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Inland Paperboard and Packaging, Rome Linerboard Mill Energy Assessment

Summary

A plant-wide energy efficiency assessment was conducted at the Inland Paperboard and Packaging's Rome, Georgia, linerboard mill in 2000. The assessment identified a total of thirty-one energy savings opportunities at the mill. The potential projects that could result from these opportunities were divided into two categories: those for near-term implementation (2001-2004) and those for future evaluation. Seven projects identified for implementation in 2001–2004 are scheduled such that the average yearly implementation cost is approximately $4.5 million, for a total capitalized expenditure of approximately $18 million in the near term. The projected annual cost savings resulting from implementation of these seven projects are $9.5 million.

Company Background

Inland Box Corporation was formed in 1925 as a producer of corrugated boxes. Two decades later, a joint venture formed with Mead Corporation resulted in the

Benefits

- Provides a sound strategy for process improvement and energy efficiency
- Estimated annual cost savings of $9.5 million
- Increases efficiency due to projected reductions in equipment downtime and more reliable production

Applications

In a paper processing facility, energy consumption is primarily associated with the conversion of steam and electrical power into mechanical power used to convey process material and the use of steam to heat water and evaporate moisture from paper. Periodic, system-level evaluations of a paper processing facility's industrial systems can reveal opportunities for significant improvements in energy efficiency and savings.

Inland's Rome, Georgia Paper Plant

construction of the Rome, Georgia linerboard plant in the mid-1950's. The Rome plant now has two paper machines that produce an average of 2400 tons/day of linerboard, used as the facing sheet in the construction of corrugated cardboard boxes. To support these paper machines, the plant has hardwood and softwood pulp production lines (digesters and washers), power and recovery boilers, black liquor recovery processes, chip and log chipping facilities, utility support systems, and wastewater treatment facilities.

Inland Paperboard and Packaging, Inc. is one of the oldest and largest of the pulp and paper companies in the forest products industry. Inland recognizes that it is being affected by increasing global competitiveness at the same time that its process equipment is aging and losing efficiency. The company became interested in a plant-wide energy efficiency assessment at the Rome paper mill to improve its energy efficiency, increase quality and productivity, and decrease energy costs to increase its global competitiveness. It is the mill's objective to eliminate fluctuating energy costs and to decrease the energy cost burden (measured in fuel expenses, including purchased electricity) by 5% per year for 4 consecutive years, beginning in 2001. This is in addition to other supply-side efforts to improve the site power production facility by adding gas turbine generation and by incorporating waste heat recovery to replace aging and inefficient boilers. Additional perceived benefits of the plant-wide study included reduction in solid waste and effluent stream flow and environmental air emissions.

Assessment Overview

The study's objectives were to identify energy savings projects in the No. 2 Paper Machine area and in the Fiber Plant. The study addressed mill-wide steam and power use, focusing primarily on the demand-side (energy consumption) systems, but implications for improvements in the supply-side (energy production) systems were also considered. The primary goal was to produce a plan to reduce the quantity of steam generated as a by-product. A secondary goal was to reduce the mill's fresh water use. One of the focal points of the study was the mechanical drive steam turbines on the No. 2 Paper Machine. The study analyzed the technical, operational, reliability, and financial consequences of replacing the two existing steam turbines with variable frequency drives (VFDs). Along with the turbine study, the steam and condensate system of the No. 2 Paper Machine was analyzed and the use of heated water around the machine investigated. The effects of water and

steam reductions at the machine and its support systems (the steam distribution and pressure reducing systems to the steam turbine generators in the powerhouse and the steam boiler supplying them) were also analyzed.

The project was a joint effort involving Inland Paperboard and Packaging, Dean Oliver, ITT Gould, Rockwell International, EPRI, and the Department of Energy's Office of Industrial Technologies (DOE/OIT). The study was partially funded by DOE/OIT and by the participants, including Inland. DOE/OIT supports plant-wide energy efficiency assessments that will lead to improvements in energy efficiency, waste reduction, productivity, and global competitiveness in accordance with OIT's Industries of the Future strategy.

Assessment Implementation

Initially, the mill's fiber, water, and steam distributions were characterized. A computerized model of the mill's water and steam balances was developed and used to evaluate alternatives for energy reduction. The list of energy reduction opportunities recommended by the project team was based on this simulation model.

The primary objective of the energy assessment was to produce a plan to reduce the quantity of steam generated at the mill. A secondary objective was to reduce the mill's fresh water use. The third objective was to identify equipment and processes that could be modified to improve electrical energy consumption. The study addressed site-wide steam, water, and electrical power use, primarily focusing on the demand side while also considering implications for energy supply-side systems.

The study concentrated on energy efficiency issues related to the No. 2 Paper Machine and Fiber Line, including:

Steam demand side improvements

- Replacement of mechanical drive steam turbines on the paper machine drive lineshaft and fan pump
- Modifications to the steam and condensate system of the paper machine drying section
- Optimization of thermal effects on water used in the paper machine and stock prep area
- Reduction in contamination levels in water used in the paper machine and stock prep area
- Improvements related to other water uses
- Optimization of cooling tower operation

Electrical energy demand and source improvements

- Replacement of fan dampers with VFDs on fan motors
- Replacement of pump discharge modulating valves with VFDs on pump motors
- Replacement of low efficiency motors and drives with higher efficiency units
- Increased electrical power generation as a result of steam demand system improvements
- Improved power factor resulting from installation of VFDs

Fuel use, boiler efficiency, and effects on the environment

- Reduction in steam generation, fuel requirements, and air emissions resulting from demand-side reductions
- Reduction of fiber losses to the effluent stream

The study also analyzed the consequences of the recommended changes, including

- Technical and product quality effects
- Operational and productivity effects
- Reliability and cost of maintenance, and
- Financial effects

Overview of Specific Actions Identified in the Assessment

Twenty-three "favorable" energy conservation opportunities were grouped into seven projects for implementation during 2001–2004. The mill plans to implement the projects with the highest projected savings-to-cost ratio first. The recommended projects for near-term implementation are:

Improve steam utilization and condensate collection systems for the No. 2 Paper Machine

- Rebuild paper machine steam and condensate system and dryer condensate drainage system
- Renovate heat exchangers and add automatic controls

Optimize mill water use to re-use cool, clean water in progressively hotter and cloudier applications

- Develop a mill-wide computerized water balance model
- Re-use vacuum pump seal water as a source of clean, warm water to feed paper machine-cleaning-shower water heat exchangers
- Modify river water supply header so that river water is clarified for use in the mill
- Modify mill water system to allow for temperature control of the mill water header
- Install automatic dumping systems for evaporator contaminated condensate
- Replace pump packing with dynamic seals and/or restrict water flow with orifice plates

Modernize and upgrade existing No. 2 Paper Machine lineshaft and fan pump drives by replacing the lineshaft and fan pump turbines with motors controlled by VFDs and associated control and operator interfaces

Rebuild existing pulp washers

Replace paper machine and pulp mill pumps and control valves with new pumps and VFDs

Add blow boxes to the paper machine and install a new dryer hood for No. 2 Paper Machine

Rebuild the broke (slurry composed of water and fiber) handling systems for No. 2 Paper Machine

- Rebuild couch pit (slurry container) to improve agitation and broke consistency control
- Provide a disk saveall for the paper machine
- Convert the existing drum filter saveall to a broke thickener
- Replace primary refiner and machine chests

Results

The assessment of the Rome, Georgia, plant resulted in the identification of multiple cost savings projects and an appropriate strategy to pursue them. Near-term projects are scheduled such that the average yearly implementation cost is approximately $4.5 million, for a total expenditure of

about $18 million for the 2001-2004 period. Projected cost savings are approximately $9.5 million annually. Projected savings will be realized from a combination of reduced fiber loss, reduced water, steam, and electricity use, and from increased power generation capacity. Other expected benefits include maintenance and reliability savings and reduced equipment down-time, as well as reductions in air emissions, effluent, water intake, and landfill use.

A re-balancing of the steam distribution system was an expected outcome of the energy assessment. Pre-assessment analysis showed that more electricity could be generated from the mill's steam turbine generators than the less efficient mechanical steam turbines being taken out of service at the paper machine. This increased production would reduce the amount of power purchased from the utility. In addition, replacement of the paper machine's mechanical steam turbines with VFDs would provide an opportunity for significant power factor correction. Steam generation reduction, fuel use reduction, and shutdowns of the least efficient boilers would also have positive consequences on air emissions. Efficiency improvement projects identified for the Rome plant should be applicable to other U.S. paper plants.

Industry of the Future—Forest Products and Agenda 2020

*In November 1994, DOE's Secretary of Energy and the Chairman of the American Forest and Paper Association signed a compact, establishing a research partnership involving the forest products industry and DOE. A key feature of this partnership was a strategic technology plan-**Agenda 2020: A Technology Vision and Research Agenda for America's Forest, Wood, and Paper Industry**. Agenda 2020 includes goals for the research partnership and a plan to address the industry's needs in six critical areas:*

- *Energy performance*
- *Environmental performance*
- *Capital effectiveness*
- *Recycling*
- *Sensors and controls*
- *Sustainable forestry*

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BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

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