

Experience from Plant design with Modular construction – The new skills required for a Process Engineer

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In a modular construction the plant is divided in different parts or modules, and built off-site, that are later assembled on-site. This approach, opposed to building on site or stick-built, offers benefits in terms of safety, schedule, quality and cost. On the other hand, it imposes design challenges to the engineering companies by compressing the project cycles and requiring a more detailed design at a earlier stage.

The key of designing a modular plant, in contrast to a traditional stick-built construction, is the 'process block concept' which requires timely interdisciplinary interactions at every level of the design. Early engineering and procurement, a clear sequence of activities, an effective interface management, early involvement of Operations and Maintenance and a new focus on size and weight of modules are the keys to a successful modular plant design. All the new technologies on Process simulation, Project Controls and Fabrication are utilized to the maximum of their capabilities when designing a modular plant.

In a traditional stick-built approach, a process engineer will gradually develop the design, starting on Process Flow Diagram and adding more and more definition to the design as more information from other disciplines becomes available. On a modular approach, the process engineer should define the process blocks (divide the scope to minimize interfaces), line sizes, materials of construction, equipment sizing (including special valves requirements), relief loads and emission collection much earlier in the design. This approach demands a set of new skills from a Process Engineer, soft skills as management, schedule and planning (higher process workforce, many parallel work fronts) as well as hard skills on areas that are normally the responsibility of the Owner / Licensor or vendors.

A modular construction and the process block concept also requires a different team organization on Project Management, Engineering Management, and all other disciplines, which have to be reorganized to support a the design of the process blocks, the involvement of vendors also occurs at a much earlier phase, and a 'fixed' design is achieved much earlier on the project lifecycle.

A number of experiences with small / truckable modules (60 tons or less) to very large modules >600 tons, at different locations will be shown, and the lessons learned discussed. The challenges encountered include increased planning logistics, engineering / procurement, a more developed front end loading, increased shipping cost, increased steel quantities, risk of equipment damage, and module plan interfaces.

The industry trend is to become more flexible, more cost cautious, demanding more fit for purpose design, while project duration cycles are drastically reduced in order to meet strict 'time to market' targets. It will be shown how Fluor envisions the future solutions for this challenge the industry faces and how modular plant design and construction has proven to solve them.