



Accelerating the progress of renewable fuels with Siemens automation and instrumentation

National Corn-to-Ethanol Research Center

Pioneering partnership

Biofuels – renewable energy sources derived from organic material such as corn – are increasingly viewed as a cleaner, cheaper, more efficient alternative to traditional fossil fuels. For nearly two decades, the National Corn-to-Ethanol Research Center (NCERC) at Southern Illinois University Edwardsville has accelerated the growth of the biorenewables industry through the commercialization of advanced biofuel products and technologies. Featuring analytical and fermentation laboratories, an intermediate-level fermentation suite and a demonstration-scale pilot plant, the center is uniquely positioned to provide clients with a full range of commercialization services – from project design and proof of concept to validation and scale-up. Biofuel and bio-based material producers across the globe make use of NCERC's vast resources to evaluate new ingredients, processes and equipment, with the ultimate goals of improving yields and reducing costs.

To ensure the success of every project, NCERC provides clients with access to a world-renowned staff of experienced engineers, operators and scientists – and to facilities equipped with leading-edge process automation and

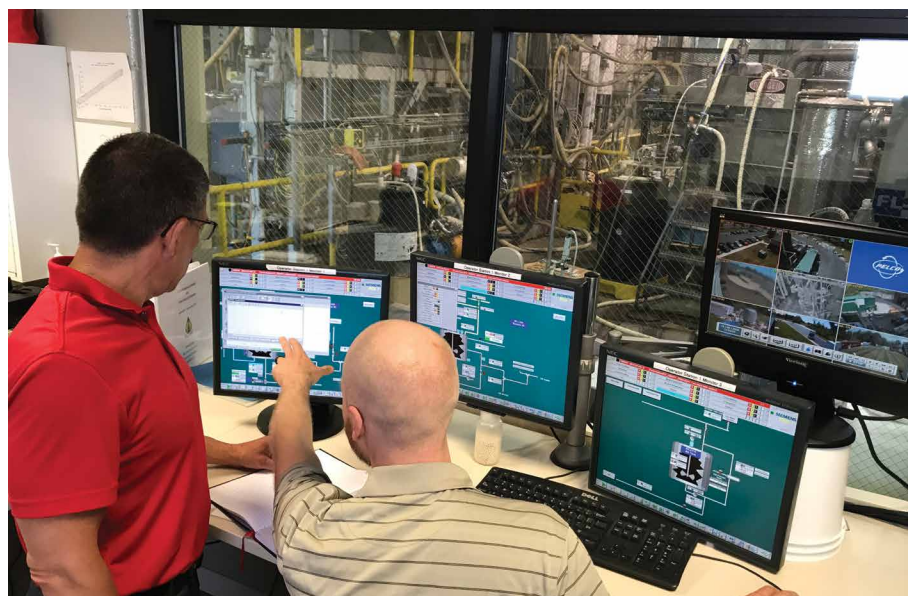
instrumentation solutions from Siemens. For well over a decade, Siemens has partnered with NCERC to elevate renewable fuel production with state-of-the-art technology for process control, simulation and monitoring.

A flexible DCS to meet diverse needs

Originally designed as a small corn-to-ethanol production facility, NCERC's 24,000-square-foot pilot plant has

been modified and upgraded to handle a much wider variety of biofuels, biopolymers and specialty chemicals. At the heart of its operations is the SIMATIC PCS 7 distributed control system, which automates, visualizes and optimizes the core process equipment for every client. With PCS 7, NCERC has the flexibility to offer continuous or batch runs for multiple feedstocks.

PCS 7 has been operating at NCERC since 2007, when Siemens made a formal donation of the DCS. The center has since modernized to PCS 7 Version 9 to take advantage of intuitive operator tools such as alarm management and interlock visualization. Their installation includes SIMATIC PLCs (S7-1200



The SIMATIC PCS 7 distributed control system automates, visualizes and optimizes the core process equipment for every NCERC client.

controllers and S7-1500 controllers with PROFINET) as well as SIMATIC AS 410 controllers connected to SIMATIC ET200 distributed IO.

NCERC also utilizes SIMATIC BATCH add-on software for batch automation, which allows them to configure, plan, control and log batch processes directly in PCS 7, as well as the PCS 7 Process Historian server solution for centralized archiving and reporting of all batch data, process values, tags and alarms in real time. With their modular approach to PCS 7 configuration, NCERC is able to change campaigns quickly and with minimal effort – making it possible to support a large number of clients with diverse needs. “We depend on PCS 7 with BATCH and Process Historian to gather all process data and export it directly to our clients,” says John Caupert, Executive Director of NCERC. “PCS 7 enables us to provide every client with the information they need to make important decisions about how to move forward with their project – whether the campaign lasts three days or nine months.”

Real-world experience with simulation

As the only organization in the world to offer both classroom training and hands-on instruction specific to the biorenewables industry, NCERC plays a key role in filling the growing need for qualified personnel to operate and manage biofuel refineries. Each year the center hosts dozens of motivated college students, interns and apprentices interested in learning how to operate a process plant. The centerpiece of this dynamic workforce education program is the SIMIT Simulation Platform for PCS 7.

SIMIT creates a virtual model of a plant’s original PCS 7 control screens, making it possible to train operators on a variety of procedures and critical scenarios – without disrupting production or endangering worker safety. NCERC uses SIMIT to develop fully functional replicas of the DCS operating in their pilot plant. The software is downloaded to a SIMIT Virtual Controller, which emulates a physical controller and eliminates the need for additional

hardware. NCERC leverages two unique features of the Virtual Controller to enhance the effectiveness of training: Virtual Time Management, which allows users to speed up or slow down simulations, and Snapshots, which save current controller and simulation states to be re-loaded for future training sessions.

“SIMIT has proven very cost-effective in training students and interns as well as new part-time and full-time employees,” says Caupert. “When we hire someone with little to no experience, we use the software as part of their onboarding process to familiarize them with PCS 7 – how to turn on a pump, how to trend, how to detect whether something is going wrong. SIMIT really helps to optimize the NCERC workforce by familiarizing them with the important control system terminology and technology.”

Additionally, as NCERC uses the Advanced Process Library (APL) feature of PCS 7, they benefit from tight integration between PCS 7 and SIMIT. APL includes pre-configured function



NCERC trains students and new hires using the SIMIT Simulation Platform, which creates a virtual model of a plant’s original PCS 7 control screens.

blocks, faceplates and block icons with corresponding templates in SIMIT that accept the outputs from the control system with no manual adaptations necessary. The APL upgrade is paying dividends for NCERC since they can easily test potential changes to the physical plant with SIMIT before putting anything into production – resulting in “right the first time” campaigns that save time and money.

Intelligent, integrated instrumentation

NCERC relies on Siemens as a trusted technology supplier for more than just process control and simulation. Today, there are more than 3,300 data points throughout NCERC’s pilot plant – including a variety of intelligent Siemens field instruments. Designed for full integration into PCS 7, these devices oversee the health of each product stream and transmit all process data seamlessly back to the control system.

As fermentation is the most common method for producing biofuels, the plant operates four 6,000-gallon, jacketed fermenters with eductor pumps for solids sweeping. The tanks, eductors and other key points in the fermentation process are monitored by SITRANS FC Coriolis mass flow meters, SITRANS P pressure transmitters and SITRANS LR radar level indicators, with SIPART valve positioners controlling pneumatic valves.

Many of the Siemens instruments in use have built-in PROFIBUS PA capabilities across a digital network, allowing for high-speed, two-wire communication of not only measured process values, but also cost-saving diagnostic and preventative maintenance information. The SIMATIC PDM (Process Device Manager) application integrated into PCS 7 collects this valuable data from all PA- and HART-enabled field devices in the plant to support NCERC operators in minimizing plant downtime – while additionally simplifying device configuration, parameter assignment, commissioning and calibration. This centralized asset management tool allows NCERC to continually interrogate their instrumentation via the PCS 7 HMI screen, ensuring consistently accurate and high-quality production runs. PDM also works with NCERC’s smart electrical devices from Siemens, including the



SITRANS P pressure transmitter monitoring the pressure in an eductor.



SIPART valve positioner on a carbon dioxide scrubber.

SIMOCODE Pro motor management system and SINAMICS variable frequency drives.

To further drive innovation, the center has incorporated Siemens gas analytics products into the facility. The NCERC team is not afraid to take on a challenge – so when a client asked about evaluating a biochemical application, NCERC added a bank of OXYMAT and ULTRAMAT gas analyzers for measuring oxygen and CO₂ levels in the fermentation process. The client production runs led to the results they had hoped for as they moved to full-scale production.

NCERC appreciates the versatility and sophistication of Siemens process automation and instrumentation, motors and drives, and analytics – but also the technical expertise that comes with it. According to Caupert, “The level of support we receive both directly from Siemens and from our local Siemens distributor is consistently high. They are very responsive to our needs and their deep knowledge means that everything will be up and running quickly, which is particularly reassuring when an installation is complicated or our staff is too busy. We like to think of Siemens support as the ‘ace in our pocket.’”

Fueling the future of an industry

To date, NCERC has assisted in the commercialization of more than 70 biofuel products and technologies generating nearly \$6 billion in revenue, and is responsible for the direct creation of 5,000 jobs. The continued technology partnership between NCERC and Siemens ensures an ever-brighter future for the biorenewables industry.



SITRANS FC Coriolis flow meter installed on a fermenter tank.



NCERC added a bank of OXYMAT and ULTRAMAT gas analyzers for measuring oxygen levels in the fermentation process.



NCERC's installation includes SIMATIC PLCs.



Level monitoring on the fermenters is carried out by SITRANS LR radar level indicators.

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