DATA-DRIVEN WINE: HOW U.C. DAVIS IS MEETING SUSTAINABILITY GOALS WITH THE PI SYSTEM™

Since 6000 BC, fermenting grapes into wine has captivated the world. As winemaking has evolved, it's become a finessed blend of art and science, leaning heavily on winemaker expertise as well as critical production markers. However, winemaking is a finicky process, susceptible to changes in soil, drought, process issues, human error, and more. At the University of California, Davis, sustainable, data-driven production facilities and processes not only help to hedge against these factors: they turn the winemaker's vision into reality. With the goals of achieving carbon neutrality, net positive energy, and reduced water usage for a multifaceted fermentation process, the UC Davis Sustainable Wine and Food Processing Center deployed the PI System, setting the stage for the next generation of winemakers.

THE PATH TO ZERO

With 80 acres of vineyard both on campus and in the nearby Napa Valley, the UC Davis research and teaching winery is the first to achieve the platinum award for environmental design from the Green Building Council. The most sustainable winery in the world, the facility captures rainwater for fermentation tank cleaning, leverages energy storage using batteries, and captures CO2 and ethanol to reach its net zero goals. The PI System serves as the nucleus for each part of the process, allowing the team to manage resources and monitor fermentation. "Our PI System is central for capturing data to manage our water systems," said Jill Brigham, Executive Director at the Sustainable Wine and Food Center at UC Davis.

POWER TO MEET DEMAND

The winery is ripe with infrastructure, including a battery controller system, 200 kW solar panels, and 260 kWh of battery storage, all of which come together to create a microgrid. To reduce the cost of energy storage, the winery used second-life batteries from Nissan Leaf cars by repackaging the individual cells in server cases. All energy production data moves through the PI System, enabling them to view how solar production and storage capacity offset building demand. "We can monitor the charge and discharge of those batteries, the total charge, the total amount of energy stored, as well as the temperature of those batteries," Brigham said. While the team is just starting with the energy storage

CHALLENGE

Create a sustainable winery that can thrive in unpredictable conditions.

SOLUTION

Use real-time PI System data to monitor energy, water purification, and fermentation.

BENEFIT

Lower sustainability and energy costs without sacrificing the quality of wine.

ELECTRICAL DEMAND & SOLAR GENERATION

PI Vision allows UC Davis to view solar production and see how it offsets building demand.

component, they've already achieved a 15-16 percent peak demand reduction, surpassing the original 10 percent goal. "We envision that we'll be able to reduce our peak demand by something on the order of 50 percent," she said.

TURNING (RAIN)WATER INTO WINE

Capturing and reusing rainwater was critical for UC Davis's sustainability goals. California operates at a water deficit, and with numerous drought years having available water is key to avoiding production curtailments. Thanks to watershed areas, the winery captures rainwater off the rooftops. Rain is piped underground to the filtering and storage building where it undergoes a reverse osmosis process to make it potable. All parameters are monitored in the PI System, including flow and the UV filtration process, ensuring it meets food grade standards. Water is then used to clean the filtration tanks and recycled multiple times, giving the winery an ample source of water that can be pumped in as needed, even during times of drought.

EXECUTING THE WINEMAKER'S VISION

While sustainability is one goal of the UC Davis winery, quality is still paramount. The winery has 166 fermentation tanks, each holding around 20-40,000 pounds of grapes. Any error in the fermentation process can devalue the wine or spoil the entire batch. For example, as the wine moves from tank to filter to barrel, CO_2 can reach unhealthy levels if flushes of nighttime clean air aren't performed. Since harvest times vary, each of the 166 tanks is on a different fermentation schedule, making it difficult to monitor quality.

Real-time data is fed from the PLCs into the PI System, giving winemakers visibility into sugar content, temperatures, CO_2 buildup, and more, on an individual or tank farm level. "The PI System enables the winemaker to easily monitor each individual fermentation by being able to see what's going on in each individual tank," Brigham said.

But the research team was not content to simply monitor existing conditions. They wanted to predict any issues so they could make adjustments before they occurred. Using the kinetic model of fermentation as a baseline, researchers input initial conditions and fed the model with real-time Pinot Noir fermentation data from the PI System. By comparing the real-time data against the preset conditions, they can understand current batch characteristics and predict what the batch will do over the next few days. With this information, the team can identify future problems and take action well before quality is compromised.

For more about UC Davis and the PI System, watch the full presentation here.

> The PI System enables us to optimize our winery water and energy usage and to create the world's first zero net energy winery."
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> *— Jill Brigham, Executive Director, Sustainable Wine and Food Center, UC Davis*

Brigham, Jill. "Using the PI System for Winery ZNE Goals" <https://www.osisoft.com/Presentations/Using-the-PI-System-for-Winery-ZNE-Goals-and-an-Extensive-Pinot-Noir-Study--UC-Davisx/>