A UK based client was considering building a major new chemical manufacturing facility in Louisiana, USA. Based upon previous projects, the client had a budgetary value for the capital cost of the project. However, before investing significant money developing a detailed ‘Front End Engineering Design (FEED), the client wished to confirm its internal estimate was of the right order of magnitude. The client was acutely aware the capital cost of a project has a significant impact on return on investment and so determined it was important to verify the budgetary estimate before proceeding further.

The client knew of ABB’s low cost RAPID methodology and decided this approach would suit its requirements perfectly. From a basic process engineering scope definition, RAPID can be used to develop a capital cost estimate in a much shorter timeframe and at a much lower cost than traditional FEED and bottom up estimating techniques. The client approached ABB to develop a capital cost estimate for the proposed new manufacturing facility in the USA. The target accuracy for the estimate was +/- 30%.

Solution

One of the advantages of RAPID is the ‘estimating’ software integrates directly with AspenTech’s standard process simulation tools. In this instance, ABB took the simulation model that had been developed in Aspen+ by the client and imported this directly into the economic analysis software package AspenTech ‘Process Economic Analyser’ (PEA).

This negated the conventional approach of manually entering design data (design pressure, temp. etc.) for a significant number of plant items, there being over 200 main plant items. Furthermore, importing from one software package to another automatically removed the risk of manual error.

The algorithms within PEA were used to physically size the main plant items and other bulk quantities (i.e. civil, pipework, electrical power, C&I, insulation etc.) using a process known as volumetric modelling to produce the conceptual definition and initial estimate (+/- 40% default accuracy).

To refine the estimate further, ABB exported the PEA output into Aspen’s Capital Cost Estimator (CCE) software. There is no ‘physical layout’ or overall plot dimensions within the process simulation and so the first stage in refining the estimate was to enter this information. In this case, four main process areas were defined - process feed, reaction & distillation, scrubbing & clean-up and storage & offloading. The width, length and height of each area were entered together with the area type which was, with the exception of storage and offloading, open steel structures.

Items not included in the process simulation were also added to the definition at this time. This included specialist items (tanker loading / offloading), utilities requirements (steam, chilled water, compressed air etc.) and infrastructure (buildings, bunds, plant drainage, site roads, fencing etc.).
Volumetric modelling was then used to generate further bulk quantities associated with the main equipment items inclusive of civil, pipework, electrical power, C&I, insulation costs etc. Additionally, the software algorithms were able to generate estimated costs for engineering (design, project management, commissioning etc.) and for construction overheads (supervision, scaffolding, welfare facilities etc.). The capital cost estimate covered the entire project from basic engineering through to final commissioning. In addition the software generated an outline schedule which defined the overall duration of the project from design through to handover.

The initial evaluation and resultant first capital cost estimate caused the client to question the accuracy of its process simulation. A number of refinements were made to the process simulation and at each stage, the changes were imported into CCE and re-evaluated so that the impact on the capital cost could be assessed and discussed internally within their organisation. With RAPID, ABB was able to update only those parts of the model that changed, thereby minimising the time required to evaluate the changes.

It is important at each stage to review and validate the output from CCE. To do this, ABB used its experienced functional expertise (civil, piping, vessels, electrical, C&I etc.) to review the system generated values in terms of scope, specification, quantities and cost; to comment on whether or not these were consistent with their experience and the client objectives. Where required, adjustments were made to the system defaults to reflect the functional experts’ comments.

Finally, following completion of the CCE model and verification by the functional experts, the software settings were re-set to a location in USA and the project was re-priced in dollars using CCE’s inbuilt functionality. Design parameters such as seismic conditions, wind loadings, distribution voltages etc. as well as construction hourly rates and productivities were automatically updated by the system to reflect the new country base. Again, these were reviewed by ABB’s functional experts to confirm that they were consistent with their experience before the final capital cost estimate was submitted to the client together with the report detailing the basis for the estimate (design standards, assumptions, exclusions etc.)

To summarise, the benefits from using ABB’s RAPID process are:

- Reduced schedule and cost to prepare capital cost estimate with enough confidence to provide basis for early business decisions
- Minimal scope definition required to start
- Cost effective preparation of option comparison
- Comparison of alternative technologies
- Evaluation of different process configurations / physical layouts

Benefits
- ABB was able to work from the existing process scope definition provided by the client
- Client was able to experiment with different plant configurations during the estimating process and receive immediate feedback on the likely impact on overall capital cost
- ABB was able to verify that the client’s internal estimate of circa £200M was of the right order of magnitude
- Client received the assurance it required in a much reduced time frame and for a cost that would not have been possible using a conventional FEED and bottom up estimating approach