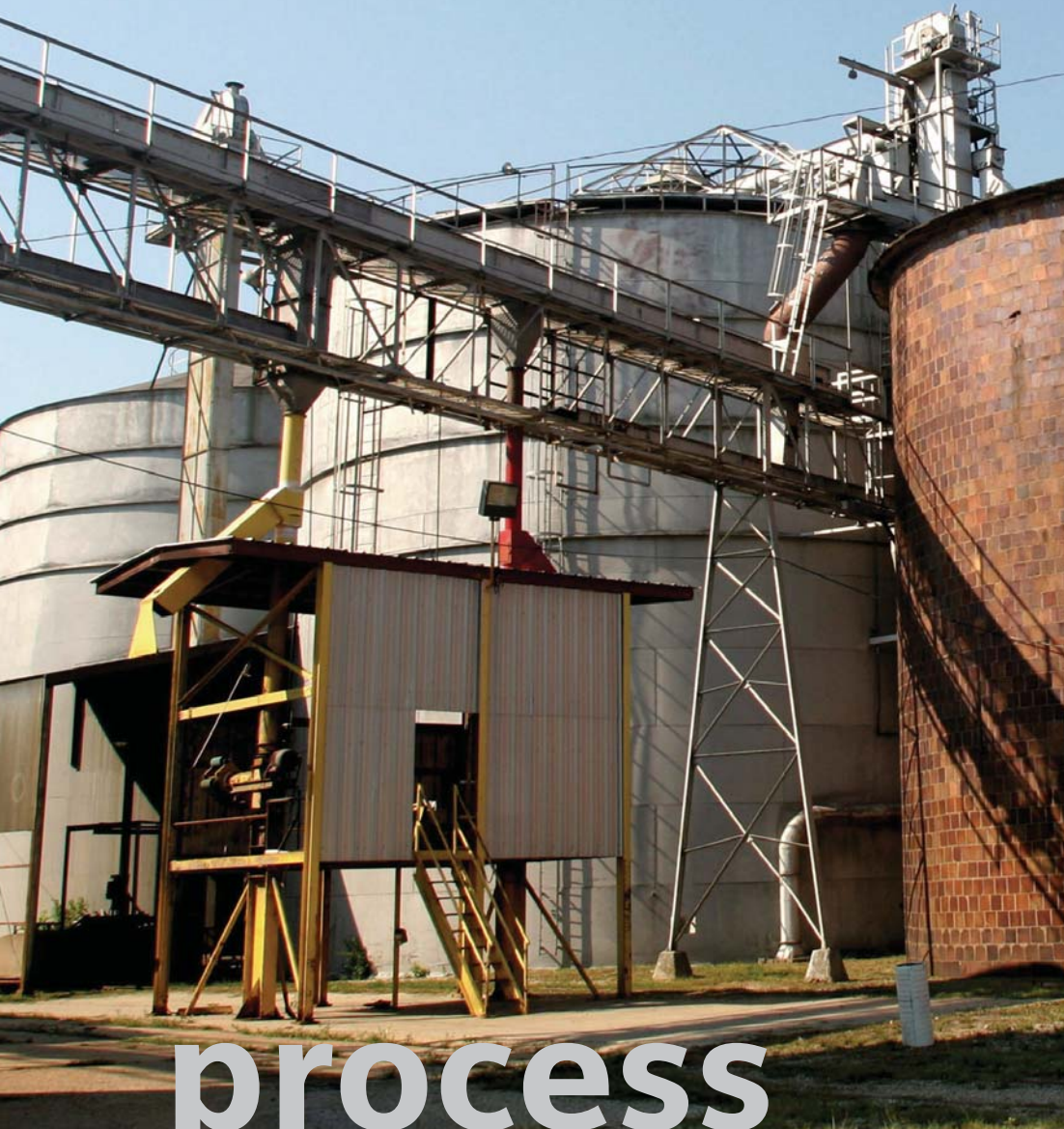


Memphis Biofuels Enters Biodiesel Market with Siemens Process Control System



process AUTOMATION

In June 2006, Memphis Biofuels, LLC, had just 90 days to convert a former chemical processing plant into a 50-million-gallon capacity biodiesel production facility which will provide an environmentally-friendly and domestically-produced alternative fuel source to the US. With the help of the SIMATIC® PCS 7 distributed control system from Siemens, the plant met the timetable and has the flexibility to thrive in a challenging biodiesel market.

When entrepreneur Ken Arnold entered the biodiesel market in mid-2006, the prices of raw feed stocks, including soybean and vegetable oils and animal fats, were low. Investors in his startup company, Memphis Biofuels, agreed that projections for biodiesel profits were solid.

All signs pointed to a great future for the company as the green field project in Memphis, Tennessee, got off the ground. But in early 2007, the prices for soybean, vegetable, and animal fat feed stocks increased to a point where it was, and remains, difficult for biodiesel producers to make a profit.

"The biodiesel market is going through a challenging time right now," says President and CEO Arnold, who has more than 30 years of chemical industry experience. "While I am confident the biodiesel business will move forward, many small producers relying on niche or local markets will not survive."



Ken Arnold, President and CEO of Memphis Biofuels proudly displays a sample of biodiesel.

SIEMENS

In addition to being one of the nation's largest capacity producers of biodiesel – 50-million-gallons annually – Arnold has reason to be optimistic about the future of Memphis Biofuels. "We have a full service laboratory, direct access to the Mississippi River, five Class I railroads in the US, and a state-of-the art process control system."

Control System Key to Fast Startup

In June 2006, after Memphis Biofuels found its investors, Arnold first had to meet the demanding investors' expectations – to convert a former chemical processing plant into one of the nation's largest capacity production facilities of biodiesel within 90 days.

A SIMATIC PCS 7 distributed control system (DCS) from Siemens Energy & Automation, Inc. became a vital component to meet this startup goal. The system was specified, integrated, and installed by Ken's brother, John Arnold, an engineer with CCA Wesco, Johnson City, Tennessee.

CCA Wesco worked through cold weather and mechanical bumps along the way to meet the timeline. "My brother, John, has worked with the PCS 7 DCS since it was introduced," Arnold says. "It is a very good, well-designed system with tight integration of the engineering and HMI environments that simplifies making configuration changes on the fly."

Both Ken and John Arnold say it would have been very hard to meet investors' expectations without the Siemens DCS. The plant would not have had enough trained people to get the plant up and running on conventional control systems, they agreed.

The decision to go with the control system was also based on long-range financial considerations. Arnold says the features of the system will help Memphis Biofuels lower the total cost of ownership through all phases of the production life-cycle – including minimizing design, engineering, and installation costs, as well as lowering operational and maintenance expenses.

Lowering Total Cost of Ownership

During the pre-commissioning phase at the plant, an advanced PCS 7 simulation program customized by CCA Wesco was used to train Arnold and his partners. He says the simulation program is indistinguishable from the plant's actual operations.

The simulation program helped lower the system's total cost of ownership by providing the team with immediate feedback and helping them understand how the system would operate. Now that the plant is operational, the simulation program is used to train new operators, as well as help the team correct operational problems at an engineering station in the plant's control room.

The flexibility of the DCS helps the plant instantaneously change the processes for maximum production, further lowering the total cost of ownership.

"When we started the design and implementation of the control system, there was a set of diagrams that implied a certain operational framework," Arnold says. "Because the control system is extremely adaptable, we could add buttons, on the fly, to help the operators determine the flow, automatically fill the tanks, and switch the modes of the loops."



Faceplate and interlock screens help operators anticipate problems and keep the process moving.

Control Room in Charge

During the startup, CCA Wesco created programmed interlocks and safety functions within the DCS hardware. Operators in the control room can quickly get to the cause of an alarm or problem, because faceplate and interlock information is readily available on the HMI.

"We handle highly flammable methanol and sodium methylene," says John Arnold. "The DCS ensures that we can properly unload trucks without a spill. The control room is in charge. Our operators have complete visibility over the entire process – including the critical variables, levels and pumps, and motors."

The entire biodiesel production process is automated and controlled from the control room. The process begins when the oils are fed from rail and truck tankers into storage tanks. The DCS monitors and controls pump and level functions, and methanol and catalyst tanks are equipped with automatic cut-off valves to enhance safety and reduce the risk of fire.

The system is connected to level indicators with high alarm and high/high alarm functions that immediately shut off the valves during an event.

It is important that the oils are always at the proper temperature in the continuous circulation loop. Operators constantly monitor temperature readings provided by Siemens SITRANS TH temperature transmitters. The temperature transmitters also monitor steam flow through the heat exchanger.

After the oil is flash dried, it is fed through Siemens SITRANS FC Coriolis flowmeters into the system. The flowrates of the methanol and catalyst are controlled by the DCS that is connected to variable frequency drive (VFD) operated pumps via PROFIBUS, a native communication protocol for PCS 7. The oil then goes through a reactor, reaches a certain temperature, and is fed into a settling area. The biodiesel separates from the glycerin then flows into a second stage reactor where the flowrate of the methanol and catalyst are ratioed to the flowrate of biodiesel.

After the biodiesel comes out of a second settling system, the methanol is again flashed, and the biodiesel is washed, settled, and then fed into a drier. The finished product is then shipped via truck and rail tankers to biodiesel distributors throughout the US, as well as to international markets.

Consistency Key to Fuel Quality

Consistency and quality are essential in every drop of the commodity product. Every shipment of biodiesel produced at the plant is tested in the facility's lab. Each shipment must meet ASTM 6751 standard criteria for quality – including clarity, sulfur content, particulate matter, and methylester levels.



Biodiesel samples. In the future, Memphis Biofuels has set a goal to produce over 100-million-gallons of biodiesel annually.

"The key to ensuring a high quality product is running in steady state, even at 100 gallons a minute," says Arnold. "We don't have a lot of fluctuations and variability. The system is very stable and very good at maintaining setpoints and parameters throughout the process."

Additionally, Arnold notes that fuel quality is enhanced by the DCS's ability to monitor operational trends on the plant's operator console screens.

"Our trend screens include all PIDs, valves, motors, tanks, and pumps," Ken says. "The standard trending capability allows the operator to bring up a faceplate for historical data in real time. Being able to go back and see what was happening at any part of the process, and then make adjustments, has been invaluable."

Faceplate and interlock screens allow operators to click on a symbol, including a pump, drive, valve, or PID loop, to quickly determine the status of the device and process interlocks. This helps operators anticipate problems and keep the process moving.

The system gives operators a comprehensive view of the entire plant from the control room. They can then drill down into a specific process area or to a specific device to get more information. "This holistic look at the system is a valuable troubleshooting tool," says Arnold.

"A control system consisting of a typical process control system and flow controllers would not ensure the product quality we have today," he continues. "The PCS 7 DCS allows us to go back to any point in time and view what was going on in the process. That is a big factor in consistently maintaining good fuel quality."

Customized Control

The system's engineering software allowed CCA Wesco to easily create and integrate custom function blocks and corresponding faceplates. Arnold says other systems require an additional visual basic software package to customize the application.

"By being able to create my own function blocks, I was able to optimize the system to meet the requirements of this application", says CCA Wesco's John Arnold. "The user-created blocks are easy to build, manage, and support"

Additionally, the plant view function of PCS 7, available in the engineering tool, facilitates remote support.

"As long as I'm at a computer, I can walk the operators through maintenance issues," he says. "We can quickly look at the same information on the screen. Having the configuration organized and structured in a way that reflects the process allows me to support the plant from remote locations."

Looking Ahead

While it remains to be seen what direction the biodiesel industry will take, Memphis Biofuels has the flexibility, capacity, location, and control technology to lead the market in any scenario.

"My brother and CCA Wesco have implemented many successful Siemens systems," Arnold says. "Also, when we worked with Siemens for technical support, service, and replacement parts, their assistance was tremendous. That was critical to our success. If we had not received that support, we would never have made it through the start-up."

Today, Memphis Biofuels is thriving in a difficult biodiesel market because of the dedicated team and a forward-thinking entrepreneur. Arnold looks to an even brighter future, and plans are underway to eventually expand the plant to produce 100-million gallons of biodiesel annually. "Right now we are using animal fat feed stock in the process; next month it could be soybean oil," Arnold says. "That is the beauty of the Siemens DCS. We instantaneously make changes on the fly to adjust to a changing market. That is the edge we need to lead the industry."