Energy Use and Related Data: 
Canadian Wood Products Industry 
1990, 1995 to 2015

Prepared for:

Forest Products Association of Canada 
Canadian Industry Program for Energy Conservation

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Executive Summary

The Canadian Industrial Energy End-use Data and Analysis Centre (CIEEDAC) houses extensive energy information relevant to Canada’s industrial sectors. One of CIEEDAC’s primary goals is to expand and improve the information on energy use and greenhouse gas (GHG) emissions by regularly assessing the reliability of data. Accordingly, this report provides information relevant to the Canadian wood products industry for the Forest Products Association of Canada (FPAC) and the Canadian Industry Program for Energy Conservation (CIPEC). It documents the quality and quantity of energy and production data on the Canadian wood products industry, identifies trends in energy use and greenhouse gas (GHG) emissions from 1990 to 2015, highlights weaknesses in existing data, and suggests ways of improving the quality of the data collected.

From 1990 to 2015, energy use in the wood products industry (NAICS 321) increased by 21% while direct GHG emissions declined by 20%; emissions are largely driven by natural gas use in the industry, which fell by 13% from last year. During the same period, gross domestic product (GDP) rose by 48%.

Energy and GHG intensity indicators were calculated using GDP as the denominator. Energy intensity declined until 2005 and then steadily increased to 2013 before dropping again to 18% below 1990 levels in 2015. GHG intensity indicators generally diminished over the period and are currently 46% below 1990 levels. Part of the reason for the decline is the shift from fossil fuels to biomass; a recent increase since 2011 can be attributed to an increase in natural gas use.

The report also contains data and analysis on two sub-groups of the wood products industry, Sawmills (NAICS 321111) and Particle Board and Fibreboard (NAICS 321216).

There are opportunities to improve the data on the Canadian wood products industry. The report offers several recommendations:

- filling gaps in the data for the energy use and production in some sub-sectors would improve our analysis of trends in energy and GHG intensity;
- disaggregation of energy use data by province would enable us to determine the indirect emissions caused by electricity use and to conduct provincial analyses;
- data on the physical production of the sector (i.e., weight or volume of the product produced instead of the value of the product sold) would enable us to generate intensity indicators to measure efficiency due to technological change. Indicators based on GDP are not always indicative of technological change because several non-energy related factors influence the indicators;
- clarification of industries/firms included in different sub-sectors to reduce misclassification errors; and
- finding a resolution to increasing levels of confidentiality.
Acknowledgments

CIEEDAC thanks the Forest Products Association of Canada and the Energy and Greenhouse Gas Section of Environment and Climate Change Canada who support the work of CIEEDAC though their sponsorship and financial contributions, which have helped fund this report.

CIEEDAC also thanks the Buildings and Industry Division of the Office of Energy Efficiency at Natural Resources Canada for their financial support to complete our series of industry reports.

This project was undertaken with the financial support of the Government of Canada. Ce projet a été réalisé avec l’appui financier du Gouvernement du Canada.
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Energy Use and Related Data: 
Canadian Wood Products Industry, 1990, 1995 to 2015

1 Introduction

Canadian industries, faced with global competition and international agreements on climate change, increasingly recognize the need for accurate data on historical energy use, greenhouse gas (GHG) emissions and output. These data can be used to (1) determine trends in energy use as a method of determining the impacts of changes in technology, processes, or attitudes towards energy, (2) compare Canadian industry performance to other countries to ensure that we are remaining competitive, and (3) monitor environmental impacts of energy use in industry, including GHG emissions.

To allow appropriate conclusions to be drawn from the data, they must reflect reality. This report presents the most up-to-date publicly available information for the wood products industry from 1990, 1995 to 2015. Data from 1991 to 1994 are excluded from the analysis because Statistics Canada (STC) did not update them when 1990 and 1995-2000 data were updated. This report comments on the suitability of the data for the purposes listed above, and recommends ways to improve their quality.

2 Objectives

The objectives of this report are:

- To document the quantity and quality of energy and production data available on the Canadian wood products industry between 1990 and 1995 to 2015;
- To identify energy use and GHG emissions trends over the period;
- To identify weaknesses in energy and production data and its impact on the accuracy and usefulness of the data; and
- To inform discussions between the wood products industry, industry associations, and data collection agencies on data issues.

3 Background

3.1 The Wood Products Industry

The Canadian wood products industry is a major component of Canada’s economy; in 2015, the wood products industry employed just over 96,200 people and contributed about $9.4 billion ($2007) to Canada’s GDP.¹

3.1.1 The Forest Products Association of Canada (FPAC)

The Forest Products Association of Canada (FPAC) is the voice of Canada’s wood, pulp, and paper producers nationally and internationally in government, trade, and

¹ Innovation, Science and Economic Development Canada [strategis.ic.gc.ca/eic/site/cis-sic.nsf/eng/home]; STC publishes no employment data on this industry.
environmental affairs and represents the largest Canadian producers of forest products. Members are responsible for 66% of certified forest lands in Canada, and third-party certification of member companies’ forest practices is a condition of membership in the Association – a world first. Canada’s forest products industry generates $65 billion dollars of revenue a year, representing about 2% of Canada’s GDP. The industry is one of Canada’s largest employers, operating in hundreds of Canadian communities and providing hundreds of thousands of direct and indirect jobs across the country.²

3.1.2 CIPEC
The Canadian Industry Program for Energy Conservation (CIPEC) was created in 1975 by industry and government leaders to provide a framework for energy conservation and a tool to increase industry’s competitiveness in a global market. CIPEC helps industry identify energy efficiency barriers and opportunities, forecast and set feasible energy efficiency targets, and develop and implement strategies to reach those targets.

3.1.3 Statistics Canada
Statistics Canada (STC) is the primary data source for energy use and production data. They gather data using a number of surveys and provide these data to the public on their website and through other institutions.

3.1.4 CIEEDAC
Established through an initiative of Natural Resources Canada, the Canadian Industrial Energy End-use Data and Analysis Centre (CIEEDAC) focuses on collecting and analyzing energy information relevant to Canada’s industrial sectors. One of CIEEDAC’s primary goals is to expand and improve the existing knowledge on energy use by regularly collecting and reporting data.

CIEEDAC provides a range of services to industry and government. It performs specific data retrieval and analyses based on requests from interested parties. It also produces various reports each year, presenting the latest data on energy use and related information for the Canadian industrial sector.

3.2 North American Industry Classification System (NAICS)
The NAICS is a system used by statistical agencies in Canada, the United States, and Mexico to classify industries and to facilitate comparison of industry data across jurisdictions. The wood products industry is included under NAICS 321 (Wood Product Manufacturing), and includes sawmills, wood preservation, veneer, plywood, engineered products, and other wood products. Statistics Canada defines NAICS categories in terms of the primary activity of an establishment. Given this definition, the NAICS codes included in the wood products industry (NAICS 321) are listed in Table 3.1.

### Table 3.1: NAICS Codes of Canadian Wood Products Industry

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Name of Category</th>
<th>Availability of Data (Years Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Energy</td>
</tr>
<tr>
<td>321000</td>
<td>Wood Product Manufacturing</td>
<td></td>
</tr>
<tr>
<td>321100</td>
<td>Sawmills and Wood Preservation</td>
<td></td>
</tr>
<tr>
<td>321110</td>
<td>Sawmills and Wood Preservation</td>
<td></td>
</tr>
<tr>
<td>321111</td>
<td>Sawmills (except Shingle and Shake Mills)</td>
<td></td>
</tr>
<tr>
<td>321112</td>
<td>Shingle and Shake Mills</td>
<td></td>
</tr>
<tr>
<td>321111</td>
<td>Wood Preservation</td>
<td></td>
</tr>
<tr>
<td>321200</td>
<td>Veneer, Plywood, and Engineered Wood Prod.</td>
<td></td>
</tr>
<tr>
<td>321210</td>
<td>Veneer, Plywood, and Engineered Wood Prod.</td>
<td></td>
</tr>
<tr>
<td>321211</td>
<td>Hardwood Veneer and Plywood Man.</td>
<td></td>
</tr>
<tr>
<td>321212</td>
<td>Softwood Veneer and Plywood Man.</td>
<td></td>
</tr>
<tr>
<td>321215</td>
<td>Structural Wood Product Man.</td>
<td></td>
</tr>
<tr>
<td>321216</td>
<td>Particleboard and Fibreboard Mills</td>
<td></td>
</tr>
<tr>
<td>321217</td>
<td>Waferboard Mills (w/ Oriented Strandboard)</td>
<td></td>
</tr>
<tr>
<td>321900</td>
<td>Other Wood Product Manufacturing</td>
<td></td>
</tr>
<tr>
<td>321910</td>
<td>Millwork</td>
<td></td>
</tr>
<tr>
<td>321911</td>
<td>Wood Window and Door Man.</td>
<td></td>
</tr>
<tr>
<td>321919</td>
<td>Other Millwork</td>
<td></td>
</tr>
<tr>
<td>321920</td>
<td>Wood Container and Pallet Man.</td>
<td></td>
</tr>
<tr>
<td>321990</td>
<td>All Other Wood Product Man.</td>
<td></td>
</tr>
<tr>
<td>321991</td>
<td>Manufactured Home (Mobile Home) Man.</td>
<td></td>
</tr>
<tr>
<td>321992</td>
<td>Prefabricated Wood Building Man.</td>
<td></td>
</tr>
<tr>
<td>321999</td>
<td>All Other Miscellaneous Wood-product Man.</td>
<td></td>
</tr>
</tbody>
</table>

**Exclusions**

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Name of Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>113000</td>
<td>Forestry and Logging</td>
</tr>
<tr>
<td>322000</td>
<td>Paper Manufacturing</td>
</tr>
<tr>
<td>337000</td>
<td>Furniture and Related Product Manufacturing</td>
</tr>
<tr>
<td>339000</td>
<td>Miscellaneous Manufacturing</td>
</tr>
</tbody>
</table>

Source: [http://www.statcan.gc.ca/eng/concepts/industry](http://www.statcan.gc.ca/eng/concepts/industry)

1 “NA” means that the data are not publicly reported by Statistics Canada at this time.

2 Production data for ‘Particle board’ is available from STC Catalogue 36-003-XIB for 1990 – 2006. However, production data for fibreboard are only available for 1996-2004 from STC Catalogue 36-003. ‘Rigid Insulating Board’ are available for 1990-1995 from STC Catalogue 36-002; we are uncertain if ‘rigid insulating board’ is equivalent to ‘insulation board’ and is also included in this NAICS category. This series was terminated in 2005.

3 If production data were available for all sub-sectors of 3211, it could be possible to convert the production data to a common unit and provide a physical production measure for NAICS 3211.

4 Production data for ‘construction-type plywood’ is available in STC Catalogue 35-001; however, we are uncertain whether this data refers to products included in NAICS 321211 or 321212 (or both).

5 GDP values for NAICS 321216 and 321217 are summed and called 32121B.

6 Real GDP data were updated in 2013 from a 2002 to a 2007 reference year. Also, the set of industries for which GDP was released was diminished. Those subsectors for whom the last date for release was 2011 are real $2002.
3.3 **Availability of Data**

Two categories of data are used in this study: energy use data, which measures energy used by the wood products industry to produce goods or services, and production data, which measures the amount of product or service produced. Both types of data are necessary for tracking changes in energy performance and each can be expressed in either economic or physical units. Table 3.1 indicates where such data are available.

3.3.1 **Energy Use Data**

The main source of energy data for the wood products industry is Statistics Canada (STC). STC obtains energy use data for the industry from two separate sources: the *Industrial Consumption of Energy* (ICE) survey, released in the fall of every year for the previous year, and the *Annual Survey of Manufacturers* (ASM). The ASM collects information on expenditures on energy by the industry while ICE focuses primarily on energy consumed. Therefore, data from the ICE survey are more useful for energy analysis. The benefits and drawbacks of ICE data are:

- Survey and data verification procedures are designed to reflect energy issues,
- ICE samples small industries and is a census of major energy-consuming industries.
- ICE includes data on non-purchased and atypical energy forms (e.g., wood waste).
- STC drew the survey frame for ICE data collection from the ASM sample until 2013 when it became STC’s Business Registry.
- ICE is not extensive enough to disaggregate data to the provincial level at 4- to 6-digit level NAICS, in part due to the limited representation of some industries in the provinces (i.e., confidentiality issues). Nationally, this level of aggregation has, however, provided a broad picture of manufacturing energy use and ICE data have been used as the primary input on industry to STC’s publication “Report on Energy Supply and Demand” (RESD). While RESD data are not identical to ICE data, recent activity has aligned them more closely.

With the shift from the Standard Industrial Classification (SIC) system to the NAICS, more disaggregated data on wood products are available from 2001 - 2015. While an equivalent historical data set is not publicly available, it may be possible for STC to provide more disaggregated historical data in the future, especially with RESD updates.

STC has historically been the only agency to collect direct information on energy use data in the wood products manufacturing industry.³ FPAC and STC have returned to a data sharing agreement for the pulp and paper industry whereby FPAC submits data collected on behalf of the industry (both members and non-members) to STC’s ICE survey. So far, this agreement has been a success for data collection from the pulp and paper sector, and FPAC and STC are currently expanding to the wood products sector as

³ The *Annual Survey of Manufacturers* (ASM) collected physical energy use for the wood products sector from 1991 to 1996; however, it currently only reports expenditures on energy.
well for the 2016 data year. This type of arrangement helps harmonize statistics and reduces respondent burden.

For the currently available data, STC provides energy information for NAICS 321 as an aggregate and reports energy use individually for the following sub-sectors:

- NAICS 321111 - Sawmills (except Shingle and Shake Mills): Includes establishments engaged in manufacturing boards, dimension lumber, timber, poles and ties.
- NAICS 321112 - Shingle and Shake Mills: includes establishments engaged in sawing blocks of wood to produce shingles or splitting wood to produce shakes.
- NAICS 321114 - Wood Preservation: comprises establishments engaged in treating wood products produced in other establishments with preservatives and establishments engaged in cutting to size treated wood products.
- NAICS 321216 - Particleboard and Fibreboard Mills: comprises all establishments engaged in manufacturing particleboard and fibreboard.

The survey collects data on fossil fuels, wood waste, electricity, and steam in natural units (tonnes, cubic metres, etc.) and converts it to terajoules (TJ). Table 3.1 above describes data availability. Energy use for the 4-digit NAICS code (3211) should equal the sum of its sub-sectors (321111, 321112, and 321114); however, CIEEDAC could not estimate energy use for NAICS 3211 for 1990-2000 due to the lack of energy data for NAICS 321112 and 321114 for those years. Starting in 2001, data on use of heavy fuel oil, propane, and wood are considered confidential for NAICS 321112, 321114, and 321216 for most years. CIEEDAC provides convenient summaries of NAICS data upon request or via their online database. Appendix C summarizes the data available from CIEEDAC. Fuel listed as confidential are reported in aggregate as ‘confidential’ at the bottom of the tables. Because GHG aggregates are estimated, the reader should use caution in interpreting and using these data.

There are also some issues with the consistency of the wood products data over time. Energy use data reported by STC for 1990 were not obtained directly from the ICE survey because the sample size at that time was insufficient to produce estimates of energy use with today’s required level of industrial disaggregation. Instead, during the NAICS conversion project, it was necessary for STC to derive estimates for 1990 values from a number of monthly, quarterly, and annual manufacturing and energy surveys and administrative records received by Statistics Canada. Their methodology is outlined in their publication “Industrial Consumption of Energy: The 1990 NAICS-based Estimates”. Between 1991 and 1994, STC did not collect data on energy use for the disaggregated set of industries based on NAICS. Some energy use data are available for

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4 STC conversion coefficients are provided in the (RESD), listed in Appendix A, Table 1.
5 www.sfu.ca/ciedac
6 The NAICS Conversion project involved converting industrial data from the previous Standard Industrial Classification system to the North American Industrial Classification system. The methodology for estimating 1990 values is described further in Hills, 2004.
the years 1991-1996 based on the Annual Survey of Manufacturers but these data are not always consistent with the ICE-sourced data. For instance, data on wood waste use as a fuel were not collected by ASM but are included in total energy reported by ICE. ASM data can be obtained from CIEEDAC upon request. In the following sections, CIEEDAC discusses trends for 1990 and 1995-2015, and excludes data from 1991-1994.

3.3.2 Historical data on electricity use
In 2005, STC updated ICE data on electricity use in the industry between 1995 and 2004 so that the data correspond more closely to the data provided by electricity distributors (primarily utilities). Since all adjustment values were negative, not only electrical but total energy use in each year declined. When indexed to 1990 (unaltered), intensity declined for each year from those presented in previous years’ reports.

3.3.3 Greenhouse Gas Emissions
Data on greenhouse gas (GHG) emissions in the wood products industry are derived from energy data. The industry emits GHGs directly from the on-site combustion of fossil fuels and indirectly through their purchased electricity use. These emissions are considered indirect because the GHGs are not generated on-site.

Direct GHG emissions are calculated by multiplying the use of each fuel by the fuel's GHG conversion factor. The conversion factors used to calculate the wood product industry’s GHG emissions are obtained from Environment and Climate Change Canada’s National Inventory Report (ECCC, 2016), as listed in Appendix A.7 Note that wood waste is considered to be CO₂-neutral (its CO₂ coefficient is zero), but it has positive emissions coefficients for methane (CH₄) and nitrous oxide (N₂O). FPAC and the National Council for Air and Stream Improvement (NCASI) indicate that there are differences in the emissions factors utilized for biomass by ECCC and the United States Environmental Protection Agency’s AP-42 database, and the International Panel on Climate Change. The ECCC values, while recently adjusted are lower than the AP-42 factors (NCASI, June 2004) and are lower than the FPAC estimates.

Table 3.2: Comparison of emissions coefficients from Environment and Climate Change Canada and the Forest Products Association of Canada

<table>
<thead>
<tr>
<th>Coefficients for Biomass (kg/tonne fuel)</th>
<th>CH₄</th>
<th>N₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment and Climate Change Canada (wet fuel, 50% moisture)</td>
<td>0.09</td>
<td>0.06</td>
</tr>
<tr>
<td>Forest Products Association of Canada (dry fuel)</td>
<td>0.216</td>
<td>0.072</td>
</tr>
</tbody>
</table>

Source: ECCC (2016); FPAC, Paul Lansbergen

FPAC recommends the use of the higher emissions factors for these emissions but, with the updates from ECCC, the differences are much closer in range than in the past. Table

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7 See CIEEDAC report, Greenhouse Gas Intensity Indicators for Canadian Industry 1990-2015 (CIEEDAC 2017). Where energy data were confidential, a weighted emissions coefficient was created by CIEEDAC based on historical data in order to estimate aggregate emissions for the total direct emissions in the graphs included in this report.
3.2 provides a comparison of the values. The direct emissions estimates resulting from the use of FPAC coefficients are 0.7% to 1.8% higher than the emissions estimated from ECCC coefficients (Table 3.3).

In the meantime, CIEEDAC continues to utilize the ECCC values for CH$_4$ and N$_2$O. Where specific data on fuel use are confidential, CIEEDAC was provided with estimates of aggregate emissions by NRCan when it was possible for them to do so without compromising confidentiality (see Appendix C). Similar data were received for CH$_4$ and N$_2$O greenhouse gas emissions.

Table 3.3: Comparison of emissions estimates using FPAC and ECCC coefficients for Wood Product Manufacturing (NAICS 321000)

<table>
<thead>
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<tbody>
<tr>
<td><strong>Direct GHG Emissions (Mt)</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPAC</td>
<td>2.25</td>
<td>2.06</td>
<td>2.44</td>
<td>2.14</td>
<td>1.69</td>
<td>1.31</td>
<td>1.42</td>
<td>1.39</td>
<td>1.72</td>
<td>1.90</td>
<td>1.94</td>
<td>1.81</td>
</tr>
<tr>
<td>ECCC</td>
<td>2.23</td>
<td>2.04</td>
<td>2.42</td>
<td>2.12</td>
<td>1.67</td>
<td>1.29</td>
<td>1.40</td>
<td>1.37</td>
<td>1.69</td>
<td>1.87</td>
<td>1.92</td>
<td>1.79</td>
</tr>
<tr>
<td>Difference (%)</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>1.4</td>
<td>1.8</td>
<td>1.8</td>
<td>1.7</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Emissions from Biomass (t of CH$_4$ and N$_2$O)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPAC CH$_4$</td>
<td>507</td>
<td>563</td>
<td>698</td>
<td>667</td>
<td>779</td>
<td>717</td>
<td>785</td>
<td>755</td>
<td>797</td>
<td>911</td>
<td>917</td>
<td>767</td>
</tr>
<tr>
<td>ECCC CH$_4$</td>
<td>228</td>
<td>253</td>
<td>314</td>
<td>300</td>
<td>350</td>
<td>323</td>
<td>353</td>
<td>340</td>
<td>358</td>
<td>410</td>
<td>413</td>
<td>345</td>
</tr>
<tr>
<td>FPAC N$_2$O</td>
<td>182</td>
<td>203</td>
<td>251</td>
<td>240</td>
<td>280</td>
<td>258</td>
<td>283</td>
<td>272</td>
<td>287</td>
<td>328</td>
<td>330</td>
<td>276</td>
</tr>
<tr>
<td>ECCC N$_2$O</td>
<td>152</td>
<td>169</td>
<td>209</td>
<td>200</td>
<td>234</td>
<td>215</td>
<td>235</td>
<td>227</td>
<td>239</td>
<td>273</td>
<td>275</td>
<td>230</td>
</tr>
</tbody>
</table>

Source: STC energy data (ICE), ECCC (2016), FPAC, Paul Lansbergen. Some data from 2001-2015 are estimated.

STC has designated several data points as “confidential” each year since 2001. While STC provides the value of these confidential cells in TJ, they do not provide equivalent CO$_2$ or other GHG emissions; CIEEDAC analysts have estimated the use of various fuels based on historical data so that GHG emissions can be estimated. While there is uncertainty associated with these estimations, the calculations provide a reasonable picture of GHG emissions levels in the industry.

Indirect emissions can be estimated by multiplying provincial electricity use data for a sector by provincial factors for the GHG intensity of electricity production. The emissions intensity of electricity production varies widely among the provinces of Canada. STC does not release provincially disaggregated data on electricity use for the wood products sector and thus it is not straightforward to estimate indirect emissions for this industry.

Some industrial sectors emit process-related greenhouse gas emissions (emissions from the process rather than fuel combustion). Several reports mention the possibility of process emissions of CH$_4$ from landfill disposal of waste. We do not consider these emissions in this report.

3.3.4 Production Data

Energy data alone are not sufficient to determine energy performance trends for an industry. Without accurate industry production data, it is difficult to conclude whether
an industry has altered its energy or possible environmental impact per unit of product produced (measured here in terms of energy or GHG intensity). Production data can be expressed in either physical terms (i.e., board feet of lumber, square feet of plywood) or economic terms, currently 2007 $millions. Physical production units are preferred to monetary units when calculating energy intensity because these indicators tend to be a better proxy for technological or process innovations. Several factors not linked with energy (e.g., costs of labour, product selling price) can affect monetary units decreasing their usefulness.

There are no statistics that represent physical production units for the industry as a whole (NAICS 321). If production units were available for each of the 6-digit sectors, and the units were of the same type (m$^3$ for example), we could add them together. Any calculation on energy or emissions intensity per unit product, however, would have to include an analysis on the energy required in different processes (even if we could choose m$^3$ as the standard unit, it might take far more energy to produce a m$^3$ of OSB or plywood than a m$^3$ of dimension lumber or shingles).

STC collects physical production data for NAICS 321111 (lumber production). Lumber production is reported in STC catalogue 35-003 as well as CANSIM Table 303-0009 but the reported values do not match. CANSIM is deemed up to date because these data are periodically reviewed and corrected; this is not so with publications. STC does not report physical production data for NAICS 321112 (shingle and shake production) or NAICS 321114 (wood preservation); thus, it is not possible to sum the production data for 321111, 321112 and 321114 to obtain a production value for the aggregate of Sawmills and Wood Preservation, NAICS 3211.8

The following sources of production data may relate to NAICS 3212; however, it is difficult to ascertain how the production data align with the available energy data:

- Fibreboard Production (STC catalogue 36-003 and CANSIM Table 303-0002, 1946 to 2003, CANSIM Table 303-0058 for 2004 and 2005, terminated)
- Rigid Insulating Board Production (STC catalogue 36-002, CANSIM label v1174 up to 2003, terminated)
- Particle Board Production (STC catalogue 36-003 and CANSIM Table 303-0002, 1946 to 2003, CANSIM Table 303-0058 for 2004 and 2005, terminated)
- OSB and Waferboard Production (STC catalogue 36-003 and CANSIM label v1176 up to 2003, CANSIM Table 303-0058 for 2004 and 2005, terminated)
- Construction-type plywood (STC catalogue 35-001 and CANSIM label v2920893 up to Dec., 2007, CANSIM Table 303-0056, terminated)

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8 Some production data on wood chips and pulp chips are available. For instance, ‘wood chips, fibre received by pulp mills’ production is published in STC catalogue 25-001 which ceased publication after 2001. Additionally, data on production of ‘pulp chips’ from construction-type plywood are available in STC Catalogue 35-001. While these data may be useful for tracking flows of biomass, it is not useful as a denominator for generating intensity indicators.
It is not apparent to CIEEDAC exactly how some of these production data match the NAICS categories. For instance, if we were to assume that the sum of particleboard, fibreboard, and rigid insulation board production data aligns with the energy data for NAICS 321216 (Particle Board and Fibreboard Mills), it may be possible to generate energy intensity indicators if data for all years where data are available (fibreboard production data is available from 1996 to 2004, rigid insulating board data is available from 1990-1995). We assume that OSB and Waferboard production data cover all products in NAICS 321217; however, the corresponding energy data are not available to develop an indicator. CIEEDAC is uncertain whether construction-type plywood production data aligns with NAICS 321211, NAICS 321212. Since all construction type plywood appears to be softwood in origin, these production values would line up with NAICS 321212.

FPAC also collects data on production, divided into 4 categories: Lumber products (as well as a subcategory that includes wood chips), engineered wood products, plywood and veneers, and treated wood. Alignment to NAICS categories or to STC categories is not obvious; a comparison of STC’s dimension lumber with the Lumber category from FPAC shows significant differences with STC roughly double the values available from FPAC.

All production data are presented in Appendix B.

STC also collects economic production data for the industry in the form of the industry’s contribution to gross domestic product (GDP). Table 3.1 provides details on data available. Informetrica historically provided gross output data for specific NAICS codes which had adequate GDP information; however, this information is no longer available and there are no timely GO data available for analysis.\(^9\)

### 3.3.5 Provincial Data

Past editions of this report discussed the provincial split for energy use within NAICS 321. Historically, provincial data were available from the ASM survey; however, these data have not been updated since 1996. We do not discuss provincial data in the present report; these are available in previous editions of this report.

### 4 Canadian Wood Products Industry Trends, 1990 and 1995-2015

The following section reports changes in energy use, production and GHG emissions for the Canadian wood industry from 1990, and 1995 to 2015. First, we discuss the aggregate sector NAICS 321 Wood Product Manufacturing, followed by NAICS 321111 Sawmills (except Shingle and Shake mills), and NAICS 321216 Particleboard and Fibreboard Mills. NAICS 321112 Shingle and Shake Mills and NAICS 321114 Wood

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\(^9\) Gross output is defined as the total value of goods and services produced by an industry, a sum of the industry’s inputs plus the change in value due to labour and capital investment.
Preservation are excluded from the analysis because the data are insufficient to determine general trends.

4.1 Intensity Indicators

Statistical performance indicators are important measurements of improvements in energy efficiency and environmental performance. The two indicators calculated in this study are energy intensity and GHG intensity. Energy intensity measures the amount of energy used to produce one unit of output and GHG intensity reflects the same for GHG emitted. Energy and GHG intensities are expressed in either physical (e.g., joules/tonne of product; tonnes of GHG/tonne of product) or economic (e.g., joules/$GDP; tonnes of GHG/$GDP) terms. As mentioned above, indicators based on physical rather than monetary units tend to be a better measure of technological or process innovations because monetary units are affected by factors not associated directly with or highly correlated to energy use.\(^\text{10}\)

To estimate and monitor energy intensity, the collection of physical or economic production data and energy use data needs to be aligned. First, the industries that consume the energy must also produce the product such that a unit energy to product ratio can be legitimately formed. Second, the physical units must be relatively comparable in space (same product from two different plants) and time (the product will be roughly the same 10 years from now). Based on the available data, we were therefore able to generate indicators only for NAICS 321000 (economic denominator) and NAICS 321111 (physical denominator). Intensity indicators are indexed (1990 = 1) to clearly show changes over time.

4.2 NAICS 321: Wood Product Manufacturing

4.2.1 Energy Use and GHG emissions

Fig. 4.1 illustrates the energy use and GHG emissions for the wood products manufacturing sector (NAICS 321). After several years of growth in total energy from 2009 to 2013 – primarily in wood waste and natural gas – energy use dropped in 2014 and 2015 to end the period 21% above 1990 levels. The large increase in NG use drove GHG emissions higher until 2014, but in 2015 they dropped once again and are 20% lower than 1990 levels. The contribution of fossil fuels to total energy use declined from 37% in 1990 to almost 20% in 2015, slightly up from last year. As a result, the GHG intensity of energy use also declined over the study period (down 34%) and up 4% from last year. See Table 4.1 for details on the fuel mix.

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\(^{10}\) See An Assessment of Data on Output for Industrial Sub-Sectors (CIEEDAC 1993) for more information on the issues of physical versus monetary units for calculating intensity indicators and on CIEEDAC's recommendations of appropriate units.
Figure 4.1: Energy Use and GHG Emissions (NAICS 321)

Table 4.1: Relative Use of Each Fuel as a Percentage (%) of Total Energy Use in the Wood Product Manufacturing Industry, NAICS 321

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>HFO</td>
<td>2.8</td>
<td>1.4</td>
<td>1.7</td>
<td>1.5</td>
<td>1.2</td>
<td>1.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Middle Distillates</td>
<td>4.6</td>
<td>4.4</td>
<td>5.6</td>
<td>3.9</td>
<td>3.3</td>
<td>3.5</td>
<td>3.8</td>
<td>3.6</td>
<td>4.2</td>
<td>3.5</td>
<td>2.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Propane</td>
<td>0.8</td>
<td>0.7</td>
<td>1.4</td>
<td>0.6</td>
<td>1.0</td>
<td>0.9</td>
<td>0.5</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Butane*</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>28.2</td>
<td>27.2</td>
<td>23.9</td>
<td>23.2</td>
<td>16.7</td>
<td>13.8</td>
<td>14.0</td>
<td>14.5</td>
<td>17.4</td>
<td>17.9</td>
<td>20.0</td>
<td>19.4</td>
</tr>
<tr>
<td>Wood</td>
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<td>46.8</td>
<td>48.5</td>
<td>46.5</td>
<td>53.7</td>
<td>56.9</td>
<td>55.4</td>
<td>55.1</td>
<td>53.9</td>
<td>54.8</td>
<td>56.7</td>
<td>52.8</td>
</tr>
<tr>
<td>Steam</td>
<td>0.2</td>
<td>0.0</td>
<td>0.2</td>
<td>0.2</td>
<td>1.5</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
<td>1.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Electricity</td>
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<td>19.4</td>
<td>18.7</td>
<td>24.1</td>
<td>22.6</td>
<td>22.8</td>
<td>24.8</td>
<td>24.9</td>
<td>22.8</td>
<td>22.1</td>
<td>18.4</td>
<td>21.3</td>
</tr>
<tr>
<td>Confidential</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>1.9</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>23.8</td>
<td>24.4</td>
</tr>
</tbody>
</table>

*Butane data were added in 2012 for 2010, 2011 and 2012. Prior to that, no wood products plant reported its use. Source: ICE from STC. Grey cells are estimated. Values represent percentage of total energy use.

Changes in energy use over time illustrated in Fig. 4.1 reflect changes in physical production to some extent. Data on physical production are not available for NAICS 321 as an aggregate but data for sub-sectors within NAICS 321 are available for some years. Currently the only STC physical data on production in the industry is sawn lumber, soft and hard wood (NAICS 321111). Production dropped 46% from the 2004 peak to 2009 (the lowest point since 1990), but has since risen by 42%. While this production level is above that of 1990 by 19%, it is still 24% lower than 2004’s peak.

Fig. 4.2 illustrates the fuel mix used in the wood manufacturing industry. As noted, the contribution of wood and electricity increases over time while the contribution of fossil fuels declines; the split has been relatively flat since 2009 although there are signs that natural gas may be providing a growing share. This helps to explain why the industry produces lower direct GHG emissions per unit of energy used than in the 1990s. We are
unable to calculate indirect emissions because provincial data for the industry’s energy use are not available.

**Figure 4.2: Use of Each Fuel as a Percentage (%) of Total Energy Use in the Wood Product Manufacturing Industry, NAICS 321**

Source: ICE from STC. Values represent percentage of total energy use. Data for 1991-1994 are omitted because NAICS-based data are not available.

**4.2.2 Industrial Production**

Economic production in the wood products industry increased considerably during the study period (Fig. 4.3). GDP continued its upward trend from last year after declining between 2006 and 2009. Up until 2006, GDP increased, exceeding $10 billion/year in 2004-2006. After a large decline, GDP has risen steadily to reach $9.4 billion in 2015, 14% below its peak but still 48% higher than 1990 and up 5.5% from last year.
4.2.3 Energy and GHG Intensity Indicators

Energy intensity levels based on GDP declined steadily after 1996 to 30% below 1990 levels in 2005. After this point, the indicator rose to 1990 levels by 2010-2013, dropping again to a point 18% below 1990 levels in 2015 (Fig. 4.4).

FPAC reports that the industry has suffered a number of market challenges in recent years, including the dramatic collapse of the US housing market that caused numerous capacity reductions. Consequently, the capacity utilization rate has declined which may
result in more intensive energy use as production is reduced (e.g., shift reductions) while some fixed energy use activities remain unchanged. This might have resulted in the increase in energy intensity noted after 2005. A structural shift in product type and rapidly increasing production (as explained in FPAC's Vision 2020 challenge) may also partly explain this change.

The GHG intensities based on GDP declined by 46% over the study period (Fig. 4.4). The declines in GHG intensity reflect the declines in energy intensity but are also a result of fuel switching from fossil fuels to wood waste. In the last few years, intensity has risen marginally as the use of natural gas increased.

### 4.3 NAICS 321111: Sawmills (Except Shingle and Shake Mills)

On average, sawmills account for 43% of the energy use in the wood products industry; in 2015 it was 51%. We use NAICS 321111 for this analysis because of its dominance and it is the only 6-digit NAICS category within the wood products sector that has data on physical production and energy use for 1990 and 1995-2015. Unfortunately, no GDP data are available for this sector, even though it is the largest group in NAICS 321.

#### 4.3.1 Energy Use and GHG emissions

Between 1990 and 2015, energy use in NAICS 321111 increased by 49% while GHG emissions decreased by 10% (Fig. 4.5). Physical production has been rising since 2009, and in 2015 was 19% higher than it was in 1990, but still 24% below its peak production in 2004. As in the overall industry, sawmills generally used less fossil fuels and more wood waste and electricity, although their shares have gone down as natural gas has gone up.

Fig. 4.6 illustrates the use of various fuels as a percentage of total energy use in NAICS 321111. Between 1990 and 2005, the sub-sector became less dependent on fuels that emit GHGs, such as heavy fuel oil, middle distillates, propane, and natural gas, and increasingly dependent on fuels that do not emit direct emissions: wood waste and electricity. By 2010, the contribution of fossil fuels to total use declined to 20% from 43% in 1990, while the contribution of wood waste and electricity increased to 78% from 57% in 1990. However, in the last few years, the share of natural gas has increased and wood waste and electricity shares have declined. This sector has adopted sophisticated equipment to increase recovery rates (i.e., volume of lumber recovered from each m³ of timber) which helps to reduce energy intensity.

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11 CIEEDAC estimated the confidential values associated with GHG emissions for various years between 2003 and 2015. These aggregated estimates can be seen in Appendix C.
4.3.2 Industrial Production

Physical production data are available for NAICS 321111 in board feet of lumber. The production of lumber is 19% higher than it was in 1990 and up 42% from 2009, departing from its downward trend since the peak year in 2004 (see Fig. 4.7).
4.3.3 Energy and GHG Intensity Indicators

Energy and direct GHG intensity indicators decline until 2003 and then increase just as production levels began to decline. Since 2011, the industry’s intensities have been more variable, but appear to be increasing. In 2003, energy and GHG intensity reached their lowest values at 33% and 56% below 1990 levels respectively. By 2015, energy intensity is 25% higher than it was in 1990, while GHG intensity remains lower than 1990 levels by 24%. The decline in GHG intensity is likely the result of the switch towards low carbon fuels (electricity and wood waste), while the more recent increase is due to more natural gas use.
4.4 NAICS 321216: Particle board and Fibreboard Manufacturing

Energy use and GHG data are available for NAICS 321216 from 1990 and 1995-2015. In 2015, energy use in NAICS 321216 represented just over 9% of the total energy use in NAICS 321. Its importance to the aggregate sector, while higher than 1990 when it represented 5%, has been declining from about 2002 on when it reached nearly 20% of the total.

4.4.1 Energy Use and GHG emissions

The energy and GHG emissions for NAICS 321216 are illustrated in Figure 4.9. Between 1990 and 2015, energy use more than doubled though it is still 50% below peak year use in 2002. GHG emissions are almost the same as 1990 levels for 2015 and down 54% from the peak year in 2002. Like other wood products industries, the degree to which wood fuel drives this industry’s operations plays a role its emissions levels.

The production data for NAICS 321216 are insufficient to generate intensity indicators for 1990 and 1995-2015 (see Appendices B and C). Physical production data are available for several different products in NAICS 321216 – particle board, waferboard, fibreboard and rigid insulating board. However, the data for each product are not available in each year and currently, no physical data are collected by STC. A further complication with generating a single measure of production for NAICS 321216 is that we do not know how much each product contributes to the energy use of the sub-sector. If one product is more energy intense to produce, an increase in its production relative to the production of other products would indicate that the sector is becoming

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12 CIEEDAC estimated the confidential values associated with GHG emissions for various years between 2001 and 2015. These estimates can be seen in Appendix C.
more energy intense; this would not be an indication of changes in efficiency. In any case, there are no physical data useful for analysis covering the study period.

Figure 4.9: Energy Use and GHG Emissions (NAICS 321216)

Data on GDP for NAICS 3212 are available but not for NAICS 321216. While we provide these data in the data tables (Appendix C), the difficulty with generating a measure of the production of NAICS 321216 limits our analysis of the energy use and GHG emissions of the sub-sector.

5 Discussion and Conclusions

5.1 Data Issues and Proposed Actions

Several data issues are identified above, including the lack of data for all years for some sub-sectors, lack of aligned energy and production data for many wood products NAICS categories, the potential for missing or misclassifying data, and inability to accurately estimate indirect emissions from the available data.

5.1.1 Energy and Production Data Availability

Energy data are available for NAICS 321 as an aggregate; however, the coverage of its sub-sectors is incomplete. Data are reported for several sub-sectors at the 6-digit NAICS level but not for the entire study period. The incomplete data set for individual sub-sectors prevents a comprehensive analysis of all the sub-sectors within NAICS 321.

Although STC provides energy use data for the aggregate of the wood products sector NAICS 321 for 1990 and 1995-2015, assessing trends in efficiency is difficult because the corresponding production data are only available in monetary units (GDP).
An important challenge to creating a single measure of the physical production of NAICS 321 is that the sector produces a variety of different products. It may be possible to find a common volume unit for the products from all sub-sectors if production data were available for all products. After production data for all sub-sectors are available, intensity indicators would need to be adjusted to reflect the different energy intensities of producing different products. Such an indicator may weigh the energy intensities by production levels to obtain a representative energy intensity value. When industry output varies, a composite intensity indicator would change accordingly to account for changes in energy and GHG intensity caused by changes in the relative outputs of different sub-sectors.

To develop a composite indicator, we must be able to monitor energy intensity within the more disaggregate NAICS codes (e.g., 6-digit). Although the availability of disaggregate energy data for the wood products sector has improved, the data still only cover approximately 60% of the total energy use in NAICS 321. NAICS 321111, which accounts for 40% - 45% of the NAICS 321 energy use, is the only category for which we could generate energy and GHG intensity indicators based on a physical measure of production. FPAC may wish to work with STC to determine if it is possible to obtain physical or economic production data for NAICS 321112 and NAICS 321114, now that energy data are being reported.

Energy data are available for NAICS 321216, Particleboard and Fibreboard, which accounts for just over 9% of NAICS 321 energy use, but the corresponding production data are incomplete. Production data are available for particleboard in all years up to 2005. Data on fibreboard production only begins in 1996 and ends in 2005 and data on rigid insulation board production ends in 1995. FPAC could work with CIEEDAC and STC to determine if it is appropriate to add these production values together to generate a denominator that aligns with the energy data, and to see if production values for the omitted data would be obtained. They could also ask STC why gathering these data has been discontinued and if that can be reversed. By filling in the data gaps, we could generate indicators of the energy intensity for NAICS 321216.

No energy data are reported for the remaining half to one third (between 36% and 50% in various years) of NAICS 321. Primarily, there is a lack of data for the remainder of NAICS 3212 and all of NAICS 3219. Some of these data gaps are significant, such as NAICS 321217 (Oriented Strand Board), which has a production several times greater than plywood (NAICS 321211 and 321212). CIEEDAC reviewed ASM data on expenditures on fuel and electricity to provide some insight into which NAICS categories are large energy consumers, and warrant data collection. Fig. 5.1 illustrates that the categories for which disaggregated energy data are available account for, on average, about 60% of total energy use. These same categories (sawmills, shingles and shakes, wood preservation and fibreboard and particleboard) account for, on average, 70% of total expenditures on fuel and electricity. For an individual sub-sector, its percentage of total expenditures on energy is not necessarily proportional to its percentage of total...
energy use. For instance, sawmills are responsible for 41% of total energy use but 55% of total expenditures. A possible explanation is that sawmills consume higher priced fuels than other sectors.

**Figure 5.1: Comparison of Total Energy used in each Subsector and Total Expenditure on Energy by those Subsectors.**

The increase in confidential data complicates the estimation of direct GHG emissions; estimated data are received from NRCan when it is possible to do so without compromising confidentiality.\(^\text{13}\) Under certain conditions, waivers can be obtained from firms reporting the use of these fuels so that they can be reported. In some cases, the number of respondents reporting these fuels may be too small to allow for a significant measure of confidence in these data anyway. CIEEDAC has used data on fuel mixes as described in this report to estimate GHG emissions for all sub-sectors reported in aggregate here. These data are available in Appendix C.

Additionally, no data are available describing physical energy use by province. Data on electricity use by the wood products sector at the provincial level would allow for an estimation of the indirect emissions for which the industry may be deemed responsible.

5.1.2 Data Quality and Comprehensiveness

Since STC is the only agency to collect direct data on energy use for the whole industry, the means to detect potential differences in method, missing facilities, or errors is greatly reduced. APA-The Engineered Wood Association collects production data for a subset of the products within the wood products sector that may provide opportunity for comparison; however, these data are not publicly available. FPAC also collects

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\(^{13}\) Heavy fuel oil, propane, purchased steam, and wood use data are confidential for NAICS 321112, 321114 and 321216 for various years from 2001 and on. Because steam and wood use are not associated with CO\(_2\) generation, the data on the sum of the CO\(_2\) from confidential fuels are also considered confidential.
production data but alignment for comparison is difficult; however, this situation should improve with the recent switch to FPAC collecting survey data on behalf of STC (see Section 3.3). Comments from industry representatives indicate that there is potential for facilities to be misclassified to the wrong NAICS codes or to be missed entirely. For example, there may be unique instances where hardboard mills are misclassified in NAICS 322 when they should have been classified under NAICS 321. Furthermore, some facilities may fall within NAICS 321 and NAICS 322, if they produce wood products and pulp or paper in the same location.

Finally, we consider the importance of the sector to overall energy use and GHG emissions within the manufacturing sector. Fig. 5.2 illustrates the contribution of different sectors to total energy use and GHG emissions of the manufacturing sector. The wood products industry consumes around 7% of manufacturing energy and emits slightly less than 3% of direct GHG emissions. In comparison, Pulp and Paper production (NAICS 3221) consumes 24% of the energy and emits just over 7% of the emissions, while the Primary Metal Industry sector (NAICS 331) emits over a quarter of the CO₂ while consuming about 22% of the energy in the manufacturing sector.

Information on the relative contribution of wood products to total energy use and emissions may have implications for future investments in data collection. Sectors with greater energy use and emissions may be deemed a greater priority for STC or NRCan.

**Figure 5.2: The Relative Contributions of Select NAICS Categories to Energy Use (in increasing order) and CO₂ Emissions in the Manufacturing Sector, 2015**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Energy Use</th>
<th>GHG Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic &amp; Rubber</td>
<td>1.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Non Metal Minerals</td>
<td>4.7%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Wood Products</td>
<td>7.0%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Refined Petroleum</td>
<td>2.8%</td>
<td>22.5%</td>
</tr>
<tr>
<td>Chem Products</td>
<td>14.5%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Primary Metals</td>
<td>21.6%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Pulp &amp; Paper</td>
<td>24.0%</td>
<td>24.0%</td>
</tr>
</tbody>
</table>

Source: ICE, NRCan. Note that the manufacturing sector excludes the Electricity generating sector and the Oil & Gas sector. This chart reflects only CO₂, CH₄, and N₂O emissions from combustion sources and excludes indirect emissions from electricity and steam as well as process emissions. CO₂ data for Plastic and Rubber are not available.

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14 Increasingly, data on GHG emissions aggregated for an industry are becoming confidential. The graph in Figure 5.2 represents estimates of GHG emissions for all industries; i.e., none of the CO₂ emissions are available.
5.2 Conclusions

In general, the data are not sufficient (especially physical production data) to draw robust conclusions about trends in energy efficiency and GHG intensity within the wood products sector. However, given the available data and considerations outlined above, the following are general conclusions about trends in energy use, GHG emissions, and production for the Canadian wood products industry.

1. Energy intensity per unit of GDP in the Canadian wood products industry declined until 2004/05, rose to 1990 levels by 2010, and now sits 18% below 1990 levels in 2015. The initial downward trend may be the result of many factors including technological or process innovations to reduce energy demand. More recently, changes in capacity utilization and perhaps even shifting to less “efficient” fuel such as wood may have caused intensity to go up again.

2. GHG intensity per unit of GDP declined as much as 50% over the study period and remains 46% below that of 1990. The declines in GHG intensity are, in part, the result of a decline in energy intensity (at least in earlier years) but also due to switching from fossil fuels to wood waste and electricity. Recent increases in the use of natural gas have pushed total emission higher again. Although the use of electricity does not produce direct emissions, it causes indirect emissions in provinces where electricity is generated from fossil fuels. We are unable to measure the indirect emissions because provincial data on wood products energy use are not available.

3. More disaggregation in energy use and physical production data would improve the energy and GHG intensity indicators.

4. The most important factor that compromises the value of the energy and GHG intensity indicators is the lack of physical production data. Without a physical denominator in the indicators, it is difficult to determine efficiency trends. To improve the indicators, FPAC could review their own data to determine if they collect something that might be suitable for use in an intensity indicator. FPAC could also consult with their membership and STC to determine which production data are most feasible to collect on an industry-wide basis and if an alternative means of deriving physical production data exists. STC has developed methods of estimating physical production based on value added by industry type; consultation with them on how this process could work for FPAC may provide insight.

5. Confidential data in this industry (and many others) is high. This lack of data restricts the degree to which analysis, especially for GHGs, can take place. Estimates were made of GHG emissions in the industries reported here.
5.3 Recommendations

We have identified several data gaps that should be addressed by FPAC and other interested stakeholders. Recommendations include:

1. Completing or improving the energy data for sub-sectors which currently have some data available;
2. Improving the physical production data set – this would require some cooperation between stakeholders that would include FPAC, STC, NRCan, CIEEDAC, and others in the industry;
3. Improving data on indirect emissions caused by electricity use – provincial data on energy use are required to determine indirect emissions;
4. Determining the degree to which the industry should be disaggregated and suggest such levels of disaggregation - this may involve assigning 4-digit NAICS levels rather than 6-digit NAICS levels, i.e., 3211, 3212 and 3219 rather than for 321211, 321212, etc. This would involve an effort to define the need and importance of further (dis)aggregation of the sub-sectors in the context of understanding the potential for energy efficiency improvement and GHG reduction; and
5. A concerted effort on behalf of this and all industries to seek solutions to issues related to confidentiality.
6 References


CIEEDAC. 2016a. *A review of Existing Cogeneration Facilities in Canada*. Includes a Cogeneration Database available on line (www.cieedac.sfu.ca). Simon Fraser University, Vancouver.


7 List of Acronyms

ASM – Annual Survey of Manufacturers
CIEEDAC – Canadian Industrial Energy End-use Data and Analysis Centre
CIPEC – Canadian Industry Program for Energy Conservation
CH₄ – methane
CO₂, CO₂e – carbon dioxide, carbon dioxide equivalent
CRF - Common Reporting Format, tables from ECCC to UNFCCC associated with the NIR
ECCC – Environment and Climate Change Canada
GDP – gross domestic product
GHG – greenhouse gas
ICE – Industrial Consumption of Energy
N₂O – nitrous oxide
NAICS – North American Industry Classification System
NIR - National Inventory Report
NRCan – Natural Resources Canada
MWh – megawatt hour
RESD – Report on Energy Supply and Demand
STC – Statistics Canada
UNFCCC - United Nation Framework Convention on Climate Change
8 Appendices and Data Tables

Appendix A: Coefficients
- Table 1: Energy Coefficients, GJ/physical unit
- Table 2: Direct CO$_2$ Emissions Coefficients, tonnes/physical unit
- Table 3: CH$_4$ Emissions Coefficients, kg/physical unit
- Table 4: N$_2$O Emissions Coefficients, kg/physical unit

Appendix B: Data Tables for Wood Products Sector
- Table 1: Physical Production Data Related to the Wood Products Industry
- Table 2: Gross Domestic Product for the Wood Products Industry (millions of 2007 constant dollars)
- Table 3: Gross Output for the Wood Products Industry (millions of 2007 constant dollars) – Currently not available

Appendix C: Data Tables for Wood Products
- CO$_2$ Emissions and CO$_2$ Intensity Indicators (1990 – 2015)
- CH$_4$ Emissions and CH$_4$ Intensity Indicators (1990 – 2015)
- N$_2$O Emissions and N$_2$O Intensity Indicators (1990 – 2015)

Data tables are provided for:

NAICS 321000 Wood Product Manufacturing
NAICS 321100 Sawmills and Wood Preservation
NAICS 321111 Sawmills (except Shingle and Shake Mills)
NAICS 321112 Shingle and Shake Mills
NAICS 321114 Wood Preservation
NAICS 321216 Particle board and Fibreboard Mills
Appendix A: Coefficients
Appendix B: Production Data, Wood Products Industry

### Table 1: Physical Production Data Related to the Wood Products Industry (000m³)

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</thead>
<tbody>
<tr>
<td>Lumber (STC)</td>
<td>54,544</td>
<td>62,577</td>
<td>76,786</td>
<td>83,158</td>
<td>81,221</td>
<td>72,407</td>
<td>57,569</td>
<td>45,452</td>
<td>53,439</td>
<td>53,406</td>
<td>55,821</td>
<td>58,899</td>
<td>59,618</td>
<td>64,729</td>
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<td>Particle Board</td>
<td>1,146</td>
<td>1,935</td>
<td>2,517</td>
<td>2,679</td>
<td>2,838</td>
<td>1,966</td>
<td>3,374</td>
<td>7,847</td>
<td>8,814</td>
<td>8,354</td>
<td>38,253</td>
<td>33,470</td>
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<tr>
<td>OSB and Waferboard</td>
<td>1,966</td>
<td>3,374</td>
<td>7,847</td>
<td>8,814</td>
<td>8,354</td>
<td>1,966</td>
<td>3,374</td>
<td>7,847</td>
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<td>8,354</td>
<td>1,000</td>
<td>1,000</td>
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<tr>
<td>Fibreboard</td>
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<tr>
<td>Rigid Insulating Board</td>
<td>38,253</td>
<td>33,470</td>
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Source: STC, CANSIM

### Table 2: Gross Domestic Product for the Wood Products Industry (2007 $millions)

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<tbody>
<tr>
<td>NAICS 321</td>
<td>6,334</td>
<td>6,262</td>
<td>9,237</td>
<td>10,886</td>
<td>10,757</td>
<td>9,702</td>
<td>8,621</td>
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<td>NAICS 321216</td>
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<td>930</td>
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<td>1,794</td>
<td>1,764</td>
<td>1,863</td>
<td>2,087</td>
<td>2,280</td>
<td>2,449</td>
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</table>

Source: STC, CANSIM Table 379-0031
Appendix C: Data Tables for Wood Products (NAICS 321000)

1) **NAICS Energy Use Report**: Energy use, industry production, intensity indicators and index are provided for wood products. Conversion coefficients from energy in physical units to terajoules (TJ) come from Statistics Canada Cat No: 57-003 XPB. See appendix A for details.

2) **NAICS Carbon Dioxide Report**: CO₂ emissions, industry production, intensity indicators and index are provided for wood products. Conversion coefficients from energy in physical units to CO₂ come from Environment and Climate Change Canada (ECCC 2016). See appendix A for details.

3) **NAICS Methane Report (2 sets)**: CH₄ emissions, industry production, intensity indicators and index are provided for wood products in both physical units of CH₄ and in CO₂e. Conversion coefficients from energy in physical units to CH₄ come from Environment and Climate Change Canada (ECCC 2016). See appendix A for details.

4) **NAICS Nitrous Oxide Report (2 sets)**: N₂O emissions, industry production, intensity indicators and index are provided for wood products in both physical units of N₂O and in CO₂e. Conversion coefficients from energy in physical units to N₂O come from Environment and Climate Change Canada (ECCC 2016). See appendix A for details.

5) **NAICS Total GHG Report**: Sum of all GHG emissions, industry production, intensity indicators and index are provided for wood products. Conversion coefficients from energy in physical units to carbon dioxide equivalents (CO₂e) come from Environment and Climate Change Canada (ECCC 2016).