Energy Efficiency Series

Jordan Winery upgrades reduce ENERGY use

BY Tina Vierra

Jordan Winery (Healdsburg, CA) embarked on several projects to improve the efficiency of their production facility, beginning in 2007. Tim Spence (Jordan's director of facility operations) has replaced an inefficient refrigeration system, installed lighting retrofits, a new piping system, and new roll-up doors.

Resource Solutions Group (RSG, Half Moon Bay, CA) advises wineries in identifying energy efficiency improvements to existing equipment that help meet operational and sustainability goals, and to secure rebates offered by Pacific Gas & Electric Company (PG&E, San Francisco, CA).

The RSG Wine Industry Efficiency Solutions (WIES) program was established in 2006 as a third-party program in PG&E's energy efficiency portfolio, to offer no-cost services for PG&E customers including: energy audits, project analysis, implementation support, and financial incentives to help achieve cost-effective energy-efficiency measures, with quick turnaround on project completion.

Chris Pilek (WIES Program Manager of RSG) began advising Spence and his team on continuing retrofits at the winery in January 2008. The WIES program conducted a comprehensive energy audit of the Jordan facility, analyzing baseline equipment conditions, making recommendations for upgrades, and identifying opportunities to reduce energy consumption.

Efficiency projects at Jordan Winery

Re-roofing of the Jordan barrel room began in October 2007 and was finished in early 2008. Crews removed two layers of roofing — the original roof and an 18-year-old roof addition, replacing them with four inches of ridged insulation topped with a "cool roof." The white vinyl cool roof is heat-reflective to reduce heat gain.

28, 400-watt metal halide light fixtures in the case goods warehouse and 25 outdoor fixtures were replaced with more efficient T8 fluorescent fixtures in 2008. Lighting retrofits continued in 2009 with 11 new fluorescent fixtures in the fermentation room and 12 in the barrel room. All new lighting was placed on motion sensors so that the lights will turn off if no one is working in a room.

Pilek projected the annual reduction in energy use with new lighting at 1,200 kWh per fixture. Through the WIES program at RSG, Jordan has earned $7,380 in lighting incentives, and reduced consumption by 58,215 kWh per year.

T-8 fluorescent lighting in fermentor rooms, casegoods warehouse, and barrel room reduces energy use by 58,215 kWh/year.

The winery is reclaiming process water for use on its landscaping. Spence's goal for 2010 is to reclaim 2,000,000 gallons.

Four steel roll-up doors were replaced — two on the warehouse loading dock in 2008 and two in the barrel room in 2009. The original steel doors, all on south-facing walls, absorbed significant heat gain from sun exposure. The new Thermocore-981, 12x12-foot roll-up doors have a foam insulation core and aluminum skin, reducing the heat load on the cool rooms. The WIES program obtained rebates for

The Smardt chillers are water-cooled and have magnetic bearings, reducing friction, energy use, and maintenance costs.

Six air-handlers atop the barrel room and five atop the casegoods warehouse, are key components of the energy-efficient new system.

COOL-FIT ABS Plus piping supplies and returns chilled water to fermentation tanks. [Left center, above tanks] Manual COOL-FIT ABS 546 ball valves can isolate supply and return to individual tank aisles.

Jordan Winery on the two doors replaced in 2009 of $2,117, and the estimated reduction in energy consumption by the winery is 15,330 kWh per year.

Spence and his team also made small efficiency upgrades, such as LED lighting in offices and a new energy-efficient refrigerator in the winery's kitchen. Restrooms were retrofit with more efficient fluorescent lighting and motion-sensor faucets in 2009.

Utility rebates for refrigeration systems

Jim Chaaban, senior account manager for wineries with the PG&E Service and Sales Division, has credited the winery with incentives on new, more energy-efficient equipment installations. Since 2007, PG&E reports Jordan Winery's participation in incentive programs has earned $46,485 in rebates, saved 340,988 kWh, and reduced energy demand by 31 KW annually.

Pilek explains that retrofit rebates fall into two categories, **prescriptive rebates** and **customized incentives**. "Rebates are simple — where enough field data has been collected over time for a certain type of energy efficiency project, a generic energy savings can be assigned and a standard cash amount is provided," he says. "A catalog listing the rebates available is on the PG&E website and includes many types of projects.

"**Customized incentives** are more complex, as each winery's potential energy reduction varies based on its equipment and operating conditions. Where catalog rebates are too narrowly defined or do not address the winery or vineyard's specific energy savings opportunities, a **customized incentive** can be calculated based on the specific equipment in use, hours of operation, and other factors. Most wineries are not aware of this path, and assume if it is not in the catalog, no rebate is available."

The **customized incentive** option involves pre-project discussions with PG&E or PG&E partners on the energy-saving options available, documenting before and after conditions, development and review of energy savings calculations, and in many cases, field measurements. With careful management, **customized incentives** give wineries access to a broader variety of energy efficiency projects that are eligible for rebates.

Typically a winery would need to hire an engineering firm to help develop the appropriate energy savings calculations and represent them to PG&E's technical reviewers in order to take advantage of this type of energy efficiency incentive. Wineries can start the **customized incentive** process at no-cost by consulting with their PG&E field representative, who will explain the resource options available for improving energy efficiency, or by calling the PG&E Agricultural Customer Service Center at 1-877-311-FARM (1-877-311-3276).

PG&E customers and WIES program participants can take advantage of **prescriptive rebates** from the Ag/ Food Processing Rebate Catalog including:

- Wine tank insulation (rebates increased in October 2009 to $2.25/square foot for indoor tanks, $3/square foot for outdoor tanks-Coastal, and $3.75/square foot for outdoor tanks-Central Valley);
- Strip curtains for walk-in boxes ($3/square foot);
- Pipe insulation for boiler systems (up to $4/linear foot);
- Replacement of HID or incandescent fixtures with fluorescent fixtures (up to $125/fixture);
- Replace T12 fixtures with T5 or T8 (up to $7.50/lamp);
- Occupancy sensors (up to $44/sensor);
- Efficient evaporator fan motor ($20/motor);
- Evaporator fan controller for walk-in coolers ($75/controller);
- Steam or water process boiler ($2/MBtuh);
- Insulation for bare suction lines ($1/linear foot).

Retrofit projects that qualify for PG&E **customized incentives** include:

- Replacing old chillers with energy efficient models that include motor controls to automatically ramp up and down based on refrigeration need;
- Installing variable frequency drives on glycol pumps and condenser fans;
- Installing controls to cycle evaporator fans;
- Installing controls for floating head pressure and suction pressure;
- Installing energy-efficient motors;
- Replacing air cooled condensers with evaporatively cooled condensers;
- Efficient aerators for wastewater ponds;
- Dissolved oxygen sensors for wastewater ponds;

- Air compressor upgrades and replacements;
- Glycol pipe and tank insulation;
- Refrigerant heat recovery devices;
- Barrel washing heat recovery.

As of January 2009, the PG&E ACR (air conditioning and refrigeration) rebate is $0.15/kWh saved, the ACRII rebate is $0.09/kWh saved, and $100 is credited for the reduction of each kW.

On September 24, 2009, the California Public Utilities Commission (CPUC) authorized the largest three-year state energy efficiency program (2010-2012) in the U.S. to the tune of $3.1 billion. New PG&E energy efficiency rebates and incentives are being finalized. Applications received for products purchased and installed on or after January 1, 2010, are eligible for the new rebates.

Wineries should check their utility's website for the most current rebates and incentives available that are subject to change.

Refrigeration system

Jordan Winery achieved its biggest reduction in energy use by replacing its refrigeration system.

"The Jordan facility requires refrigeration to chill jacketed wine tanks during harvest," Chaaban explains, "and to maintain cold storage for barrels and case goods year-round. The Jordan project qualified for PG&E's **customized incentive** program, and provided the winery with an annual savings of 261,001 kWh, reduction of 14 KW of demand, and a PG&E incentive of $36,540."

Spence chose his existing maintenance contractor, Indoor Environmental Services (IES, Santa Rosa and Sacramento, CA), to install the new refrigeration system.

"The winery's existing mechanical system contained a wide variety of equipment that was added on and changed over many years," says Ken Petro, CEO of IES. "Service repair costs and the age of some equipment were concerns that led the winery to choose to upgrade. We designed an energy-efficient mechanical system retrofit, replacing existing chillers, air handlers, and the control system."

Three key energy-saving features of the new systems at Jordan Winery are:
1) Two Smardt chillers with Turbocor compressors: Replacing conventional reciprocating compressors with Turbocors resulted in a drop from 1.3 kW/ ton to 0.7 kW/ton;
2) Two Evapco cooling towers: Changing from air-cooled to water-cooled compressors further dropped the energy usage from 0.7 kW/ton to 0.5 kW/ton;
3) Six air handlers and two circulation pumps, and changing direct-expansion controls to a Honeywell/Tridium control system.

The Turbocor compressors with the water-cooled Smardt chillers are the latest in modern compressor technology, with magnetic instead of traditional bearings, eliminating both mechanical wear due to friction, and the use of oil. The variable-speed compressors can be adjusted up or down depending on winery demand. PowerPax electronic expansion valves, and the optional use of load-balancing valves at very low loads are included.

"Field reliability has been outstanding — not surprising when you consider that 80% of all chiller problems in the field are due to failures in compressor oil return, and the Smardt chillers use no oil," explains Joe Cortese, PE, IES project engineer in charge of the Jordan installation. "Turbocor-trained engineers and technicians have found that total maintenance costs for oil-free chillers are well under half the cost of traditional, lubricated chillers.

"The elimination of oil usage for lubrication ensures that the efficiency of the Turbocor compressors remains constant over the years. In older technology, oil usage would lead to a gradual degradation of the heat transfer of the chillers."

The Honeywell/Tridium controls regulate all aspects of the mechanical system, from the start/stop of chillers, to humidity and CO_2 levels, temperature, and operating pressure of each compressor. The controls monitor, mark trends, and archive data for future reference. The Web-based system allows winery personnel remote access to 125 set-points. The combined technologies of the chillers, compressors, and controls deliver energy-use reduction along with very quiet operation.

Jordan Winery reduced energy use by 108,600 kWh in its first year with the new equipment. System demand on the utility's grid was reduced by 14kW in 2008. PG&E credited the winery $36,540, based on an estimated energy-use reduction of 261,000 kWh per year with the new system.

Testing with Elite Pro meters shows that the actual performance of the new chillers is far better than originally calculated. Engineers believe the industry-standard SPC Estimation Software and engineering calculations used to give wineries the catalog rebate amounts are too low for the high-performing Turbocors.

Jordan Winery's condenser system loop is completed with two Evapco fluid coolers receiving water from two condenser pumps, while two system pumps circulate chilled water to air handlers throughout the facility. The fan motors in the cooling towers have variable-frequency drives, minimizing the energy required to operate the fans while achieving required heat rejection.

In March 2009, Spence's team upgraded the case goods warehouse with five more air handlers, and put two outside tanks onto the new cooling system.

More than 1,200 feet of old piping throughout the fermentation cellar was replaced by a new COOL-FIT™ ABS Plus pre-insulated piping system (175 feet of 4-inch diameter "main" lines, 400 feet of 3-inch diameter piping in tank aisles, and 650 feet of 1½-inch diameter connections to tanks). The system includes pipes, fittings, manual and actuated valves, and measurement and control devices. The pipe is black, UV-resistant insulated plastic, suitable for outdoor or indoor mounting, and Spence reports that the system maintains a consistent chilled water temperature of 32ºF throughout the piping

The unusual pipe joints fit together internally and are sealed with a solvent, so the insulation is not removed to perform joints, and seals are water- and vapor-tight. The smoothness of the plastic interior of the pipes inhibits deposit buildup and flow reduction, so the pipes experience less pressure loss and contribute to greater system efficiency.

With the further system upgrades and refinements to the new equipment to improve its performance in 2009, in early December, Spence measured Jordan's reduction at 221,407 kWh for 2009.

Future efficiency improvements

Pilek reports that recommendations for further lighting retrofits and a wastewater pond aerator upgrade are among the next group of projects from the WIES Program at Jordan Winery in early 2010. The energy reduction, if implemented, is estimated at 75,000 kWh per year, about $11,250 in annual cost savings.

Spence and Chaaban reviewed the winery's utility rate structure in January 2010 to explore switching some of the winery's agricultural accounts to more suitable rate schedules. The idea came from Chaaban, who believes that if the winery qualifies for a better rate schedule, Jordan Winery may save up to $5,000 per year.

In January, Jordan Winery implemented a new "Power Shaver" program recommended by IES. Cortese and Nicholas Moen of IES installed five "power factor correction" devices on large equipment motors at the Jordan facility. Field-tested at the winery in summer 2009, the devices are expected to improve the power factor of the energy pulled from the utility grid from 85% to 95%.

Moen explains that the devices are designed to flatline energy spikes in motors operating at 7 hp or above on startup (acting as voltage regulators), and to increase the motors' ability to maximize the use of power as it comes in from the utility grid (converting wasted magnetic energy to useful energy). Acting as capacitors reducing wasted current, the devices should allow the motors to get more use out of the energy they pull from the utility grid, thus reducing the amount of energy needed to run them.

Spence believes Jordan Winery will be one of the first wineries to use the Power Shaver devices, and thinks the experimental program (not eligible for utility rebates) will pay for itself in energy-cost savings. IES estimates the payback period of the installation at 2.46 years, and that the winery can save $14,866 per year on energy bills.

PG&E does not recommend using power factor correction equipment to save energy, nor are any PG&E incentives available for power factor devices.

Spence and his team continue to monitor the winery's energy use, vineyard and winery operations and practices, and overall carbon footprint. His eventual goal? "With facility improvements and future projects, we hope to become carbon neutral," replies Spence. ■

Resources

The website for wineries and vineyards interested in utility rebate programs in California is www.pge.com/wineries/.

IES (Indoor Environmental Services) can be found at www.ies-hvac.com/.

Information about the Wine Industry Efficiency Solutions program (WIES) offered by Resource Solutions Group can be found at www.rsgrp.com/wine.php.

Reprint From:

PRACTICAL WINERY & VINEYARD

www.practicalwinery.com ▪ 415/479-5819

Ongoing Coverage of Energy Efficiency Series:

Water is the new Energy **(May/June 2010)**

Wineries earn incentives to reduce Energy on demand, Part II **(Jan/Feb 2010)**

Wineries earn incentives to reduce Energy on demand, Part I **(Nov/Dec 2009)**

Winery lighting upgrades **(March/April 2009)**

Merryvale Vineyards' Starmont Facility – Energy efficiency and sustainability **(Jan/Feb 2009)**

SUBSCRIBE TODAY!
Go to PWV website and subscribe for 7 issues for the price of 6!