

Characteristics of Wood Fuel Pellet Manufacturers and Markets in the United States, 2010

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Abstract

The wood fuel pellet industry has been growing rapidly in recent years. The survey results reported here are focused on the annual production, raw material, production cost rankings, market radius, barriers to market expansion, and other data that give an overview of the industry during a very difficult economic period. Eighty-four mills across the United States were contacted and 53 responded. The average volume of production was over 59,000 tons per year. Raw materials for pelletizing and labor were the principal costs of production according to respondents. Market demand and capital costs were cited as the chief barriers to expansion.

The industry is clearly subject to market forces that influence the cost and availability of raw materials as well as the cost of heating fuel alternatives such as oil. Despite the economic difficulties, demand continues to grow for pellet fuels both in the United States and in Europe.

Few wood products industries have grown as dynamically as the wood pellet industry in recent years. In the United States, the recent growth of the fuel pellet industry is the result of increases in the cost of fossil energy, legislative support for biobased fuels, and policies aimed at reducing greenhouse gas emissions, specifically carbon dioxide (Spelter and Toth 2009, Pellet Fuels Institute 2010a). The purpose of this research was to survey the US pellet industry to collect information about the annual production, raw material, production cost rankings, market radius, barriers to market expansion, and safety issues. Safety issues will be reported later. The survey was focused on pellets for use as fuel. There is an increasing demand for pellets used for animal bedding and other purposes that were not assessed in this survey. The survey is part of ongoing research to develop a model to predict production costs and the sensitivity of critical cost elements to potential profit for northeastern fuel pellet mills.

According to the US Census Bureau (2010) approximately 2.2 million households (2%) use wood as a primary source of heating (Fig. 1). Statistics are scarce for the use of wood pellets but the Hearth, Patio, and Barbeque Association (HPBA) estimates shipments of pellet appliances from 1998 through 2009 were about 800,000 units, with shipments far above average when the price of fuel oil was high in 2005, 2006, and 2008 (HPBA 2010). The association now estimates that approximately 1 million pellet burning appliances are in use in the United States (Pellet Fuels Institute 2011). The use of pellets for residential

heating has grown, primarily in New England where heating oil (usually no. 2 fuel oil) is a major household heating source. On average, fuel oil for home heating purposes in the United States is used by 9 percent of homes. In New England oil is used by 55 percent of households (Energy Information Administration 2010). Pellet use is not limited to New England, but in most regions of the United States, the use of wood pellet stoves, like conventional wood stoves, seems to be most commonly used as a supplemental source of thermal energy for residential use.

The wood pellet industry in the United States and in Canada has been growing rapidly since 2005 (Spelter and Toth 2009). In addition to residential use, the growth has resulted from firms that provide pellets for commercial applications, such as schools, theaters, and manufacturing facilities, that use wood pellet burning furnaces and boilers (e.g., International Wood Fuels 2010). While heating costs have probably been the primary impetus for pellet fuel use, some of the growth is the result of policies and incentives from both state and federal sources for renewable, green fuels (Database of State Incentives for Renewables &

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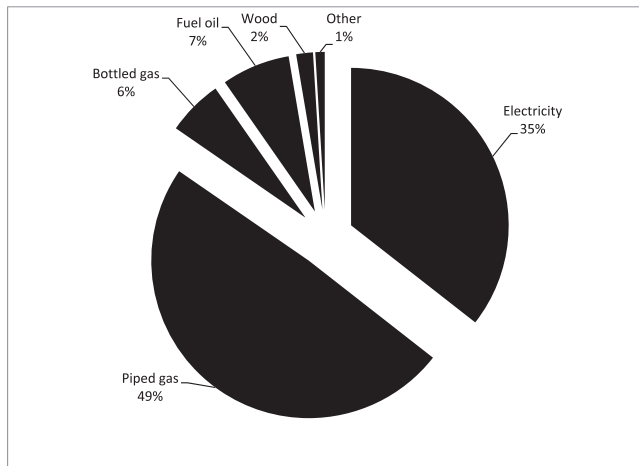


Figure 1.—Primary source of thermal energy for household heating. Adapted from the US Census Bureau (2010, table 1-5).

Efficiency 2010 [DSIRE], Pellet Fuels Institute 2010a). More recently, international demand for fuel pellets has been the impetus for the establishment of several large manufacturing facilities in the southern United States that were not in operation when this survey was done. Also, some of the demand has been generated by wholesalers who do not manufacture pellets but who purchase large quantities for export or for sale to institutions and municipalities.

Anecdotally, the demand for pellets in parts of the United States is related to the price of oil (Thomas 2005). The link between pellet sales and oil prices is not well established due to poor tracking mechanisms, off-season pellet purchases, inventory buildup, and other reasons. Industry shipments of pellet burning hearths or “appliances” are also used as an indicator of demand, although the link to current pellet sales is tenuous at best (Pellet Fuels Institute 2010b). It is clear that wood pellet manufacturing capacity expanded rapidly in North America from just over 1 million tons in 2004 to over 6 million tons in 2009 (Spelter and Toth 2009). Market fluctuations continue to make operating difficult for producers, and the current markets show a contraction based on the survey results shown below.

Background

Wood pellets, briquettes, and other forms of compressed wood residues have been of interest for many years. As early as 1930, compressed sawdust in the shape of logs was marketed and sold for fuel (Letts 1951). Most commonly, fuel pellets were made from dried mill residues, but more recently other forms of wood waste such as used pallets have become more common (Aruna et al. 1997a).

Currently, the countries of the European Union are the largest wood pellet producers in the world. In 2007 the production of pellets in all of Europe was about 9 million tonnes,¹ with Sweden, Austria, and Germany as the main producers (Egger and Öhlinger 2009). Gibson (2010) reports over 400 pellet plants in Europe, but estimates in the literature vary greatly and the range is from 300 to over 700.

¹ Tonne refers to a metric ton equal to 1,000 kg or about 2,205 pounds.

Many of the manufacturers are small operations with limited output.

In Europe as in North America, the rate of growth of the wood pellet industry has also been impressive during the last decade. For example, production was expected to grow about 25 to 30 percent in 2009 (Egger and Öhlinger 2009). Industrial pellets for large-scale wood pellet using installations, generally termed CHP or combined heat and power plants, are often found in Sweden, Germany, Belgium, and the Eastern European countries, whereas small-scale residential heating installations are common in Sweden, Austria, Germany, and Italy (The Pellet Atlas 2009). The binding agreement of the European Union members to have 20 percent of their energy supplied from renewable sources by 2020 should also enhance demand for pellets. Increased demand should spur domestic growth of the pellet fuels industry and should increase the import of pellet fuels (Council of the European Union 2007).

Exports of pellets have been a subject of study for years. Among others, Aruna et al. (1997b) described the potential and need for exporting pellets to Sweden and the reasons for the investigations are sound. According to Swaan and Melin (2008) and Rakos (2009), wood pellet consumption exceeds production in Europe. In 2009, the estimated European wood pellet consumption was around 11 million metric tonnes, which suggests that about 2 to 3 million metric tonnes were imported. The European Biomass Association (2011) showed an expected import volume of about 4 million tonnes in 2010. Exports to the European Union seem to be a large potential market for US producers, although competition from Canada and Russia is strong (Swaan and Melin 2008). Denmark, Italy, Belgium, and the Netherlands are the leading importers (Egger and Öhlinger 2009).

Costs are critical for pellet manufacturers who are often caught between suppliers of sawdust or chips and market competition. Much of the sawdust produced by sawmills is used on site for boiler operations. According to informal discussions with wood chip buyers in paper-producing states, the competition for bark-free chips between pellet producers and pulp mills keeps the price of chips high. Thek and Obernberger (2004) analyzed wood pellet production costs in Austria. They found that raw material costs were the largest single cost of production. In the literature, the cost of raw materials is a recurrent theme affecting profit and use. For example, Egger and Öhlinger (2009) identify raw material costs as “crucial” to market development. Also important, according to Thek and Obernberger (2004), are drying costs for the raw materials. Together, raw material purchases and drying accounted for over one-half of the total production costs (Fig. 2).

Methods

A survey instrument, developed for an e-mail/telephone survey, was designed and sent to all major pellet mills in the United States. The survey was conducted from late 2009 to April 2010. One respondent requested a mailed survey and responded via mail. Prior to sending the survey nationwide, a small pilot study was done, with feedback requested from specialists in the field. After some small adjustments to the survey instrument, the survey was sent out to pellet manufacturers nationwide. Lists of manufacturers were compiled from three sources: The Log Rack (2010), the Pellet Fuels Institute (2010c), and Spelter and Toth (2009).

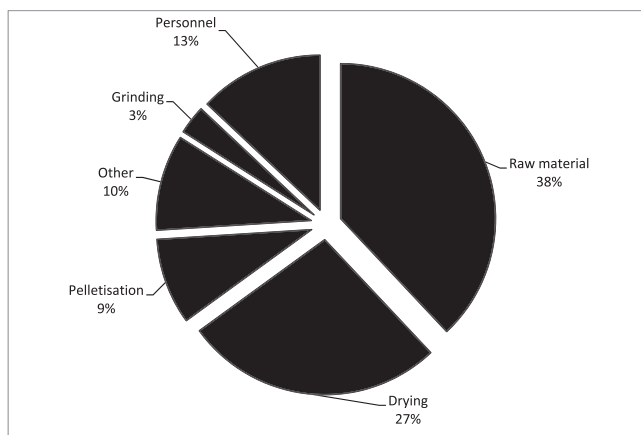


Figure 2.—Major cost categories as a percentage of total production cost according to Thek and Obernberger (2004).

Some small (approximately 1,000 tons or less per annum) mills are known to exist and were not considered due to the small volumes and largely seasonal output. E-mail surveys were sent with a letter promising anonymity with regard to responses, and phone interviewees were given the same promise.

Results

Survey response rates

Eighty-four plants were contacted. Fifty-three questionnaires were completed and nearly always by the chief operating officer or designee. Given the nature of the industry and the current state of the economy in the United States, it was expected that some plants would no longer be in operation. However, the number of mill closures was surprising. Of the 84 plants contacted, nearly 24 percent reported they were not producing pellets. Of those who gave reasons, most cited the economy or market demand as key factors. It is assumed that most of the plants reporting a cessation of production still have the capability of resuming operation should economic conditions improve. The overall response rate was 63 percent (Fig. 3). The geographic distribution of respondents and the geographic regions are provided in Table 1.

Production and employment

According to respondents, their annual wood pellet production (2008 to 2009²) was approximately 3.8 million tons and was substantially higher than the 1.98 million tons (~1.8 million tonnes) estimated by Spelter and Toth (2009) for 2008. The increase may be the result of overproduction on the part of the industry, which experienced higher prices and demand during the winter of 2007 to 2008 due to the high price of heating oil. Daily production ranged from 12 to 1,300 tons. The average number of operating days was 278.

According to respondents, the average mill produced 59,500 tons of pellets during the year prior to the survey, although some respondents probably reported capacity rather than actual production. The average mill size was skewed due to the size distribution that actually exists. Most of the plants are relatively small, and 38 percent reported

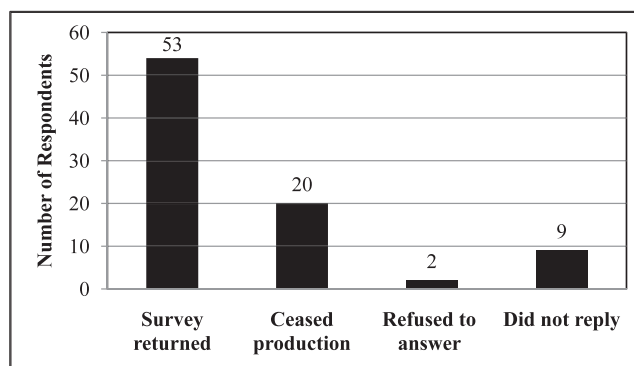


Figure 3.—Survey response rate (N = 84).

Table 1.—Classification of contacts and respondents by region and states comprising region.

Region	States comprising region	No. of contacts	No. of respondents
Southwest	Texas, New Mexico, Oklahoma, Arizona	8	2
West	Montana, Wyoming, Colorado, Utah, Nevada, Idaho, Oregon, Washington, California	15	13
Midwest	North Dakota, South Dakota, Nebraska, Kansas, Missouri, Illinois, Ohio, Indiana, Minnesota, Michigan, Iowa, Wisconsin	20	13
Southeast	Kentucky, Tennessee, West Virginia, Virginia, North Carolina, South Carolina, Florida, Mississippi, Alabama, Louisiana, Georgia, Arkansas	23	12
Northeast	New England, Pennsylvania, New Jersey, Delaware, Maryland, New York	18	13

production of less than 30,000 tons per year (Fig. 4). Eighty percent of respondents reported that their facilities were stand-alone facilities while 20 percent were part of other wood product processing plants.

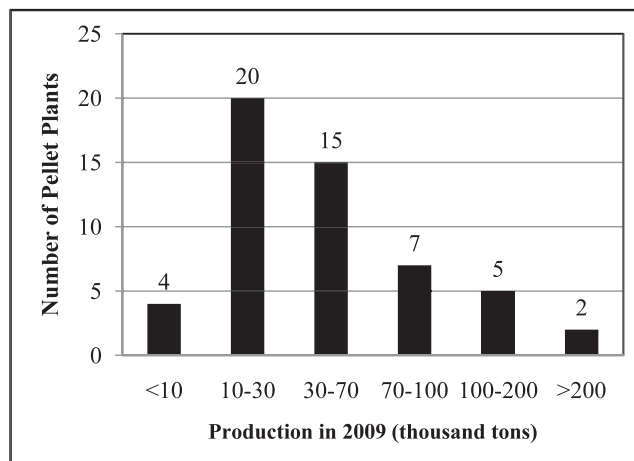


Figure 4.—Reported pellet mill production, by category.

² Generally, the production data are for the calendar year 2009.

Most pellet mills are automated and few employees are required to prepare furnish or to monitor the pelletizing process. The reported employment levels (Fig. 5) reflect the small number of employees needed and also the modest plant sizes.

Raw materials used for production

According to respondents, 53 percent of wood pellets are made using hardwood exclusively, 33 percent use softwood exclusively, and only 14 percent of wood pellets are made using a hardwood–softwood blend. Sawdust and wood chips are the major raw material sources for wood pellet production, although about 20 percent of pellet producers that are stand-alone facilities use roundwood as a raw material source (Fig. 6). Two mills identified “beetle-killed trees” as a source of furnish and no mills identified wood pallets as a source although they are known to be used in some areas. Both the composition of the furnish and the use of roundwood were surprising because pellet producers are usually stand-alone facilities and the composition of the pellet furnish should reflect the output of local residue suppliers as well as the price and availability of the raw materials in the local market. The raw materials for many pellet manufacturers, particularly in the Southeast and Northeast, originated in areas having hardwood and softwood mills, so more blended furnish was expected. However, it is well known that, due to the density of pellets,

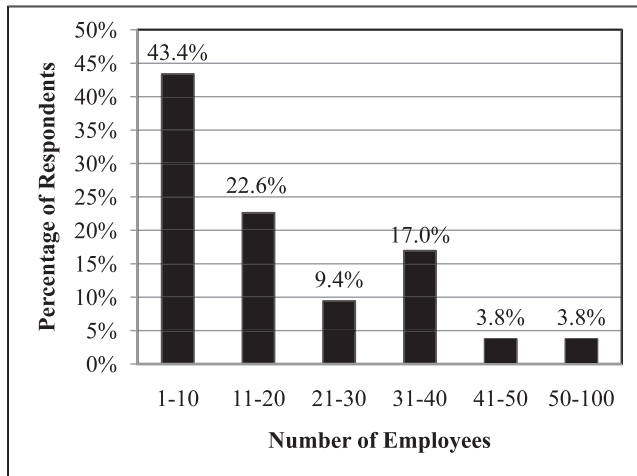


Figure 5.—Number of employees as reported by respondents (n = 53).

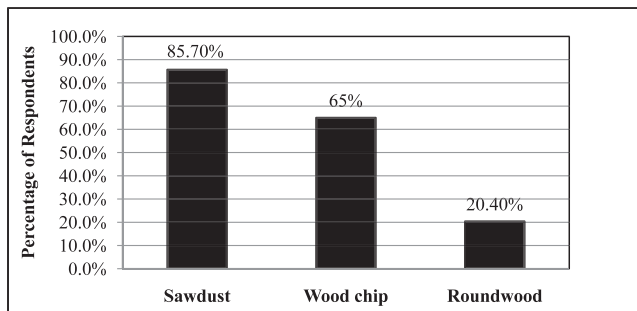


Figure 6.—Raw material sources for wood pellets.

less raw material is required to make pellets from higher density hardwoods than from lower density softwood. An analysis of the responses showed that all of the roundwood users were stand-alone facilities. Coincidentally, in the northeastern, western, and midwestern regions, 23 percent of respondents used roundwood furnish. In the southeastern region none of the respondents used roundwood, and in the southwestern region all of the respondents used roundwood furnish.

The reported use of roundwood was also quite high. Roundwood requires substantially more processing (cutting to length, debarking, hammermilling, etc.) than purchasing either clean wood chips or sawdust. As such, the costs of using roundwood for pellet manufacture are likely to be higher. Conversely, beginning the process with roundwood reduces the dependence of pellet mills on sawmills that are subject to housing and furniture market fluctuations. Using roundwood allows mills to market other products such as mulch from bark. As discussed below, raw material is the highest cost item for most pellet mills.

Markets and market channels

Pellet dealers (wholesalers) and retailers (Home Depot, etc.) are the principal customers for wood pellet plants accounting for 83 percent of the market share. Nine percent of wood pellets are sold to consumer market suppliers and 8 percent are sold directly to consumers. According to respondents, nearly 86 percent of pellets are bagged at the mill and about 14 percent are sold in bulk. As market shares move toward more commercial facilities being heated with wood pellets, the percentage of bulk shipments is expected to increase.

The markets for pellet producers tend to be distant from the mill. About 80 percent of respondents have a market radius over 200 miles from the mill. Only 15 percent of the pellet producers surveyed report exporting their production to either Canada or Europe. Anecdotally, producers have cited transportation costs, quality standards differences, and their plant capacity as major reasons for not exporting from the United States.

Production costs and major equipment

Respondents were asked to rank their top three production costs (Fig. 7). Raw material was dominant, with 76 percent

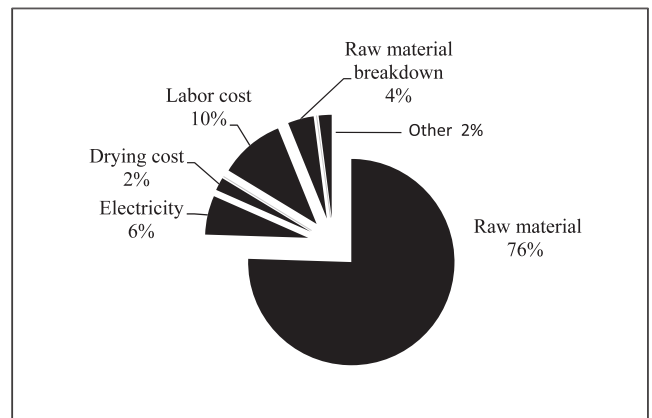


Figure 7.—Ranking of production costs. Percentage of respondents listing the category as the largest production cost.

of respondents indicating that it was the number one cost item. Labor costs were indicated by about 10 percent of respondents as being the primary production cost. Although not directly comparable, the data appear contrary to Thek and Obernberger (2004) who reported that drying costs were nearly equal to raw material as a production cost (Fig. 2). In this survey only 2 percent of respondents ranked drying as the most important production cost and only 9 percent ranked drying among the top three cost categories. Raw materials, labor, and electricity were each cited by over 70 percent of respondents as being among the top three categories. There were no geographic trends among respondents who did not choose raw material as the most important production cost.

Pelletizing presses and drying equipment are the most important and the most costly items to operate in pellet mills. For pelletizing presses, Andritz/Sprout has the largest market share and accounts for 64.4 percent of installations. The Andritz company, with headquarters in Austria, has been involved in pellet press manufacture for many years and has undergone a number of mergers and acquisitions during its history. Bliss, an Oklahoma-based company, and California Mill (Crawfordsville, Indiana) are distant rivals (Fig. 8). Pellet producers seldom use presses from different manufacturers in their plants. Thus, in a given plant, all presses are likely to be made by the same manufacturer.

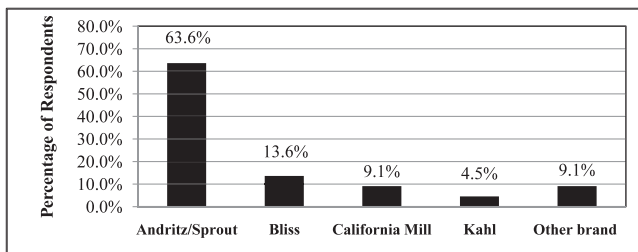


Figure 8.—Pellet press types used by respondents (n = 44).

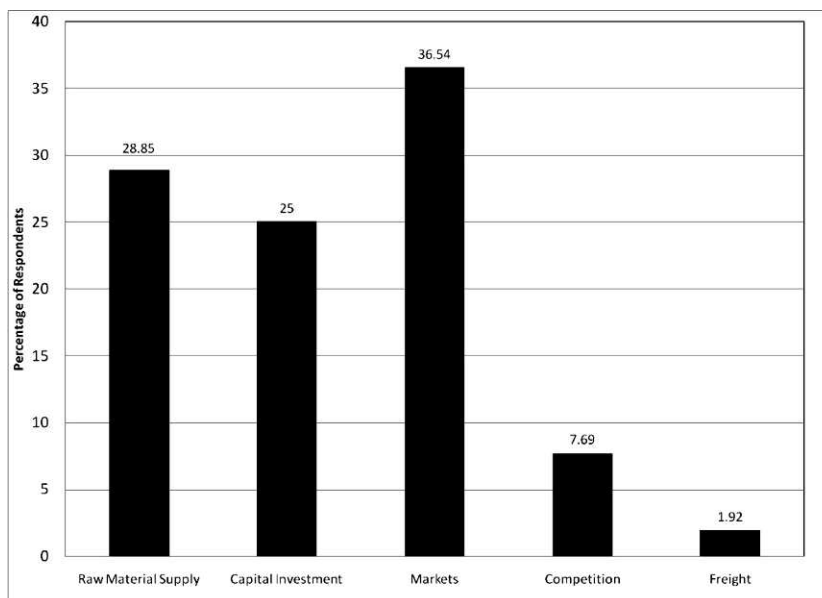


Figure 9.—Barriers to expansion, percentage of identifying category as primary barrier (n = 52).

In the pellet fuel industry it is common to add pelletizing capacity in modular increments by adding additional presses rather than increasing capacity by buying a larger press. Generally, the output of a single press is 4 to 6 tons/h. The practice has several advantages for the manufacturer. First, pellet press maintenance is high, and the need to replace pellet dies and other parts requires shutting the press down and interrupting production. Multiple presses allow production to continue while maintenance is performed on a single press. Second, mills with multiple presses can choose to reduce capacity to match poor market conditions without shutting down the entire mill. Finally, for mills with multiple shifts, capacity can be adjusted to meet a smaller workforce on a second or third shift.

Respondents were less specific about drying systems for pellet furnish than they were about pellet presses. Many dryer manufacturers were reported, and some systems were cobbled together from multiple sources. Most were triple pass rotary drying systems often using wood waste to provide the thermal energy for drying. We did not ask the respondents to separate the costs of drying fuel from residues used for pelletizing, although the costs may have been considered in the ranking of costs requested. Twenty-eight percent of mills had no dryers, suggesting that the furnish is supplied, at least in part, in the dry condition. In order to bond the fibers in a pellet press, the furnish should begin with a moisture content of 10 to 12 percent (wet basis moisture content). Some mills use a blend of wet and dry furnish to make pellets.

Barriers to expansion

The survey was conducted during difficult economic times for all regions of the United States. Not surprisingly, respondents cited market demand as the largest barrier to expansion (Fig. 9). Raw material supply ranked second as a barrier. Most of the raw material comes from sawmills and chipping facilities that were facing market weakness and, therefore, not producing the sawdust or chips used to manufacture pellets.

Capital costs were cited by 25 percent of respondents as being a barrier to expansion. Within the industry, profit margins are small and equipment is expensive. Pellet presses and drying capacity tend to be the limiting factors in output. A common rule of thumb in the industry is that it costs about US\$1 million to add a ton per hour of production capacity.

Only about 8 percent of manufacturers cited competition as a barrier to expansion. In view of the number of mills that were closed and market conditions, it was expected that competition would be high. Further, since pellet mills tend to operate in areas where the raw material sources are concentrated, competition for raw materials should also be high. The responses require further investigation.

Conclusions

Our survey focused on fairly large manufacturers making pellets for the purpose of fuel in the United States. Within those limits, we further restricted our survey to specific areas related to production costs including raw materials and equipment types in use. Also, we did not address the costs of transport, which are substantial.

Pellet fuel manufacturers have faced some difficult times, and closures were common during the survey period. Markets for existing mills were also soft. Pellet fuels seem to be a supplemental source of heat, and their use largely depends on the price of fossil fuels.

Most wood pellet plants rely on residues and shavings from wood-processing plants and had relatively small production levels. According to respondents, 74 percent of pellet plants produced less than 70,000 tons of output in 2009.

While markets and raw material costs clearly affected manufacturers, only 15 percent export their production to either Canada or Europe. International demand for pellet fuels continues to grow and those markets should be cultivated for US manufacturers.

Literature Cited

Aruna, P. B., J. G. Laarman, P. Araman, E. Coulter, and F. Cubbage. 1997a. Used pallets as a source of pellet fuel: Current industry status. *Forest Prod. J.* 47(9):51–57.

Aruna, P. B., J. G. Laarman, P. Araman, and F. W. Cubbage. 1997b. An analysis of wood pellets for export: A case study of Sweden as an importer. *Forest Prod. J.* 47(6):49–52

Council of the European Union. 2007. Presidency conclusions, March 8/9. http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf. Accessed July 5, 2011.

Database of State Incentives for Renewables & Efficiency (DSIRE). 2010. Database of State Incentives for Renewables & Efficiency. <http://www.dsireusa.org/>. Accessed. July 2011.

Egger, C. and C. Öhlinger. 2009. Burning issues: An update on the wood pellet market. *Renewable Energy World*. April 7. <http://www.renewableenergyworld.com/rea/news/article/2009/03/burning-issues-an-update-on-the-wood-pellet-market>. Accessed August 23, 2011.

Energy Information Administration. 2010. U.S. overview—State energy profiles. Northeast Data Abstract. Data are from 2000. <http://www.eia.doe.gov/state/index.cfm>. Accessed July 5, 2011.

European Biomass Association. 2011. Development of pellets production and consumption in Europe and North America. December 2009 data. <http://www.aebiom.org/?cat=19>. Accessed July 5, 2011.

Gibson, L. 2010. Conference panel addresses pellet export opportunities. *Biomass Power & Thermal*. November 3. <http://biomassmagazine.com/articles/5100/conference-panel-addresses-pellet-export-opportunities>. Accessed August 23, 2011.

Hearth, Patio and Barbeque Association (HPBA). 2010. Hearth, Patio and Barbeque Association statistics. <http://www.hpba.org/statistics>. Accessed August 23, 2011.

International Wood Fuels. 2010. Heat energy. <http://www.iwoodfuels.com/what-we-do/heat-energy/>. Accessed August 24, 2011.

Letts, W. W. 1951. Briquets from sawdust, bark and other waste. *Forest Products Research Society*. 5:202–203. <http://www.worldcat.org/title/briquets-from-sawdust-bark-and-other-waste/oclc/258033269>. Accessed August 23, 2011.

The Log Rack. 2010. Pellet manufacturers 2010. http://thelograck.com/pellet_manufacturers.html. Accessed July 2, 2011.

The Pellet Atlas 2009. PELLET@LAS European market overview report. PDF available at <http://www.pelletatlas.info/cms/site.aspx?p=9176>. Accessed August 26, 2011.

Pellet Fuels Institute. 2010a. Biomass appliance tax credit extended, reduced. <http://pelletheat.org/biomass-appliance-tax-credit-extended-reduced/>. Accessed July 1, 2011.

Pellet Fuels Institute. 2010b. HPBA hearth shipments. <http://pelletheat.org/industry-resources/industry-data/>. Accessed July 5, 2011.

Pellet Fuels Institute. 2010c. Member directory. <http://pelletheat.org/membership/member-directory>. Accessed July 5, 2011.

Pellet Fuels Institute. 2011. What are pellets? <http://pelletheat.org/pellets/what-are-pellets/>. Accessed July 5, 2011.

Rakos, C. 2009. The development of international wood pellet markets. proPellet Austria. The Austrian Pellet Industry Association. www.biomasseverband.at/uploads/tx_osfopage/.../Rakos_long_EN.pdf. Accessed August 23, 2011.

Spelter, H. and D. Toth. 2009. North America's wood pellet sector. Research Paper FPL-RP-656. USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin. www.fpl.fs.fed.us/documnts/fplrp/fpl_rp656.pdf. Accessed August 23, 2011.

Swaan, J. and S. Melin. 2008. Wood pellet exports: History, opportunities and challenges. Presented at the Small Wood Conference 2008, Forest Products Society Conference, May 13, 2008, Madison, Wisconsin.

Thek, G. and I. Oberberger. 2004. Wood pellet production costs under Austrian and in comparison to Swedish framework conditions. *Biomass Bioenergy* 27:671–693.

Thomas, J. 2005. Wood pellet stoves are hot. http://www.treehugger.com/files/2005/10/wood_pellet_sto.php. Accessed July 5, 2011.

US Census Bureau. 2010. American housing survey: Fuel types. <http://www.census.gov/hhes/www/housing/ahs/ahs09/ahs09.html>. Accessed July 15, 2011.