SAVING OF RESOURCES IN WINERIES – WHAT ARE THE INTERNATIONAL BENCHMARKS

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LEED Platinum UCD Teaching and Research Winery
Net Positive Winery

- **Water Positive**
  - Rainwater Capture
  - Reuse process water & cleaning solutions multiple times
  - No wastewater pond

- **Energy Positive**
  - Renewable Power & Storage
  - Solar Panels
  - Li-Ion Batteries for Energy Storage

- **Carbon neutral**
  - Capture & Sequester CO2
Aerial view
Jess S. Jackson Sustainable Winery Building

- One of the most thermally-insulated buildings in California
- Certified Net Zero Energy by the Living Building Challenge program
- Designed to be passive, low energy building – provide all energy and water for LEED Platinum Winery
- Designed on PassivHaus principles
The Building has heavily-insulated walls (R=60) and Roof (R=85).
The indoor temperature variation is $1/10^{th}$ that of the outside air.
It has tubes within the floor to heat and cool the building.
It is cooled by night air displacement.
It is designed for a future underground rock bed for additional cooling.
The California winemaking industry consumes over 400GWh of electricity annually, the second largest electricity-consuming food industry in California.

“Energy Efficiency Opportunities in Wineries for Retrofit and New Construction Projects” BASE Energy
UCD Winery Power Demand During Harvest – 1 Day

![Graph showing winery power demand during harvest](image-url)
UCD Winery Power Demand During Harvest – 1 Week
UCD Winery Solar Energy

- 280 kWh consumed
- 450 kWh surplus produced

01-Sept-14 to 02-Sept-14
Energy Storage

- Second-Life lithium-ion batteries are recycled after replacement in electric vehicles
- Charged each day by solar photovoltaics, power UCD Winery at night and shift peak loads during the day
- 260 kWh storage capacity
- Donated by Nissan and 4R Energy, California Energy Commission funding
Battery Assemblies
UCD Winery: Energy Sustainability

- 180 kW Solar Photovoltaic Panels
- 260 kWh second-life lithium-ion batteries
- Energy Peak Shaving – store energy at renewable generation peak for use at energy consumption peak
Cost of Energy in EU

Electricity prices for non-household consumers, second half 2017
(EUR per kWh)

(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.

Source: Eurostat (online data codes: neg_pc_205)
Electricity prices by country in 2015 (USD/kWh)
Energy supply in Germany

GROSS POWER GENERATION MIX GERMANY 2016
Share of energy sources in German power production

- Natural gas: 78.5 TWh (12.1%)
- Nuclear: 84.9 TWh (13.1%)
- Lignite: 150 TWh (23.1%)
- Hard coal: 110 TWh (17%)
- Wind power: 79.8 TWh (12.3%)
- Biomass: 51.7 TWh (8.2%)
- Solar: 38.3 TWh (6.3%)
- Hydropower: 21.5 TWh (3.3%)

Total: 648 TWh [bn kWh]

Source: AGEB, 2016
Ways to Save Energy

- Optimize usage
  - Temp control of buildings
  - LED, natural light
  - Heat exchangers
  - Energy efficiency of walk-in coolers
  - Optimizing cleaning and sanitation
  - Using solar to heat/cool water
  - Optimize winery control

- Renewable energy and storage
  - Shift energy form renewable generation peak to energy consumption peak
Fermentation Temperature Control – Hot Water

- Sun heats water in Evacuated Tube Collectors
- Heat Pipe absorbs heat from tube heat absorber fin & hot vapor rises to heat pipe header
- Water circulates through the header pipe and is heated
- Water is stored at 50°C (120°F)
Fermentation Temperature Control – Cold Water

- Ice chips are made during the day using photovoltaic energy
- Water is passed over the chips to provide 40°F (5°C) for the Winery by direct heat transfer
Water Sustainability

- Rain water harvest
- Water Filtration
- Water Reuse
California’s Water Sources - Groundwater

The graph illustrates the change in groundwater storage in millions of acre-feet from 1962 to 2002. The data is categorized into Variable to Dry, Variable to Wet, Dry, Wet, Dry, and Variable to Dry periods. The graph shows a significant decrease in groundwater storage, particularly in the Central Valley Overall region, with notable fluctuations in specific regions such as Sacramento Valley, Delta and Eastside Streams, San Joaquin Basin, and Tulare Basin.
Water Use in the Winery

Breakdown of water use by process in Kendall Jackson Winery *(from Kendall-Jackson 2011)*.
Water Storage
Potable: 1,000,000 L
Non-Potable: 680,000 L
Non-Potable Water

- Collected from swales
- Filtered, treated with ozone
- Used for irrigation & toilets
Rainwater Harvest
• Why rainwater?
  • No Aquifer Depletion
  • High Quality
  • No Hardness or Silica
  • Low RO Energy Requirement
Hook-ups for the Jackson Building and the LEED Platinum Winery

- RMI North & South Roof
- Rainwater Capture and Delivery
- LEED Platinum Winery
- CO₂
- 4 RW Tanks
- CO₂
- RO Water Loop
- Used CIP Solutions
- Fresh CIP Solutions
- NF
- CW
- HW
- Rock Bed
- Jess Jackson SW Building
- 6 RW Tanks
- Fermentation Temperature Control, 5 and 50°C
The LEED Platinum Teaching and Research Winery

- Produce more water & power than winery needs in a season
- Energy positive & water positive
- Onsite capture & storage
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