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Simulation Reduces Costs at BP Oil Refinery

Case Study

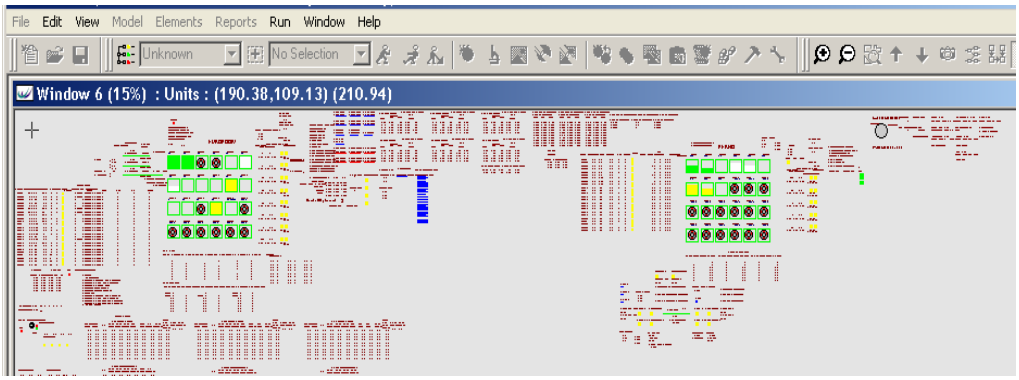
Saker Solutions use Witness at BP

Introduction & Background

The Nerefco Oil Refinery has the largest crude oil refining capacity in Europe. The company is a joint venture, with BP owning 69% of the venture and the remainder by ChevronTexaco. The production site is located in Europoort with storage facilities at both Europoort and Pernis for the import and export of product. Both sites are near Rotterdam in the Netherlands.

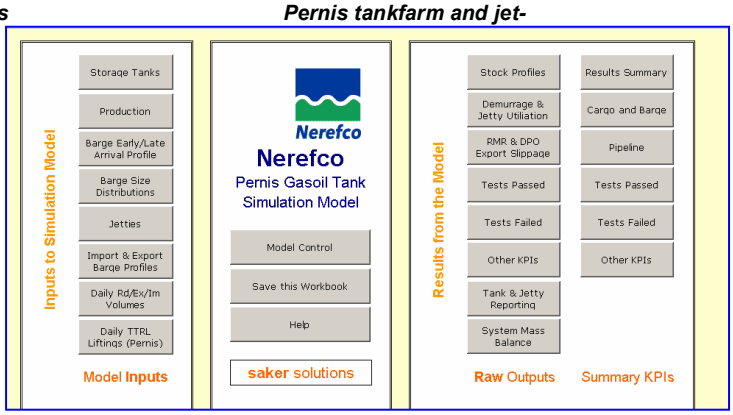
The refinery imports different grades of crude oil as feedstock via super tankers and a pipeline from the North Sea. The crude oil is refined into a number of products which include Aviation Kerosene, Heating Oil, Automotive Diesel, Gasoline, LPG, Benzene and Naphtha. Each of these products is stored in tanks at Pernis and Europoort from where they are exported via road tanker, pipeline, barge or cargo ship.

A simulation study carried out by Saker Solutions, in conjunction with BP, has enabled Nerefco to optimise offsite facilities performance by minimising demurrage and maximising tank and pipeline utilisation. This has identified savings worth millions of dollars over the life of the project, and shown the potential to increase the throughput of one product grade by 10%, whilst reducing the risk associated with implementing changes for the decision makers.



Europoort tankfarm and jetties ***Pernis tankfarm and jet-***

Figure 1 Simulation Model and Model Manager Front



Special points of interest:

- **Saker Solutions** can provide support in a number of Simulation Packages including WITNESS.
- **Savings** identified worth millions of dollars through the use of simulation.
- **'What If'** capability of simulation provides additional operational benefits.
- **BP** used simulation to minimise demurrage and maximise tank and pipeline utilisation.

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Challenges and Constraints

One of the significant costs that Nerefco faces is demurrage. If there is insufficient available storage to discharge an import vessel, or there is insufficient stock to load an export vessel, then the ship or barge would need to wait. If this delay results in the vessel turnaround time being exceeded then demurrage becomes payable for each additional hour of delay.

In order to be effective the simulation model had to take into account a number of complexities related to the operation. For example…

- Each ship has unique characteristics such as dead weight tonnes (DWT) and length
- Each berth has constraints related to the following characteristics
  - Maximum DWT
  - Maximum length
  - Maximum pumping rate
  - Specific loading arms (i.e. which products can be loaded/offloaded)

- The pipe-work has specific limitations; for example, not all tanks are connected to the jetties
- Some products can be imported and exported concurrently; other products have mutually exclusive importing and exporting operations
- Product stored in tanks must have been tested successfully before the product may be exported

With the option to berth ships at both Nerefco and Pernis, Nerefco has some flexibility to change its operating practices in order to improve efficiency, increase throughput and drive down demurrage costs. In addition, consideration has also been given to further opportunities such as the configuration of the tank farm (at both sites) through investment. The simulation model has been used to understand the return on investment (ROI) before committing to expenditure.

Benefits Achieved

The challenges facing Nerefco production planning department are to use fewer tanks, save costs for tank turnaround and free up tanks / ullage for increased blending flexibility. Previous studies recommended changing the duty of three smaller tanks, which would increase utilisation of gasoline tankage, free up two current gasoline tanks, and increase gasoline flexibility. The simulation model was able to validate the new tank set-up and show potential de-

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Simulation Reduces Costs at BP Oil Refinery .....cont'd

murrage savings.

In addition, the simulation's ability to carry out 'what if' analyses helped to identify improvements which showed the possibility to increase the import and export yearly throughput of one of the product grades by approximately 10%. When the impact on the offsite facilities, especially on the jetties, was analysed it was found that the step change had minimal increase on demurrage costs.

The simulation model has provided the Nerefco Refinery with a tool for ongoing value creation; it has enabled Nerefco to:

- Make operational decisions to minimise demurrage and maximise tank and pipeline utilisation.
- Carry out 'what if' studies that can realise potential increased blending opportunities and identify operational constraints.
- Assist project selection within the Capital Value Process (CVP).

Simulation in BP

For many years BP has used simulation to evaluate proposals for change. BP uses Discrete Event Simulation modelling to help its decision makers weigh up alternatives, maximise throughput and identify cost saving opportunities, whilst at the same time mitigating the potential risk in their operations. Discrete Event Simulation involves creating a computer model of an operation that mimics the real system itself. As such, the logic, behaviour and characteristics of the real system are reflected in the model in order to ensure that it is a realistic and accurate representation.

BP has repeatedly applied simulation to many projects including shipping circuits, port operations, supply chains, refineries and plant reliability.

BP is using Saker Solutions as its simulation consulting partner to develop models because of Saker's experience in oil and gas, commitment to quality, and track record of successful and timely project delivery. During every simulation project, Saker's consultants spend time on the client site to ensure that a full and credible understanding of the operation is reflected in the simulation model, and that all parties have bought into the process and thereby the value that was created.

Saker Solutions

Saker Solutions Limited is an independent supplier of simulation products and services. Saker staff have been involved in applying experience gained within the simulation industry to a wide range of industrial and commercial sectors.

Saker operates in partnership with a variety of organisations to ensure that clients get the right solutions for their requirements. With a depth of experience in providing simulation services to a large variety of major companies, Saker Solutions can help clients to understand the right software for their needs, provide the software as well as offering consulting, training and support services for a variety of simulation products including Witness, Simul8, Anylogic, eMplant and Flexsim.