

## Life-Cycle Analysis of Wood Construction Products

Life-cycle assessment research identifies all material and energy inputs and environmental emission outputs associated with production of specific products, and in some cases use and final disposition of products. The Forest Products Laboratory (FPL), in cooperation with the Consortium for Research on Renewable Industrial Materials (CORRIM), is providing life-cycle analysis for wood products used in construction of buildings in the United States. Building designers can use this information to choose building designs and component structural products—wood or nonwood—that have the lowest environmental impacts associated with their production and use. Life-cycle information is needed by building designers to guide material choice decisions and gain credit toward green certification of buildings under standards such as LEED, the National Green Building Standard, the International Green Construction Code, and CalGreen. Wood product producers can advertise the environmental performance associated with lumber, engineered wood beams, and panel products by publication of Environmental Product Declarations (EPDs) that contain life-cycle environmental impact data for each wood product they produce.

### Background

For more than a decade, CORRIM and FPL have conducted cooperative research, including surveys of wood product manufacturers on their material and energy use and emissions, in order to generate and publish life-cycle inventories (LCIs) (raw detailed data) and life-cycle assessments (LCAs) (environmental impacts by aggregate category) for lumber, engineered wood beams, and wood panel products. Research also includes quantifying emissions from

harvesting, log transport, and tree planting. Using guidelines provided by the International Organization for Standardization (ISO), LCIs and LCAs have been prepared for softwood and hardwood lumber, softwood plywood, oriented strandboard, laminated veneer lumber, wooden I-Joists, and glulam beams for various regions.

Much of the life-cycle data for construction wood products were collected more than three years ago. Some production processes have been modified, and new life-cycle data are needed to update U.S. national and international life-cycle databases for use by building designers in their analyses and by producers in the preparation of EPDs to document the performance of their products. An EPD can be either “business-to-business” (BtoB) or “business-to-consumer” (BtoC), depending on the use. Most EPDs are categorized as BtoB which need cradle-to-gate mill output LCA data.

### Objective

The main objective of this project is to provide up-to-date cradle-to-gate life-cycle data for production of all wood construction products produced in all major U.S. regions and in Canada, covering all processes from harvest and replanting through production to mill output gate. An additional objective is to provide these data for the development of BtoB EPDs that wood product manufacturers can use to provide scientific documentation of the environmental performance of their products.

### Approach

Production data will be collected in cooperation with wood industry associations from wood product production mills and from secondary data sources. Life-cycle

Impact category	Unit	Total	Forestry Operations	Wood Production
Global warming potential (GWP)	kg CO <sub>2</sub> equiv	92.89	14.52	78.38
Acidification Potential	H <sup>+</sup> moles equiv	49.90	11.34	38.56
Eutrophication Potential	kg N equiv	0.0371	0.0120	0.0251
Ozone depletion Potential	kg CFC-11 equiv	0.0000	0.0000	0.0000
Smog Potential	kg O <sub>3</sub> equiv	21.66	6.37	15.29
Total Primary Energy Consumption	Unit	Total	Forestry Operations	Wood Production
Non-renewable fossil	MJ	1342.09	212.57	1130.54
Non-renewable nuclear	MJ	182.35	2.10	180.25
Renewable (solar, wind, hydroelectric, and geothermal)	MJ	25.31	0.23	25.08
Renewable, biomass	MJ	2586.16	0.00	2586.16
Material resources consumption (Non-fuel resources)	Unit	Total	Forestry Operations	Wood Production
Non-renewable materials <sup>5</sup>	kg	0.0853	0.00	0.0853
Renewable materials	kg	403.17	0.00	403.17
Fresh water	L	179.38	0.00	179.38
Waste generated	Unit	Total	Forestry Operations	Wood Production
Solid waste	kg	13.22	0.22	13.00

Environmental performance of 1 m<sup>3</sup> planed dry softwood lumber, NE-NC. An excerpt from the Cradle-to-Gate LCA of Softwood Lumber Production from the Northeast-North Central (Puettmann et al. 2013).

analysis results will be produced using SimaPro life-cycle analysis software. Data will be placed in U.S. national and international life-cycle databases for manufactured products.

### Expected Outcomes

The expected outcomes will include published LCI and LCA data for wood construction products produced in the United States and Canada. Building designers will be able to use these data to recognize the low environmental impact of wood products when choosing building designs and structural building products based on environmental performance. Wood product manufacturers will be able to use published EPDs to document environmental performance to prospective buyers, and buyers will be able to make choices among products that include consideration of environmental performance.

### Timeline

Funds for three years were provided starting in January 2013 and ending December 2015. Data collection

from industry will be completed by the end of summer 2014, and cradle-to-gate LCA reports are expected by spring 2015.

### Cooperators

Consortium for Research on Renewable Industrial Materials (CORRIM)

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