



Overview

Country or Region: Montreal, Quebec, Canada

Industry: Pulp & Paper

Company Profile

Montreal-based Abitibi Consolidated, Inc. is the world's largest producer of newsprint and value-added paper.

Business Situation

To create a system for monitoring electric power usage at multiple paper mills, enabling response to internal and external factors on a timely basis to reduce the cost of power following market deregulation in the province of Ontario.

Solution

The PI System provided a centralized archive for real-time production data that can be shared easily with other corporate applications, as well as linked to external data sources for optimizing electric power utilization.

Benefits

- Implemented entire system for \$77,000 (instead of \$3 million for an off-the-shelf application)
- Saved an estimated \$1 million in excess power purchases
- Saved an estimated \$450,000 a year for support and maintenance

Using the PI System to optimize power purchases saves Canadian paper maker more than \$1 million in the first year



“Our philosophy from the beginning has been that this energy management system doesn’t replace human involvement in the decision-making process. It simply provides the information to facilitate real-time business decisions. It doesn’t tell managers what to do, it just provides them with the information they need to make their own, timely decisions... management now has complete control over how they respond and how quickly.”

Guy Roussel, Senior Analyst, IT Planning, Abitibi Consolidated, Inc.



The company faced a Y2K-type deadline in 2001 when the province of Ontario confirmed plans to deregulate the electric power market on May 1, 2002. As a buyer of more than CDN\$100 million in electricity annually for its five mills in Ontario, the company was challenged to install systems that would allow the company to better monitor power consumption to match fluctuating market pricing and availability so it could afford to maintain production in the newly deregulated environment. This study reports on how the company saved millions of dollars - first by creating its own in-house energy management application rather than spending \$3 million for an off-the-shelf solution; second, by giving management an effective tool to proactively optimize production around market conditions. The second approach yielded a \$1 million reduction in electricity costs in its first year alone. The entire solution was created and deployed in less than six months.

Abitibi Consolidated

Abitibi Consolidated, Inc. is a major producer of wood products. The company maintains approximately 16,000 employees worldwide, deployed in 27 paper mills, 21 sawmills, three remanufacturing and one engineered wood facilities, and 10 paper recycling centers. Each year, Abitibi manufactures approximately six million tons of newsprint, nearly two million tons of value-added papers, and more than two million board feet of lumber. Recycling operations recover more than 2.2 million tons of recyclable paper.

Electrical power is a critical element in mill production processes. In 2001, Abitibi faced a huge challenge when the Ontario provincial government confirmed a deadline of May 1, 2002 for deregulation of Ontario's electrical power marketplace. Five Abitibi paper mills are located throughout Ontario - from Kenora, Fort Frances, and Fort William in the west to Iroquois Falls in the north and Thorold in the south, near Toronto. Together these five mills historically have purchased more than \$100 million in electrical power every year. In a regulated power market, this was never a problem. The company knew the cost per megawatt/hour and approximately how much power it would consume each year to produce the pulp and paper needed to service customer demand.

Electricity deregulation, however, raised a number of issues that directly affected Abitibi's ability to produce pulp and paper. Like any commodity marketplace, electricity is now subject to wide swings in both availability and pricing. Heat waves in the summer and intense cold in the winter will elevate power demand throughout Ontario.

Breakdowns of generating equipment and power availability in neighboring markets also affect the electric supply and cause fluctuations in pricing. Three of Abitibi's five Ontario mills have some degree of hydroelectric generating facilities so they can supplement or replace some provincial power as needed. What the company does not generate is purchased from the Ontario grid at market price or per contractual agreement. Poorly managed power purchasing could result in additional costs of hundreds of thousands of dollars.

Responding to this situation required that Abitibi put in place a system that could overlay energy market information on its real-time electrical consumption so that they could monitor real-time conditions and make better business decisions on a more timely basis. Abitibi first investigated off-the-shelf energy management systems, but the only potentially suitable solution was priced at about \$3 million, not counting annual support and maintenance costs. These costs were prohibitive, given the current economic situation in the newsprint market. The company then examined Ontario operations to see if it could build its own in-house application more cost-effectively. After much creative reflection from a team that included personnel from both mills and head office, the company decided the answer was yes; Abitibi had the tools in place to create its own system. While that might not offer all the "bells and whistles" of the packaged system, the company felt that it nevertheless had all major factors covered.



Abitibi accomplished all of this within a total budget of only \$77,000, using existing internal staff, instead of spending \$3 million plus an estimated \$450,000 a year for support and maintenance.

Leveraging the PI System

One element supporting the system was Abitibi's existing PI System from OSIsoft, Inc. of San Leandro, California. The PI System was already in use at 18 of Abitibi's mills, functioning as the nerve center for all production data and reporting. The Platform was linked to various equipment, such as DCS systems and programmable logic controllers (PLCs), via Windows-based human machine interface (HMI) software. Because the PI System was on the critical path for managing production at each mill, each System could be tapped to provide necessary raw process data, including metering information.

Primary modules included the OSIsoft's PI System™ real-time data engine, PI ProcessBook,™ and PI DataLink.™ For Abitibi, Microsoft SQL Server is an integral part of the solution because it is extremely reliable and facilitates deployment of the application in the various sites. With MS-SQL 2000 and Visual Basic (which is the company's corporate standard) and the PI API, Abitibi had all necessary tools required to develop its Energy Management System (EM-SYS). The company is taking full advantage of the Microsoft ecosystem by using OSIsoft products, Microsoft tools (Visual Studio), and components from such Microsoft partners as ComponentOne.

Abitibi added a PI server at one mill that previously did not have one, and added a second PI server at headquarters offices in downtown Montreal. That server functioned as the control center for the entire application. The company redeployed an earlier PI System as a hot backup so that if anything happened to the primary server, they could switch over instantly. They then set up DataLink™ between the remote PI servers at each mill and the center in Montreal (Figure 1).

The next step was to deploy OSIsoft's HTML interface, accessing the new Independent Electricity Market Operator (IMO) Web site to obtain market information over the Internet. The IMO is to the electric marketplace what the stock market is to the financial world. This link provides continuous, up-to-the-minute information on the availability and pricing of electricity. The company also set up a link to the Environment Canada Web site so that they could collect current weather information on both the metropolitan Toronto area and mill locations, in order to match weather changes to market conditions. They extended the use of PI/HTML by gathering information on the commodities futures markets for natural gas and crude oil.

In October 2001, the company began to work on this solution, which it called the ACI Energy Management System (EM-SYS). One positive aspect to immovable deadlines is that they force people to work together for a common goal. In this case, Abitibi absolutely had to complete the project before May 1, 2002. They were fortunate in enjoying the full support of executive management, allowing them to request the services of internal resources, including key programmers and specialists from various North American locations for temporary assignment to the project.

Abitibi's IT staff worked closely with both corporate management and mill energy managers to determine their exact needs. Design and programming staff from various divisions worked together to build applications specifically to fit those requirements. They used the PI ProcessBook to create the system's graphical user interface, which incorporated PI DataLink for reporting and exporting data into other applications, such as Excel for spreadsheets. Since they were able to gather any necessary production data from any mill, in real time, they could overlay energy needs on required and actual loads. They also created links between the PI Systems and electric meters at each site, so they knew exact power usage patterns during any production situation. Finally, they used a small OSIsoft utility called eNotification, allowing automatic sending of e-mails to support groups when a system problem arose or major price change occurred. Some mills also integrated their paging system into EM-SYS.

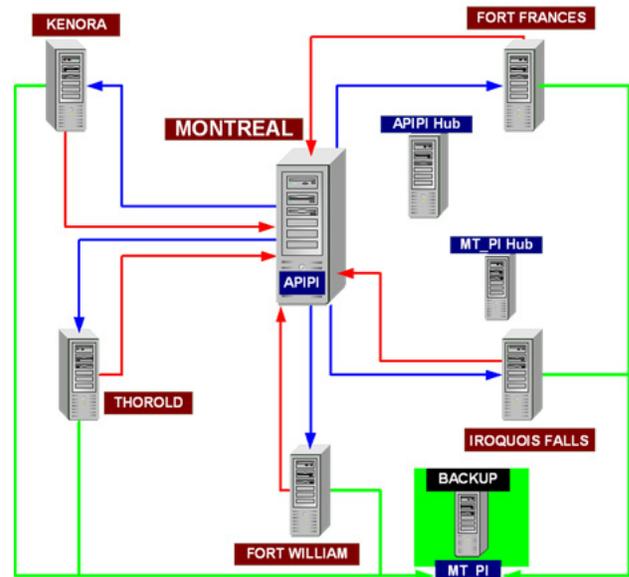


Figure 1. System diagram for ACI/EM-SYS

Easy navigation overview

On the IT side, the heart of the EM-SYS system is the System Watch screen, which monitors all servers, hubs, and links on a 24x7 basis and provides continuous information on how the network is running (Figure 2). Should a connection be lost, an alarm flashes and an email is sent to appropriate personnel, and to the mill's IT manager. This screen provides an overview of all five mills and their consumption at every moment, along with Web connections to the IMO, Environment Canada, and other valuable sites. Messages can be posted by EM-SYS users and can be seen throughout the system.

The Control Center screen (Figure 3) allows operators and managers to look at any of the five mills to see their planned demand, their actual load consumption, weather-related factors and comparison of actual versus planned consumption. Staff can also click on the IMO Price Watch to monitor current and forecast prices.

EM-SYS also includes a Load Plan Module that allows each mill to plan its daily load. This load plan shows a one-day window, with small rectangles representing fifteen-minute increments. This screen covers all heavy equipment for that mill, such as the thermo-mechanical pulp systems, refiners, paper machines, winders, and so forth. The base load is configured for every piece of equipment according to how many megawatts of power each machine consumes at full speed. A green display means that for a specified period of time (i.e., between midnight and 7:00 a.m.) it will consume X amount of electricity. Yellow indicates the equipment is running at partial load - somewhere between 0 and 100 percent. Users can drill down and see, for example, that the day's production plan in one mill may be to run from 7-7:15 a.m. at 11.6 MWH, or 65 percent capacity, enabling various strategies to be planned for critical times. When units are red, the equipment is off and there's no power load at all.

This load plan screen allows management to click on a button, call up the data and see when different pieces of equipment are going to run (Figure 4). They also can see the status of all turbine generation equipment.

Abitibi considers generation to be a negative load because it's electricity they don't have to purchase from Ontario Power. Managers can adjust production to match power availability and pricing by clicking on the Update button, then selecting the equipment they want to run for a selected time period along with percent utilization (Figure 5). They can quickly build daily scenarios simply by selecting equipment for operation at desired time periods.

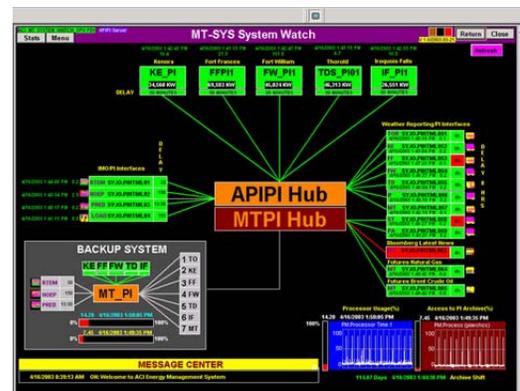


Figure 2: The System Watch screen, which gives IT staff an overview of every element of the ACI/EM-SYS energy monitoring system to monitor status of servers, PI historians, and current electricity consumption figures.

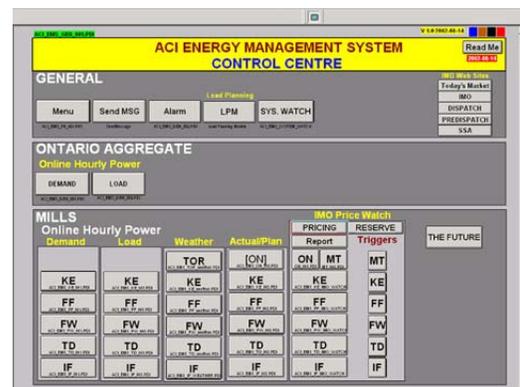


Figure 3: The Control Center screen allows operators and managers to monitor planned demand for all five mills, along with actual load consumption and weather-related factors. It also provides one-click electricity pricing checks.

Flexible monitoring means more options

Abitibi monitors aggregate demand for the five Ontario mills as well as individual mill demands. Mills such as Iroquois Falls have their own generation facility, so they might have a negative load because their power purchases go down when they're generating during the day (Figure 6). They can purchase electricity at night and use their own generation during the day. When the price is high they can elect to shut down some equipment - or even the entire mill if the situation demands - and sell their generation to the grid. At times, electricity is the commodity of the day. Having this overview of the entire system is important because they're not only concerned with power purchases, but they want to maintain their water level behind the dam.

Abitibi also monitors aggregate demand for the whole Ontario grid to track demand variation. Green and red lines indicate positive or negative demand (Figure 7). Yellow graph lines show the maximum load incurred for the month on an hourly basis. The market has different rules, regulations, and costs for high and low peaks, both day and night, so they must monitor the maximum that they consume during those peak periods to achieve the lowest maximum peak during the daytime. The strategy is to incentivize users not to use peak loads during high demand periods.

The company even factors in the weather (Figure 8). They draw data from Environment Canada's Web site and primarily monitor the Toronto area because it's so heavily populated, making demand vary more widely. If the temperature rises in Fort Frances, it won't affect the grid much; but if it rises in Toronto, the grid will be heavily affected. They monitor temperature, wind chill, dew point, wind speed, relative humidity, atmospheric pressure, and even precipitation, which is important for the mills that perform generation because they want to know whether the water level in their dams is rising or falling.

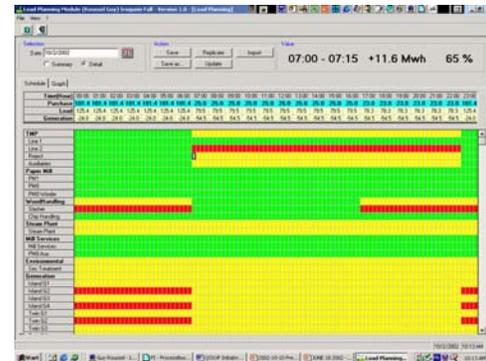


Figure 4: This typical load planning module screen lets mill operators schedule heavy equipment use for each process task, based on optimal times for power consumption.

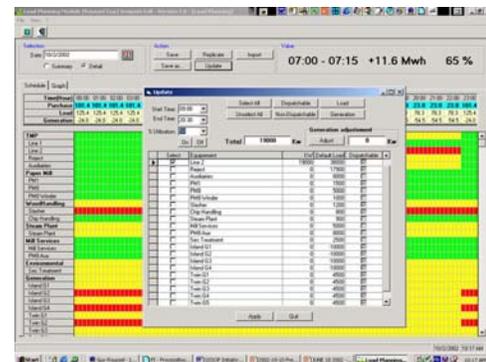


Figure 5: The load-planning screens can be updated easily to adjust to changing pricing conditions. Results are reflected instantly in the load planning module, visible to all plants.

Realistic pricing

All of this information comes together in the pricing arena. Abitibi pulls pricing information from the IMO site on three price variants. The first is the Real Time Energy Market (RTEM), which basically is the spot market for electricity. This pricing is updated every five minutes. In addition, Abitibi monitors the Hourly Ontario Energy Price (HOEP), which is the hourly average of RTEM pricing. Since pricing is based on HOEP, this is the most important figure. Using RTEM, a predicted HOEP can be calculated every five minutes, so operators have a sense, in advance, of the true HOEP at the end of the hour. Five-minute tracking provides a heads-up so the company can anticipate the hourly average.

The third price movement tracked is what the IMO calls the Pre-dispatch, or forecast for the next day. This comes between noon and 1 p.m. every day. So far the IMO's forecast pricing has not been very reliable, but it can be useful as a rough indicator for planning the next day's operations.

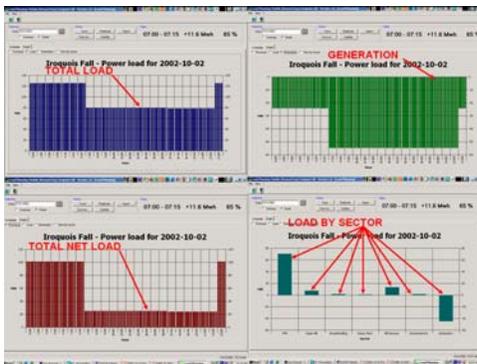


Figure 6: This screen shows the load plan for Iroquois Falls, which is set to run at about 65% of capacity for this 15-minute period in the morning.

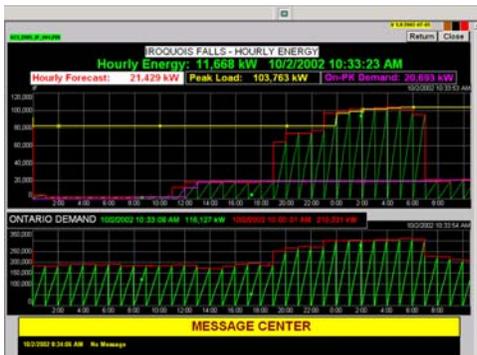


Figure 7: This hourly view of consumption at Iroquois Falls graphs actual vs. planned demand and provides an overview of how the mill is staying with peak limits of the IMO.

The result - tightly controlled costs

The system has worked very well during its first year of operation. Before the market was deregulated, consumers and corporations alike paid \$43 per megawatt/hour. Since deregulation, the average cost has been \$59 per MWH from May 1, 2002 to April 9, 2003. Thanks to the EM-SYS Abitibi has had an even more granular view, helping the company to fully optimize energy costs. For example, from May to December 2002, average cost was \$52 per MWH, but from January to April 2003 it was \$75 per MWH, due to weather conditions. Now, pricing can be viewed on a basis of five-minute increments or any average up to one year.

The bottom line is that electricity is more expensive now. When a company is consuming millions of megawatt hours, efficient management is critical. Abitibi must be able to respond to fluctuations on a continuous basis or suffer huge losses. As an example, during the first year of EMI-SYS operation, the HOEP showed at one point a peak of about \$800 for one hour. One mill reacted to that right away and altered production operations. Another looked at it and doubted that pricing was accurate. At the end of the hour the staff called the IMO to verify the data. It was correct, and that hour cost one mill tens of thousands of dollars.



Figure 8: The ACI/EM-SYS Weather Center screen shows all weather factors for the previous day's actual conditions and the current day's forecast, since weather can have a big effect on power consumption.

Planning ahead with confidence

How does this information help Abitibi in planning operations? If the market is very high, for example \$200 per MWH, and management schedules a shutdown for the next day, management might decide to take the shutdown right away and sell that power - which automatically goes to the grid at market price. Or they may decide, when possible, to run their pulp machines at night, when the cost is lower. The company cannot accumulate electricity but it can make and store pulp if it has the capacity and reservoirs, so the power goes straight to the market at the market price and the company nets that per-megawatt price.

Another scenario might be to have a mill run its own generation during the day, when prices are high, if they must make paper to meet customer deliveries. They can then purchase power at night, when it's cheaper. If the EM-SYS system indicates that a certain generation/consumption profile might last for a period of days, management can use the Replicate button to preserve that profile and use it for the duration. Or if they're planning a maintenance shutdown for 10 days, they can build or replicate the profile for that. The system is so easy to use that some energy managers have even saved standard scenarios by name.

The PI System: a decision-making tool

Abitibi's philosophy from the beginning has been that an energy management system doesn't replace human involvement in the decision-making process. It simply provides the information to facilitate real-time business decisions. A system doesn't tell managers what to do, but rather provides them with the information necessary to make their own timely decisions. Also, mistakes can be reduced or eliminated. The system provides pricing and mills integrate that into their local business rules. Different mills will have their own respective strategies depending on paper grade, the money they make on it, and other factors - but management now has complete control over how it responds and how quickly.

As Jean-Guy Trudel, Abitibi Consolidated Vice President, Newsprint, states: "This new tool enables the five Ontario mills to manage their electricity consumption and save an estimated CDN\$1 million per year. In addition, the system can be adapted for the company's other mills in the short term with minimum modifications."

And Abitibi accomplished all of this within a total budget of only \$77,000, using existing internal staff, instead of spending \$3 million plus an estimated \$450,000 per year for support and maintenance.



Figure 9: The IMO Energy Price Watch screen brings together all factors that drive MWH pricing in Ontario. This screen includes the Real Time Energy Market (RTM), the Hourly Ontario Energy Price (HOEP), and the pre-dispatch pricing for the next day so that mill operators can better plan the next day's process activities. The message section on each screen lets them highlight information communications among themselves as well.