



**eco-innovation**  
WHEN BUSINESS MEETS THE ENVIRONMENT

**DELIVERABLE D 7.4:**  
**Layman's report**

**TV4NEWOOD PROJECT**

**AGREEMENT NUMBER:**  
**ECO/12/333079/SI2.653690**

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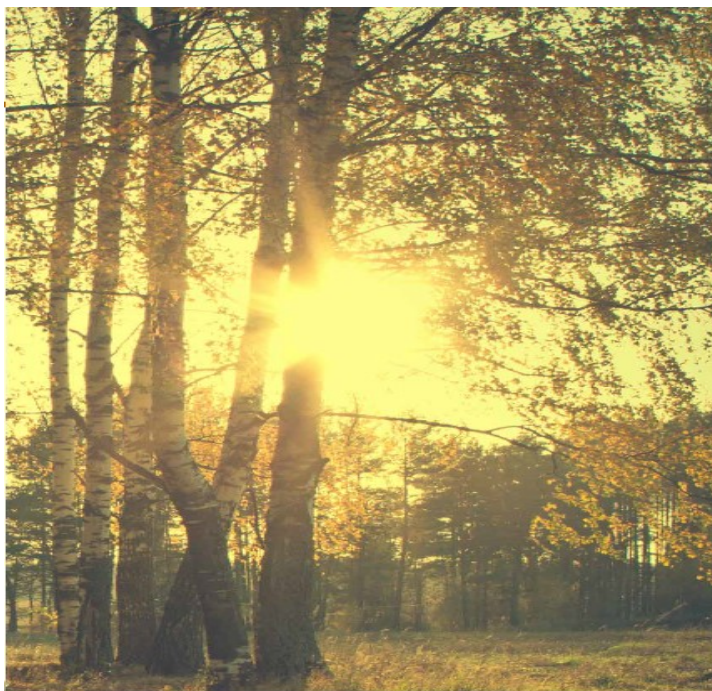
Dissemination level: **public**



Co-funded by the Eco-innovation  
Initiative of the European Union

## **Thermovacuum** for a new kind of wood

Tv4newwood project, financed by European Commission with Eco Innovation programme 2012, has the aim to create and disseminate in European market a new process for generate thermally modified wood that has special properties of strength and durability. The timber produced is created without adding chemicals and with a considerable saving in energy, this is possible with a technology that operates "under vacuum".



**Project started** 1st September 2013

**Project end** 31st August 2016

**European Countries involved** 3: Italy, Sweden, France

**Partners Involved:** 6

**Project budget:** 1.771.928

**European fund (50%) :** 885.964



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**The challenge**

**Why is the development of such solution interesting?**

|  |  |
|--|--|
|  | Introduction of new European rules for tropical wood import: traceability mandatory, sustainable production, |
|  | High demand of wood products   |
|  | Very low value of European wood and low exploitation   |
|  | High production of CO <sub>2</sub> to export tropical wood around the world                                  |
|  | Widespread use of wood products treated with chemicals   |
|  | Possibility to have a wood transformation process with little water consumption                              |
|  | Possibility of having a local wood product with improved performance of durability                           |
|  | Availability of a new wood product chemical free   |



## Process overview and obtained results

|  |
|--|
| WP N° 1 Project Management                                   |
| WP N° 2 Manufacturing process definition and data collection |
| WP N° 3 LCA (Life Cycle Assessment)                          |
| WP N° 4 Process and product certification                    |
| WP N° 5 Market Replication                                   |
| WP N° 6 Business Plan  |
| WP N° 7 Dissemination Activities                             |

The aim of the project is to create and disseminate in European market a new process for generate thermally modified wood that has special properties of strength and durability. The timber produced is created without adding chemicals and with a considerable saving in energy, this is possible with a technology that operates “under vacuum”.

We implemented the following actions:

- project management and business plan;
- construction of first industrial ThermoVacuum plant
- test on 7 European woods fir, spruce, oak, beech, poplar, maritime pine
- physical and chemical analysis for durability and mechanical characteristic of the treated wood
- Life cycle Assessment for new process and a comparison with competitors process
- first application of ThermoVacuum treated wood for naval sector
- trademark registration VacWood®
- product certification and product availability in 4 target countries in Europe and extra EU.



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## Process innovation in three stages:

**DRYING:** The wood is properly dried until it contains an extremely low moisture content, close to 0%, using a vacuum drying process within a superheated steam atmosphere in order to guarantee the quickest and most effective drying, without stressing the woody matter.

**HIGH TEMPERATURE:** During the thermal vacuum treatment stage, the temperature is raised up between 170°C and 210°C, depending on wood type and expected result; wood stays in this condition for between two to four hours. Thanks to the continuous extraction of the internal atmosphere by an innovative vacuum pump system, the emissions of the gases produced by the wood are condensed, diluted and stored without any risk to the environment. The cooling period follows, whereby an air-air heat exchanger is used, down to a temperature of 90°C, without the addition of coolants or direct contact with the atmosphere.

**CONDITIONING:** Starting from the pre-existing under-vacuum values, the conditioning stage consists of increasing the pressure within the cell using the steam produced by atmospheric pressure. This process allows the wood, which is practically anhydrous, to regain an equilibrium moisture content of approximately 4%, thereby avoiding the stress of atmospheric contact.



### The positive project effects are:

- ✓ Raising the value of the European wood today underexploited
- ✓ Use of European wood from certified forests for production in different market sectors
- ✓ Decrease of tropical wood of dubious origin demand
- ✓ Decreased production of CO<sub>2</sub> due to the transport of large quantities of wood from long distances
- ✓ Rising employment in the wood industry
- ✓ Dissemination of wood products completely biodegradable

### Main project results:

- ✓ Vacwood® registration trademark and certificated product
- ✓ 8 production plants world wide 2 in France, 1 in Belgium, Norway, Italy, Poland, 2 in USA and further 3 plants are in construction
- ✓ Decrease of tropical wood of dubious origin demand for about 35.000 m<sup>3</sup> in 5 years (actual potential production)
- ✓ Potential production of Vacwood® for 9000 m<sup>3</sup> in 2017
- ✓ Innovative Vacwood® available for Indoor parquets / Naval furnishing and cladding / house restructuring / external joinery

### The new process is chemical free, cheaper, safe for environment

The LCA results show that VacWood® for three on four main environmental impact categories: Fossil fuels, Respiratory inorganics and Land use categories has an impact reduced for 50% compared to the Coated timber.

VacWood® has environmental impacts very similar to wood with very good durability characteristic and VacWood® has very less environmental impacts than the same wood species that has not received any treatment.

The Life Cycle Assessment results confirm the need to treat some European wood species to provide technical and environmental features very close to other some excellent species.

**Formattato:** Tipo di carattere: 12 pt, Grassetto, Colore carattere: Grigio 50%, (asiatico) Giapponese, Non Evidenziato

**The new wood is chemical free, cheaper, and useful for internal and external use**

**Temperature of wood treatment**

|                      | 160° | 170° | 180° | 190° | 200° | 210° | 220° | n   |
|----------------------|------|------|------|------|------|------|------|-----|
| <b>Spruce</b>        | X    | X    |      | X    |      |      | X    | 540 |
| <b>Fir</b>           | X    | X    |      | X    |      |      | X    | 540 |
| <b>Maritime pine</b> | X    |      |      |      | X    | X    | X    | 610 |
| <b>Douglas</b>       |      |      |      |      | X    | X    | X    |     |
| <b>Ash</b>           |      |      |      | X    | X    | X    | X    | 488 |
| <b>Beech</b>         |      |      |      | X    | X    | X    | X    | 628 |
| <b>Poplar</b>        |      |      |      | *    | X    | X    | X    | 650 |
| <b>Oak</b>           | X    | X    |      |      |      |      |      | 192 |

Table 1: combination of species and *T<sub>pr</sub>* for the thermal treatment performed.

**NATURAL DURABILITY OF STUDIED WOOD SPECIES (EN 350-2) without any treatment**

|   |                                       |                      |
|---|---------------------------------------|----------------------|
| <b>Poplar, beech, ash fir, spruce:</b>  | <i>non-durable</i>                    | <i>class 5</i>       |
| <b>Maritime pine, douglas fir, oak:</b> | <i>moderately to slightly durable</i> | <i>class 3 to 4,</i> |

Wood durability is improved and shifted to 1 or 2 upper durability classes. This improvement allows to shift not durable woods (class 5) in durability class 3 allowing the use of this wood in exterior conditions (risk class 3). This is achieved only at treatment temperatures equal or higher than 210°C.

**Loss of mass**

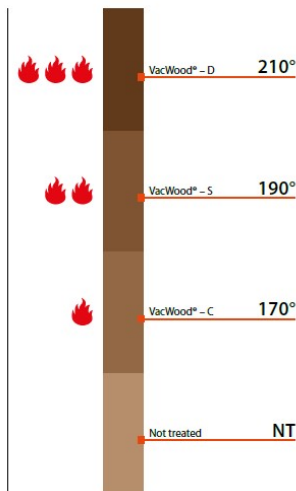
Loss of mass is the best indicator and guarantee of treatment intensity and is closely linked to thermal degradation, which indicates the way in which the wood is changing its chemical structure via the partial evaporation of certain components.

**Equilibrium moisture content and dimensional stability**

The variation in the equilibrium moisture content of **VacWood®** correlates to the exposure temperature. Its value decreases, while maintaining this feature over time, in a range between 4% and 8%.

**Colour**

The colour of **VacWood®** changes throughout the three treatment categories described previously. The higher the exposure temperature, the darker the wood becomes. The colour acquired by wood is uniform throughout its surface, inside and outside.



**Tv4newood consortium**



**WDE-MASPELL SRL**

*Project Coordinator*

Owner of innovative solution patent and Vacwood® Trademark. Wde-Maspell designs and manufactures plants for the heat treatment of wood



**CNR IVALSA**

The Trees and Timber Institute of the National Research Council (CNR) Technical responsible of project perform the laboratory tests for the product certification of treated wood, the standard-setting process and implementation of the LCA



**CONLEGNO**

Italian national wood and cork services consortium (CSLS) CSLS is responsible for dissemination project results for end users, stakeholder, buyers.



**SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES (SLU)**

Department of Forest Product. SLU perform laboratory tests for the certification of the finished TVW product



**ECOLWOOD (ECW)**

French Sme for wood treatment. ECW is the first industrial Vacwood® manufacturer in Europe. ECW produced the Vacwood® for laboratory tests and the TVW samples.



**MEDITERRANEAN REFITTING GROUP**

Italian SME for the interior and exterior of the luxury boats. MRG is the first user of vacuum heat-treated wood for the furniture of a prestigious yacht





## The market and European added value

The import of tropical timber is an European phenomenon, and all EU countries can thus be affected by the project. The issues related to tropical wood import are perceived all over Europe and there is the Eutr regulation to counteract illegal import; Eutr required for all wood importers to undertake a risk management exercise so as to minimise the risk of placing illegally harvested timber. The Regulation covers a broad range of timber products including solid wood products, flooring, plywood, pulp and paper. The application of EUTR (legally binding on all 28 EU Member States) should have the consequences to enhance the use of local species through the creation of traceability systems of sources and the quality of timber health insurance. Tv4newood project allow to European wood workers to buy an European wood with characteristic of durability very similar to tropical timber.

Tv4newood has an European approach for the following reasons:

- Tv4newood project reduce tropical wood imports and foster the replacement by ennobling and enhancing the use of local wood species;
- Vacwood® support the "green" economy and its certification, in this case, the adoption of ThermoVacuum technology helps the competitive development of SMEs through the simplification of environmental certification schemes.
- Vacwood® support green economy because is wood produced by a controlled and sustainable supply chain.
- Tv4newood project reduce CO2 production, deriving from the transport of wood from other continents and furthermore with road transport for long distances.

The project allows to produce 9.000 m3 of ThermoVacuum treated wood in one year of production.

## Contacts

**For more information please visit [www.tv4newood.it](http://www.tv4newood.it)**

**Or write to [tv4newood@wde-maspell.it](mailto:tv4newood@wde-maspell.it)**

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