

Networking

UPM centralizes its energy optimization and emissions trading within Europe with the help of ABB's Energy Management System

Jaakko Juntila, Marja-Liisa Parkkinen

UPM-Kymmene Corporation is one of the world's leading manufacturers of printing paper. Energy plays an important role in production and, as part of its corporate strategy, the company aims for a high level of self-sufficiency in energy production. Knowing the expected energy demand and optimizing the energy resources brings about significant savings.

To reach this goal, the company has, over the years, invested considerably in energy efficiency, availability, and in the predictability of energy use and supply. One of the key tools in this area is energy management. Energy Management Systems supplied by ABB have been in use at the Finnish mills for some time, and it was decided that to better manage and optimize energy in the whole corporation, it was best if all the European mills were linked together into the same system.

Thus, by early 2006, energy management systems had been implemented and are now running at all UPM production facilities in Central Europe. Similar systems already in use at Finnish mills have been upgraded to the latest version of the product.

Productivity

UPM-Kymmene has 10 paper mills in Central Europe and eight in Finland. Production is based on strong vertical integration as well as tight coordination of raw materials, energy and the production process. In fact, with the aid of several generations of energy management systems from ABB supplied over the past 20 years, UPM has been a leader in predicting energy needs. “Taking care of our energy balance, the focus of the ABB system, involves balancing our time-dependent energy consumption in real time with respect to surpluses or deficits,” said Anja Silvennoinen, Vice President, Energy at UPM. “In addition to energy generated by its own units, UPM-Kymmene purchases and sells energy to and from external partners and market operators.”

In 2007, the company was able to meet approximately 70 percent of its own electricity needs. In Finland, UPM is self-sufficient in electrical power, but outside Finland most electricity used by company mills must be purchased locally. The effective use of energy reserves and hydro-power contributed to an increase in profits for the energy division.

UPM's centralized energy management system has been expanded to include UPM mills in Austria, Germany, the United Kingdom and France. From the beginning of 2005, all energy management information from these mills is consolidated in a control center system in Augsburg, Germany to yield

their total energy-balance history and consumption forecast. Because UPM-Kymmene trades energy with external partners, the center is able to balance the load and share resources across the entire network.

UPM's centralized energy management system has been expanded to include UPM mills in Austria, Germany, the United Kingdom and France.

This consolidated information is routed from Augsburg to Jämsänkoski, UPM-Kymmene's Finnish energy management control center, which optimizes the use of energy resources and electricity trading for the Finnish mills and controls the hydropower generation. As this older system in Jämsänkoski has been upgraded to ABB's new product platform, UPM-Kymmene can get an overview of its entire European energy operations from a single place.

Predicting energy needs

Prediction lies at the heart of the integrated energy management system. Energy consumption is dependent on the operating mode of the mill – how the paper machines and other units will be run. Once the operating schedule of the units is known, their energy needs can be forecasted based on previous history. This information

can then be used to make real-time decisions on how to use, generate, purchase or sell energy. The decision making is supported by a model that takes into account the available resources, their prices and various operational constraints. A group of several mills can benefit from economies of scale to purchase and sell energy in the most effective way.

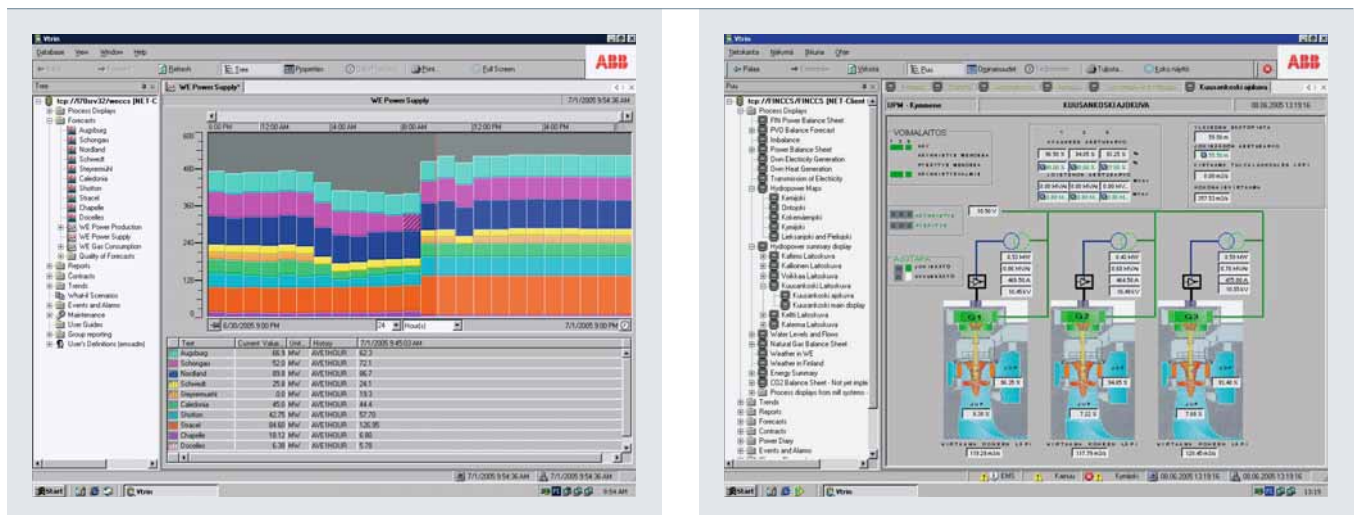
An essential step in the process involves feeding data – historical, real-time and forecasted – into one central

Factbox Real-time database (RTDB) and standard user interface (VTRIN)

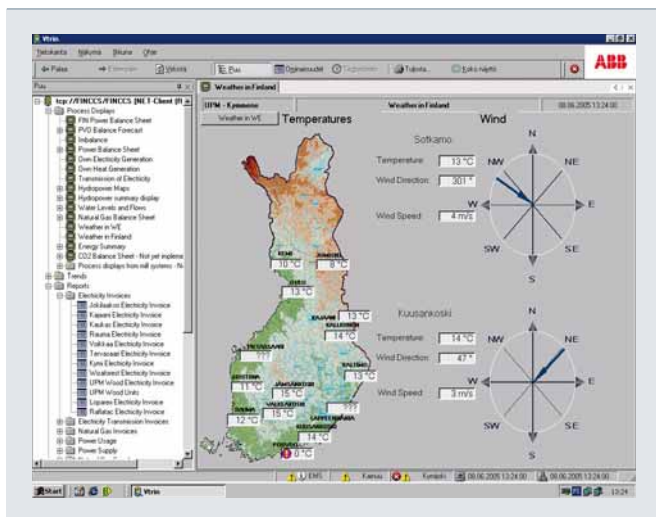
The database is implemented through ABB's RTDB product, a relational database designed and optimized for process information management and extensive history recording. RTDB combines the benefits of an easy-to-use relational database with high reliability, performance and real-time functionality. Real-time process data is collected from various data acquisition systems through interfaces and is stored in the database.

The information in the database is available for all users through ABB's standard user interface (VTRIN), which allows the flexible navigation, presentation and linking of process information according to the user's preferences. VTRIN is based on Microsoft's .NET architecture – modern development tools and architecture based on the latest trends in usability technology.

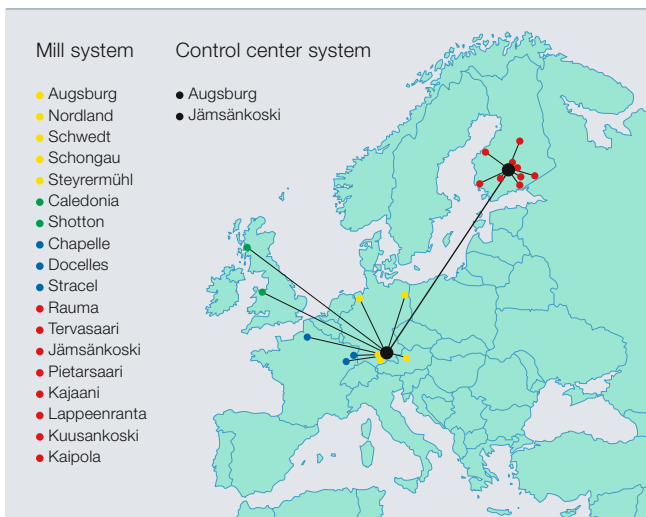
1 Historical, real-time and forecasted data gives the operator vital production and energy information necessary for decision making.



- 2 Weather data is necessary and available because of its effect on energy consumption.



- 3 UPM-Kymmene's corporate-wide Energy Management System includes mill-wide systems at 10 paper mills in Central Europe and eight mills in Finland, plus two inter-connected control center systems.



database **Factbox**. This data allows the operator to see what has been happening in production, how much energy has been used and the amount required in the future.

An essential step in the process involves feeding data – historical, real-time and forecasted – into one central database.

Energy management and optimization

ABB has extensive experience in developing and supplying energy management solutions for the process industries and in particular for the paper and metal industries, which are very energy intensive. The company's energy management systems are built on the real-time database (RTDB) and standard user-interface platform (VTRIN) using a set of generic functional modules that are configured and parameterized for the customer's application. Such functional modules are available for energy consumption forecasting, energy contract and balance management (including sales and purchase recording, resource booking, and energy cost allocation to consumers), optimization, and real-time monitoring of energy balance and purchased energy 1 2.

Consumption forecasts for paper machines are derived from the planned production grade and rate, which may be entered into the system from the production planning system through an interface. Mechanical pulp production is a big energy consumer, and its energy consumption is dependent on the running state of the refiner and grinder units. Some consumers follow weekly load profiles, which can be used in their consumption forecasting. The total mill consumption is obtained by summing individual unit consumptions.

Energy Contract Management selects the energy resources to match the time-varying energy consumption at optimal cost. In addition, it also provides a number of related functions for system users. The total energy network is modeled as a number of balance areas, such that total consumption matches total production at all times. The balance equation takes into account a mill's generation, purchase and sales contracts in the balance area and any transfer of energy between the areas. The time resolution depends on the balance area, eg, it is one hour in Finland and 15 minutes in Germany, due to country specific regulations.

The system administrator can specify and set: the parameters for the various balance areas; energy trading partners;

contract types; and the users' record sales and purchase transactions with prices, amounts, validity times and all other relevant information.

The results of the energy supply calculations together with measured energy consumption can be used to internally allocate energy costs, and bill consumers. They can also be used to verify external energy invoices.

The control center system compares the consumption forecast with available energy production capacity and existing purchase and sales contracts.

With the scenario management facility, the user can simulate "what-if" scenarios by modifying energy system parameters without affecting the real system data. For example, new purchase or sales contracts can be simulated to assess their profitability, or unit operating schedules can be changed to see how they affect related energy costs.

Eighteen mills in one energy net

The Finnish mills, and those in Austria, Germany, the United Kingdom and France, predict their future energy

Productivity



needs within their own mill systems

3 The control center systems in Jämsänkoski and Augsburg then collect and consolidate the mill-wide consumption and production histories and forecasts.

The mill systems predict both electric power and steam consumption. Natural gas consumption is predicted at those mills that use it as fuel. Some mills include water in their balance calculations, since process water manufacturing is a key paper mill resource. Water and steam, however, remain mill-internal issues and only the electric power and natural gas data are transferred to the control center.

ABB's Energy Management and Optimization product is the result of state-of-the-art software technology combined with years of experience.

The control center system compares the consumption forecast with available energy production capacity and existing purchase and sales contracts. It uses this information to help the control center staff place bids on the electricity markets in preparation for energy purchases and sales.

All of UPM's Central European electricity and natural gas purchasing is managed from the Augsburg control center. Due to the different electricity markets, and the difference in the energy supply structure of the company in the Nordic countries and in Central Europe, the systems in Jämsänkoski and Augsburg are not totally identical.

Pasi Svinhufvud was responsible for implementing the new energy management systems at UPM. "We try to save energy, and now have the tools to monitor energy expenditure in real-time. By keeping abreast of the situation, we can plan our operations to match our objectives. We use energy when it's cheapest and procure it from the sources that have the best market conditions for production," he said. "In the two energy control centers, we produce data on electricity and fuel market trends and forward it to the mills, thus enabling them to plan their own energy production. In return, we receive their generation plans, which allow us to manage the corporate energy balance. Mills that have extra electric power generation capacity can transfer it to the control center, which then either sells it to another mill or to the external electricity marketplace."

UPM emissions trading in Augsburg

Greenhouse gas emissions reporting and the trading of emission rights are

managed centrally at UPM. The Augsburg team trades emission rights on behalf of all the mills. The Jämsänkoski team plays a supporting role in the decision making and keeps emissions records on behalf of the Finnish mills. In a centralized system, the use of emission permits and emissions reporting can be managed cost-effectively, thus avoiding any work duplication.

ABB's system implemented early

ABB was able to implement the Central European energy management system two months ahead of schedule.

The updated Jämsänkoski control center and mill systems in Finland represent the fourth generation of ABB energy management systems at UPM. ABB's Energy Management and Optimization product is the result of state-of-the-art software technology combined with 20 years of experience gained in supplying hundreds of challenging industrial process information management systems worldwide.

This article was originally published in *ABB Review* 3/2005.

Jaakko Junttila

ABB Process Automation
Helsinki, Finland
jaakko.junttila@fi.abb.com

Marja-Liisa Parkkinen

(formerly) ABB Process Automation
Helsinki, Finland