

Workflow Challenges During Front-End Engineering

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Abstract

Every year, several billion dollars are invested in building new plants, revamping existing plants, improving safety and environmental compliance, and increasing system reliability in the hydrocarbon and related process industries. Still more is invested in asset management and maintenance.

But the challenges don't stop there. Today, projects must be delivered cost effectively on ever-tighter schedules, all while contending with critical shortages of skilled engineers. This scarcity of engineering resources affects every phase of the plant from concept, through design and construction, to operations and maintenance. And impacts every link in the supply chain, including suppliers of plant equipment – which are reporting increased lead-times even for common items such as valves and pumps. Securing materials and labor to deliver projects or carry out maintenance is a critical success factor for businesses, and requires the efficient, effective sharing of information among the multifaceted disciplines and companies involved in these efforts.

Because information generated by one discipline at a particular phase of an asset lifecycle is not always shared or reused in another phase, businesses suffer from inefficient use of capital, poor returns on investment (ROI), and increased risks in the projects.

The pressures to make the right investment decisions earlier in a project are increasing, and there are ever-fewer skilled resources available to make those decisions. The process industries can improve business performance by adopting a multidisciplinary, concurrent workflow to ensure engineering decisions made during the front-end engineering phase of a project are based on sound asset lifecycle knowledge and best design practices. This white paper presents the approach taken by Bentley to address workflow challenges faced by process engineers during front-end engineering.

Keywords

1. Traditional approach to front-end engineering

The traditional approach to front-end engineering is to separate conceptual design from basic engineering activities, and to execute various tasks sequentially.

Conceptual design is primarily performed by process engineers, who generally work with a variety of stand-alone software tools and applications, such as process simulation programs, heat exchanger design programs, and equipment sizing and data sheets, as they sketch process flow diagrams (PFDs) and identify critical control requirements on preliminary piping and instrumentation diagrams (P&IDs). All of these activities are typically accomplished using discrete workflows with little or no reuse of data. Each specialist communicates the data he or she is responsible for in the form of sketches, files, and reports, and all of these documents are then collectively passed on to the basic engineering phase.

However, as the fast-tracking of projects becomes the norm, and the ROI expectations of owner-operators become more aggressive, more and more decisions made rely on the availability of key items that need to be ordered and secured more quickly. Front-end engineering and, in particular, conceptual design, have become pivotal to successful project implementations. Companies now realize that key decisions made earlier in the conceptual design phase not only drive downstream engineering tasks and govern operability, performance, and the economics of the operating facility, but also impact the entire viability of the business. By optimizing this front-end phase, businesses can make investment decisions with confidence, as well as deliver significant savings in capital and operating costs over the entire asset lifecycle.

Bentley has paid special attention to the conceptual design phase of a project and its interrelated workflows, and addresses it using a concurrent engineering approach.

2. Bentley's approach to front-end engineering

In a concurrent engineering environment, all major disciplines work simultaneously from a common database, which means both data and graphics are always consistent. . This allows process engineers to manage multiple process simulation case studies and rapidly establish the governing case, equipment designers to re-use this data to design or rate critical heat transfer equipment, mechanical engineers to develop their equipment specifications in the form of data sheets using their familiar Excel sheets, and cost engineers to extract the early design scope for their conceptual cost estimates, all while working from the common project design basis.

AXSYS.Process is a data-centric, database driven solution that provides rule-based features for automating selection of items and drawing creation directly from process simulation results. By combining users' best design practices in the form of templates, the resulting process flow diagrams (PFDs) are generated automatically, and preliminary P&IDs can be generated very quickly with minimum user intervention.

Interfaces to most industry standard process simulators are supported, including HYSYS, Aspen Plus, Pro/II, and UniSim Design, along with widely used heat exchanger design programs such as HTFS and HTRI. In addition, interfaces to cost estimation tools such as ICARUS are available, and Excel-based data sheets and reports are supported as standard tools.

The PFDs and P&IDs generated from AXSYS.Process can be brought into the Bentley Plant Creation tools for 2D schematics in either MicroStation or AutoCAD formats, and the data can be shared with the integrated project database. Integration with project and asset lifecycle systems is also supported through Bentley's ProjectWise tools, including ProjectWise Lifecycle Server for asset lifecycle management.

3. Benefits of AXSYS.Process

To realize the full benefits of AXSYS.Process, one must consider the "how-tos," such as, how to generate process design deliverables, and "what-ifs," such as, what if a different process technology is used, what if these parts are not readily available from the manufacturer, or what if a different material selection is made for prolonged asset lifecycle?

By integrating process design, with operations and maintenance implications to the asset lifecycle, organizations can achieve a significantly higher ROI from

their capital projects. Front-end engineering, particularly the conceptual design phase, is considered by many to be the optimum opportunity to impact best design practices. In addition, by evaluating as many processing options as possible during the conceptual phase, organizations can plan contingencies to minimize project risks.

AXSYS.Process provides a unique opportunity to:

- Reduce process engineering effort by up to 50 percent or double the productivity of current engineering resources
- Eliminate the need to re-enter data between various analysis tools, thereby reducing errors and saving time
- Utilize existing Excel applications and data sheet templates, thereby providing tools that are familiar to the organization's engineers and are easy to learn.
- Provide a data-centric environment in which all disciplines work concurrently with full revision and change management controls to minimize rework and duplication of effort
- Jump-start the basic engineering phase with graphical and design data carried forward in the most common formats of MicroStation and AutoCAD to Bentley Plant design applications, or via interfaces to PDS, PDMS, and SmartPlant P&ID
- Openly integrate with Bentley ProjectWise Lifecycle Server and other project engineering workflow collaboration servers for global projects, enabling the capture and re-use of engineering knowledge across the plant lifecycle

For further information on AXSYS.Process and how Bentley can significantly improve front-end engineering activities, visit www.bentley.com/axsysprocess.