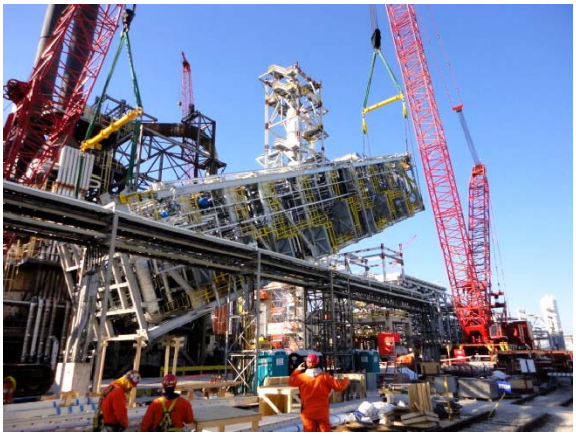
Project Development
Front End Loading



Major Projects

Refiners face numerous challenges including intense global competition, fluctuating crude oil prices, changing product slates, low product demand growth, tighter product specifications and more stringent pollutant emission limits. All these issues put downward pressure on profit margins and availability of funds so it is imperative that all available capital is spent wisely and efficiently ("the right project at the right time in the right location"). Refiners should therefore adopt a phased project approval process as this enables increasingly accurate reviews of costs, economics and risk to be carried out as the number of feasible options is reduced and the project scope is developed and refined.

Project Stages

A phased approval process for major projects typically comprises 5 stages; concept development, feasibility study, front-end engineering design (FEED), engineering procurement and construction (EPC) and operate. A sixth stage, decommissioning (including demolition and site remediation), should also be considered during FEED to ensure end-of-life costs are minimised. Changes and improvements to the project scope can be made more quickly and at much lower cost in the early stages of the project. Hence the first 3 stages, which are collectively known as front-end loading (FEL), focus on clarifying business objectives, identifying deliverables and validating the business case for investment.

Front-End Loading

The first stage in any major project is concept development which seeks to properly define the opportunity to be captured or the problem to be solved. Key inputs include capacity required and feed and product specifications. Key outputs are a conceptual design, an overall mass balance and an order of magnitude (OOM) cost/benefit analysis. The OOM cost estimate is typically based on "in-house" historical data from similar projects with statistical factors applied to account for differences in location, capacity, complexity and local labour productivity/manhour rates. The results of the concept development stage establish whether or not there is sufficient incentive to progress to the next stage.

The second stage is the feasibility study which seeks to identify, evaluate and rank feasible options. Key inputs include market conditions (supply of feedstocks, demand for products, price volatility, etc) and, in the case of a revamp project, a base case representation of current refinery or plant performance based on fully-optimised, start-of-run operation. A key output is the Class III cost estimate which typically has an overall accuracy in the range ± 40% to ± 50%. This will be based on budget quotations provided by key equipment manufacturers and estimates for bulk materials and installation obtained by applying statistical factors to the major equipment costs. Another key output is a preliminary statement of requirements (SOR) document which sets out the business objectives and success criteria for the project.

The third stage is the front-end engineering design (FEED) study which seeks to develop a basis for detailed design and procurement. Key outputs include a preliminary design for the preferred option, a set of process and instrument diagrams (P&IDs), a design review report, a process hazard analysis (PHA) report, a final SOR and a Class II cost estimate which typically has an overall accuracy of around ± 20% (± 15% to ± 25%). The final SOR should provide a technical description of the process or intended modification, a preliminary design, preliminary estimates of capital and operating costs, a preliminary estimate of expected benefits, a preliminary execution schedule and a quality assurance plan. The Class II cost estimate is used for financial approval (final sanction) to proceed to the EPC stage.

Value Improving Practices

Peer assists and peer reviews provide an opportunity for experienced engineers from other refineries or organisations to help develop or validate, respectively, processing schemes before costly, long-lead equipment has been purchased or irreversible decisions on project execution strategy have been taken. Other value improving practices (VIPs) such as setting business priorities, technology selection, value engineering, constructability and waste management studies can all help improve cost, schedule, reliability and value if applied appropriately during the FEL phase of the project.

Peter Marsh
Director – XBP Refining Consultants Ltd