ENVIRONMENTAL PRODUCT DECLARATION

NORTH AMERICAN CELLULOSIC FIBERBOARD

AMERICAN WOOD COUNCIL
CANADIAN WOOD COUNCIL

Cellulosic fiberboard (insulation board) is a low density wood panel used in residential and commercial construction.

The American Wood Council (AWC) and Canadian Wood Council (CWC) represent wood products manufacturers across North America. The AWC and the CWC are please to present this Environmental Product Declaration (EPD) for North American cellulosic fiberboard.

EPDs enable comparison between products but do not themselves compare products. EPDs can only be used for comparison between different building products and systems if they have been assessed on the basis of the same functional unit and service life using the same Product Category Rule. Information in this EPD is provided using a declared unit and shall not be used for comparison.

The EPD includes life cycle assessment results for all processes up to the point that cellulosic fiberboard is packaged and ready for shipment at the manufacturing gate.

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ENVIRONMENTAL PRODUCT DECLARATION

AMERICAN WOOD COUNCIL

Canadian Wood Council / Conseil canadien du bois

North American Cellulosic Fiberboard (CFB)
North American Structural and Architectural Wood Products

According to ISO 14025 and ISO 21930

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	American Wood Council
DECLARATION NUMBER	4787319688.101.1
DECLARED PRODUCT	Cellulosic Fiberboard
REFERENCE PCR	FP Innovations. 2015. Product Category Rules (PCR) for preparing and environmental Product Declaration (EPD) for North American Structural and Architectural Wood Products. https://fpinnovations.ca/ResearchProgram/environment- sustainability/epd-program/Documents/pcr-v2.pdf.
DATE OF ISSUE	February 24, 2016
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	FP Innovations PCR review committee info@fpinnovations.ca
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Wade Stout, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas Gloria, Industrial Ecology Consultants

Environment

Description of Industry and Product

Description of North American Cellulosic Fiberboard (CFB) Industry

The North American forest products industry is a major contributor to both the United States and Canadian economies. Wood manufacturing jobs, including those required to produce cellulosic fiberboard (CFB) serve as the primary economic drivers in rural areas of both countries. In 2012, CFB production in North America was 702 million ft^2, 0.5 – inch basis (828 thousand m^3).

North American CFB is used in residential and commercial construction. Various uses and applications for fiberboard include: 1. Sound-deadening board, 2. Structural sheathing, and 3. Roofing substrate (i.e., roof fiberboard). Asphalt is used internally as a binder to improve strength properties and externally as a coating. Coating of CFB is not part of this EPD. CFB is a panel product developed to utilize industrial wood residue. Wood residues originate from industrial wood waste such as shavings, sawdust, and chips produced during other wood manufacturing processes and from under-utilized whole trees. Additional feedstock sources include mixed paper and construction wood waste.

Manufacturers of CFB in North American are members of the North American Fiberboard Association, Rolling Meadows, Illinois. Seven CFB manufacturers contributed production data from the United States and Canada. No CFB manufacturers were in operation in Mexico (Table 1).

Table 1. North American Cellulosic Fiberboard Manufacturers (2012)

Manufacturer	City	State/Province, Country
Temple-Inland Forest Products	Diboll	Texas, United States
Georgia Pacific	Jarratt	Virginia, United States
Blue Ridge Fiberboard	Danville	Virginia, United States
Western Louisville Fiberboard	Calgary	Alberta, Canada
Louisville Specialty Products	Louisville	Québec, Canada
International Bildrite Inc.	International Falls	Minnesota, United States
Building Products of Canada	LaSalle	Québec, Canada

Description of Cellulosic Fiberboard Product

Cellulosic fiberboard falls into the North American Industry Classification System (NAICS) Code 321219, reconstituted wood products. Over the last several decades, CFB has evolved into a highly engineered product designed to meet specific end-use requirements. The most common dimensions of CFB panels are 0.5 inch (12.7 mm) thick, 4.0 feet (1.22 m) wide and 8.0 (2.44 m) long. However thickness, width, and length can vary to meet end-use requirements.

The product profile presented in this EPD is for a declared unit of 1 cubic meter of CFB. One cubic meter of average North American CFB weighs 254 kg excluding moisture. The product composition is presented below and represents the weighted average of the wood fiber and additives used in CFB manufacturing.

- Wood: oven dry 234.48 kg (92.22%)
- Asphalt flake: 9.61 kg (3.78%)
- Starch: 3.84 kg (1.51%)
- Wax: 2.83 kg (1.11%)
- Clay: 1.51 kg (0.59%)
- Alum: 1.44 (0.57%)
- Other: 0.55 kg (0.22%)

This EPD is based on LCA studies that considered the entire range of CFB product sizes and functions. For reference purposes the results are provided for 1 cubic meter of finished product, which is equal to 35.31 cubic feet.

Cradle-to-Gate Life Cycle of Cellulosic Fiberboard Production

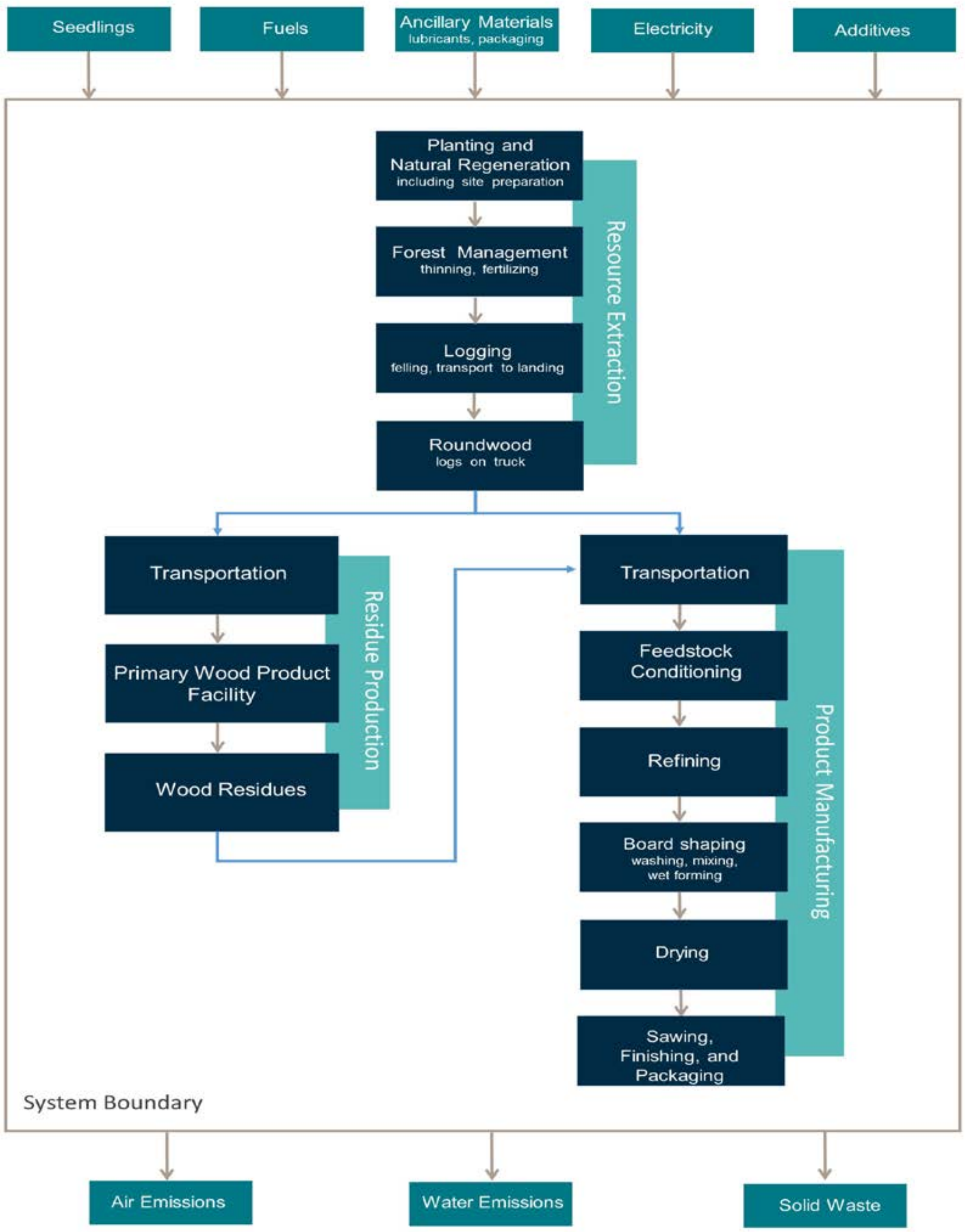


Figure 1 Cradle-to-gate system boundary for cellulosic fiberboard

Forest Operations

The PCR requires that the production system include extraction of raw materials including reforestation activities. Therefore, the life cycle assessment of a wood product includes the energy use and emissions from all forestry operations which include plantation establishment, management, and harvesting. In the EPD for cellulosic fiberboard, the cradle-to-gate product system begins with the establishment of a natural or managed forest by natural regeneration or planting of seedlings, respectively. The boundary also encompasses all forest management activities which may include site preparation, thinning, and fertilization.

Cellulosic Fiberboard Production

The manufacturing process of CFB begins with processing wood residues to produce a homogeneous feedstock. The prepared feedstock is refined by mechanically reducing and thermally softening the material into fibers. The fibers are then washed and mixed with water and additives to create a fiber slurry. No resins are added to produce CFB. A thermo-mechanical process reduces the wood fibers and binds them with a starch for recombination into CFB. Other additives may include alum, clay, and wax. Asphalt can also be added in the mix to improve strength properties. Adding water to the fiber creates a slurry that is then transformed into a fiber mat. The wet mats have a moisture content of 65-75 percent before drying. Presses and large dryers are used to remove water resulting in a final moisture content of CFB of about 4 percent. Boards are trimmed to dimension and packaged for shipment.

Packaging of Cellulosic Fiberboard

Packaging materials represent less than 1.0 percent of the cumulative mass of the model flow. Wrapping material can vary between products and manufacturer. Cellulosic fiberboard sheets are dead-stacked on pallets and wrapped using polyethylene laminated paper. For shipping, there can up to 80 CFB (1/2”) sheets wrapped to together on a single pallet (unit). A total of 20 units are shipped on flat-bed trucks. Wood spacers are used between units. Pallet production and transportation of packaged CFB are excluded from this EPD.

Methodology of Underlying LCA

Business-to-business EPD and Cradle-to-Gate LCA

Business-to-business (B-to-B) EPDs include the life cycle of the product up to the point that the product has been manufactured and is ready for shipment. This is commonly referred to as a cradle-to-gate life cycle assessment. The cradle-to-gate processes included in this EPD are outlined in Figure 1. The use phase and end of life scenarios can be omitted in a B-to-B EPD.

This Type III environmental declaration is developed according to ISO 21930 and 14025 for cellulosic fiberboard. This EPD reports environmental impacts based on established life cycle impact assessment methods. The reported environmental impacts are estimates, and their level of accuracy may differ for a particular product line and reported impact. LCAs do not generally address site-specific environmental issues of related to resource extraction or toxic effects of products on human health. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction. Forest certification systems and government regulations address some of these issues. In this EPD the woody residues used in the production of CFB coming from Canadian and US forests are harvested under the applicable federal, provincial, and state laws. EPDs do not report product environmental performance against any benchmark.

Declared Unit

In accordance with the PCR, the declared unit for CFB is one cubic meter (m^3) which is equal to 35.31 cubic feet. The average density of North American CFB including additives is 254 kg/m^3 oven dry. Cellulosic fiberboard produced in North America has a moisture content of 4 percent at the plant gate when it is ready for shipment. Moisture content of CFB is quite stable due to the high temperatures used during the manufacturing process.

System Boundaries

The system boundary begins with the planting, growth and harvest of trees in North American and ends with CFB packaged to leave the mill gate. The forest resources system boundary includes: forest regeneration and stand management, felling the trees, removing limbs, transportation of logs to landing, and cutting to shipping lengths as needed. Excluded from forestry operations are maintenance and repair of equipment, and building and maintenance of logging roads, logging camps, and weigh stations. The transportation of logs from the woods to the mill is accounted for with the CFB manufacturing. Cellulosic fiberboard production includes feedstock collection, storage (wood residues, logs, construction waste, and paper), processing, and packaging. Outputs include 1 m^3 of CFB ready to be shipped, air and water emissions, solid waste, and co-products.

Cut-Off rules

The cut-off criteria for flows to be considered within the system boundary are as follows:

- Mass – if a flow is less than 1% of the cumulative mass of the model flows, it may be excluded, provided its environmental relevance is minor.
- Energy – if a flow is less than 1% of the cumulative energy of the model flows, it may be excluded, provided its environmental relevance is minor.
- Environmental relevance – if a flow meets the above two criteria, but is determined (via secondary data analysis) to contribute 2% or more to the selected impact categories of the products underlying the EPD, it is included within the system boundary.

Data Quality

Precision and Completeness

Primary data on raw materials, energy, and emissions were provided by CFB manufacturing facilities based on purchase inputs, production outputs, and reported process emissions. All upstream and downstream secondary data (e.g. forestry operations and fuel production) were drawn from publicly available databases, primarily the United States Life Cycle Inventory (USLCI) database and other public LCI data sources. The LCA practitioners performed quality control on all secondary data sources to ensure completeness.

All inventory flows were modeled and no data were excluded due to application of the EPD cut-off criteria.

Consistency and Reproducibility

To ensure consistency only primary data, as provided by the CFB manufacturers, were used to model gate-to-gate CFB manufacturing processes. All other secondary data (upstream and downstream) were consistently applied and adaptations to the databases were documented in the LCA reports.

Reproducibility by third parties is possible using the background LCIs documented in the CORRIM and Athena reports.

Temporal Coverage

Primary data collected from the manufacturing facilities related to the product processes of interest are representative for the year 2012.

Geographic Coverage

The geographical coverage for this EPD is based on North American (NA) system boundaries for all processes and products.

Treatment of Biogenic Carbon

Biogenic carbon dioxide emissions were accounted as global warming neutral in accordance with the PCR. Under this approach, the carbon dioxide emissions from the combustion of internally generated wood fuels are considered equal to the carbon dioxide uptake in the forest during tree growth.

Crediting carbon sequestration against the global warming potential was excluded as the long term carbon storage is dependent on gate-to-grave processes not considered directly in this EPD. The expected carbon sequestration for average end-use and end-of-life treatment is provided in the section on “Additional Information.”

Allocation

According to the PCR (FPInnovations 2015) if one or more co-products are generated during the production process, it is necessary to allocate the inputs and outputs using a standardized approach. The LCA on CFB follows the allocation rules which states that when the total revenues between the main product and co-products is more than 10%, allocation shall be based on the revenue [economic] allocation. A no allocation method was applied to CFB. An economic allocation was applied to upstream wood residue production.

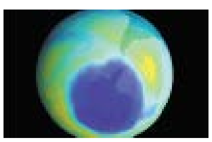
Data Collection and Calculation Methods

Primary data for the LCI was collected through surveys. This study relied almost exclusively on production inputs and emissions data provided by CFB producers in North America, with some secondary data from the USLCI database. A no allocation approach was applied therefore all inputs and outputs into the CFB manufacturing process were allocated to CFB (main product). Survey data were converted to a unit production basis of 1 cubic meter and a weighted average of input data was calculated based on production data.

Life Cycle Assessment Results

The life cycle impact assessment (LCIA) established links between the life cycle inventory results and the potential environmental impacts. In the LCIA, results are calculated for impact category indicators such as global warming potential and smog potential. These impact category indicator results provide general, but quantifiable, indications of potential environmental impacts. Consistent with the requirements of the PCR, five impact categories are reported in Table 2. The TRACI 2 method was used to characterize the reported environmental impacts.

Table 2: Impact Assessment Categories

Impact Category Indicators		Characterization Model
Global Warming Potential		Calculates global warming potential of all greenhouse gasses that are recognized by the IPCC. The characterization model scales substances that include methane and nitrous oxide to the common unit of kg CO_2 equivalents.
Ozone Depletion Potential		Calculates potential impact of all substances that contribute to stratospheric ozone depletion. The characterization model scales substances that include CFC's, HCFC's, chlorine, and bromine to the common unit of CFC-11 equivalents.
Acidification Potential		Calculates potential impacts of all substances that contribute to terrestrial acidification. The characterization model scales substances that include sulfur oxides, nitrogen oxides, and ammonia to the common unit of kg SO_2 equivalents.
Smog Potential		Calculates potential impacts of all substances that contribute to photochemical smog. The characterization model scales substances that include nitrogen oxides and volatile organic compounds to the common unit of kg O_3 equivalents.
Eutrophication Potential		Calculates potential impacts of all substances that contribute to eutrophication. The characterization model scales substances that include nitrates and phosphates to the common unit of kg N equivalents.

Cradle-to-Gate Impact Assessment

Modules included in the EPD are (Table 3): A1- Raw material supply, which includes resource extraction and residue production processes, A2 – Transportation of resource to residue production or residues to CFB, and A3 – Cellulosic fiberboard production. The impact assessment results for CFB are shown in Table 4. This LCIA does not make value judgments about the impact indicators, meaning that no single indicator is given more or less value than any of the others. All are presented as equals. Each impact indicator summarizes a different group of environmental emissions based on their pathway to potential impact using reference units that are common to the group but not comparable between the groups. For this reason the indicators should not be combined or added.

The results presented below indicate the potential impacts caused by the cradle-to-gate production of CFB. Ozone depletion was below 10^{-5} kg CFC eq. for forestry operations, residue production, and CFB production and is thus not reported in the results. Water consumption was a total from the LCI as required by the PCR and includes all water withdrawals without netting out non-consumptive use. As a result, the total water consumption is a conservative value which may overstate the use.

Table 3. Life cycle stages included in the LCA.

Product stage			Construction process Stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

X = modules included in the study
MND = Module not declared

Table 4: Cradle-to-Gate Impact Assessment Results - 1 m^3 North American Cellulosic Fiberboard					
Impact category Indicator	**Unit**	**Total**	**Forestry operations**	**Wood residue production**	**CFB Production**
Global warming potential	kg CO_2 eq.	295.0548	3.2387	10.5869	281.2292
Acidification Potential	kg SO2 eq.	2.9207	0.0439	0.0912	2.7856
Eutrophication Potential	kg N eq.	0.0712	0.0069	0.0063	0.0580
Ozone depletion Potential	kg CFC-11 eq.	0.0	0.0000	0.0000	0.0000
Smog Potential	kg O_3 eq.	20.6424	1.2793	1.8262	17.5369
	Unit	**Total**	**Forestry operations**	**Wood residue production**	**CFB Production**
Total primary energy consumption	MJ	6,148.23	50.04	198.75	5,899.44
Non-renewable, fossil	MJ	4,395.48	49.49	161.71	4,184.28
Non-renewable, nuclear	MJ	442.95	0.49	18.32	424.14
Renewable, biomass	MJ	1,018.29	0.00	10.07	1,008.22
Renewable, other	MJ	291.51	0.06	8.65	282.80
Material resources consumption	**Unit**	**Total**	**Forestry operations**	**Wood residue production**	**CFB Production**
Non-renewable materials	kg	0.3173	0.0000	0.0013	0.3160
Renewable materials	kg	333.208	186.194	145.590	1.424
Fresh water	L	3,795.78	0.63	6.68	3,788.47
Non-hazardous waste generated	**Unit**	**Total**	**Forestry operations**	**Wood residue production**	**CFB Production**
Solid waste	kg	56.98	0.05	0.65	56.28

Impact Assessment Results by Life Stage

Figures 2 and 3 show the CFB manufacturing life cycle stage is the primary driver of impacts in the cumulative cradle-to-grave product system. Cellulosic fiberboard manufacturing consumes 92% of fossil fuels and 96% of biomass energy which drives the impacts in all categories.

Figure 2: Cradle-to-Gate Impact Assessment Results

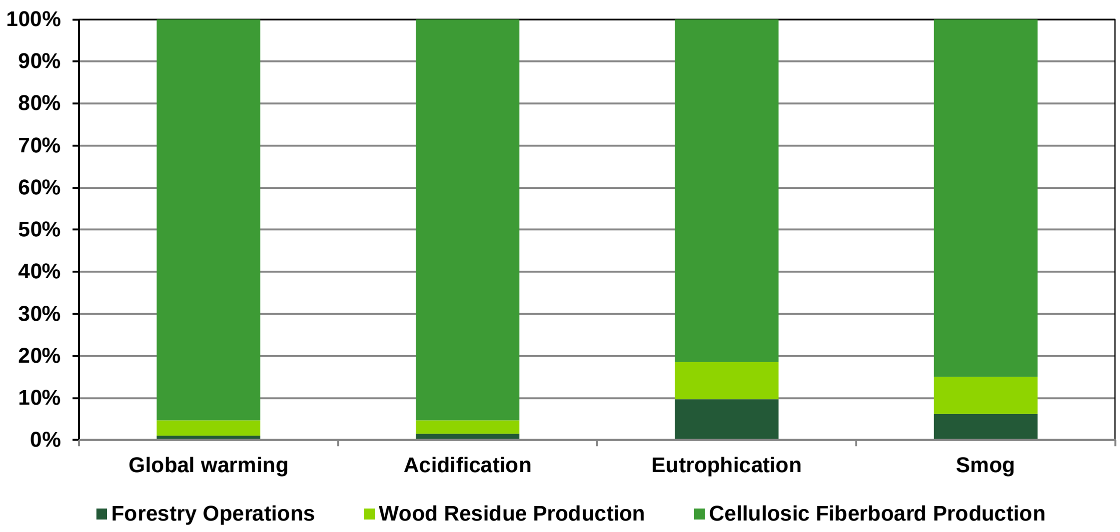
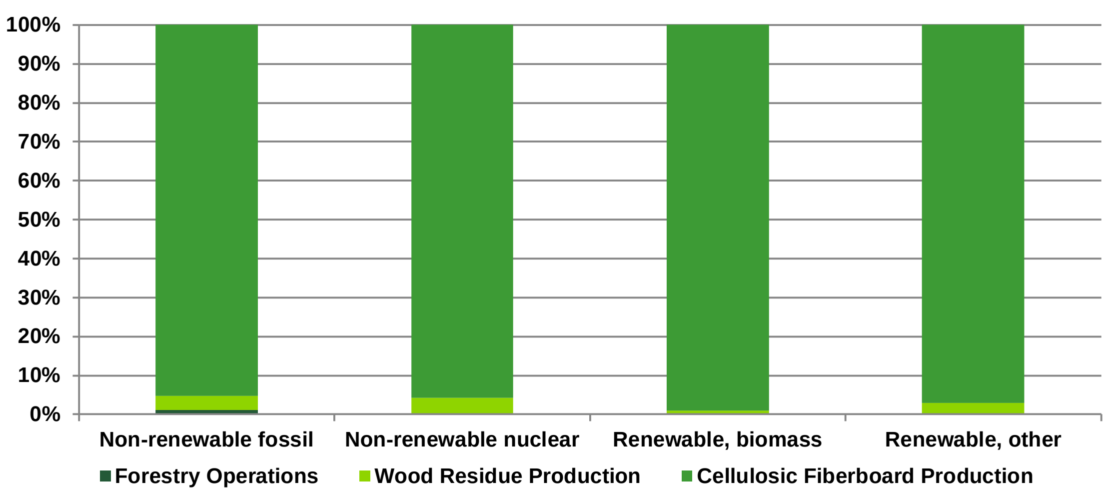


Figure 3: Cradle-to-Gate Primary Energy Consumption



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Primary Energy Consumption by Resource

Figures 4 through 7 show the primary energy consumption by type for the total cradle-to-gate, forestry operations, residue production, and CFB production life stages respectively. The CFB production consumes the bulk of the energy consumption and is reflected in the total cradle-to-gate chart (Figure 4).

The forestry operations portion of the life cycle relies heavily on oil-based energy consumed mainly in the form of diesel used by heavy equipment during planting, management, and harvesting of the resource. Oil accounts for 79 percent of primary energy resources consumed in forestry operations, followed by natural gas making up most of the rest at 17 percent (Figure 5).

The majority of the total cradle-to-gate biomass fuel, 81 percent, is consumed during CFB production. Wood residues are the primary fuel used in production of wood residues representing 40 percent of the total energy. Wood residue are generated during the production of products such as lumber and plywood, it is used to replace the use of fossil fuels for heat generation (Figure 6).

While the majority of the biomass fuel is used during cellulosic fiberbaord production, fossil fuels remain they main energy source. Very little wood waste is generated during the production of CFB which makes using wood waste as a fuel source difficult. Around 17 percent of the total energy comes from biomass with over half from fossil fuels. Coal is used directly in boilers during CFB production, representing 27 percent of the total energy. Hydopower use is approximately 5 percent and is from electricity that is consumed throughout the cradle-to-gate production system (Figure 7).

The cradle-to-gate renewable biomass energy use in the life cycle of CFB reduces the energy consumption derived from fossil fuel sources by 19 percent which results in a lower overall carbon footprint.

Figure 4 Cradle-to-Gate Energy Use

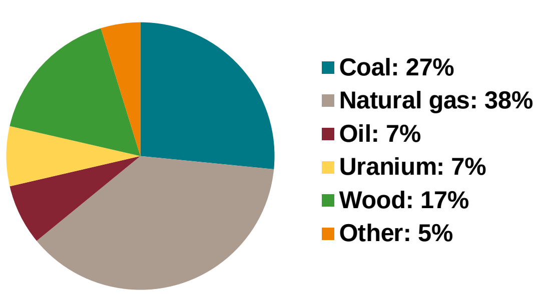

Figure 5 Forestry Operations Energy Use

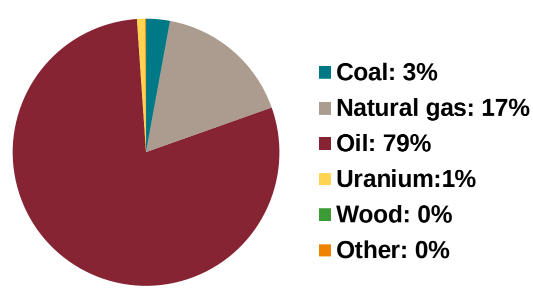

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Figure 6 Residue Production Energy Use

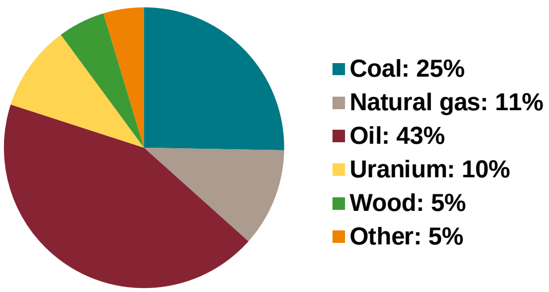
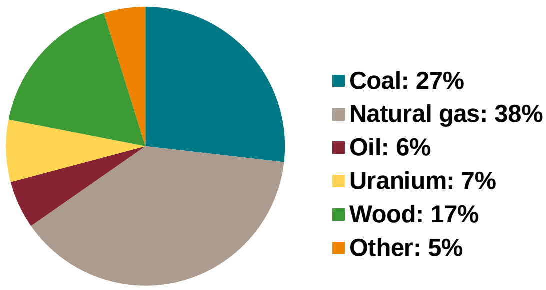


Figure 7 Cellulosic Fiberboard Production Energy Use



Additional Information

Range of Applications

Cellulosic fiberboard is primarily used as sound-deadening board, structural sheathing, and roof fiberboard in residential and commercial construction. It is classified as part of a product group of Cellulosic Fiber Insulating Board and Wood Fibre Insulating Boards for Building. The carbon sequestration calculation on the following page is based on the expected service life for CFB. To complete this calculation, the various end used for CFB were estimated based on the classification for "non-structural panels" as provided in the FPInnovations B-to-B carbon sequestration tool.

The following lists the breakdown of insulating board end uses in North America:

- New non-residential construction: 30%
- Commercial roofing: 30%
- New single family residential construction: 5%
- New multi-family residential construction: 1%
- Other end-uses: 34%

Carbon Sequestration

This PCR requires that carbon sequestration may only be credited to the product if the end-of-life fate of that carbon is considered in the LCA study. FPInnovations (FPI) has recently published a carbon sequestration calculation tool that estimates the emissions from typical end-of-life treatment of wood products that includes recycling, combustion, and landfilling. The carbon sequestration in the product at the manufacturing gate serves as the basis for such an analysis and is as follows (all conversion factors and assumptions are documented in the carbon tool):

1 m^3 Cellulosic Fiberboard = 234.48 oven dry kg = 117 kg Carbon = 429.89 kg CO_2 eq.

This initial carbon sequestration may then be considered against its emission as the cellulosice fiberboard product reaches the end of its service life in various applications. The FPI carbon tool is used to estimate the biogenic carbon balance at year 100, including service life estimations for various applications and the average landfill decay rate. The carbon tool gives the following results for nonstructural panels:

Carbon sequestered in product at manufacturing gate:
429.89 kg CO_2 eq. = - 429.89 CO_2 eq emission

Methane emitted from fugitive landfill gas:
2.00 kg CH_4 = 50.00 kg CO_2 eq emission

Carbon dioxide emitted from fugitive landfill gas and the combustion of waste and captureed landfill gas:
142.04 kg CO_2 eq emission

Carbon sequestration at year 100, net of biogenic carbon emissions:
237.84 kg CO_2 eq emission = - 237.84 kg CO_2 eq emission

Additional Information

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