

WHITE PAPER / **FACILITY COMMISSIONING**

OPERATIONAL AND COST BENEFITS OF EARLY COMMISSIONING

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Engaging commissioning and startup staff early in the project life cycle and detail design helps to minimize potential startup and operational risks. A comprehensive turnover, commissioning and startup plan sees to it that all aspects of a facility, power plant, refinery or electrical substation function as expected.



Commissioning (Cx) is a systematic process of documentation, verification, testing and initial operation to confirm facility systems and assemblies are designed, installed, tested, operated and maintained as per the applicable equipment requirements. Proper preparation and planning before the start of the project can be extremely beneficial in providing a strong finish to the project. Cx planning can be applied to any size of industrial or commercial facility, whether it's new construction or modifications to an existing facility. A systematic process to Cx can be applied to traditional facilities' systems, controls and electrical as well as a range of emerging systems (building enclosures, renewable power and information technology) and nontraditional systems and infrastructure (robotics, lithium processing, packaging lines, wastewater treatment and power turbines).

Early planning for Cx helps project teams understand what is expected and how a system is supposed to function. Owners/operators have specific construction and operational requirements that must be met, and a systematic Cx plan can see that those requirements are achieved.

SIMPLER BUILD PROCESS

Every construction project has specialized operational requirements. Early Cx provides a road map to everyone involved in the project and helps them understand their roles and responsibilities.

Early engagement of the Cx planning can help determine if the processes of the facility are complying with the project standards and confirm that the facility is operating as it was envisioned. Furthermore, early Cx of operating systems helps in identifying certified and established equipment suppliers, which leads to fewer warranty callbacks by contractors and less downtime in the facility.

EFFICIENT OPERATION

Comprehensive scheduling and coordination of information in the Cx process allows contractors to manage and schedule work in an efficient manner. An established, comprehensive Cx plan sets priorities, drives the project schedule and helps owners/operators, design and contracting teams, facility operators and users follow the project plan through the life cycle of the project.



By identifying issues during Cx planning, the contractor can address these issues early during design and construction. It diminishes the possibility of the owner identifying problems and requiring the contractor to return to the site for repairs while the facility is in service. Early Cx planning allows operations personnel to understand what is expected of the facility and how the system is supposed to function.

The Cx plan identifies the documentation to be developed during the project. This documentation becomes a reference for facility owners and operations staff to smoothly operate the facility. Cx documentation provides insight into original operating conditions, documented setpoints and other operational information that might be useful in the future. Checklists and worksheets provide documentation to see that proper procedures are followed during disputes with equipment manufacturers. Operating procedures, maintenance manuals and recorded training sessions are all included in the Cx plan.

The Cx process begins during the design phase and is executed during the construction phase. The Cx plan includes training for operations personnel, providing an opportunity to understand the functioning of the facility. Additionally, the plan outlines their participation in running the facility, confirming operation of each component and control units, witnessing system alarms when failures are replicated, modifying setpoints and seeing the system's response helps in understanding the system and preparing for emergencies.

COST-EFFECTIVE

Cx planning is a cost-effective benefit to facility owners/operators. A system that functions properly and efficiently without wasting costly utilities eliminates the immediate need to replace, clean and repair costly parts that will wear out over time. Different components of the equipment continue to remain consistent and require less maintenance and repairs as the operating system ages. Additionally, early Cx in the build process helps save money with fewer change orders by providing synchronization among the owner, the design team and the contracting team connected with the design, construction and operation of systems. Cx gives a holistic perspective to design, construction and operation that integrates and improves distinct functions.

By involving the Cx team in the project, project members can understand how a system will operate and save money by designing it effectively the first time. It also eliminates unnecessary shut down. For example, a compressor that must be shutdown and cleared — all gas vented from a specific portion of piping — to replace a suction strainer means operational downtime. Cx planning can allow for specific system cleaning to reduce or eliminate this downtime.

Advanced and high-tech buildings are quite cost-effective and save energy due to their energy-efficient systems. Projects with a comprehensive approach to early Cx achieve nearly twice the total average savings. It can be a significant, cost-effective means of increasing energy efficiency. Enhanced control strategies, such as start/stop timing based on conditions, occupancy-defined scheduling, setpoint adjustments based on requirements, equipment performance, loop modification, and other performance confirmations during the Cx process can help reduce energy consumption.

RISKS OF NOT COMMISSIONING

Cx planning can help reduce safety, operational, financial and regulatory risks. Lack of Cx planning and execution can lead to costly and time-consuming redesign, construction modifications and retrofits.

Projects can be complex and present numerous opportunities for errors and omissions. A well-developed project execution plan, including Cx plans, provides owners with confidence that the facility and processes will be properly commissioned and will function as designed. The lack of proper Cx can have severe impact on the initial operation, life and warranty of the equipment within the facility. Not developing a Cx plan can lead to delays, and equipment failures, which can extend the length of the project, shorten the warranty period and delay facility commercial operation.

Prior to project completion and facility handover, an increase in change orders can lead to additional time being needed to fix issues — leading to an increase in project costs. And any issues left undiscovered can result in unnecessary problems: reduced equipment lives, excessive energy usage and more.

CONCLUSION

Cx efforts typically include involvement across all project phases. By participating actively throughout the life of a project as an owner advocate, Cx professionals contribute to the project's success and serve as a conduit of communication and problem-solving among all parties. Cx brings a holistic perspective to design, construction and operation by combining and improving upon conventionally distinct functions.

The Cx process is important to the life of any facility. Early Cx can help a facility achieve its maximum efficiency and life expectancy by identifying potential hazards and areas where there may be potential for revenue loss. Investing in early Cx can save projects time, money, personnel hours and equipment life when the facility is beginning the initial operations phase. It reduces field engineering and construction rework through accurate procurement requirements, greatly improving the cost and schedule, allowing the project to move from construction to Cx on time.

BIOGRAPHIES

DAN MAY is a department manager for testing and commissioning in the Energy Group at Burns & McDonnell. He has more than 25 years of experience in power plant design, control systems and distributed control systems, and power plant commissioning. Dan is a leader in commissioning for emerging energy technologies including solar and battery storage. He earned a Bachelor of Science in electrical engineering from the University of Nebraska-Lincoln.

DAVID MEYERS is a director of commissioning at Burns & McDonnell. He has 24 years of experience in providing Cx, design and construction services for healthcare, higher education, mission-critical, manufacturing, aviation and corporate clients, as well as the Department of Defense and federal agencies. He earned a Master of Architecture from Washington University in St. Louis. He is the American Institute of Architects' AIA Representative for commissioning, serving as the organization's formal connection to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) as it sets guidelines and standards.

STEVEN WICKER is startup supervisor at Burns & McDonnell. He has more than 15 years of experience in GE gas turbines, GE steam turbines, GE generators, Alstom steam turbine startup, power plant startup and boiler feed pumps. Steven specializes in commissioning and startup projects including fractionation, gas processing, refinery and storage terminal facilities and different process systems, including but not limited to compressors, heaters, pumps and processing. He earned a Bachelor of Science in mechanical engineering from Lamar University and Master of Business Administration from the University of Phoenix.

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