequency drives (VFDs, also called variable speed drives) tends to have strong potential for savings. The implementation of VFDs will allow systems to work only at the rate they are required to complete the job they are responsible for; in situations where conservation strategies such as shutting systems off completely are not possible, they are therefore a viable option for substantially decreasing energy use. Installing a VFD on a pump or fan reduces the rotational speed of the motor, which then decreases the speed of the pump. This allows the pump to provide exactly the amount of water or air required for system use.

It should be noted that wineries may want to assess conservation opportunities before installing VFDs. For example, before installing a VFD on air handler fans, wineries should first investigate the possibility of turning them off for a large portion of the year, when neither heating nor cooling is required. This will save the winery more energy in the long run, and may negate the cost-effectiveness of VFD implementation. In situations where conservation strategies are not possible, however, VFDs are a very viable option for substantially decreasing energy use.

VFDs can be installed quickly and efficiently by an electrician, and do not require that wineries purchase new pumps or fans. VFDs come in manual and automatic models; manual VFDs require that the system owner changes sets the system to work at the desired level, while automatic models discern the necessary rate and alters the level accordingly. Because automatic VFDs include system sensors, they are more expensive. Manual systems will often work well for wineries, given the seasonality of water and air usage in their operations.

#### Environmental Benefits

It is difficult to estimate specific energy savings that will be derived from the installation of VFDs, due to the fact each winery's pump and fan infrastructures will vary, and VFDs may be applicable only for some of the systems. Regardless of system specifications, however, VFDs save energy in an exponential manner; in addition to the reduction in water or air flow which in itself will save energy, VFDs will also decrease pressure drops through piping and system equipment, resulting in additional energy savings. The net effect of installing a VFD to a pump that reduces the water flow rate by 20 to 30 percent, for example, is a dramatic savings of 50 to 80 percent in system energy consumption.

## Temperature Uniformity Measures in Barrel Storage Areas

### Project Description

Many wineries expend considerable energy maintaining temperatures in their barrel storage areas and cellars. To ensure that no energy is being wasted and that temperatures remain consistent throughout these commonly large cavernous spaces, Ecos recommends that wineries simultaneously install temperature sensors and high-volume low-speed fans.

#### Temperature Sensors

Often, temperature sensors in barrel storage areas are very limited; most wineries have one sensor per room or HVAC unit installed, despite employees' concerns regarding temperature stratification and the resulting uneven wine barrel temperatures. Ecos therefore recommends that wineries install multiple temperature sensors located at different elevations and regions of the space. The goal is to measure actual space conditions more accurately. Wireless temperature sensors allow for adequate measurements without the need for extensive wiring. The cost will vary on the quantity of sensors as well as the level of sophistication of controls and reporting hardware and software required.

#### High-Volume Low-Speed Fans

Because temperature-controlled barrel storage rooms are typically large voluminous areas with high ceilings, attempts to use small residential fans are very ineffective at moving the necessary amount of air required for adequate mixing and uniform space temperature control, at times causing flavor differences in the wine stored in different portions of the room. In place of these, Ecos recommends that wineries install high-volume low-speed (HVLS) fans that will move large volumes of air efficiently in spaces with high ceilings.

In many barrel rooms, HVAC air supply fans operate 24x7 year round; even when they are not in cooling or heating modes, the fans are always operating. When neither heating nor cooling is required, the HVLS will be more efficient at mixing the air and creating uniform conditions than the HVAC fans are. These HVAC fans can then be turned off when not needed, allowing for the capture of additional energy savings.

The investment required will depend on the desired degree of automation for the control system and the difficulty of locating and installing the HVLS fans. If a manual control system is used (in which the winery turns off HVAC units when not needed and manually turns on HVLS fans) and the HVLS can be self-installed (similar equipment is required for installing HVLS fans as for changing out high-bay lighting), total costs can be kept fairly low. Alternatively, if automated controls are installed, the total project cost can increase many times the base system estimate.

### Environmental Benefits

While the sensors by themselves are unlikely to result in energy savings, they will likely have a positive impact on wine quality control and lead to an increased understanding of barrel room temperature performance. Installing these sensors will give the wineries the opportunity to assess the current status of the room, and to purchase only the HVLS fans that are needed to ensure that conditions are uniform throughout the room.

The energy savings captured by installing HVLS fans will depend on the size of the room and the number of fans required. In regions such as Oregon with moderate fall and spring temperatures, heating and cooling is not required during half of the year; the HVAC fan can therefore be deactivated and HVLS fans can be used during that time.

## On-Demand Hot Water Heaters

### Project Description

Replacing gas or electric hot water heaters with on-demand water heaters can capture substantial energy savings for many wineries. Traditional hot water heaters waste both energy and water: they operate constantly, continually heating the water in the tank as it cools or as it is used to maintain a consistent temperature. In addition, the water left in the pipes cools over time, requiring the spigot operator to wait until the cold water has cleared the pipes before hot water from the water heater tank is delivered.

While traditional hot water heaters may be sensible for industrial facilities that require large amounts of hot water to be available at any time, most wineries only use heated water for cleaning purposes and therefore have limited heated water needs. This implies that many wineries will benefit from the installation of an on-demand system.

Demand water heaters heat water directly without the use of a storage tank. They therefore avoid the standby heat losses associated with traditional water heaters. When a hot water tap is turned on, cold water is piped in and heated by either a gas burner or an electric element. As a result, demand water heaters deliver a constant supply of hot water.

On-demand systems also have a 20-year life expectancy, generally twice as long as traditional water heaters. Periodic water heater maintenance can significantly extend your water heater's life and minimize loss of efficiency. Read your owner's manual for specific maintenance recommendations.

The cost effectiveness of this recommendation is dependent on a number of factors, and we encourage you to do further due diligence before considering implementation. The largest factors that will impact whether on-demand water heaters are financially feasible is whether any alterations to related infrastructure need to be made, such as natural gas line improvements or the addition of venting.

### Environmental Benefits

Because on-demand hot water heaters only heat the water that is being used, it is estimated that these systems will save ten to twenty percent of your organization's water heating bill. This can be higher if the current traditional water heater is oversized or an older model.

## Free Cooling

### Project Description

Ecos recommends that wineries investigate the feasibility of implementing “free cooling” or air side economizer HVAC systems in warehouses and barrel storage rooms. Free cooling is increasingly gaining importance in the heating, ventilation and air conditioning (HVAC) market. Free cooling refers to the utilization of the favorable outdoor weather conditions rather than using mechanical cooling, which requires greater electricity to cool building spaces. This leads to substantial savings in energy costs and also has a limited carbon footprint. Free cooling generally is a relevant solution for any large operation that requires the maintenance of stable temperature and humidity levels year round, like those located in mild climates with cool night temperatures, even during peak summer months. Oregon tends to be a good region for the implementation of this technology, given its relatively low night temperatures, even during the summer; many wineries will be able to use free cooling on most nights throughout the year, even during the peak summer months. Mechanical cooling, however, will still be required during summer daytime hours when outside air temperatures are above the desired barrel room temperature. The effectiveness of a free cooling system depends on the acceptable level of variability in space air temperature that will not impact the wine being stored in the warehouses and barrel storage rooms.

In addition to the energy savings captured by pre-cooling the barrel room with outside air at night, free cooling can provide further savings if the room is allowed to warm up to temperatures higher than the current set points during the day. The higher daytime temperature set point will reduce the amount of time mechanical cooling is required to operate as the room warms during the day. Prior to implementing a free cooling system, tests should therefore be completed to determine the minimum and maximum temperatures the room can fluctuate over the course of 24 hours while allowing the barrels to remain at a constant temperature.

### Environmental Benefits

Free cooling is not a new concept; it has been in existence for over 30 years, but has become more economically feasible in recent years as energy rates continue to increase and HVAC control systems have become more sophisticated. Bringing in outside air at lower temperatures only requires power for the fans to move the air; this system therefore avoids the need to operate the energy-intensive refrigeration equipment such as the condenser tower, compressor, chilled water pump and so on used in mechanical cooling systems. It has been estimated that companies can capture energy savings of approximately 20 percent of the energy costs related to existing mechanical cooling systems. In addition to cost savings, free cooling also reduces CO<sub>2</sub>, NO<sub>x</sub> and other harmful emissions.

## Solar Photovoltaics (PV)

### Project Description

Solar photovoltaics (PV) are a method for generating solar power by converting sunlight directly into electricity through the use of solar cells packaged in photovoltaic modules. There is good potential for solar power generation in Oregon: according to University of Oregon's Frank Vignola, two-thirds of Oregon receives more solar radiation than does Florida, and even Astoria gets more sunlight than Germany, which leads the world in solar installations. The fact that Oregon has enacted environmental goals to achieve 25 percent of power from renewable sources by 2025 implies that financial incentives for solar PV in Oregon will remain strong.

Incentives for solar PV implementation include:

- ▶ **Federal Business Energy Tax Credit or Grant**, which will cover 30 percent of the costs associated with PV installation. See <http://www.irs.gov> for more information.
- ▷ **Oregon Business Energy Tax Credit**, which will also cover up to 50 percent of eligible project costs, distributed over 5 years. See <http://www.oregon.gov/ENERGY/RENEW/Solar/Support-BETC.shtml> for more information.
- ▷ **Energy Trust of Oregon**, who works with its utility partners to offer incentives for solar PV. If you're a customer of PGE, Pacific Power, NW Natural, Cascade Natural Gas, or Avista, you are eligible for an incentive of approximately \$1.75 per watt created; the specific incentive rate is dependent on the size and configuration of the project you install. See <http://www.energytrust.org/solar/commercial/standard.php> for details.
- ▷ **Rural Energy for America (REAP) Program**, which provides grants and loan guarantees to farmers, ranchers, and small businesses for purchasing renewable energy systems or make energy efficiency improvements. Grants for renewable energy systems can be between \$2,500 and \$500,000, not to exceed 25 percent of the project cost. See <http://farmenergy.org/index.php> for additional information.

Some utilities also may offer incentive programs for solar PV directly to their customers. To see if your utility has an additional program, contact your utility representative.

The best location for a PV technology installation is on a flat roof, a sloped roof, or acreage clear of trees and buildings with good southern exposure. A key constraint for an adequate roof location is the structure's weight load capability; a typical installation requires that the roof be capable of supporting an additional 10 pounds per square foot.

### Environmental Benefits

The environmental benefit acquired by installing solar PV is dependent on a number of factors, including the type and size of system purchased and the efficiency of the system as a whole. As a frame of reference, a 50,000 square-foot portion of roof space with good southern exposure will allow for the installation of a 500 KW PV system. A PV system of this size using a 30-degree tilt of the panels will produce approximately 820,000 kWh annually.