

## Swedish Oil Company Uses Simulation to Develop New APC Controllers, Reduce Product Variation 50%

Preem turns to aspenONE® Engineering and Aspen HYSYS dynamic simulation technology to create a unique, more effective advanced process control solution—improving product quality and saving operating costs.

With headquarters in Stockholm, Sweden, Preem is the largest oil refining company in the Nordic countries with two refineries and more than 500 petrol stations. Preem's Lysekil refinery alone processes 11.4 million tons of crude oil every year, and is considered among the most modern facilities in all of Europe.

It was at the Preemraff Refinery where the company recently addressed the challenge of controlling its Propylene/Propane (PP) splitter, which is used to separate C3 streams into 99.5% pure chemical-grade propylene and 98.5% pure propane. Any deviations in quality could affect Preem's profitability since there is a high market value for pure propylene.

Instead of using live plant step tests to develop a model-predictive controller for the PP splitter, Preem's engineering team leveraged the power of *Aspen HYSYS* to integrate rigorous simulation models of the PP splitter with the *Aspen DMCplus* process controller. Once online, this innovative, HYSYS-enhanced controller helped reduce propylene variation by 50%, saving Preem more than \$55K a year. In addition, the same models were leveraged for operator training simulators to improve plant performance.

*"When the Aspen HYSYS-based DMCplus controller was put in prediction mode with the real plant, the results were so good that no live plant tests were needed."*

— Dr. Nicholas Alsop, APC Manager, Preem

## Customer Profile

### Preem

Petroleum Refining

#### Challenge:

Implement model-predictive control for PP unit without live plant test data

#### Solution:

Integrate Aspen HYSYS® simulation models into Aspen DMCplus®

#### Best Practice:

Model-based Operations Decision Support & Safety

#### Benefits:

- Reduce propylene variation 50%, improve product quality
- Eliminate costly, time-consuming plant tests
- Select and test more sophisticated control schemes
- Use models in plant operations to improve performance



## Control Design Challenge of PP Splitter

The purpose of model-predictive control (MPC) for the PP splitter is to drive the process to an optimum economic benefit, while respecting all equipment constraints. Reliable plant step test data—traditionally used to create an MPC design—was very difficult to obtain in this case because of excessive settling times and disturbances that prohibit the PP unit from reaching a true steady state. For these reasons, it was decided to develop the MPC model from data generated by a dynamic simulator instead of the actual process.

## Modelling the Unit

The starting point for a dynamic simulation is a sound steady-state simulation. For this project, a steady-state HYSYS model of the splitter, heat pump, and ancillary equipment was re-used from a previous study. The HYSYS model predictions of column temperature profile and other variables were validated against plant data. Next, a dynamic simulation was constructed using *Aspen HYSYS Dynamics* by specifying additional engineering details including pressure/flow relationships and equipment dimensions. In addition, all basic controllers were built in the model, which was then checked for consistency and calibrated against process data.

The dynamic simulation was configured to run automatically a sequence of events and record all selected variables. Step tests were then run with *HYSYS Dynamics* and the data was exported to the *Aspen DMCplus* model application. Once the step test data was imported into *Aspen DMCplus*, the task of dynamic model identification took on the appearance of any other DMCplus project. Historical process data was also imported into DMCplus to validate the dynamic models. Finally, a DMCplus controller was built and a connection to the DCS was established.

## Design Procedure Validated

Due to the extensive simulation effort—and the fact that the underlying model of the PP splitter was sound—no additional controller tuning was necessary during commissioning. The design procedure using dynamic simulation as an alternative to models from plant tests was validated. The *HYSYS Dynamics* model was then used as the engine for an OTS, further increasing the value of using dynamic simulation for this study. “As a result of this good experience we are going to use HYSYS as a tool in every DMCplus controller project implementation,” said Dr. Nicholas Alsop, APC Manager at Preem.

### About AspenTech

AspenTech is a leading supplier of software that optimizes process manufacturing—including oil and gas, petroleum, chemicals, pharmaceuticals and other industries that manufacture and produce products from a chemical process. With integrated aspenONE solutions, process manufacturers can implement best practices for optimizing their engineering, manufacturing and supply chain operations. As a result, AspenTech customers are better able to increase capacity, improve margins, reduce costs and become more energy efficient. To see how the world's leading process manufacturers rely on AspenTech to achieve their operational excellence goals, visit [www.aspentech.com](http://www.aspentech.com).



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