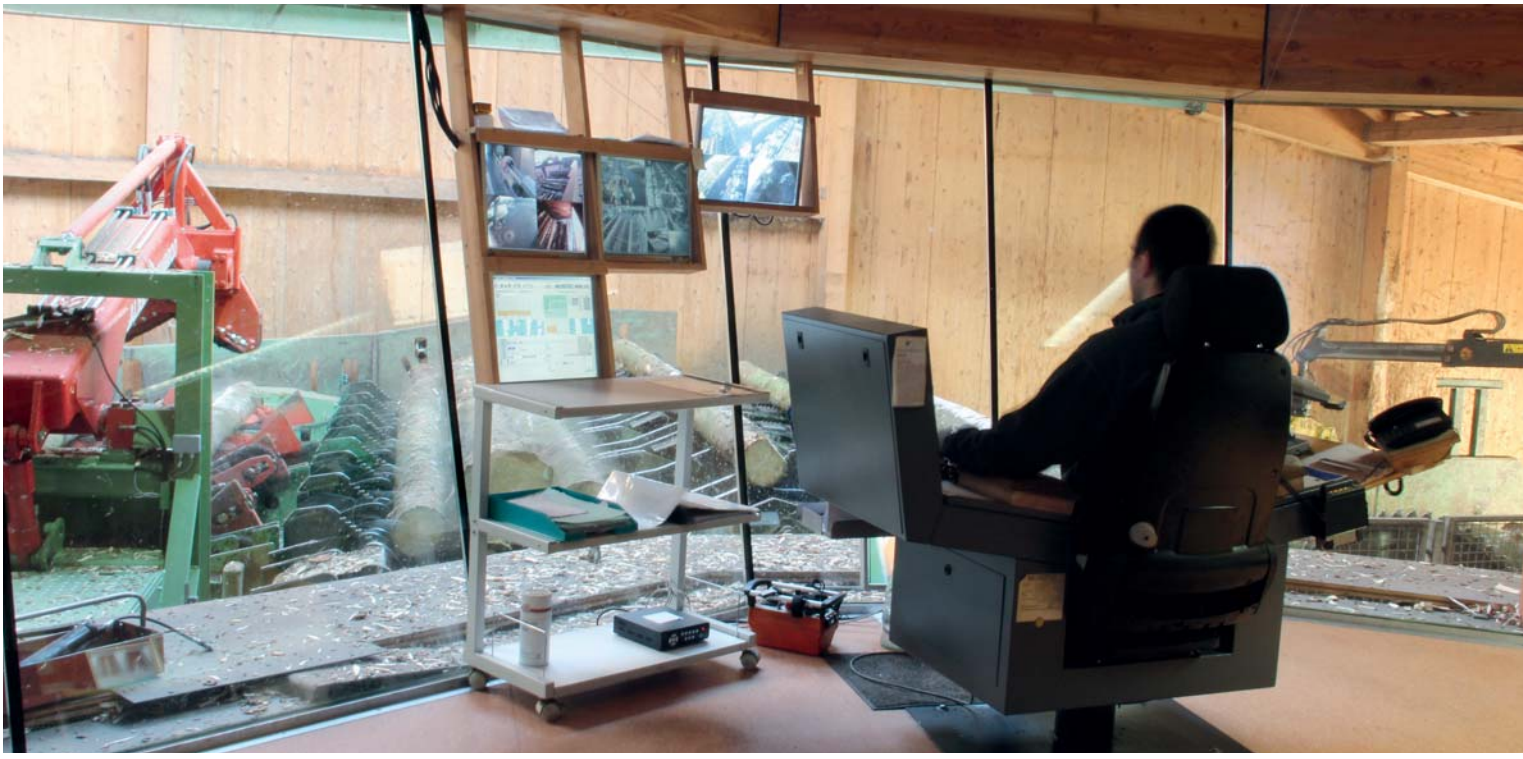
Embedded PCs and power measurement terminals provide flexible energy data collection for lumber mill

Data transparency goes hand in hand with optimization of energy management and consumption

Despite the fact that the production of lumber requires a great deal of energy, Holzwerke Weinzierl in Germany generates more electricity than it consumes.



The energy management system captures and analyzes energy consumption values from all processing systems like this area, for example, where tree trunks enter the plant.

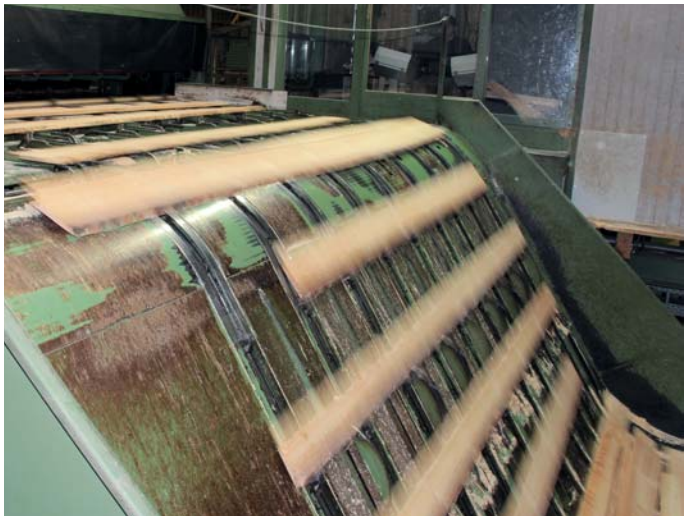
The drying and processing of wood is a process that requires a lot of energy. Holzwerke Weinzierl GmbH in Germany nevertheless manages to generate more power than it consumes. The basis for this achievement is a modern energy management system that uses power measurement I/O terminals and Embedded PCs from Beckhoff to make the plant's energy use transparent while continually optimizing it.

Located on a property spanning 22 hectares (54 acres) in the Bavarian town of Vilshofen, Holzwerke Weinzierl GmbH produces roughly 600,000 cubic meters of round logs and 150,000 metric tons of wood pellets per year. The company's most important energy transfer medium is electricity, which it distributes via seven transformer stations fed by its own medium-voltage grid. The total annual power consumption amounts to roughly 30 million kilowatt-hours, spread at about one-third each over the lumber production, the pellet plant, and 36 drying kilns. By using three solar panel arrays and burning wood bark in four combined bio-mass power and heat generation systems, however, Weinzierl produces 35 million kilowatt-hours of green electricity annually, which enables it to sell roughly 5 million kilowatt-hours to the public grid. Josef Brauneis, Weinzierl's Head of Electrical Engineering, explains the company's approach: "Our business is based on three product lines: lumber, pellets, and energy generated from the renewable resource, wood."

Answering a wide range of energy management and data acquisition requirements

For ecological as well as economic reasons, Weinzierl decided in 2011 to implement an energy management system (EMS) according to the DIN 50001 standard, because only a comprehensive energy data acquisition system would provide the transparency needed to exploit all potential for optimization and maximize the annual power surplus. For starters, the complete power supply systems were connected, including the seven transformer stations and the low-voltage distribution panels. Over time, the end users will be added, i.e. roughly 40 large drives, until finally all energy data and production performance indicators flow into the system.

Selecting the right energy management software was not easy, explains Josef Brauneis: "The systems available at the time did not deliver the capabilities,



In the foreseeable future, Weinzierl wants to integrate energy consumption data from its larger machines into its energy management system, followed by production performance indicators.

Josef Brauneis, Head of Electrical Engineering at Holzwerke Weinzierl, explains the facility's power consumption display.

flexibility or price-to-performance ratio we were looking for. Although the market has improved in the meantime, most systems either facilitate pure data collection with limited interfaces or you must install a powerful building control system. That's why we picked the highly flexible Zenon visualization system, which we were already familiar with. It provides very good display, archiving and reporting capabilities."

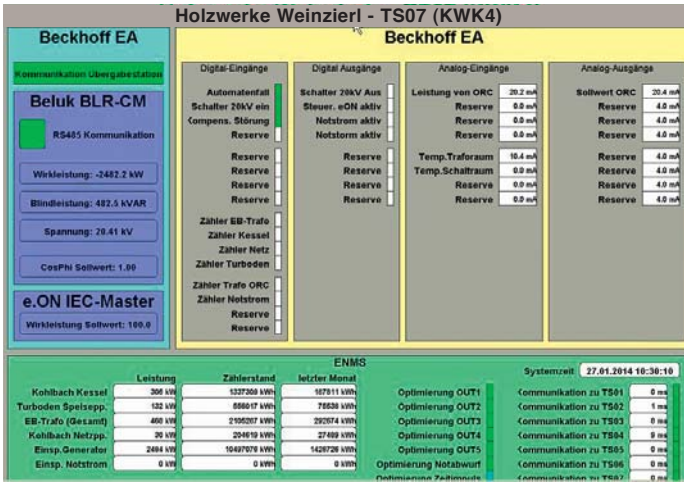
In order to implement such a widely distributed and complex EMS with features that went beyond simply collecting data, Brauneis placed high demands on the process interfaces. For example, the system had to cover all energy-relevant facilities on the large grounds and protect against network problems by storing and analyzing the data on site. It also had to handle all current performance indicators and accommodate new ones in a cost-effective manner. Furthermore, it had to be able to use the existing networking infrastructure and keep the control technology as compact as possible, because space was limited.

For Brauneis, having a system with flexible data collection capabilities was also critical for the following reasons: "The interface spectrum had to be broad enough to take and accept energy-relevant signals, preferably from all systems controllers. This included, for example, the integration of an interface ("EisManSlave") to the utility company's feed-in management system, the reliable transmission of signals to the combined power-heat generation systems, and the collection, transmission and linking of all signals from the power distribution facilities such as power switch settings, transformer and room temperatures, and fault signals from compensation systems. Needless to say, the visualization software also had to be able to read all of this information."

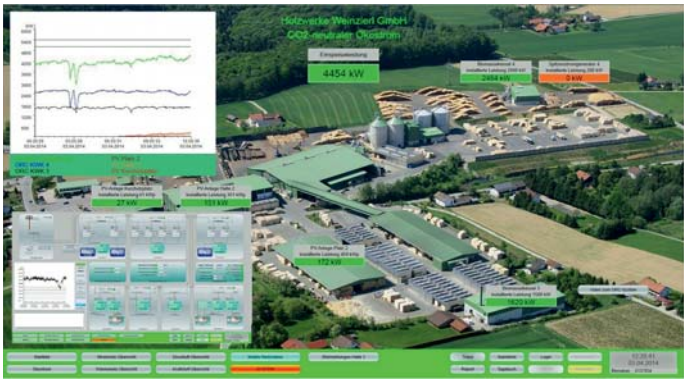
Embedded PCs and EtherCAT terminals provide the best solution

"The broad product spectrum from Beckhoff was best suited to handle the extensive process interface requirements," Brauneis continues. "Since implementation, the system consisting of Embedded PCs and EtherCAT Terminals has certainly proved its capabilities in practical use. For example, we were able to easily import the TwinCAT PLC projects via the visualization software's editor. The same applies to the important separation between the production and EMS networks. With an Ethernet LAN adapter and appropriate function blocks from the TwinCAT PLC library, we were able to easily implement the required data consistency between the EMS and the S5 and S7 controllers on the wood processing machines."

Today, the EMS comprises roughly 200 measurement points for roughly 400 measurement values regarding output, power, voltage, and power factor. Over the medium term, i.e. after integrating the larger single drives, there will



The web-based visualization system provides a rapid overview and diagnostic capabilities.



With several bio-mass boilers and solar power installations, Holzwerke Weinzierl generates "green" electricity that is CO_2-neutral.

be roughly 500. In the final stage, when heat output, compressed air consumption and diesel fuel consumption as well as the key production performance indicators are included, the system will comprise roughly 1,000 measurement points. The core of the energy data acquisition system is made up of one CX5010 Embedded PC in each transformer station. The Embedded PCs are networked via fiber optic cable and Ethernet, and are equipped with 1.1-GHz Intel® Atom™ processors, providing ample computing power. To collect the energy data, 45 x EtherCAT EL3403 and 30 x EL1014 digital four-channel terminals are currently in use to collect the pulses of various counters. They are supplemented by 20 additional digital input terminals for the signals emitted by the signaling system and numerous analog I/O terminals.

Brauneis particularly appreciates the open and compact design of the Beckhoff control system: "Our systems have grown over many years, which is why they differ significantly from each other. In our old building from 1998, for example, we collected no energy data at all in the past, while the newer systems we added starting in 2006 forward energy data in the form of pulse signals to the next boiler controller, where they are totaled up. Accordingly, we built a new power data collection system with EL3404 power measurement terminals and installed EL1014 digital I/O terminals for the S0 interface of the power meters to use existing information. Just like with the easy integration of the production controllers and the visualization software, this approach demonstrates the great advantages of the open systems from Beckhoff. They also feature a compact design, which is particularly beneficial when you retrofit an energy management system in applications with very little available space."

If compact size is critical, the EL3403 3-phase power measurement terminals provide another advantage. Since each phase can be analyzed separately and the respective converter ratios can also be computed individually in the PLC, the user can measure three asynchronous motors in single-phase mode instead of the three phases of a single drive. The three-phase performance values can then be easily computed with precision which is sufficient for the power factors and cycle times required for a lumber mill. This approach requires significantly fewer terminals and saves a great deal of space in tight control cabinets. It also contributes to energy savings, because additional terminals and converters would themselves consume additional electricity.

Optimized energy efficiency through better data acquisition

The main benefit of the energy management system is that it makes energy consumption transparent across the entire lumber mill. While the power consumption of the 36 drying kilns with 12 x 3-kilowatt drives each had always been tightly controlled, all sorting and wood rounding systems, as well as the pellet systems with their conveyor dryers and boilers, are now integrated as well. Josef Brauneis: "We added things like a color-coding system to support the line operator. A red signal indicates that the system's power consumption needs to be reduced, for example, by cleaning a dirty photo sensor or doing some other maintenance. Another example involves turning on the flue gas fans in the boilers with some delay, because each of them consumes a considerable 160 kilowatts. By taking steps like these we were able to continuously reduce our power consumption by roughly 150 kilowatts and keep our peak usage unchanged despite the fact that we added another line and two more drying kilns.

Many ideas for improvements came about as a result of receiving all this information about factors such as unexpected usage peaks. For example, our production buildings feature large exhaust systems that now have additional shut-off devices so that we can turn off the energy-intensive ventilation in specific areas when they are not in use. The EMS also enables us to analyze our energy consumption for individual cost centers and product batches.

Further Information:
www.holzwerk-weinzierl.de
www.beckhoff.com/measurement