The GG 530 CHP with an efficiency of 91% is a central component of the “Energiebunker” (a converted anti-aircraft bunker) in Hamburg-Wilhelmsburg, Germany which won the German TGA Award 2014.

Universal and open control technology simplifies remote monitoring of CHPs

According to the physical principle of cogeneration, gas-powered combined heat and power plants generate heat as well as electricity with high efficiency. As one of the world’s leading Combined Heat and Power (CHP) manufacturers, SOKRATHERM switched to Beckhoff controllers three years ago. One of the main reasons for this transition was that PC-based control is extremely well-suited to support remote monitoring applications.

With around 1,300 delivered CHPs, family-owned and operated SOKRATHERM located in Hiddenhausen, Westphalia, Germany, is one of the leading manufacturers of compact CHP modules with an electrical output of 50 to 500 kW. Their flagship product is the GG 530 CHP compact module, which delivers an electrical output of 532 kW and a thermal output of 686 kW, with an efficiency of 91%. According to the company, it is the world’s most compact CHP in the 500 kW class.

“The success of our company is built on our ability to accommodate individual customer requirements, instead of delivering only standard products,” says General Manager, Klaus Pollmeier. CHPs normally supply heat and electricity, which are then used in buildings. However, an operating company sometimes requires not only hot water, but also steam for its processes. Consequently, mass flows have to be changed and temperature levels adapted. This in turn requires changes on the control side, as additional parameters must be acquired and monitored. “The finely-granular Beckhoff I/O system gives us a clear advantage in this regard,” says Klaus Pollmeier. “If, for example, two additional temperature readings have to be monitored, we don’t need to purchase a new 8- or 10-channel input module as would be the case with other control systems. Instead, we just leverage our systems’ existing EL320x dual-channel input terminals, to which the additional temperature sensors can be easily connected. This way, necessary adaptations can be made inexpensively.” Depending on the
version, the core of SOKRATHERM’s iPC CHP controller, introduced as standard in 2011, consists of a CP6207 or CP6201 “Economy” built-in Panel PC with 5.7 or 12-inch touchscreen and TwinCAT automation software. The Intel® Atom™ processor was selected because the low heat dissipation makes a fan unnecessary in the Panel PCs.

**TwinCAT as an open and flexible software solution**

Three years ago, SOKRATHERM ported the programs from the previous PLC controller over to the Beckhoff system. The goal was to provide as many different interfaces as possible to other bus systems, in order to extend the system more easily and, above all, to implement remote monitoring capabilities. “Important for the decision in favor of Beckhoff components was the fact that telecontrol protocols such as IEC 60870-5-10x and IEC 61850 are easy to install using TwinCAT library supplements,” says Klaus Pollmeier, justifying his decision for Beckhoff, and he adds: “You can never rule out the possibility of unforeseen complications somewhere in the technical system overall. Against this background, it was also crucial that our combined heat and power plants be equipped with comprehensive remote monitoring.” It is now also possible to provide customers with remote services to optimize their operations.

The CHP module can be connected to an already existing building management system via the protocols commonly used in building automation such as PROFINET, Modbus, BACnet, TCP/IP, or LON bus. BACnet (Building Automation Control Network) is a standard, vendor-independent communication protocol that is mainly used in the areas of HVAC, light control, safety, and fire alarms. With its Building Automation Libraries, TwinCAT offers preconfigured basic functions for control and regulation, as well as for signal processing and communication, which enables faster adaptation. In the case of BACnet, for example, templates can be created and BACnet objects can be linked with each other easily using TwinCAT BACnet/IP. “Whatever communication requirements our customers may have, we can make all common interfaces available to them without extensive programming costs,” says Klaus Pollmeier.

**Programs quickly ported to PC**

The SOKRATHERM programmers, led by Stefan Kiele, also received extensive assistance from Beckhoff application engineers. “The Beckhoff team helped us familiarize ourselves with their solutions quite quickly, helping simplify the port of the first program version in particular. Starting from there, we began to put into practice our ideas for improved monitoring and enhanced operator comfort,” Stefan Kiele says, praising the co-operation. “These initiatives came to fruition within nine months. We carried out extensive tests of all possible sources of error and verified that the machine enters a safe state under all operating conditions. It was only then that we decided to standardize on the new controllers.” Since winning this trust, almost 400 CHP units with Beckhoff controllers have been successfully installed in the field. “If adaptations need to be made, we can now do it ourselves. This enables us to act as flexibly as possible in the market with customer-specific solutions,” says Klaus Pollmeier, underlining the choice of Beckhoff technology.
Through the automatic documentation function, the operating company obtains a monthly report for its operational monitoring that includes meter readings for electricity and heat generation, as well as gas consumption and degree of utilization, start/stop behavior, and plant availability, including the resulting characteristic data. At the same time, the combined heat and power plant can be integrated via TwinCAT into the building management system or a group of virtual power stations.

Remote monitoring as an essential service

"Many of our plants are operated with maintenance contracts extending over a period of 10 years. That's why we need a system that enables our employees, working from their desk, to identify any problems in the plant in the shortest possible time and determine how the problem can be solved remotely," says Pollmeier, emphasizing the importance of efficient remote monitoring. Four former commissioning engineers from the SOKRATHERM facility in Nordhausen, Germany now coordinate the services and provide assistance to the company’s own employees in the field and to the operators of the CHPs, as well as the loading of software updates, error analysis, and optimization of plant operation. The service technicians can access operational data online using PCs, notebooks, and smartphones via multiple-secured access points. All events that impair operation are recorded and displayed to service personnel, depending on the escalation level. Customers now also use the remote monitoring system to have status messages displayed on their smartphones as well.

Three CHP installations in Chilean hospitals show how important remote monitoring has become. SOKRATHERM is presently establishing a service partner network in Chile, but the monitoring services ensure smooth operation is carried out from the Nordhausen site in the meantime. "We tackled these elements as part of the overall changeover, which would have been not possible without the Beckhoff control technology," says Pollmeier in summary. "The total package of control performance, remote monitoring performance, and electronic maintenance documentation with automated evaluation is unrivalled in the market, allowing us to achieve maximum transparency with our customers."

In the context of an energy contracting project, the GG 140 CHP compact module contributes to considerable heating cost savings for the major Frankfurt newspaper, Frankfurter Allgemeine Zeitung (F.A.Z.).