Conoco Enhances Advanced Process Control with Profit Controller

Conoco chose Honeywell Hi-Spec Solutions’ Profit Controller to upgrade the advanced process control at its Humber Refinery. Profit Controller was installed on the crude and vacuum distillation units, replacing earlier generation multivariable predictive control technology.

Profit Controller employs Hi-Spec Solutions’ Robust Multivariable Predictive Control Technology (RMPCT) - the industry’s leading algorithm for advanced control and optimization. The Profit Controller upgrade, which included a post audit, was performed with minimal disruption to plant operations while achieving significant additional benefits. Upon completion Conoco engineers came to the following conclusion:

“This project has shown there is justification for updating advanced control technology on units where advanced control already exists.”

The Process
The Crude Topping Unit (CTU) and Vacuum Distillation Units (VDU) consist of two desalter vessels, a preheating train, preflash column, atmospheric column with atmospheric gas oil and diesel strippers, two vacuum columns and three associated heaters. The crude unit bottoms are heated and fractionated in the first vacuum column, VAC1. VAC1 light residue is further heated and fractionated in VAC2. Part of the charge can be sent directly to VAC 2 to alleviate column or heater constraints. During unit upsets, the light vacuum residue from VAC1 can be routed to storage. The crude unit is operated to atmospheric gas oil colour and CTU diesel cloud point specifications. The vacuum unit is operated subject to a light gas oil colour specification.

The Challenge
Earlier generation controllers were under-utilized showing service factors around 70%. The upgrade was seen as an ideal opportunity to gain a new perspective on plant operation and profitability. Conoco embarked on this project to:
- observe new and revised unit constraints and updated operating objectives
- improve operation by reducing the amount of intermediates routed to storage
- simplify advanced control implementation
- increase controller utilization
- assess newer technology with built-in optimization
- eliminate VAX maintenance and support costs
- increase profits through improved control

Existing advanced control benefits had to be maintained and enhanced for the migration to be justified. Advanced control should increase unit throughput and improve product specifications while abiding by unit constraints.

The Solution
The previous control strategy included two earlier generation multivariable predictive controllers co-ordinated by a steady-state linear program. This was replaced by one Profit Controller covering the entire CTU1, VAC1 and VAC2 units. Profit Controller was designed to encompass the three towers in series because of the interactions between the units, especially the configuration of the preheat trains. With Profit Controller’s built-in optimizer, all units could be controlled and optimized in the same package eliminating the need for a separate linear program.

Migration Ease
Models were identified over approximately three weeks using the Profit Controller Identifier. Profit Controller was installed on-line and points were built using the Profit Controller Point Builder. The bulk of the commissioning took two days and...
tuning modifications continued for approximately three weeks. The Performance Monitor was installed following unit turnaround.

Conoco has found both the operator interface and the modeling package to be of high quality. Profit Controller and the Performance Monitor integrated neatly into the control system architecture. The ease of use of the packages enabled Humber to commission the crude unit controller from design, step testing, modeling through commissioning in half a person-year total effort.

Results and Benefits
The objective of migrating to Profit Controller was to maintain or enhance the existing advanced control benefits, while reaping the rewards of lower maintenance and support costs. A post audit, conducted to assess benefits and to compare the two technologies, confirmed that Profit Controller surpasses the performance of earlier generation controllers. Controller utilization increased to 97% — a clear indication of operator acceptance. As well, Profit Controller provided tighter control over product qualities while stabilizing unit operations. CTU1 diesel cloud point and overhead pressure compensated temperature (PCT), both quality indicators, showed significant improvement with the PCT standard deviation dropping from 2.2°F under the former controller to just 1.3°F under Profit Controller.

Prior Investment Leveraged
Much of the prior investment in the former controller was utilized:
- prior control design strategy used as a starting point
- past experience enabled quicker commissioning
- operators adapted quickly

Profit Improvements Realized
Profits were increased through:
- reduction in VAC2 bypass which exceeded expectations
- maximization of heater outlet temperature
- 58% reduction of off-spec product
- improved stability

Improved Maintainability
- TDC LCN node removed
- VAX and database removed
- custom graphics no longer required
- single loop strategies simplified or eliminated

Improved Control
- fully dynamic linking of crude and vacuum units
- faster, smarter control moves
- built-in optimization
- robust to noise and bad data

Profit Suite Options Give You Flexibility to Meet Your Optimization and Plant Performance Goals
Advanced control and real-time optimization have become essential technologies for enabling companies in the process industries to compete effectively and attain profitability goals. The challenge is to identify and use those technologies that provide the highest return on investment and are easily maintainable with a plant’s available engineering resources.

Hi-Spec Solutions, Honeywell’s advanced applications and services group, offers Profit™Suite, a unified family of products using industry-proven, patented technology. Profit Suite includes Profit Controller for advanced control and local optimization, Profit Optimizer for dynamic plant-wide optimization and ProfitMax for first-principles modeling and real-time optimization of highly non-linear processes.

Hi-Spec Solutions, Your Business Optimization Partner
Honeywell Hi-spec Solutions’ staff is available to implement your advanced control and optimization solutions — from robust multivariable control and dynamic optimization to complete first-principles modeling solutions. Following each every project, we offer experienced support personnel, training, remote monitoring, and maintenance services to ensure that the expected benefits remain long after initial installation.

To learn more about Profit Suite applications and other Honeywell Hi-Spec Solutions products and services, contact your Honeywell sales representative or visit our web site at http://www.hispec.com.

Reference:

This case study is based on the content of the referenced article and interviews with Conoco and Honeywell engineers. To request a reprint of the cited paper, please phone Carol Morton at 519-640-6548 or fax to 519-679-3364.