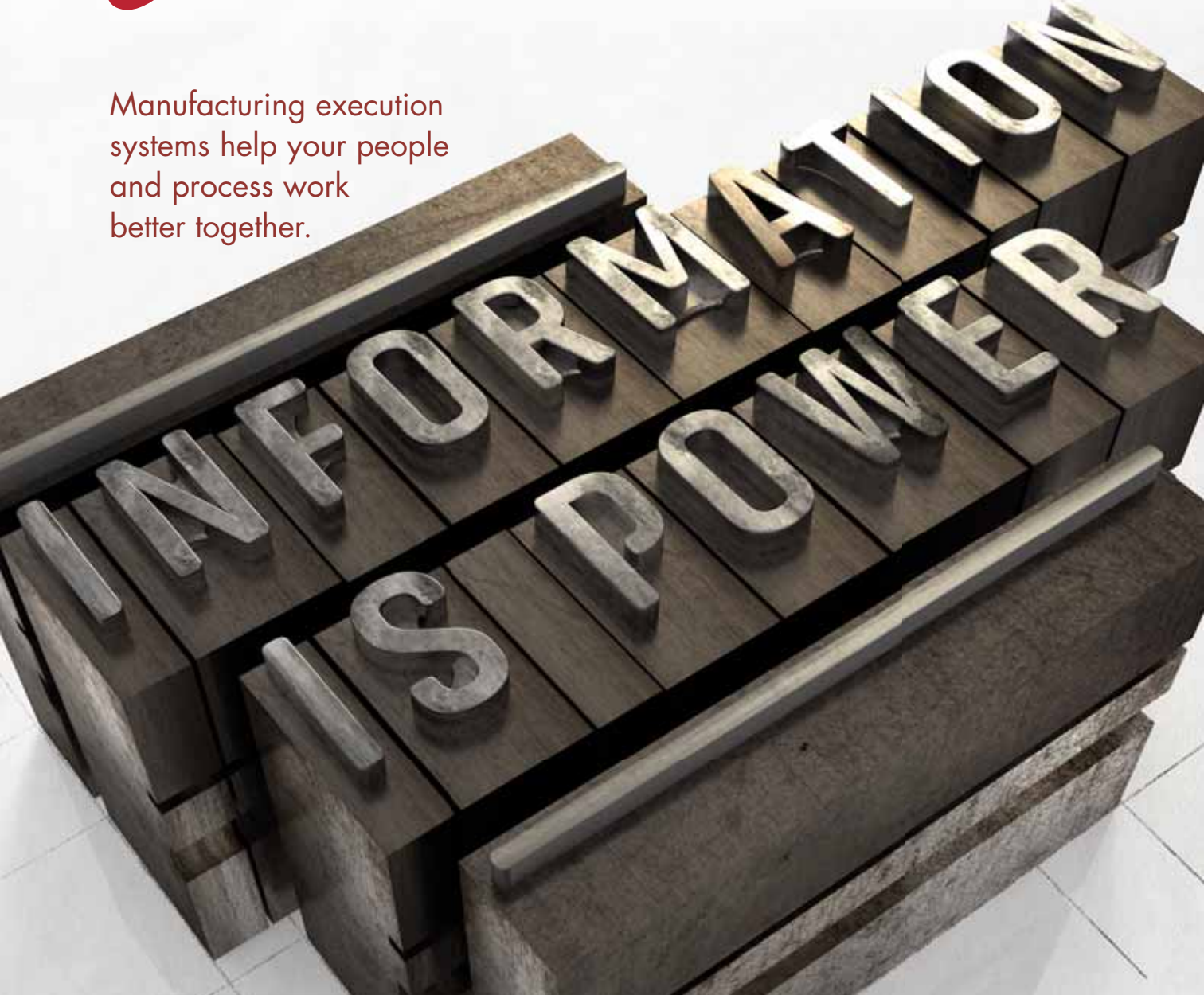


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# HOW CARGILL ACHIEVES SUSTAINABLE PROCESS OPTIMIZATION

Agricultural firm boosts efficiencies, throughput and yield with global rollout of control loop performance-monitoring and advanced diagnostics solution.

*By Sheila Kennedy, Contributing Writer*







Cargill aims high: it strives to be the global leader in nourishing people. With 155,000 employees across 70 countries and fully integrated supply chains — from the farm to retail stores and restaurants — the agricultural conglomerate is well on its way.

Food processing is a major part of its business, from smaller-footprint oilseed crush plants, corn oil refineries, starch refineries and salt production plants, to the more-complex ethanol distillation and corn fermentation facilities.

In pursuit of plant-wide process optimization, a structured, global continuous improvement (CI) initiative is in progress at Cargill. Plant by plant, CI workshops are being performed, culminating in implementation of standard operating procedures to improve plant performance.

Naturally, process control is a high priority, because it affects throughput, yield, energy consumption and production quality. “As part of our CI program, process control studies are performed, and then control strategies are standardized and deployed across plants with similar processes to improve efficiencies,” says Chris Christie, refinery process control lead in Cargill’s Corporate Engineering & Data Sciences team.

The results are encouraging — to a point. “Because we’ve been on this journey, we’ve implemented control loops and seen the value they provide,” explains Christie. “However, we quickly realized that the results were not sustainable for various structural and skill set reasons.”

To better maintain the gains from Cargill’s process optimization initiatives, a control loop performance-monitoring and advanced diagnostics solution was needed. Christie and his team led an evaluation, selection and pilot proof of concept for options, and now are rolling out PlantESP from Rockwell Automation Encompass™ Product Partner Control Station to more than 70 of Cargill’s manufacturing sites worldwide.

## Progress Had Its Limits

A typical Cargill manufacturing facility — depending on the size — uses tens, hundreds, if not thousands of PID controllers to regulate production. Though a policy was established to have all controllers operate in automatic mode, when process control engineers got a plant running in automatic, they would later find some controllers returned to manual. As a result, gains from the optimization effort were lost.

At the time, there was no way to track mode status, and accountability at the plant level was lacking, so performance analysis and actions such as PID tuning were triggered only after issues were found. “For our simpler processes such as oilseed crush and refining, there was no process control person, so we never looked at those things in a concerted way,” explains Christie.

Investigations were complex and time-consuming, and typically involved looking at trended data for patterns and manually comparing multiple trends side-by-side to identify which of the controllers was causing the problem. “Such a manual approach to analysis must also take signal noise into consideration as it makes the patterns more challenging to identify,” says Bob Rice, vice president of engineering at Control Station.

“I recall one of my projects took about three to four months for completion. You’d have to understand the process and all the control loops in it very well, including why they’re set up the way they are, and then troubleshoot them,” adds Christie.

The control loop monitoring tool (right) provides advanced diagnostics and plant-wide process optimization to help Cargill centralize data from various local plant historians and transform it into actionable information accessible from one dashboard in the plant control room.

To better maintain performance consistency across its fleet of production facilities, Cargill needed a control loop monitoring tool to increase visibility of loop performance, detect impending problems, provide diagnostics for troubleshooting and recommend fixes.

### Search for a Solution Begins

In mid-2015, Christie initiated a feasibility study comparing nine different solutions. Two of them met Cargill's functional and user interface requirements and had the desired technical metrics, so those were then evaluated for compatibility with Cargill's existing OSIsoft PI data historian from Rockwell Automation Encompass™ Product Partner OSIsoft, LLC.

Ultimately, Cargill chose Control Station's PlantESP for its ease of deployment, configuration and use; direct connection to Cargill's data historian via the OSIsoft PI-SDK; and its centralized server, which supports connections to multiple plants.

Additionally, PlantESP's capabilities complement Rockwell Automation solutions. Cargill primarily uses Allen-Bradley® ControlLogix® control systems to run its oilseeds plants, and some PLCs dating back to PLC-5®. It also uses Rockwell Automation processors, drives and human-machine interface (HMI) software.

The PlantESP software provides advanced diagnostics and plant-wide process optimization using key performance indicators (KPIs) to identify, isolate and characterize control loop performance issues. It would help Cargill centralize raw process data from numerous local plant historians and transform it into actionable information accessible from a dashboard.

It analyzes PID controller performance characteristics, identifying changes caused by mechanical, PID tuning or process interaction issues. It provides advanced forensic utilities to simplify root cause analysis, and provides Cargill management with tools for assessing the relative performance of plants across its fleet.

"Ease of use is an important aspect of the technology because it essentially eliminates the 'fear-factor' that's often associated with introducing advanced analytical tools," says Dennis Nash, president and CEO of Control Station.



### Pilot Serves as Proof Point

The pilot began in late 2015 with critical loops at three Cargill plants:

- An oilseed crush plant in Kansas City, Missouri, with 104 loops.
- A corn oil refinery plant in Blair, Nebraska, with 250 loops.
- A unit operation at a starch refinery in the Netherlands with 23 loops.

Two activities occurred simultaneously, including:

1. Developing a central architecture that would serve as a blueprint for accommodating more than 70 plants globally.
2. Pulling data from each site's local data historian into the central server, and configuring the plants from within the central server for analysis.

By early 2016, all three facilities were successfully running live in a single instance on a centralized server.

Consequently, Cargill launched a rollout that is expected to conclude in 2020. To date, PlantESP has been deployed across more than 60 plants, including oilseeds crush, refining and salt manufacturing facilities. At each site, the entire plant team is trained on where the data comes from and what to do with the results.

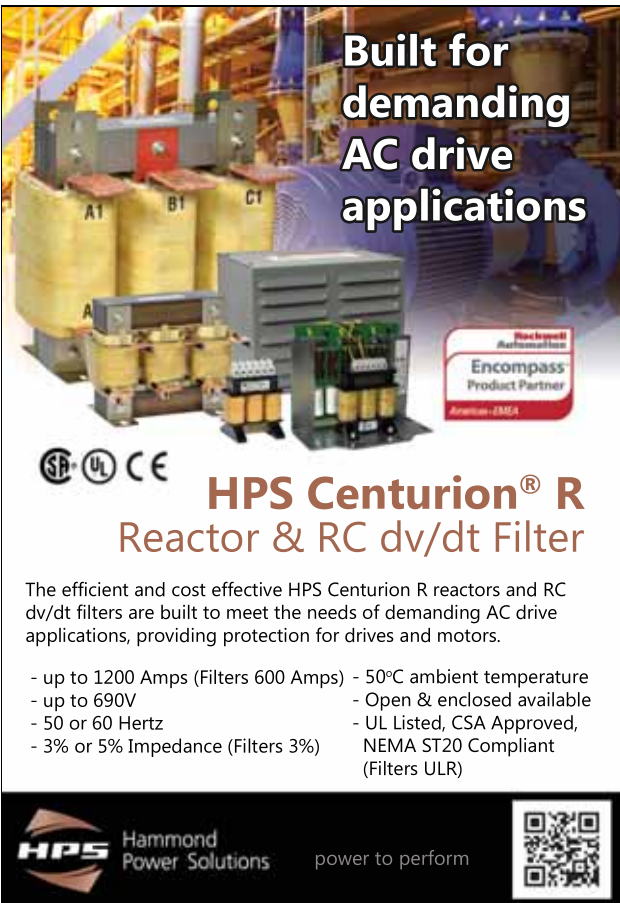
### Consistent Process Optimization Realized

At facilities using PlantESP, Cargill now can hold PID controller performance to a standard. When the standard of sustained loop closure is not maintained, automatically generated reports allow local staff to take appropriate action before the controller is placed in manual mode.

"This has enabled Cargill to keep controllers in their 'normal' mode for more than 95% of the time, which in turn has reinforced the value of their investments in automation," says Rice.



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“We have better visibility of the performance of our control loops and therefore the processes, so we are better able to sustain the value from our control strategies,” Christie observes. “From this, we have seen improvements in yield and efficiencies as well as increased process throughput.”

Simple metrics such as Percent Time in Normal and Overall Loop Health now are available to different people in the local plant operations teams and reported up the chain of command. Advanced metrics such as Oscillation Likelihood and Stiction Likelihood are available for high-level troubleshooting.

Daily and weekly plant production meetings incorporate the metrics along with Cargill’s guidelines for what to do when issues are found.

Use of local and central control resources is improved. Tuning on certain loops is reduced because the software proactively alerts when mismatches are identified, and it provides a tuning assessment along with recommendations for new parameters.

Because the software automatically captures and models everyday output changes, the engineering team no longer needs to perform bump tests. Instead of 3 to 4 months of manual analysis, the tool’s forensic capabilities help to streamline the company’s plant-wide optimization efforts.

In addition, programming anomalies now are detectable. In stripper-deck level valves with very similar controllers and control loops, PlantESP flagged that plant operators were changing one deck’s levels more frequently than the others. It was determined that one was programmed differently, and fixing the program solved the problem.

Also, issues are now detected that might have gone unnoticed. When plant operators resolved a big process upset overnight, errors appeared in the metrics the next day. An investigation revealed the root cause to be a mix of human errors and training lapses, which were promptly addressed.

For manufacturers seeking similar outcomes, Christie recommends having stakeholders who understand the value of process control, confirming the site team is accountable for the metrics, and starting with the high-value control loops before adding others. □

*Control Station, Inc., is a participating Encompass Product Partner in the Rockwell Automation PartnerNetwork™ program. The company provides tools to help simplify process control and plant-wide optimization. Its PlantESP control loop performance monitoring solution identifies, isolates and corrects issues that affect efficiency and throughput. Loop-Pro Tuner is an industrial-grade PID controller tuning product.*

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