***Xstrata Zinc – Brunswick Mine, located in Bathurst, New Brunswick, is the world's largest underground zinc mine. Since the 1970s, the company has employed energy management techniques to reduce costs and improve efficiency. With an EMIS in place and a goal to reduce energy intensity by 1% each year; the company exceeded its target, cutting energy intensity by 8% from 2006 to 2008.***

## For more information:

Jean-Guy Paulin, P. Eng.
Energy Management and Six Sigma Black Belt
Xstrata Inc.—Brunswick Mine
Bathurst, New Brunswick
Tel: 506-546-6671

www.xstrata.com and
www.xstrata.com/operation/brunswickmine
JPaulin@xstratazinc.ca

*Efficiency NB's industrial program is designed to help accelerate industry investments. By using energy-reducing practices and new equipment that will lower energy intensity, it will allow industry members to better manage their energy costs in the long term while improving their competitiveness. For more information on Efficiency NB visit www.efficiencynb.ca.*

*An Energy Management Information System (EMIS) is comprised of data collection instruments, software to process the data and a reporting and management structure that helps industries turn information into action.*

## Mining the energy savings at Xstrata Brunswick Mine

Xstrata Zinc – Brunswick Mine (Brunswick), owned by Xstrata plc of Switzerland, is one of the world's largest underground zinc mines. With more than 800 employees, Brunswick has mined more than 125 million tonnes of ore containing zinc, lead, copper and silver since 1964.

Energy—the majority of which is generated by electricity and bunker C oil—represents about 13% of Brunswick's operating costs, using the equivalent of 600 million kilowatt hours each year. Parent company, Xstrata Zinc, has a target is to reduce average energy consumption by 1% each year, while Brunswick has reduced its energy intensity by 2% each year since 2005.

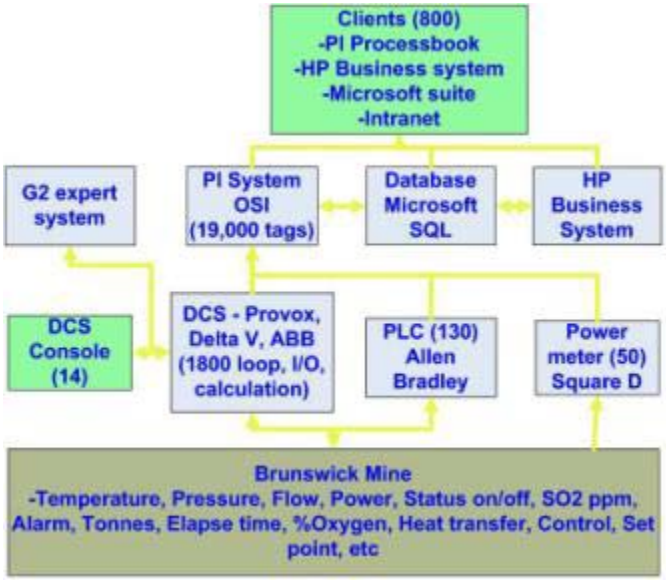
Few North American mining companies have as long a track record in energy management as Brunswick. Jean-Guy Paulin, Brunswick's energy manager, says that it was the oil crises of the 1970s that first spurred the company to manage its energy costs.

Brunswick began by metering electricity, bunker C and compressed air usage. As management information system and data management software technology improved, Brunswick integrated its metered energy data with its production process data to create operational energy information used by plant managers and operators. A data historian, implemented for process control purposes, was then used to convert the energy data to energy management information, creating a "home grown" energy management information system.

# Brunswick's Energy Management Information System

Brunswick's EMIS includes:

- Meters that capture energy data from about 200 key production process locations. Since all plant operational energy data is instantaneous, process control adjustments can be made in real time. All meters are connected to a data collection system, which then transfers the data to the company's information system (PI Processbook).
- Energy management information (PI Processbook-based) available via Brunswick's network in real-time for operations management. Energy information about each of the mine's processes allows staff to analyze the data, model energy performance and control energy usage.
- Energy data integrated with distributed control systems for production process operators.




**The schematic shows how information from the various meters is connected to the Brunswick information system. Graphic courtesy of Xstrata Brunswick Mine.**

Energy information is used to manage Brunswick's energy performance by displaying key performance indicators, usages, trends and reports in real time at operations managers' desktop computers and on the operators' production process control system interface screens. As a result, operations management can track progress toward energy reduction for each process area.

In 1999, Brunswick adopted Six Sigma,[1] a data-driven business management strategy that can be applied to virtually any industry to eliminate waste and defects in operations. Jean-Guy Paulin, Brunswick's energy manager, is a Six Sigma Black Belt.[2]

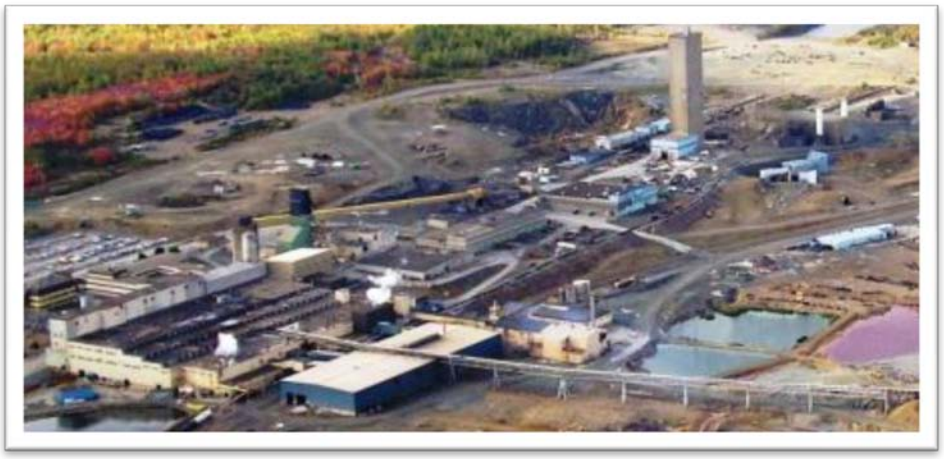
Xstrata plc, also developed a corporate-wide Sustainable Development Framework,[3] which guides Brunswick's energy management program. The framework's 17 development standards include standards for sustainable and efficient resource management and lifecycle management.

[1] www.isixsigma.com.
[2] According to the Six Sigma Academy, Black Belts can save companies up to $230,000 per project.
[3] www.xstrata.com/sustainability/sustainable_development/standards.

## Actions

Since Brunswick has been engaging in energy management for decades, this case study reviews some of the actions taken by the company in more recent years.

As noted above, Brunswick's EMIS continually captures data on how and where energy is used throughout its operations. Mr. Paulin explains that this information helps the company decide which of the mine's operations offer the most promise in terms of energy savings.



An aerial view of Brunswick Mine. Photo courtesy of Xstrata Brunswick Mine

### *Waste heat recovery*

At Brunswick, steam is used extensively in the concentrator's flotation process. The steam is produced from bunker C-fired boilers, so any reduction in steam use would directly mitigate oil costs, as well as significantly reduce greenhouse gas (GHG) emissions.

In 2004, Brunswick began working within the Six Sigma process to develop an energy balance that would identify waste heat that could be recovered to reduce the steam load. The analysis was supported by real-time energy data captured by Brunswick's EMIS. The energy balance was integrated with Brunswick's metallurgical simulation model to evaluate the benefits of planned actions. The zinc dryer exhaust, compressor cooling water heat exchanger and thickener overflows were identified as the main sources of waste heat.

Detailed engineering led to the zinc dryer exhaust waste heat recovery project. Working from a design developed by both internal and external engineers, a 20-foot high tower with a 60-foot stack was constructed; the tower is designed to recuperate 95% of the available heat, heat that is then used in the flotation process.

At the beginning of 2007, the tower was connected to three of the mine's five dryers and, after one year in operation, the project had cut steam consumption by 16% and reduced energy costs by $850,000. Scrubbers inside the tower have also reduced particle emissions into the atmosphere by 25% and total both direct and indirect GHG emissions by 2.2%.[4]

[4] www.xstrata.com/sustainability/case_studies_2007/xstrata_zinc/01/.

Waste heat was also recovered from the thickener overflows and the compressor cooling water. In total, these waste heat recovery projects have reduced the steam load by an average of 20 GJ per hour, GHG emissions by 13 kilotonnes annually and saved approximately $2 million per year.

Other projects have included:

- Computer-controlled fans. Of the mine's 230 underground auxiliary ventilation fans, 70 are computer-controlled to shut down twice daily in areas where they are not needed
- Mine air heating optimization. Propane, used to heat the mine workings in winter time, is controlled by a sophisticated control algorithm that tracks the build up of ice in the ventilation shaft
- Peak power control. A computerized system is used to manage the plant's electrical demand peak and optimize electricity peak demand charges.
- Steam trap audit and condensate system optimization.
- Root blower speed reduction. A variable speed drive is used to optimize air flow.
- River pump flow optimization.

## Challenges & Benefits

The mine is now reaching the end of its life and capital for large projects is limited. As a result, energy management and Brunswick's EMIS have become key elements in management's efforts to implement cost saving measures at minimal expense.

"We will continue to look for energy reductions as long as there is money to be saved," says Mr. Paulin.

### *Results*

- In 2007, Brunswick reduced energy consumption by 6%, exceeding its 1%/year reduction target
- The zinc dryer waste heat recovery project saved the company $850,000 and captured the 2007 Innovation Award from the Consulting Engineers of New Brunswick.
- Overall, compared to 2005, Brunswick has reduced energy intensity by 8% and direct GHG emissions by 18,000 tonnes (21 %). Of that 5,500 tonnes was due to the zinc dryer project.

### *Advice to others*

Mr. Paulin believes that employee involvement is a critical aspect of any company's EMIS. "You need to increase the knowledge of your employees and allow for a discussion of the issues," he says. If employees don't have an understanding of energy management, he explains, it's difficult to engage them in energy-reducing strategies.

He also advocates that industries just starting down the EMIS path perform a general energy audit of their operations. “Without the data, it would have been impossible to manage our energy utilization and identify and justify new projects,” he says. “Once you know your energy usage, you can determine which areas you want to concentrate on.”

In addition, Mr. Paulin says that energy managers should be cautious about trying to do everything at once. “You get credentials by concentrating in one area and getting results. Even small changes can have big impacts.”

## Next Steps

According to Mr. Paulin, the next step is to incorporate energy target settings within each major area or processes to provide a better set of tools to help manage energy. “Employees use energy management techniques as part of their regular job, to save money and to improve operations, but we need to improve energy performance information. ” says Mr. Paulin.

“We’re exploring our options now with respect to our energy management,” he says. “We have made very good progress, so we want to ‘sustain the gain’ by improving on what we already have.”