Building a greener tomorrow, one board at a time!

THE COMMERCIAL SIDE OF THERMALLY MODIFIED WOOD

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Background

It has been known for centuries that burning the surface of wood in open fire will make it more durable in exterior use. Even the Vikings used this method in outdoor structures such as fences. Heat treatment of wood was scientifically studied in the early nineteen hundreds in Germany and the US, and has since become an increasingly researched and developed technology. Most recently, research work has been carried out in Finland, France, and the Netherlands in the 1990s. The most intensive and comprehensive research work was conducted by the VTT technical research centre of Finland. Significant practical research is also being done by YTI (the Institute of Environmental Technology).

The Manufacturing Process

ThermalWood is manufactured using a method developed by VTT. The manufacturing process is based on the use of high temperature and steam. The wood material is heated to a temperature of at least 180 degrees Celsius while it is protected with steam. Besides providing protection, the steam also affects the chemical changes taking place in the wood. A major environmental benefit is that no chemicals are used in the treatment. As a result of the treatment, environmentally friendly ***ThermalWood*** is created. Its color darkens, it is more stable than normal wood in conditions of changing humidity, and its thermal insulation properties are improved. If carried out at a sufficiently high temperature, treatment also makes the wood resistant to decay.

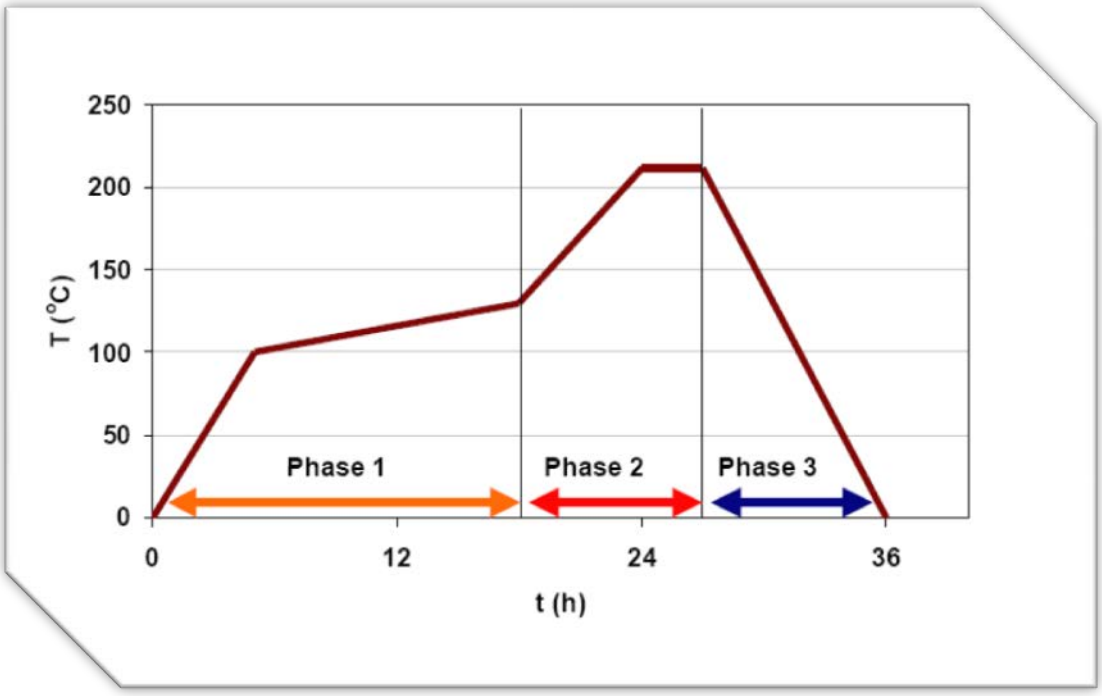
The ***Thermo Wood*** process is patented and is owned by the Finnish Thermo Wood Association. The process can be divided into three phases:

1. **Temperature increase and kiln drying:**
   The air temperature in the kiln is raised at a rapid speed using heat and steam to a level of around 100 °C, the wood temperature follows at a similar level. Thereafter the temperature is increased steadily to 130 °C and drying takes place. Either green (un kilned) or ready kiln dried raw material can be used. Steam is used as a vapor membrane to prevent cracking of the wood. The steam also facilitates chemical changes taking place in the wood. At the end of this phase the moisture content is reduced to almost zero.

2. **Intensive Heat Treatment:**
   During the intensive heat treatment phase the air and wood temperature is increased to a level of between 185 – 225 °C. The peak temperature depends on the desired end use of the material. When the target level is reached the temperature remains constant for 2 – 3 hours. Steam is used to prevent the wood from burning and cracking and it also continues to influence the chemical changes taking place in the wood.

3. **Cooling and Moisture Conditioning:**

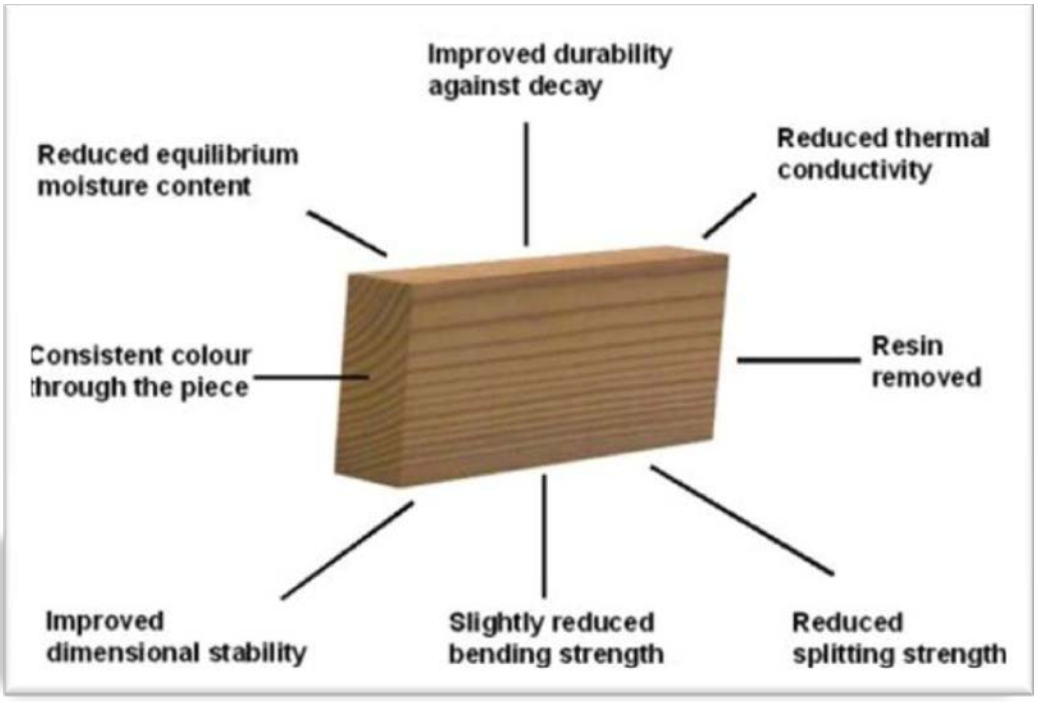
The temperature is reduced using water spray systems. Conditioning and re-moisturizing takes place to bring the wood moisture content to a workable level over 4 percent.



Environmental Aspects

Since no chemicals are required and only water and heat are used, the ***ThermalWood*** process is environmentally friendly. As the process releases extractives from the wood, these must be processed - for example, by burning to avoid an odor nuisance. No significant amount of waste water is generated by the ***ThermalWood*** process. The solid components of the generated waste water are separated out in a special settling basin, and the rest is processed at waste water works. When used for outdoor materials the life expectancy is dramatically higher than that of normal wood, therefore the need for replacement and maintenance is no longer necessary (i.e. deck boards). Another notable benefit of this method is the reduction in thermal conductivity in the finished product, meaning that the insulating abilities of the wood are increased. When used for exterior cladding, heat/electricity costs can be reduced.

Key Characteristics



The density is measured by measuring the weight and the dimensions of the sample. The unit of density is kg/m3. The ***ThermalWood*** process reduces the density by about 10 % on average. Generally the strength of wood has direct correlation with density. The process slightly lowers the density and therefore some effects on the strength values occur, but weight-strength-value can be practically unchanged.

• Bending strength and modulus of elasticity

Material treated at temperatures below 200 °C does not experience a significant loss in bending strength. A clear reduction in horizontal bending strength can be found in material treated at temperatures above 200 °C. The ***ThermalWood*** process has been found to maintain or even slightly improve the modulus of elasticity. At this stage it further testing is required before ***ThermalWood*** has tables for specifying horizontal load bearing structural usage.

• Compression strength

The Compression strength is mainly dependent on the actual density of wood. According to tests it is has been found that the ***ThermalWood*** process has no significant effect on the compression strength values.

• Splitting strength

This method can cause some reduction in the splitting strength depending on treatment temperature, the reduction increases as the temperature goes over 200 °C.

• Screw holding strength

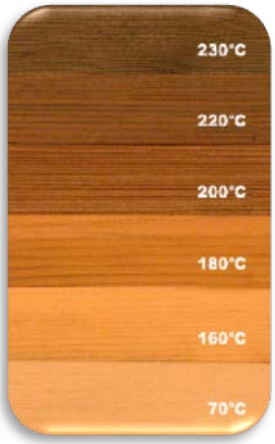
The screw holding strength has a strong correlation with density. The main effect on screw holding strength comes
from the general variance in wood density rather than from the ***ThermalWood*** method. It was found that material with lower density has better results when narrower pre-drilled holes are used.

Key Characteristics (continued)

In regards to moisture content and stability the ***ThermalWood*** process leads to a reduction in equilibrium moisture content. When treated at the highest temperatures the equilibrium moisture content can be 40-50 percent lower compared to untreated wood. Because of lower equilibrium moisture content and the changes in the chemical composition of the wood the tangential and radial swelling decreases significantly compared with the original material. In some cases the reduction in dimensional movement can be as much as 40-50%.

In terms of permeability, this method reduces the water uptake of wood; the levels may differ depending on the original wood species. Another great factor of the finished wood is its thermal properties, the thermal conductivity is 20-25 percent lower compared to untreated wood, thus giving improved insulation performance. Tests made in laboratory conditions have proven a significant improvement in biological durability. Improvements in biological durability are a result of the removal of natural food sources in the wood and also changes in the chemical and structural composition. Levels of resistance to fungal decay increase as higher temperatures are used.

One of the biggest attributes to the finished product is most certainly its aesthetics. Depending on the temperature and length of the process certain shades of brown can be achieved, this darkened shade in the finished product is throughout the entire piece of wood making it ideal for wood working and furnishing.



Treated Birch & Untreated

Treated Aspen & Untreated

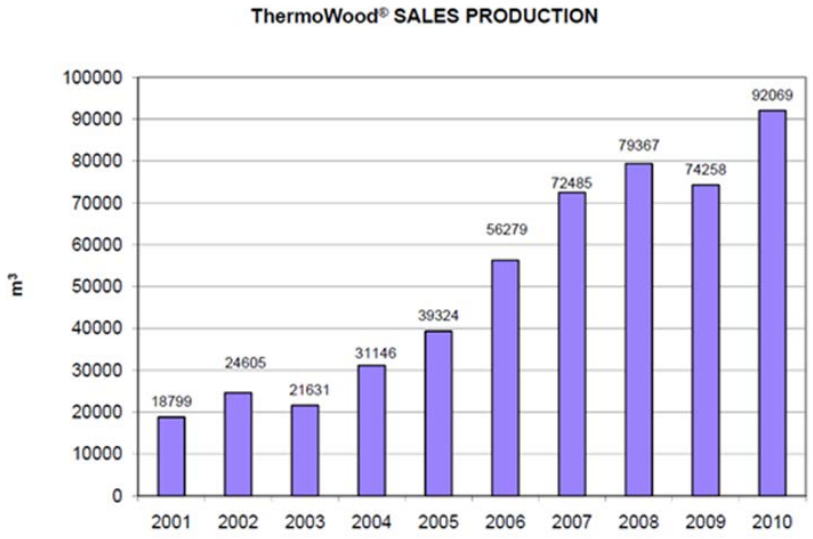
A unique finish makes for beautiful aesthetics!

European Influence

Presently in North America there are 11 individual companies operating 16 ovens of various capacities. Out of those 11 operators you will find 4 different technologies all situated on the East Coast of North America;

- MEC
- Perdure
- Westwood
- ThermoWood

ThermoWood is the most recognized of all and from which the standards have been set for all technologies. FAWP operates this technology and represents 5% of the overall capacity in North American. If we refer to the following production graph from Europe, we can see a steady increase in sales since 2004 and if we can relate this back to requests we are getting to supply thermally modified wood, I believe we are at the beginning of that growth trend in North America. (Referenced from the ThermoWood Association statistics of 2010)



Where are the commercial Opportunities?

Services

Simply offering services of thermal modification to manufacturer is our primary business. Customers are able to supply us with their wood, we then prepare the wood to be cooked, process the wood, and then finally prepare the wood for shipping and sent back to the customer. All processing is done by means of strict quality control to insure a superior finished product. These arrangements can be quite flexible and

are generally circumstantial, we can work with the customer in order to suit their needs, and in some cases we are able to provide the wood for our customers at the additional cost of the raw fiber itself.

Manufacturing

This process has ***"created opportunities"*** for nontraditional species of wood to be used in alternative markets. An example of that would be "Maple", which traditionally has been used for interior hardwood flooring, now why not use it for exterior decking products and combined with some French ingenuity you have given maple a new life. Future Alternative Wood Products manufactures ***ThermalWood Decking,*** an innovative ground level decking system that uses an invisible fastening system (Clip Juan) that creates a product that is superior in quality, aesthetics, and resistance to fungal degradation. Using the same invisible fastening system we also have ***ThermalWood Siding*** which we can manufacture in the profile of your choice.

This process is ***"providing solutions"*** to issues that have been around for many years. For example performance issues that arises due to lack of stability in the woods that are being exposed to an environment of very high humidity.

- Musical instruments
- Hard wood flooring in bathrooms, kitchens or applied directly on concrete floors

- Excess waste material being generated by discolorations in wood
- Chemical free wood products to be used in green interpretation centers

We also offer alternative products like:

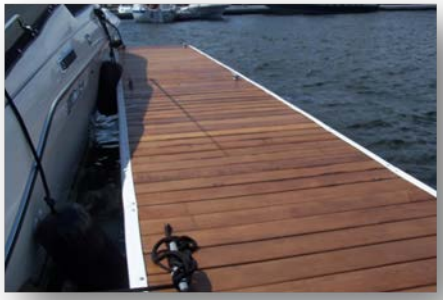
ThermalWood Garden line sold as a “Do It Yourself” kit

- Raised garden beds
- Compost boxes
- Rain water barrels

ThermalWood furniture for both residential and commercial

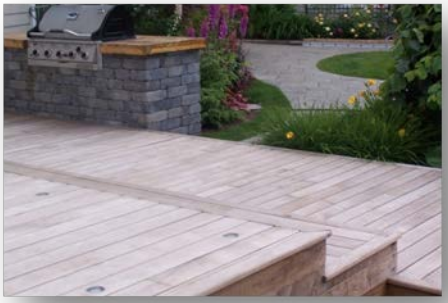
- Patio furniture
- Park benches
- Garbage/Recycle bins

Have something different in mind? Let us know! Our flexibility in manufacturing can accommodate almost any demand. Our technological ability to treat plywood, finger-jointed lumber and many different species came from customer requests. This process is new to North America and the challenges of the different species and building practices have been a great learning ground for us, and an amazing proving ground for our products.



To Take Into Consideration

- If you do not put any UV protective coating on the exterior application the wood will go grey very fast
- If you don't have issues with the grey it is recommended to put a clear coat to prevent surface shakes to form
- The product can be glued but it takes 50% more time to bond
- This product is not recommended for structural use due to a10% lost of bending strength
- If the product is to be machines, sharp tool knives are required
- We at FAWP provide a 25 year guarantee against issue with decay provided a number of critirial are met.



Our Facility

Future Alternative Wood Products ltd. is located in Bathurst, on the northeastern tip of the province of New Brunswick, in Canada. The ***ThermalWood*** production takes place in our 40,000 sq foot facility located in the industrial park in Bathurst. Our current processing is done by means of one 30 cubic meter oven allowing us to produce roughly 16,000 board feet per batch. We are in planning phase of implementing multiple ovens for maximum production capabilities.

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Beauté... Naturellement
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Naturally Beautiful

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