

# Collaborative Process Plant Engineering to Optimize Cost and Time-to-Market

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# Introduction

There is an upheaval in customer demand for “personalized” products which results in increasing product and process complexities for development and production adding to the challenges that manufacturing enterprises face on a daily basis. Increasing complexity and the need to produce multiple product variations simultaneously, at different production plants that are diversely located globally are a cause 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. Understanding that an engineering plant is complex arrangement of different equipment working in a synchronized manner to produce the desired product, plant designing involves multi-disciplinary engineering from mechanical, chemical, electrical to civil engineering and much more. The amount of data handled during plant design and building is humongous. However with the advent of computer applications, communications, Design Codes and standardization of practices in plant design it is now possible to collaborate in design, installation and commissioning.

This whitepaper discusses the various stages and disciplines involved in designing and developing a plant and how plant owners can benefit by collaborating with Engineering Services Outsourcing (ESO) across the globe for the design and development cycle to speed up the time for plant realization and overcome challenges.

## Questions that Summarize the Issues

To stay in the 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 plant design engineering.

- Is the Plant Design efficient?
- Can the operational and per unit cost of electricity be lowered?
- Is the design sustainable and come with a warranty?
- If the plant design is competitive in terms of cost compared to equipment?
- How to ensure plant efficiency while meeting cost per unit of electricity goals?
- How can we reduce time-to-market?

## Challenges in Process Plant Design Engineering

Design, integration as well as layout of industrial equipment in terms of plant design and engineering to ensure operational efficiency become highly crucial since it involves many factors and since in recent future, the plant sizes have been growing at a faster speed. The challenges involved in plant layout design also has hiked skyward.

To meet the increasing demand and maintain the pace of the rapidly growing market, all the process, utilities & manufacturing industry are focusing on core technologies and new products suitable for local market as well as increasing global requirement.

Engineering solutions should be agile, innovative, robust and profitable at the same time. It's well known what a client wants from our engineering services, but very few have the resources and the capabilities to achieve that feat.

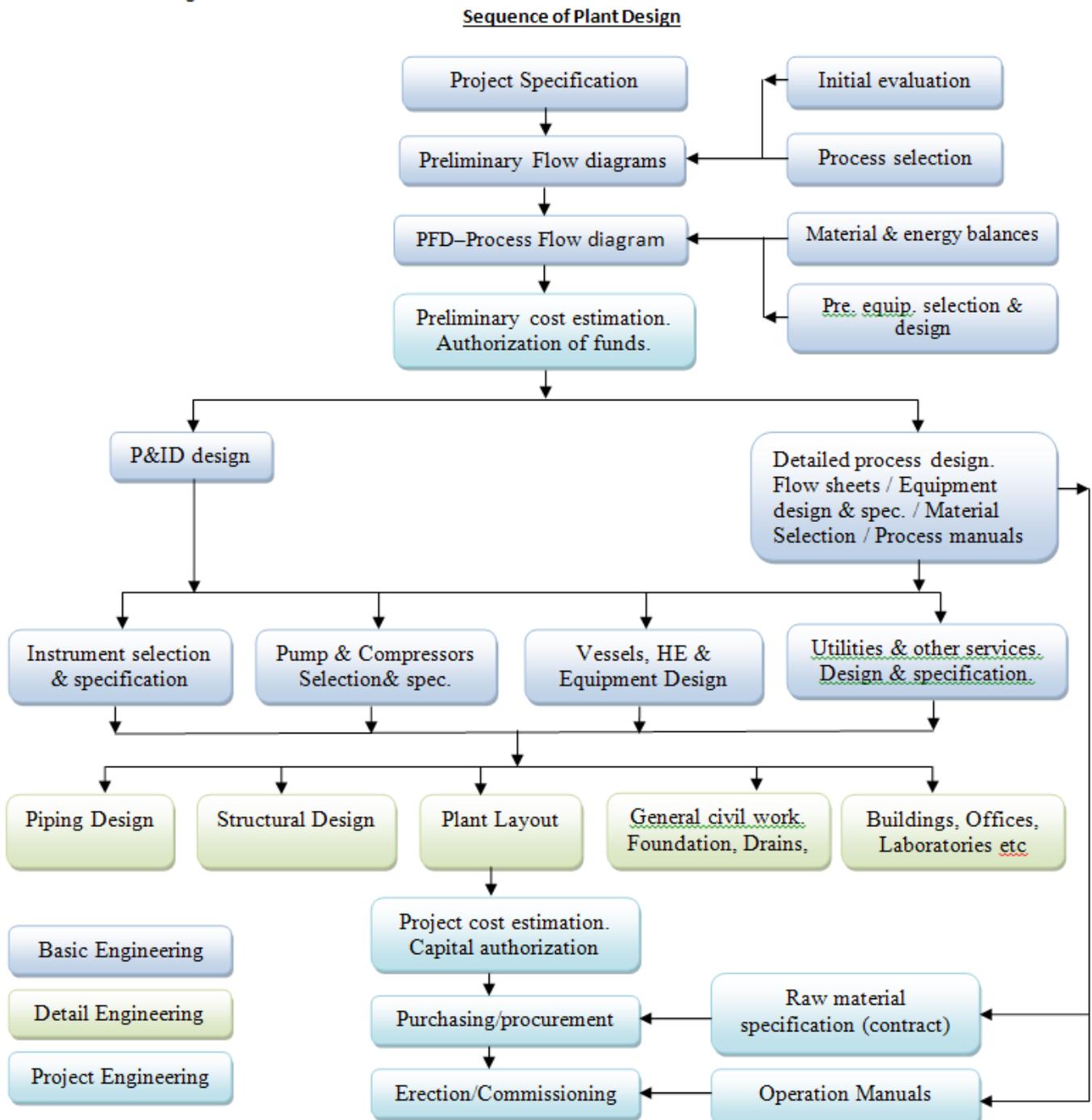
The common most challenges that process plant design engineering faces can be summarized as below:

- Multiple disciplines of engineering that are involved in plant design
- Need for data standardization to enable different stakeholders involved in delivery of a plant from concept design to operationalization
- Domain expertise in the plant design
- Data consistency in design of plant when being transmitted from one stage of design to another and also among stake holders
- Expertise in overall design, basic design and detailed design in multiple engineering disciplines

# Solutions to Ensure Optimized Cost and Reduced Time-to-Market

Understanding that the challenges require customised and niche engineering services which, best suit the needs of dynamic market environment. Be it in plant design engineering in various domains such as water, power, and oil & gas in mechanical, piping, civil, E&I, 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 sequence of steps in the plant design engineering for construction and startup of a typical process plant is shown in Figure below.



The plant design engineering process can be divided into two broad phases.

**Phase 1:** As mentioned in the above Plant design sequence, the process design is also called as Basic Engineering, which it starts with the initial selection of the process to be used in a plant, through to the issuing of the process flowsheets (Process Flow diagram) and it includes the selection, specification, design of equipment and preparation of the piping and instrumentation diagrams. In a typical organization, this phase is the responsibility of the Process Design Group. Also the basic engineering involves in economic design of plant layout, arranging the equipment as per the process with all other aspects to run the plant. This work will be carried out by Chemical, Mechanical & civil engineers.

**Phase 2:** The phase 2 of Plant design engineering is Detail Engineering, which it includes the detailed mechanical design of equipment, the structural, civil, Interconnecting piping, electrical design, MTO, Specifications and procurement. These activities will be the responsibility of Detail Engineering team, having expertise in the whole range of engineering disciplines.

## Plant Design Engineering Industries

A plant or factory is a collection of machines that work together to produce a finished product. A complete plant not only contains production machinery, but includes infrastructure such as power, cooling, waste and ventilation systems. The Plant design engineering is the design of layout and development of equipment to transform raw materials into a product through a series of operation to produce final product.

Below are some examples of plants that oblige plant design engineering,

<b>Process</b>	Chemical processing
	Mining and quarry
	Oil & Gas
<b>Utilities</b>	Power generation
	Water treatment
	Waste handling
<b>Factories and manufacturing</b>	Production machines for consumer goods, Pharmaceuticals, white goods, electronics
	Packaging machines for consumer products, food and beverages
	Raw materials production such as paper mill, textiles and steel

## Market Situation of Plant design Engineering

The market situation of plant design engineering is intensely interrelated with the individual engineering industries (like water, oil & gas, Power etc) growth, which it leads to extension of existing plant or new plant design for increase in global market demand.

We have discussed here the global market and its forecast on plant design engineering in water, Oil & Gas and Power, which will helps us to forecast the market of Plant design engineering globally.

## Global Water Market in Plant design

The global water market is \$630 billion out of these, 51% is water & wastewater utilities and remaining 49% is water & waste water solutions & services.

Most of the plant design & consulting happens in water & waste water utilities, plant design comprises 9%, therefore \$29billion of market revenue.

## Global Market in Power Plant design

Global Industry Analysis – GIA releases the comprehensive global report on thermal power plant markets. Global Thermal power generation is forecasted to reach 20.2 Trillion KWH by 2020, driven by spirally demand for electricity.

Due to higher levels of economic growth and anticipated improvements in the quality of life over the next few years, developing countries will likely see a rapid increase in power demand. India, for instance, is poised to see annual consumption increases of up to 3.2% between 2012 and 2040, while China's annual demand is forecast to grow by 2.1% for the same time period as per the source OECD.

China and India are at the forefront of this growth with the two countries expected to install 165 and 50 new coal-fired power generation plants installing into 250GW and 70GW of incremental power. It is obvious the global market demand increase leads to build & design new plant. Which will increase the demand of Plant design engineering globally.

## Global Market in Oil & Gas Plant design

According to the report released by Organization of the Petroleum Exporting Countries, the size of the world economy in 2040 is anticipated to be 234% that of 2016. The overall GDP increase is estimated at almost \$141 trillion. Much of the expected growth in the global economy is driven by emerging economies, with China and India accounting for around half of the increase. Growth in the world economy requires more energy, whereas energy demand increases by 30%.

Global liquids demand (oil, biofuels, and other liquid fuels) increases by around 15 Mb/d, to reach 110 Mb/d by 2035. All of this demand growth comes from emerging economies, as rising prosperity leads to increased oil demand, with China accounting for half of the growth. In contrast, OECD oil demand continues its trend decline (-8 Mb/d). Supply increases are driven by holders of large-scale, low-cost resources, especially in the Middle East, US and Russia, as these producers are assumed to respond to the growing abundance of oil resources by asserting their competitive advantage.

OPEC is assumed to account for nearly 70% of global supply growth, increasing by 9 Mb/d to 48 Mb/d by 2040. The energy demand is fulfilled by the various fuel types like Oil, Coal, Gas, Nuclear, Hydro, Wind and Biomass. The world primary demand by fuel type is forecasted upto 2040, this will result in addition of plant to overcome the market demand. This addition of plant demands the plant design engineering and its services.

## Need for Collaboration in Plant Design Engineering

- Very high demand for plant design and short of time to market adding to lack of available expert engineers and skills to do this work.
- With availability of software tools and communications, process plant design phases of Basic and Detail engineering, which forms bulk of the work can be done remotely across the globe with cost advantages that can be leveraged with experience ESO.
- Time to design, install and operationalize is reduced by seeking help from ESO.

# Current Trends in Plant Design Engineering

- Digitization of the design from concept to realization of the process plant.
- Use of GIS technologies to optimize the plant installation and total cost of the plant.

## Tools in Plant Design Engineering we use

Open Plant, PSDS, Solid Works, 3D CAD, AutoCad, Cadworx, Tekla.

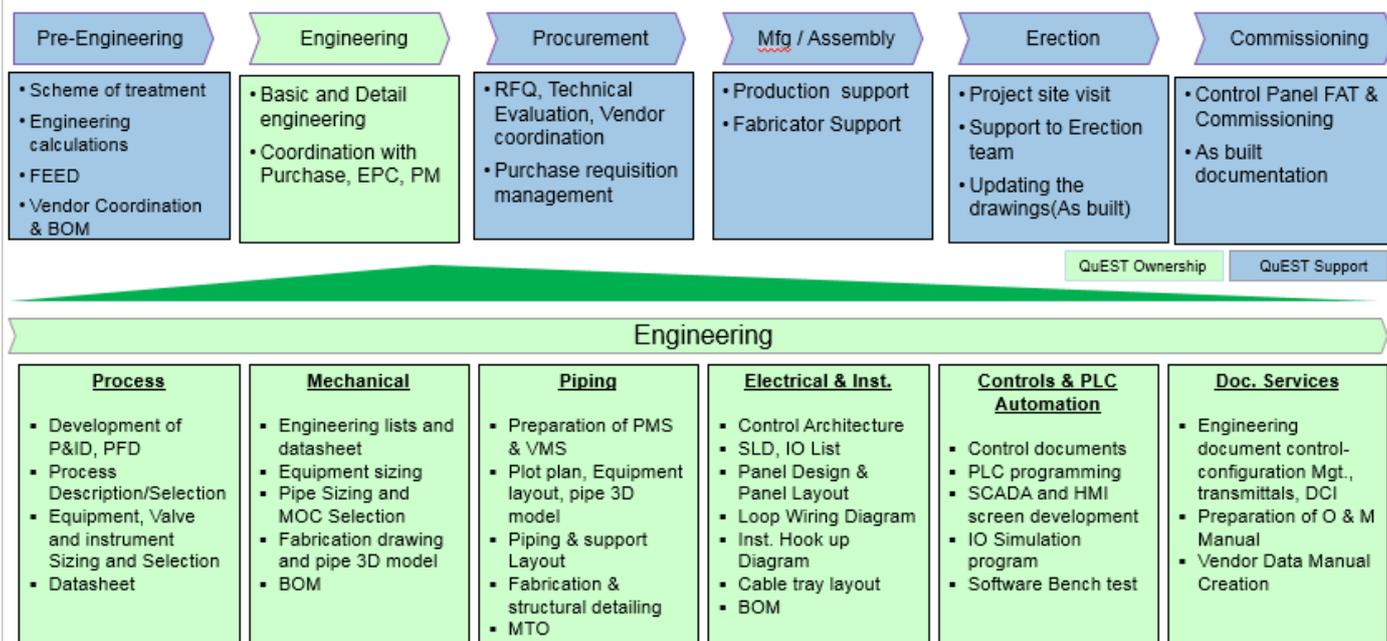
We solve several problems of Basic engineering and Detail engineering as shown in the chart below.

## QuEST Global in Plant Design Engineering

We have 700+ Engineers in QuEST Global engineering with vast experience in Plant design engineering under various domains like Water, Oil & Gas, Power & Mining industries. Our plant design team provides multidisciplinary engineering design for new Greenfield and Brown filed sites to achieve full operational site.

- We have the expertise in plant design engineering at QuEST to provide solution globally for various vertical like Asia pacific, North America, Australia, Europe and Middle East region.
- QuEST engineering team designs plant with incorporating every reasonable precaution and provision for the safety of all operation and maintenance of plant.
- QuEST has vast knowledge in different standards and codes to be used for the design of plants for global market like BS, DIN, ANSI, API, AWS, ASME & ISO. Our team has designed in accordance with internationally recognized codes and standard pertaining to Power, Water, Oil & Gas industry.
- Application of our expertise starts with the observation of customer Tender document deviation, Pre & Post Bid, Process Engineering, Mechanical Engineering, Piping Engineering, E& I, PLC Programming & Technical publications.
- QuEST team has handled so many projects in plant design engineering with different capacity with respect to man hrs. & plant capacity(MTD) from 500 man hrs to 20000 man hrs and upto 12MLD plants. We have most competent plant designers with different tool knowledge like PSDS, Solid Works, Open plant, Tekla, CADWorx & SAP.

### Multi disciplinary Engineering capability



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# The QuEST Advantage

QuEST understands that process plant design and engineering is a complex and diverse process. To provide the business with a profitable solution we acknowledge that the process has to be lean and should be designed in such a way that it minimizes while keeping initial capital costs and ongoing operating expenses low.

Working closely with plants to upgrade plant layout designs, we offer the following advantages

- Time-to-market is shortened
- Domain expertise
- Low cost plant design
- Compete ownership of design

## Authors Bio

**Venkatesh kumar** is a technical manager in QuEST Global. He has over 14 years of experience in Plant design engineering - Basic and detail design engineering, Piping engineering in various domains like Water/Waste Water treatment plant, Cements & Minerals plant projects. He has more than 7 years of experience in EPC projects in Mining Plant design engineering.

In his 4 Years in Quest, he has designed many industrial water/wastewater plant like ETP, STP, ZLD UPW & WTP plants in various capacities for South East Asia and Middle East Region.

He holds a Bachelor's degree in Mechanical Engineering from SRM University, Chennai.

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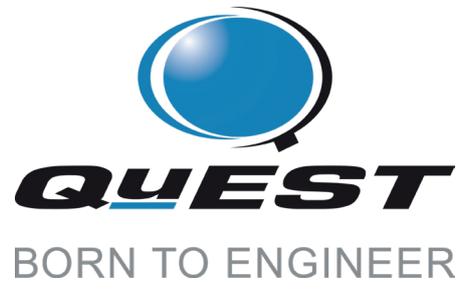
 <https://www.youtube.com/user/questglobal10>

### About QuEST Global

For more than 20 years, QuEST Global has aimed to be a trusted global product engineering and lifecycle services partner to many of the worlds' most recognized companies in the Aero Engines, Hi-Tech, Aerospace & Defense, Transportation (Auto and Rail), Power and Industrial, Oil & Gas and Medical Devices industries. With a global presence in 14 countries, 67 global delivery centers and 12,000+ personnel, QuEST Global believes that it is at the forefront of the convergence of the mechanical, electronics, software and digital engineering innovations to engineer solutions for a safer, cleaner world. QuEST Global's deep domain knowledge and digital expertise aim to help its clients accelerate product development and innovation cycles, create alternate revenue streams, enhance consumer experience and make manufacturing processes and operations more efficient.

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