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2014 CASE STUDY

MODERNIZING THE GRID

Blackouts

How a utility cured an Ibuprofen plant's biggest headache

In cooperation with

SIEMENS



CASE STUDY SNAPSHOT

Problem
- Grid reliability. Two to three significant power outages per year at Albemarle Corporation's Ibuprofen plant in Orangeburg, S.C.

Players
- Albemarle Corporation's Orangeburg, S.C. Ibuprofen plant
- Orangeburg Department of Public Utilities
- Electrical Engineering Consulting & Testing
- Siemens Smart Grid division

Solution
- Distribution automation: A fast bus transfer system that can handle more than two sources

> "There is a significant quantifiable impact [when outages occur]."

Richard Shirer,
Electrical Superintendent
at Albemarle Corporation

Blackouts

How a utility cured an Ibuprofen plant's biggest headache

The morning shift at Albemarle Corporation's manufacturing facility in Orangeburg, South Carolina began as usual on February 18, 2012, with the world's largest Ibuprofen plant gearing up for another all-out day of production.

But at 8:27 a.m. the plant and its more than 300 employees were plunged into sudden darkness. All electric power was lost, its production equipment shut down and the reassuring hum of complex manufacturing processes gave way to complete silence.

Almost right away, the "emergency generators cranked up," says Richard Shirer, electrical superintendent at the plant, but a return to full production was still some way off as equipment had to begin a slow ramping to restart.

Immediately, the economic costs began to mount. "There is a significant quantifiable impact," says Shirer, although details about the economic costs are proprietary. But the February 2012 outage, which lasted until 9:53 a.m. was not the first that year. Another had occurred in April, lasting 61 minutes.

The problem: Grid reliability

"On average, we have experienced two to three significant power outages each year where the plant completely lost power from anywhere from a few seconds to an hour or more," Shirer says.

The 2012 outages were not quite the last straw, and the problem was not bad enough to consider relocating operations to a place with more reliable electric service, Shirer says. Instead, they started a conversation about improving the reliability of the power feed to the plant.

> "Albemarle got pretty perturbed; they said none of their other plants are having this problem."
>
> **John Bagwell,**
> Director of the Electric Division at the Orangeburg DPU

The Albemarle facility is an anchor of the economy in the Orangeburg area. Its 10-megawatt load is the largest among roughly 25,000 retail customers of the Orangeburg Department of Public Utilities (DPU), the largest municipal electric utility in the state.

"We might go a stretch of eight to 10 months without [an outage], then we'll have one. Lightning, act of god, tree, car, squirrel, bird – you name it, we've probably had it," says John Bagwell, director of the electric division at the Orangeburg DPU.

While able to shut down the plant "so that there were not environmental or safety impacts," the outages created "serious production losses and waste generation" for the plant, Shirer explains.

"Albemarle got pretty perturbed; they said none of their other plants are having this problem. They were losing too much money. They threatened that it could result in them leaving Orangeburg if this continued. I couldn't allow that to continue," says Bagwell.

"Reliability is a factor," says Shirer, for Baton Rouge, Louisiana-based Albemarle "in deciding where to produce a new product."

The search begins

Richard Shirer gives John Bagwell credit for taking "the initiative to investigate various options for switching schemes that would reduce or nearly eliminate power outages." Bagwell turned to Electrical Engineering Consulting & Testing (ELECT), a consultancy in Wendell, North Carolina, for advice. "It wasn't a problem with the distribution

Distribution lines at the Albemarle Corporation

Orangeburg substation at the Albemarle Corporation

system," ELECT's Barry Tyndall quickly deduced. "It was a problem on Orangeburg's [46-kilovolt] subtransmission system."

Tyndall examined a number of options to address the problem.

The first was a loop distribution option, but that was "quickly eliminated," Tyndall says. It was a bad match for the plant's distribution system and cost "in excess of $200,000, which was sort of the magic number for Orangeburg."

Next, Tyndall considered installing static transfer switches, but once again he found cost to be an obstacle. Then, he looked at a high-speed transfer system of less than 30 milliseconds, such as ones that have been implemented in Europe. "But the way it's implemented, it uses circuit breakers which are in metal-clad switch gear," Tyndall says. "They don't have an outdoor, overhead design that could provide the same performance. Our solution had to be outdoor and it had to be overhead."

"So that got us to the fast bus transfer system" offerings from a variety of manufacturers. But the vendors' products, while solid, either did not mesh well with the Albemarle subtransmission system or were more costly than Orangeburg could afford.

That's when Tyndall got in touch with Andre Smit, product development manager with the Siemens Smart Grid division just down the road in Wendell, North Carolina. Smit understood the need for a fast bus transfer solution that would be seamless and could move power

> **"It wasn't a problem with the distribution system. It was a problem on Orangeburg's subtransmission system."**
>
> **Barry Tyndall,** Electrical Engineering Consulting & Testing

Engineers at the Siemens testing facility

between more than two sources, just like the Orangeburg substations serving Albemarle.

Modernizing the grid

"Siemens had exactly what I was looking for," Bagwell says. "I asked Andre Smit how fast he could transfer – he said under 100 milliseconds. I said that's great, [...] that's a very fast transfer and I think that's enough to ride me through the contacts on the motors, should an outage occur."

At a large manufacturing plant in Little Rock, Arkansas, Siemens deployed a solution to solve a problem very similar to the one at Albemarle. That solution uses "pole-top applications or pole-top switch gear so it's very cost effective," he says. "And it can expand to multiple sources – up to eight sources."

"The products currently available could only do that with two sources at the speed at which Albemarle needs this to be done. Albemarle can only have a very short interruption in supply when this transition takes place," Smit remarks. A key factor in making the solution work is that Albemarle had "a third source that was a feeder coming past the plant and if they could tap into that and create a fast transfer system using three sources, that would basically solve the problem," he says.

Tyndall and Bagwell paid a visit to Siemens to test the solution.

"Andre and his guys put together a pretty good routine for us," Tyndall says. "We had an opportunity to play with [the technology] and to try different scenarios. It really performed well in the factory. The actual reclosers and controls that Orangeburg used were put together in a test bay at the Siemens plant and put though pretty rigorous test paces to ensure that everything was communicating properly and that the scheme would work."

A return on investment

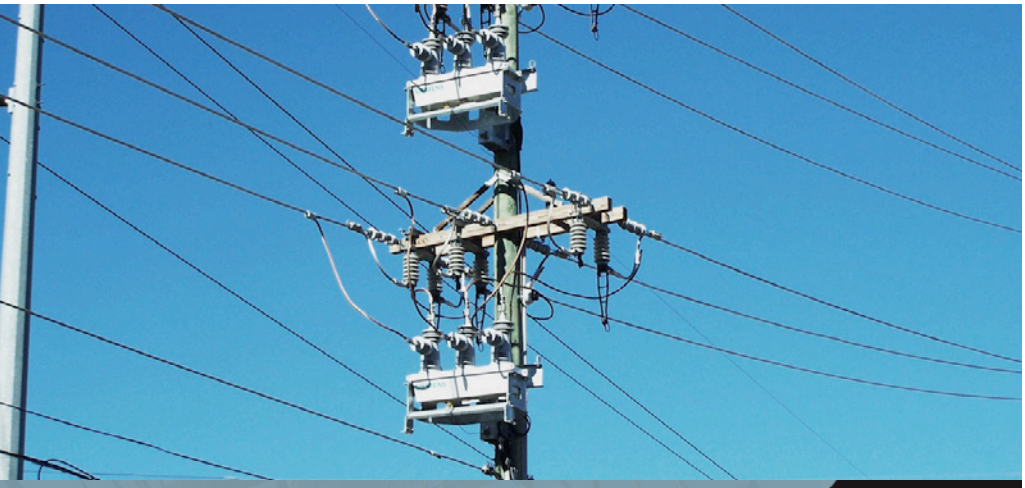
Many large industrial plants in the U.S. invest in on-site cogeneration facilities to provide power to the site, with any excess power being sold back into the market.

But "[Albemarle] didn't want to spend the money," says Bagwell, pegging the cost at $10-12 million.

A less expensive option was to install enough backup power to serve the entire site in the event of an outage. In fact, "we already have backup generation for key processes," Shirer explains. "But it would be too expensive to install enough generation capacity to run the entire site."

> "We have created something that was never available..."

Andre Smit,
Product Development Manager at Siemens



New reclosers supplied by Siemens

Smit estimates that it would have cost "$1 million plus" to install enough capacity for the entire Albemarle plant site.

At the end of the day, Orangeburg and Albemarle settled on the Siemens technology solution not just because it worked, but because it came in at a cost that met the tight guidelines of a municipal utility. Tyndall initially worked with a budget of $200,000. Siemens came in with a bid of $87,000.

"We have created something that was never available; the thing that was available was very expensive; and it could only handle two sources," Smits says. "The price point of this technology makes it possible for utilities to serve their communities better. It's price – that is the big thing for munis. It's affordable enough that utility customers can afford to pay for it," Smit says.

The Siemens solution was deployed at the Albemarle plant in late summer 2013. So far, there hasn't been a single interruption to the chemical plant's production.

Without Orangeburg Department of Public Utilties working closely with Albemarle, the world's largest Ibuprofen plant may have been forced to find a new home.

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