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Efficient Cooling Systems Key to Reducing Winemaking Costs

Optimizing cellar temperatures and fermentation processes can lead to significant energy savings during the harvest season.

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As the 2025 harvest season begins, the sound of cooling units fills the air in winemaking regions. These units are crucial for maintaining the right conditions in wine cellars, and their operation significantly impacts production costs. Alongside water, electricity is a major expense in winemaking, excluding consumables. Efficient cooling management is essential to control these costs.

Pieter Vergeer, a senior engineer at Stamicarbon Advance, shared insights on optimizing cooling systems in cellars. Understanding these systems is key to identifying potential improvements. Cooling involves three main areas: the fermentation tank, the cellar's ambient temperature, and the outside temperature.

The fermentation tank's temperature is crucial for achieving the desired wine quality and style. This temperature is influenced by the sugar content in grapes, which releases energy during fermentation. Controlling this process affects the final product.

The cellar's ambient temperature should be close to the fermentation tank's desired temperature. This minimizes the energy needed to maintain the tank's temperature. The goal is to reduce the temperature difference between the current and target temperatures, conserving energy.

Outside temperature is particularly important during harvest in South Africa's Western Cape, where it can get extremely hot. High temperatures can disrupt the controlled environment inside fermentation tanks. Insulating the cellar and tanks from heat is crucial. Energy should focus on cooling the fermentation process rather than the entire cellar.

Advancements in yeast strains allow for quality white wines to be produced at higher temperatures, reducing the temperature difference needed for optimal operation. This can lead to energy savings.

A well-insulated cellar reduces the cooling system's workload. Grapes bring in heat from outside, affecting the final product's quality by altering its chemical composition and causing premature fermentation. High temperatures also increase energy usage. Cooling a ton of grapes by 2.5°C requires about 1 kWh of energy. On hot days, cooling grapes from 30°C to 15°C needs around 6 kWh per ton.

Consider a 10,000-liter tank fermenting wine over 21 days. Fermenting at 13°C for 21 days consumes 524 kWh, while fermenting at 16°C for 16 days uses 392 kWh. The energy needed for cooling is 33 kWh per degree Celsius difference between the cellar's ambient temperature and the optimal fermentation temperature. The mash cooler uses 2 kWh per ton for every 5°C it cools the grapes. Electricity costs about R0.30 per kWh

in 2024.

For Sauvignon Blanc fermentation, consider two scenarios. With minimum cooling, fermenting at 16°C for 16 days with grapes arriving at 20°C and a cellar temperature of 20°C consumes 419 kWh, costing R125.70. Maximum cooling, fermenting at 13°C for 21 days with grapes at 30°C and a cellar temperature of 25°C, uses 771 kWh, costing R231.50.

These figures only reflect direct cooling cost savings, excluding other expenses like water usage for cooling towers or cooling unit efficiency. Like high school physics calculations, these estimates don't account for inefficiencies and energy losses, which vary by cellar. They should be seen as potential percentage savings.

Energy savings could reach about 45.7% of cooling energy bills during harvest. While savings might seem small per tank, proper planning and optimization can significantly impact an entire cellar without needing costly infrastructure.