What to Do Before Breaking Ground on Your New Winery

WHITE PAPER

BARNUM
MECHANICAL INC

Contents

Introduction

Whether you are expanding production at your current facility or building a new winery, there are critical decisions to be made early in the project which will lay the groundwork for the future. This guide provides fundamental considerations for the winery design and construction which will set you up for success and will help your team:

- save money during construction
- reduce costly change orders
- meet your target timeline
- lower your operating expenses such as labor, utilities, and maintenance
- lay the infrastructure for future expansion

Build Your Team

The design and construction of a new winery is a complex undertaking. Everyone involved must work to create the most efficient and reliable process system while working within the constraints of budgets and timelines. With the pace of change today, versatility and adaptability are crucial features in a new process system. The same must apply to the physical plant which will be built or renovated to house the system. The goal is to make the most of today's best technologies, while simultaneously anticipating tomorrow's innovations.

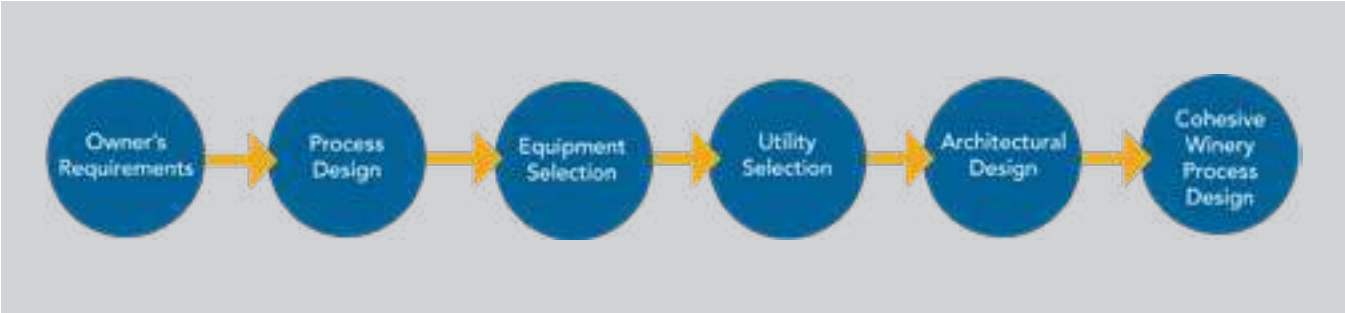
Each stakeholder in your project has different perspectives and goals and they each speak a unique language. Some stakeholders may not understand the wine making process which makes it important to thoroughly explain what you need, why you need it, and how you envision your winery coming together. This context will reduce assumptions and mistakes, and make your team more efficient, and effective.

View your winery and the fermentation process system as a cohesive unit, and design them as such.

Solve Problems Upfront

The further you get into the construction process, the more expensive it is to make a change. Early engagement of the key team members ensures a deeper understanding of the owner's goals, budget, time frames and constraints, speeds up decision-making and reduces implementation time. The process design impacts the equipment and utilities selection. The process, equipment, and utilities all impact the building design. Each process is unique, and each element of the process has a direct impact on the building design specifications, space for maintenance, storage, access, and growth.

Interconnected Decisions



It is important to select an experienced process design firm and it is equally important to select an architect and general contractor (GC) with demonstrated winery experience. Your initial team should consist of:

Intercompany Team	Consulting Team
Owner	Architect
Financial Officer	General Contractor
Operations Manager (Vinter)	Process Design Engineer
Maintenance Manager	Subcontracted Engineers (Structural, Electrical)
Sales Manager or Brand Manager	Alcohol Beverage and Legal Compliance Firm

It may not seem obvious but each of these team members have different perspectives which can impact the design of the winery, the building, and expansion plans. For example, your sales manager may advise creating new product offerings such as non-alcoholic or alcohol reduced wines which will require special equipment.

Site Selection

The site location is a key early decision which will drive many factors of the winery design. The primary consideration for site selection is the proximity to the vineyard. If you have not selected a location and you plan to buy land, you will want to consider if the location can handle the following:

- Reliable water supply for irrigation and production
- Wastewater treatment and, or, holding ponds
- Fruit receiving and crush
- Fermentation and cellar operations
- Barrel storage and maturation
- Packaging
- Receiving and unloading of bulk materials, and shipping of your product
- Tasting room and DRC experience
- Parking and storage space

There are legal issues to consider such as:

- Are there special constraints, ordinances, or rules specific to your location?
- Will the zoning classification of your project be permitted in your proposed location?

Site Utilities

Is the site located near the utilities you will need? Consider your needs for:

- Electrical (primary panel capacity, voltage and phase, configuration and expandability)
- Potable water (line size, pressure, availability and limits)
- Internet/Communication(s), connection types and bandwidth
- Municipal sewer or treatment/discharge system and ponds

If you are renting or refurbishing an existing building, you will want to consider:

- The TI budget/agreement with the property owner
- Rules, regulations and constraints imposed by the property owner
- Height or other spatial requirements of the proposed facility

Brands and Strategy

The number of product types, product mix, batch sizes and packaging types are all critical to downstream decisions about the use of space as well as the need for equipment. It is important to consider your plans regarding contract or co-packing operations if those are to be considered in the space. Related considerations are:

- Are you planning to make products other than wine, such as grappa, brandy, alcohol reduced wine, extractives, grapeseed oil or wine flour? If so, what?
- What is your anticipated product mix (i.e., % by brand)?
- Do any of your products require dedicated equipment such as tanks, hoses, pasteurizers, fillers?
- NFPA storage and handling

Capacity

Capacity is a crucial design criterion, but it can be approached from different angles, such as expanding production of an existing winery versus building a new winery from scratch. Consider your desired production volume(s) and your growth plans. Your budget or other constrains might prevent you from initially building the winery of your dreams but you will want to ensure your design can be expanded in the future to accommodate your success.

Your team will need to know:

- What size system (or systems) are being considered?
- Do you intend to produce "short batches" which are smaller than the rated capacity?
- For smaller specialty wines, is separate crushing equipment necessary?
- Is the process system customizable or is it pre-engineered/prefabricated by the OEM?
- What level of automation is available or desired on the system?
- What are the process steps in your fermentation system?

Vinification Process Flow

Mapping out your process flow is vital to your team's understanding. Here is a sample list of winery process steps:

1. Harvest
2. Bulk delivery and conveyance
3. Crushing and de-stemming, grape preparation
4. Fermentation and maturation
5. Pressing and solids separation
6. Fining, filtration and blending
7. Packaging
8. Shipping

Equipment Selection

The overall function(s) of the equipment should be versatile, easy to clean, and facilitate the ability to perform product/brand changeovers. The process design will specify the equipment required to support the process. Different types of processes call for different approaches and design considerations, and evaluating the numerous options is complex.

We highly recommend purchasing tanks with extra ports for sampling, aeration, racking arms, pump-over piping or instrumentation. Adding extra ports later may require confined space entry and the cost of such modifications can easily exceed the cost of the original tank.

To provide better control during fermentation and cold soaking, tanks with multiple glycol jackets may benefit from multiple thermowells.

It is vital to partner with process designers who have experience in material handling and processing of the specific ingredients used in wine making. There are different processes for each ingredient relative to equipment/lines, raw material and processing environment, and the versatility of the equipment to handle these differences is critical.

Existing Equipment

If you have existing equipment which you plan to use in the new or expanded winery, you will want to provide all relevant technical documents to your process designer including:

- Equipment specifications
- Electrical loads (voltage, phase, and amperage)
- Physical dimensions and weight
- Utility requirements (compressed air, water, steam)

Piping and Connectivity

Most sanitary process equipment is connected by piping which runs over, under, and around the equipment. In some cases, catwalks and access platforms are required. The process designers will ensure the design prevents piping traps, dead legs, and hard-to-clean-or-maintain areas. To ensure the most efficient process, the building should be designed to accommodate the process and not the other way around.

Bulk Ingredient and Material Handling

Buying bulk ingredients is beneficial due to storage efficiency, ease of handling, and lower cost. Bulk ingredients often require specialized equipment and automation to achieve their full potential. Aside from the grapes, the most common bulk ingredient in wine making is CO_2 gas, which has unique storage and handling systems designed to limit hazards. For example, cryogenic CO_2 systems house dangerously cold gases which can displace oxygen and cause suffocation. Atmospheric monitoring and forced ventilation systems are now required in some regions.

Ingredient storage has its own set of considerations. Here are a few which should be built into your plan.

- Do you require CO_2?
- Will you reclaim CO_2?
- Will you generate, and store of nitrogen onsite?
- Will you generate ozone onsite?
- Is your source of fermentation oxygen in the form of sterile air, or high-pressure O_2 cylinders?
- Will your facility be certified Organic by the USDA?

Rice Hulls in Pressing

Pressing white wine grapes can be difficult and sticky. Many vintners add rice hulls during pressing to prevent clogging and create pathways for juice to pass through allowing free run and press run to easily escape.

If using rice hulls, we recommend using bulk handling procedures with automated conveyance to reduce cost, improve yields, and eliminate potential hazards.

Fermentation and Maturation

Product mix and lifecycle will dictate the maximum theoretical capacity required for blending tanks and maturation tanks. Tanks should be procured with similar glycol jacket designs as tanks with different glycol pressure requirements will not cool easily or efficiently.

Your process designer will need to know:

- Will you require tanks with an ASME rating for greater than 15psi?
- What is the shortest, longest, and average fermentation cycle of your brands?
- Do you intend to blend your wine with water or other ingredients prior to packaging?
- Will you ever need to ferment a batch of wine which does not fill the tank? How full?
- How many zones of temperature control do you need in your fermentation tanks?
- Will tanks be purged with CO_2 or nitrogen?

Filtration, Separation and Centrifuges

Filtration and separation require special equipment and processes, and create waste streams such as biosolids, filtration medium, and clarifying agents. There are several types of clarification strategies such as:

- Enzyme clarification
- Finings/settlement
- Filtration
- Centrifugation
- Colloid stabilization

The growing popularity of centrifugation has been beneficial to vintners and process designers alike. The placement of this piece of equipment, if selected, should address the following criteria:

- Noise mitigation (if greater than 85db, an enclosed room may be necessary)
- Forklift access or lifting gantry for periodic bowl maintenance.
- Proximity to solids holding tank (for storage of discharged solids)
- Supply pump in proximity to the cellar

If crossflow or other polishing filtration step is performed after centrifugation, consider a buffer tank or additional storage tank(s) to store the wine between centrifugation and polishing. A buffer tank is recommended as it facilitates simultaneous production.

Automated Control Systems, IT, and Factory Floor Networking

As you plan your process, you will want to evaluate the level of automation you want to include today and then imagine what you might want to automate tomorrow. Automation is a force multiplier and can help drive intelligent business decisions as you grow. At a base level, automation can limit your need for labor, increase quality, and reduce downtime. Infrastructure considerations include:

- Electrical and communication network backbone and distribution points
- Wireless and local area network requirements
- Server storage (which requires climate-controlled rooms or enclosures)
- Determining peak electrical loads to ensure the building's electrical service is suitable for the application
- Is there a need for remote monitoring, alarm escalation, or data collection and visualization?
- Do you have an in-house or consultant IT person to help with networking and communications?
- Does the accounting and or logistics department need to digitally track raw materials or processes?
- Will you be using an Enterprise Resource Planning (ERP) software? If so, which one?

Automated Pump Over

The timing and frequency with which wine needs to be pumped over is dependent on the grape variety, the wine being made, and the fermentation phase. Cap management is time-consuming but crucial and requires constant monitoring of key elements to ensure the highest quality product. An automated pump over system can automatically:

- Monitor, report, and adjust temperature(s) as required
- Measure and control oxidation-reduction potential (ORP)
- Monitor and report Brix levels
- Control the timing and duration of pump overs for maximum extraction

The benefits of automated vs manually controlled pump overs are:

- Reduced labor cost
- Total control of the fermentation process via automated measuring/monitoring of key elements such as must temperature and micro-oxidation
- Improved sanitation as the product has limited exposure to bacteria and other contaminates
- Improved safety and risk management for employees (no lifting heavy hoses on ladders or over-exposure to CO_2)
- Improved product quality and consistency

Flash Extraction

Some wineries avoid the need for pump over and punch-down, by employing flash extraction. Flash extraction heats and vacuums the grapes while rapidly extracting color, tannin and flavor, and removing pyrazines and unwanted aromas. Flash extraction requires special equipment and utilities but eliminates the need for other equipment and improves efficiency by reducing the number of wine transfers.

Utility Support Systems

Each type of utility system adds equipment and requires distribution and connection points. Here are a few considerations for planning utility support systems.

Heat Sources and Thermal Management

Steam boilers and condensate recovery systems are the best source of thermal power in wineries as they are a low-cost solution for CIP, barrel cleaning, sterilization and pasteurization. Planning is essential to an efficient and well-designed steam and condensate return system and can dramatically reduce fuel and water costs. Due to regulatory constraints, local fuel costs, or environmental concerns, the primary source of heating might require a different system such as solar thermal or geothermal. In any case, the system should be designed in a way which optimizes utility usage, reduces heat waste, and ensures operator safety.

Your team will need to consider the following:

- What is the primary heat source for production?
- Are there any auxiliary heat or hot water sources which can support the winery?
- What is the heat source for other operations within the winery such as:
  - Fermentation heating circuits
  - Distilling or alcohol-reducing equipment
  - Barrel washing and sterilizing systems
  - Hot water for cleaning
  - CIP skids
  - Packaging equipment
  - Clean steam or steam generators (Does your location have an ordinance or rule against high-pressure steam >15psi?)
  - Pasteurizers or thermal processors
  - Wastewater treatment such as anaerobic reactors

Nitrogen and CO_2

Nitrogen is used in wine sparging and can help prevent oxidation in other areas too. It can be used inexpensively to store barrels when not in use, and to purge wine tanks, vats, pumps, hoses and bottles.

Processes which require nitrogen or CO_2 will need either a generator or liquid storage tanks paired with an evaporator. The nitrogen or CO_2 generator requires indoor space near the compressed air receiver tank while a liquid supply and evaporator require a protective outdoor space on a concrete pad. Accommodation for bulk deliveries, including off-hours scheduling, should be considered.

Due to the rising cost and limited supply, Nitrogen as a partial substitute for CO_2 is growing in popularity. Nitrogen generators require a significant volume of compressed air which is clean and free of oil residues. If adding a nitrogen generator, your existing compressed air system should be sized for the added load or supplemented with a standalone compressed air system to support the generator.

Cryogenic gases such as liquid nitrogen and carbon dioxide require heating and evaporation prior to use within the winery. Electric or atmospheric heat exchangers are the conventional means for evaporating cryogenic gases, but a third option is using the winery's glycol system. By exchanging heat between liquid CO_2 and glycol, it is possible to perform the evaporation step while simultaneously cooling the glycol. These types of glycol evaporators are sustainable and cost effective.

Corona Discharge Ozone Generators

Many winemakers have eliminated the use of chlorine, chlorinated water, chlorine-based cleaning products, and other halogenated compounds throughout the winery as they can all affect the flavor of the wine and lead to "corked" wine. In lieu of chlorine and other compounds, winemakers have chosen to employ corona discharge (CD) ozone generators which are an economical and effective sanitation solution, and they provide many other benefits throughout the winery.

Ozone can be produced on site and quickly and naturally dissipates by decomposing into ordinary oxygen after use. It does not leave by-products or residual contaminants such as THMs which can impact taste and odor and otherwise degrade the quality of the product. It is pH neutral and does not change the acid/alkaline balance in the product. Ozone is approved by the FDA and categorized as generally recognized as safe (GRAS) for use as a sanitizer and is approved under the USDA Organic Rule.

Ozone cannot be stored and must be electrically generated on-site and used immediately. CD ozone systems create high quantities of pure ozone. The systems can be permanently mounted and fixed in place or mobile, with multiple operators in multiple locations. It is important the CD system be sized to produce the optimum level of ozone for each application in the winery. For example, 20 gallons per minute (GPM) might be required for Clean in Place systems, with only 10 GPM needed for barrel washing.

Using ozone as a lone source organic sanitizer in the winery will:

- Kill a broad spectrum of bacteria, fungus and molds, yeasts, spores and cysts much faster than halogenated chemicals
- Extend barrel flavors
- Minimize bottling line maintenance costs and cool down cycles
- Save water and energy
- Reduce BOD discharge
- Minimize the purchase, storage, mixing and disposal of other chemicals such as sulfur and sulfur dioxide
- Save money on the prohibitive costs of replacing contaminated wine barrels
- Reduce the expansion and contraction of bottling line components with the use of cold sterilization resulting in less bottling line downtime and maintenance cost

Applications for Ozone Sanitation in Wineries

- Automated CIP of process and transfer piping, valves, pumps, hoses and fillers
- Surface and equipment sanitation (harvest bins, crushing and de-stemming machines, conveyors, floors, walls, and drains)
- Tank and press sanitation
- Barrel washing and barrel bung sanitation
- Bottles and bottling equipment
- Air sanitation and vector control

Compressed Air

Almost every sanitary process system requires compressed air, necessitating ample space for the air compressor(s). Compressors are noisy and many vintners store their compressors outside in protected spaces or in separate rooms, and pipe to multiple application points throughout the plant. ***Compressed air is the most wasted utility in the U.S. and efficient design can save substantial money in operational costs.***

Compressed air can act as a motor gas for valves, pistons, and pumps but also has applications in aeration, evacuation and sparging. Key considerations are:

- What types of valves will be controlled using compressed air?
- Will your packaging equipment require compressed air?
- Will any AODD (diaphragm) pumps be used to move wine or must in the winery?

- Is there any contact, incidental or intentional, between compressed air and the product?
- Do you need redundancy or isolation in the air system for maintenance or emergencies?
- Will compressed air be used for CO_2 evacuation in fermentation tanks?
- Will your aeration be by venturi or by direct injection of compressed air? Will this be a separate dedicated system?
- Do you have hydraulic, pneumatic presses, or other equipment which require high-pressure air?

Hot Water

Processes requiring hot water will need electric heaters or a fuel source for steam boilers. Boilers may seem expensive but the cost of generating steam with electricity can be two to three times more expensive than using fuel giving boilers a faster ROI.

Electric heaters may be required in locations where a fuel source (natural gas, propane, fuel oil, etc.) cannot be routed, and they should be positioned near where the hot water is needed. On-demand systems offer the benefit of saving space, but they require a much larger utility supply. When space comes at a premium and utilities (fuel or electricity) are ample, on-demand systems can be an excellent solution. Be aware that water quality, mineral hardness, and other water conditions, are a critical concern for these systems. Pre-treatment of the water and periodic maintenance will be required to prevent system failure.

Alternative hot water generation such as solar thermal heat is also available and becoming more attractive. Solar thermal systems can be used in locations with good sun exposure and roof structures which can handle the added weight load. (These solar piping systems are different from solar photovoltaic panels which are used to create electricity.) Systems with parabolic lenses or other means of amplification can generate near-boiling temperatures with the potential for a good ROI. Given the seasonality of sun exposure, these systems are typically used in conjunction with another more conventional source of heating.

Glycol Chilling and Heating Systems

Some winery operations require both chilling and heating systems, and others require only chilling. In either case, it is imperative to accurately design and size the chiller/heating system to manage potential load fluctuations and future expansion. To reduce pump demand and ensure system effectiveness, your process designer will design the piping runs which are as short as possible.

Insulation and condensation are key components of system effectiveness and should not be overlooked. Condensate formation on pipes is a source of mold growth and an indication that the insulation is not adequate or compromised and that the system is losing thermal energy.

Smaller systems tend to be air-cooled whereas larger systems are often coupled with an evaporation tower. Chillers should always be sized with the worst-case ambient conditions (temperature and humidity) in mind.

Power failure to the system can cause fermentation to quickly get out of control and is a serious risk to product quality. Redundancy for the chiller system is highly recommended when possible. For the same reason, it is recommended to have a backup generator which can maintain cold glycol during a power failure. Locations with unstable power grids will find a short ROI on this equipment.

A well-designed glycol distribution system will be cost-effective, hygienic, expandable and aesthetically pleasing. There are many options for piping, but the best performers are stainless steel or pre-insulated plastic systems such as Georg Fisher COOL-FIT.

Copper and PVC can also be used but they require maintenance for corrosion and cracking and the total cost of ownership is much higher than stainless steel or pre-insulated plastic systems.

Cleaning and Clean-in-Place (CIP)

Cleaning and CIP functions are critical to safe production, and careful design will reduce labor costs, process downtime, water and chemical usage.

Each operation is unique and must be specified to best meet the needs of the process. For example, some CIP systems require a centrally located stationery CIP skid, or a mobile CIP tank which is rolled to where it is needed. Other operations may require multiple-tank and/or multi-circuit systems to clean multiple processes at once. Multiple-tank systems may be quite large and are often housed in separate rooms, away from the processing equipment.

Before selecting a CIP solution, you should consider the type and number of cleaning processes which need to happen concurrently. If a system is selected which can only clean one process at a time, scheduling conflicts may result in production delays. The CIP system should be designed to prevent operator hazards such as spills, contact burns, chemical burns, slips, or toxic atmospheres.

Flooring and Drainage

Another key design criterion are winery floors and drain plans. Will you use the same drainage system everywhere in the plant, or break up the layout into smaller zones? Will you be catching the drained effluent in a sump pit or wastewater vault? Does your facility have special rules or prohibitions about solids, heat, or pH going down the drain? The flooring and drainage decisions may also tie into your downstream strategy for wastewater treatment.

Flooring for wineries must meet specific and sometimes competing needs. When planning the flooring for production areas, cellars, and tasting rooms it is important to consider the specific needs of each area. Flooring for production and bottling areas may take the most abuse due to forklift traffic and caustic chemicals, and thermal shock and thermal cycling from hot water washdowns can significantly impact the lifecycle of the floors.

Most American wineries use concrete flooring with an epoxy-aggregate or polyurethane coating to produce a durable flooring system with sufficient traction. Finding the right balance between slip-resistance, durability and cleanability is a challenge. Typically, the more slip-resistant the floor, the more difficult it is to clean. And the more "grippy" the texture of the floor, the more wear and tear on hoses and equipment. Aesthetics, function, and practicality should work together to ensure slip-resistance, maintenance, durability, and cleanability.

Coving and Drains

Floor systems which employ coving where the floors meet the wall are an imperative in production and bottling areas. Stainless steel trench-style drains will ensure water and product spills are easy to clean and sanitize. Drains can be arranged to demarcate walking areas, as well as positioned to facilitate cleanability.

Seams, Crevices and Corners

Seams, crevices and corners in the flooring system are hotbeds for the collection of dirt, bacteria, foreign yeast strains and other spoiling organisms, and they are difficult, if not impossible, to completely sanitize. Your flooring system should be designed to eliminate or minimize them wherever possible.

Pitch

All wineries need a proper floor slope to facilitate proper drainage. If the pitch is too high, it can cause slip and falls, and be difficult to use push carts. If the slope is too low, it may create puddles and require the use of a squeegee to remove water or product spills. If your winery will be open to the public for tours, wine tasting, or other events, it is important to ensure the slope meets the Americans with Disabilities Act (ADA) compliance.

Consider these questions before selecting your floor type and drainage plan:

- Will you be collecting and treating your facility's process waste prior to discharge?
- Will you be pouring a new slab or utilizing an existing?
- Will the slab, existing or new, be level or sloped. If sloped, at what pitch?

Sustainability

Incoming Water Quality and Treatment

The incoming water quality used for process, cleaning, and utility purposes will determine the need for pretreatments such as softeners, RO, GAC filtration or other options. Your team will need a water quality report to determine which is the best solution. In addition to pre-treatment, you will need to ensure you have an adequate water inflow and pressure. If not, a holding tank and a pressure system may be required.

Wastewater Management and Reclamation

Water is a precious resource, and most process systems require wastewater management and or treatment. Treatment options vary from filtration methodologies to anaerobic digestion. The solution(s) will depend on your location, capacity, and sewer fee structure. In some cases, municipal treatment is not an option. Most treatment solutions entail specialized equipment, dedicated piping and storage tanks which can be installed indoors or out, and even settling ponds.

Estate wineries can treat their waste and send it back to an irrigation pond for use on the grapes and recycled water can be used to wash tractors and other harvest equipment.

Care must be taken to ensure re-use water is not contaminated and is an acceptable quality for irrigation or land application. Long term accumulation of sodium in effluent and soils can be detrimental to plant health and the use of sodium in CIP chemicals, water softeners, and barrel washing solutions should be minimized wherever possible.

Vintners sometimes avoid adopting wastewater treatment solutions because of their perceived complexity, but with help from your process engineers the solutions can be manageable and cost effective. Your process engineers will help you identify water/sewer municipality requirements, find the most suitable treatment system, and the appropriate piping for process waste.

Biosolids Management

Wineries can produce a high volume of waste such as pomace and yeast sediment. Biosolids and their disposal are highly regulated, and many vintners are employing specialized solutions such as biorefinery to reduce the associated storage, transportation, and energy costs. Some vintners are proactively using their biosolids to produce other products such as grappa, wine flour, fertilizer or compost. These innovative solutions are environmentally sustainable and can be integrated into plant operations with planning during the early stage of process design.

Stems and crushed grapes are very concentrated forms of solid effluent which can be expensive to treat and discharging them to the sewer may be prohibited. The best and least expensive way to manage them is to side-stream these materials and separate them from your other waste streams.

Here is a list of considerations to discuss with your system designer.

- Will these materials be accepted by your waste hauler?
- Is the winery located nearby an industrial composting facility?
- Is the winery located nearby a municipal water treatment facility?
- Will the winery be using a centrifuge to separate yeast and other solids from your wine?
- Will the winery use a wastewater treatment system of any kind?

Energy Recovery

Energy recovery is vital to reducing utility costs. In addition to selecting high-efficiency equipment, vintners are recapturing heat in closed-loop systems and using it to heat water for processes such as CIP. There are numerous techniques for energy recovery involving heat exchange and product-to-product regeneration. Each of these techniques requires equipment and space, the cost of which will vary with complexity.

Employing micro turbines, combined heat and power (CHP), and solar arrays can provide sustainable electricity and significantly reduce cost. As with wastewater and biosolids management, these solutions must be built into the process design and the architectural design of the plant, or space should be set aside for future integration.

Storage and Chai

The primary requirement for storage in winery environments is for barrel storage. It may be tempting to constrict access isles and forklift lanes to maximize storage space, but care should be taken to leave isles uncluttered. An organized cellar will be less likely to create breakage, foster hazards to employees, and attract pests such as rodents and insects.

Cold Storage (Chai) and Distribution

Most wineries use cold storage and require cold distribution methods. The storage and distribution methods must be carefully sized and specified to meet your needs.

- Do you require on-site cold storage for raw materials or finished goods?
- What quantity of materials – or square footage of space – will be required?
- What temperature will be maintained for the bottle or barrel storage?
- Do you require high-pressure emitters for humidification of your storage area? Will the humidification process be automated?

If you intend to utilize the winery glycol system to cool your chai structure, care should be taken to size the chiller and supply headers to accommodate existing and future loads. Consider the need for chiller redundancy as a system failure will potentially compromise all the stored product unless the problem is addressed immediately. The biggest chilling load in the storage area tends to be from outside air entering the chai and utilizing automated doors can drastically reduce unnecessary load on the chiller compressor.

Chemical Storage and Distribution

Your chemical storage and distribution processes can have a significant impact on your process layout and the design of your plant. Chemicals can be stored in large tanks and piped to their use points, or they can be stored in drums and manually distributed to their usage locations. Chemical storage rooms may have unique requirements due to corrosives and the potential need for secondary containment.

Your plan should specify which chemicals and materials should be separated from your production area.

Where will hazardous materials (compressed gas cylinders, lab solvents, CIP chemicals) be stored? Will CIP chemicals be dispensed manually or via an automated CIP skid? In any case, chemical storage and distribution should be built into the process and architectural design.

Space Planning and 3D Modeling

The piping and instrumentation diagram (P&ID) depict the process but does not necessarily help the team envision the space requirements. For that, the process must be translated into a functional digital 3D model. The 3D model will reflect the space requirements for:

- Process equipment
- Utilities
- Piping and connectivity
- Automated control systems
- Bulk ingredient handling and storage
- Cleaning and CIP
- Cross contamination prevention
- Transport paths
- Maintenance access
- Storage
- Growth and expansion

All equipment and functions should be mapped and planned for maximum process efficiency and identify possibilities for future expansion.

Specialty Rooms/Activities (Barrel Aging and R&D)

Winery architects and builders routinely devise creative solutions for meeting floor-space and ceiling-height demands and the earlier they can contribute their insight, the better-designed the winery. Some operations many require segregation.
Your designer will need to know:

- Will the winery have a dedicated area for other products such as wine flour?
- Will the winery be producing brandy, port, grappa or other fortified wines? If so, will you require a separate bonded area dedicated to this production? Fire mitigation measures such as sprinklers might be required where ethanol fumes might accumulate.
- Does the winery require cold storage for barrels or aging tanks?
- Will the winery have a publicly viewed showcase system or an R&D area?
- Will the winery require accommodations for tours, catwalks or viewing windows?

Auxiliary Spaces

Some wineries have showcase installations and allow public tours of the facility. Some even have restaurants, tasting rooms and gardens. Each of these spaces will need planning and may impact support utilities and wastewater management. Your team will need to know if you require auxiliary spaces such as:

- Tasting rooms
- Food service areas
- Restrooms
- Employee break rooms
- Office space
- Landscaped spaces

Transport and Operator Paths

Creating the most efficient and reliable system requires planning the paths in which people and materials are moved from point-to-point. Including the paths in your planning will ensure enough space and optimize your process design.

Maintenance and Inspection Access

Access points for maintenance and inspections are easy to overlook, but expensive to refurbish or create on the fly. Access points and maintenance paths must be designed into the process to ensure maintenance can be performed as efficiently as possible.

Growth and Expansion

Consider the ways your plant and its processes may expand or transform in the future. To prevent costly upgrades, your process designer should size piping, utilities and electrical, networks, control systems, production, and storage space for your future needs. Your process designer can include future connection points in critical utilities like steam, glycol, air, water, and process. This small investment up front will make expansion less intrusive and reduce costs later.

Maximizing Process Efficiency

Assembling the right team before you break ground or embark on an expansion will protect your investment and ensure your production goals are achieved. Their collaboration is instrumental in creating a winery with maximum process efficiency today while accommodating for growth and flexibility in the decades to come. While you cannot know exactly what the future will bring, planning for greater possibilities can save you considerable time and money in the future.

For More Information

For more information, contact Andy Hooper at ahooper@barnummechanical.com or 916.517.5851.

Andy is BMI's Director of Business Development. He is an award-winning Brewmaster with experience in sanitary process engineering, sustainability and wastewater treatment. He holds a B.S. in Biochemistry from Cal Poly, San Luis Obispo, CA.

About Barnum Mechanical Inc.

Barnum Mechanical Inc. (BMI) is a forward-thinking design-build firm specializing in the food, beverage and specialty process industries. BMI is known for superior design, project management and installation services. BMI has operated throughout the United States since 1980.

BARNUM
MECHANICAL INC

3260 Penryn Road • Loomis, CA 95650

(800) 922-7686

barnummechanical.com • info@barnummechanical.com

General Engineering Contractor
Class A License #612589