

PULP AND PAPER COMPANIES SAVE ENERGY AND RESOURCES THROUGH CLIMATE WISE

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*A PROGRAM TO CUT COSTS AND REDUCE EMISSIONS ENCOURAGES COMPANIES TO
TAKE ADVANTAGE OF THE ENVIRONMENTAL AND ECONOMIC BENEFITS OF
ENERGY EFFICIENCY IMPROVEMENTS.*

Several pulp and paper companies are implementing energy efficiency procedures to cut costs and reduce emissions through Climate Wise, a program jointly sponsored by the U.S. Environmental Protection Agency and the U.S. Department of Energy. Climate Wise is a key part of the Climate Change Action Plan, which consists of a group of initiatives designed to help the United States honor its international commitment to reduce greenhouse gas emissions to 1990 levels by the year 2000. This voluntary program encourages U.S. industry to take advantage of the environmental and economic benefits associated with energy efficiency improvements and greenhouse gas emission reductions.

The paper industry is among the most energy intensive, ranking third in purchased energy consumption among U.S. manufacturing industries (after chemicals and primary metals). While its 1994 energy consumption totaled 2700 trillion Btu (3.1% of all U.S. energy consumption), an average of 56% of its total was derived from self-generated and residue fuels such as spent pulping liquors, bark, and wood residues (1). The industry is among the nation's leading cogenerators of electricity, producing 48.8 trillion kW·h.

Climate Wise companies are seeking new ways to reduce energy use and become more competitive. In joining the program, Climate Wise partners agree to initiate, expand, or accelerate cost-effective measures to increase energy efficiency and prevent pollution. By the year 2000, Climate Wise companies will save more than US\$ 300 million annually and reduce more than 18 mil-

lion metric tons of carbon dioxide. Companies enroll by completing a one-page Climate Wise Partnership Agreement followed by an Action Plan detailing their strategy for increasing efficiency and reducing emissions.

Companies that become Climate Wise Partners receive assistance in developing a portfolio of actions that help them save money, improve productiv-

ity, and prevent pollution. They also have access to technical and financial assistance, are invited to participate in regional business-to-business exchange workshops, and receive public recognition for their "greener" efforts.

The potential reductions in greenhouse gases from energy efficiency actions in the pulp and paper industry are substantial (2). If the industry were to reduce energy consumption (Btu) per pound of product manufactured by 2% per year, it would result in cumulative savings of approximately 800 trillion Btu over five years (with 1994



1. Louisiana-Pacific's totally chlorine-free pulp mill at Samoa, CA

Central Products-Brighton
 Erving Paper Mills
 Georgia-Pacific
 Louisiana-Pacific-Western Division
 Repap Wisconsin Inc.
 Weyerhaeuser
 3M
 3M-Austin

1. Climate Wise partners with pulp and paper operations

as the baseline year) and a fuel cost savings of about US\$ 1.6 billion, assuming constant production levels. Using a weighted CO₂ emission factor for the sector, this energy savings translates into a cumulative CO₂ savings of 25 million metric tons.

Table 1 lists several pulp and paper operations that are participating in the program as Climate Wise partners.

Two pulp and paper companies that are working to reduce energy use through the Climate Wise program include Louisiana-Pacific and Georgia-Pacific. Actions they are taking and how they are integrated into the Climate Wise program are highlighted below.

LOUISIANA-PACIFIC

Louisiana-Pacific has already begun a series of energy efficiency actions and plans to use Climate Wise as a rubric to take on new steps. The company's Western Division, which includes 25 facilities and employs 2000 people, made a commitment to become more energy efficient and environmentally conscious. Joining Climate Wise was a natural next step, complementing its energy savings and environmental awareness projects.

Through Climate Wise, Louisiana-Pacific has targeted its Samoa, CA, pulp mill to undergo an energy assessment. The assessment will lead to a comprehensive Action Plan for energy efficiency and pollution prevention at the mill. It will include collecting and analyzing data, selecting process optimization projects for energy conservation, and benchmarking paper mill performance in the industry with regard to energy consumption and water usage. Louisiana-Pacific's participation in the Climate Wise program will build on already groundbreaking initiatives at the Samoa facility, shown in **Fig. 1**.

To save energy at its Samoa pulp mill, Louisiana-Pacific has installed a Closed Cycle Bleached Kraft production unit, the first in the world. The mill, constructed in 1964, produces an average of 650 tons of bleached kraft pulp per day from wastewood chips generated by local sawmills. In January 1994, the Samoa mill became the only North American kraft pulp mill to produce bleached pulp without the use of chlorine or chlorine-

containing compounds on a permanent basis. It achieved this by using hydrogen peroxide and oxygen. Already some exciting energy savings have occurred.

Based on initial energy balances, intensive bleach filtrate recycling produces energy savings of approximately 540 billion Btu per year as natural gas or 1.7 MW of electrical power generation. The savings are largely from the capture of heated wastewater flows and redirection to strategic points in the process. In a conventional five-stage bleaching process, hot fresh water is used on each pulp washer. The used hot wash water is then sewerred, carrying spent chemicals, wood extractives, pollutants, and heat. The closed cycle process uses only one fresh hot water input and recycles this water to other bleach washers. The flow of recycled wastewater is "counter-current" to the pulp flow and proceeds to the recovery boiler for energy and chemical recovery. Additional direct energy savings can also be realized by reducing the size of, or possibly eliminating the need for, energy intensive treatment systems.

If only 50% of the mills adopted closed cycle technology, the industry as a whole would save approximately 86 trillion Btu per year. There is a potential savings of an additional 3 trillion Btu per year by eliminating the use of secondary treatment systems. Primary manufacturing energy also is saved because hydrogen peroxide requires less energy to produce than elemental chlorine (3).

In addition to the energy savings associated with implementing this technology, there are considerable environmental benefits to be derived. The closed cycle process potentially eliminates the discharge of kraft pulp bleach wastewater and pollutants, including dioxin and furans, to waterways. It also reduces annual freshwater consumption by 875 million gal.

In another action, foresters at Louisiana-Pacific developed a new resource management tool called Terra Vision, a detailed computer database compiled from satellite imagery and on-the-ground observations of such elements as the type and size of trees on the land, the soils, roads, topography, wildlife, and streams. Terra Vision allows the company's resource managers to make day-to-day forest management decisions and to provide the information needed for harvesting permits. Terra Vision will enable foresters to determine what actions will promote sustainable forestry practices and maintain forest health.

GEORGIA-PACIFIC

Georgia-Pacific became a Charter Partner of Climate Wise in 1994, after thoroughly examining the economic and environmental benefits of the program. The company was particularly interested in the program's approach, a voluntary industry-government partnership. As a com-

pany in the forest products industry, with manufacturing installations utilizing biomass fuels and with extensively managed woodlands, Georgia-Pacific believed that Climate Wise presented a logical foundation for their voluntary efforts in greenhouse gas emissions reduction.

Sergio Galeano, manager, product and environmental policy assurance, and Susan Vogt-Moore, director environmental policy, training, and regulatory affairs, identified the benefits of joining the Climate Wise program and presented them to the company's officers. In their discussions, they focused not only on the environmental benefits of reducing CO₂ emissions through a voluntary program but also on the cost-saving opportunities for reducing energy costs in general. They stressed that joining Climate Wise would allow for a cohesive review of existing Georgia-Pacific management practices and would provide the ability to link the various components of the company's carbon flows, including forestry, manufacturing, and transportation. Additionally, they noted that corporate outreach opportunities would be enhanced by Climate Wise membership, largely resulting from a better communications database of Georgia-Pacific's accomplishments, focusing on carbon cycle issues.

Through Climate Wise, the company was able to tailor its program pledge to Georgia-Pacific plans and structures. The company structured its Climate Wise pledge to include Georgia-Pacific's principles and goals on energy and forestry practices, and build on and reflect improvements in energy management systems, forest sustainability programs, transportation achievements, and cost-effective energy savings programs.

Georgia-Pacific outlined a three-year phased approach for implementing its energy efficiency strategies, with the first year for development, the second for implementation, and the third for monitoring and reporting. The idea was not to overstress the staff with additional demands and to ensure that new employees were not needed.

In its Climate Wise pledge, Georgia-Pacific agreed to four areas of activity:

1. Energy management systems
2. Increased energy efficiency in energy utilization
3. Increased carbon sequestration
4. Transportation efficiency improvements.

Georgia-Pacific pledged to reduce wastewood sent to landfills, to increase carbon sequestration through increased biomass fuel use and sustainable forestry practices, to implement transportation actions including containerboard and pulp trading and backhauling, to collect a site-specific energy database, and to retrofit five facili-

ties with energy-efficient lighting. The company also formed a Climate Wise Steering Committee and an energy management team. It assigned energy consultants throughout its facilities to oversee and implement the Climate Wise program.

Energy management systems activities focused on collecting site-specific baseline data on Btu per unit of production (energy intensity) by Dec. 31, 1994. The company set site-specific goals for energy reductions and began measuring its achievements in 1995. Energy data collection quality control was emphasized, with the focus on capturing energy savings projects and installing energy coordinators on site. Quality control was enhanced by comparing energy reporting to standards, issuing progress reports, and assessing site performance. Uniformity of data collection across different sources was also implemented.

Georgia-Pacific established new forms and approaches to energy management and conducted intensive training for designated individuals from each location. Employee seminars emphasizing energy efficiency and management also were held. Energy coordinators from 85 Georgia-Pacific facilities attended four training sessions.

Six Georgia-Pacific business units—chemicals, gypsum, lumber chips, plywood and specialty woods, primary paper, and primary pulp—have established energy efficiency targets that will reduce purchased electricity and fossil fuel usage per unit of production by Dec. 31, 1999. These reductions range from 3% in the chemical group to 9% at the primary paper mills. Two business units project increasing or flat energy use. Energy use in lumber mills is expected to increase due to conversion to a new lumber-drying technology, resulting in an offset of any energy savings. The use of electricity at paper converting facilities is expected to remain flat as new technologies are added to improve product quality.

In order for the company's pulp and paper mills to set realistic energy reduction goals, a reliable methodology for analyzing the mills' energy consumption needed to be adopted. Traditional methods of assessing energy use typically require that complex heat transfer and recovery systems be sized before the overall pattern of energy use can be understood. This process is time-consuming, with results not always revealing the minimum possible thermal energy consumption (energy target) for the mill. Instead, Georgia-Pacific employed Pinch Technology to aid the mills in setting site-specific goals for energy reduction.

By identifying the fundamental temperature constraint—the process "pinch" temperature, which thermodynamically limits energy recovery in the system—Pinch Technology makes it possible to establish realistic stan-



2. This Georgia-Pacific seedling nursery near Jesup, GA, grows 25 million seedlings annually. As part of its commitment to sustainable forestry, Georgia-Pacific plants more than 80 million seedlings every year on company lands and plans for natural regeneration of many more millions of trees.

dards for the operating and capital costs of energy systems before they are designed (4). Potential energy savings projects are then paired with the economics of the project, and the estimated economic value is added. If the project cannot demonstrate a positive after-tax rate of return, it is not implemented.

Five facilities—packaging plants at Denton, TX; Mt. Olive, IL; Asheboro, NC; Milan, MI; and Cleveland, OH—were retrofitted with energy efficient lighting within a year of joining the program. These plants realized annual cost savings of nearly US\$ 50,000, corresponding to annual energy savings of more than one million kW·h.

Georgia-Pacific established 60 environmental goals in 1994, consistent with its Climate Wise pledge. These goals included conservation and sustainable use of resources, such as regenerating every acre harvested by planting 80 million seedlings annually on company-owned lands. **Figure 2** illustrates a Georgia-Pacific seedling nursery. In 1995, Georgia-Pacific fully implemented its 11-point Forest Resources Environmental Strategy, reflecting the company's commitment to good forest management and the practice of sustainable forestry.

The company increased acreage in the Forest Management Assistance Program (MAP) by 5% in 1994. This program promotes sustainable forestry practices among thousands of owners of private nonindustrial land (acreage increased from 400,000 in 1994 to 650,000 in 1995). Georgia-Pacific also developed Green Places, a program to identify and protect special sites on company lands. To date, more than 20 sites from Maine to Florida to Oregon have enrolled in the program.

A baseline measurement was established by Dec. 31, 1994, for Georgia-Pacific's pulp and paper operations' net water discharge per unit of product, as were plant-specific reduction goals for 2000. Recovered fiber use is expected to increase 25% by 2000 in pulp and paper operations, using 1993 as the baseline. In 1993, company facilities used approximately 1 million tons of recovered paper. With the 1996 addition of a new recycled linerboard machine rebuild at Toledo, OH, and a new recycled linerboard facility at Big Island, VA, Georgia-Pacific increased recycled fiber use by approximately 50% to 1.5 million tons, with further increases in recovered paper use expected. By increasing the use of recycled paper in production at integrated mill sites, further energy and CO₂ reductions are realized in comparison to the energy use involved in using virgin pulp, or in complete paper production at an isolated paper mill.

TECHNOLOGIES TO HELP SAVE ENERGY AND REDUCE EMISSIONS

As part of the technical assistance that companies receive from the program, Climate Wise has developed a list of project activities that its partners could undertake to support their participation in the program. The cost-effectiveness of each technology is both time and application specific; additional analyses would need to be performed to determine the feasibility of each technology at a particular site.

- **Chemical Pulping.** State-of-the-art technologies for chemical pulping include continuous digesters for large units and displacement heating for small units. For mechanical pulping, increased heat recovery in thermomechanical pulping will bring large energy savings. These technologies are estimated to reduce U.S. pulp and paper energy consumption by 26% (from 1990 levels) by the year 2010. Advanced technologies, such as alcohol-based solvent pulping, biopulping (using enzymes for chemical pulping), nonsulfur chemimechanical pulping, and a sodium sulfite-based pulping process for mechanical pulping, will bring an additional estimated 10% savings (5).
- **Bleaching.** State-of-the-art bleaching processes include oxygen predelignification, oxygen bleaching in the first extraction stage, and displacement bleaching. Displacement bleaching is estimated to reduce electrical energy by 30% to 40% compared to conventional bleaching processes (6).
- **Chemical Recovery.** In the chemical recovery stage, state-of-the-art technologies, such as improved lime kiln waste heat recovery, and turumix and Tampella recovery systems, will reduce U.S. pulp and paper energy consumption by an estimated 37% by 2010. Advanced

technologies, such as freeze concentration of black liquor, direct alkali recovery systems, and black liquor gasification, are estimated to bring an additional 33% savings (7).

- Paper Making. The largest energy savings will be realized in the papermaking stage. State-of-the-art technologies, such as extended nip presses and infrared moisture profilers, combined with improved mechanical and thermal water removal techniques, can reduce papermaking energy use by 32%. Energy savings of 2% are possible with the use of an infrared moisture profiler (8). Advanced technologies, such as displacement pressing and impulse drying, can reduce energy use by an additional 27% (7).
- Paper Mills. Automation can be applied in a paper mill in the form of a computer integrated manufacturing (CIM) system that maximizes plant production. A CIM system in a paper mill can include process controls (distributed control systems for controlling individual processes and gathering production data), product quality control management, control systems for papermaking and finishing, energy management and control systems, a pulp-making information system, and a production planning and production control system. A CIM system installed in one of Japan's largest pulp and paper manufacturing facilities reduced overall plant energy costs by 1.8% in the first year of operation (9).
- Internally Generated Fuels. The pulp and paper industry is in the enviable position of being able to rely on its own internally generated fuels from renewable biomass sources for more than half its process energy requirements. In the near future, the industry has the

potential to provide essentially all of the energy requirements needed at many of its facilities and perhaps even to sell biomass-generated power to other users. Advanced biomass-based cogeneration systems are undergoing rapid development. Such systems are likely to be commercially ready in a few years. Increasing competition in wholesale electricity markets may create opportunities for the industry to market renewable electricity directly (10).

CONCLUSION

The Climate Wise program has successfully recruited many companies to join and pledge to reduce energy use and the associated CO₂ emissions. The two paper companies highlighted above represent excellent examples of what can be achieved through environmental commitment and dedication. Georgia-Pacific has committed to significant reductions in energy use in its primary paper mills, as well as other business units. Louisiana-Pacific is well positioned to achieve state-of-the-art results. Thanks to their continued participation in the Climate Wise program, both companies stand to reduce energy use significantly and become more competitive.

For more information on the Climate Wise program, contact the Climate Wise director, Pamela Herman Milmoie or director of outreach, Kevin James, at EPA, +1 202 260-4407.TJ

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