

Western Wisconsin Energy LLC

Rockwell Software Plant-wide Optimization Solution puts the “proof” in ethanol production for Western Wisconsin Energy.

Western Wisconsin Energy

Western Wisconsin Energy, LLC (WWE) produces 50 million gallons of ethanol and 140,000 tons of premium distillers grain annually at its ethanol plant near Boyceville, Wisconsin. The company's mission is to provide economic benefits to western Wisconsin by enhancing the value of agricultural products in an environmentally sound manner.

An investment in a model predictive control (MPC) and optimization system from Rockwell Automation yields Western Wisconsin Energy LLC a near eight percent increase in overall production rate, a near six percent improvement in ethanol yield, and a 362 percent return-on-investment.

Key Results:

- ROI in six months
- 7.9% increase in 200-proof ethanol production rate
- 5.8% increase in fermentation yield
- 114% improved Karl Fischer in 200-proof product
- Improved quality, reliability and consistency, based on anhydrous ethanol moisture levels

The Challenges

WWE wanted to increase its ethanol production from 50 million to 60 million gallons per year and researched various options to help achieve its goal. Upfront, the company recognized a need to add a single fermenter to its process, but in addition, considered purchasing additional costly equipment, including molecular sieves, pumps, and heat exchangers.



The Rockwell Software Control and Optimization Solution

Rockwell Automation proposed its Rockwell Software Ethanol Plant-wide Optimization Solution as a cost-effective alternative to the purchase of additional capital equipment to meet WWE's challenge. The company realized that implementing a model predictive control system, along with the single fermenter, would be their most cost-effective solution. The plant-wide optimization solution included water balance, fermentation, distillation/sieves, and dryers/evaporator MPC applications/modules. The successful track record of Rockwell Software systems, helping to maximize plant utilization, gave the company the confidence to select this solution.

Step-by-step Process Improvements for WWE:

In the first step of the ethanol production process, the Rockwell Software system controls the dry milling and water balance of the grain feeding the fermentation vessels. Controlling the slurry solids' water content and percentage backset - as well as coordinating cook and beer feed rates through fermentation gap/inventory level controls - enables WWE to produce a more consistent feedstock that improves the predictability and stability of the fermentation process.

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Automation

Fermentation

In the fermenters, the control system adjusts the conditions and enzyme levels in each fermentation cook. By reducing overall variability in the fermentation process, the plant can produce more ethanol from each bushel of grain and reduce the amount of enzymes needed to produce each gallon of ethanol. The plant can also produce a more consistent product with lower sugar content, since more sugars are being converted to ethanol.

Waterbalance

The waterbalance stabilizes the fermentation feedstock by controlling

slurry consistency, which in turn, improves fermentation performance. The control system also continuously manages the link between the pre-fermenter and post-fermenter process units, allowing the plant to run higher capacities. Model predictive control provides better stability through coordination between these units.

Distillation/Sieve

During the distillation process, the control system reduces the variability of energy use, by judging cost trade-offs between the molecular sieve operation and ethanol distillation train, to produce the desired ethanol content. It also

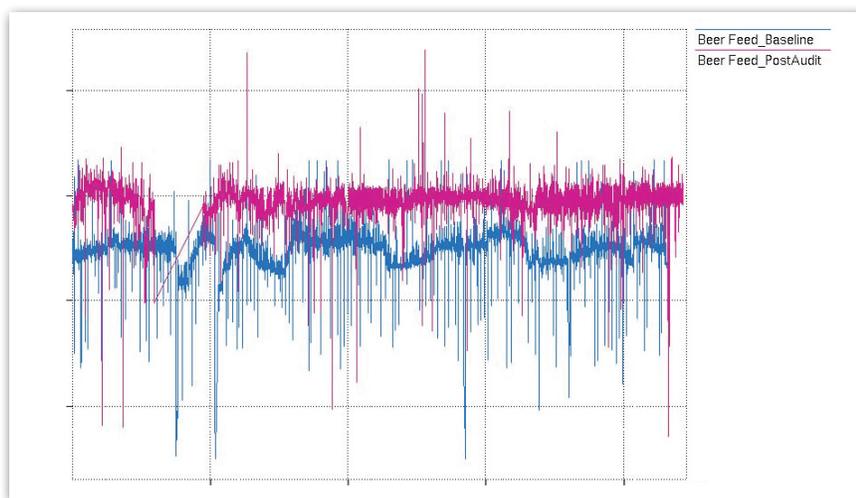
balances the value of ethanol losses in the bottom of the beer column or side-stripper with the relative costs of throughput vs. energy required to capture the ethanol.

Control system data helps plant operators identify sieve operating constraints that enable them to change the sieve timer operation for greater system efficiency. Better sieve control also enables the plant to push toward the higher allowable limits of moisture in the ethanol. Using pre- and post-implementation data, plant operators found they can run 114 percent higher moisture in the anhydrous product than in the past and were able to maintain the product within specification limits.

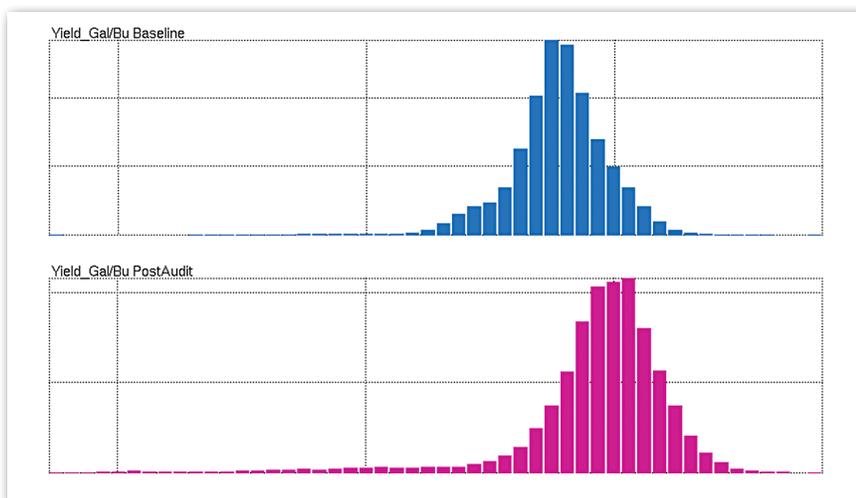
Stillage/Drying

In the stillage/drying step, the Rockwell Software solution manages slurry solids and controls the wet cake drying process for optimum energy efficiency. The grain flow into the dryers is managed by adjusting centrifuge feed, gas flow, and syrup feed to consistently and efficiently achieve the desired level of distillers grain moisture content.

Ethanol production plants can be greatly affected by variations in the production process and WWE is pleased that its Plant-wide Optimization Solution has been able to help their plant improve batch-to-batch consistency and ethanol yield.



7.9% Ethanol Production Rate Increase (200-proof)



5.8% Fermentation Yield Increase

"We are confident that the Rockwell Software system has helped our plant operate more consistently. Our operators are now able to accurately identify plant constraints and manage them so they can operate closer to our plant's optimum processing capability."

Brian Kieffer
Plant Manager
Western Wisconsin Energy, LLC

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