Augusta Newsprint: Paper Mill Pursues Five Projects Following Plant-Wide Energy Efficiency Assessment

Benefits

- Saves an estimated 11,000 MWh of electricity annually
- Saves an estimated $1.6 million annually from energy reduction and other improvements
- Improves system efficiency and reliability
- Produces a more consistent product
- Project paybacks range from 4.3 to 21.4 months

Application

The Augusta Newsprint plant-wide energy assessment focused on the technical and economic evaluation of existing energy systems and operations in order to determine energy and cost savings. During this assessment, personnel identified those systems and operations that could benefit from equipment modifications, byproduct recovery, and advanced control systems. The results illustrate opportunities for replicating efficiency improvement projects and for saving energy and money at other paper mills.

Summary

Augusta Newsprint undertook a plant-wide energy efficiency assessment of its Augusta, Georgia, plant in the spring and summer of 2001. The objectives of the assessment were to identify systems and operations that were good candidates for energy-efficiency improvements, then ascertain specific energy saving projects. The assessment team identified the thermo-mechanical pulp (TMP) mill, the recycled newsprint plant (RNP), and the No. 1 and No. 2 paper machines area as the systems and operations on which to focus. The project evaluation process was unique for two reasons, (1) much of the steam is a by-product of the TMP process and, because it is essentially "free," it precludes opportunities for steam conservation initiatives; and (2) the company is reportedly Georgia's largest electricity customer and consequently has very favorable rates.

Despite these perceived disincentives, the company found strong economic justification for five projects that would reduce electricity consumption. Four of the five projects, when complete, will save the company 11,000 MWh of electrical energy each year ($369,000 per year). The remaining project will produce more than $300,000 each year in the sale of a process byproduct (turpentine). The largest annual savings ($881,000) will come from eliminating Kraft pulp by using better process control. All of the projects are potentially applicable to other paper mills and most of the projects have potential applicability to other industries.

DOE-Industry Partnership

The U.S. Department of Energy's (DOE) Industrial Technologies Program (ITP) cosponsored the assessment through a competitive process. DOE promotes plant-wide energy efficiency assessments that will lead to improvements in industrial energy efficiency, productivity, and global competitiveness, and will reduce waste and environmental emissions. In this case, DOE contributed $100,000 of the total $299,000 assessment cost.

Company Background

The Augusta Newsprint mill is part of a partnership between Abitibi Consolidated and the Woodbridge Company, Ltd. The mill produces up to 440,000 metric tons of standard newsprint each year from southern pine and recycled newspaper and magazines. The mill has two paper machines and employs 380 workers.

Abitibi-Consolidated is a global leader in newsprint and uncoated groundwood papers with ownership interests in 27 paper mills in Canada, the United States, the United Kingdom, and Asia (including its 50% interest in Pan Asia Paper Company). The company also has

ownership interests in 22 sawmills, 2 remanufacturing facilities, and a market pulp mill. Abitibi-Consolidated employs approximately 18,000 people and supplies products in nearly 100 countries.

The Augusta Newsprint mill is already a world-class mill in regards to operating efficiencies and energy uses with limited potential for improvement. Nevertheless, the company staff aggressively pursued the plant-wide energy efficiency assessment and continues to pursue plant upgrades with full commitment. It is the plant's objective to reduce energy costs by 1% per year for 5 consecutive years beginning in 2001.

Assessment Approach

The plant-wide energy efficiency assessment focused on the technical and economic evaluations of existing energy systems and operations that could benefit from equipment modifications, byproduct recovery, advanced control systems, and other changes. The systems that were evaluated as part of the assessment included those producing and/or using significant quantities of steam, water, and electrical power. Assessment personnel sought opportunities to improve ease of maintenance, control, and operations—plus boost reliability, quality, and/or productivity. The assessment team believed that improvements made in these areas should reduce downtime, paper breaks, and off-standard products.

The assessment team consisted of members of Augusta Newsprint process engineering. The review was a joint effort of energy management experts from Pacific Simulation, Dean Oliver, ITT Gould, and others. The plant electrical engineer managed the plant's activities and in-kind services, writing work orders, purchase orders, and scheduling assessment activities around production and maintenance activities. The process engineering team used flow sheets, piping and instrumentation diagrams, mass flow balances, and observed operational activities to identify potential projects. Area and plant management staff reviewed these early results and selected a list of the most appealing opportunities for further development. The assesssment team provided periodic briefings to the plant technical director and the plant production manager. These briefings showed progress relative to the budget, schedule, and scope.

The assessment team and management divided up some of the larger tasks, assigning them to separate organizations. A consulting engineer, Dean Oliver International, provided a three-person team to determine the current fiber, water, and steam distribution of the mill. Rockwell International provided cost data for various motor-drive applications and ITT Gould executed numerous computer models for possible pump retrofits. Pacific Simulation provided technical analyses and estimated benefits for an Advanced Quality Control (AQC) system, which is a computer-based means to predict and optimize effects of process variables in increasing energy efficiency, reducing waste, and improving plant productivity.

Results and Recommendations

Augusta Newsprint organized the plant-wide assessment by certain geographical or process area boundaries such as, (1) the TMP area; (2) the RNP; (3) the No. 1 and No. 2 paper machines; and (4) the boiler, waste water treatment, and utilities. The company selected these areas because they are known to: (1) consume the most energy, (2) be the most promising areas for reducing the specific energy per ton of pulp produced, and (3) be areas where pulp quality and yield can potentially be improved.

The TMP area proved to be key for efficiency improvements, receiving 80% of the most-promising projects (for immediate implementation). The TMP plant accepts chips from the on-site wood yard and chipping facility and turns them to pulp in the TMP refiners. The specific energy per ton

changes in the TMP because of the variations in the chips' characteristics. Massive, 12,000-hp synchronous motors (132,000 hp in all) power each of the 11 refiners. Hence, the TMP process for producing pulp is extremely energy intensive. It is a continuous operation and the process nearly fully loads the motors at all times.

The RNP proved to be the second most important area for efficiency improvement projects. Outside suppliers provide recycled newspapers and magazines in bales to the RNP. Plant operators then re-pulp, de-ink, and clean the material in a continuous operation that provides almost half of the paper fiber needed for the two newsprint machines. Within the RNP are the pressurized de-inking modules (PDM), which are composed of two parallel banks of cells. Each bank consists of four in-line cells, each with a large fan inlet pump (400-hp) and hand-operated inlet valves for flow balancing. The assessment team selected the fan inlet pump impellers for one modification (see below).

The plant-wide energy efficiency assessment identified three projects that could not be economically justified, five projects for further evaluation, and five opportunities for immediate implementation. These last five were scoped, cost estimated, and evaluated for justification. Table 1 lists the five projects selected for implementation and indicates the budget years, expected project costs, estimated annual savings, and expected payback periods. As indicated in the table, the RNP project to replace pump impellers is expected to have a simple payback period of only 4.3 months (just over 1/3 year). Even the longest projected payback period, for recovering turpentine in the TMP refiners and reboilers, is well under 2 years.

Table 1. Estimated Savings for Recommended Energy-Efficiency Projects

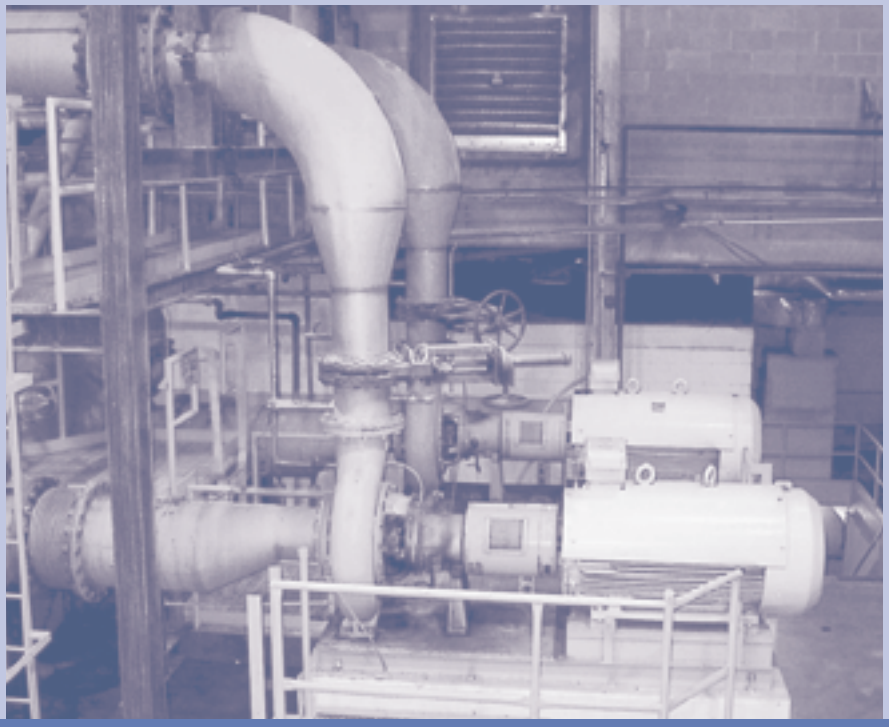
Project	Plant Area	Budget Year	Project Cost ($)	Annual Savings ($)	Payback (mo)
Replace pump impellers in PDM cells	RNP	2001	31,200	86,000	4.3
Equip both stock transfer pumps with drive system	TMP	2002	17,500	21,300	9.5
Recover turpentine from refiners and boilers	TMP	2004-2005	585,000	300,300	21.4
Eliminate secondary screen feed pump	TMP	2002	10,000	26,500	4.5
Implement Advanced Quality Control (AQC)	TMP	2002-2005	1,491,000	1,120,000	15.1
		Totals	**2,134,800**	**1,554,100**	

Projects Identified

The following discussion provides details of the selected energy-efficiency projects developed during the plant-wide assessment. Because of the similar basic processes used in paper mills, all of the projects have high applicability to other paper mills. In addition, the fundamental technical aspects of most of these projects have an even broader applicability to other industries.

Project 1—Replace pump impellers in PDM cells.

The plant-wide evaluation of inefficient pumping applications indicated that the impellers used in six of the 400-hp PDM fan inlet pumps were not the optimum size. The impellers produced excess pressure that hand and control valves had to dissipate. Typically, operators must set the valves at 25% to 75% closed,



De-Inking Module Pumps (Project 1)

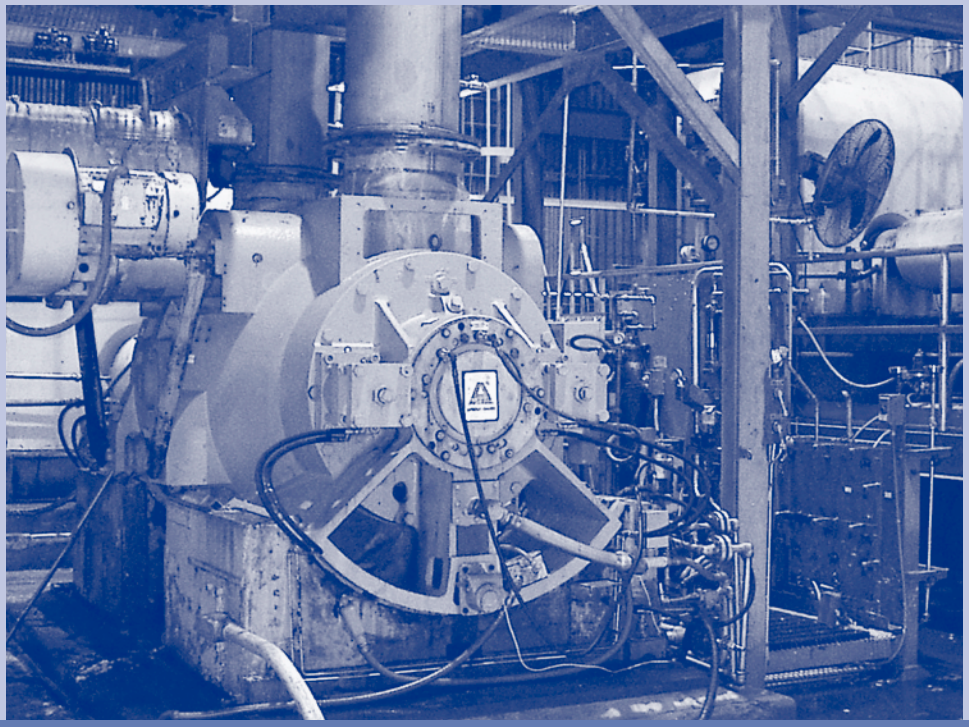
causing an effective drop in horsepower. Therefore, the assessment team decided that the best option would be to convert to size-optimized pump impellers, which would effectively lower the horsepower requirements. Augusta Newsprint completed these modifications that have completely eliminated the need to use hand valves in the control scheme. The total estimated energy savings are 404-hp per year. This equates to an energy savings of approximately 2,568 MWh annually.

Project 2—Equip both stock transfer pumps with a drive system.

The low-density stock transfer pumps move stock from one tower to another to balance plant operations. The 200-hp pumps often waste energy as they operate against a partially or fully closed 10-inch control valve, which must be adjusted because of variable operating conditions. The operating conditions also force the pumps to function away from their "optimum reliability point," increasing maintenance costs for seals and bearings. Engineers conducting the assessment decided to install a "smart" motor controller that would monitor system parameters and adjust motor and/or pump speed accordingly. By reducing and maintaining necessary flow control, the newly installed pump controller will save approximately 100 hp per year. This equates to an energy savings of approximately 636 MWh annually. Also, removing the control valve eliminated its maintenance and repair costs.

Project 3—Recover turpentine from refiners and reboilers.

The TMP process produces turpentine, which is a chemical embedded in wood fibers. The turpentine can be recovered from the steaming tube, plug screw feeders, the reboilers' vent steam, and water pressed from raw material (pressate) in the primary refiners. This would prevent the release of approximately 381 pounds per hour (lbs/hr) of turpentine vapor into the atmosphere and 1,500 lbs/hr of turpentine condensate flow into the process sewer. The project will allow operators to collect



TMP Refiner Prior to Turpentine Recovery (Project 3)

turpentine-laden pressate from the plug screw feeders and turpentine-laden flash steam from the TMP system reboilers and carry the combined flow, using a steam eductor, to a new recovery and separation system. The recovery system will use condensers, decanters, and scrubbers to separate the turpentine from the steam and water vapor. The system will then reuse the cleaned water. The company will be able to produce 757 gallons of turpentine per day and sell it at $1.10 per gallon ($304,000 annually), plus recoup $23,500 from the recovery of energy for paper machine shower water. Yearly separation expenses are $27,000 for eductor motive steam, including a small amount for electrical power.

Project 4—Eliminate secondary screen feed pump.

The TMP primary feed screen pump feeds stock flow to the No. 1, 2, and 3 screens and the overflow is diverted to the secondary screen feed tank. Then the secondary screen feed pump transfers the stock to the No. 4 and 5 screens. The assessment team determined that the secondary system (tank, pump, and piping) was not necessary because the existing primary feed screen pump has the capacity to provide the complete flow to all five pressure screens. Therefore, project personnel planned and implemented modifications where piping changes made possible the elimination of the secondary screen feed pump and secondary screen tank agitator. Elimination of the secondary pump saves 790 MWh annually.

Project 5—Implement Advanced Quality Control (AQC)

The assessment team determined that it would be advantageous to improve the TMP control system to: (1) decrease process variability, (2) reduce the specific energy consumption, and (3) reduce or eliminate the use of Kraft pulp. The team focused on the AQC because other pulp and paper mill sites had implemented and refined the system in full-scale installations. This control system is a computer-based means of predicting and optimizing the effects of process variables to increase energy efficiency.

The team developed a project using AQC to reduce process variability while reducing Kraft pulp usage, which was 1% of the total, and reduce the specific energy used for TMP pulping. The AQC provides supervisory control over the four primary refiners, four secondary refiners, three rejects refiners, screening operation, and pulp blending. The proposed technology performs supervisory control by monitoring the on-line and off-line newsprint test results during operations and by using the computer model to optimize the process. Following project development, it is now believed that the project will be successful in (1) accomplishing more pulp refining while reducing the specific energy per ton, (2) modifying the production schedule to match real-time pricing from the electrical utility, and (3) eliminating the need for Kraft pulp ($881,000 annual raw materials and energy savings) while still meeting industry standards for a strong and consistent product. The annual energy savings in the refiners is estimated to be 7,125 MWh.

The AQC Optimizes Process Variables for Greater Energy Efficiency (Project 5)

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