Process modelling services at a refinery

ABB was approached by the operator of an oil refinery to provide options for a major plant upgrade and product spec change for a hydro-desulphurisation plant.

ABB has access to the complete range of Aspen Technology engineering products and have experts that are fluent in the use of the Aspen Plus, Hysys and HTFS product lines.

The upgrade project needed to be completed in time for the scheduled major shutdown in 10 months time. An existing Hysys model of the HDS plant existed but the originator had moved on, leaving a complex but undocumented model behind.

Solution
ABB took ownership of the model, improving it to predict the equipment which needed upgrading. We worked with the catalyst manufacturer to support the choice of a new catalyst. The model was fully documented and a simplified user interface built to facilitate use by new users.

Extended support
After the project, in the absence of any on-site modelling expertise, an ABB modelling expert was seconded to the refinery to act as refinery modeller, developing the refinery models and coaching the existing process engineering team to spread the use and benefits of modelling within the refinery. During the secondment, ABB used modelling in the following ways.

Each of these services is also available individually on an ‘as needed’ basis either on site or performed in ABB offices.

- Built new models and calibrated performance to plant data
- Modelled the crude column heat integration to predict key temperatures (de-salter feed temperature, pre-flash feed temperature, furnace feed temperatures etc.)
- Explored the operating window to improve day to day profitability
- Generate steady state relief stream data for column fault cases (loss of cooling, reflux failure, pump around failure etc.)
- Linked a rigorous, equipment based, model of the column overheads to the crude column model allowing the influence of pressure changes on the column to be predicted. This allowed the true, real world, benefit of operating changes to be assessed.
- Assessed equipment limits for alternative crude oils and determine blending limits for novel feed stocks
- Predicted required equipment upgrades for increases in production rate
- Predicted maximum put through for a range of product spec changes
- Extracted learning from obsolete models and incorporated into current models
- Coached process engineers in the use of modelling tools to spread the use of modelling through the refinery
- Developed simple user interfaces for existing models and provide documentation so the usefulness of the models extends beyond the tenure of the originating engineer

Detailed equipment models where also developed by modelling experts in the ABB offices where the client did not have the required licence for a product on site.

Benefits
The project was successfully implemented in time for the refinery’s scheduled major shutdown with the following benefits:

- 15% increase in plant capacity
- Increased catalyst life cycle from 24 months to 30 months
- Able to take early advantage of a regulatory product spec change
- Out of spec product was eliminated

Some of the benefits realised through modelling were:

- A capital investment was identified to increase profitability by $20M/year with an 18 month payback
- The heat integration model provided data for a pinch study, also performed by ABB, that identified potential energy savings of 15% of the total heat load
- Simulation identified an under rated distributor and mal-distribution in its packed bed. A new distributor and replacement packing were installed at the next plant shut down
- The maximum safe spiking limit for a cheaper alternative feedstock was identified, allowing profitable running of the refinery at a time of poor margins
- Existing relief cases were modelled in a more rigorous fashion and a new governing case identified