LIFE

Eco Timber Cell

LAYMAN's report

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June 2022

The LIFE EcoTimberCell project has received funding from the European Union's LIFE programme.

LIFE EcoTimberCell Project

Project title

Ecological cellular structural systems for a Building model for Climate Change Mitigation and Forest value enhancement

Project acronym LIFE EcoTimberCell

Location Spain (Galicia, Asturias & Cataluña)

Project Start date 01/09/2018

Project end date 30/06/2022

Duration 46 months

Total project budget 2.003.142 €

EU contribution 1.179.369 €

Web www.life-ecotimbercell.eu

Consortium

Coordinator partner

Platform for Structural Wood Engineering of the University of Santiago de Compostela (PEMADE)

Beneficiary partners

Betanzos HB

Centre of Forestry and Wood Technology (CETEMAS)

Catalonia Institute of Construction Technology (ITEC)

3eData environmental engineering

Our home. Our responsability

Climate change is a reality that is becoming more and more present. It is a problem that affects everyone and puts the sustainability of future generations at risk. This situation has led both politicians and the scientific community to work on adopting urgent measures to tackle the consequences of climate change.

Preparing our homes and buildings for a greener future becomes a point of interest in our social development and also a key point to reach the climate targets for the fulfilment of the European Green Deal.

The European Green Deal is about improving people's well-being and protecting our natural habitat, with the main goal of making Europe climate neutral by 2050.

The buildings represent:

40% of the energy consumed

36% of energy-related greenhouse gas emissions

To achieve the decarbonisation targets, action will be needed in all sectors of our economy: energy, industry, mobility and **buildings**, including raw material transformation, construction, transport, building use and the end-of-life transformation phase.

Our proposal. EcoTimberCell systems (ETC)

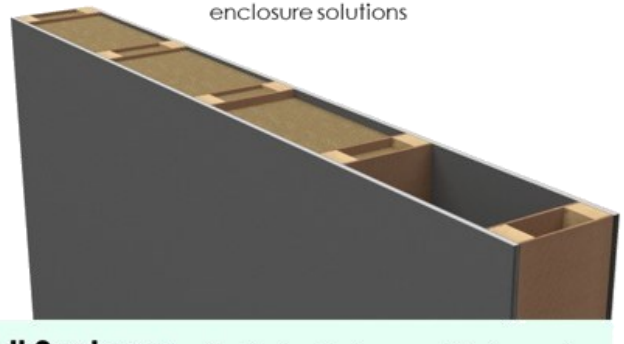
Creation of low-carbon building elements, substitutes for products derived from energy-intensive industries such as concrete and steel, and which also provide long-term carbon sequestration with sustainable materials.

By implementing this cell, it is possible to design slabs, roofs and walls, allowing a single-family house to be built entirely under this new structural system.

EcoTimberCell

ETC BOX System –
framing and roofing solutions

ETC FRAME System –
enclosure solutions



EcoTimberCell Systems – EcoTimberCell as a matrix element

Objectives of the LIFE EcoTimberCell Project

Making sustainable use of our natural resources.

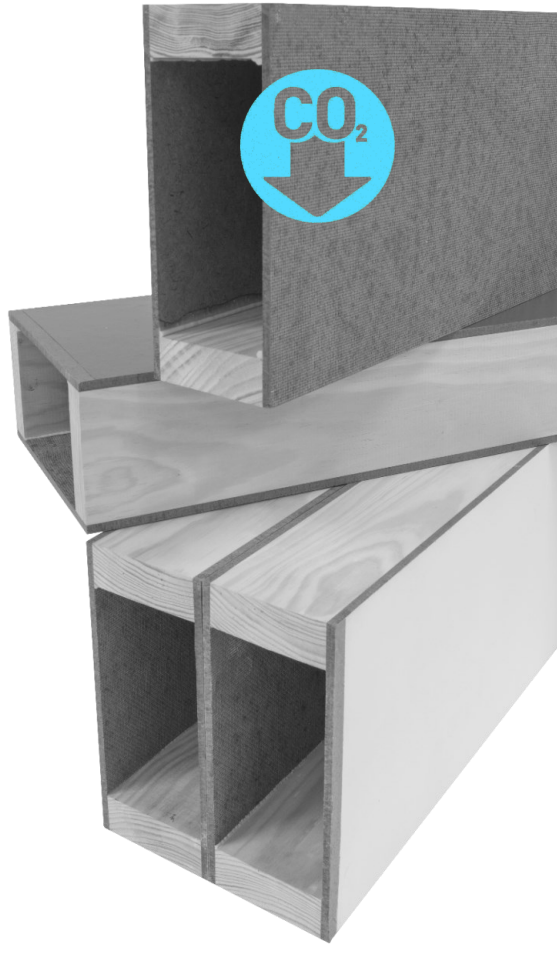
Responsibly sourced wood has emerged as the material with the greatest potential to reorient the building sector towards sustainability.

The added value that EcoTimberCell systems bring to local wood for use in building, and the increase in demand for certified wood that the commercialisation of these systems entails, promotes forestry certifications and with it the improvement of biodiversity and the landscape.

Decarbonising our building system to achieve climate targets.

Carbon emissions from the building sector can exceed 23% of total global greenhouse gas emissions.

The LIFE EcoTimberCell project involves the substitution of materials with a high ecological and carbon footprint (concrete, steel, brick), offering the market innovative wood-based systems with long-term carbon sequestration.



Reducing energy demand in building use and waste generation.

Construction and building use account for 36% of the world's final energy use. In Spain in 2018, the waste generated from construction exceeded 14 million tonnes.

EcoTimberCell systems enable the design of highly efficient building envelopes, which reduce the energy demand of buildings and therefore their lifetime energy consumption.

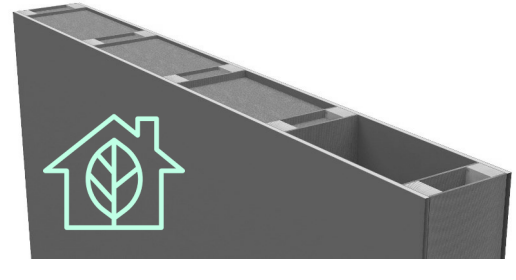
With the application of these wood-based systems, we are making use of recyclable materials, saving in the generation of waste and its subsequent treatment.

Reducing water consumption in building.

Water consumption grew twice as fast as population in the last century, and almost half of the world's population already lives in areas with potential water scarcity for at least one month a year. The industrial sector accounts for about 19% of total water withdrawals and the building industry is among the largest users.

Increasing urbanisation drives demand for building materials and concrete reached an annual production of more than 32 Gt in 2017, being responsible for a global water consumption of 16.6 Gm3.

Building with EcoTimberCell systems is an interesting alternative for the reduction of water consumption in construction.



ETC HOME dwelling means...

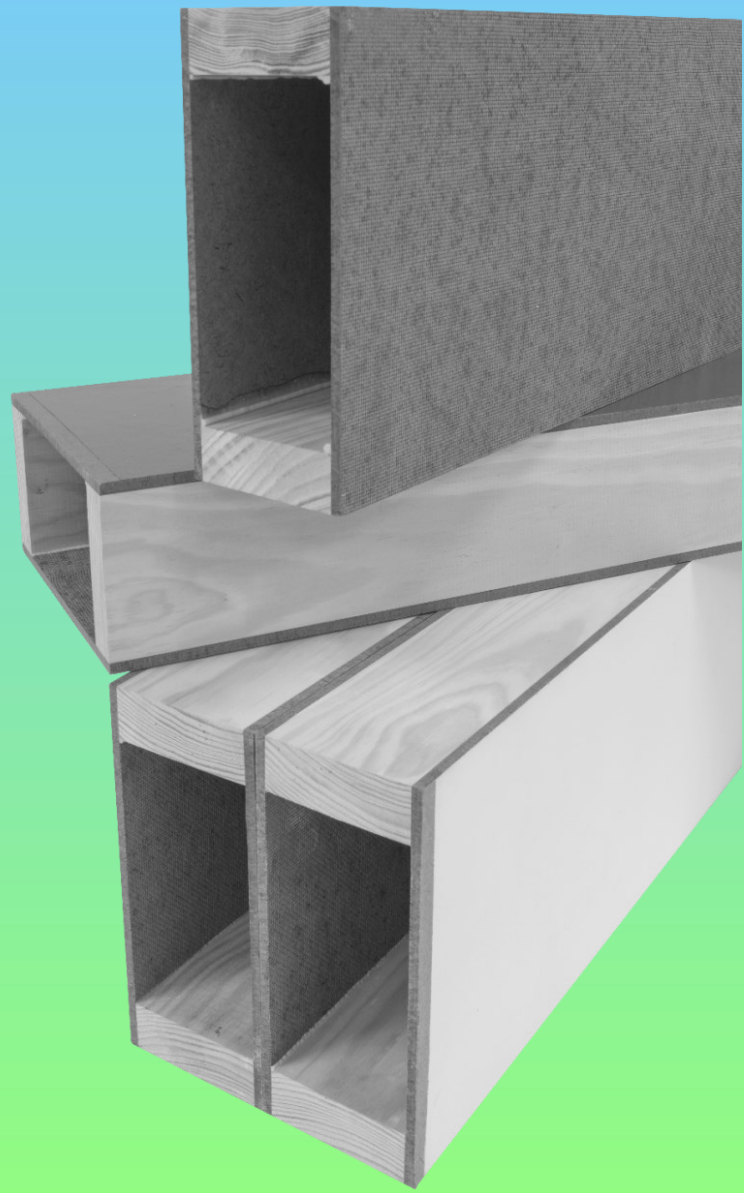
16,75 m^3 of certified sustainability managed wood

538 t reduction in waste generation
compared to a conventional dwelling

Data obtained from an ETC HOME type dwelling with a surface area equal to 150m^2

-17 t of carbon dioxide sequestered

92.400 liters water savings in the construction phase compared to a conventional dwelling (*in situ* work and incorporated in the materials)



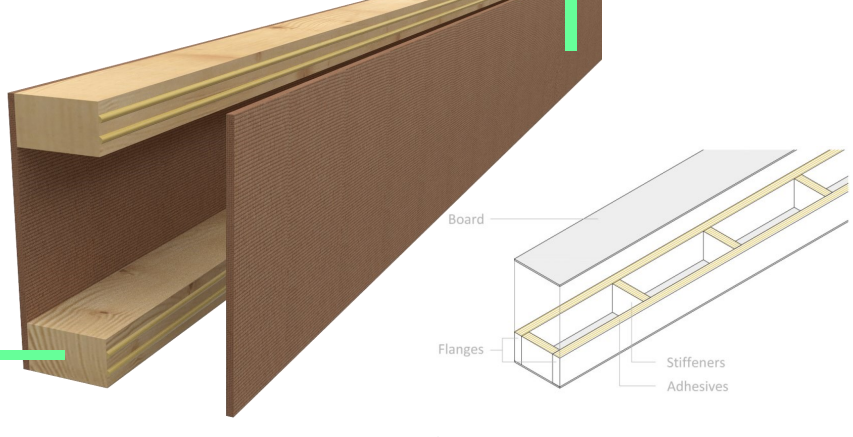
Two elements, one origin: locally sourced and sustainably managed forest plantations.

Tablex board.

High density fibreboard is sustainably produced from certified wood and by-products of the forest industry.

Wood.

Certified sawn timber of Pine (*Pinus pinaster*, *Pinus radiata*), Eucalyptus or Chestnut trees, graded, cleaned and finger-jointed at the ends.



Wooden slats connected across the board with the help of polyurethane structural adhesive.


How is EcoTimberCell
manufactured?

Board. Studies carried out in the project

In the LIFE EcoTimberCell Project, the study and improvement of the hardboard of wood fibres is carried out, obtaining **a 6.4 mm fibreboard adapted to the EcoTimberCell structural systems** with improved qualities of mechanical resistance, humidity resistance and reaction to fire.

Characterisation campaign for the determination of physical and mechanical properties

Thermal conductivity

Humidity

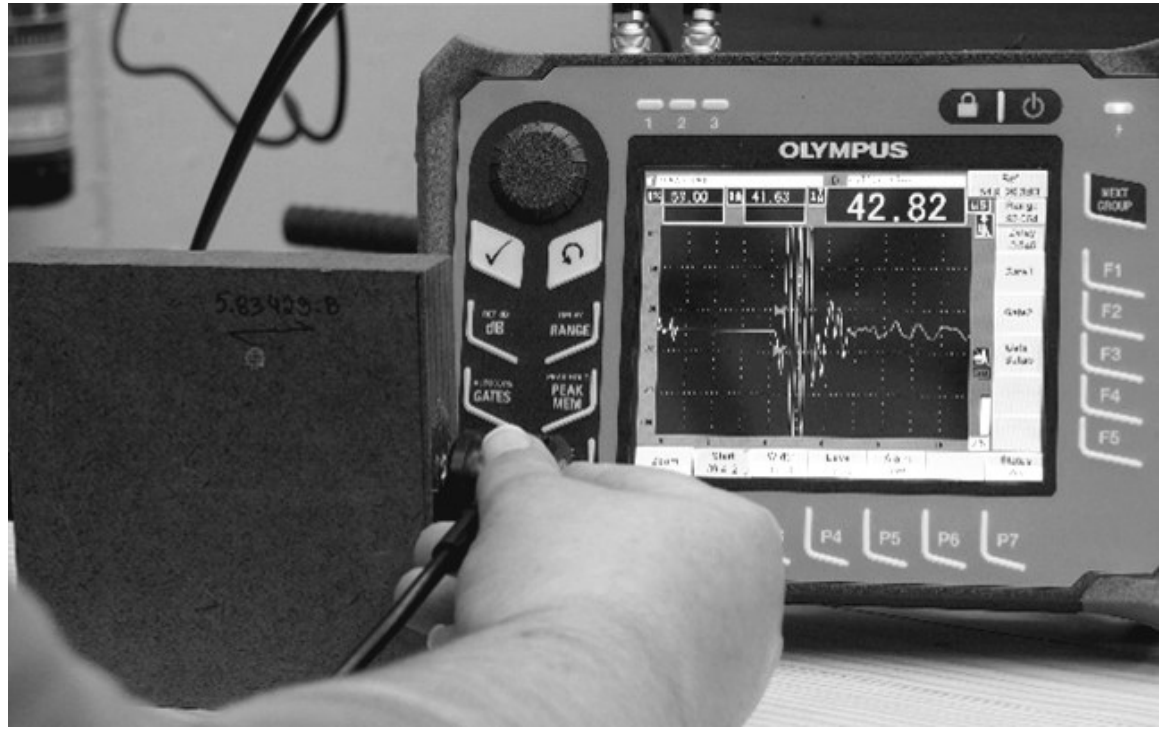
Density

Water vapour permeability

Mechanical properties

Reaction to fire

The Tablex board has been characterised with non-destructive acoustic testing. The application of ultrasound is a tool for innovation and quality control improvement for manufacturers and users.



Wood. Studies carried out in the project

Within the LIFE EcoTimberCell project, the aim is to obtain a correlation of parameters to complement and improve the objectivity of the classification, so that a definitive assignment of a wood resistance class can be made.

A wood characterisation process has been developed, which firstly takes into account the **singularities of the material through a visual classification and the mechanical properties** independently, with the performance of experimental tests applying non-destructive and destructive methodologies

Characterisation campaign for the determination of mechanical properties

Visual classification

Mechanical classification

Non-destructive methods

With the non-destructive methodology, the step formulas between parameters [bending tests and non-destructive methods] were obtained, which allow the estimation of the mechanical properties of the wood without any damage to the wood.

More wood,

And wit sustainable forest management

"More than 49% of the wood harvested worldwide is used as biofuel. The LIFE EcoTimberCell project promotes the use of wood in construction, storing carbon in the long term and contributing to climate change mitigation."

FAO & PNUMA 2020. The State of the World's Forests 2020. Forests, biodiversity and people. Rome.

Economically, socially and environmentally responsible use of existing wood through sustainable forest management is needed

Certification is an incentive to improve forest management, taking into account economic, social and environmental criteria. It is also a market tool for products from certified forests, generating public recognition of the management and responsible use of forest resources.

The importance of sustainable development that promotes the economic, social and respectful use of forests has led to the development of a steady increase in forest certification both in Galicia and in Spain.

According to the latest data from PEFC y FSC® **the certified forest area in Spain totals 2,986,590 ha, of which almost 11% corresponds to Galicia.**

POLLUTION

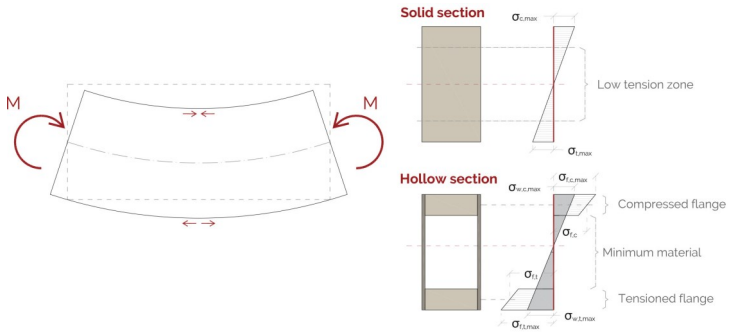
400.000 premature deaths per year due to atmospheric pollution

ECONOMY

190.000 millions euros of estimated annual losses in the event of a 3°C increase in global average temperature

Climate change could lead to a **20% increase in food prices by 2050**

In the situation where a beam carries gravity loads spanning a space between two supports, it is subjected to a principal bending stress. The bending stress compresses the material on the upper face and pulls the material on the lower face, leaving the intermediate material less stressed. In this case, it is possible to optimise the material by removing the less stressed material. Both steel and concrete have sought this optimisation, which is why we can find the whole series of rolled profiles in the form of a double T in steel, or hollow-core slabs in concrete. **The EcoTimberCell is based on this idea of material optimisation.**



The EcoTimberCell is the basic structural element from which slabs, roofs and walls can be designed, allowing a single-family house to be built entirely under this new structural system.

The EcoTimberCell is a new type of lightweight wooden beam designed under the concept of minimal wood. EcoTimberCell optimises with its geometry the capabilities of its components where the chords of the beam are mainly subjected to axial forces. The deck, in charge of making the connection between them, is mainly subjected to shear stresses, when bending occurs on the element; thus taking advantage of its greater capacity for resistance to tangential stresses.

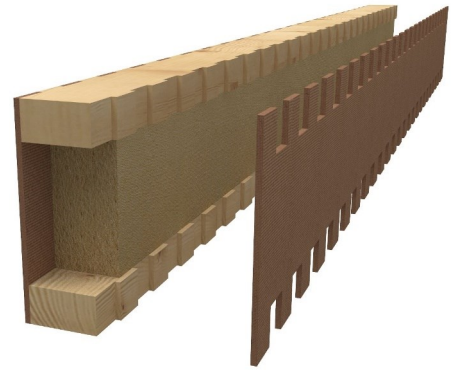

EcoTimberCell. The Cell

ETC+ Cell. Zero adhesives, more sustainability.

The ETC+ cell proposes the connection between the board and the wood by interlocking, avoiding the use of structural adhesives.

The first efforts in the development of the ETC+ cell are focused on this connection by means of numerical simulation and mechanical tests. The manufacture of the ETC+ cells has been carried out thanks to the collaboration of the higher degree in carpentry and furniture of the IES Politécnico of Lugo, allowing for precise and finished quality manufacturing of ETC+ cell prototypes.

Through the numerical simulation previously carried out, it can be seen that the mechanical behaviour of the structural element has been approximated. This simulation has been validated by means of laboratory tests together with measurements using digital image correlation techniques (ARAMIS).



The systems. A cell as a matrix element of a sustainable and efficient building system.

High-performance slab or roof systems have been developed in which the material is optimised to achieve large spans.

The **ETC BOX** system is an aggregate of ETC elements that form modular panels with high structural efficiency and high thermal performance. The panel structure itself allows the inclusion of thermal insulation in the interior.

ETC FRAME is a highly energy-efficient lightweight framed wall for the construction of vertical enclosures.

Advantages of building with EcoTimberCell

LIGHTENED PRODUCT

System designed under the minimum wood concept: maximum structural efficiency with the lowest use of resources

EASY INSTALLATION

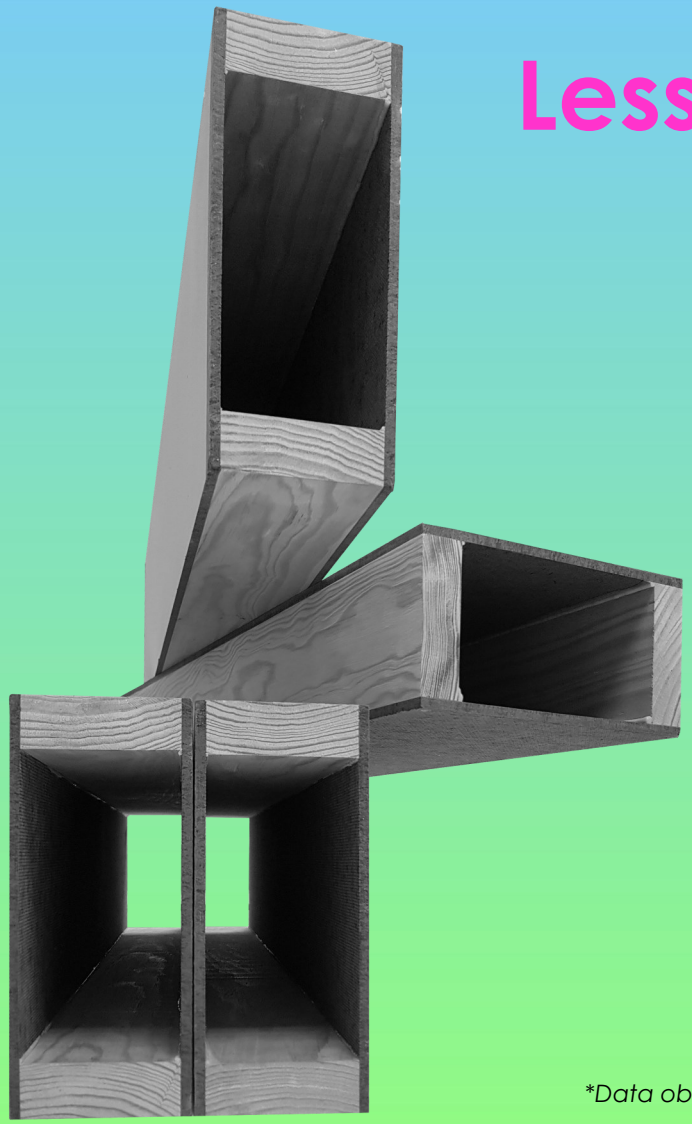
Lighter weight structural products for on-site installation

REDUCTION OF THERMAL BRIDGES

Incorporation of insulation inside the structural element. Reduction of the total thickness of slabs or walls

REDUCTION OF ARTIFICIAL BINDERS

Use of 100% ecological boards, with no added adhesives. Wood-to-board connections designed to reduce the use of adhesive



Less is MORE

Less wood

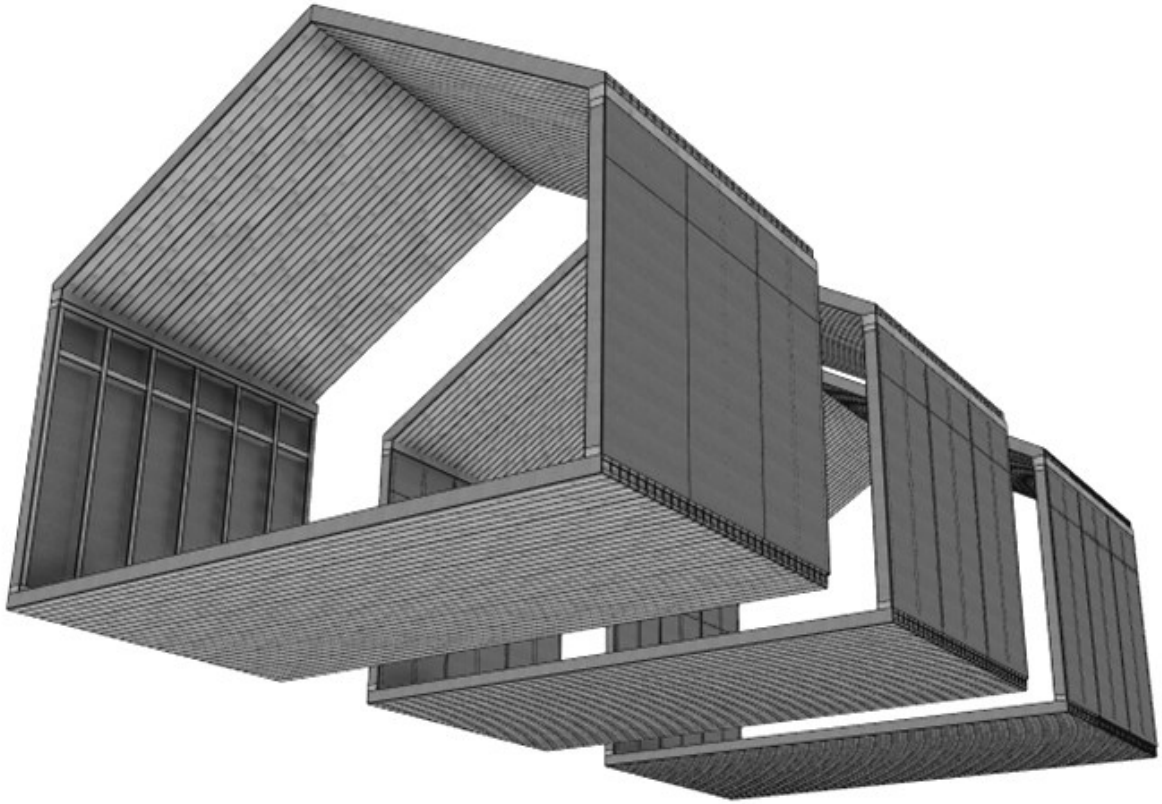
The EcoTimberCell cell reduces by up to **50%** the amount of material used compared to a traditional solid beam of equal mechanical capacity

Less adhesives

ETC HOME housing means a reduction in adhesives of up to **76%** in comparison to a mixed house with framing and cross-laminated timber*

MORE sustainability

**Data obtained from a house with a surface area equal to 120m²*



Total net wood consumption(m^3)

Dwelling with CLT	**91,40**
Light-frame dwelling	**17,82**
ETC HOME	**16,75**

Data obtained taking as a reference an ETC HOME dwelling type of 150m^2

ETC HOME

The use of EcoTimberCell elements and systems allows the development of modular architectural solutions called ETC HOME. This is a modular construction system comprising the design of several housing modules, the combination of which makes it possible to design homes adapted to the environment and the specific needs of the user.

ETC HOME proposes a series of standard modules that when combined allow multiple configurations, from a single equipped module to modular combinations on the ground floor and/or in height that meet the requirements of the end user. The architectural proposals are visually attractive, ecological, sustainable and economically competitive compared to traditional building.

ETC HOME means a reduction in the use of raw materials. A single-family house of 150m2 built with EcoTimberCell systems means a reduction of up to 5 times in wood consumption, compared to a house of the same characteristics built with cross-laminated timber. The added value of the EcoTimberCell structural system compared to lightweight framing lies in the valorisation of the raw material used in its manufacture.

Certifications obtained

The tests and studies carried out throughout the project have enabled **obtaining CE marking for Eco-TimberCell cell products and ETC BOX system.**

The European document setting out the technical assessment of the performance of a manufacturer's product or kit in relation to the essential characteristics applicable for its intended use, where this is not covered or not fully covered by a harmonised technical specification, is referred to as a **ETE – European Technical Assessment**.

It is drawn up on the basis of the European Assessment Document (EAD) which covers the product and its proposed uses, and makes the Declaration of Performance and CE marking possible. This assessment, together with the CE marking, facilitates the marketing of non-standard and innovative products and systems on European and non-European markets.

ETC systems have been recognised in the 2020 edition of the National Environmental Congress for their eco-design, and also highlighted in the Galician Innovative Materials Competition for their innovative character and their potential to be applied in multiple building systems..

TimberSoul spin-off and marketing of EcoTimberCell products

One of the most relevant milestones in the LIFE ETC project is the creation of the spin-off TimberSoul by Cándido Hermida SL, which started its business activity in January this year, promoting certified local timber through the commercialisation of EcoTimberCell structural systems.

The priorities of TimberSoul by Cándido Hermida range from positioning ETC products as synonymous with quality and innovation, to promoting and raising awareness of the use of wood as an ecological alternative in construction, providing tools that facilitate the use of ETC products that facilitate the use of ETC products to promoting the transfer of innovation in the Wood building sector.

The spin-off will work to connect construction professionals with industrialists specialising in wood building, with the aim of achieving sustainable constructions that mitigate the effects of climate change.

Timbersoul by Cándido Hermida S.L. is currently the only company both manufacturer and distributor of EcoTimberCell products, as well as offering a comprehensive technical consultancy and installation service for the prescription and installation of ETC locally, nationally and internationally.

TIMBER SOUL
by CANDIDO HERMIDA

Replicability & transferability.

In addition to the continuity of the project through TimberSoul by Cándido Hermida, replicability and transferability efforts have been made with the same objective in mind.

LIFE Wood for Future is a project for the recovery of poplar groves in the Vega de Granada for the improvement of biodiversity and long-term carbon sequestration in structural bioproducts, which will replicate different aspects of LIFE EcoTimberCell such as the development of construction elements based on local and certified wood or the promotion of sustainable forest management.

The link with other LIFE projects has been very fruitful, generating collaborations or the possibility of using EcoTimberCell elsewhere, such as with the projects **LIFE My Building is Green**, **LIFE Renatural NZEB** or **LIFE Lugo+Biodinámico** among others.

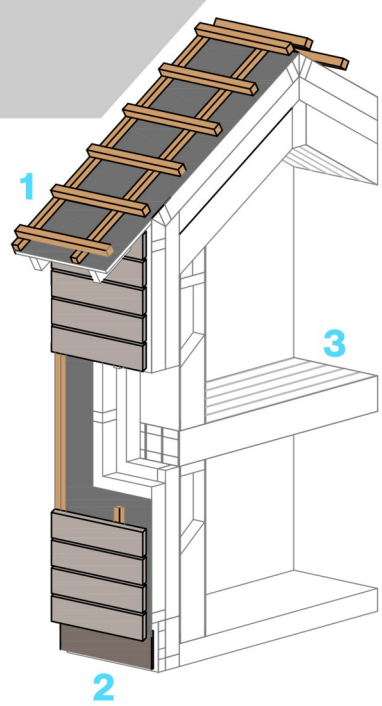
We highlight the full-scale model of the EcoTimberCell products, in which we have integrated existing products on the market that have been developed in the context of the LIFE projects:

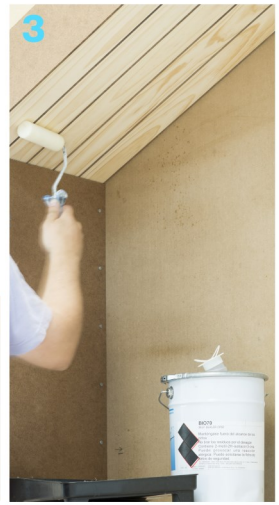
LIFE HeroTile & **LIFE SuperHero**: Innovative tile roof capable of increased ventilation

LIFE Wood (Tricoya): High-performance fibreboard for extreme outdoor and indoor conditions

LIFE Biopaint: ultra-violet cured wood coatings from bio-renewable raw materials

LIFE Eco Timber Cell





lifeHEROTILE life SUPERHERO tricoya BIOPAINT

More information
on the results of the LIFE EcoTimberCell project

About the **Board** characterised in the Project (Tablex)

Catalogue on Enhanced Board for EcoTimberCell Systems
Bulletin 3 LIFE EcoTimberCell
Video Characterisation of the Board

About the **Wood** characterised in the Project

Guide to the supply and characterization of structural Wood
Bulletin 2 LIFE EcoTimberCell
Video Characterisation Local Wood

About the **Cell** (EcoTimberCell)

Bulletin 4 LIFE EcoTimberCell
Video First demonstrative with EcoTimberCell products

About the **Systems** EcoTimberCell

Technichal datasheet of the ETC BOX
Article on EcoTimberCell systems in ECOCONSTRUCCION magazine
Bulletin 5 LIFE EcoTimberCell

Apply results of LIFE EcoTimberCell

About creating an university **Spin-off** company

Quick Guide for creating a spin-off

Video What is a spin-off?

About the **Certification** of structural products

Guide for licensing environamental technologies

Guide to obtaining environmental certifications and verifications for wood structures

Video ¿What are CE marking, environmental and technology certifications of a product?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