

Benefits of Energy auditing for your winery

BY John Garn

Understanding energy usage is one of the most difficult aspects of winery operations. It is vital to know what you don't know. The investment of time and money to find and organize all of your energy information may not seem worth it, but ignorance of how you use energy could be costing your winery dearly. To reduce that risk, have a professional do an energy audit at your winery every two years and maintain an ongoing program of self-assessment. In the meantime, let's find out what you don't know by asking a few simple questions.

How much total energy does your winery consume?

For the moment, let us ignore the energy use of any given motor, drive, and pump. Instead, we want to look at the "big picture" — before we try to target the bulls-eye of specific efficiency measures. We want to develop an awareness of total energy coming into the winery.

For most operational people, energy equals electricity. But energy is often more than that. At the highest bird's eye level, it includes vehicle trips (gasoline), air travel (jet fuel), natural gas, propane, and diesel. This is the

total energy consumed by your winery in the production of wine.

For many senior managers, the "big picture" is a dollar amount; they just want to know the total cost of energy usage at their winery. However, we are not talking just dollars here — we are talking kilowatts and BTUs. We have to know those energy numbers before we can determine how much it costs in dollars to produce each case of wine per year.

This is where the energy baseline for the entire winery demonstrates its value. By knowing where we are with current energy use, we can determine where we can go with future energy efficiency measures. This also provides the opportunity to demonstrate cost savings over time.

An often-overlooked aspect of an energy efficiency program is the inclusion of a strategy for reinvesting a percentage of the savings generated from initial efficiency actions. If there isn't any strategy for using a percentage of the captured savings for implementation of future efficiency measures, the money often disappears into the general fund, and any additional requests for capital improvements are harder to justify on a cost/benefit basis.

Once you know the total kilowatts and BTUs per year, and the total number of cases or gallons produced in the same year, you will have the formula to calculate the total kilowatts and BTUs, or "energy intensity," per case or gallon of wine. The selection of gallon or case will depend on your winery operations.

With many wineries outsourcing bottling, having a metric of gallons is more useful. If your facility also bottles, then a case metric might have more meaning. This calculation begins to establish the metric needed to gauge investments for future efficiencies and allows you to ask the next question.

What are tools for benchmarking energy use?

The baseline number of total energy use (your most important tool) can be computed by your accountant or bookkeeper. They usually have access to the energy bills, but they probably have only been recording the amounts due, and are not tracking the kilowatts or BTUs.

If the operation or facility manager takes on the task of tracking energy use, they can contact the accountant to get the energy bills and then enter the use information into a database. Keeping track of energy usage requires an investment of time and a willingness on the part of the accountant or bookkeeper, along with direction from the owner.

A more efficient tool can be the utility itself. Most, like Pacific Gas & Electric (PG&E, www.pge.com), have online services that allow the energy user to obtain up to three years of historical data for their operation. A sim-



Kunde Winery installed a new 15hp air compressor to replace a 50hp compressor and added a second, larger 2,560-gallon air holding tank to the existing 1,670-gallon tank in 2004. The increased air-holding capacity allows a smaller air compressor to run less often while maintaining a constant pressure.

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ple registration form needs to be completed online for this service.

There are several other energy services on the PG&E website at www.pge.com/biz. You can request net year-to-date information, usage over comparative years, per-meter usage, and complete account information. This is the easiest and most cost-effective way to understand total energy use of your winery.

Another tool that is just becoming available for wineries is interactive software developed by Lawrence Berkeley National Laboratories (Berkeley, CA) and Fetzer Vineyards (Hopland, CA). The Benchmarking and Energy and Water Savings Tool (BEST) winery software is free and is being distributed at workshops in California. It was developed because the wine industry is the second largest user of electricity in the California food industry. (See sidebar, page 10).

How does your total energy number compare with other wineries?

Once you have the big numbers on energy use, you need to gain additional perspective on just what those numbers mean. Many wineries believe that they are very energy-efficient, but not many know their energy-intensity per case or gallon. It is not easy to compare with other facilities to see whether your operation is as energy-efficient as you perceive, or if you are spending three times more on energy per case or gallon than other wineries.

The new BEST software (see sidebar) will provide the ability to compare your operation with a very energy-efficient "reference" winery. This will give you a benchmark against the best winery in energy- and water-efficiency.

Another way to gain a broader perspective is to talk to the PG&E specialist who does energy-efficiency walk-throughs. He will have heard from all of the wineries he is working with about their total energy use per case or gallon of wine. He will have a good idea of a "general" industry average even though no official metric exists. In addition, perhaps your own contacts at other wineries can give you an accurate metric for their energy use.

A comparison of your total energy-intensity is available through a sustain-

able practices assessment that is free to any California winery that participates. The statewide program, the *Code of Sustainable Winegrowing Practices*, is a workbook that includes a chapter on energy efficiency (with a criteria list, see Table I) that has 11 practices to be assessed by any participating winery or vineyard. Simply submit your assessment, and then receive a customized report showing your scores in relation to other wineries in your county, and to all participating California wineries. To date, more than 100 wineries are in the assessment data set. For a listing of upcoming workshops go to: www.sustainablewinegrowing.org/c_works.html.

What are the biggest users of energy at your winery?

A detailed energy audit will complement your benchmark by adding detail to what you already know about overall energy use at your winery, and acting as a test of your perception of your winery's energy efficiency. An energy audit is useful to identify the aspects of winery operations, or pieces of equipment, that are using the largest amounts of energy, or using energy most inefficiently.

These energy hogs are also known as the "low-hanging fruit." This "fruit" is often associated with boilers, refrigeration, compressors, and lighting, and it can be dropped in numerous ways.

An often overlooked area to consider when looking for low-hanging fruit is the water system. Water can be a big energy user, and each gallon of water has a specific unit of energy associated with it. Pumps are required to extract water out of the ground to make it available for the winery, and to irrigate vines and landscaping. Large amounts of energy are used to heat it, deliver it to the appropriate area, treat it, and dispose of it.

An especially large energy user is the aerators in wastewater ponds, which often run around the clock. Reducing the amount of water used in the winery can play a significant role in overall energy-efficiency plans for any facility.

Resources

It is best to leverage experience when possible, and the BEST software tool comes with a PG&E specialist who can visit your facility for a "walk-through." You can initiate this process by contacting PG&E via phone or email. A walk-

New free software helps wineries increase efficiency

How it works and where to obtain it.

California wineries now can obtain "BEST Winery," an easy-to-use, computer-based tool and handbook to help reduce energy and water costs, thanks to researchers at the Department of Energy's Lawrence Berkeley National Laboratory, who worked with Fetzer Vineyards.

BEST (Benchmarking and Energy and Water Savings Tool) Winery incorporates information about how energy and water is used in each step of wine production, based on key characteristics entered by a user. Winery personnel can enter data such as location, climate of vineyards, tons of grapes and juice received, and amount of wine produced, stored, and/or bottled.

The BEST reference winery is based on a very efficient winery model with the same characteristics as the user winery. But the reference winery uses state-of-the-art, commercially available energy- and water-efficient technologies.

BEST Winery provides an interactive menu of over 100 opportunities for improvement. BEST Winery contains efficiency opportunities for water, refrigeration, pumps, compressed air, motors, lighting, hot water production, cogeneration, and other applications. Best of all, the free software is built for use by small to medium-size wineries.

With support from Pacific Gas & Electric, three free training sessions were held in May 2005 to introduce the tool, and train winery staff to use the BEST Winery software.

After June 1, to obtain a copy of the software, contact: www.LBNL:ies.LBL.gov/iespubs/ievapubs.html or www.energy.ca.gov/pier/iaw/index.html. ■

through will provide several options for pursuing energy efficiency:

1. Equipment review and rebate availability. This is the simplest walk-through. It focuses on major equipment, with rebate information where appropriate.

2. No-cost measures. This visit expands the audit to include lights being left on and air compressors left running. These simple behavioral changes can promote immediate efficiencies and savings, but they do require persistence and commitment on the part of management if the changes are to become permanent.

3. Low-cost measures. These measures include actions that have a 12-month pay-back or less. They might include changing high-bay mercury lights to T5 fluorescents or installing motion detectors.

4. Investments. These measures require an investment that has a longer pay-back but can save large amounts of money over time. They include actions such as variable speed drives and tank insulation.

With a walk-through by a PG&E specialist, you will be able to select the level of information and detail that you want for your winery. The specialists are trained to help you understand the energy use of all equipment, help you identify the "low-hanging fruit" to drop, and suggest the best approach to dropping it. They can help you develop an energy conservation plan, to leverage early savings for the next set of improvements.

For a complete set of PG&E's business tools go to: www.pge.com/biz/biztools.html.

PG&E also offers energy efficiency workshops specifically for the agriculture sector. For a listing of upcoming workshops in your area, go to www.pge.com/pec.

In addition, PG&E offers several rebate programs to help you with the cost of new lighting, compressors, pumps, and motors (see "Rebates for energy-efficient wineries," *PWV*, September/October 2004). To get the overall picture of available services and rebates available from PG&E, contact Jim Salomone at 707/579-6437, or email him at jxs8@pge.com.

Another useful resource for audits can be universities. Many universities have classes that are researching energy efficiency, with students in search of an interesting project. Students at Sonoma State University (SSU, Rohnert Park, CA) and San Francisco State University (SFSU) have conducted detailed energy audits for wineries.

These studies provide very useful information, give students hands-on experience, and require no capital outlay

Table I:
List of energy-efficiency criteria*

1. Planning, monitoring, goals and results,
2. Refrigeration system,
3. Tanks and wine-transfer lines,
4. Motors, drives and pumps,
5. Heating, ventilation and air conditioning (HVAC),
6. Lighting — offices and lab,
7. Lighting — shops and facilities,
8. Lighting — outdoor and security,
9. Office equipment,
10. Alternative sources of power,
11. Alternative fuel sources — vineyards

* From Wine Institute/California WineGrape Growers Sustainability Workbook, Chapter 9

from the winery. Maybe most important of all, these audits get operation managers thinking about how much energy their facilities are using and of ways to be more energy-efficient.

Finally, companies wanting to help you with your energy efficiency may provide auditing services as part of their "bid" for services. There are two kinds of companies providing these services. First are those specializing in energy efficiency. These are professional engineers who do audits for a living. The second kind is equipment suppliers, who will conduct an audit to identify inherent savings available if you select their product(s).

For example, if you are thinking about insulating tanks, but you don't know whether it makes economic sense, a company specializing in tank insulation can come in, review your energy use and calculate costs on tank insulation. The more equipment the company provides, the more detailed an audit they will provide up front.

Another overlooked resource is other wineries. The network of wineries that are very proactive about energy efficiency and are investing in renewables is growing, with new solar installations (Rodney Strong Vineyards, Healdsburg, CA), solar thermal (J Wine Company, Healdsburg, CA), and methane digestors (Clos du Bois, Geyserville, CA) among projects in recent years, plus solar installations at Evergreen Valley Winery (Luthersburg, PA) and Stargazers Vineyard (Coatesville, PA).

Other wineries are implementing energy efficiency measures that are easily replicated, such as connecting dissolved oxygen monitors to waste-

water pond aerators (Beringer Blass Wine Estates, St. Helena, CA); use of frequency-drives on pumps, crush operations, and bottling lines (Jordan Winery, Geyserville, CA); and changing lighting from T12s to T8s (Kunde Estate Winery, Kenwood, CA). Getting in touch with the facility and operation managers of these wineries can provide a wealth of information. Perhaps most beneficial of all, they might share with you what, if anything, they would do differently if they were to do the project over again. This kind of experience does not have a price tag.

Winery self-audit checklists

Wineries can employ self-audits to begin to realize immediate energy savings. Several examples of a self-audit checklist can be found online (see **Table I**).

There is no energy audit checklist that is specific to wineries. A general energy analysis can be helpful if you are just getting underway with energy efficiency.

To complete an online Business Energy Analysis from PG&E go to www.pge.com/biz/energy_tools_resources/energy_audit/index.html. This will help you reduce your energy bill, improve the productivity and comfort of customers and employees, obtain information about incentive programs, and improve your bottom line.

If you are going to prepare a self-audit, it is important to include both behavioral and technical changes. There are many examples of technology being purchased but not used effectively, so the estimated savings just never materialize.

Behavioral changes are especially useful after developing the big picture and performing a winery self-audit. Something as simple as cleaning light fixtures as part of general maintenance can enhance efficiency. This can be the easiest thing to recommend to staff — and the hardest thing for them to adopt.

"Employees are the biggest factor, because when they fully understand energy efficiency, the spark of innovation ignites and all kinds of ideas get generated," says Matt Atkinson, ranch manager of Benziger Family Winery (Glen Ellen, CA). "Employees are really the biggest factor in energy efficiency because they are doing the work, so they have a better perspective on how to improve things in their operation area."

Lighting efficiency and the SBEA

The Small Business Energy Alliance (SBEA) is a limited resource program sponsored by the California Public Utilities Commission to assist small companies in California.

For businesses using under 500kW per meter per account, the SBEA offers assessment of lighting systems, thermostats, and small refrigeration units (though not winery-scale HVAC and refrigeration systems). The program also has some funds to help businesses upgrade or replace such systems with more efficient ones.

In 2003 and 2004, the SBEA helped Cline Cellars (Sonoma, CA), and the Valley Wine Warehouse (Napa, CA) replace metal halide lighting with high-output T-5 lamps and motion sensors. Sonoma County program manager Ken Moore says the SBEA would love to work with more small wineries to increase efficiency.

The SBEA can be found online at www.sbeaonline.com, or at the "Program hotlines": 888/759-9800 (southern CA), and 800/881-SBEA (northern CA).

One useful tool is an employee bulletin board where information can be posted. This is a great way to obtain feedback from employees about the total energy use of the winery. Asking for feedback can bring energy use to the awareness of everyone, so that behavior change gets reinforced and becomes part of the winery culture.

Technology changes can be very low-tech. They might include the addition of window film to reduce solar heat gain, or making sure that glycol lines and hot water pipes are insulated. They could be easy-to-do measures, like installing motion detectors and using natural lighting, which can begin to save money and provide energy security with very little initial investment.

Efficiency changes can also involve more advanced technology, such as the use of refrigeration jackets for white

wine fermentation, or equipping tanks with reset controls.

(See the Self-Audit Starter List, this page.)

Case studies

Benziger Family Winery was audited by Sonoma State University in 1999 using the baseline of 1998 energy use. "The Living Machine" (a wastewater technology) was in use at a brewery that is now the site of the family's Imagery Estate Winery. Several students volunteered to operate the Living Machine, and one student approached ranch manager Atkinson about conducting an energy audit for the winery. The audit was very detailed, looking at the wattage of everything from the refrigeration system to the phone answering machine.

While the final report was overwhelming at first, Atkinson was able to get the "big picture" of total energy use. "The report allowed us to focus on the low hanging fruit, which was the lighting system," says Atkinson. Replacement with energy-efficient fixtures was the first post-audit project.

In 2003, Benziger rebuilt the entire crush pad area. Efficiency improvements included insulating tanks and putting foam insulation in the barrel barn ceiling. The 2005 project is to incorporate 480 voltage throughout older buildings to allow more efficient use of electricity and better operation of variable-speed drives.

Atkinson now tracks electrical and water use monthly, and uses the energy report to refresh his memory about equipment use, as he gets ready to replace worn-out equipment with more efficient equipment. Benziger has been able to reduce energy use by over 20%.

Kunde Estate Winery was audited by San Francisco State University students in summer 2004 when assistant winemaker Andy Willbanks agreed to participate in a U.S. Department of Energy (DOE)-sponsored program offering energy efficiency services to wineries at no cost. The DOE audits are a detailed look at all equipment and electronic devices at a facility; they also include a comprehensive waste audit.

The audit was led by SFSU Engineering Department faculty with assistance from graduate students, who provide the winery with a detailed report

STARTER LIST

Winery self-audit questions

In assessing your winery for eco-efficiency opportunities to implement, keep in mind that this is not a "one size fits all" program, and it is not necessary to try and do them all. This self-audit is meant to promote thinking and point you in the right direction.

It is encouraged that winery executives or operations managers do self-audits with winery personnel who may have important information to contribute. In addition to getting a better picture of the winery, everyone will be on the same page as you move forward.

What is total energy use per year?

What is total use of electricity? natural gas? propane? diesel? other?

What is total wine production (in gallons or cases)?

What is the energy-intensity per gallon or case?

Has the winery had an energy-audit in the past two years?

If yes, where is the information?

If not, why not?

Is there a regular maintenance cycle for heating, ventilation, air-conditioning (HVAC)?

If so, what is regular maintenance cycle?

If not, what is efficiency of the HVAC?

Are HVAC thermostats set for proper temperature (such as 65°F in winter, 78°F in summer)?

Is there a policy to turn off lights and machinery when not in use? If yes, is it being followed?

What kind of lighting is used in offices and winery? How effective is natural lighting being used?

Are tanks insulated?

Are glycol lines insulated?

Are hot water pipes insulated?

When was the last time the compressed-air system was checked for leaks?

Were any leaks found? If yes, were leaks repaired?

Is there enough air-holding capacity to reduce compressor-run time?

How old is the refrigeration equipment, air compressor(s), and boiler(s)?

Are the wastewater aerators operated around the clock, or regulated by timers?

If not, what is frequency of operation?

Is office equipment *Energy Star*-certified for efficiency?

identifying the best measures to save money and increase energy-efficiency.

The SFSU auditing team was also available to the winery after the report is completed to answer questions and provide expertise during future implementation of their recommendations. The report is thorough enough to be used by engineering firms that wineries later retain to implement large efficiency projects.

It seems that there is no downside to working with students. All that is required is time to coordinate the project, provide energy and waste bills for the benchmark period, and give a facility tour. The total time investment is about six to 10 hours for the winery.

Willbanks completed implementation in 2004 of the first of six recommendations — air compressor modifications. A 50hp compressor

was replaced with a 15hp compressor (reducing run-time of the compressor) and an additional holding tank installed (ensuring there is enough pressure when needed) for bladder inflation on two membrane presses, for air pumps in the cellar, and the bottling line.

Kunde Winery is replacing T12 lights with T8 lights. Willbanks uses the report to help him plan the efficiency implementations, and will continue with more recommendations. Three other recommendations are: install energy-efficient motor when a burned out motor needs replacement; augment or replace existing insulation on chiller lines; and optimize refrigeration system compressor head pressures.

For more information about SFSU DOE winery audits, contact Ahmad

Ganji at 415/338-7736 or email: aganji@sfsu.edu.

Conclusion

The goal of energy audits is to identify ways to increase energy efficiency and to save money. But it is also to educate you and your staff about the total energy use, get everyone thinking about where energy is being wasted, and provide you with the opportunity to identify the most valuable questions to ask energy experts. It also makes you a smarter equipment shopper.

Remember, finding answers is not necessarily the most cost-effective strategy. Knowing the most valuable questions to ask, and knowing whom to ask, can often be worth a lot more. ■

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