MECHANICAL INSULATORS
LMCT
Labor Management Cooperative Trust
ENERGY CONSERVATION SPECIALISTS

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The following pages will outline a case study, which shows the benefits in energy and cost savings of properly installed mechanical insulation.

Insulation is a proven means for conserving energy, reducing greenhouse gas emissions, increasing process productivity, providing a safer and more productive work environment, controlling condensation (which can lead to mold growth), supporting sustainable design technology and a host of other benefits.

Mechanical insulation does all of this, while providing a return on investment (ROI) rate, which is seldom rivaled. Despite the proven ROI, insulation is often overlooked and its benefits undervalued. Insulation is truly the lost or forgotten technology. Can you think of a more important time than now to think about how insulation can help you?

An insulation system is a technology, which needs to be engineered and maintained throughout the entire process. Several studies have estimated roughly 10 to 30 percent of all installed insulation is now missing or damaged.

The practice of not replacing or maintaining an insulation system in a timely and correct manner reduces the full benefits of insulation, and in return, decreases the ROI. In many cases, significant other issues - such as excessive energy loss, corrosion under insulation (CUI), mold development, increased cost of operations and reduced process productivity or efficiency - develop.

You can learn more on www.MechanicalInsulatorsLMCT.com, where additional case studies can be viewed.

Please do not hesitate to contact me should you have any additional questions.
Thank you,

Peter Ielimi

Executive Director
Mechanical Insulators Labor Management Cooperative Trust

BOISE INC. ST. HELENS PAPER MILL ACHIEVES SIGNIFICANT FUEL SAVINGS

ANNUAL ENERGY SAVINGS EXCEED $1 MILLION

BENEFITS

- Achieved annual energy cost savings of more than $1 million
- Achieved annual fuel savings of approximately 154,000 MMBtu
- Revealed innovative method to save energy
- Generated a simple payback of less than one month

Located at Mt. Iron on the Mesabi Iron Range in northern Minnesota, the U. S. Steel Minntac plant produces approximately 14.5 million tons of taconite pellets annually.

KEY FINDINGS

- Boise Inc.'s St. Helens mill has a successful energy management program.
- The Save Energy Now assessment validated some projects that were being considered and uncovered additional savings opportunities.
- After the assessment the mill achieved significant fuel savings by reducing energy use of a parasitic load.

APPLICATIONS

Steam systems are widespread in the pulp and paper industry and can account for a significant part of a paper mill's fuel consumption. Improving the efficiency of a paper mill's steam system can significantly reduce energy costs while maintaining reliability.

SUMMARY

In April 2006, Boise Inc. received a U.S. Department of Energy (DOE) Save Energy Now assessment at its pulp and paper mill in St. Helens, Oregon. The goal of the assessment was to evaluate and identify natural gas savings opportunities in the mill's steam system. The assessment was performed by DOE Energy Expert David Morgan of Akamai Energy LLC, who also provided training to the mill's employees on how to use DOE's suite of steam system software tools to identify energy savings opportunities.

Following the assessment, personnel at the mill took a strategic approach to the mill's steam system. The assessment validated some measures that were under consideration, such as lowering the oxygen (O2) content on three boiler stacks and recovering waste heat from the whitewater process. Then, using some of the insights gained from the assessment, they identified and implemented a project that significantly reduced energy use by a process in the steam system. As a result, the mill achieved total savings of approximately $1 million annually in energy costs and 154,000 MMBtu in fuel. With total implementation costs of $31,000, the mill achieved a simple payback of less than one month. In addition, the results of the implementation of the mill's opportunities were shared with other Boise Inc. paper mills in the United States.

PROJECT DRIVERS

The St. Helens mill has a proactive energy management policy and participates actively in Oregon state-sponsored energy efficiency efforts. As a result, the mill's employees continuously strive to improve the energy efficiency of the mill's process, thermal, and motor-driven systems. The Save Energy Now assessment validated some opportunities that mill personnel had considered and helped them look at other process areas for ways the plant could reduce energy consumption. This led the mill's personnel to uncover an opportunity to reduce parasitic use of steam with significant energy savings potential.

COMPANY AND PLANT BACKGROUND

Headquartered in Boise, Idaho, Boise Inc. manufactures packaging products and papers includ-ing corrugated containers, containerboard, label and release and flexible packaging papers, imaging papers for the office and home, printing and convert-ing papers, newsprint, and market pulp. In 2007, the Paper and Packaging businesses posted net sales of $2.4 billion.

Boise Inc. operates five integrated pulp and paper mills, five corrugated products plants, a corrugated sheet plant, two distribution facilities, and a trans-portation business. The St. Helens mill employs 500 people and produces nearly 1,000 tons of pulp and specialty paper per day, including a wide variety of light-to-heavy weight paper and napkin-grade tissues. The mill's steam system is served by six boilers, including two Kraft recovery boilers that can run on black liquor and No. 6 fuel oil, and four dual-fuel package boilers that can operate on natural gas and No. 6 fuel oil. On average, the steam system gener-ates more than 340,000 lbs/hour, which is delivered in three pressure headers at 400, 235, and 50 psig, respectively. Steam is used to dry paper, create wood pulp, and help drive seven steam turbines.

The mill has a vigorous energy management program headed by a dedicated, full-time energy engineer supplemented by efforts from an employee energy team. Employees utilize a modern suite of process management tools to track and trend energy usage and performance metrics in real-time. All personnel have access to energy usage data and are encouraged to suggest ways to improve energy efficiency and production.

Goodyear is the nation's largest supplier of tires to the original equipment market. Steam trap maintenance is critical to ensuring that the Union City plant's tire presses operate reliably and produce a consistent product.

ASSESSMENT OVERVIEW

The Save Energy Now assessment at Boise Inc.'s St. Helens mill was sponsored by the DOE Industrial Technologies Program (ITP). It was conducted by an Energy Expert who formed an assessment team with several mill employees and installed DOE's steam system assessment tool (SSAT) software on their computers. The Energy Ex-pert showed the team how to analyze plant data using SSAT and other steam-related tools.

Participating in a Save Energy Now assessment allowed us to evaluate energy savings opportunities in areas we had not previously considered. It validated the merits of some potential projects we had previously identified, and provided access to some valuable software-based tools that were useful in evaluating energy improvements.

– Pat Loupin, Technology Resources Manager, Boise Inc. St. Helens Mill

ASSESSMENT RECOMMENDATIONS

Using historical and current data, the assessment team identified potential energy-saving measures and evaluated each for technical and economic feasibility. After reviewing expected energy savings and the associated payback periods of near-, medium-, or long-term, the team determined the following 10 opportunities.

NEAR-TERM OPPORTUNITIES

- **Modify Feedwater Heat Recovery Exchanger Using Boiler Blowdown**—The mill had a heat exchanger that was out of service due to a mal-function. The assessment showed that if the heat exchanger was repaired and placed in service downstream from a condensate tank that served two boilers it would yield energy savings of almost 5,000 MMBtu and $32,000 per year.
- **Improve Boiler Efficiency**—The stack O2 content for several of the package boilers was unnecessarily high. It was calculated that if the stack O2 content was lowered by an average of 0.5%, it would result in annual energy and cost savings of 6,000 MMBtu and $40,000.
- **Increase Recovery Boiler Efficiency** —The stack O2 content on a recovery boiler was also high. The

assessment showed that this boiler's stack O2 content could be lowered by 2.1%, which could yield energy and cost savings of 15,000 MMBtu and $104,000 per year.

- **Improve Insulation**—The sloped underside of a blow tank serving the batch digesters was not insulated. Using DOE's 3E Plus® software tool, the team calculated how much insulation was needed to fully insulate the tanks. The assessment showed that insulating this section of the tank could yield energy savings of 1,500 MMBtu and save approximately $10,000 per year.
- **Recover Waste Heat from Wetlap Whitewater**—Water from the whitewater process was being returned to the effluent stream without recovering the heat content. By modifying some of the mill's existing piping it would be possible to reuse the heat from the whitewater, resulting in estimated an-nual energy and cost savings of 3,000 MMBtu and $20,000.

MEDIUM-TERM OPPORTUNITIES

- Install Backpressure Steam Turbine Between High and Medium Pressure Headers—The mill currently uses a pressure reducing valve (PRV) to let 400 psig steam down into a 235 psig header. The assessment showed that if an extraction backpressure turbine generator was installed in place of the PRV it could generate approximately 7,000 kW for the plant. Although it would result in slightly greater fuel use, it would yield annual energy savings of approximately 62 million kWh and more than $1.6 million.
- Install Backpressure Steam Turbine Between Medium and Low Pressure Headers—Installing a backpressure turbine generator in place of the PRV currently in service between the 235 and 50 psig headers would generate approximately 3,000 kW. This would yield annual energy savings of approximately 27 million kWh and cost savings of more than $718,000.
- Preheat Water to Plant by Recovering Waste Heat in Effluent Stream— The assessment showed that the recovery of heat from the effluent stream could enable the plant to preheat the water it draws from the Columbia River. Estimated annual energy and cost savings were 876,000 MMBtu and $5.8 million.
- Replace Yankee Dryer with Gas Turbine—On behalf of an outside company, the mill operates a tissue machine that is served by a gas-fired Yankee dryer. The assessment suggested that the Yankee dryer could be replaced with a gas-fired combustion turbine generator, and the machine could use the gas turbine exhaust to heat the air supply required by the Yankee dryer. By removing the existing gas-fired dryer the mill would reduce electricity demand from the dryer's electric-driven fans by approximately 261 kW and save more than 207,000 MMBtu per year since the turbine generator would use less natural gas. At the same time, the gas turbine could generate approximately 1,200 kW for the mill. Annual cost savings were estimated at $2.1 million.

LONG-TERM OPPORTUNITIES

- Use Alternate Fuel—The assessment noted that if the mill were to install a hog fuel boiler annual fossil fuel consumption would be reduced by approximately 70%. This opportunity was evaluated using a base case with natural gas at $6.80/MMBtu, a boiler ef-ficiency of approximately 81%, and a steam header pressure of 235 psig. The hog fuel boiler assump-tions included hog fuel at a Btu equivalent of $2.50/MMBtu, a hog fuel boiler efficiency of 65%, and a 600 psig steam header. Based on these assumptions, the increase in hog fuel purchases was vastly offset by the decrease in natural gas consumption. The net estimated annual natural gas and cost savings were almost 3 million MMBtu and more than $9 million.

If all the above opportunities were implemented, the total annual energy cost savings was estimated at more than $19 million.

RESULTS

After carefully evaluating all of the energy efficiency opportunities identified by the assessment team, St. Helens mill personnel were able to implement a couple of the near-term measures right away. They lowered the package boiler stack O2 levels, and made some changes to the piping leading to the effluent stream in order to recover waste heat.

A team of mill personnel then re-examined various processes within the generation side of the mill's steam system and identified a new opportunity to reduce steam supplied to a parasitic load during peri-ods when it was not providing any useful work. This led to a sharp reduction in steam usage by that load. In conjunction with other conservation activities this enabled the mill to shut down one of the package boilers. Annual energy savings from this project were approximately 147,000

MMBtu and $984,000.

Total annual energy savings from the implementation of some of the assessment recommendations plus the reduction in parasitic energy usage was nearly 154,000 MMBtu. This yielded annual natural gas cost savings of more than $1 million. With total implementation costs of approximately $31,000, the mill achieved a simple payback of less than one month. The other opportunities could not be imple-mented because of capital constraints and other legal and technical issues. However, information about the assessment and results of the savings opportunities were shared with other Boise Inc. mills.

LESSONS LEARNED

Independent evaluations of industrial steam systems by outside experts can provide valuable insights that can lead to significant energy savings opportunities. At Boise Inc.'s mill in St. Helens, Oregon, employ-ees are accustomed to independent feedback. The assessment by the DOE Energy Expert provided some additional insights into the energy usage pat-terns of mill´s steam system. Later on, the mill´s employees adopted a different approach toward evaluating steam usage that enabled them to uncover a new opportunity to reduce parasitic energy usage.

SSAT and other DOE software tools such as AIR-Master+, the Fan System Assessment Tool (FSAT), MotorMaster+, the Process Heating Assessment and Survey Tool (PHAST), the Pumping System Assessment Tool (PSAT), and 3E Plus can be used to analyze industrial systems and processes and gener-ate energy efficiency opportunities.