

Beating the Meter Reader

Alternative Energy Sources and Energy-Saving Devices

by *Mick Winter*

Sep 2001 Issue of Wine Business Monthly

Reducing energy use and finding alternative and cheaper sources of energy--particularly electricity--are a good idea at any time. With electricity shortages and price increases such as California has recently been experiencing, now is an even better time for considering other ways of powering, heating and cooling your winery.

No matter where in the world you're located, the expertise and materials are available to help you decide if, and how, you should do this. We look at a few wineries that have already done this, and discuss other techniques and devices that are available to help you be more energy-efficient.

Alois Lageder, Italy

Alois Lageder, in northern Italy near Bolzano, is a winery with a four-generation heritage of winemaking. But it is hardly stuck in the past. The winery is a leader in the use of solar and other alternative forms of energy.

The buildings at their historic Tenuta Löwengang estate in Magrè were expanded in 1995 and 1996 with the construction of new winemaking facilities and administrative offices.

The winery's project had two main goals:

- The creation of a natural, healthy and esthetically pleasing environment for both man and wine, and
- The creation of a basis for a sound, sustainable economy that assures future generations will inherit a livable world.

Construction principles emphasized low energy consumption and the use of biological materials. Measures include heat radiating ceiling panels, heat retention in the air distribution unit, and solar panel collectors for heating water. These all contributed to the reduction of emissions released into the environment.

The photovoltaic system used in the new buildings covers many of the winery's essential electrical energy needs while protecting the environment. The winery considered a central solar energy system an extension of its philosophy of the connection between man and nature. Since the sun of the Alto Adige region ripens grapes of such an optimal quality, the winery believed it should also be used to heat man's environment in a clean, efficient and qualitative manner.

The new buildings are designed to integrate into the existing 15th century buildings as well as later renovations conducted in the 1800's. The external façade is characterized by a large, open roof structure typical of the architecture of the southern part of the Alto Adige region.

With very few exceptions, only natural materials such as wood and stone were used. The result is a building where offices lead into an interior winter garden, where working areas are free of electromagnetic radiation, and where a glass roof and large windows reduce the need for artificial lighting to a few hours a year.

Natural Winemaking

The objective of the new winemaking facility was to vinify grapes in the most natural way possible, yet use state-of-the-art equipment and computer technology. The facility is based on two basic natural principles:

- The force of gravity

- The circular form

Grapes, must and wine are moved by gravity. A "vinification tower" 14 meters high eliminates the need for pumps and other mechanical methods and tools. Fermentation tanks are located in a circle equidistant from the tower so that the grapes need travel only a minimal distance to reach them.

Future plans include the digging of an underground cellar within the limestone rock walls, so that wines in barrels and bottles can mature and age under natural temperature and humidity conditions.

Energy Conservation

Construction methods for the new buildings assure energy conservation. The office's external walls and roof take advantage of the best available thermal insulation. Loss of heat in winter is far lower than usual, and a fresh, cool internal temperature is easily maintained in summer.

The cellars are completely temperature-controlled. A heat recovery system has been installed that captures 70 percent of the heat expended during fermentation. The winery needs only 22.5 kW for heating instead of 75 kW. It was also able to reduce cooling energy needs from 43 kW to 12.9 kW.

The offices are heated with radiator panels in the ceiling with a low temperature radiation, which maintains a temperature of 38-43° C (100-109° F). Using this radiant heat, an optimal temperature can be maintained that is plus or minus 3 to 5 degrees Celsius lower than with traditional solutions, resulting in significant energy savings.

Other benefits include higher air humidity, because of lower temperature, and cleaner air, since without convective hot air movement, dust does not stay suspended in the air.

Geothermal Energy

Along the back part of the offices and the deepest parts of the winery runs a large cave that borders a natural rock wall. External air enters through a respiration grill four floors up and descends diagonally along the rock wall into the cave, which has a constant temperature of 10° C (50° F).

These unique natural conditions present in the heat of the earth allow air to be heated in winter and cooled in summer. Three ventilators in the deepest part of the cave distribute this air throughout the winery, and suck out exhaust air.

The compressors for controlling temperature during fermentation and cooling the wine, and the industrial water used for cleaning the production, are connected to the same system, allowing for the use of geothermal energy for heating and cooling. Two of the three refrigeration systems (each with an electrical absorbing potential of 25 kilowatts) can be used as either heat or cold pumps. A pool closes the distribution circle of water. There is a higher-grade complexity and efficiency in this system of heating and cooling.

The winery is thus able to avoid the expense of burning fossil fuels such as diesel, and produces no toxic gases. The entire heating/ cooling system is controlled by a computer system that addresses the changing needs of each area of the facilities.

Solar Energy

In the office area, an interior garden covered by a glass roof harvests and distributes light and heat from the sun's rays. In summer, louvered glass windows are opened to take advantage of fresh air and natural air currents.

Twenty-four square meters of solar panels and two thermal tanks of 1,500 liters supply the winery with all the hot water it needs. These solar collector panels each have a capacity of about 17.5 kilowatts (at a solar radiation of 1,000 watts per square meter). The computerized SPS system is aligned with the hydraulic one, and functions of both are connected to the office's radiating heat panels.

Electrical energy production occurs through the solar panels. On top of the building's roof are 160 solar panels covering 136 square meters. The roof structure is inclined 30 degrees facing south-southeast and is covered with layers of copper. Its electrical capacity is up to 17.7kWp (electrical energy capacity at a

solar radiation of 1,000 watts per square meter). Eventually this central solar system will be enlarged in order to obtain more than 50kWp.

The energy produced by the solar panels enters the electrical network at a low voltage via an inverter, and is therefore available for all the winery's electricity needs. Any excess electrical energy is metered and sold to the region's grid. Because of its connection to the larger grid, the winery can also obtain electricity when larger quantities are needed than the winery itself can produce.

All measurements of solar energy are tracked and stored by computer, in order to obtain maximum efficiency, adequate records, and an accurate energy balance.

The winery's solar system is the largest and most modern in northeastern Italy, and the first in that country financed by private funds.

Architects for the project were Abram & Schnabl of Bolzano. Ecological Building Consultant was Rolf Disch of Freiburg, Germany.

Alois Lageder

www.lageder.com

Abram & Schnabl Architects

I-39100 Bozen/Bolzano
Sparkassenstrasse 15
Via Cassa di Risparmio 15
Phone/Fax: 0471.974690.
www.abram-schnabl.com

Rolf Disch, Architect

Wiesentalstrasse 19
79115 Freiburg, Germany
Phone: 0761.459440
Fax: 0761.4594444
www.rolfdisch.de

Banrock Station, Australia

At the opposite end of the world from Alois Lageder is **Banrock Station**. The winery is located in South Australia near the town of Kingston-on-Murray, about 2.5 hours from Adelaide. The 600 acres of vineyard sit among 3600 acres of natural bushland and wetland. Since the vineyard is a vital link between the surrounding native vegetation and wetlands, Banrock Station makes certain that its viticultural practices have no impact on the natural environment.

Prior to **BRL Hardy's** purchase of the property in 1994, it had been used for over 100 years for grazing sheep and cattle. Since then the winery and environmental groups have worked to restore the surrounding wetlands and woodlands.

In 1999, Banrock Station opened the *Wine and Wetland Centre*, where visitors can learn about, and enjoy, both wines and wetlands. Most of the building's power requirements are provided by solar photovoltaic arrays with tracking equipment to follow the sun.

The center was constructed from stabilized rammed earth using regional soil, steel framing and timbers from sustainable sources. Building layout, orientation, materials and insulation were designed to maintain comfort in the building by natural means wherever possible. The building collects rainwater from its extensive roof area, and water for toilets comes from wastewater from sinks and hand basins that has been filtered through a natural reed bed system.

The center also offers a seven-kilometer boardwalk and walking trail that takes visitors through restored lagoons, reed beds and bird habitats.

Banrock Station

www.banrockstation.com.au

Lost Valley Winery, Australia

Elsewhere in Australia is **Lost Valley Winery**, located 110 kilometers north of Melbourne. The winery is not connected to the area's grid and has no choice but to produce its own electricity. It does this with twelve large solar panels and a back-up 18hp Kubota diesel generator. All are connected by a sophisticated 48V inverter system to a battery bank of 2000ah.

The winery's peak average daily draw is calculated at 11.6KW hours, which allows for standard electrical equipment, irrigation, and the running of a 120-meter bore.

Lost Valley Winery

www.lostvalleywinery.com

Fetzer Vineyards, USA

Fetzer Vineyards in California's Mendocino County has been a leader in environmental responsibility since it began its organic gardens in 1985. What started out as organic vegetables for its delicatessen expanded until Fetzer is now the largest grower of certified organically grown grapes on California's North Coast, with its 2,000 vineyard acres all farmed organically. It also leads the industry in its company-wide recycling efforts, energy reduction programs, naturally filtered water management system, composting, waste reduction (reducing waste to landfill by 94 percent since 1990), and packaging, using 40 percent recycled glass in its bottles, and 100 percent recycled materials in its case boxes.

In keeping with its long-standing environmental viewpoint, Fetzer in 1993 built a new administration building using rammed earth construction. The building's 18-inch thick walls use the PISÉ (Pneumatically Impacted Stabilized Earth) method developed by **Rammed Earth Works** of Napa. **Valley Architects** in St. Helena was the lead architect.

Three years later Fetzer installed photovoltaic tiles developed by **PowerLight Corporation** on the roof of the building. The project, in cooperation with Hopland, California neighbor **Real Goods Trading Corporation**, resulted in a source of solar energy that in the year 2000, operating at 96 percent efficiency, produced 56,500 kWh (about \$6700 worth) of electricity, enough to provide 75 percent of the building's electricity needs.

The patented *PowerGuard* tiles used on the Fetzer building incorporate state-of-the-art photovoltaic cells from AstroPower, Inc. backed with insulating polystyrene foam, which turns the sun's energy into usable power while increasing the thermal insulation (to R-19) of the building and extending the life of the roof.

PowerLight's tiles work on both new roofs and as a retrofit over existing roofs. With new roofs they are used instead of conventional roofing materials. The tiles are mounted in arrays surrounded by conventional roof pavers for walkways. As a retrofit, tiles are placed directly over existing roofing, adding extra longevity to the roof's life. Weight of the tiles is only five pounds per square foot, considerably less than conventional roofing materials.

Research data indicate that using PV cells as tiles is more effective than conventional rack-mounted PV systems, when installed on flat to moderately sloping roofs. The tiles are easy to install, interconnect easily due to their tongue and groove construction, and require no penetration of the roof itself. They can provide up to 10 watts per square foot, which meets the peak load of most large buildings.

To fulfill its electricity needs for the entire winery facility, Fetzer since 1999 has bought 100 percent of its externally acquired power from renewable sources through Enron Energy Services.

Fetzer Vineyards

www.fetzer.com

Rammed Earth Works

1001 S. Coombs, Suite N
Napa CA 94558
Phone: 707.224.2532
Fax: 707.258.1878
www.rammedearthworks.com

Valley Architects
1560 Railroad Avenue
St. Helena Ca 94574
Phone: 707.963.1466
Fax: 707.963.5027
www.valleyarchitects.com

PowerLight Corporation
2954 San Pablo Avenue
Berkeley, CA 94710
Phone: 510.540.0550
Fax: 510.540.0552
www.powerlight.com

Real Goods Trading Corporation
200 Clara Avenue
Ukiah, CA 95482
Phone: 707.468.9292
Fax: 707.462.4807
www.realgoods.com

Geothermal Energy

Coming Soon to a Winery Near You

Geothermal plants produce electricity throughout California and other areas of the world that have geysers, hot springs, or other sources of hot water from subsurface volcanic activity. However, there is another way to tap into energy from the earth that does not require living in a volcanically active area.

Geothermal heating and cooling can be used throughout the world in almost all climates. This technology does not produce electricity but it does dramatically reduce the amount of electricity needed by a business or home for heating and cooling.

Geothermal heat pumps (GHP), also known as "ground-source heat pumps" or "geoexchange" systems, are among the most efficient heating and cooling technologies available. They take advantage of the nearly constant temperatures of the earth a few feet below the surface (approximately 55° F in northern latitudes, no matter what the temperature on the surface), collecting heat from the earth during the heating season and transferring heat from the building to the earth during the cooling season. They are appropriate for use in warm or cold climates, and are more efficient than traditional heat pumps that exchange heat between a building and the outside air.

The main unit, located inside the building that it heats and cools, is connected to a loop of durable piping that runs into the earth. In a horizontal loop system, the piping is buried in underground trenches at least five feet deep. In a vertical system, piping is installed in boreholes similar to those drilled for water wells. Closed-loop systems circulate a water anti-freeze solution through the system, while open-loop systems go outside the loop to circulate groundwater or water from a pond or lake.

For heating, heat is extracted from the fluid in the earth connection by the geothermal heat pump and distributed to the home or building, usually through a system of air ducts. Cooler air from the building is returned to the geothermal heat pump, where it cools the fluid flowing to the earth connection. The fluid is then re-warmed as it flows through the earth connection.

In cooling mode, the process is reversed. The relatively cool fluid from the earth connection absorbs heat from the building and transfers it to the ground.

GHP systems can also provide hot water in a manner than is four times more efficient than standard electric water heating.

The US Environmental Protection Agency reports that a geothermal heat pump can save 30-40 percent on heating and cooling bills, as well as reduce greenhouse gas emissions by 55-60 percent.

Although geothermal heat pumps cost more to install than conventional space conditioning systems, the additional investment can be recovered in three to five years through lower heating and cooling bills, low-interest loans, and rebates. If financed through a mortgage, loan or lease, GHPs usually provide positive cash flow immediately, since the extra money in the monthly payment needed to cover the additional first cost is usually far outweighed by the energy and maintenance savings.

One winery already using a geothermal system is **Silver Rose Winery** of Calistoga, California. **Earth Energy Systems, Inc.**, also of Calistoga, installed a closed-loop geothermal system that runs ten feet below the surface of a one-acre pond on the winery's property, and provides all of the facility's heating and cooling needs. Estimates show that the winery will save 50 percent of its annual energy costs, a significant amount considering temperatures in the area can reach 110° F.

Silver Rose Winery

www.silverrosewinery.com

Earth Energy Systems, Inc.

2436 Foothill Blvd., Suite J,

Calistoga, CA 94515

Phone: 707.942.8173

Fax: 707.942.5480

www.earthenergysystems.com

Geothermal Heat Pump Consortium

www.geoexchange.org

Energy Saving Devices

WineTemp Systems--Cooling Efficiency

WineTemp Systems, Inc. is an industrial refrigeration/air conditioning manufacturer and contractor specializing in winery accounts. The company works with approximately 60 wineries in the Napa Valley and others outside the area.

WineTemp is currently working with an Illinois manufacturer that has developed a valve unit that when installed on refrigeration equipment will reduce energy consumption from 18-35 percent. The valve, in effect, *increases* the total area where the refrigeration effect takes place, thereby increasing the capacity of an existing system and thus increasing its running performance. PG&E is sponsoring a test of the valves at two Napa Valley wineries; **Artesa** and **Clos du Val**. (The valves themselves have already been proven in another industry on the East Coast).

WineTemp has been monitoring energy usage at both wineries prior to installation of the valves, so will soon be able to provide precise on the effectiveness of the new valves. The company is also testing a product that is a "chamber" added to a refrigeration system. This chamber "turbulates" the refrigerant, increasing system efficiency by up to 30 percent.

WineTemp Systems, Inc.

email: coldwine@napanet.net

Other Contacts

Solar

Atlantis Energy Systems, Inc.
4610 Northgate Blvd., Suite 150
Sacramento CA 95834
Phone: 916.920.9500
Fax: 916.927.1697
www.atlantisenergy.com

Light Energy Systems
965 D. Detroit Ave.
Concord CA 94518
Phone: 925.680.4343
Fax: 925.680.6588
www.lightenergysystems.com

Solar/Wind/Hydro

Advance Power Company
Calpella, California
(Mendocino County)
Phone: 707.485.0588
www.advancepower.net

wbm