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Firestone Predicts Future of Energy Savings

By Paul Studebaker, Editor in Chief, *SustainablePlant.com*

You know by now that steam conservation offers one of the most profitable opportunities to reduce plant energy consumption. But what if your process includes a set of fussy hexane purification columns? How are you going to get those distillation columns to use less steam without compromising quality or production rates?

"Steam savings add up to $34,000 per month." Firestone Polymers' Nikky Brown told how the company is saving money and cutting its carbon footprint by using model predictive control on its distillation towers.

At Firestone Polymers' Orange, Texas, facility, Production Superintendent Nikky Brown drew on the expertise of James Beall, Emerson principal process control expert, and the advanced process control intelligence embedded in DeltaV Predict model predictive control. In their crowded session at this week's Emerson Global Users Exchange, "APC Reduces Energy and Lowers Carbon Footprint in Firestone Polymers' Orange Facility," Brown and Beall described their journey.

The plant uses a mixture of butadiene and hexane as a reactor feed. Raw solvent and recovered solvent are purified in distillation columns, and a vent gas recovery system captures hydrocarbons from the vent gases returned from all areas of the plant. A previous project in 2005 to convert the plant from pneumatic controls to DeltaV included upgrading the instrumentation and final control elements as needed. To reach the next level, Firestone installed advanced process control (APC) on the solvent recovery unit, drying column and vent recovery system controls.

The multivariable model-predictive advanced controls (MPC) use dynamic process models built on historical data to predict where the process is going and make appropriate corrections to optimize it, for, say, throughput, cost or quality parameters. "It learns the past to predict the future," says Beall. The controller understands which parameters and variables are manipulated, controlled, disturbance and constraint variables. It calculates a set of output moves to bring all controlled variables to their targets".

As one might expect, the manipulated variables, such as steam or solvent flow, are used to achieve the controlled variables, but in APC, the other variables are allowed to float within constraints to achieve the higher goal of optimization. A well-tuned APC system also minimizes the effects of disturbances. Columns that are often upset by changes in feed qualities—lights and heavies—can be brought under optimum automatic control.

"It works like having your best operator right on that column all the time," Beall says. With conventional controls, "It's easier to run a column by overdriving it—more steam, more reflux. With MPC, it's common to get 5% to 25% steam savings right away." The Firestone project began with a benefit analysis, analyzing historical data to find the best achievable steam-to-feed ratio. Then the engineers established a base case to represent current operations, measure the project's potential return on investment and, ultimately, baseline its real improvements.

Through multiple APC projects around the world, Emerson has developed an extensive library of advanced control applications that can be reused and configured for a specific project. This library drives down the cost of implementing advanced control functions by providing pre-engineered, tested, configurable control modules.

The DeltaV Predict system offered a six-month payback and was installed and commissioned in 16 weeks. "Steam savings on five columns and the vent recovery system add up to $34,000 per month," says Brown. She and one other onsite engineer will support the system, with perhaps an occasional call to Beall.

And that's how you get distillation columns to use less steam.

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