Weyerhaeuser Company: Longview Mill Conducts Energy and Water Assessment that Finds Potential for $3.1 Million in Annual Savings

Benefits

- Identified estimated annual savings of $3.1 million
- Found potential energy savings of 1.8 million MMBtu/yr
- Identified opportunities to increase onsite power generation by 15 MW
- Found options for decreasing water consumption by 3,600 gpm

Application

Weyerhaeuser and American Process, Inc. performed an evaluation of energy and water use at the Longview pulp and paper mill using pinch analysis and Successive Design Methodology (SDM™). The evaluation identified nine opportunities to improve energy efficiency and reduce water consumption. By taking advantage of these opportunities, Weyerhaeuser can cut its operating costs, conserve natural resources, and address environmental concerns. Energy-saving opportunities identified through this analytical approach can be replicated at other Weyerhaeuser mills and throughout the pulp and paper manufacturing industry.

Summary

Weyerhaeuser completed a plant-wide energy assessment at its pulp and paper manufacturing facility in Longview, Washington, in 2002. The assessment identified nine projects for improving energy efficiency and reducing water consumption. Implementing these projects will save an estimated $3.1 million annually, based on regional natural gas cost forecasts from the Energy Information Administration of the U.S. Department of Energy (DOE). These measures will also reduce site water consumption by 3,600 gallons per minute (gpm). The cost of these improvements is estimated at $5 million to $11 million. Aside from the nine projects discussed above, the assessment team also identified the potential to increase onsite power generation by up to 15 megawatts (MW).

Public-Private Partnership

DOE's Industrial Technologies Program 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 assessment cost, which exceeded $250,000.

Plant Description

Weyerhaeuser Company is an international forest products business headquartered in Federal Way, Washington. Founded in 1900, it is the leading producer of softwood and hardwood lumber and the world's largest producer of softwood market pulp. Of the company's many manufacturing facilities, 12 produce pulp, 10 make fine paper, 13 produce containerboard, and 4 make kraft paper. With more than 58,000 employees in 18 countries, Weyerhaeuser generated $14.5 billion in sales in 2001.

The Weyerhaeuser Company complex at Longview, Washington, includes a wholly owned pulp and paper mill and the North Pacific Paper Corporation (NORPAC) newsprint mill, which is a joint venture with Nippon Paper Industries. Weyerhaeuser's Longview mill consists of a kraft mill that produces bleached pulp for a fine paper machine and a paperboard machine. This mill also produces kraft pulp for the NORPAC mill. The NORPAC mill has three machines producing newsprint from a mixture of thermomechanical pulp, recycled newsprint, and bleached kraft pulp.

The Longview mill also produces steam for use at both mills as well as onsite lumber kilns. Steam is generated at a rate of about 1.25 million pounds per hour in one recovery, one multi-fuel, and three package boilers. Three of these boilers burn natural gas, one burns black liquor, and one is capable of burning hog fuel, coal, and fuel oil.

Some of the steam produced by the boilers is used by turbine generators to produce about 40 MW of electricity. Total electric power consumption at the site is approximately 240 MW. Purchased power is supplied to the site by the Cowlitz County Public Utilities District. Every day, the complex uses approximately 50 million gallons of water from the Columbia River.

Assessment Approach

The plant-wide energy assessment conducted by Weyerhaeuser focused on energy and water use at the Longview and NORPAC mills. The study objectives were to:

- Assess minimum site thermal energy demands and quantify potential for reducing energy consumption
- Define steam savings projects for present process operations that are consistent with future facility plans
- Examine economically justifiable options for reducing water use and decreasing thermal discharge to the Columbia River
- Identify opportunities to decrease power purchased through cogeneration improvement and demand side changes.

Improving energy performance is an important part of Weyerhaeuser's overall corporate strategy to enhance manufacturing efficiency and reduce operating costs. It also represents an effective way for the Weyerhaeuser Company to address potential environmental concerns associated with thermal discharge to the Columbia River.

The assessment team included American Process, Inc., the Institute of Paper Science and Technology, the Electric Power Research Institute (EPRI), the Cowlitz County Public Utility District, and Weyerhaeuser employees from both Longview and the Weyerhaeuser central technical organization. American Process, Inc. performed an evaluation of energy and water use in the Longview and NORPAC mills using pinch analysis and an assessment technique known as Successive Design Methodology (SDM™). SDM examines site operations and utilities using an integrated approach aimed at identifying synergies between water, electricity, and steam conservation efforts. SDM provided a systematic approach for simultaneous application of water and energy conservation in practical mill situations. The study also included operability reviews and the development of key performance indicators to compare the mill's performance to industry benchmarks.

Assessment team members first created process flow diagrams (PFDs), using mill data and piping and instrumentation drawings. The diagrams were verified by mill personnel familiar with day-to-day operations. Next, they reviewed all process set points and practices affecting the magnitude of hot and cold streams. The objective was to compare performance indicators with industry benchmarks and energy efficiency standards. The team also identified opportunities for water re-use and discussed them with mill personnel. Applicable PFDs were also used to build a process simulation model that rigorously accounted for mass and energy flows during normal operating conditions. The assessment team incorporated flow streams for fiber, water, pulping liquors, chemicals, and steam into the model. Upon completion, the process model served as the basis for the pinch analysis.

In the pinch analysis, process data corresponding to major heating and cooling requirements were extracted from the process model output. The pinch analysis was then used to define the "pinch temperature" and the minimum thermal energy input required to operate the site. A pinch temperature represents the temperature above which there is a scarcity of heat that must be satisfied using steam. Below the pinch temperature, there is a surplus of heat available. Site energy performance is improved by identifying and eliminating heat transfers across the pinch temperature (called "cross-pinch transfers").

The assessment continued by assembling a temperature-enthalpy grid of the major process heat flows. Cross-pinch heat transfers were identified and better heat transfer matches between process streams were established. The team devised improvement projects to eliminate cross-pinch heat transfers and decrease the steam requirements. To ensure meaningful results, the team excluded process streams that could not be eliminated or are not practical candidates for heat recovery or water re-use.

Results and Projects Identified

Based on results of the pinch and SDM analyses, the plant-wide energy assessment team successfully identified eight cost savings projects and practical alternatives for improving energy efficiency and reducing costs at the Longview mill and one project at the NORPAC mill. Together, these projects have the potential to reduce steam production from natural gas and fuel oil by an estimated 1,800,000 million British thermal units per year (MMBtu/yr) and to reduce water consumption by 3,600 gpm. Implementing these projects at an estimated cost of $5 million to $11 million is projected to save Weyerhaeuser $3.1 million per year.

Project details were developed with input from key mill personnel. Estimated savings for each project are summarized in Table 1.

Table 1. Assessment Recommendations and Estimated Savings*

Project	Description	Water Savings, gpm†	Natural Gas Savings, MMBtu/yr‡	Estimated Annual Savings
Longview Mill Project 1	Improve digester washing and reduce dilution factor	200	310,000	$580,000
Longview Mill Project 2	Change evaporator area configuration	1,750	570,000	$650,000
Longview Mill Project 3	Add digester heat recovery	0	130,000	$280,000
Longview Mill Project 4	Modify heated water system	0	80,000	$150,000
Longview Mill Project 5	Re-use white water and modify water system	1,250	100,000	$220,000
Longview Mill Project 6	Upgrade condensate polisher and increase condensate return	200	190,000	$390,000
Longview Mill Project 7	Add waste heat boiler on incinerator exhaust	0	110,000	$180,000
Longview Mill Project 8	Implement recaust dissolving tank temperature control	200	0	$0
NORPAC Mill	Add water/glycol system for heating building and process ventilation air	0	310,000	$650,000
	Totals	**3,600**	**1,800,000**	**$3,100,000**

* Estimated cost savings are based on U. S. Energy Information Agency regional prices for natural gas and electricity.
† Gallons per minute
‡ Million British thermal units per year

Aerial view of Weyerhaeuser's Longview, Washington, pulp and paper mill

The assessment team also identified many opportunities for the facilities to generate additional electricity onsite. These opportunities can be realized by:

- Decreasing the pressure of steam used for process heating whenever possible
- Minimizing steam flow through pressure reducing valves
- Increasing turbine efficiencies
- Replacing mechanical drive steam turbines with electrical drives.

When these opportunities are combined, there is a potential for Weyerhaeuser to generate an additional 15 MW of electricity and reduce power purchased from the utility. The assessment team did not identify specific projects to capture this additional power generation potential because it was beyond the scope of the assessment. However, Weyerhaeuser plans to further investigate cogeneration opportunities that the pinch and SDM analyses identified.

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Project Partners

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American Process, Inc.
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Cowlitz County Public Utility District
Longview, WA

Electric Power Research Institute (EPRI)
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Institute of Paper Science and Technology
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