

Universal automation for buildings and production

# Maximum energy efficiency thanks to networked heat sources


Modern packaging designs must meet high requirements that are constantly changing. Cardboard packaging, for example, has evolved to be much more than just a method for handling and protection during transport; they must now also perform important tasks such as point of purchase (POP) advertising and promotion. The associated manufacturing processes must accordingly be efficient and flexible – but unfortunately these are also energy-intensive. This concern extends beyond machinery to also include HVAC for plant facilities. At Friedrich Wenner Vollpappen-Verarbeitungswerk, for example, it has been proven that energy efficiency when heating production buildings can be significantly increased with a universal and open building automation system, i.e. with intelligent control of the heat generators. The system supplier Brüggemann implemented energy-saving solutions, needs-based control and other functions through the use of over 200 Beckhoff Bus Terminals.

“Friedrich Wenner Versmolder Vollpappen-Verarbeitungswerk GmbH” (solid board processing), based in Versmold, Germany was established in 1930 as „Friedrich Wenner Holzkistenfabrik” (wooden box factory). The production of folding cartons began in the late 1960s with the aid of the first punching machines. Today the company is one of the leading manufacturers of food cartons made of solid cardboard which, in accordance with their increased importance as a customer-specific means of marketing and presentation, are printed in high quality using a modern offset method. The processes behind this are not only highly complex, but also very energy-intensive. Automatic punching machines as well as printing, folding and gluing machines consume around 1.5 million kWh of energy per year at Wenner.

## Existing structure with high efficiency potential

“Manufacturing individualized packaging,” says Managing Director Stephan Potthoff-Wenner, “is very intensive in terms of product development. New and changing customer requests must be met continuously, requiring changed techniques and also investments in new machines. For a long time, machines were simply acquired for this, and when space ran out we simply built an additional factory hall.” However, the investment into a new machine especially for printing solid cardboard up to a thickness of 1.5 mm led in 2009 to a re-think and strategy shift where energy was concerned. Stephan Potthoff-Wenner comments: “Such machines have connected loads that should be checked beforehand. The additional power requirements led us directly to consider: ‘Is increased energy consumption the only direction we can go?’”

This question gave rise to the building automation project at Wenner, which is overseen by works technician Nils Ellwart: “We noticed very quickly that there was no ready-made solution that we could buy. Nevertheless, the project also had to be realized relatively fast. There was also no ‘role model’ for the right solution, but instead a large amount of information to sift through with varying quality about energy consumption at the company.” It quickly became clear that such a complex energy efficiency task could only be achieved with the aid of automation technology. The system supplier Brüggemann, also based in



The five screw compressors for compressed air generation exchange data or operating states with one another via the Sigma Air-Manager.

Versmold, was brought in as an expert partner. Volker Herden, who is responsible there for the electronics division, explains: "For the optimum control strategy it was necessary to filter the abundance of information in order to focus on what was most important. However, every energy and heat supplier, extending as far as the photovoltaic system and the groundwater-assisted air-conditioning, had to contribute to energy efficiency." The items to be integrated included ceiling air heaters, measuring units in the control cabinets, calorimeters, combined heat and power plants, peak load units, air compressors and heat pumps.

### Automation upgraded during operation

The specifications placed high demands on the control technology, in particular with regard to a uniform and universal implementation. Nils Ellwart says: "We wanted to commission the solution during plant operation, but without high risk. The open system from Beckhoff was very accommodating here – especially since the production machines themselves are already controlled to a large extent by Beckhoff technology. It was possible to integrate the various loads and energy sources very well via Modbus which also standardized the interfaces. Proprietary solutions, conversely, would have made the energy system endlessly complex."

The Wenner energy efficiency system also features innovative solutions such as the look-ahead control of linked energy sources. If it is to be expected, for example, that heat can be provided – whatever the source – then other heat generators can be reduced in power accordingly. The task of the Beckhoff system partner Brüggemann was now to design a control system that would link all components and machines harmoniously with one another. Volker Herden comments: "The innovative thing about this project was that installation took place during operation. However, intelligent networking requires that the interdependencies of the individual data points are known. In addition, the documentation of the data is important in order to adjust the plant parameters in accordance with these empirical values."

### Good operability despite high complexity

The networked structure raises a fundamental question, which Nils Ellwart formulates as follows: "How does one make sure that the plant remains fully operable?" Because at Wenner not every energy source is optimized separately, but always with regard to the other loads and sources as well. As a result, the Kaeser air compressors and the air circulation of the hall heating are coupled to one another, for example. The basic prerequisite for this is that the selected Modbus coupling is easily scalable. If a further unit is added, for example, then an additional Bus Terminal is simply inserted into the control cabinet and the corresponding drivers are written or copied.

In principle the plant is centrally structured. Only the independently running ventilation system in the digital printing area uses its own CX9010 Embedded PC from Beckhoff, which is connected by a fiber-optic cable to the central server. Otherwise, a fanless C6925 Industrial PC with Intel® Celeron® M-ULV processor serves as the central PLC. A BC9020 Ethernet Bus Terminal Controller controls the vacuum system and 13 BC9050 Compact Ethernet Controllers are responsible for the acquisition of operating data. Six BK9000 Bus Couplers as well as two BK9050s and two BK9100s are used for the Ethernet TCP/IP connection.

A total of 1,066 physical data points – which are integrated via 231 Beckhoff Bus Terminals and give rise to around 7,500 software data points –

have to be coped with. Nevertheless, the programming was very convenient thanks to the powerful TwinCAT automation software platform. Its versatile driver libraries facilitate the Modbus coupling, for example; the control and timer switch programs come from the TwinCAT HVAC library. This open structure of the library has greatly simplified the adaptations in practice according to experience gained at Wenner.

### Recognizing and taming energy hogs

It is a well-known, but often ignored fact that standby circuits are energy hogs. As a result, the plant control system at many companies continues to run through the night in order to avoid possible problems when switching on again the next day. Nils Ellwart comments: "At Wenner we operate predominantly in a single shift. An unnecessary standby would be much too expensive here, for which reason we turn our control system off." Project Manager Volker Herden from Brüggemann confirms: "The Beckhoff components are successfully put to the test every day when switching on."

Since a great deal of compressed air is required for processing solid cardboard, particular importance is attached to the compressors, which are known to be energy hogs in any case due to their high energy waste in the form of heat. However, that is precisely where there is a great deal of efficiency potential: instead of utilizing a second large compressor unit, Wenner installed five smaller screw compressors, which are considerably easier to control in the partial load range. Using automation technology from Beckhoff, a much more effective management of operating hours can be achieved. In addition, heat recovery can be used more purposefully with the smaller units which means more energy-efficiency, because the compressors exchange data with one another and thus "know" which compressor is running under load and can supply heat accordingly.

Considerable energy savings have also been realized in the piping network/hydraulics of the air-conditioning. For this Brüggemann opted for the innovative Zortström technology, which simplifies the accumulation and distribution of hot and cold air. Thanks to this technology the most diverse generators and consumers of heating and cooling in the system can be controlled with maximum efficiency.

### Worthwhile investment in building automation

The investment in modern building automation at Wenner was worthwhile in two primary regards: in operation Wenner benefits from the simplified service because, if need be, the Brüggemann technicians can gain insights into the plant controller via Internet without great effort. A VPN tunnel solution guarantees sufficient access while at the same time ensuring the desired security for Wenner. Added to that are the considerably reduced energy costs, as company boss Stephan Potthoff-Wenner explains: "We were already able to lower our electricity consumption by 10 % in 2011, the first year after the implementation. It looks like we will achieve similar savings in 2012 and gas consumption has also been significantly reduced."

Further Information:

[www.wenner-gmbh.de](http://www.wenner-gmbh.de)

[www.technik-im-haus.de](http://www.technik-im-haus.de)

[www.beckhoff.com/building](http://www.beckhoff.com/building)