# Paper mill reduces compressed air, steam, and water use

A MnTAP intern evaluated compressed air, steam, and water use at the paper mill to determine opportunities to save energy and water. The implemented solutions save the mill $92,000 per year.

Boise Paper Solutions, previously Boise Cascade, is a wood products and paper company headquartered in Boise, Idaho. They own and operate a 1,500 ton capacity paper mill in International Falls, Minnesota.

The paper industry exists in a highly competitive global market, so taking advantages of opportunities to improve efficiencies is important to survival. The process of making paper is both energy and water intensive. Boise is a large facility with high energy costs. Opportunities to increase efficiency can lead to direct reductions in the company's bottom line. Boise treats and heats much of their water which provides an opportunity to improve water and energy conservation efforts and is a potential for cost savings.

Engineering staff at Boise were vital in identifying opportunities for energy and water savings at the mill. Due to a lack of time to spend on all of the improvement projects at the mill Boise requested a MnTAP intern to help scope and determine the feasibility of implementing energy and utility-saving projects. The intern's focus was on investigating the compressed air, steam, and water systems for potential reduction opportunities. The recommendations included improving maintenance practices and re-engineering systems.

## Compressed Air

Compressed air is used throughout the mill, for operating pneumatic process control equipment and guiding paper through the equipment during operation and process interruptions, such as paper breaks.

## Benefits Overview

| Waste Reduction Option | Waste Reduced/ Materials Savings | Annual Cost Savings |
|---|---|---|
| Compressed air adjustments | 119,000 kWh | $4,800 |
| Steam line insulation | 8,700 mmBTU | $87,200 |
| **Total** | | **$92,000** |

The MnTAP intern (right) worked with a Boise Cascade supervisor to evaluate compressed air systems in the paper mill.

### I1 Excess Air to Base Mill

There are two major sections of the Boise mill: the base mill, the older part; and I1, the newer section. The base mill and I1 have independent compressed air systems. The base mill has six main rotary screw compressors totaling over 1600 hp, and I1 has three 500 hp centrifugal air compressors. Centrifugal compressors have a limited ability to throttle back their output because of a destructive condition known as surge. To avoid surge, the I1 compressors were connected to a vent pipe with a control valve. The control valve would open, based on a pressure signal, and bleed compressed air from the system to avoid the surge condition. This control scheme protects the equipment, but it wastes compressed air and energy. In the base mill, the rotary screw compressors are adaptable to throttle back without wasting compressed air.

The MnTAP intern investigated opportunities to connect the two air systems so the centrifugal compressors could run fully loaded and the base mill rotary screw compressors could efficiently throttle back to match plant needs. Much of the pipe needed to connect the two systems was already in place in a bridge between the plants. The intern gathered cost information about pipe welding and other related equipment for the tie-in, such as valves, check valves, and control valves. The project is planned to have a six month payback



MnTAP • 200 Oak Street SE, Suite 350 • Minneapolis, Minnesota 55455-2008
612.624.1300 • 800.247.0015 (Minnesota only) • FAX 612.624.3370 • www.mntap.umn.edu

and could result in savings of $64,000 and 1.2 million kWh of electricity annually.

### Outside Air for I1

Centrifugal air compressors are able to improve efficiency by using colder intake air rather than denser warm air. The mill location, International Falls, puts the mill in an ideal setting for a cold air intake system. Additionally, the I1 compressors are conveniently located near an outside wall so ducting the intakes to the outside is inexpensive. One concern with using outside air was the capability of the motors driving the compressors. The MnTAP intern talked with plant personnel and compressor manufacturers and their suppliers to determine that the existing motors could handle the added load created by taking air from outside. The outside air modification is a planned improvement that will have a 10 month payback and will yield $20,000 per year and 400,000 kWh per year savings.

### Find and Fix Air Leaks

Compressed air leak detection and repair should be an important part of any manufacturing facility's maintenance plan. However, like many facilities, Boise had not been checking for and repairing leaks. The intern ran economic calculations on known air leaks in the plant and found that 2.4 million kWh or $60,000 per year in savings were available by fixing compressed air leaks. The evaluation prompted Boise to re-establish their compressed air leak detection and repair program.

### Compressed Air Condensate Drains

Compressed air systems must be drained of condensed moisture to ensure proper operation of the pneumatic equipment downstream. Automatic condensate drain valves open up on a timer to let condensate drain from the bottom of air receivers. The MnTAP intern timed the drain valves and calculated how long it took to evacuate the condensate from the system. From this study the timer settings were changed, saving 119,000 kWh and $4,800 per year.

## Steam

Steam is used at the mill to heat water and dry the paper as it goes through the paper machine.

### Insulate Steam Lines

Most of the steam lines at Boise Cascade are well insulated, but in any facility of its size there is a certain amount of maintenance and repair on the steam system. Sometimes these repairs require removal of steam line insulation, and with the large amount of maintenance demands at the mill, insulation is not always replaced right away. The MnTAP intern inventoried the steam systems in the mill for missing insulation and insulation in need of repair. The intern created a list of insulation projects and prioritized them based on energy losses. The energy loss calculations were performed using the US Department of Energy's software, 3EPlus. A total of 8721 mmBTU per year of energy losses were identified. Insulating these lines saved Boise over $87,200 per year in thermal energy.

## Water

Water is used to create pulp slurry, to wash down screens and other parts of the paper machine, and to cool equipment.

### Replace Work Knock-off Shower Nozzles

Knock-off shower nozzles spray pressurized water onto the backside of the paper machine web to clean debris before the paper gets to the front end of the machine. It is common practice to replace these nozzles every two years due to wear which results in a larger nozzle diameter. The I2 paper machine at Boise had not had its nozzles replaced in over 10 years. The MnTAP intern measured that the diameter of the nozzles had increased by 70%. Flow testing is required to determine the exact amount of excess water being used. However, a nozzle diameter increase of just 10% would result in an excess 17.9 gallons of water per minute than required. Additionally, energy was wasted by heating the excess water. By replacing the nozzles, 9.2 million gallons of water and 410 mmBTU could be reduced, a total of $6,500 in potential annual savings. Boise replaced the nozzles in the I2 mill, and is now planning to check the remaining nozzles throughout the mill.

## Results and Benefits

The MnTAP intern project helped Boise Cascade implement solutions saving the mill 119,000 kWh, 8,700 mmBTU, and $92,000 per year. The recommendations that are in the planning stage could result in reductions of 9.2 million gallons per year, 4 million kWh per year, and 410 mmBTU of thermal energy. These reductions could provide an additional $150,000 in savings to the paper mill.

#193 08/10

## For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <mntap.umn.edu>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's Intern Program.

*This project was conducted in 2007 by MnTAP intern John Kallemeyen, a junior in chemical engineering at the University of Minnesota Duluth.*