

Sustainable Practices for Virginia Wineries

A pilot project to assist Virginia's wine industry in their efforts to be more sustainable.



Funding for the pilot project is from the U.S. Environmental Protection Agency.

Sustainable Practices for Virginia Wineries is a pilot project funded through a grant from the U.S. Environmental Protection Agency. The project is administered through the Manufacturing Technology Center in Wytheville, Virginia; and it involves partnerships and support from Virginia Tech's Grape Chemistry program, the Virginia Department of Environmental Quality, and Virginia Green, the state's partnership program to encourage green practices in its tourism industry.

The goals of the project are to (1) document ongoing sustainable practices at several Virginia wineries; (2) identify opportunities that will reduce environmental impacts, save money, and improve profitability; and (3) develop reports that detail these findings so that other Virginia wineries might learn from these techniques, including summary fact sheets of the wineries involved with recommendations for future research.

Each winery included in the project received a technical assistance visit from the project team. This summary provides only preliminary findings as the project team continues to work with the winery to research and propose specific practices and projects that will result in environmental benefits and cost savings for the winery.

Subject Winery:

DuCard Vineyards
Etlan, Virginia



DuCard Vineyards is located in Etlan, Virginia. It is owned by Scott Eliff, who has operated the vineyard since 2001. In 2010, they opened their tasting room (1200 sq ft) and warehouse facility for case storage (600 sq ft), which was designed to be a sustainable structure, powered by solar power and featuring many sustainable practices and building materials. The production facility is a 3000-square foot "bunker" that was constructed in 2012. Current production is 2000 cases annually. The evaluation team visited DuCard on September 9, 2013.

Sustainable Practices in Place

Certifications & Awards

- DuCard is a certified Virginia Green Winery.*
- In 2011, Ducard received the Virginia Green Travel Star Leader Award.



Wastes

- Wastes are collected by a local hauler. The winery staff currently collects recycling and takes it to local transfer stations in Charlottesville.
- Winery staff collects recycling and compostable materials in the tasting room year-round. All disposable plates, cutlery, and cups are compostable. The winery collects all food wastes and disposables from all events and composts them on the property.
- All residuals from production are composted on-site in the vineyard.
- Winery collects corks for local flooring company reuse program, and the winery uses agglomerated corks. Winery uses screw caps for certain wines.
- Eco-efficient wine bottles are made with recycled glass and less material. DuCard uses bottles that weigh only 16 ounces, versus more traditional bottles that weigh 29 ounces or more.



Energy

Tasting Room

- Solar-Powered Tasting Room
 - 18 solar panels generate 5KW
 - The solar panels are tied to the energy grid and generate the full amount of electricity required for heating, cooling, and lighting in the tasting room.
- Tasting room is designed with R30-rated walls and R50 for the ceiling.
- The warehouse has R30 walls and R30 ceiling insulation and was constructed on concrete slab to provide mean temperature of 60 F.
- Energy Star-rated Anderson windows and doors throughout.
- Energy Star-rated heat pump (1 of 2), thermostats, hot-water heater, and dishwasher.
- Energy efficient lighting throughout the tasting room.
- Natural lighting & ceiling fans.



Production & Storage

- Built-into hillside to maximize earth's cooling and thermal consistency.
- Building is built with structurally-insulated panels (R25 walls) and R30 ceiling.
- Building uses the ethylene glycol (2x2.5 ton) system for cooling tanks to also cool the building.
- All glycol lines are fully insulated.
- Programmable thermostats in several zones in production areas
- Metal halides in production / storage area.



Water

- All water from production is processed through a mounded sand filter waste water treatment system that uses an innovative finishing process with wetland plants to further clean the wastewaters. The system collects and re-circulates the effluent constantly across a finishing basin that incorporates wetland plants to remove nutrients prior to final dispersion in a septic field.
- DuCard has worked diligently to create and maintain a 50 foot buffer around the creek that runs through the property.
- Production uses an on-demand, hot-water system.



Note:

Constructed wetlands require some maintenance, including regular inspections of all components and care of vegetation to ensure adequate growth. Water levels must be monitored and controlled: if too low, the wastewater may not make sufficient contact with the plants' root structure to perform properly; too high and it may reach the surface of the gravel media, creating smelly conditions and prime mosquito habitat. Cold weather can be another problem for constructed wetlands, slowing the flow of water and retarding biological processes. But a uniform layer of well-decomposed organic mulch can allow subsurface-flow wetlands to operate throughout the winter even in very cold conditions.

Additional Sustainable Practices

- Reclaimed hardwoods from the original barns and other reclaimed building materials were used in the Tasting Room for the flooring and the bar.
- 90% of all construction materials and tradesman were local (100 miles or less).
- Plant wildflowers throughout property to encourage beneficial insects.
- Sustainable, non-toxic cleaning supplies
- Renewable Energy Credits are purchased (Terrapass) annually to offset the carbon footprint of their operations.



Customer Engagement Areas

- Well-labeled recycling and trash containers located together
- Food items, displayed art, and other items are from local farms, shops, etc.
- Virginia Green flag, certificate, award, and decals displayed
- Excellent webpage on environmental stewardship – www.ducardvinyards.com/steward.html.



Opportunities for Improvement

Tracking Environmental Impacts / Sustainability Progress

Currently, only energy use is tracked. We generally recommend tracking and/or metering of all environmental data so that it might be used to set goals and gauge continued progress over time. The simple table below provides a basic annual summary format that can serve as your organization's sustainability progress report.

Additionally, the following Energy Star Tracking Tool (ETT) is available at the link below. It allows you to track any item purchased and compare it to a base line year. You can also compare your material usage to cases of wine produced. This allows you to understand your energy or material usage intensity. The program also allows goals to be established and results are automatically compared to established goals.

http://www.energystar.gov/ia/business/industry/downloads/Energy_Tracking_Tool_v1.xls

- **Wastes, Recycling, & Composting.** Currently no information available.
 - Recommend performing some sort of waste audit or estimates using average weights (reference EPA site) to establish a baseline for wastes, recycling, and composting.
 - Establish a recycling / landfill diversion rate.
- **Energy.** Solar energy system is currently achieving a "net zero" for the tasting room facility. However, we still recommend:
 - Full tracking of energy expenditures for both tasting room and production facility.
 - Include tracking of cooling / glycol unit and consider metering.
- **Water.** Water is well water and there is currently no information available on water use.
 - Recommend water metering during wine production and for other all other uses.
- **Carbon Footprint.** Waste, energy, and water data (and some other factors such as travel) can be used to calculate overall carbon emissions.

	2011	2012	2013	Goals for 2014
Wastes				
+Recycling				
+Composted				
Energy Used				
Water Use				
Carbon Footprint				

Energy

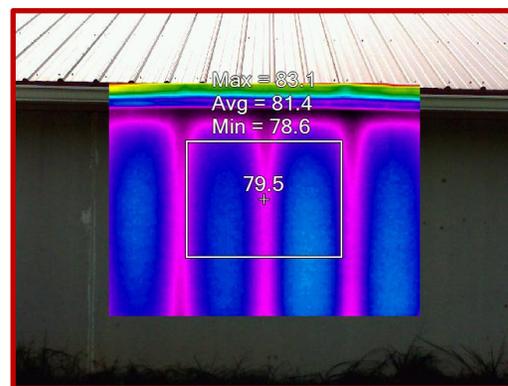
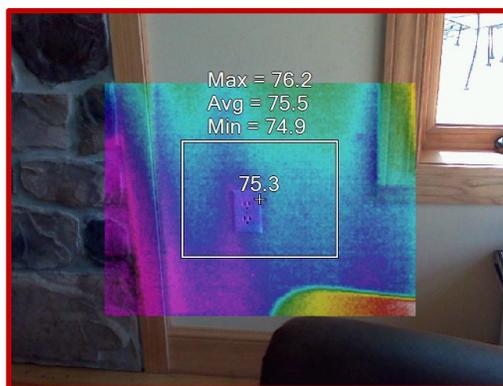
- **HVAC Systems.** One of the two heat pumps in the tasting room is not currently Energy Star rated.
 - Recommend monitoring utility bills with consideration for this unit to ensure that usage is meeting performance expectations.
- **Tanks.** Tanks are constructed with minimal thermal blankets.
 - Recommend full consideration of tank blankets, sprays, and other measures during cold stabilization and storage.
- **Winemaking / Stabilization.** Currently, stabilization occurs through refrigeration via ethylene glycol (33%).
 - Recommend full consideration of bitartrate stabilization techniques that will minimize refrigeration demands.
 - Note: the following link provides useful information for proper operation of your glycol cooling system.

http://www.legacychillers.com/cms_data/uploads/ChillerTechNet-Chiller%20Systems%20and%20Glycol.pdf



For energy opportunities regarding eliminating cooling cost refer to Appendix B

- **Winemaking / Chilling of Grapes.** Currently the winery does not refrigerate grapes prior to production.
 - Recommend pre-chilling grapes that will need stabilization in order to minimize cooling needs.
- **Door & Seals.** The main door to the production & storage facility had some low-level gaps around it. This heat sensor graphic shows the temperature differential and associated cooling loss.
 - Recommend considerations for replacing or augmenting these door seals and adding door insulation if practical.
 - Research was conducted in order to determine if secondary doors were available to further insulate infrequently used garage doors. None were found that would offer the convenience you requested. Proper seal maintenance is recommended.
- **Solar Block & Roof Coatings.** While the roof of the production & storage facility is insulated, the roof is fully exposed to sunlight and it is painted red, which retains a significant amount of heat. Preliminary thermal readings indicated temps in excess of 140 degrees F for the roof and for the south-facing walls of the building.
 - Recommend:
 - Coating roof with reflective paint.
 - Consider some sort of solar block that shades the south side of building from direct sunlight.
- **Compressor.** Tank transfers occur with help of compressors that adds to heat load in the production and storage area.
 - Recommend operating the compressor outside.
- **Natural Lighting.** Currently, no natural lighting in the storage / production area.
 - Recommend consideration of installing insulated sky-lighting.
- **Lighting.** Metal halide lighting in storage / production room is a significant producer of heat.
 - Recommend practices to limit use, such as motion-activated sensors.
- **Building Envelope.** During the assessment, thermal images were taken of the tasting room construction and no areas of heat loss were identified. Similar images were taken in the cold storage unit, and only minimal energy loss was noted.



Water

- **Barrel and tank cleaning.** As mentioned, there is currently no available data on water use. Owners are aware of high water cleaning demands.
 - Recommend installation of a meter and documentation of water use in cleaning procedures.
 - Install high-pressure cleaning equipment to minimize water use.
- **Stormwater.** Wineries are categorically required to get stormwater discharge permits if wastewaters from production, parking areas, or other operations are directed directly to streams, ponds, wetlands, etc.

- Recommend full consideration of this regulatory requirement prior to future expansions.
- **Septic Tank Discharge.** The State of Virginia's environmental regulations state that the natural quality of groundwater must be maintained for all constituents not set forth in groundwater standards. This is also called the *anti-degradation criteria* (9 VAC 25-280-30). For example, manmade chemicals would not be found naturally in groundwater, hence their allowable concentration or standard would be less than detection (or zero in laymen's terms). Adding any compound to groundwater to detectable levels would be a violation of Virginia's anti-degradation groundwater criteria.
 - Recommend that the above information be considered when decisions are made regarding disposing of any man made products into the septic tank drains.

Wastes

- **Universal and hazardous wastes.** Currently, there is no system for documenting the generation and management of spent fluorescent lamps, solvents, aerosol cans, batteries, pesticides, and other-potentially hazardous materials.
 - Recommend:
 - Development of a policy, log, and records that document proper handling of these items.
 - Include development of a green purchasing policy that requires consideration of hazardous properties, regulatory considerations, and a hazardous materials inventory.
- **Recycling Rates & Management.** Currently, wastes are picked up by a hauler and recycling is transported by the staff to regional drop-off centers. No estimates of weights have been made.
 - Recommend:
 - Contact your waste haulers and ask for pricing on recycling services. As winery continues to expand and popularity grows, hauling to local transfer station will become inefficient process. It is likely that local haulers will charge much less than labor / time and effort for hauling to “free” drop off.
 - Develop estimates of waste and recycling generation based upon weight standards and consideration of “how full” the containers are. This will provide an implied recycling rate and insight for adjusting hauler services, saving money, etc. Below is an example of how a recycling rate might be calculated (assuming 96-gallon totes).
 - Consider performing a **waste stream audit** to determine actual weights of trash and recycling and to identify waste reduction opportunities and needs for specific waste items.



	Containers	AVG wt	Weekly	Annual
Mixed Recycling	4 (full)	80 lbs	320	16,640 lbs
Trash	2	110 lbs	220	11,440 lbs
Implied Recycling Rate = 60%				
http://www.epa.gov/osw/conservation/tools/recmeas/docs/guide_b.pdf				

For a practical guide to enhance your existing recycling program consult Appendix A.

- **Pallets.** Currently, a dozen or so wooden pallets are stored outside / behind the production & storage area. This is not perceived as a problem by owners as they are periodically removed by vendors or reused. However, we recommend:
 - Estimating the number that dropped off and reused or recycled, as these



weights can be considered in conjunction with data on recycling / waste diversion.

- **Bottles & Corks.** Currently, the winery uses a combination of composite corks and screw tops. Additionally, it uses bottles that are lighter than standard-sized.
 - Recommend consideration of:
 - Full conversion to screw top bottles
 - Sleeveless (eliminating use of metal wrappers)
 - Recommend calculation of the greenhouse gas emissions reduced from using lighter wine bottles and resulting reductions in shipping costs, emissions, fuel usage, etc.

Customer Engagement Areas

- **Communication of environmental information.** The winery does a good job of communicating its environmental commitments and its certification as a Virginia Green Winery on its website and at the winery. We also recommend:
 - Consider cross-promoting other Virginia Green certified facilities such as local B&B's, attractions, festivals and events, or even other wineries.
 - Consider development of green getaway packages or other arrangements to appeal to green consumers who want to support your efforts and others with similar commitments.
 - Consider installing a monitor or posters providing environmental data related to your Virginia Green commitments, environmental achievements, and continuing progress.
- **Signage & Placement of Containers in the Tasting Room.** Currently, the container for collecting food wastes and other compostables is a trashcan with a lid with some instructions in marker that indicate the container is for compostables. The trash and recycling are similarly marked in another area. We recommend:
 - That the containers be co-located so that consumers clearly understand the choices available when disposing of materials.
 - Printed signage for all of the containers, especially for recycling and composting. This sign is an example of what might be used.



*Virginia Green Winery certification is achieved through self-certification process and all green practices and commitments are documented in the winery's Virginia Green "profile" that is available to the public at http://www.deq.virginia.gov/Portals/0/DEQ/PollutionPrevention/VirginiaGreen/DuCard_Profile_12-2010.pdf.

The Virginia Green program challenges consumers to provide constructive feedback that will encourage its partners to continuously improve over time.

Appendix A: Recycling Program

How to Design a Recycling Program that Really Works

Steps for Successful Recycling

- Set up appropriate recycling programs in administrative offices, food service areas, and public areas. It is best to concentrate on areas that produce significant amounts of particular materials.
- Walk through the facility noting what type of waste is discarded in each area. A walk-through will help determine which types of bins are needed. Typical programs are likely to involve some of the following:
 - Offices—paper, corrugated paper or cardboard, cans, bottles.
 - Food service areas—glass, metal cans, plastic containers, corrugated paper, cardboard (make sure food waste is separated or that it goes down the garbage disposal).
 - Public areas—newspaper, magazines, bottles, cans.
- In placing bins, make sure that they achieve a balance between convenience and cluster. Bins should be close enough to where the waste is discarded so the people will use them, but not so widespread that people will trip over them. It is a good idea to talk to people who work in a particular area to determine exactly where bins should be placed.
- Make sure that bins in public areas are well-marked. It is best to choose bins with specialized openings, such as a hole for cans or a slot for newspapers, for these areas. Inform employees about proper recycling procedures. Issue a memo, throw a kickoff party, and explain any separation procedures when distributing bins.
- Set up a log book or a receipt system to record the volume of recyclables leaving the premises. This will ensure proper compensation for materials and allow for appropriate action if volumes decrease.
- Include recycling information in orientation materials for new employees. Explain the overall recycling program to janitors, and use them as the program's eyes and ears. Have them report any areas with major contamination problems, and follow up with improved recycling education in these areas.
- After policies have been established, train janitorial staff by showing them what to do with new bins, how to collect waste separately, and where to bring separated materials. For a 24-hour operation, plan pick-ups as appropriate to avoid problems with overflowing bins. Be sure that grounds crews know to keep yard waste separate from other waste.
- Ask the waste hauler for advice about keeping recyclables and wet waste separate. Depending on the company's trucks and equipment, the hauler may provide separate containers for trash and recyclables.
- Remind employees to keep food waste out of recycling containers and trash. Food waste should go down the garbage disposal or be handled separately from trash and recyclables.

Conducting a Waste Audit

- The waste audit is one of the first steps in starting a recycling program. Elements of a good waste audit include:
- Composition of the waste stream. The first step in the audit process is to look at what materials are currently being disposed of and in what quantities. In developing the program concentrate on the high-volume materials (in retail, it would be cardboard, and with offices, it would be paper). Also look at high-value materials such as toner cartridges and aluminum cans.
- Determine weight/volume. Look at the weight and volume of the materials currently disposed of that could be recycled. Restaurants and bars generate large quantities of glass and are often charged a surcharge for collection due to the weight. Retailers generate large volumes of cardboard that can quickly fill dumpsters. If the establishment generates a high volume of cardboard it may pay to look at baling the material; this can also help increase the marketability of the cardboard.
- Sources of waste. Look at overall operation and determine where the waste is being generated and if this material can be reduced (e.g., make two-sided copies), reused (e.g., reuse packing material), or recycled (e.g., collect and recycle office paper).

Appendix B: Energy Opportunity

The calculations listed below are the cost of cooling 15,000 liters of wine to 30 F. (\$29.05)

15,000 liters (3,962 gallons) from 60 F to 30F or a Delta of 30 F. Cost is \$0.10 kWh.

$3,962 \text{ gal} \times 8.34 \text{ lbs/gal} = 33,043 \text{ lbs} \times 1 \text{ BTU/lb per degree F} = 33,043 \text{ BTU per degree} \times 30 \text{ degree} = 991,290 \text{ BTU} = 290.5$

$\text{kWh} \times .10 = \$29.05/3,962 \text{ gallons}$

The above assumes 100% efficiency.

The calculations listed below are the cost of keeping 15,000 liters of wine at 30 F for 30 days. (\$17.00)

Provided by NC State.

$\text{Area} = 10 \text{ ft} \times \pi \times 8 \text{ ft} + 2 \times \pi/4 \times (8 \text{ ft})^2 = 351 \text{ ft}^2$ The first term is the side of the tank and the second accounts for the top and bottom. The heat transfer is:

$Q = U \times A \times \text{delta T}$. U is in this case $1/10$ (or $1/R$ value) roughly and delta T is 30F

$Q = 0.1 \times 351 \times 30 = 1056 \text{ BTU/hr}$

That's the size system needed to keep it at temperature. I'd feel better if we doubled it to 2,000 BTU/hr just to make sure we haven't forgotten something.

We can assume the cooling unit has a COP of about 2.5 (maybe more), so the electrical energy used is:

$\text{Electric Power} = 2,000 \text{ BTU/hr} / 2.5 \text{ COP} = 800 \text{ BTU/hr} = 235 \text{ Watts}$

Over 30 days, this is:

$\text{Monthly Energy} = \text{Power} \times \text{hours} = 235 \text{ Watts} \times 30 \text{ days} \times 24 \text{ hrs/day} = 169 \text{ kWh/month}$

At \$0.10/kWh, this is about \$17 per month. If the tank is not as well insulated, then we'll have to re-figure.

You can use the same COP to take the wine down to 30F. $\text{Energy} = 990,290 \text{ BTU} / 2.5 \text{ COP} = 396,116 \text{ BTU}$ of power = $116 \text{ kWh} = \$12$