The forest products industry is accelerating the pace of new technology development and deployment through active participation in the Industries of the Future partnership.
Unified vision fosters collaborative partnerships

With annual shipments valued at $262 billion, the U.S. forest products industry is a world leader in the production of lumber, wood products, pulp, and paper. The industry employs close to 1.3 million people and ranks among the top 10 manufacturing industries in 46 states. Although the industry meets over half of its energy needs with biomass-derived fuel, it is still the fourth-largest user of fossil energy in the U.S. manufacturing sector.

In 1994, leaders in the forest products industry joined in a unique partnership with the U.S. Department of Energy’s Office of Industrial Technologies (OIT) to foster the development and use of advanced technologies and processes. The Industries of the Future partnership has helped effectively position the U.S. forest products industry for continuing prosperity while advancing national energy efficiency and environmental goals.

Achievement of the goals in Agenda 2020 will make the U.S. forest products industry “a clear global leader in providing safe and essential products in harmony with the environment and ... a sustainable contributor to our nation’s economy and to the quality of life of its citizens.”

Energy Sources for Lumber, Wood Products, Paper, and Allied Products

- Biomass-Derived Fuel 54%
- Natural Gas 20%
- Coal 10%
- Electricity 9%
- Fuel Oil 7%

The forest products industry currently derives over half its energy from biomass.

Source: EIA, MECS, 1994
Industry Drives the Process

Under the leadership of the American Forest and Paper Association (AF&PA), the U.S. forest products industry is actively implementing the Industries of the Future strategy. By coming to consensus on common goals and priorities, the industry has created a powerful force for attracting and guiding public and private investment in new technology development. With multiple successes already under its belt, the partnership continues to pursue promising technologies and take an active role in moving advances into commercial use.

### Vision

#### Agenda 2020—
A Framework for Cooperative R&D

The landmark 1994 document established long-term goals and broad research priorities based on key market, business, and environmental trends.

### Roadmap

#### The Path Forward—
An Implementation Plan

Industry-led task groups working through AF&PA meet regularly to refine research priorities, issue proposal requests, rank recommended proposals for funding, and review ongoing projects.

### Implementation

To date, OIT has provided cost-shared support for over 90 R&D projects proposed by collaborative partnerships to address industry-defined priorities and meet national goals for energy and the environment.

### New Technology Strategy

The industry recently reaffirmed its commitment to the partnership by revisiting the 1994 agenda and refocusing priorities on:
- Higher-value supply
- Lower manufacturing costs
- Workforce development
- Improved energy performance
- Superior environmental performance
- New forest-based materials

#### Benefits to local communities and the nation:

- A cleaner environment
- Improved national energy security
- Reduced emissions of gases implicated in global climate change

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**Energy Use by Sector**

[Graph showing energy use by sector]

Source: EIA, MECS, 1994

Note: EIA data on energy use by pulp mills not available for 1994; data for paper mills includes a number of integrated pulping and papermaking operations.

The pulp and paper sector is the most energy-intensive part of the forest products industry, accounting for nearly 85 percent of all energy used.
Boosting industry performance

Based on industry-defined priorities and recommendations, OIT awards cost-shared support to projects that will improve the industry’s energy efficiency and global competitiveness. Each year, OIT provides approximately $3 million to new projects and about $8 million to ongoing projects in OIT’s forest products portfolio. All awards are made on a cost-shared basis through a competitive solicitation process. Solicitations are open to collaborative teams with members from industry, academia, national laboratories, and other sectors that have a stake in the future of the forest products industry.

Since beginning the Industries of the Future process, OIT’s Forest Products Team has awarded a total of $78 million in OIT funding to over 100 projects. For its share, the industry has provided over $33 million in project funding in addition to specialized expertise, materials, and facilities.

Demonstrating Success

Eight technologies funded through OIT have completed development and are currently in the demonstration phase. Two of these projects are applicable to the manufacture of both wood and paper products: Feedstock-to-Product Characterization Tools, which recently received the R&D 100 Award (see sidebar), and Steam Reforming Black Liquor Gasification, a process that maximizes chemical recovery while generating two to three times more electrical energy per ton of biomass feedstock than conventional technologies.

A third demonstration project, Low-VOC Drying of Lumber, uses radio frequencies to pretreat lumber and remove volatile organic compounds (VOCs) with minimal energy. The remaining five demonstration projects address various stages of the energy-intensive papermaking process.

The OIT Forest Products R&D portfolio addresses a broad spectrum of industry priorities. A representative listing of projects is shown at right. Eight are now in the demonstration phase (shown in bold type). To learn more about the projects in OIT’s Forest Products portfolio, visit www.oit.doe.gov/forest
Active Industry Involvement

Through the Industries of the Future process, industry plays a central role in focusing near-term and long-term research investments. Industry-led task groups for each Agenda 2020 focus area work with DOE to conduct annual solicitations, merit review of all incoming proposals, and technical review of all ongoing RD&D projects. OIT makes the final selection for new R&D awards based on ranked lists from these task groups. Up to three mentors from the industry guide each R&D project, advising researchers on real-world operations and considerations. Industry representatives also participate in periodic portfolio reviews with OIT.

Feedstock-to-Product Characterization Tools

Partners have developed a technology that can instantaneously and non-destructively determine the chemical and mechanical characteristics of wood, wood products, and other plant materials, even during high-speed processing. It will help guide paper mill operations and optimize the use of standing trees.

Partners:
- Weyerhaeuser
- Rayonier
- Champion International
- Mead
- Georgia-Pacific
- National Renewable Energy Laboratory
- Westvaco

This project received the prestigious R&D 100 Award as one of the 100 most technologically significant new products in 2000.

* This listing is a representative sampling of the many Forest Products Industry of the Future RD&D projects.

** Does not include energy used for raw material growth, harvest, or transportation; recycling energy is included in pulping.
OIT’s Forest Products Team supplements its own R&D budget by coordinating activities with other OIT programs that can help advance the industry’s goals. For example, OIT’s program in Industrial Materials supports development of specialized materials that withstand the harsh environments in pulping and papermaking. Similarly, OIT’s Agriculture Team funds R&D that can offer carryover benefits for tree growth, selection, and characterization. Emerging technologies gain credibility through mill demonstrations funded under OIT’s NICE³ program.

OIT programs of value to the forest products industry include research and development of enabling technologies, BestPractices initiatives, and financial assistance. In addition, State-Level Industries of the Future programs are starting up in a number of states to bring the energy, environmental, and economic benefits of industrial partnerships to the local level.

**Enabling Technologies**

**Advances of Value to All Industry**

OIT works with industry, the national laboratories, academia, and others to research, develop, and commercialize enabling technologies that can benefit a wide range of industries, including forest products. In Industrial Materials, the focus is on strong, durable materials that can withstand harsh, high-temperature industrial environments. Efforts in Combustion target clean, cost-effective technologies that will increase productivity, improve energy efficiency, reduce emissions, and enhance fuel flexibility. Research in Sensors and Controls addresses such challenges as improving sensor reach and accuracy in harsh environments and providing integrated, on-line measurement systems for operator-independent control of mill processes in real time.

**Plant-Wide Assessment of Boise Cascade Mill**

Water pinch analysis of the company's pulp and paper mill in International Falls, Minnesota, identified opportunities to recycle hot effluent streams to reduce the need for process steam, fresh water, and energy to cool the effluent. The four projects and two process modifications selected will remove 45.6 million Btu per hour from the effluent, save $707,000 annually (with a payback of 3 years), and reduce steam use by 28,100 pounds per hour.

The President’s Biobased Products and Bioenergy Initiative (issued August 1999) is designed to triple U.S. use of biobased products and bioenergy by the year 2010. The initiative will increase the technical and economic feasibility of using crops, trees, and agricultural and forestry residues to generate energy and produce industrial chemicals.
BestPractices

Boosting Productivity with Today's Technology

Through the BestPractices program, OIT helps forestry, wood, pulp and paper, and related industries apply existing technologies to save money, cut emissions, and reduce wastes. OIT and over a dozen retired executives from the forest products industry work directly with mills to alert them to opportunities for funding, tools, expertise, and applicable technologies emerging from OIT’s extensive R&D portfolio. The returns for industry can be significant. For example, improving motor systems in U.S. paper mills—which consume an estimated 55,775 gWh per year—can potentially save the industry from $103 million to $248 million per year.

BestPractices also offers plant-wide assessments, helping manufacturers develop a comprehensive strategy to increase efficiency, reduce emissions, and boost productivity. Up to $100,000 in matching funds is awarded for each assessment through a competitive solicitation process. Participants agree to a case study follow-up of results. Alternatively, small to mid-sized manufacturers can take advantage of the Industrial Assessment Centers, which provide no-charge assessments through a network of engineering universities.

Financial Assistance

Promoting Technology Innovation and Demonstration

Two financial assistance programs are offered by OIT to accelerate technology development and application. The Inventions and Innovation program awards grants of up to $200,000 to inventors of energy-efficient technologies. Grants are used to establish technical performance, conduct early development efforts, and plan commercialization activities. The second program, NICE³ (National Industrial Competitiveness through Energy, Environment, and Economics), provides cost-shared grants of up to $500,000 to industry-state partnerships for demonstrations of clean and energy-efficient technologies.

For more information, please contact the OIT Clearinghouse at (800) 862-2086.
For more information on the Forest Products Industry of the Future, contact the OIT Clearinghouse at (800) 862-2086 or visit www.oit.doe.gov/forest

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov