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## COLLABORATIVE PROCESS PLANT ENGINEERING

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The upheaval in customer demand for “personalised” products has increased product and process complexities for manufacturers. This increasing complexity and need to produce multiple product variations simultaneously, at different production plants across the globe are causes of concern for the manufacturing industry. There is a growing need for integrated information flow and streamlined automated processes, which are exceedingly flexible, easy to adapt, and highly efficient. The amount of data handled during plant design and various stages of production is humongous. However, with the advent of computer applications, communications, design codes, and standardisation of practices in plant design, it is now possible to collaborate in design, installation and commissioning.

To stay in business while upgrading plants to meet growing demands, plant owners and plant integrators face a list of questions that usher the need for a streamlined process. These questions usually revolve around the efficiency and sustainability of the plant design, operational costs, warranty, time-to-market, etc.

### CHALLENGES

Design, integration as well as the layout of industrial equipment in terms of plant design and engineering to ensure operational efficiency has become crucial as it involves many factors. Recently, the size of the plant has been growing at a faster pace, which has increased the challenges involved in plant layout design. To meet increasing demand and to maintain the speed of the rapidly growing market, process, utilities and manufacturing industries are focusing on core technologies and new products suitable for the local market as well as increasing global requirements.

Engineering solutions should be agile, innovative, robust, and profitable at the same time. While we usually know what the client wants, very few have the resources and the capabilities to achieve that feat.

The most common challenges that plant design engineering faces can be summarized as below:

- Multiple disciplines of engineering are involved in plant design
- Need for data standardisation to enable different stakeholders involved in the delivery of a plant from concept design to operationalisation.



- Domain expertise in plant design
- Data consistency plant design when being transmitted from one stage of design to another and among stakeholders.
- Expertise in overall, basic and detailed design in multiple engineering disciplines

### SOLUTIONS

Understanding that the challenges require customised and niche engineering services that best suit the needs of a dynamic market environment is a must. Be it in plant design engineering across various domains, such as Water, Power, and Oil & Gas in mechanical, piping, civil, controls & operation and structural services, there is a growing need of streamlining processes to meet increasing global demand while keeping the cost low and within budget.

The following shall be considered in plant design for cost optimisation and reduced time to market –

### INCREASED PLANT PERFORMANCE

Increased performance of the plants plays a crucial role in ensuring cost optimisation and reduced time to market. This can be achieved by minimising maintenance costs, increasing maintenance intervals, reducing energy consumption, and improving the yield of valuable products.

### OPTIMISATION OF DESIGN STAGES

The number of design stages is linked with capital cost

and operating cost in plant design. The more the stages, the higher the capital cost and the lower the operating cost.

#### **DESIGNING THE PLANT WITH CONTINUOUS PROCESS STEPS**

While designing the plant, manufacturers should identify the process to increase the quality constantly while lowering the operational cost. The continuous process tends to increase the consistency in the quality of the product and reduce the operational cost by effectively using the utilities and reduced waste. The batch process tends to be inefficient and more difficult to control.

#### **INCREASED AUTOMATION**

Automation in plant design will help in making the plant more economical and efficient. The key process is automated using a control system by integrating machines, monitoring performance, and key information being communicated to increase productivity. It reduces the time loss, electrical loss, and helps in focusing more on eco-friendly methods to protect the health of employees which adds up to the increased performance of the plant.

#### **OPTIMISATION APPROACH**

An optimised approach in plant layout will determine the most efficient plant layout arrangement equipped with associated connectivity. Connectivity, operations, land, area, safety, construction, retrofit maintenance, organised production, etc. are the cost and management drivers to be considered in plant design. The vertical structure mounted arrangement (multi-floor process plant layout) is the optimised approach in process plant layout arrangement rather than grade mounted horizontal arrangement. The land area, the number of floors, allocation of equipment to each level, and overall layout of each level were determined by the optimisation model as per the process required to minimise the total cost.

#### **COMPUTER-AIDED SIMULATION**

Computer-aided simulation provides a structured procedure for understanding and quantifying the new improvements in plant design. It is actively used in the development, decision-making, and subsequent improvement in plant design, aiming at maximising the process performance and minimising the processing cost. The computer-aided simulation starts with process data selection and validation, creating the model and validation, recognizing constraints and optimising process parameters and model through virtual commissioning/training simulator.

#### **REMOTE WORKING TOOLS**

In the engineering services industry, the exceptionally

high demand for plant design and shorter time-to-market has led to a lack of expert engineers and skills to do this work. With the availability of software tools and communications, process plant design phases of basic and detail engineering, which forms the bulk of the work, can be done remotely across the globe with cost advantages that can be leveraged with experience.

#### **NEED FOR COLLABORATION**

Organisations are moving towards providing better customer-centric products and services to improve market share and size with continuously growing revenue. An engineering plant is a complex arrangement of different equipment working in a synchronised manner to produce the desired product. Designing of the plant facilities involves multiple and diverse stakeholders. Whether it's the architect, structural and MEP engineer, plant designer or project specialist, this assorted design team need to share important project information with each other and stakeholders efficiently.

A typical project would lead to multiple departments collaborating during various stages, and if this collaboration is seamless, it makes the project successful. For example, during the plant design process, the capacity of the pump would be designed by the process engineer and the head requirement and construction of the pump would be calculated by the mechanical team. Other teams will also be involved to install the motor and automate it, and all these teams need to be in sync for the efficient functioning of the plant. Multi-disciplinary engineers seamlessly collaborating with other disciplines during the development of plants will lead to the economic evaluation of the process, design, and sizing of equipment, installation, and maintenance of the plant. It also encourages accountability, streamlined project management, and gets everyone involved in the sense of ownership.

#### **PLANT DESIGN ENGINEERING IN THE FUTURE**

Collaboration has always been the key to success in many industries. The Architecture, Engineering, and Construction (AEC) industry consists of separate players who work together to bring a project to fruition. Efficient co-operation between client and all the parties is vital to reduce the iterations and bring the design to life in its entirety. Better collaboration helps reduce the time taken for project completion and errors while saving huge costs. The availability of GIS technologies helps optimise plant installation and total cost of the plant while the design from concept to realisation of the process plant is digitised for a seamless process. 

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