

## Thermally Modified Wood: Marketing Strategies of U.S. Producers

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Thermally-modified wood (TMW) has enhanced properties and its production does not involve the use of chemicals. However, the adoption of TMW in the marketplace has been limited in the U.S. for reasons that have not yet been clearly established. In this study, the marketing practices of U.S. producers and distributors of TMW were investigated, by conducting semi-structured interviews. Topics included major products and species, markets, distribution channels, promotional strategies, perceived barriers to adoption, and the outlook for TMW markets. Results show that TMW producers in general export a significant percent of their production; that TMW is considered a high-end product; and that customers are not as sensitive to prices as in other mainstream markets. Common products sold include siding, decking, flooring, millwork, and components for musical instruments. Respondents believe that the low awareness of TMW among the American public is a major barrier to wider adoption of TMW. However, companies envision a bright future for TMW as sales and inquiries have increased at a fast rate during the last few years.

*Keywords:* Thermally modified wood; Marketing strategies; Distribution channels; Awareness; Barriers

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### INTRODUCTION

The thermal modification of wood has been investigated since the early twentieth century (International ThermoWood Association 2003; Hill 2011). However, product development and commercial success of thermally-modified wood (TMW) was only achieved in Europe in the 1990s, driven in part by regulations limiting the use of toxic chemical treatments to protect wood from biological attack (Hill 2011). Heat treatment involves subjecting wood to elevated temperatures (180 to 215 °C) and steam for short periods of time (International ThermoWood Association 2003; Esteves and Pereira 2008). As a result, the chemical and physical properties of wood are changed. Research has shown that thermal modification improves wood's dimensional stability and enhances its resistance to biological attack (Rapp and Sailer 2000; International ThermoWood Association 2003; Leitch 2009). As a consequence of the treatment, the wooden material becomes darker, which can be an advantage or disadvantage depending on consumer tastes and preferences. TMW has been successfully used for applications where the material is exposed to high-humidity conditions, such as for sauna and bathroom furnishings and outdoor structures such as decking, door and window components, cladding, shutters, and garden furniture (International ThermoWood Association 2003). However, when wood is thermally treated, it loses weight and strength (Yildiz *et al.* 2005) due in part to the

degradation of hemicelluloses. Therefore, thermally-modified wood is not suitable for applications where structural performance is critical.

TMW-based products were first introduced into the European market, and annual production capacity there reached 280,000 m<sup>3</sup> in 2013 (UNECE/FAO 2014). In North America, adoption of TMW, so far, has had limited success (Donahue and Winandy 2014). The only statistic indicating the volume of TMW produced in the U.S. is from the UNECE/FAO's Forest Products Annual Market Review for 2012 to 2013, indicating that North American production of TMW was 100,000 m<sup>3</sup> (42.4 million board feet) in 2012 (UNECE/FAO 2013). This is equivalent to less than the output of an average-sized softwood sawmill in 2008 (Spelter *et al.* 2009).

The limited size of the TMW industry allowed for the development of an industry participant directory through Internet searches and consultation with industry experts. Ten firms producing or distributing thermally-modified wood, located in the U.S., were identified. Typical TMW products offered by these companies included lumber, decking, siding, fencing, and pergolas. Donahue and Winandy (2014) state that the adoption of TMW into U.S. markets has been hindered in part by some unsupported claims about the performance of TMW products during the early stages of market introduction, and that the wide range of variants in the processing techniques and resulting products' characteristics has led to consumer confusion. This has motivated industry participants to develop the "AWPA/ANSI guidance document for data requirements for listing TMW in AWP standard" (Donahue and Winandy 2014). Based on European experience and factors observable in the U.S. (explained in the following paragraphs), indications exist that there is considerable growth potential for TMW in the U.S.

One such factor is directives to halt illegal logging. Both Europe and the U.S. have started enforcing regulations to reduce the trade of illegally-harvested timber and its products. In the U.S., the Lacey Act was amended in 2008 to include forest products (INECE 2008). Since most illegal logging occurs in tropical countries (at a rate of 5.3 million hectares per year) (Lawson and MacFaul 2010; Pepke 2013), imports of forest products from those locations are likely to decline. This represents an opportunity for domestic producers to replace some of these imports with domestically sourced material (ITTO 2012), particularly thermally treated hardwoods, which have rich color and enhanced durability and can compete with naturally durable tropical species. Moreover, market trends indicate that darker colors, usually associated with exotic tropical species, are increasingly becoming preferred by consumers (Powell 2010).

Environmental concerns are another factor. There is growing concern for potential damage to the environment from the chemical treatment of wood. For example, treatment with chromated copper arsenate (CCA) has been discontinued in Europe and the U.S. for most residential uses (EPA 2014). Several substitutes have emerged, such as acid copper chromate (ACC), alkaline copper quat (ACQ), and copper azole (CBA-A and CA-B), among others (Lebow 2004). These alternatives, however, have not shown the same level of performance as CCA and they possess various drawbacks including leaching, unpleasant odors, a need for special fasteners, and, most importantly, none of these treatments is free from environmental concerns (Lebow 2004). A more costly alternative is to use naturally resistant species such as red cedar, locust, or selected tropical species. However, the use of these substitutes is limited by the volume available for harvesting in the short term and by the capacity for their natural or artificial regeneration in the longer term. Thus, TMW products, sourced from U.S. forests and with environmental certification, have the potential to become a leading substitute for treated lumber and tropical species. This may present an

opportunity to increase sales of TMW in those markets (both domestic and international) where environmental regulations are more stringent.

Existing literature about TMW shows that the technical aspects of the thermal modification of wood, including process- and material-related issues, have received considerable attention in the past (Rapp and Sailer 2000; Esteves and Pereira 2008; Hill 2011; Ferrari *et al.* 2013). However, only limited attention has been paid to market opportunities for TMW-based products. There is a potentially favorable climate for the increased usage of TMW products if the industry understands its customers' needs and concerns and addresses them properly. This study addresses the need for information about marketing practices in the U.S. TMW industry.

The objective of this research was to understand the major marketing strategies used by manufacturers and distributors of thermally-modified wood in the U.S. Specifically, the study identified the major products and species offered, markets served, and messaging strategies used. Firms' perspectives on barriers to adoption and the outlook for TMW usage in the U.S. were also examined. The input of these actors is important since allows researchers to understand current promotion and messaging practices and are important considerations when formulating the business implications of the research results.

## **METHODOLOGY**

Semi-structured phone interviews were used to collect data for this study. Manufacturers and distributors were contacted and interviewed by phone. Since the TMW industry in the U.S. is in its early stages, the number of companies that manufacture and distribute these products is small; thus, covering a large percentage of these businesses with phone interviews was feasible. However, although a set of questions for all interviews was used, a large degree of freedom was given to interviewees to express their perspectives, and conversation could take different turns depending on topics suggested by the respondents. Below, the methods used are explained in more detail.

### **Questionnaire Development**

Based on the research objectives, an initial list of topics was drafted and was reviewed by two industry experts. A revised version was prepared based on the feedback received and was used for the interviews. The topics included are listed in Table 1.

### **Sampling Strategy**

At the time this study was conducted, no industry association for TMW producers or distributors existed and the North American Industry Classification System (NAICS) (U.S. Census Bureau 2015) did not list a category for this product. Thus, a distribution list was compiled based on Internet searches and by consulting experts familiar with the forest products industry. Examples of search words used included "thermally modified wood", "thermal modification of wood", "thermally treated", and others. Additionally, all interviewees were asked if they knew of other companies manufacturing or distributing TMW. An initial list of 16 companies resulted from this search.

**Table 1.** Topics Included in the Interviews of TMW Producers and Distributors

Topic Category	Topic
Company and respondent characteristics	Type of operation
Product	Location
	Position of interviewee in the organization
	TMW-based products offered
Markets	Wood species offered
	Product standards used
	Location of customers
Marketing strategies	Distribution channels used
	Price sensitivity of customers
	Media for product promotion
TMW Adoption in the U.S.	Attributes of TMW used for promotion and messaging
	Barriers to TMW adoption in the U.S
	Level of awareness about TMW in the U.S.
	Outlook for TMW in the U.S.

### Interview Implementation

Using the distribution list obtained in the previous step, companies were contacted by email or phone to ask for their participation in the study. Out of 16 companies, three did not answer repeated requests for an interview, one closed down shortly before the study was carried out, and two were duplicates (company divisions created to commercialize TMW as a separate brand). A total of 10 companies were interviewed for this study between November of 2014 and January of 2015. Interviews were recorded and lasted 30 min on average. Recordings were transcribed, coded, and analyzed using spreadsheet software following guidelines for qualitative research (Glaser and Strauss 1967; Berg 2001).

## RESULTS AND DISCUSSION

### Company and Respondent Characteristics

Table 2 lists the location, type of company, and position of all participants in the study.

**Table 2.** Company and Interviewee Characteristics for Participants in This Study

No.	Region*	Type of company	Position
1	Midwest	Manufacturer	Owner/CEO
2	South	Manufacturer/Technology Supplier	President
3	Northeast	Manufacturer	Owner/CEO
4	West	Manufacturer**	Owner/CEO
5	Northeast	Manufacturer/Distributor	Director of Operations/Sales
6	Midwest	Manufacturer/Distributor	Sales Manager
7	Midwest	Importer/Distributor	Owner/CEO
8	Midwest	Manufacturer	General Manager
9	Midwest	Distributor	Owner/CEO
10	South	Manufacturer**	VP Sales

\* Only region is reported to protect privacy

\*\* Outsources heat treatment

Most were managers or owners and all firms were manufacturers of TMW with one exception (a business that did not produce, only distributed, TMW products). One company was both a supplier of thermal treatment equipment and also sold treated lumber to other companies. Half of the companies were located in the U.S. Midwest region, two in the South, two in the Northwest, and one in the West.

### Products, Species, and Standards

The most common TMW products listed by the companies interviewed for this study were decking components, siding, and flooring (Table 3). Gunstock, pergolas, and fencing were also mentioned.

**Table 3.** Major Markets, Products, and Species Offered by Companies Participating in This Study

No.	National Markets	Export Markets	Products	Species
1	California, Maine, Georgia	Japan, China, Germany	Decking, siding, components for musical instruments	Northern hardwoods (musical instruments) and softwoods (decking)
2	Most U.S. states (50% of production)	Italy, Spain, Russia, Ukraine, India, Taiwan	Decking, siding	Ash, yellow-poplar, elm
3	Does not sell in the U.S.	West Africa, France, China	Decking, siding, mouldings, doors	Ash, yellow-poplar
4	Yes (did not specify states/regions)	Japan, Portugal	Gunstocks, flooring, decking, components for musical instruments	Maple, cherry
5	Chose not to respond	Chose not to respond	Siding, lumber	Yellow-poplar, ash, red oak, soft maple
6	Minnesota, Wisconsin, Iowa, South Dakota, Michigan	No exports	Decking, siding	Red pine, southern yellow pine, eastern white pine, western pine
7	Yes (did not specify states/regions)	Canada	Decking, siding, flooring	Eastern species
8	Most U.S. states (60% of production)	Japan, Vietnam, China, Philippines, Belgium, Turkey, Israel, India, Australia, New Zealand, Canada	Decking, lumber, pergolas, arbors, fencing, docks, siding	Southern yellow pine (TX and TN), hardwoods (IN)
9	Many states in the U.S. (did not specify)	Canada, others	Decking, siding	Ash, red oak (from MN and WI), preferably certified
10	Southeast U.S., California, Oregon	No exports	Flooring, siding	Locally sourced: yellow-poplar, ash, sweet gum, red oak, maple. Eucalyptus

Two companies indicated that components for musical instruments were one of their major product types. Research has shown that TMW has desirable acoustic properties, such as reduced damping, sound velocity, “radiation ratio” (a material’s speed of sound relative to its density), and that its sound characteristics resemble that of naturally-aged wood (Pfriem *et al.* 2005; Pfriem 2007).

Regarding species, both hardwoods and softwoods can be successfully heat-treated, with some differences in the “cooking recipes” used (hardwoods tend to degrade more easily, as they contain more hemicellulose (Esteves and Pereira 2008)). The hardwoods employed most frequently, as listed by the companies interviewed for this study, were ash, yellow-poplar, red oak, and maple. One company imports eucalyptus (*Eucalyptus grandis*), heat-treats it, and sells it to producers of millwork and flooring. The most common softwood species used were southern yellow pine, eastern white pine, and red pine.

Participants in this study were also asked whether they used a standard for their process, products, or testing. Currently, there is no widely recognized standard for TMW, but a guidance document was recently developed, listing TMW in the AWP standard (Donahue and Winandy 2014). Respondents indicated that no common standard is being used other than the established grading rules for softwoods and hardwoods (NHLA 2008), and, for example, the Southern Pine Inspection Bureau’s grade standards for some softwoods (SPIB 2015). Regarding process parameters, producers use proprietary recipes to treat lumber, depending on the species and final application. The technology used for the heat treatment was, for the most part, imported from Europe (Finland, Russia, Italy, and Estonia). To the knowledge of the participants of this study, no equipment manufacturers for the thermal modification of wood currently exist in the U.S.

### Markets and Customers

The major markets in which the respondents operate are listed in Table. Most of the respondent firms sell to both domestic and international markets. Export markets include North America (Canada and Mexico), Europe (Germany, Italy, France, Spain, Portugal, and Belgium), Asia (India, Japan, China, Vietnam, Taiwan, Philippines, Turkey, and Israel), Oceania (New Zealand and Australia), and West Africa. At least three companies were exporting 50% or more of their production, suggesting that U.S. TMW products are competitive in international markets.

Respondents also were asked about the price differences between TMW products and their substitutes (tropical hardwoods, wood plastic composites, and pressure-treated lumber) and their customer price sensitivity. Most companies agreed that TMW is a high-end product and that their customers are not as sensitive to higher prices as in the markets of “conventional products” such as treated lumber. One respondent indicated that their prices are comparable to those of exotic (tropical) hardwoods and cedar products for siding and decking.

### Distribution Channels

Companies were asked about their distribution strategies. The responses to this question are summarized in Table. Most companies sell through more than one channel. A majority of companies rely on distributors, including lumberyards and distributors of building products; three sell only to distributors. Others sell to manufacturers of millwork, windows, doors, guitars, and gunstocks. Half of the respondents reported that they sell to contractors, and three companies sell directly to architects.

**Table 4.** Channels of Distribution for U.S. Sales

No.	Distributors*	Architects	Manufacturers	Contractors	Others
1	X	X	X		Landscape architects
2		X		X	
3	X		X		
4			X		
5	X			X	
6	X				Retail lumber yards
7	X				
8	X				
9		X		X	
10	X		X	X	

\* Distributors included lumber yards, building products distributors,

### Awareness

Companies were asked for their perceptions about the level of awareness of TMW among the American public and building industry professionals. All participants agreed that the level of awareness among end consumers is low, but that it is growing among architects and lumber and design professionals. Several mentioned that awareness is high among lumber professionals and large manufacturers. However, the low level of awareness of the general public was a recurring theme during the interviews and was also mentioned by most of the respondents as a barrier to the adoption of TMW in the U.S.

### Promotional Channels and Major Attributes of TMW

All companies participating in this study indicated that they employ websites to promote their TMW products and brands. Also, all but one respondent attend tradeshows and conferences for promotional purposes. The conferences and tradeshows mentioned by respondents were the biannual International Woodworking Fair (IWF) in Atlanta, events organized by the Woodworks organization (Woodworks 2015), and the Greenbuild International Conference and Expo. Only two respondents reported using trade journals or magazines to promote their brands and products. Several of the interviewees indicated that they focus mostly on promoting their products to distributors and other businesses and not as much to end customers. Two companies conduct on-site educational events for architectural firms and designers. One company installed displays at the offices of several lumber distributors to increase awareness.

Companies also were asked about the attributes of TMW that they emphasize in their promotional materials. The answers to this question are summarized in Table 5. Most respondents (7 out of 10) indicated an emphasis on durability and resistance to biodegradation in their promotional efforts, and an equal number of companies indicated the rich color and appearance of their products as major selling points. The chemical-free nature of TMW was another frequently mentioned attribute. TMW's competitive price and machinability were the least mentioned attributes. Other qualities not listed in Table 5 but mentioned by interviewees were "better sound", "locally sourced", "lighter", and "not a health hazard". Most respondents stressed the importance of "managing expectations" and avoiding over-promising the benefits of thermally modified wood. Most respondents also stressed that producers and distributors should inform customers that TMW is not a "maintenance-free and ever-lasting" material.

**Table 5.** Product Attributes That TMW Manufacturers and Distributors Promote

Product Attribute	Number of Companies
Durability, improved rot-resistance	7
Rich color, attractive appearance, exotic appearance	7
Chemical-free, zero toxicity	6
Dimensional stability, lower hygroscopicity	5
Environmentally friendly	3
Competitive price (compared to tropical)	1
Machinability, sands and finishes easily	1

### Barriers to TMW Adoption in the U.S.

All of the company representatives interviewed for this study agreed that the single most important barrier to TMW adoption in the U.S. is the low level of awareness of the product among the American public. This was followed by the lack of availability of technical information about TMW. One interviewee stated that, “technical data is not available yet for distributors and manufacturers of this product and a lot of it could be done by third party people that could give us a base line on how to test this wood to compare it to other products.” Several company representatives also cited the lack of industry standards as a major barrier, which, according to these individuals, has contributed in part to some companies over-promising the advantages of TWM. Three companies considered the high cost of TMW as a barrier to wider adoption. On the more technical side, one interviewee listed the degradation that occurs after treatment (for example, knots becoming loose, affecting quality), loss in strength properties, increased brittleness, and internal checking as barriers.

### Outlook for TMW in the U.S.

There was consensus among all interviewees that the market for TMW is growing at a fast pace and that interest in the product is increasing, based on the number of customer inquiries received. Three respondents mentioned that they have plans to increase capacity in the short term. However, most interviewees also indicated that they expect TMW to be a niche market product for some time, primarily because of its relatively high costs.

## CONCLUSIONS

1. The major TMW products manufactured in the U.S. are decking, siding, components for musical instruments, doors, mouldings, gunstocks, and flooring.
2. Both hardwoods and softwoods are used for TMW, with the major species being ash, poplar, and elm, maple, and cherry.
3. Producers sell to distributors, architects, secondary manufacturers, and contractors. Direct sales are not common.
4. All interviewees agreed that the level of awareness of TMW among the U.S. public is low. The major means of promotion of TMW products are internet presence, tradeshow, and, to a lesser extent, advertising in trade magazines. TMW producers and distributors engage in little to no advertising aimed at end-users.
5. The major TMW attributes promoted by firms include its durability, chemical-free nature, environmental friendliness, dimensional stability, “local” nature, superior

acoustic properties, rich color, exotic appearance, easiness to work with, compatibility for outdoor applications, and competitive price as compared to tropical species and cedar. Respondents indicated that their customer base is not as sensitive to prices as in mainstream markets for similar products and that TMW is competitive with tropical species and cedar but less competitive with chemically-treated softwoods.

6. The barriers to the adoption of TMW in the U.S. mentioned by companies include the low awareness among potential users and end-users, the lack of information about TMW, past overpromising of TMW's benefits, and the lack of product and product use standards.
7. Respondents stressed that the outlook for TMW usage in the U.S. is positive, with interest by potential adopters increasing, although some interviewees forecast that TMW will be a "niche" product for some time.
8. Some of the recommendations that emerged from this study include:
  - In promotions and advertisements, an emphasis on the chemical-free characteristic of TMW is warranted.
  - Target marketing efforts on parties that influence potential customers' purchase decisions (*i.e.*, influencers).
  - Use social media to amplify traditional advertising efforts to increase awareness and reputation.
  - Form an industry association to leverage resources and develop a uniform message to counter misperceptions and emphasize the advantages of TMW.

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