Braskem

Livia Tizzo, Process Control and Automation Engineer, Braskem

aspentech | Case Study

"We saved around six months on APC implementation using Aspen DMC3."

- Livia Tizzo, Process Control and Automation Engineer, Braskem

20%

Total reduction of energy spent per ton of ethylene

CHALLENGE

- Variability in product quality
- High energy usage and utilities spend
- Excess reflux
- Limited internal advanced process control (APC) resources

SOLUTION

Implemented Aspen DMC3™ on cold end units of ethylene site to reduce variations in quality and energy usage. Used Adaptive Process Control within Aspen DMC3 to deploy controllers in just two weeks to start accruing benefits immediately. While benefits accrued, data was simultaneously collected in the background to keep models aligned with unavoidable changing process conditions.

BENEFITS

- Lowered energy usage by 20 percent, increased production rates and reduced process variability
- Implemented with existing internal resources and over a shorter time frame, leading to faster, proven results
- Set new records for improving energy usage KPIs, leading to two internal awards

Global Leaders in Technology, Innovation and Sustainability

Since founding in 2002, Braskem has been a major player in the international petrochemical market. Braskem is the largest petrochemical company in Latin America, the leading producer of polypropylene in the United States, and the eighth-largest resin producer worldwide.

Braskem is positioned between extraction and plastic resin manufacturing, responsible for transformation from naphtha, natural gas, ethanol and salt into basic petrochemicals for polymer plants. The main final products Braskem produces are polyethylene (PE), polypropylene (PP) and PVC. Among basic petrochemicals, Braskem also produces solvents, aromatics and fuels.

Recognizing Potential and Making Moves

There are around 210 AspenTech advanced process control (APC) controllers installed among four Brazilian cracker sites: Bahia, Rio de Janeiro, Sao Paulo and Rio Grande Do Sul. Sao Paulo and Rio are both considered the "southeast" region and are the most recently acquired plants. In the southeast region, up until 2015, advanced process control was only installed on furnaces. The lack of an optimization algorithm on distillation columns resulted in lost potential benefits and unnecessary excess spending. There were frequent composition peaks and an excess of reflux, meaning excess utility spent on refrigeration compressors that use high pressure steam. Braskem decided to implement an optimization strategy using Aspen DMC3 to improve product quality and reduce project costs.

AspenTech's Adaptive Process Control technology in Aspen DMC3 allows simultaneous optimization and data collection with no interruptions to the process. Plant test data is used to build and update models which predict process response to manipulated variable moves and measured disturbances. That information is used to calculate the best moves to apply to the manipulated variables to stabilize production and push the process to the optimal point. Models are continuously adapted to represent unavoidable changing plant conditions.

Braskem was able to implement Aspen DMC3 on their own with existing internal resources. In total, there were three engineers working on this project, all with less than five years' experience.

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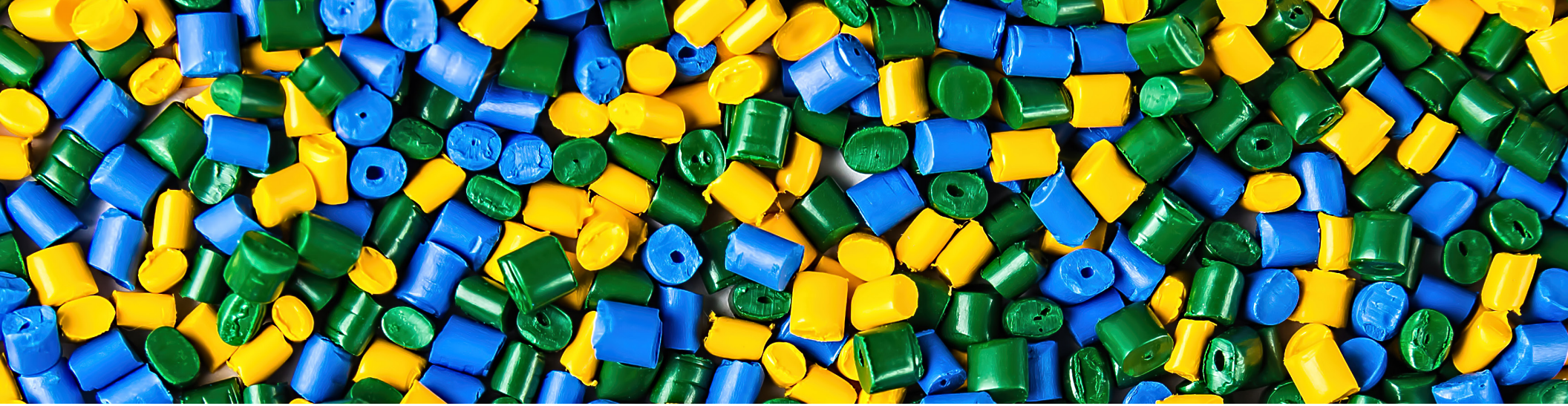
Project Implementation

After some assistance from AspenTech on the first set of models, Braskem was able to implement Aspen DMC3 on their own with existing internal resources. In total, there were three engineers working on this project, all with less than five years' experience. Process engineers also contributed especially in identifying the first matrix, manipulated variables and control objectives. There were weekly meetings between the two groups to ensure all applications were well performing and to make any necessary adjustments to the tuning parameters.

All the activities were carried out using Aspen DMC3 Builder™. The first steps in implementation were the control matrix design and regulatory control loop diagnostics. A simple and fast step test was done to develop a seed model, which took 10-14 days. The controller was then turned on to begin accruing benefits. As benefits accrued, data was simultaneously collected in the background, which took about one month.



The main updates from the seed model were seen in the gains; process directions and response times stayed about the same. A strategy was designed to significantly reduce variability and energy consumption, all while keeping the process within safety and environmental regulations. The main KPI monitored was the high-pressure steam consumption on the refrigeration compressor's turbine. In the deethanizer and depropanizer columns, the objective was to minimize reflux ratios, meaning less propylene refrigeration spent. As a result, less high-pressure steam is required in turbines running the condensers for cooling, reducing fuel gas usage on boilers which create that high-pressure steam. Reducing fuel gas consumption means less money spent!

Smart Tune in Aspen DMC3 was used to set objectives of the controller without the need for tedious controller tuning. This was "very fast and easy," said Livia Tizzo, a Braskem control and automation engineer. Each column took about two months total, which was considered to be a very good project duration, considering control and automation engineers are very busy and have many other tasks to attend to. "We saved around six months on implementation using Aspen DMC3," Tizzo said.

Management of Change

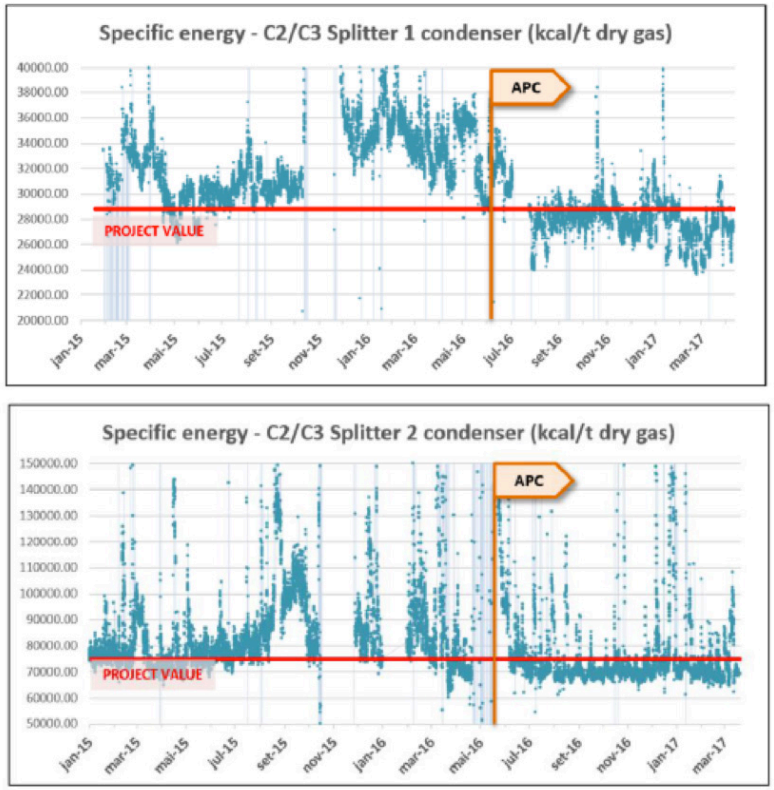
In parallel with controller design, APC engineers worked on management of change and document preparation for operator training. Operators had never worked with APC on distillation columns before, and it was very important to prepare them for the changes.

"During the testing phase using Calibrate mode, I received feedback from the operators that they forgot that the columns exist. They don't have to change reflux manually anymore, because the APC is doing its business," said Tizzo. "We were very careful explaining how Aspen DMC3's Calibrate mode works. As soon as we explained that we cared about the same restrictions they did, they were comfortable, and they accepted it in a very good way."

Success and Recognition

After APC implementation, there was a significant reduction on energy spent for each deethanizer (shown here) and depropanizer column. For the deethanizer column, the top composition was increased 4.8 times higher, resulting in a 10 percent decrease in reflux. In the second C2/C3 splitter column, similar improvements were realized. Top composition was 3.8 times higher, and there was a 5 percent reflux decrease. In the depropanizer column (C3/C4 splitter), similar results were observed: top composition increased by 3.8 percent, and reflux was decreased by 4.7 percent.

The other objective, energy reduction, was achieved on the C2 fractionator DMC3 controller . The total amount of energy spent was reduced by 20 percent per ethylene ton.



20 percent reduction on energy consumption per ethylene ton

In recognition of this project, the Braskem Production Management Recognition Program awarded the team two internal awards, one in Sao Paulo and one in Rio de Janeiro. The APC team said their keys to success were existing process knowledge, easy seed-model building and fast controller startup. All of those factors led to early benefits accumulation using Calibrate technology and great operator acceptance (service factor of about 98 percent).

Conclusion

As a result of these successes, and the fact that controller design and implementation took only two months, Braskem plans to expand Aspen DMC3 coverage to additional units, including C3 fractionators, demethanizers, and cold boxes. It is also planned to have a master controller, combining multiple single-column controllers, in order to take the optimization to the next level. With Aspen DMC3, Braskem can expect to continue to improve, maintaining their leadership in technology, innovation and sustainability.

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