DEDICATED TO MAKING A DIFFERENCE

The sustainable forest products industry,

carbon and climate change

Key messages for policy-makers

World Business Council for
Sustainable Development

Technical content developed by

ncasi

> Biomass fuels are fundamentally different from fossil fuels because biomass fuels recycle carbon to the atmosphere whereas fossil fuels introduce 'new' carbon to the atmosphere. This is why biomass fuels are called 'carbon-neutral'.

John Luke Jr., MeadWestvaco, and Elisabet Salander Björklund, Stora Enso,
Co-chairs, WBCSD Sustainable Forest Products Industry working group

World Business Council for Sustainable Development I WBCSD

The World Business Council for Sustainable Development (WBCSD) is a coalition of 175 international companies united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress. Our members are drawn from more than 30 countries and 20 major industrial sectors. We also benefit from a global network of 50+ national and regional business councils and partner organizations.

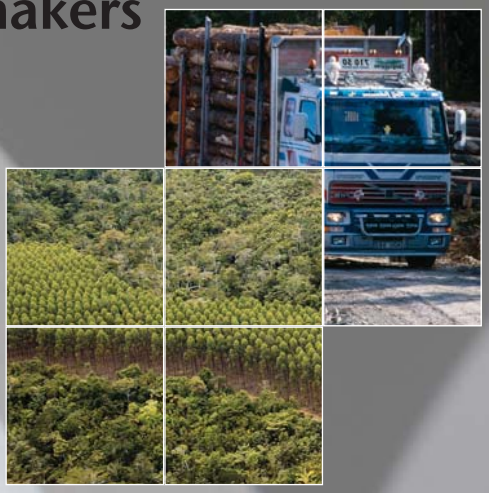
Our mission is to provide business leadership as a catalyst for change toward sustainable development, and to support the business license to operate, innovate and grow in a world increasingly shaped by sustainable development issues.

Our objectives include: *Business Leadership* – to be a leading business advocate on sustainable development; *Policy Development* – to participate in policy development to create the right framework conditions for business to make an effective contribution towards sustainable development; *The Business Case* – to develop and promote the business case for sustainable development; *Best Practice* – to demonstrate the business contribution to sustainable development solutions and share leading edge practices among members; *Global Outreach* – contribute to a sustainable future for developing nations and nations in transition. For more information visit www.wbcsd.org.

National Council for Air and Stream Improvement I NCASI

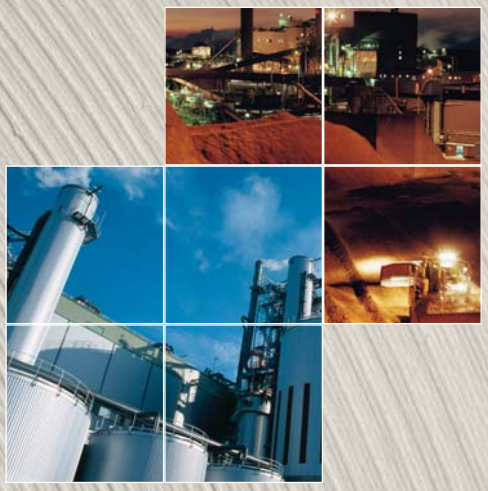
The National Council for Air and Stream Improvement (NCASI) is an independent, non-profit research institute that focuses on environmental topics of interest to the forest products industry. Established in 1943, NCASI is recognized as a leading source of technical and scientific information on environmental issues affecting this industry. Although NCASI receives most of its funding from forest products companies, it also receives funding from government agencies, associations and other organizations interested in better understanding the connections between the forest products industry and the environment. For more information visit www.ncasi.org

Executive summary for policy-makers



The Sustainable Forest Products Industry – Responsible managers of carbon

> We supply products that store carbon, require lower energy inputs during their life cycle than most alternative non-wood products, and are highly recyclable.
> We use forest resources sustainably and efficiently.
> We are energy intensive, but meet most of our energy needs with carbon-neutral biomass fuels.



Our carbon challenges

> The connections between our industry and the global carbon cycle are complex, and hastily enacted climate change policies can have unintended consequences on our industry's future.
> We are capital intensive, making it difficult and expensive to change technology in response to short-term policy measures.

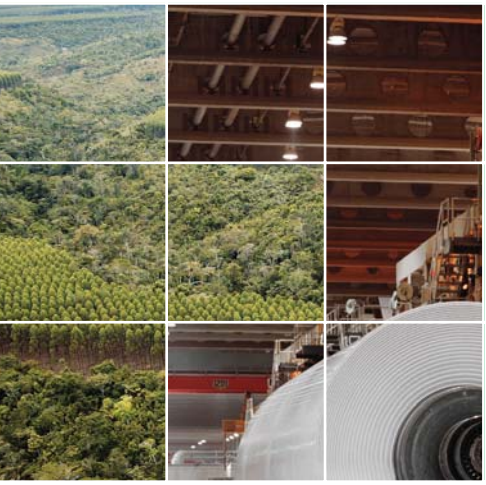
Our carbon opportunities

> Breakthrough technologies are needed to significantly reduce energy consumption within the industry.
> To assist in the efforts to reduce society's energy use and greenhouse gas emissions, the forest products industry can:
  - Become more energy efficient and increase its share of biomass in energy production;
  - Help supply society with increasing amounts of wood and fiber for use as a raw material and for bioenergy;
  - Strive to increase the use of recycled fiber.

Our policy recommendations

> Improvements in energy- and carbon-intensity can be accelerated by public policies that promote faster turnover of capital stock.
> Biomass energy is an important component of policies to control atmospheric CO_2, but unless they are balanced, these policies could significantly impact the forest products industry. Policies must secure:
  - Adequate supplies of fresh fiber;
  - The carbon life cycle benefits associated with forest products;
  - An increase in the recovery of used wood and fiber.

Responsible managers of carbon



While carbon is stored in forest products, it remains out of the atmosphere. Studies indicate that the amounts of carbon stored in forest products are increasing by about 40 million tons per year. Currently, forest products store more than 3 billion tons of carbon globally.

Source: UNFCCC Technical Paper. Estimation, Reporting and Accounting of Harvested Wood Products. FCCC/TP/2003/7, 27 October 2003.

> Biomass fuels are fundamentally different from fossil fuels because biomass fuels recycle carbon to the atmosphere whereas fossil fuels introduce 'new' carbon to the atmosphere. This is why biomass fuels are called 'carbon-neutral'.
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Forest products store carbon

Forest products store carbon, require lower energy inputs during their life cycle than most alternative non-wood products, and are highly recyclable

When measured against common alternative building materials, wood-based structures of comparable thermal performance use less energy and have fewer CO_2 emissions. This is because wood building materials require less energy to manufacture and because much of the energy required to produce them comes from biomass fuels – a carbon-neutral source of energy.

Virtually all goods produced in the global economy leave an environmental and carbon footprint throughout their life cycle, from resource extraction through manufacturing to distribution, use and end-of-life disposal. Too often climate change policies focus on greenhouse gas mitigation at only one stage in a product's life cycle. When viewed on a life cycle basis, wood-based building materials are substantially less carbon intensive than substitute materials.

Energy and carbon benefits of increasing wood use in New Zealand housing[1]	Wood used	Embodied energy	Carbon released	Carbon stored
	1000 m3	PJ	Tons	Tons
Typical House Construction	632	18.1	363'000	158'000
Wood-based House Construction[2]	688	8.0	158'000	172'000
Percent change from using more wood	**8.9%**	**-55.8%**	**-56.5%**	**8.9%**

1. Estimates represent New Zealand totals for housing construction only
2. Replace brick exterior with wood and aluminum window frames with wood

Source: *Buchanan and Levine, "Wood-based building materials and atmospheric carbon emissions", Environmental Science and Policy 2 (1999)*

Figure 1

Sustainably managed forests are a renewable natural resource

Optimum forest management practices will be those that ensure continued carbon sequestration in the forest, provide wood fiber for biomass-based products and carbon-neutral biomass fuels, and protect the ecological values of the forest in a balanced way.

The income landowners receive for products grown on their land encourages them to maintain, renew and manage this valuable resource sustainably. This is an especially important consideration in places facing economic pressures to convert forestland to non-forest uses.

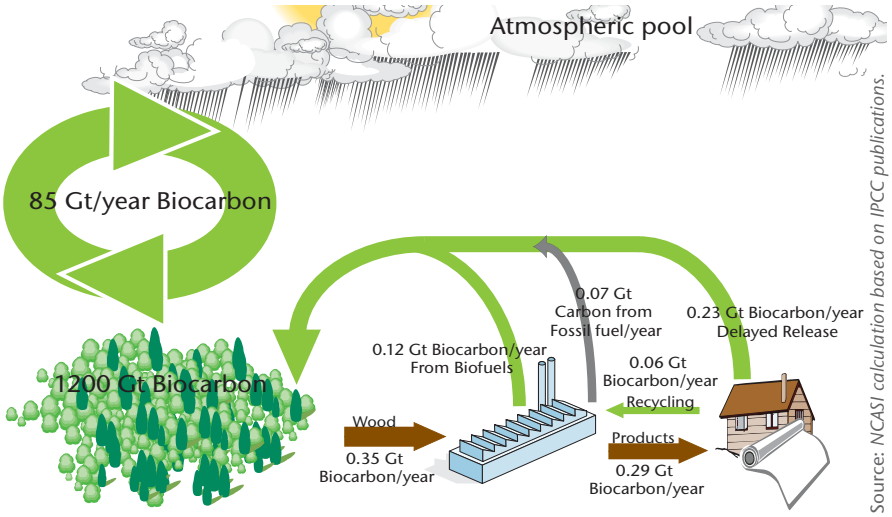


Figure 2: The carbon removed from the forest by the forest products industry represents only about 0.5% of the carbon that is recycled between the forest and the atmosphere annually, and less than 0.03% of the carbon stored in the world's forests.

The forest industry is highly resource efficient

Essentially all of the material removed from the forest is used either in products or as biomass fuel in the forest products industry. Therefore the industry has created and supports an extensive infrastructure essential for collecting biomass from the forests.

1. Paper recovery rate is generally defined as the percentage of paper and paperboard consumed domestically that is recovered for recycling or other uses. Data are from national trade associations for 2003, or the most recent year for which data are available. Because the data sources and definitions vary somewhat among national associations, comparisons between countries must be done with caution.

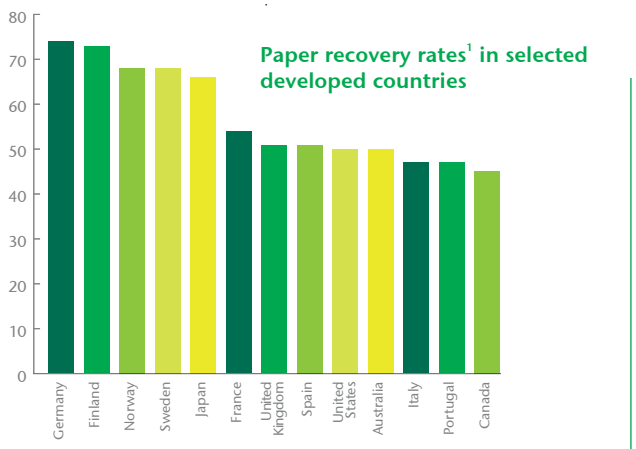


Figure 3: In many industrialized countries over one-half of the paper is recovered for recycling, allowing forest fiber to serve repeated uses.

The forest industry is energy intensive, but meets most of its needs with carbon-neutral biomass fuels

It is the new carbon from fossil fuels that, according to the Intergovernmental Panel on Climate Change (IPCC), is primarily responsible for the increases in atmospheric CO_2 that have occurred in the last 100 years.

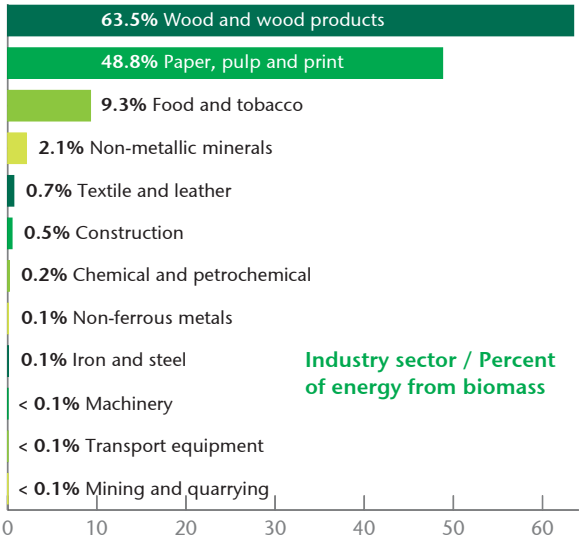
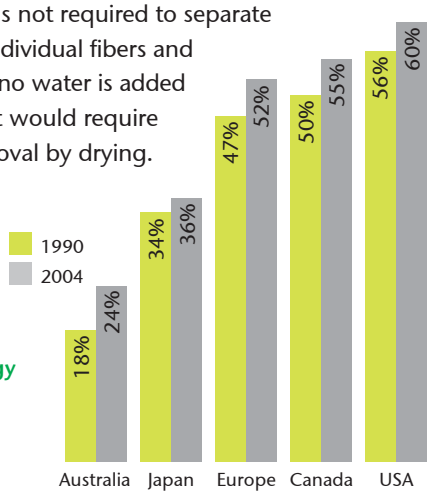


Figure 4: The forest products industry derives a greater fraction of its energy requirements from biomass than any other industry. In developed countries, on average, the forest products sector obtains more than half its energy from biomass.
Source: *Based on data from Energy statistics of OECD Countries: 2000-2001. Paris, France: OECD/IEA.*

Although the pulp and paper industry is considered to be an energy-intensive industry, its energy efficiency has steadily improved.

Wood products manufacturing is usually less energy intensive than paper and paperboard manufacturing, largely because energy is not required to separate the wood into individual fibers and because little or no water is added to the wood that would require subsequent removal by drying.



Source: *NCASI based on trade association data.*

Figure 5: Renewable biomass energy is supplying an increasing share of the energy required by the pulp and paper industry. The graph illustrates the increased reliance on biomass fuels since 1990. The country-to-country variations are largely due to differences in the types of mills in each nation. The industries in Australia and Japan, for instance, are comprised of a larger fraction of recycling mills that generally have fewer opportunities for using biomass fuels.

Direct greenhouse gas (GHG) emissions from fossil fuel combustion in the forest-based industries are approximately 264 million tons of CO_2 per year, which is about one percent of global GHG emissions. Indirect emissions from purchased power are estimated to be 130 to 180 million tons of CO_2 per year.

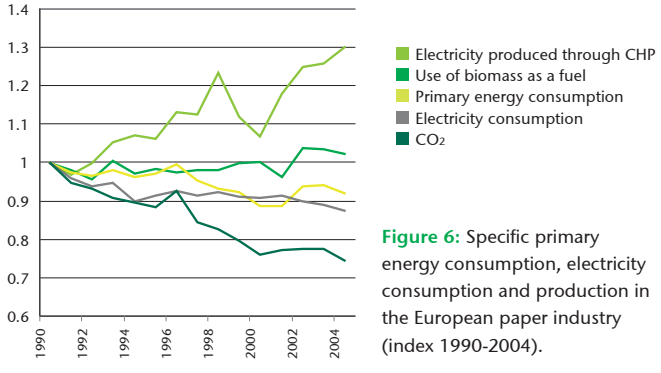


Figure 6: Specific primary energy consumption, electricity consumption and production in the European paper industry (index 1990-2004).

Source: *CEPI – data covers 91 % of products (market pulp, paper and board).*

Our carbon challenges

A study of the pulp and paper industry by researchers at the University of Maryland and Boston University concluded that:

"...regardless of [the industry's] location, resource availability and production structure, an increase in the rate of capital turnover is the most important factor in permanently changing carbon emission profiles and energy efficiency in the pulp and paper industry."

Source: Davidsdottir, B. and Ruth, M. "Capital vintage and climate change policies: the case of US pulp and paper", Environmental Science & Policy, issue 7, 2004, pp. 221-233.

The connections between the forest products industry and the global carbon cycle are complex, and hastily enacted climate change policies can have unintended consequences on the forest products industry.

Attempts to increase carbon storage in forests via prohibitions on harvesting can:

- Reduce the availability of wood fiber for the forest value chain and for biomass fuels;
- Increase the risk of loss of stored carbon via fire or infestation;
- Increase the costs of forest products, causing them to lose market share to competing products that do not store carbon and are more energy and carbon intensive.

Attempts to expand the use of biomass fuels without ensuring commensurate increases in virgin and recovered fiber supplies could create competition for wood fiber, thereby:

- Reducing the availability and increasing the cost of wood fiber for manufacturers of forest products;
- Resulting in the loss of market share to non-wood based products that may be more energy and carbon intensive;
- Threatening the viability of forest product manufacturing facilities that provide more economic sustainability benefits than operations that merely burn fiber for energy.

Active forest management practices, such as competition control, fertilization, thinning and prescribed fire, can enhance forest carbon sequestration. In pursuing these forest carbon sequestration benefits, however, other important functions of forests must also be considered – especially their role in supplying raw material for biomass-based products and biomass fuels that displace fossil fuels.

Forestry is challenged with very long investment horizons and uncertain economic returns on investments in improved productivity. Where these challenges can be met, however, forest management for wood fiber provides a critical economic incentive for keeping land in forests rather than being converted to uses providing no climate and energy benefits.

Long value chain and the high recycling rates

When tailoring policies for the forest products industry, it is important to consider not only the industry's manufacturing facilities, but also the long value chain and high recycling rates. Long timescales over which carbon and climate impacts occur and the industry's unique carbon profile further complicate the development of appropriate policies for the forest products industry.

Forests

- Recycle CO_2 between the atmosphere and the terrestrial environment;
- Provide biomass-based raw material for forest products;
- Provide biomass for carbon-neutral fuels.

Wood product manufacture

- Uses little or no fossil fuel so they have limited opportunities to make major reductions in GHG emissions;
- Often consumes purchased electricity, however, making them vulnerable to increased electricity costs;
- Has the potential for playing an important role as nodes in an expanded biomass infrastructure aimed at supplying increased amounts of biomass fuels to industry and society, because of their dispersed locations;
- Relies on fossil fuel-based transportation of raw materials and products.

Pulp and paper manufacturing

- Is energy intensive, but energy efficiency has steadily improved over time, and continued incremental improvements are likely;
- Is seeking ways to reduce energy use due to increasing fossil fuel and electricity costs and GHG emissions reductions usually occur as a result;
- Uses large amounts of steam, making pulp and paper mills ideal hosts for combined heat and power (CHP); the sequential use of steam for several purposes within the production process allows these systems to be highly energy efficient;
- Is already a leader in the use of CHP in many countries, but significant

Forest products industry is capital intensive

The forest products industry is capital intensive, making it difficult and expensive to change technology to accommodate near-term policy actions.

The best way for the forest products industry to reduce emissions is through technological innovation and accelerated capital stock turnover. However, the industry is capital intensive, with very long-lived capital equipment. For example, the typical predicted lifetime for a power plant, chemical pulp mill or paper production line is 25 years. Decisions concerning fuels, energy procurement options, production processes and their efficiencies, as well as main raw materials and product categories, are set years in advance. Long planning horizons are one of the most difficult challenges facing this industry.

Climate change-related policies like taxation, licensing opportunities and procedures and emissions pricing and trading all affect our competitiveness. Even though these policies are intended to steer our industry towards a less carbon-constrained society, they may not provide our industry with measures sufficient to mitigate our emissions because of the high capital costs involved.

The industry is based on big investments: The new Veracel pulp mill, which is jointly owned by Aracruz Cellulose and Stora Enso, was built in the Brazilian state of Bahia at a cost of US$ 1.25 billion. The pulp mill started its processes in May 2005. When in full operation, the mill will create 3,000 direct jobs at an investment cost of US$ 400,000 per job.
Photo: Stora Enso image bank

Power plants

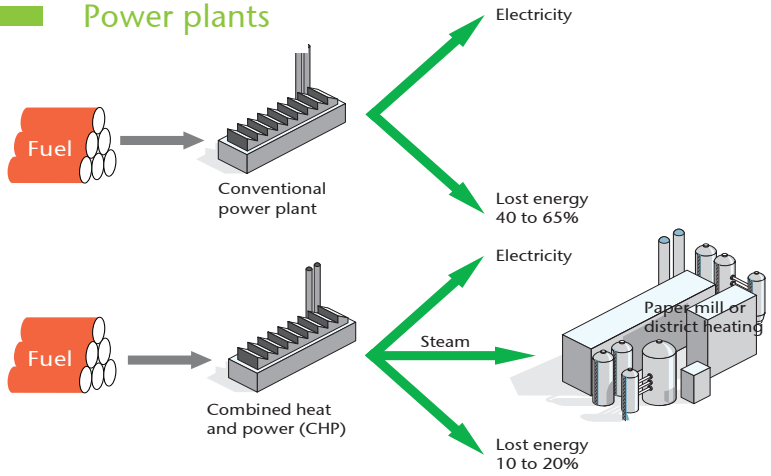
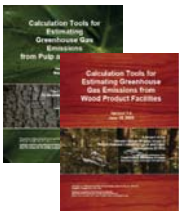


Figure 7: Compared to conventional electrical power generation systems, combined heat and power systems produce twice as much usable energy from the same amount of fuel.

Managing GHG emissions

The industry has developed tools for calculating GHG emissions from pulp and paper and from wood product manufacturing. These tools, which have been accepted for use under the WRI/WBCSD GHG Protocol, are available on the GHG Protocol website *www.ghgprotocol.org*



Calculation tools developed by the International Council of Forest and Paper Associations, working with the WBCSD and the World Resources Institute.

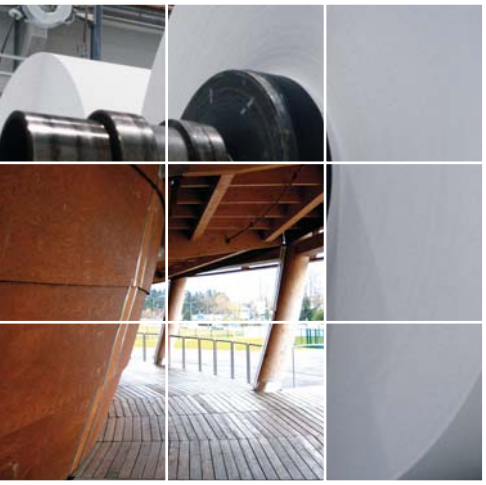
untapped potential remains; in some locations, the challenges to utilizing this potential include regulatory and market limitations;

- That uses virgin fiber usually derives a significant amount of its energy from biomass – i.e., wood waste, bark or spent pulping liquors which contain the lignin removed from the wood during pulping;
- Has opportunities in part to increase the use of biomass fuels, and in some cases mills have opportunities to replace a share of fossil fuels with biomass fuels;
- Has challenges to making these improvements, including required capital costs and insufficient quantities of affordable biomass fuel;
- Like wood product facilities, supports a biomass procurement and distribution system that could be expanded to produce additional amounts of biomass fuels for society.

The industry continues to research breakthrough technologies that have the potential to accomplish dramatic reductions in energy use. Key focus areas include mechanical pulping processes, pulping liquor recovery systems and paper dewatering and drying technologies.

Forest products

- Store carbon during use, then slowly return the carbon to the atmosphere;
- Often compete against products that are more energy and carbon intensive;
- Can usually be recycled, providing eco-efficient use of forest resources;
- In the end of their life cycle, can be used as biomass fuels displacing fossil fuels.



Although the pulp and paper industry is already a leader in using CHP technology, more can be done. A study by the US government indicated that "CHP presents a significant opportunity for improving energy efficiency and reducing carbon emissions in the pulp/paper and the chemicals industries. [...] There are about 17.8 GW remaining technical potential for CHP in the pulp/paper industry..."

Source: Khrushch, M., et. al. Carbon Emissions Reduction Potential in the US Chemicals and Pulp and Paper Industries by Applying CHP Technologies. Report LBNL-43739. Berkeley, CA: Lawrence Berkeley National Laboratory, 1999.

Wood buildings reduce greenhouse gas emissions

Research carried out at the University of Canterbury in New Zealand found that "...wood buildings require much lower process energy and result in lower carbon emissions than buildings of other materials such as brick, aluminum, steel and concrete. ... [A] 17% increase in wood usage in the New Zealand building industry could result in a 20% reduction in carbon emissions from the manufacture of all building materials, being a reduction of about 1.5% of New Zealand's total emissions.

Source: Buchanan and Levine. "Wood-based building materials and atmospheric carbon emissions". Environmental Science and Policy 2 (1999), pp. 427 – 437.

Research

Because the forest products industry is energy intensive and biomass based, there are significant opportunities to leverage breakthrough technologies.

Examples include:

- Development of forest-based biorefinieries to convert forest biomass into gaseous and liquid fuels and other commercial products[1].
- Significant breakthroughs in the most energy-intensive areas of forest product manufacturing – i.e., mechanical and chemical pulping, pulp and paper drying and chemical recovery.

The WBCSD's Sustainable Forest Products Industry working group encourages public-private partnerships such as the European Forest-Based Technology Platform and the US Agenda 2020 Technology Alliance to help accelerate the deployment of breakthrough technologies needed to accomplish dramatic reductions in energy use and greenhouse gas emissions.

1 – Gasification technology converts biomass into a gaseous form that can be used to produce electricity more efficiently than conventional biomass-based generation techniques. If successful, it could transform the forest products industry from a net consumer of power into a net exporter of "green" biomass-based electricity for use by society. Gasification also has the potential to produce bio-based transportation fuels and chemicals needed to make the bio-based products of the future.

At its mill in New Bern, North Carolina, Weyerhaeuser Corporation is partnering with gasification technology developer Chemrec to address a number of issues (efficiency, throughput, reliability and pulp mill integration) that need to be resolved for spent pulping liquor gasification technology to be commercially viable.
Photo: Chemrec

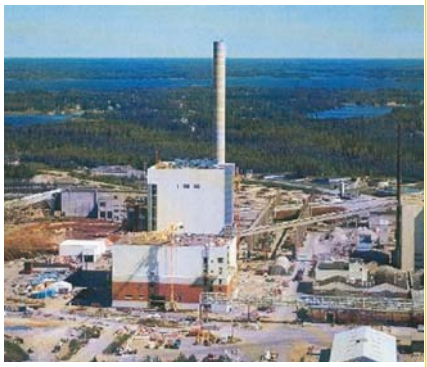
The Sustainable Forest Product Industry's role

The Sustainable Forest Products Industry can do a number of things to help reduce society's energy use and greenhouse gas emissions.

The industry can become more energy efficient and increase its use of biomass for energy.

- The European pulp and paper industry has volunteered for a 2010 goal of achieving on average a 25% increase in biomass share of on-site biomass primary energy consumption for heat and power and an increase in biomass share of total on-site primary energy consumption from 49% to 56%.
- The American Forest and Paper Association has taken on a goal of reducing the greenhouse gas intensity (i.e., a reduction in greenhouse gas emissions per ton of production) of its membership by 12% by 2012.
- Canada's pulp and paper sector cut greenhouse gas emissions by 22% during the 1990-2000 period while expanding output by a similar magnitude. In November 2003 it became the first industry in Canada to sign a Memorandum of Understanding with the federal government committing to further emissions reductions in the 2008-2012 period as part of Canada's plan for reaching its targets under the Kyoto Protocol.
- The Japan Paper Association has targeted a 13% reduction in energy intensity and a 10% reduction in CO_2 emissions intensity by 2010, compared to 1990 levels.

The increased use of biomass is a central element of all of these commitments.



The Alholmens Kraft biofuelled power plant in Pietarsaari, Finland is one of the largest in the world. The plant is a CHP facility producing electricity for the owners as well as steam that is used by a nearby UPM mill and by the local municipality for district heating. The plant is designed to use 150,000 to 200,000 cubic meters of loose or bundled logging residue annually.
Photo: TEKES brochure 2002

The industry can help supply society with increasing amounts of sustainably produced fiber for use as a raw material and for bioenergy.

The forest-based industry is finding ways to increase forest productivity while protecting their environmental value.

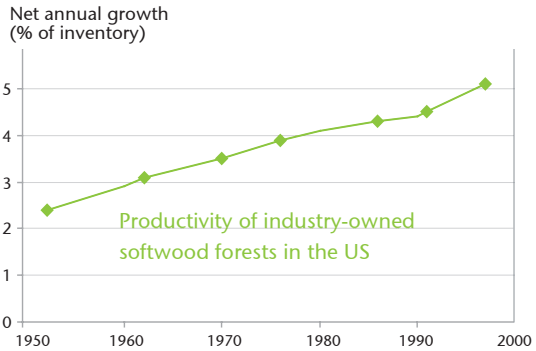


Figure 8: Continuing improvements in forest productivity can provide benefits to carbon sequestration in forests and forest products and add to supplies of biomass fuels and wood. SOURCE: Haines R.W. "An analysis of the timber situation in the United States: 1952 to 2050". U.S. Forest Service Report PNW-GTR-560. February 2003.

The industry can strive to increase recycled fiber use.

The industry has committed to a range of recycling goals, which vary in timing and scope, to reflect the conditions in different parts of the world. In some cases the commitments are for recovery rates, defined as the fraction of paper consumed that is recovered for recycling.

Other commitments are based on utilization rates, the fraction of fiber used in new product that is from recovered fiber.

Some of the different recycling goals are:

- The Japan Paper Association has a goal of reaching a wastepaper utilization rate of 60% by 2005;
- The American Forest and Paper Association has a goal to recover 55% of all paper consumed in the US by 2012;
- The Confederation of European Paper Industries (CEPI), the European Recovered Paper Association (ERPA), and the European Federation of Corrugated Manufacturers (FEFCO) have committed to "take measures to ensure that by 2005, at least 56% of the paper and board products consumed in Europe will be recycled;"
- In January 2003 the Forest Products Association of Canada's membership announced they would support a 25% increase in recovery rates by 2010. That would increase the recovery rate to 55%.

Public policy warning

Public policy needs to consider not only the climate-change implications of biomass use, but also the economic and employment benefits to society that could be threatened by policies that diminish the vitality of the forest products sector. Using wood in the forest products value chain creates more than ten times the value added and one hundred times the employment of using the same wood only for energy.

The renewable energy target for the European Union could result in demand for wood that exceeds the current use by the entire European pulp and paper industry.

Source: CEPI. Renewable Raw Materials vs. Renewable Energy: Two Competing Goals. 2003

Recommendations

The forest products industry supports the ongoing recognition of biomass as a low-impact, renewable and CO_2 neutral energy source. We also believe that the most efficient and effective long-term greenhouse gas mitigation policies are those that consider the emissions profile of a product over its entire life cycle. The industry can make significant contributions toward meeting the world's climate goals if certain policy recommendations are effectively implemented:

① The many benefits of biomass-based products and fuels can only be realized if public policies promote the development of adequate supplies of wood and recovered fiber;

② The use of biomass as a carbon neutral energy source must be balanced against the economic, social and environmental benefits of using this resource within the forest products value chain;

③ Incentives for the development and deployment of biomass-based technologies (such as biomass gasification) are needed to make our industry energy self-sufficient and potentially a net supplier of energy;

④ Government policies that help reduce the cost of capital through lower interest rates, tax incentives and accelerated depreciation;

⑤ The many benefits of combined heat and power production are well known throughout the forest products industry, therefore regulatory barriers that discourage facilities from maximizing combined heat and power potential should be removed;

⑥ Forest–based carbon sequestration should be carefully considered to avoid unintended consequences, such as the withdrawal of productive forests from the forest products value chain, artificial pricing of forest resources, or limiting fresh fiber availability for processing.

⑦ The carbon removed from the atmosphere and sequestered in forest products throughout their useful lives should be more fully recognized, as should the carbon and energy attributes of forest products compared to competing products.

Key information and data sources

FAOSTAT Database, United Nations Food and Agriculture Organization (FAO), Rome, http://faostat.fao.org/

Forest Products Industry Associations in major producing countries and regions including:
Australia – www.a3p.asn.au
Brazil – www.bracelpa.org.br
Canada – www.fpac.ca
Chile – www.corma.cl
Europe – www.cepi.org
Finland – www.metsateollisuus.fi
France – www.copacel.fr
Germany – www.vdp-online.de
Global – www.icfpa.org
Italy – www.assocarta.it
Japan – www.jpa.gr.jp
New Zealand – www.nzfic.org.nz
Norway – www.pulp-and-paper.no
Portugal – www.celpa.pt
South Africa – www.pamsa.co.za
Spain – www.aspapel.es
Sweden – www.skogsindustrierna.org
United Kingdom – www.paper.org.uk
United States – www.afandpa.org

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World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD). *The Greenhouse Gas Protocol Initiative*. USA: WBCSD/WRI, 2004. www.ghgprotocol.org

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