

Winery Design in the 21st Century

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Introduction

A modern winery is a major investment. The capital needed to convert grapes into wine in a cost effective and socially responsible manner means that any decision to build a winery should be taken with great care. You can expect the earliest payback will be ten years or longer, which is why we find so many wine businesses happy to have the wine made by contract winemakers rather than install their own expensive facilities. However many still see the benefit in establishing facilities to suit their individual styles of wine, winemaking, wine marketing or other business objectives and proceed to build a modern winery.

In designing a winery in the 21st century, we should understand that while the fundamentals of winemaking may not have changed over the centuries, the design of a functional winery has changed dramatically. They are now much more than just processing facilities housed inside buildings of varying architectural merit. They need to be efficient in terms of energy and resources, be environmentally responsible and of equal importance, they must be able to support the brand image where required. Support for the brand image can include the architectural theme of the buildings; a public display of winemaking processes; specialised hospitality and cellar door facilities; or any other public face of the business.

This article discusses the factors demanding consideration by the market and society when building a winery. These factors reflect the values of today's wine industry, and indeed responsible industry in general. They include:

- quality outcomes;
- environmental impact;
- resource conservation;
- occupational health and safety; and
- new technologies.

These factors will have a major impact on the design of the winery and its surrounding facilities and must be considered at the concept stage before hitting the drawing board. Here we will focus on the small to medium sized wine making enterprise.

If you have attended wine industry conferences over the last two or three years, you will have noticed the change in focus of the industry. Leaders of the industry are challenging winemakers, engineers and suppliers to deliver to the quality and cost of production targets that will take Australian and New Zealand wines into new markets both domestic and international.

Planning & Design

Whether you are building a new winery or upgrading an existing facility proper planning at the concept stage is critical. You should develop a design brief which clearly identifies and addresses the stakeholders' requirements, including:

- The philosophy behind the project including environmental, processing and marketing considerations;
- Production projections covering all likely eventualities;
- Winemaking methods required for each style;
- A project timeline and budget; and
- The project team and an outline of responsibilities.

A well prepared design brief assists in the smooth running of the winery design and construction stages and provides all members of the project team with a thorough understanding of the objectives.

Design Development

It is only through an in-depth understanding of winemaking practice and process that the most innovative and appropriate design solutions can be found. To ensure functionality a winery building should be designed from the inside out.

Begin by defining the logistics of grape receipt, the specific requirements of the processes to suit the style of wine to be produced, efficient workflows, the impact of the site conditions, environmental considerations, efficient energy systems and occupational health and safety matters.

Based on the above, the spatial requirements (floor area by height) for the various winery areas are then developed. At this point the architectural needs can then be considered as to the style and functionality of buildings and associated facilities such as cellar door, amenities, access and infrastructure.

A critical stage in the design is determining the winery layout, based on the relationship of each winery area to the others. For example, grouping the winemakers office, laboratory and tasting room provides many movement and management benefits. But consideration should also be given to:

- The possible benefits of direct access to tank catwalk systems from the winemakers office and laboratory;

- the importance of clear line of sight from the wine makers office to the receival and production areas, particularly in smaller operations where the winemaker may be working alone or with few staff; and
- the location of noisy or smelly associated processes, particularly in the vicinity of the tasting area.

Quality Outcomes

Quality in its broadest sense covers all aspects of the finished product, the processes, regulatory compliance, responsible practices and the achievement of overall business goals. Clearly the quality of the wine produced will have a significant impact on most parts of the business and will be the main measure the market uses to assess the success or otherwise of the enterprise.

Quality is not absolute; it is relative to the price/quality perception that the product achieves, that is, is the product good value for money? This means for a successful winery the designers must understand the market expectations of the wine that will be produced. Will it sell for \$10 a bottle or \$50? From a winery design perspective probably the most difficult project is one where you want to produce both the \$10 bottle and the \$50 bottle.

Environmental Impact

The development of many totally new wine regions, the push of the urban fringe, and increasing environmental awareness and responsibility now mean that any new winery expansion or development will come under increasing review by local community and council. Environmental impact assessments will, and rightly should, address all aspects of the development from resource conservation through to the management of waste streams and noise pollution.

Many regional councils are still in the process of gaining sufficient knowledge of wine production to make planning and development decisions with a degree of comfort. Consequently they often require guidance during the planning process to ensure that development plans are not held up or rejected.

A well planned winery, particularly if located in a vineyard, can offer a level of sustainability not readily afforded to many industries. The potential exists for the reuse of waste materials and by-products, in the form of irrigation of treated wastewater, composting of solid waste and the uptake of carbon dioxide by the vines. Gone are the days when wastewater could be allowed to leach into the ground and possibly the waterways or large volumes of solid waste sent to landfill. Recent developments in effluent treatment plant design have resulted in a number of packaged plants being available which offer increased effectiveness and significant energy savings.

To optimise the performance of any effluent treatment plant waste streams will need to be tackled as close to their source as possible. For example, drains should be located at high liquid flow areas such as barrel washing, and collection baskets should be designed into the floor drainage of the winery to collect and remove coarse solid waste.

Further downstream in-line screening of finer solids will also reduce the load on the effluent treatment plant. The use of chemical neutralisation of effluent will be reduced by combining waste streams to achieve coarse pH correction or dilution.

In all cases, stormwater must be prevented from entering the process waste stream to avoid overloading the treatment system.

Resource Conservation

The consumption of utilities in wineries, such as hot and cold water, electrical power and inert gases, can be managed by efficient design, good operating practices and effective process control to reduce usage and costs. Effective insulation materials used for building construction, storage tanks and service piping, in addition to recovery of waste heat for water heating will contribute significantly to energy savings.

A single automation system can now more effectively control and monitor the operation of the refrigeration plant, effluent treatment plant, energy management system and irrigation system as well as recording plant performance parameters and generating production management reports. Many process control systems are compatible with inventory control management and winery management systems.

Water usage rates of up to 10 litres of water per litre of finished wine have been recorded. Depending on winery function and size we expect that good design and work practices would reduce this rate to between 2 and 4 litres, of which at least 25% to 50% should be potable. The water supply, whether it is rainwater, dam, mains or bore needs to be assessed and suitable storage must be made available where necessary. In remote regions where the annual rainfall is variable, storage requirements may need to exceed one year's usage.

Water supply or storage capacity will also have to be sufficient for the fire fighting needs of the winery and surrounding buildings. These needs may vary from region to region depending on local regulations.

If water quality is an issue, there may be a need for dual water supply with one reticulation system for high quality potable water, and a second system for lesser quality washdown water.

As an alternative to hot water reticulation in smaller wineries, a high pressure cleaner with inbuilt heater can reduce water usage and energy for barrel cleaning or general cleaning.

Occupational Health and Safety

Equipment layout and workflow design must consider the safety of operating and visiting personnel as well as the hygiene requirements of the plant and processes. Other factors to be considered are forklift access, anti-slip floor treatments, operating and maintenance access, lighting, safety showers, chemical storage, fire fighting equipment and personal protective equipment.

When determining the ventilation requirements of the winery, consideration must be given to the dissipation of carbon dioxide produced during fermentation, which, being heavier than air will tend to collect at the low points of the building. Therefore the design of the building must avoid enclosed pits or trenches that cannot be ventilated, such as crushing pits. In areas where carbon dioxide build up is a concern, consideration should be given to installing forced ventilation plus a permanent atmospheric monitoring and alarm system.

New Technologies

A number of new technologies have been introduced into the wine industry in Australia and New Zealand over recent years. These are contributing to both countries gaining leading positions globally in terms of product quality, productivity, environmental management and cost of production.

Clearly for producers to maintain a competitive edge the design process must incorporate existing technologies where appropriate, as well as ensuring there is flexibility in the design to allow the introduction of new technologies as they become available.

Some current technologies which should be considered include micro-oxygenation, reverse osmosis and cross flow filtration. These technologies can have a significant impact on the pattern of process flow and hence the winery design.

An example of this is the incorporation of the micro-oxygenation technology in the production of a red wine that was once solely matured in oak barrels. Since the technology in its current form requires the product to be stored in tank the process flow may have significant impact on overall tank capacity.

Plant and Equipment Selection

Correct plant and equipment specification and selection is critical to successfully achieving the wine styles, quality, logistics and overall business objectives. The challenge is to plan, design and construct cost effective processes that are integrated systems without bottlenecks, while still offering the winemaker the flexibility to tailor winemaking to specific requirements.

Overview

Winery design requires a very clear vision of what is to be achieved in the new plant, especially:

- a) Is it simply an operational winery manufacturing wine at the most economical price; and/or
- b) Is it part of the marketing strategy incorporating a tourism venue to attract tourists to the facility and the brand;
- c) Does it meet the operational, economic, and sustainability targets; and
- d) Does it allow for future expansion and/or adoption of new technologies?

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