What to do Before Breaking Ground on Your New Processing Plant

WHITE PAPER

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Build your team. Cement your plans.

The design and construction of a new food and beverage (F&B) processing plant is a complex undertaking. To do the best job possible, everyone involved must work to create the most efficient and reliable 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 processing system. The same must apply to the physical plant which will be built or renovated to house the process. The goal is to make the most of today's most suitable technologies, while simultaneously anticipating tomorrow's innovations.

View your plant and process as a cohesive unit, and design them as such.

Experience has taught us that most successful projects begin with ensuring all the key players are at the table early in the design process. When the owner, process engineers, architect and general contractor come together early, the result will more closely align with the owner's vision.

Reduce costs by solving problems upfront.

The further you get into the construction process, the more expensive it is to make a change. Construction experts estimate that change order cost increases can average 8 – 14 percent of the original contract price. That's big money. Engaging your team early can prevent costly change orders.

Experience counts.

The design of your building should facilitate process and traffic flow, and optimize the space for maintenance, storage, access and growth.

It is important to select an experienced process design firm and it is equally important to select an architect and general contractor with demonstrated expertise in F&B standards and regulations.

Your initial team should consist of:

- Owner
- Process Designer
- Architect
- General Contractor

This early involvement ensures a deeper understanding of the owner's goals, budget, timeframes and constraints, speeds up decision-making and reduces implementation time. The detailed design will be developed by the owner, process designer, architect and general contractor. This collaborative unit has the best possible chance to deliver a plant which facilitates maximum process efficiency and accommodates growth and flexibility in the decades to come.

Your architect and general contractor need to know early.

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 influence on the building design specifications.

For example:

- Using powders in your process may require a separate production room with adequate air filtration, as well as headroom for whatever transport mode will move and lift the powder for loading
- Milk processing requires sloped floors and specific drain capacities to prevent pooling
- Processing peanuts or other allergens has a significant impact on building design to avoid cross contamination

Equipment selection impacts the process design, utility support systems and the building design.

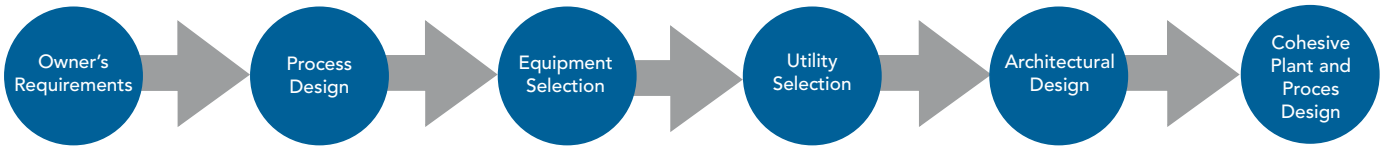
The process design will specify the equipment required to support the process. Different types of systems and equipment call for different approaches and design considerations, and evaluating the various options is complex. For example, some Clean-in Place (CIP) systems require a centrally located stationery CIP skid, or a mobile CIP tank which is rolled to where it's 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. Your team will need to know early.

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:

Steam boilers and condensate recovery systems are ubiquitous in F&B. These systems may require their own room which is large enough for multiple boilers. A common approach is to use a centrally located boiler room and to pipe the steam to where it is needed and return the condensate. Advance planning is essential to an efficient and well-designed steam and condensate return system and can dramatically reduce fuel and water costs.

Interconnected Decisions



Almost every processing system requires compressed air, necessitating ample space for the air compressor(s). Compressors are noisy and many processors store their compressors outside in protected spaces or in separate rooms, and pipe to multiple application points throughout the plant.

Processes which require nitrogen or CO_2 will need either a generator or liquid storage tanks paired with an evaporator. The nitrogen/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.

Processes requiring hot water will need either natural-gas for steam or electric heaters. Electric heaters may be required in locations where natural gas cannot be routed and they generally need to be positioned near where the hot water is needed.

Chilled water requires ice banks or chillers. Ice banks are limited to 34° F or warmer and require more space. Conventional chillers may use glycol and are requisite for processes which require temperatures below 34 °F. Both options require outdoor space and a piping distribution system

Wastewater management

Water is a precious resource and most processes require wastewater management and or treatment. The options vary from filtration methodologies to anaerobic digestion. Most solutions entail specialized equipment, dedicated piping and storage which can be installed indoors or out, storage tanks and even settling ponds. 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

Biosolids and their disposal are highly regulated, and many processors are employing specialized solutions to reduce the associated storage, transportation and energy costs. Some processors are proactively using their biosolids to produce other products such as fertilizer, compost or animal feed and some have reduced their organic load by as much as 95%.[1] These innovative solutions are environmentally sustainable and can be integrated into plant operations with planning at the early stages of process design.

Energy recovery

Energy recovery is vital to reducing electrical costs. In addition to selecting high-efficiency equipment, processors 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 such as BTU exchange and product-to-product regen for reheating and cooling. Each of these techniques requires equipment and space.

Employing micro turbines and solar arrays can provide sustainable electricity and significantly reduce costs. 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.

Chemical storage and distribution

Your chemical storage and distribution processes can have a significant effect on your process layout and the design of your plant. Chemicals can be stored in large tanks and piped to where they need to go, 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.

[1] Sierra Nevada Brewing Company in Chico, California.

In any case, chemical storage and distribution should be built into the process and architectural design.

Automated control systems

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. If your initial plan has limited automation, you may want to plan for the infrastructure you will need as you add automation. Typical considerations include:

- Electrical and communication network backbone and distribution points
- Wireless and local area network requirements
- Server storage (which requires climate-controlled room or enclosures)
- Determine peak electrical loads to ensure the building's electrical service is suitable for the application

Bulk ingredient handling requires forethought.

Bulk ingredients and their delivery methods vary widely so the plant may need to accommodate everything from bulk bags to liquid tanker trucks. If you use bulk bags, you will need high ceilings to accommodate the unloader, and a layout which allows enough space to navigate forklifts. Liquids often arrive via tanker trucks which can deliver more than 11,000 gallons per delivery. The liquids can be stored in jacketed tanks outside and pumped inside later or pumped directly inside at the time of delivery.

Sizing the delivery system to meet the required flowrates involves factoring in the number of use-points, the length of piping required and more. Advance planning will optimize your delivery system efficiency.

Food and beverage architects and builders routinely devise creative solutions for meeting floor-space and ceiling-height demands and the sooner they can contribute their insight, the better-suited the plant.

Piping and connectivity

Most sanitary process equipment is connected by piping and the piping runs over, under, and around the equipment. In some cases, catwalks and access platforms are required. The process designers will ensure the process 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.

Transport, operator and maintenance 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.

Preventing cross contamination takes preparation.

Part of the planning includes taking steps to prevent cross contamination. This will require mapping the product flow from receiving through finished goods and all the steps along the way. With the product flow mapped out, look for intersections and create a plan for avoiding contamination in those areas. Some processes require separate rooms and even separate air filtration. Your process designer and architect can work together to ensure there is ample space and a reliable and efficient process for preventing cross contamination.

Storage

Some processes do not require much storage as the product is moved through the plant and shipped out within hours. Other processes require storage for months as the product matures. Your architect and general contractor will need to plan accordingly.

Maintenance access

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

Cleaning and CIP

Cleaning and CIP functions are constant and critical to safe F&B production. All cleaning processes should be determined and mapped to ensure accessibility as well as water availability and proper drainage.

Water/sewer municipalities have different regulations for trade effluent and drainage systems may include separate drains for clean and dirty discharge.

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 network control systems, production and storage space for your future needs.

The piping and instrumentation diagram (P&ID) depicts 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
- Automated control systems
- Piping and connectivity
- Bulk ingredient handling and storage
- Transport paths
- Cross contamination prevention
- Storage
- Maintenance access
- Cleaning and CIP

All equipment and functions should be mapped and planned for maximum process efficiency. The layout should identify possibilities for future expansion of plant capacity.

More efficient and productive today.

More possibilities in the future.

Assembling the right team will protect your investment and ensure your production goals are achieved. Their collaboration is instrumental in delivering a plant with maximum process efficiency today while accommodating for growth and flexibility in the decades to come. While you can't know exactly what the future will bring, planning for greater possibilities you can save considerable time and money in the future.

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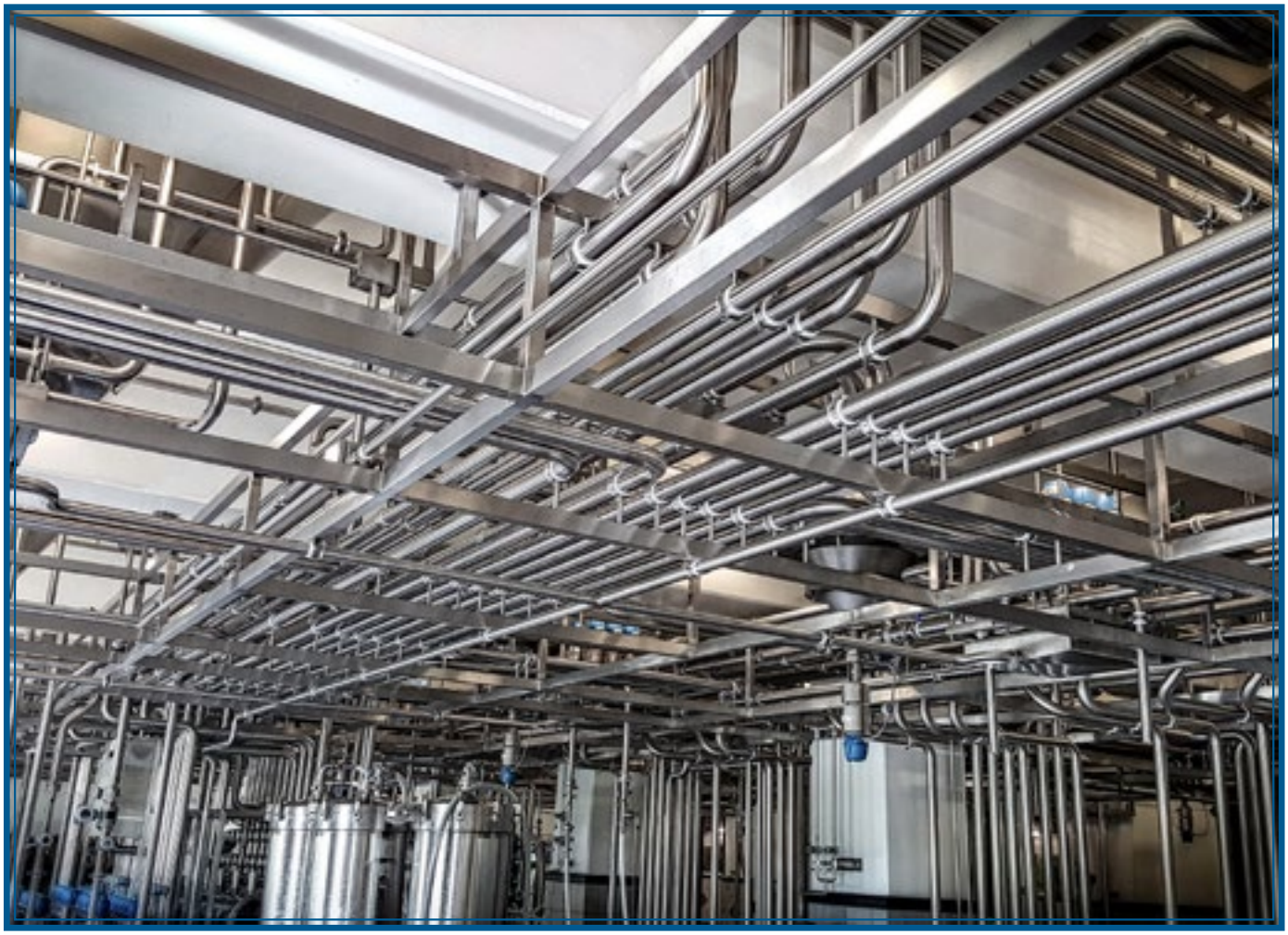

"We selected Barnum Mechanical because they have designed and built so many breweries. Barnum was instrumental in the design phase. We had ideas about what we wanted and Barnum was able to help shape the building design as well as the overall process. We ended up with everything we wanted and more. It was great working with them!"

Vinnie Cilurzo,
Co-owner, Russian River Brewing Company

For More Information

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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.

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