

ENERGY AND THE US HARDWOOD INDUSTRY – PART I: PROFILE AND IMPACT OF PRICES

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According to the Energy Information Administration two fifths of the energy used by US wood products manufacturers comes from electricity and natural gas, the costs of which have pointedly increased over the last decade. Empirical indications exist that higher energy prices affect the industry's profitability. Together with other developments such as, for example, unfavorable trends in hardwood stumpage prices, higher transportation costs, increasing government regulations, a challenging economic situation, or the ongoing globalization of markets, the US hardwood industry has to cope with some serious challenges threatening its profit potential. To understand the impact of energy prices on wood products manufacturers' profitability and to gain insights regarding actions the industry is taking to respond to energy-related challenges, a survey was conducted among Eastern US primary hardwood products manufacturers in late 2010. Results show that, overall, the share of energy expenses on total production costs of respondents was 7.9%. A majority of respondents (61.8%) agreed that their energy expenses have increased by an average of 18.7% during the last five years. Half of the respondents reported a 5% or higher negative impact of higher energy prices on their profits over the same period. Actions undertaken by the industry to alleviate the negative impact of rising energy prices are presented in a second paper in this two-part series.

Keywords: Energy; Hardwood products; Energy efficiency; Energy consumption

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INTRODUCTION

According to the American Forest & Paper Association (AFPA, 2002), energy expenses are the third largest cost for the US forest products industries, after raw materials and labor. In 2009, energy purchased represented four percent of total direct costs for the wood products industry (e.g., sawmills, engineered wood products, millwork, pallets and containers, kitchen cabinets, and non-upholstered household furniture) (NAICS 321, 337110, and 337122 U.S. Census Bureau, 2011). The share of energy expenses on total costs of wood products manufacturers has likely risen over the last decade (1998 to 2008) as electricity prices have risen at an average annual rate of 1.4%, diesel prices by 9.3%, and prices for natural gas for industrial use by more than 100% (adjusted for inflation using PPI, Energy Information Administration, 2011). Figure 1 shows the changes in cost per million British Thermal Unit (btu, left axis) for electricity, diesel, and natural gas from 1998 to 2008. For comparison reasons, the price for 4/4 red oak lumber has been included in Fig. 1 (\$/MMBF, right axis).

Natural gas and electricity account for about two fifths of total energy consumption of the wood products industry. Particularly affected are hardwood products manufacturers (e.g., sawmills), as sawing and drying hardwood lumber requires two thirds more electric and thermal energy as does softwood lumber (FAO, 1990). Reasons for this higher energy requirement for hardwoods versus softwoods include the fact that hardwood lumber is sawn to maximize grade, is typically a denser material requiring longer drying times, and is commonly dried to lower moisture content. Thus, the rising cost of energy (Fig. 1) has a detrimental impact on the often small profit margins in the hardwood industry (American Hardwood Export Council, 2006). Hardwood products manufacturers' sensitivity to rising energy prices can best be understood when realizing that actual hardwood lumber prices (e.g., producers' main source of revenue) have been decreasing at a fast rate. For example, the price of hardwood lumber has decreased at an average annual rate of 3.9 percent between 1998 and 2008 (see Fig. 1). Other trends adding to the industry difficulties are the increasing competition for wood fiber, expected to grow as biofuels are increasingly generated from wood biomass (Gonzalez et al. 2011); little control over timber prices, which can constitute up to 60 percent of hardwood lumber production costs (American Hardwood Export Council, 2006); and the historical steady increase in stumpage prices (e.g., in the 1961-2002 period hardwood stumpage real prices increased at an annual rate of 4.6 percent; Wagner and Sendak, 2005). Thus, hardwood lumber manufacturers' profit margins are constantly squeezed, a problem magnified by rising energy costs.

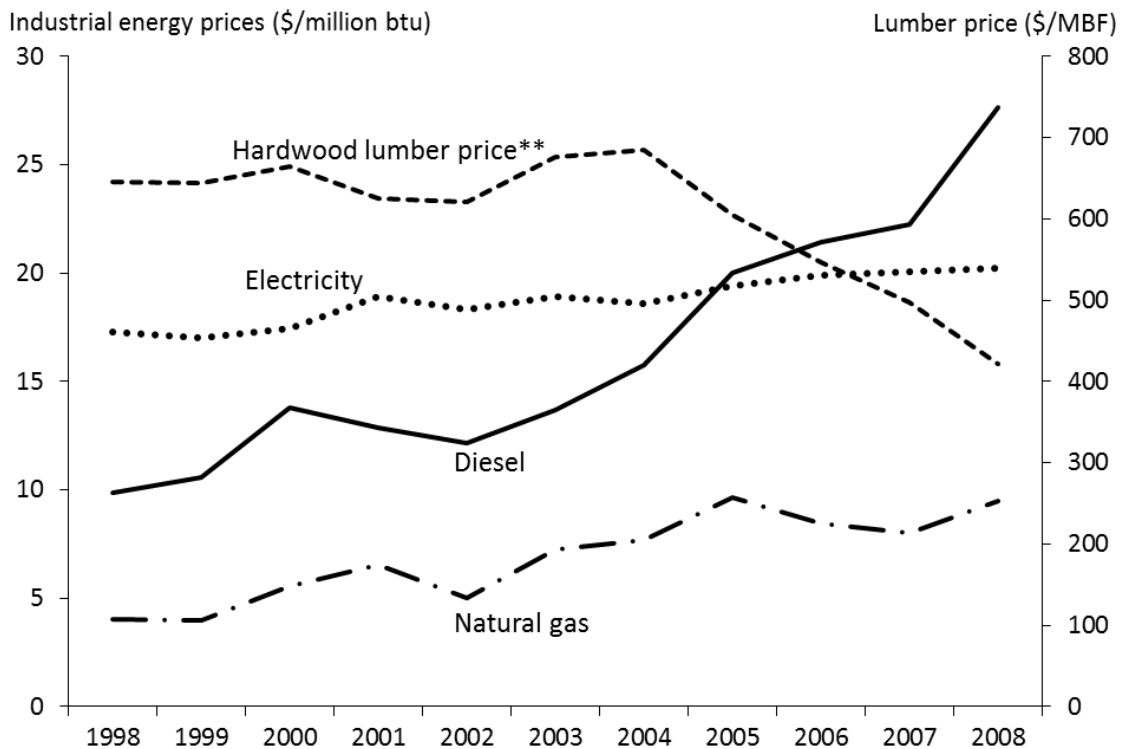


Fig. 1. Energy and lumber prices for the 1998-2008. Data from Energy Information Administration (2009), Bulletin of Hardwood Market Statistics (Jones, 2009) & Bureau of Labor Statistics (2010). Prices in 2010 dollars, using Producer Price Index. Hardwood composite price calculated as a weighted average of major hardwood species, using percentages from Bowe (2000)

Given the trajectory of energy prices and the energy intensity of the US hardwood industry, energy consumption and the resulting costs are a high priority issue. However, data as to the impact of rising energy costs on US hardwood products manufacturers or as to the initiatives being undertaken to address the issues are not available. The objective of this research was to investigate the impact of rising energy prices on the US hardwood products manufacturing industry and learn about the actions the industry is taking to face this challenge. This manuscript reports on the energy consumption profile and the impact of rising energy prices on the industry, while a second manuscript (Espinoza et al. 2011) reports on actions undertaken by the industry to alleviate the negative impact of rising energy prices on the industry's profitability.

MATERIALS AND METHODS

To obtain information about the impact of rising energy costs and efforts to address resulting challenges, a mail survey involving hardwood products manufacturers in the Eastern US was conducted. The questionnaire contained 34 items, and the purpose of the survey was explained in an accompanying cover letter. Responses were collected and analyzed using descriptive statistics and other methods to be described later in this section.

Questionnaire Development

A questionnaire was developed and pre-tested by three academics and three industry representatives. The final version of the questionnaire contained 34 questions in 6 sections: (1) general information, (2) energy management activities, (3) impact of energy prices and actions to improve energy efficiency, (4) energy consumption and expenses, (5) wood energy generation systems, and (6) lumber drying. Most questions were multiple choice and numerical; however, open-ended questions were included, too. The questionnaire was intended for primary (NAICS 321) and secondary producers (NAICS 321 and 337) of hardwood products. Primary solid hardwood producers typically process hardwood logs into lumber. Secondary manufacturers process lumber into value-added products, such as, for example, furniture, kitchen cabinetry, flooring, or millwork. Since not all wood products manufacturers are involved in lumber drying, questions pertaining to lumber drying were placed at the end of the questionnaire. This way, companies with no drying activities would not be discouraged from filling out the form. When trends were of interest, questions referred to changes during the last five years to 2009.

Sample Frame

The mail survey targeted US hardwood products manufacturers in 35 states of the Eastern US. A mailing list of 2,405 companies was compiled from various sources, including industry association websites (AHMI, 2009, AWI, 2011, KCMA, 2008, NHLA, 2011, NWFA, 2009, WCMA, 2011, WPMA, 2011), business directories (Hoover's 2011, Manta 2011), and state government agencies (ForestryUSA, 2010). In particular, manufacturers classified in the following NAICS codes were of interest: 3211131, 3211137, 321911, 321912, 321918, 337110, 337122, 337129, 337211, and 337212.

Efforts were made to find a personal contact at each company to whom to address the questionnaire, since it was hypothesized that this might positively affect the survey response rate. Initial screening of addresses obtained was performed to remove organizations that were no longer in business or were not part of the target population from the list. Additionally, the first question in the survey asked whether the respondent was a manufacturer of hardwood products. Recipients not involved in the manufacture of hardwood products were asked to return the unanswered questionnaire to the sender to allow the calculation of correct survey statistics.

Survey Execution

The survey was executed following Dillman's Total Design Method (Dillman, 2009), and mailings were made in August to October 2010. Two sets of questionnaires and postcards were mailed, with a two week-separation between each mailing. Questionnaires were accompanied by a cover letter explaining the objectives of the research and benefits for the industry. A booklet format was used for the questionnaires, and the mailing included prepaid postage, to facilitate the returning of the survey. An electronic-delivered questionnaire was not considered due to the difficulty in compiling an email address list for the population of interest.

Data Analysis

Data collected with the survey were analyzed first using descriptive statistics. Normality was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests. Comparisons of means were carried out with T-Tests and ANOVA for normally distributed data; and Mann-Whitney and Kruskal Wallis when non-parametric tests were appropriate. Pearson Chi-Square tests were used to see whether a relationship existed between two categorical variables (Field 2009). To test whether the difference between two proportions was significant, Z-tests of proportions were used (Zou, Fielding, Silverman and Tempany, 2003). Microsoft Excel and IBM SPSS 18 were the software tools used in the data analysis.

Non-response Bias

The adjusted response rate was of 9.0%. To estimate non-response bias, early and late respondents were compared. This approach assumes that there is a continuum in the likelihood of a company completing and returning questionnaires, and thus late respondents are used as a proxy for non-respondents (Dalecki et al. 1993; Etter and Perneger 1997; Lahaut et al. 2003). Five characteristics were compared: geographical location of facilities, material input, number of employees, industry sector (primary manufacturers or secondary manufacturers), and change in energy-related expenditures. Also, since the geographic location of all non-respondents was known, a comparison of geographical distribution could be made. Statistical tools used to make the comparisons were the Z-test of proportions, the Mann-Whitney test, and the Pearson Chi-square test. No differences were found between respondents and non-respondents for the five dimensions compared (e.g., all Z-values lower than 1.96 and p-values lower than 0.05). Table 1 presents the individual statistics of the non-response bias analysis performed.

Table 1. Non-response Bias Assessment Results

----- Geographical Location (number of companies) -----			
	Initial sample	Respondents	Z value*
Midwest	797	69	1.075
Northeast	565	49	0.835
South	1043	67	1.817
* Z test of proportions, alpha=0.05. No difference when Z<1.96			
----- Material Input and number of employees -----			
	Early respondents	Late respondents	p-value**
Lumber input (board feet ¹)	4,926,368	4,041,030	0.718
Number of employees	49.5	36.3	0.292
** Mann-Whitney test, alpha=0.05			
----- Industry sector (number of companies) -----			
	Early respondents	Late respondents	p-value***
Primary manufacturers	43	35	0.851
Secondary manufacturers	60	47	
*** Pearson Chi-Square test, alpha=0.05			
----- Change in energy expenditures (number of companies) -----			
	Early respondents	Late respondents	p-value****
Increase	57	45	0.838
Decrease	7	4	
Unchanged	28	24	
**** Pearson Chi-Square test, alpha=0.05			

¹ Board foot is a unit of volume commonly used for lumber, and is equivalent to a square 12 inches of side and 1 inch thick.

Study Limitations

As with all mail surveys, limitations apply to the results obtained from this study (Alreck 2004). Although respondents mostly were members of the senior management team, the respondents' answers may not necessarily reflect the perspectives of other managers within the company or company policy.

Most of the results from this survey reflect the activity of the companies during 2009, when US manufacturing output was at its lowest during the recession that started in 2007, as measured by value of shipments (U.S. Census Bureau, 2011). Thus, results of this research may have been influenced by a considerable decline in economic activity for respondents' businesses.

Lastly, some of the data requested in the questionnaire included what some companies may consider sensitive information, especially in regards to production volumes and energy expenses. Likely, this affected the response rate in those questions and it is opportunely noted in the relevant sections of the two manuscripts.

RESULTS AND DISCUSSION

One hundred and eighty-eight (188) usable questionnaires out of a total of 2,405 mailed were returned. Accounting for wrong addresses (215), companies out of business (9), and companies not part of the target population (100), the adjusted response rate was 9.0%.

Company Characteristics

As shown in Fig. 2 (left), the primary activity of 41.1% percent of respondents was hardwood lumber manufacturing, followed by millwork (13.5%), kitchen cabinets (11.9%), and hardwood flooring (11.4%). The “Other” category included manufacturers of picture frame moulding, cutting boards, custom turnings, urns, drawers, toys, novelties, and boats. For the rest of this manuscript, respondents other than sawmills will be referred to as “secondary manufacturers,” and the terms “sawmills” and “primary manufacturers” are used interchangeably. Also shown in Fig. 2 (right), is the respondents’ species distribution of sales: red and white oak were the major species (36.2%), followed by maple and yellow-poplar (18.4 and 11.7%, respectively).

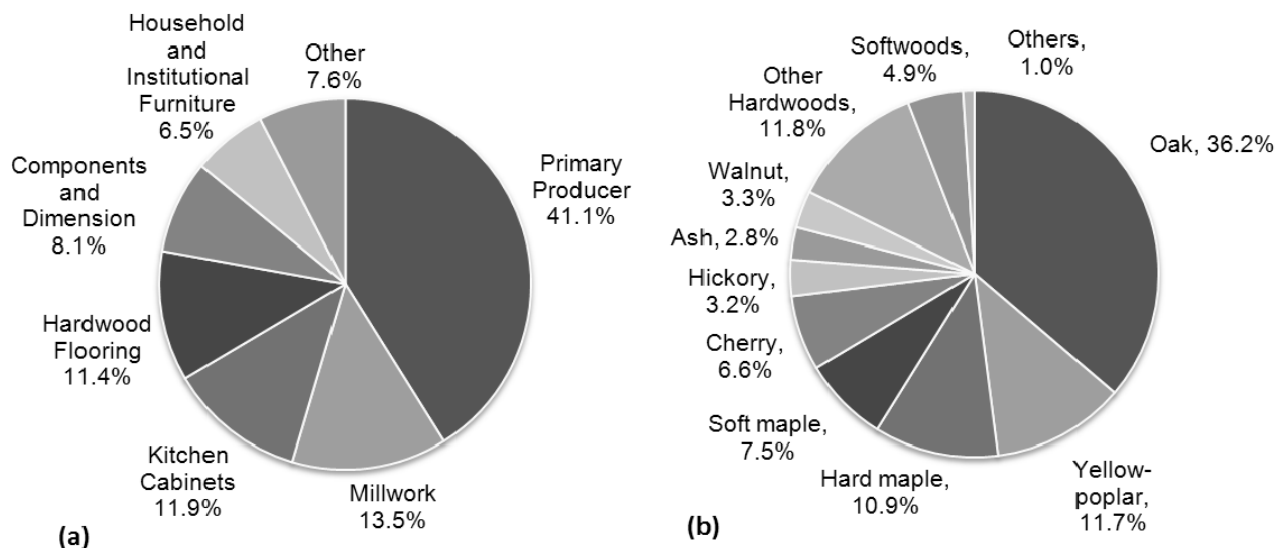


Fig. 2. (a) Primary activity and (b) species distribution on total sales (board foot basis)

The average raw material input for the entire sample was 4.5 million board feet (MMBF), with an average of 6.4 MMBF (log equivalent, Doyle scale) for sawmills and an average of 2.7 MMBF for secondary manufacturers (Table 2). Lumber output is only reported for sawmills, and was 6.7 MMBF on average.

Lumber output figures for primary manufacturers in Table 2 are lower than what was reported in previous studies. Perkins (2009) and Bove et al. (2001) listed averages of 7.6 and 7.6 MMBF, respectively. Similarly, the average number of employees for sawmills reported in this study (33.1) was found to be higher in Perkins' (37.0, 2007) and Bove et al.'s (34.3, 1998) studies. The difference may be explained, in large part, by the recent downturn in the economy that has caused many companies to downsize (Howard and Westby 2007).

Table 2. Company Characteristics of Respondents

Sector	Average	Median	N
----- Material input* (MMBF) -----			
Overall	4.5	2.0	129
Primary manufacturers	6.4	4.0	54
Secondary manufacturers	2.7	0.3	75
----- Lumber output** (MMBF) -----			
Primary manufacturers	6.7	5.2	50
----- Number of employees -----			
Overall	45.2	20.0	175
Primary manufacturers	33.1	21.0	73
Secondary manufacturers	51.1	19.0	102
----- Hours worked in 2009 -----			
Overall	2,082	2,000	171
Primary manufacturers	2,170	2,000	71
Secondary manufacturers	2,019	2,000	100

* Log input in Doyle scale for primary manufacturers.

** Only primary manufacturers reported.

Global competition may also play a role, as it reduces the domestic demand for hardwood lumber (Buehlmann and Schuler 2009; Grushecky et al. 2006). In fact, the US Bureau of Labor Statistics reported a drop of 33% in employment in the sawmill sector for both softwood and hardwood mills from 2001 to 2009 (U.S. Bureau of Labor Statistics, 2010). Table 2 also lists the number of hours worked by respondents during 2009. Average numbers correspond with an 8-hour shift; only 9 companies reported 3,000 or more hours, and 10 reported working 1,000 or less hours in 2009.

Of all respondents, 80.0% were single-facility companies and 20.0% had more than one manufacturing plant. The ratio between single and multiple facility companies was close for both primary and secondary manufacturers (81.0 vs. 19.0% and 79.0 vs. 21.0%, respectively).

Lumber Drying

About 90 percent of the total energy input for a typical hardwood sawmill operation is used in lumber drying (FAO 1990; Bergman and Bowe 2008). Therefore, a section of the questionnaire inquired about this process with questions ranging from drying capacity to type of boilers used to generate steam.

A little more than a third (34.4%) of respondent companies reported some kind of lumber drying activity, and for those companies with drying operations, 72.3% of the total lumber processed was kiln-dried at the respondents' facilities. Companies with drying operations were roughly equally distributed among primary and secondary manufacturers (53.2% and 46.8%, respectively). The most common drying methods reported were air-drying and conventional steam-heated kiln drying (each technology

used by 69.4% of companies with lumber drying operations), followed by pre-dryers and dehumidifiers (17.7% and 14.5%, respectively); only 8.1% of companies used direct-fired kilns. Table 3 reveals more details about the total and median air and kiln-drying capacity of respondents with drying operations.

Table 3. Kiln-Drying Capacity Reported by Survey Participants in Thousand Board Feet (MBF)

	Air-Drying	Kiln-drying*
Total capacity	119,880	27,132
Average capacity	3,155	589.8
Median capacity	1,850	357.5
N	43	48

* Includes steam-heated and direct-fired kilns.

There is a substantial difference between the figures in Table 3 and what was reported by Rice et al. (1994) and Luppold et al. (2000). The former conducted a nationwide survey of primary and secondary manufacturers, and reported an average kiln-drying capacity for hardwood lumber of 290.0 MBF per firm. Luppold et al. reported that the average kiln capacity of lumber manufacturers for different regions in the Eastern United States, ranging from 150.0 MBF for the Lake States to 450.0 MBF in the Central region. However, as reported by Perkins (2009), hardwood products manufacturers added drying capacity at a high rate during the last decade, to provide more added value to their customers.

The survey also inquired as to what kind of boiler respondents used to generate thermal energy for lumber drying. Of those respondents reporting operating boilers, 60.0% were using fire-tube boilers, which are typically used in smaller operations (up to 10 million Btu per hour in capacity, [Energy and Environmental Analysis Inc., 2005]). Another 34.7% of respondents indicated that they were using water-tube boilers. The remaining 5.3% of respondents reported using hybrid boilers, which consist of a water-tube boiler for main generation followed by a fire-tube boiler, to recuperate additional energy from the exhaust gases from the first boiler (Hutchinson, Anderson and Hassler, 1998).

Overall, 69.5% of companies reporting kiln-drying were using wood biomass as a major fuel for thermal energy generation. More secondary manufacturers were using biomass-based thermal energy (81.5%) than primary manufacturers (59.4%). The rest of the companies reported energy from fossil fuels and electricity.

Lastly, the questionnaire included questions about specific kiln-drying technology relevant for energy usage. Kilns can be operated manually or automatically. In the former, changes to set points are made manually by the drying operator as lumber moisture content changes; in automatic kilns, changes to set points (desired levels of process parameters, like temperature and relative humidity) are made by an automatic control system. Automatic control systems allow for smooth transitions between given sets of conditions, rather than the sudden steps executed in manual control, which can lead to wasted energy by keeping a set of drying conditions longer than needed (Simpson, 1991). Overall, more companies reported drying manually than with automatic control (54.7% and 28.3% of companies reporting kiln-drying, respectively, the remaining 17.0% reported using both systems). Another factor that can affect energy consumption in

lumber drying is the use of adjustable speed fans; this feature can save 40 to 70% in electricity costs (Denig et al. 2000). In the survey, 52.8% of companies with kiln-drying operations reported having adjustable speed fans.

Information from this section can be used to estimate the total energy needs of facilities for lumber drying. For example, given that the typical sawmill in this survey produced an average of 6.7 MMBF in 2009, and 72.3% if the lumber is dried on-site, 4.8 MMBF of lumber were dried at the respondents' facilities. Considering that a fairly efficient kiln requires approximately 3.4 million btu/MBF to dry hardwood lumber from green to 7% MC (Denig et al. 2000), then 16.3 billion btu were needed for lumber drying at the average facility.

Biomass for Energy

The wood products industry is a big user of biomass for energy generation. In total, 49.8% of the total energy used by the US wood products industry comes from biomass (virtually all wood biomass), as compared to only 12.3% for the entire US manufacturing sector (Energy Information Administration, 2009, Energy Information Administration, 2010). Overall, 33.9% of companies reported generating energy from wood biomass, 57.4% of which were secondary manufacturers. The most common pretreatment for wood fuels was size reduction (e.g., hammer mill or knife hog), acknowledged by 94.6% of companies using wood as energy source. Seventy percent of companies used either suspension or grate burners as combustion methods; e.g., technologies that require control of particle sizes (Hutchinson et al. 1998). Twenty four percent of respondents reported using pile burners as a combustion method and 7.4% reported gasification (percentages do not add to 100% because some respondents reported more than one combustion method).

The most commonly used wood fuel was sawdust (reported by 77.2% of companies), followed by wood chips (33.3%). A great majority of users of wood fuels generated their biomass fuel on-site (91.2%). Biomass input figures were provided only by 23 respondents; all of them used wood biomass for thermal energy generation in drying. These 23 respondents reported that the average usage of wood biomass was 4,754 tons per year for energy generation. Since respondents also reported the percentage of lumber dried at their facilities and the total lumber processed, it is possible to calculate the biomass usage per lumber volume dried. Respondents needed 0.67 tons of wood biomass fuel per thousand board feet (tons/MBF) of lumber dried on site. This corresponds with a study by Bergman and Bowe (2008), who studied wood waste usage for thermal energy generation for lumber drying at 20 mills and quantified the average wood waste requirement as 0.66 tons/MBF.

Companies were also asked about whether they were using some kind of cogeneration technology. Cogeneration is the simultaneous generation of thermal and electric energy, and has efficiencies typically twice as those of traditional utility generation from fossil fuel (Kowalczyk, n.d.). Only six companies (3.4% of respondents) reported some kind of cogeneration technology, and four companies were using biomass as a fuel. Possible reasons for this lack of widespread adoption of cogeneration are the high initial investment costs, not enough steam pressure generated on-site for cogeneration, complexity of operation, more profitable outlets for biomass, environmental regulations, and costs outweighing benefits.

Energy Consumption and Expenses

Companies were questioned as to their energy consumption figures for 2009. Along with data for wood biomass for energy generation, this was the most ambitious part of the questionnaire, since it required respondents to search for past utility bills and give up what some respondents may consider sensitive information. Expectedly, response rate for these questions was lower than for other sections of the questionnaire, with 59.5% of respondents reporting consumption and expenses for electricity, 28.6% for natural gas, 13.0% for gasoline, and 29.2% for diesel. Figures provided varied greatly, since the sample included companies with a wide range of production volumes. Therefore, when possible, ratios of energy consumption and lumber processed were calculated (referred to as specific energy consumption in the literature; Morvay and Gvozdenac 2008). No figures of specific energy consumption are presented for secondary manufacturers, since large amounts of materials other than lumber (i.e., kitchen cabinet manufacturing usually make use of sizeable quantities of medium density fiberboard or particle board) are involved in these operations, and ratios would be misleading.

Natural gas

Average annual natural gas consumption for 2009 was 4.7 million cubic feet (MMCF) and average expenses of \$32,562 for the entire sample (based on 53 responses). Primary manufacturers consumed an average of 1.8 MMCF and spent \$42,869 (10 companies), while the same figures for secondary manufacturers were 5.2 MMCF and \$30,164 (43 companies).

Electric energy

Average annual electric energy consumption for all respondents was 1.8 million kWh and \$149,109 in electric bills for 2009. Primary manufacturers' average annual consumption and expenses were 1.9 million kWh and \$169,764, respectively; and secondary manufacturers paid \$139,060 for 1.8 million kWh of electric energy annually. Bergman and Bowe (2008) reported electrical energy consumption for sawmills of 238.2 kWh per MBF, while this study's corresponding figure is 247.6 kWh/MBF. A possible explanation for this difference may be the average size differences of the mills involved in this and Bergman and Bowe's (2008) study (6.9 vs. 16.6 MMBF, respectively). The average expense for electricity for sawmills was \$39.3 per MBF of hardwood lumber produced.

Impact of Energy Prices on the Industry

Share of energy expenses on total costs

First, the survey established the percentage of total operating costs spent for energy in respondents' companies. Answers obtained varied, and subsequent statistical tests ($\alpha=0.05$) were unable to detect significant differences across sectors and subsectors. However, the average amount spent by primary manufacturers for energy was higher (although not statistically significantly higher, $\alpha=0.05$) than the amount spent by secondary manufacturers (9.7 and 7.1%, respectively), while the overall average spent was 7.9%. Table 6 shows the share of energy costs on production costs according to respondents' input. Also listed is the average share of energy expenses on total costs by subsectors (Table 6). It should be noted that the four percent figure in the introduction

was calculated as a ratio between purchased energy and direct costs (labor, materials, and energy), thus cannot be directly compared to the values in Table 6.

Table 6. Share of Energy Expenses on Total Costs

Sector and subsector	Average
Overall	7.9%
Primary manufacturers	9.7%
Secondary manufacturers	7.1%
Hardwood flooring	6.8%
Components and dimension	5.9%
Household and institutional furniture	7.8%
Kitchen cabinets	6.8%
Millwork	6.2%

No significant difference between sectors and subsectors. Mann-Whitney U test ($p=0.279$) and Kruskal Wallis ($p=0.653$), respectively

Change in energy expenses

When asked whether energy expenses had increased, decreased, or stayed the same over the last five years, a majority of respondents (61.8%) answered that their energy-related costs had increased (Fig. 6). However, no significant difference across subsectors (Pearson Chi-Square test, $p=0.672$) could be found, but on average, especially kitchen cabinet manufacturers (90.5%) agreed that energy expenses did increase over the last five years (Fig. 4).

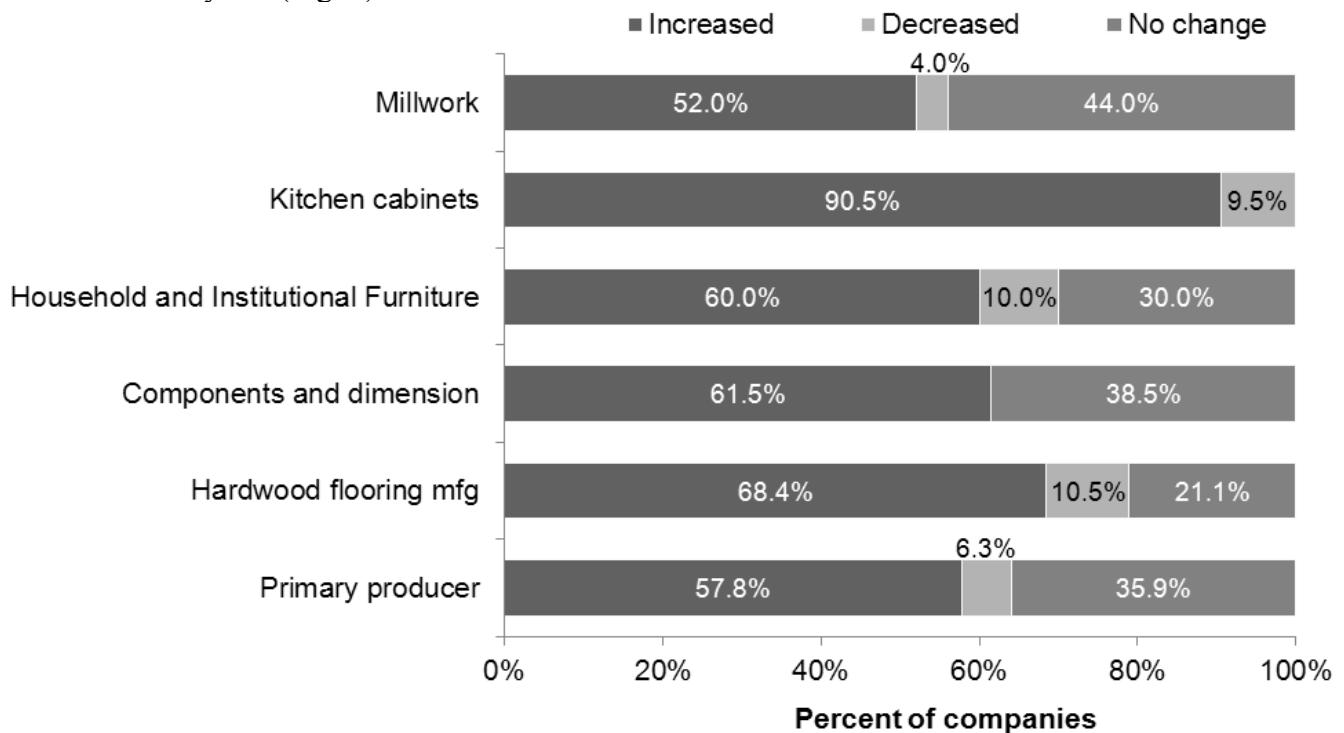


Fig. 4. Change in energy expenses during the last 5 years. No significant difference across subsectors. Pearson Chi-Square test (p -value=0.672)

For those companies noting an increase in energy expenses, the average increase reported was 18.7% (average of all respondents). Primary and secondary manufacturers experienced significantly different growth in energy expenses (Chi-square test, $p=0.024$), with average increases reported of 26.2 and 14.5%, respectively. This difference may be explained in part by considering that primary manufacturers reported spending, on average, 9.7% of their total costs on energy, while secondary manufacturers indicated 7.1% (Table 6). Thus, primary manufacturers spend more on energy than do secondary manufacturers. The importance of energy costs to the profitability of the primary industry becomes clear when considering that typical total profit margins are lower than 4% (American Hardwood Export Council, 2006).

Impact of rising energy prices on profits

Higher energy expenses impact manufacturing costs, and thus affect companies' profits. The impact of higher energy prices on respondents' profits was assessed using six categories going from no effect (0%), to having an impact of more than 20% on company profits. Figure 5 shows the results obtained from all respondents and segregated by industry sector (primary and secondary). Overall, 50% of respondents reported that higher energy prices had an effect of 5% or greater on their profits during the last five years. Differences were significant between primary and secondary manufacturers (Chi-Square test, $p=0.002$). Given the more energy-intensive business of primary manufacturers, they feel the effect of higher energy prices on their profits to a more pronounced extent than do secondary manufacturers; 65% of the former reported 5% or higher effect on profits, while 40% of secondary manufacturers reported a 5% or higher negative impact on profits.

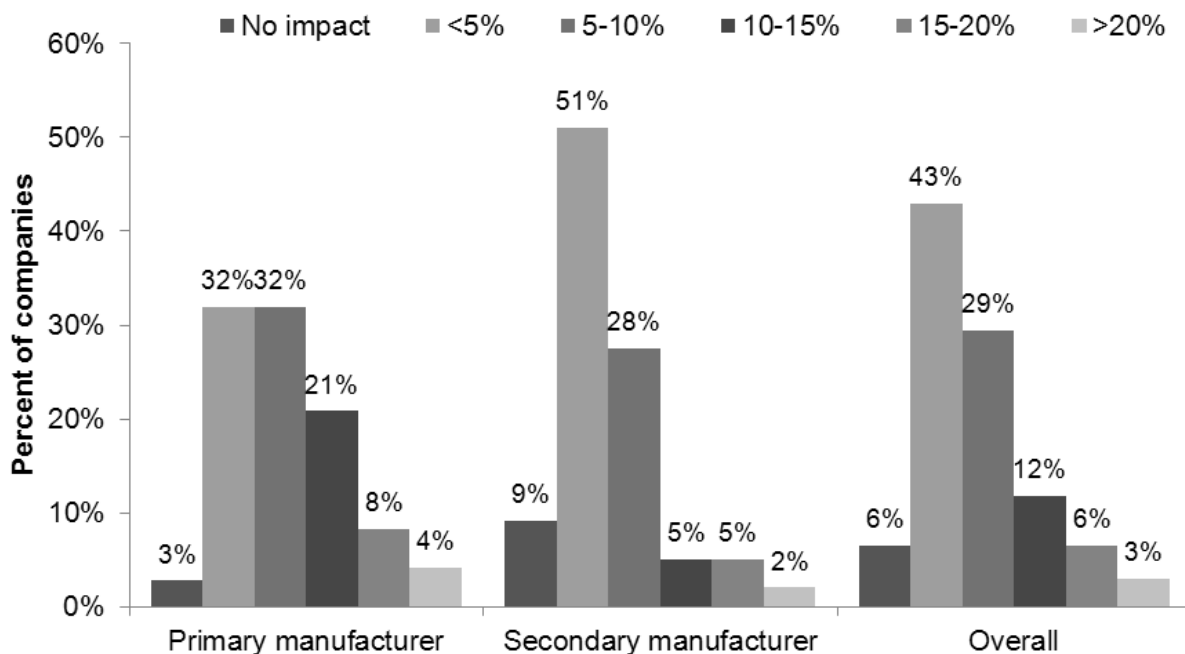


Fig. 5. Impact of higher energy prices on profits during the last 5 years. Pearson Chi-Square test was significant (p -value=0.002)

Only 6.5% of respondents reported no impact on their profits due to higher energy prices. The lower importance of energy prices for secondary manufacturers, whose business is less energy intensive, was also shown by the fact that 9.2% of secondary manufacturers claim to see no impact on their profitability from rising energy prices, while the same number was only 2.8% for primary manufacturers. While this may be true for these manufacturers, it can be argued that if these respondents would use true cost accounting, they should see a negative impact of rising energy prices on their profitability. Thus, rising energy prices have an impact on all wood products manufacturers and, lacking the ability to raise selling prices due to cutthroat global competition, industry profitability suffers.

SUMMARY

The US hardwood products industry was surveyed in 2010 to learn about the impact of rising energy prices. A total of 188 usable responses were obtained, yielding an adjusted response rate of 9.0%. Hardwood sawmilling was the primary activity of 41.1% of respondents, while the rest of respondents' companies were involved in secondary wood products manufacturing activities.

1. Forty-one percent of respondents to this survey were primary manufacturers. The average material input was 6.4 million board feet (MMBF) for sawmills and 2.67 MMBF for secondary manufacturers. About a third (34.4%) of respondents were involved in lumber drying. The average kiln-drying capacity reported was 520.8 thousand board feet. Overall, 33.9% of respondents reported using wood biomass as an energy source, but few (4 companies) also generated electricity (cogeneration). The average electric energy consumption for sawmills was 1.9 million kWh and the specific electricity consumption was of 247.6 kWh per MBF.
2. Overall, the share of energy expenses on the total production costs of respondents was 7.9%. Energy expenses were higher for primary manufacturers (9.7%) than for secondary manufacturers (7.1%). A majority of respondents (61.8%) agreed that their energy expenses have increased during the last five years, and reported, on average, an increase of 18.7%. Half of all respondents (50.6%) reported that the negative impact of higher energy prices on their profits was 5% or larger, with 90% of those reporting a negative impact indicating a negative influence of 15% or larger.

As energy prices continue to grow, pressure on hardwood products manufacturers to reduce energy consumption and improve energy efficiency keeps rising. With the industry's pricing power weak, efforts must be made to reduce manufacturing costs. Reducing energy costs is one way to do so.

Increased energy costs put a measurable burden on the profitability of hardwood products manufacturers. Improving companies' energy efficiency does reduce costs and reduces businesses' exposure to further increasing energy prices. Actions undertaken by the industry to alleviate the negative impact of rising energy prices are presented in the second manuscript in this series: "Energy and the US hardwood industry: Part II - responses to increasing prices" (Espinoza et al. 2011).

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