



LAYMAN'S REPORT

GREEN JOIST PROJECT

LIFE 2013 ENV/IT/000996



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Beneficiary list:

IMAL SRL
CEPRA – Centro Promozionale Acimall SpA
J.M. COLOMER SA
EIREBLOC LIMITED
CHIMAR HELLAS S.A.

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Start date:

01/07/2014

End date:

30/06/2018

Project number:

LIFE13 ENV/IT/000996

Project title:

Production of recycled high-quality joists from wood waste

Total project budget:

1,706,456 Euro

EU financial contribution:

818,333 Euro



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THE PROJECT:

GREEN JOIST is a 48 month project co-funded by the European Commission through the LIFE+ programme which represents a powerful instrument to support the conservation of the environment and nature.

The **LIFE + GREENJOIST** project has demonstrated the value and feasibility of an eco-innovative recycling process, able to reuse and valorise wood waste deriving from production processes or from landfills, to produce green, high quality and cost effective joists to replace virgin wood joists currently used in various sectors such as manufacturing, transportation, logistics and construction.

This project will contribute to the consolidation of sustainable eco-innovative businesses in the EU woodworking industry contributing to the achievement of EU 2020 goals of Resource Efficiency, avoiding dangerous impacts on human health and the environment.

With an ambitious potential to substantially cut the currently landfilled wood waste, amounting to 15 million tons per year, the LIFE + GREENJOIST project has set out a well-structured plan and has reached the following key objectives:

1. Showcase an innovative process for the production of high-quality, cost-effective joists, equivalent to virgin wood joists, but manufactured from recycled wood waste deriving from production processes or landfill, through the realization of a pilot plant at a pre-industrial, non-commercial scale demonstrating the technical, economic and environmental feasibility and effectiveness of this novel process.
2. avoid the use of virgin wood in the construction of new joists, saving trees while cutting the CO₂ emissions generated for transportation and processing the wood into a finished product.
3. Promote the shift from using potentially harmful chemicals to natural components in the production of joists.

The Green Joist project also promotes awareness in Europe of the need to become a sustainable society where recycling materials and the avoidance of waste becomes a natural action to sustain the environment and to raise awareness of eco-innovative solutions in the public sector in general, in political offices and businesses operating in the wood industry, focusing on the environmental and economic advantages as well as the actual technical feasibility, conducting a survey on the various stakeholders with the aim to understand their level of awareness and to plan campaigns to raise environmental awareness.

The GREENJOIST project has been accomplished through the close collaboration of a team of 5 partners coming from four different European countries, who have pooled their skills and resources to successfully and efficiently bring the project to fruition. The project





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involved Spain, Italy, Ireland and Greece for the development, engineering and validation of the pilot line with:

- IMAL, located in Italy, has extensive experience in the field of eco-innovative processes. It is a world leader in the wood-based panel industry;
- J.M. COLOMER, a Spanish SME specialized in machines and plants for the production of wood-based products, with a in-depth knowledge of the EU market in terms of mechanical components and systems for the woodworking industry;
- EIREBLOC, an Irish SME, specialized in cleaning wood waste for recycling purposes, with a detailed knowledge of all the aspects related to the manufacture of recycled wood products, technical details, market requirements and related forecast.
- CHIMAR, a Greek company with a keen focus on R&D activities for the wood working industry, whilst at the same time maintaining the tradition of a highly qualified service, offers a series of versatile resin and glue solutions for the wood-based panel industry throughout the world.

In addition to these, two other partners (ACIMALL and IMAL) were actively involved in the global dissemination of the results, giving the project a true value on a European and international scale. The GREEN JOIST partnership has been created with top ranking European partners possessing and pooling the dimensions and skills of the best in their field.

1. Wood waste management and recycling

Waste management is one of the top priorities on the Environment agenda for Europe, as stated in the recent environment Action Programme for 2020.

In particular, while notable efforts and actions have been made through the introduction and update of policies and European legislation, support studies and research, there is still a strong need for improving recycling practises and raising the acceptance and uptake of such processes.

Waste in fact, is also a priority topic in the current LIFE + programme and especially in various countries such as Italy where IMAL the coordinating beneficiary is located and Spain where COLOMER is located where the following is indicated as a priority:

"promoting waste prevention, recovery and recycling with a focus on life-cycle thinking, eco design and the development of recycling markets", by demonstrating an innovative eco-process to produce quality and cost-effective joists made from super compacted recycled wood (SCRW).

LIFE + GREENJOIST will create impact and potential for the growth of recycled wood products, which in turn implies an increase in the demand for recycled wood and hence a reduction in the amount of wood waste going to landfill (be it legal or illegal) or burned with a reduction in the amount to carbon dioxide released into the atmosphere.

In fact, whilst overall progress has been made in Europe on waste management efforts in recent years, increasing the awareness of the European citizen, 60% of solid waste is still being landfilled or incinerated. The LIFE + GREENJOIST project will contribute to diverting additional wood waste (about 10 tons a day or 3000 tons a year) which is not managed at present in an eco-sustainable manner. Proponents of the project are aware that recycling wood waste is not new in many areas of the EU. At present, wood is mainly recycled in two ways:

- 1) Remanufacturing of engineered panels (MDF, OSB, etc.).
- 2) Used as biomass fuel to produce energy.

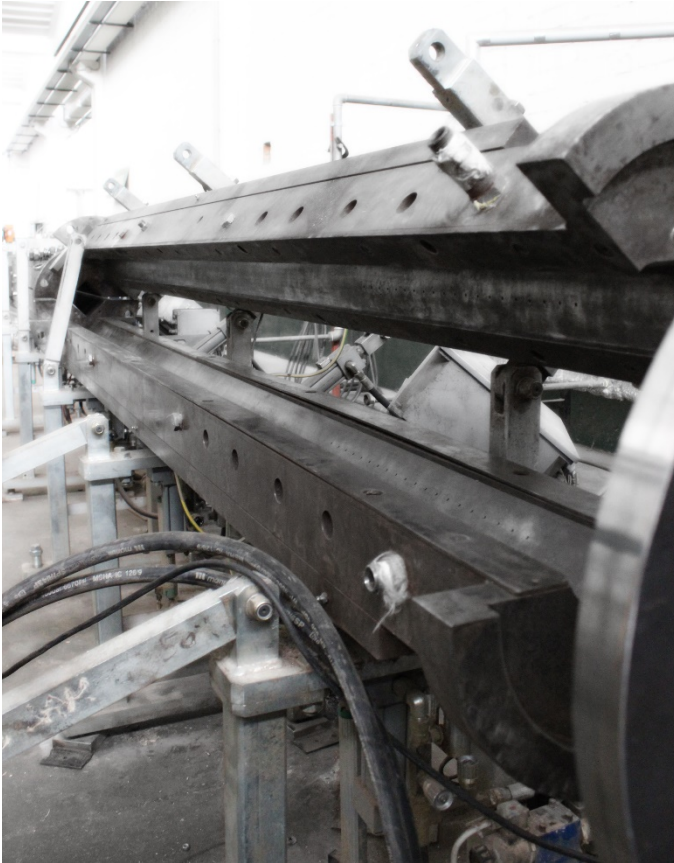
As for wood waste, about 15 million tons/year (the size of a 3 km long train) still goes to landfills in Europe, with figures varying in relation to the level of awareness of the local population (official numbers only, without considering unauthorised dumps).



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From the GREEN JOIST partners' calculations, it may be assumed that at least 60 million cubic metres of virgin wood are being consumed by the manufacturing industry alone for joists (conservative figure taking manufacturing only into account and excluding logistics, packaging, etc.). The proposed GREENJOIST solution, a green eco-sustainable made from recycled wood, will be high quality and cheaper than the virgin wood joist which is currently being used. Additionally, most engineered panels use a mix of virgin and recycled wood (in varying quantities depending on the type of board).

With regard to biomass production, it is only possible to use certain types of wood waste, such as that from wood sawing and /or pure wood or destined for landfill. The remaining wood in the value chain (e.g. panels, furniture, fencing, etc.) cannot be burned because it contains variable amounts of other substances (chemicals, additives), with the potential risk of releasing extremely harmful substances into the ecosystems.

To the best of the proponents' knowledge, an effective system such as the one proposed in the LIFE + GREENJOIST project that enhances the potential for reutilizing wood waste, using 100% recycled wood to produce a product of high quality and convenience, thus strongly valorizing this material at the end of its life cycle, does not exist at present. Since the joists produced by LIFE + GREENJOIST will be totally green, they will in turn be recyclable themselves, effectively closing the waste cycle.

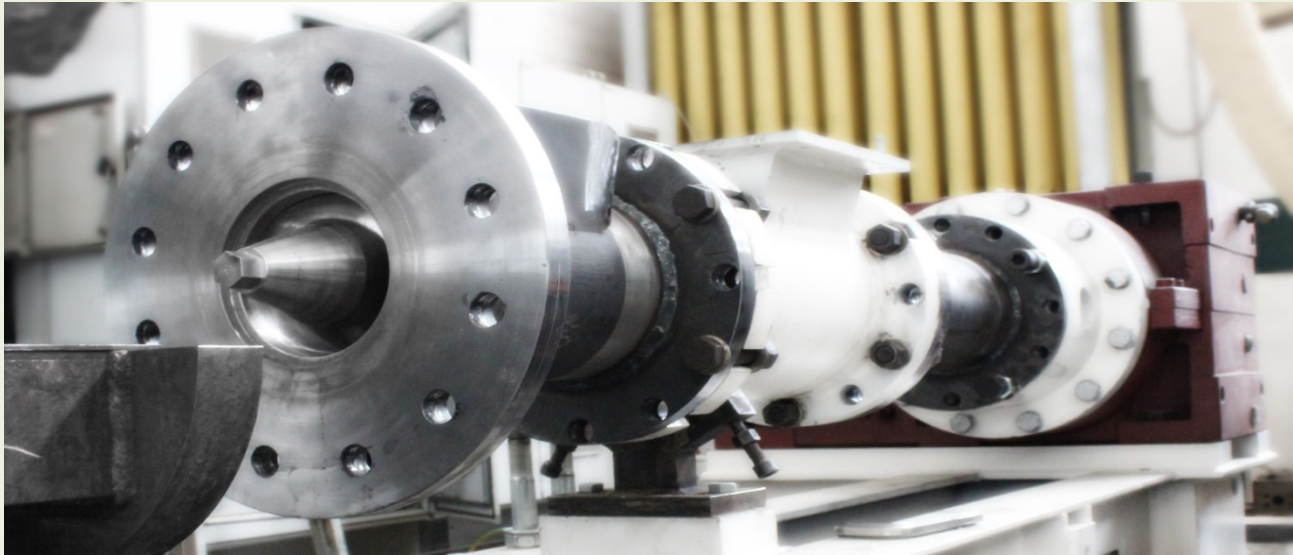
2 Reduction and substitution of dangerous substances

LIFE + GREENJOIST technology, by using recycled wood waste (waste or trimmings from the production process) and a high temperature steam injection process, will avoid the use of harmful chemicals and the related impacts on health and the environment. Additionally, the glues used will replace at least 50% (conservative estimate) of the raw petro-chemical materials, with materials from renewable resources drastically cutting chemicals in the mixture, making the joists themselves easily recyclable.

It has to be underlined here that pallets and joists produced from virgin wood require fumigation, a process where toxic and hazardous chemicals are used to destroy any bacteria which may be present in the wood, and to render the end product compliant with international and EU health and safety standards (ISPM15).



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Some of the chemicals used in the fumigation process and other sub-processes of virgin wood are: methyl bromide, phosphine; phosphine; chloropicrin; 1,3-dichloropropene; formaldehyde; methyl isocyanate; hydrogen cyanide; iodoform; isocyanate-based resins (for moisture protection) and which tend to pollute the air ecosystem. Due to the effect of the high temperature applied in the green joist production process, the use of these chemicals will be avoided and the product will still be compliant with export regulation requirements.

As mentioned earlier, for outdoor use, where weather protection is required, the GREENJOIST system will use an innovative type of glue based on raw materials from renewable sources, namely lignin, tannin or starch to produce the joists.

These natural materials will be used as substitutes for raw petrochemical materials like phenol or melamine in the synthesis of PF (phenol or formaldehyde based resins) and MUF resin [urea, melamine and formaldehyde based resins). Bonding systems have been evaluated and experimented based exclusively on these natural materials and using hardeners at levels of less than 20%. All the tests have been developed at lab scale (2-5kg) and their physical chemical characteristics have been determined by standard and modern analytical methods.

The information has thus been synthesized to proceed with the tests on a larger production scale so as to ensure a smooth and safe transfer of the green joist technology for production on a large scale.

The new materials are more environmental friendly and have a lower impact as fewer petrochemical resources will be used, whereas on the basis of the laboratory tests, we expect the joists produced to have better mechanical properties without formaldehyde emission.

3 REDUCTION OF GREENHOUSE GAS EMISSIONS

The LIFE + system, once operating at full capacity will be able to produce 950.4 km of extruded length or 633.600 pieces that are 1.5 metres long.

The raw material (wood waste) used for this production will be 3300 tons/year or 6072 m³/year. This means that the process will avoid consuming at least 3960 tons/year of virgin wood, or 7286 m³ / year.

This total amount of wood material saved/recycled would be approximately 13,400 m³ / year, equivalent to saving approximately 13,400 trees a year seeing that one tree produces about 1 m³ of virgin wood (0.24 x 0.24 x 3.14 x 6 – average diameter 0.24 m of average height 6 m).



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Estimating that the sequestration power of a tree is on average 22 kg CO₂ eq/year [D. Geraldo, Correia PJ, Filipe J, L. Nunes-carbon stored in trees according to the CARBON MARKET journal], we can say that the LIFE + GREENJOIST system will contribute to saving approximately 295-300 tons of CO₂ eq/year.

SOCIO-ECONOMIC EFFECTS OF THE PROJECT

The main advantages derived from the LIFE + GREENJOIST project will regard several socio-economic areas:

- a. Consolidating the uptake of recycled wood waste
- b. Growing awareness of sustainable recycling processes
- c. Creation of new green jobs

Consolidating the uptake of recycled wood waste:

Recycling wood waste is an ongoing priority for a sustainable Europe. The main output markets are biomass, animal/outdoor bedding, engineered wood products (MDF / OSB).

Despite this around 15 tons/year of wood waste is still destined for landfill or incinerated in the EU. The creation of a new eco-innovative product like the LIFE + GREENJOIST project will consolidate and widen this green market and will give wood waste a new lease of life.

The main short term market for the GREENJOIST system regards logistics as joists are useful for lifting equipment or heavy bulk loads by fork lifts. Other sectors where the product is used consume an approximate average of 30 cubic metres of joists a year. This is due to the fact that the joists are easily consumed daily, often ruined by the tips of the fork lift, or damaged due to overloading or lost (e.g. loaded and never returned).

Joists, which are currently made from virgin wood, are utilized in logistics (e.g. in storage areas) especially when loads are moved around frequently. The LIFE+ GREENJOIST joists have properties which are comparable to virgin wood joists, for example two joists that have a section of 10 x 10 cm and 5 m long can hold a load of about 8 tons.

Additionally, they are less prone to getting damp, chipping and comply with ISPM 15 requirements and hence suitable for international transportation. In terms of market volume, and making a cautious estimate, we can consider around 2.1 million users – a value based on 2015 figures – and considering solely the manufacturing industry in Europe (and not logistics, construction, etc. one of the greatest consumers of joists).

If we then consider just the medium and large enterprises, the market is represented by about 85,000 companies (or 4.5% of the total) in Europe; if only 50-60% of these companies were to consume joists (very conservative estimate) at the estimated 30 cubic metres a year, this would mean approximately 1.2-1.5 million tons of virgin wood consumed by this kind of company alone which could be potentially substituted by the new technology and accounting for approximately 8-10% of the currently unused wood waste. It should be added that the final price of the GREEN JOIST, with respect to virgin wood joists, will be at least 35% less (conservative estimation of the final price), making it highly competitive especially in a sector (manufacturing) where quality wood is not the main focus but rather an inevitable cost.

Going beyond the economic and practical incentives, many companies are now extremely environment aware (often due to rising customer pressure), and using a product like GREENJOIST will enable them to “green” their production process.

An important additional market for GREENJOIST is that of pallet and joist producers:

Wood pallets and wood packaging make up nearly 6% of the world's total packaging consumption.

Of this, 90-95% of all the pallets produced across the globe are made from wood. It is evident that wooden pallets are preferred by the market because of their structural characteristics that can be summarized in strength, stiffness, durability, usability, easiness to configure (dimensions) and relative low cost. The GREENJOIST joist could cover approximately 50-60% of the pallet block production (which is already covered by other technologies that produce pressed pallet blocks directly, such as that designed by IMAL and EIREBLOC).

From a preliminary market study by IMAL, it has been estimated that approximately 5000 companies deal with pallet and joist



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production in Europe, and will be potentially interested in acquiring eco-innovative technology to boost their competitiveness and enlarge their market for the following reasons:

- the GREENJOIST technology is perfectly adaptable to the existing processes. The introduction on the market will make it possible for these companies to utilize the same traditional cutting machinery with the new recycled joists, without having to completely renovate their production process, saving costs at the same time (the final cost of the green joist used to obtain pallet blocks will be at least 35% lower than standard market values).
- the price of virgin wood (established on the raw material market on a global scale) is subject to high fluctuations throughout the world.

The aim of the implementation of the GREENJOIST technology is to insert a variable between pallet production and the price of virgin wood, making it possible to utilize wood waste, widely available on the market, especially at a local level.

The GREENJOIST project is also extremely interesting and has a high potential economic value for numerous other sub-sectors of the wood-working industry, which will be able to transform the waste from their work process (wood dust and materials) into a useful and valuable product. These sectors include:

- sawmills: an estimated 2500 mills are currently operating in the EU;
 - manufacturers of non-recycled wood panels: about 200-250 operating in the EU;
 - furniture manufacturers: a large and extremely promising market, counting approximately 50,000 companies in the EU.
- We can estimate that 30% of this market would be potentially interested in this new technology, because they could use the new green joist for their own logistic purposes as well as for manufacturing parts of furniture (table legs, kitchen frames and so on).

Lastly we can also add some other end users of the green joist such as for example:

- Packaging and logistics in general: a very large and vast sector. If we consider the area where pallets and wood joists are used for packing and logistic purposes, we can estimate at least 20,000 potential end users (prudential estimate);
- construction companies: joist can be used in several ways for non-structural functions in the green building sector. If we consider the potential end users of wood joists as a percentage of the entire construction industry (e.g. a very prudential 1%), this would make a rough figure of around 24,000-25,000 of potential users.

B) Growing awareness of sustainable recycling processes:

Although in recent years, Europe has been investing and making good progress in recycling, the problem still remains to cut the amount of waste produced or to reutilize it to produce other products, as an estimated 60% of waste is still going to landfill (with rather broad national differences).

While statistics and trends are promising, better results can and should be achieved as environmental awareness grows amongst the European citizens.

Europe is in fact aiming to recycle over 50% of all household waste by 2020.

Although policies and rules are important for achieving these goals, awareness is also a key factor. The LIFE + GREENJOIST project will demonstrate to both wood working stakeholders and the general public that not only recycling is feasible but it is also advantageous proving that a 100% top quality recycled product is cheaper and cleaner than its non-recycled counterpart.

Through extensive dissemination activities, the project shall contribute to raise awareness and drive towards a green and sustainable society where "seeing is believing".

C) Creating new green jobs:

LIFE+ GREENJOIST will be a green, sustainable joist which will consolidate and broaden the recycled wood ecosystem. This will translate into more business opportunities, increased demand which in turn will lead to the creation of new jobs primarily in the eco-manufacturing sector as well as in waste management.

Furthermore, the new green product will also foster the creation of new "green" jobs within a sustainable, efficient and circular economy. The European 2020 strategy promotes sustainable growth by building a resource-efficient and viable economy, reinforcing the competitive advantages of businesses, particularly in manufacturing and SMEs, and through assisting customers to value resource efficiency.

This process requires the need for incentives and policies on the one hand and on the other hand, a shift in company culture and



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willingness to review the production processes, especially in existing businesses. Recent studies actually show that in certain cases, retraining towards green jobs may be less than expected. Indeed the **LIFE+ GREENJOIST project** shall improve this condition as the project partners are each specialised in their own core business and already invest in ongoing training on new eco-sustainable technologies.

The project shall serve to consolidate this practice and foster new green jobs within the wood working industry and manufacturing in general.





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PROJECT COORDINATOR

Since its foundation in 1970, IMAL has steadily expanded over the decades to become a world leader in the manufacture and supply of plants and machinery for wood based products. The company specialises in a wide range of high-tech instruments and equipment; IMAL's production covers the entire wood working category, focusing in particular on the production of equipment for the manufacture of engineered boards [PB, OSB, MDF boards and pallet blocks].

IMAL is also a world leader in glue blending systems, in the production of quality control equipment as well as in the refurbishment of second-hand equipment.



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Acimall is the Italian Woodworking Machinery and Tool Manufacturers Association. Its main mission is to promote the Italian industry abroad. It was established in Milan in 1966 and has about 180 member companies, representing over 85% of the national personnel [10.000 people] employed in the wood industry with a turnover of about 1 billion euro, 80% of which comes from exports. CEPRA, the Acimall promotion centre, is the operating arm of the association: it organizes **Xylexpo**, an international exhibition that is the world's most important industry fair, held every two years, and publishes the bimonthly magazines *Xylon* (in Italian) and *ItalianWoodTech* (in English).



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EIREBLOC is the newest entrant to the composite block manufacturing business in Europe.

The plant is state of the art and the first of its kind to produce extruded pallet blocks from recycled wood.



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Founded in 1968, the company dedicated itself to the sale of machinery to various interrelated sectors including machinery and plants for the production of engineered PB, MDF and OSB panels.

The company works as a dealer/consultant for different machine manufacturers in Europe (e.g. Italy, Germany, Austria etc). COLOMER has always invested in technical expertise and innovation.

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Chimar Hellas S.A. develops and provides technology and R&D services to the resin and wood-based panel industries, specifically technology for the industrial production of adhesive resins, the production of resin additives as well as technology for the application of said products in the industrial manufacture of wood panels.