Energy management solution for the process industry
cpmPlus Energy Manager
Reduce energy costs and improve profits

Energy cost, efficiency and environmental implications have top priority all over the world, in particular for heavy energy consumers. ABB’s cpmPlus Energy Manager offers the tools to help you reduce energy cost, improve your energy efficiency, and manage your carbon footprint.

ABB has extensive experience providing energy management systems for the process industry. ABB’s cpmPlus Energy Management solution is available for all facilities that consume large quantities of energy. Typical customers are found in the pulp and paper, metals and minerals, oil, gas and petrochemical industries.

cpmPlus Energy Manager helps you reduce energy costs and improve your overall carbon footprint. Many companies consider these goals essential to their viability as a business in today’s economy. Energy Manager is based on real time data from process monitoring systems, automation systems, production planning systems coupled with the information available from your energy providers.

Energy Manager includes planning and scheduling tools to help you optimize energy use and supply, energy balance management tools to help you get the best price for the energy you require, and reporting tools to help you monitor energy consumption, costs, efficiency and other energy-related information.

Energy Manager is scalable from a single facility energy reporting application up to a multi-facility company wide system serving hundreds of users as they manage energy planning and procurement for your corporation.

Opportunities for cost reduction are greatest when energy consumption and prices vary over time. Typically, cpmPlus Energy Manager can help you achieve overall cost reductions of 2 to 5 per cent of your company’s total energy cost. You can quickly calculate the savings using these simple factors:
- Payback results from reduced energy consumption and price
- Total savings (%) = consumption savings (%) + price savings (%)
- Total savings up to 2-5% of the energy bill

<table>
<thead>
<tr>
<th>Value of total savings (%)</th>
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<tbody>
<tr>
<td>20000</td>
</tr>
<tr>
<td>24000</td>
</tr>
<tr>
<td>28000</td>
</tr>
<tr>
<td>4%</td>
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<tr>
<td>3%</td>
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<tr>
<td>2%</td>
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<tr>
<td>1%</td>
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<table>
<thead>
<tr>
<th>Cost savings (£/yr or US$/year)</th>
<th>Reduction in Carbon footprint (Tonnes CO2 equivalent/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1%</td>
</tr>
<tr>
<td>8000</td>
<td>2%</td>
</tr>
<tr>
<td>12000</td>
<td>3%</td>
</tr>
<tr>
<td>18000</td>
<td>4%</td>
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<table>
<thead>
<tr>
<th>Site Energy Use (MM$kW)</th>
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<tbody>
<tr>
<td>0</td>
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<tr>
<td>20</td>
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<tr>
<td>40</td>
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<tr>
<td>60</td>
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<td>80</td>
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<td>100</td>
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<td>120</td>
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<td>140</td>
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<tr>
<td>160</td>
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<td>180</td>
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cpmPlus Energy Manager provides the opportunity for significant cost savings and increased profits. The savings result from various sources, for instance:
- Lower electricity purchase prices due to accurate consumption plans and real time power monitoring
- Avoiding price peaks and penalty charges
- Employing optimal resources in the supply of electric power
- Enhanced awareness of energy consumption and energy costs
- Early detection of poor performance based on real time monitoring of performance against set targets.
Comprehensive software toolset

cpmPlus Energy Manager provides a sophisticated and comprehensive toolset for managing and optimizing energy operations when your energy market offers the opportunity for variable pricing.

Planning tools for energy scheduling

cpmPlus Energy Manager includes planning tools that are used to predict energy consumption and calculate the corresponding energy supply schedule. In the balancing process, the schedules are calculated and agreed daily for the next day. In strategic planning and budgeting, the schedules may extend over several months, or even years, while during real-time monitoring they may cover only the next few minutes or hours.

Load planning

Consumption schedules for major consumers are calculated based on the planned production schedule. Production line load schedules are derived from the planned production grades and rates, which are received from production planning systems. As an example, in a steel mill, the arc furnace is the largest consumer. Its load schedule is based on planned production and typical load profiles during the melt cycle.

Other consumers’ load levels may be predicted using weekly load profiles. An outage with a low consumption level can be scheduled for any consumer. The total facility load schedule is calculated as the sum of individual consumption unit schedules.

The predicted load schedule contains valuable information for the power supplier, especially if consumption is high and varies over time. With the advance information of the load schedule, the planning and optimization of the supply schedule becomes possible. Large energy consumers can plan and optimize their energy supply themselves using cpmPlus Energy Manager, while smaller facilities may submit predicted load schedules to the power supplier. Accurate load schedules help lower the price of purchased energy.

Energy supply

cpmPlus Energy Manager balances time-varying energy consumption with supply resources. Your energy system is modeled as an Economic Flow Network. The Economic Flow Network considers the transfer and conversion of utilities such as fuel to steam, steam to electric power, fuel to CO₂, etc. Depending on your objectives, energy resources are scheduled/dispached to minimize the total energy cost or to maximize the total profit of the operation over a specified time range.

This configurable model is populated with data such as prices, volumes, validity times and other relevant information. The data may be either manual entered or acquired automatically, where available.
**Real-time balance monitoring**

cpmPlus Energy Manager can be used during the real-time operating phase to monitor the execution of power schedules. With real-time monitoring, deviations or unexpected events are detected and reported to help you minimize their costs. The load planning module automatically recalculates the load schedule based on changes in process measurements, production plans or user inputs. If an imbalance between predicted power consumption and planned supply is detected, the deviation from plan may be balanced through additional power trading.

The Power (Tie-Line) Monitoring module predicts total utility consumption within the current billing period by integrating and extrapolating the flow in the tie-line. If the predicted volume exceeds pre-set or calculated alarm limits, alarms can be generated enabling the operator to take action to limit the deviation.

**Planning and scheduling tools**

- Load Planning to predict and schedule energy demand
- Economic Flow Network model to balance energy demand and supply at optimal costs
- What-If Scenarios and Simulation to evaluate and compare alternative operating scenarios

**Day-ahead planning and optimization**

<table>
<thead>
<tr>
<th>Mill production plan</th>
<th>Load planning</th>
<th>Load schedule</th>
<th>Power supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power resources - availability - cost - constraints</td>
<td>Optimization of energy demand and supply</td>
<td>Resource schedules - purchase - sales - own generation</td>
<td></td>
</tr>
</tbody>
</table>

**Benefits:**

- Employ optimal power resources
- Lower power price by sending load schedules to power supplier
- Avoid expensive power by demand scheduling

**Real time balance monitoring tools**

- Load planning to predict short term consumption and imbalance with supply plan
- Power monitoring to predict current period consumption

**Energy monitoring and reporting**

**Real time monitoring and reporting**

<table>
<thead>
<tr>
<th>Resource schedules</th>
<th>Load schedule</th>
<th>Load planning</th>
<th>Predicted imbalance</th>
<th>Load control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power monitoring</td>
<td>Predicted energy import</td>
<td>Real-time measurements</td>
<td>Load control</td>
<td>Load control</td>
</tr>
</tbody>
</table>

**Benefits:**

- Lower balancing power and cost
- Lower demand charges and penalty fees
- Higher energy efficiency and reduced carbon footprint
Energy monitoring and reporting based on cpmPlus technology

The cpmPlus application platform comes with cpmPlus History, a relational database designed and optimized for high performance process data management. Industry standard interfaces, including OPC, SQL, and web services, are available for process data collection from various data acquisition systems and for accessing the collected information from external systems. There is no need for duplicate data definitions to connect into ABB’s system 800xA, improving engineering efficiency.

cpmPlus Energy Manager user interface has been implemented on Microsoft .NET technology providing a single click, role based, thin client user interface. cpmPlus Energy Manager tools and information are available to all authorized users with access to your company computer network. Users can implement application specific calculations using an interactive calculation tool, and the system is integrated with Microsoft Excel to automatically populate your spreadsheets with relevant information. The appearance of the user interface, including graphics, trends, and other display elements are fully configurable from the user client.

A modular product

cpmPlus Energy Manager is modular and allows an implementation to start small and grow over time. An entry level system built upon the cpmPlus application platform makes use of the cpmPlus History database, user interface, calculation and reporting tools to provide an Energy Monitoring and Reporting package. A system can be quickly and easily delivered to the customer, configured to collect process measurements, and applied to monitor, analyze and report energy use. The system helps reduce energy consumption by comparing the actual energy consumption against targets and identifying in real time the areas, where improvement is required.

Energy monitoring and reporting functions analyze the use of energy and utilities. They support energy efficiency improvement by quickly and accurately indicating actual performance and comparing it with set targets. Some examples of the performance reports are:

- Consumption and cost of utilities per hour/day/month/year, by individual and aggregated users
- Consumption and cost of utilities per end product unit
- Analysis of load profile and peak demand
- Benchmarking (comparing current performance against the past)
- Rating energy performance against targets
Managing energy resources and reducing costs

ABB’s energy management systems are based on over 20 years of experience gained in supplying hundreds of challenging industrial process information management systems worldwide.

UPM-Kymmene’s corporate-wide energy management system
UPM-Kymmene Corporation is one of the world’s leading manufacturers of printing paper. Energy plays an important role in production. As part of its corporate strategy, the company seeks a high level of self-sufficiency in energy production. In addition to using and generating power and steam, UPM is trading electricity with external partners on the local markets. Knowledge of expected energy demand and optimizing energy resources create significant savings.

To achieve this goal, the company has invested considerably in energy efficiency, availability and the predictability of energy supply & demand. The key tool in this area is the corporate wide energy management system consisting of 17 mill level systems - 10 in Central Europe and 7 in Finland – and two control centers. The system has been implemented and extended in several phases over more than 20 years.

The mill level systems collect real-time data from the process, calculate and report electricity, steam, water and natural gas balances and predict energy consumption considering the firm’s own generation capacity given the paper mill production plans. Energy balance data and consumption schedules are consolidated in control centers.

These control centers trade electricity and natural gas with external parties, and distribute the same commodities within the corporation at internal rates. Trading is based on the balance between predicted consumption schedules, the firm’s own generation, and existing sales and purchase contracts.

cpmPlus Energy Manager tools are applied when selecting the optimal balancing resources during the planning phase and predicting and monitoring the balance in real time.

The system also performs extensive reporting functions both at mill and corporate level, including greenhouse and flue gas emission reporting in accordance with the law and regulations.

Energy management at Mayr-Melnhof’s board mills
The Mayr-Melnhof Cartonboard Group is the leading producer of recycled cartonboard within Europe and world-wide.

In 2001, ABB delivered mill-wide energy management systems to several Mayr-Melnhof board mills in Austria, Germany, the Netherlands, Switzerland and Slovenia.

“We use the system to manage energy, water, chemicals, compressed air, production and quality data and statistics. The ABB system represents our connection between local processes and offices, and provides a handy instrument for optimizing the process and detecting failures more easily. We are happy with the system and have also ordered software version upgrades in order to obtain further benefits”, explains Mr. Johan Maier, responsible for energy and water management at Mayr-Melnhof.
The extent of the UPM energy management system is characterized by the following figures:

- 20 TWh electric yearly total procurement
- 100 energy resources including fossil, nuclear, and hydro
- 17 mill level systems and 2 corporate level control centers
- up to 600 simultaneous users
- 40,000 tags in databases
- 50 interfaces for process data collection
Energy management at Swiss Steel
Swiss Steel AG, located in Emmenbrücke near Luzern is one of the leading suppliers of high quality, refined and free cutting steels to European automobile, machine and component industries.

The energy management solution delivered by ABB to Swiss Steel reduces the price of electricity by sending predicted load schedules to the electricity supplier and monitoring actual consumption. These load schedules present consumption for the current and following day at 15-min intervals.

The energy management system receives the production plans of the steel mill and hot rolling mill from the production planning systems, and calculates the corresponding energy consumption schedules. The biggest consumer is the electric arc furnace, whose load changes sharply between zero and maximum power during a melt cycle of around 50 min. The rolling mill’s consumption depends on the type of end product and the mill train in operation.

Due to the electric arc furnace the load schedules exhibit a strong time variation. If the consumption schedule is not correctly predicted, the electricity supplier incurs additional costs, which are transferred to the user in the form of penalty charges. To avoid these penalties, any changes in production plans or disturbances in operation are continuously updated in the energy management system, and the revised load schedules are sent to the electricity supplier.

Operators monitor consumption using the tie-line monitoring display that activates an alarm if a deviation leading to a penalty charge is expected.

The energy management system allocates the energy costs to the users (mill departments). The penalty fees are shared between those users that have caused them by not consuming energy according to the predicted schedule. This will motivate the users to improve the planning of their operation and results in reduced energy cost to the entire facility.

Energy management & optimization at Public Works Government Services Canada (PWGSC)
PWGSC is responsible for government assets including office buildings, central heating and cooling plants as well as high voltage, water and sewage distribution systems that vary in size, complexity and age. Its activities include delivering, verifying, planning and reporting on utilities, such as electricity, natural gas, water and different grades of fuel, for all of these facilities. These tasks are complicated by the need to deal with different energy suppliers and different energy commodities for many internal departments and other government departments.

PWGSC found that the multiple budgeting, reporting, billing and planning systems in place could not effectively manage all of its required energy and asset management activities. As a result, it compiled comprehensive specifications for a new energy management system. The answer proved to be ABB’s cpmPlus Energy Manager, which PWGSC identified as the one “commercial off-the-shelf software package” that could provide it with a unified approach to energy conservation and optimization across all of its facilities.

Furthermore, by providing “what-if” scenarios and contract management, cpmPlus Energy Manager helps optimize energy costs. The system collects real-time data from different energy markets, such as the Independent Electrical System Operator, Environment Canada and other energy markets within North America. cpmPlus Energy Manager tools support the analysis of the cost impact of different combinations of electricity and natural gas purchased from different sources, and provide the information needed to negotiate and purchase different energy commodities directly from the main suppliers and markets.
The energy management system at PWGSC helps determine optimum energy conservation schemes for different buildings, so that they can be operated at maximum energy efficiency while reducing greenhouse gases. The reports include:

- Energy usage and cost per m² for all utilities per day/month/year
- Energy usage and cost by building
- Average daily profile – showing average pattern of demand over a specified period by individual meter/multiple meters/building
- Aggregate analysis – totalizing data points and determining peak, minimum and maximum consumption to determine demand-limiting options for all utilities.
- Normalization of building consumption against its characteristics
- Temperature and weather correlation
- Benchmarking
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