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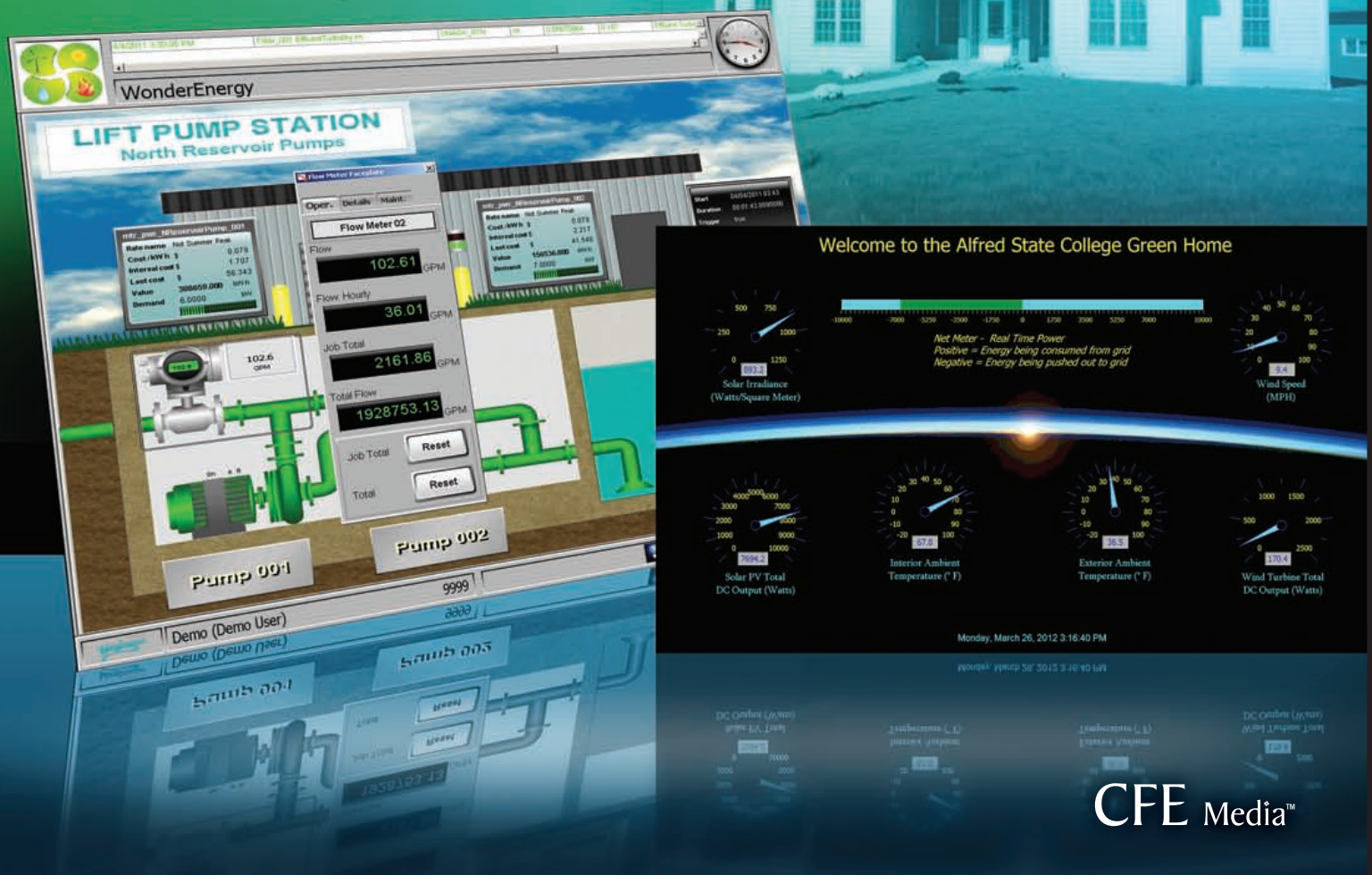
SUPPLEMENT TO CONTROL ENGINEERING

From the Home to Factory and Beyond: Automation Technology Powers the Green Movement



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by David Kostick

Displaying the benefits of green technology

Robust monitoring/control system tracks the performance of energy-saving features in green home built by college students

Home of the Future: This green home, designed and built by students at Alfred State College in New York, demonstrates a potential new use for automation and control technology. Courtesy of Alfred State College

IF SOMEONE TOLD YOU THEY WERE MOVING INTO A "GREEN HOME," you probably wouldn't expect their new digs to come equipped an industrial-grade monitoring and control system.

But those expectations could soon change—thanks to the successful use of automation and control technology in tracking the performance of energy-saving features in a demonstration home built by students at Alfred State College in western New York.

Deploying a monitoring and control system as part of this project offered many advantages, including:

- Showing the public the impact of investing in a renewable energy project
- Providing an effective means of assessing the long-term performance, determining maintenance needs, and maximizing the ROI of the project
- Enhancing the project's educational value for students.

Alfred State College, based in Wellsville, NY, is a technology-based institution, part of the State University of New York (SUNY) system. Project-based learning is a cornerstone of Alfred State's curriculum, and that philosophy led to the construction of this showcase "zero-energy" home.

The home was designed and built completely by students. The primary goal was to integrate "green" construction and renewable energy systems and to provide a platform for educating the future workforce in green building techniques. Funded primarily by the Federal Appalachian Regional Commission (ARC), the home is essentially an open classroom for students and the public, alike. The home also earned a "Gold" certification by the National Association of Home Builders.

Fortuitous encounter

The design and construction phase of the project took place between 2009 and 2011. The Alfred State faculty then started looking for a reliable method of measuring

the project's effectiveness. "We had set specific goals and knew we had to monitor and measure our results," explains Craig R. Clark, P.E., dean of the School of Applied Technology at Alfred State.

For a while that search appeared to be fruitless. Then, Jeffrey Stevens, an associate professor who coordinates most of the renewable energy systems work at the green home, went to an industry conference, where he had a chance meeting with Dave Kostick.

Kostick is an automation engineer with IMT Solar, a company that markets quality control, test and measurement equipment to users of renewable energy systems.

IMT Solar is based North Tonawanda, N.Y., roughly 100 miles from Alfred State College, which made it easy to launch a collaborative effort on the green home project. But a specific product that IMT Solar was developing made this partnership the ideal fit.

IMT Solar was harnessing off-the-shelf hardware and software—primarily from Siemens Industry—to develop a technology platform for automatically controlling and monitoring energy systems. The platform, which IMT Solar calls REVTOS—or the Renewable Energy Visual Tableau Operations System—was designed for use in small to medium-sized wind and solar applications, but Stevens evaluated REVTOS and found it more than suitable for measuring the performance of the energy systems in the Alfred State green home.

The home's high-end monitoring and control system was funded by the New York State Energy Research and Development Authority (NYSERDA) and the college needed it to be operational by Jan.1, 2012. With hard work and long hours the target was met.

A joint venture between Alfred State and IMT took shape in fall 2011, with a contract for deploying REVTOS in the green home signed in late October. "We knew the time frame would be a challenge," observes Stevens, "but it was evident from the beginning that this system would give us the capability we needed to share data about the green home's performance with our students, our faculty, and the public."

Specifically, in addition to monitoring the performance of the renewable energy systems, the school wanted to monitor a number of house parameters, among them losses through insulation techniques used in the walls and ceilings. "They also wanted our system to simulate the needs of a family of four actually living in the home," adds Kostick, "including controlling water flow valves, turning lights on and off, and simulating electrical loads as they varied through the day and evening."

The home's renewable energy system includes an 8.8-kW solar array on the roof, a 2.5-kW wind turbine, a solar thermal system to provide hot water, and a 3-ton geothermal system with four wells or "bore holes" to meet heating and cooling needs.

A portal to excellence

The REVTOS platform that's now supervising the green home's energy system is based on off-the-shelf Siemens technology. It includes:

- Two S7-1200 PLCs installed in separate control panels
- Three Simatic Comfort Panel HMIs—one 9-in. panel, one 12-in. panel, and a WinCC Advance RT HMI running on a 23-in. PC.
- Scalance industrial Ethernet switches for Ethernet networking
- SmartService Web servers.

All elements are connected via a Siemens engineering software package called the Totally Integrated Automation (TIA) Portal.

"This was the first time REVTOS had been used to monitor a geothermal and a solar thermal system together," observes Kostick. "And it was the first time we used multiple PLCs and different-sized HMI devices."

Using TIA Portal enabled IMT Solar to create a first-class system on an extremely tight schedule, Kostick says. The tool allowed changes to be made quickly in a PLC and instantly reflected to tags in the HMIs.

According to Kostick, the engineering software's most important features include:

- An intuitive nature. Easy to use, it enabled IMT Solar's newest engineer come up to speed quickly with no need for formal training.
- Multiple user work capability. Two engineers worked on the system simultaneously but separately, and then brought their work together quickly into one result.
- An exceptional user library. Work from previous projects can be reused easily, saving measureable time on the fast-paced project.
- Scalability. Earlier systems had shipped with just one HMI and one PLC. TIA Portal made it fast and simple to expand to three HMI platforms and two PLCs at Alfred State, with user library functions again saving valuable time by extending PLC and HMI code to the multiple platforms.
- Automatic scaling capabilities. HMI screens can be scaled automatically as they are moved from one platform to another, again saving days of work to rescale graphics for the three platforms.
- Diagnostic functions. The ability to point to any development problem areas quickly significantly reduces the time needed to debug a program.
- Program storage/archiving capacity. Automatically saving and archiving files across all PLCs, HMIs, and the network to one project folder simplifies tasks.

Finally, IMT Solar embedded Siemens' SmartService Web capability and remote diagnostics into the HMI de-

vices to enable safe and secure communication and system interaction. As a result, personnel with appropriate security access can log into an HMI and interact with the green home from anywhere—within the college intranet and across the Internet—to bring data into the classroom and to the public.

"Because of the tools available in TIA Portal," adds Kostick, "we estimate—conservatively—we saved 15% on pure engineering and commissioning time for PLC code and HMI development. Plain and simple, we were able to quote, and complete, the job competitively" because of the software tools.

Reaping the benefits, expanding the influence

Overall, the project has reaped important benefits for education, business, and industry:

- The green home illustrates the use of renewable energy and supports its benefits with solid performance data.
- The project demonstrates how educational institutions can extend their reach throughout the country and around the world, conducting long-term research, bringing short-term real-time data into the classroom, and educating and training the future technology workforce.
- The systems exemplify the influence of sophisticated, electronic tools such as Web-based portal software.

"The monitoring system really amazes people," declares Dean Clark. "Many knew we had a great green home with zero-energy potential, but the visualization on those screens makes a huge difference in their understanding what we're doing here.

"It's nice to build a green home, but unless you can provide exact details about how it is operating and how it is automated, you can't really sell to the public or to potential students the power of a zero-energy home."

David Kostick is sales and engineering manager with IMT Solar.

For more on REVTOS, visit the IMT Solar website at **http://www.imtsolar.com/page/Renewable-Energy-Visual-Tableau/54.html**; for more on Siemens Automation products, including TIA Portal, visit **http://www.industry.siemens.com/topics/global/en/tia-portal/pages/default.aspx**.

For more about the Alfred State College green home, go to **http://www.alfredstate.edu/green-home**.

Data Display: One of the three HMIs in the monitoring and control platform controlling the Alfred State College green home displays electrical and water consumption data. Courtesy of IMT Solar

Remote Access: The HMIs on the REVTOS platform have SmartService Web capability, allowing users with the appropriate security credentials to log in from anywhere and get information such as which devices in the green home are producing and consuming power. Courtesy of IMT Solar