



# Forest based composites for facades and interior partitions to improve indoor air quality

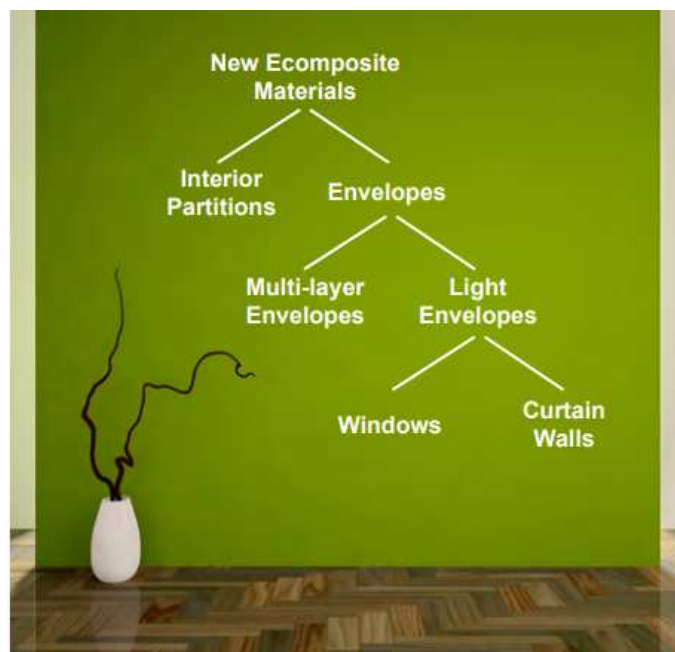
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# Goal of the project

To improve indoor environmental quality and energy-efficiency by developing forest based bio-composites and products for facades and interior partitions to be applied in retrofitting and new building



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9 SMEs



5 RTDs



2 Large companies



2 Public bodies



# Key Innovations

we started with little and went .....



# Key Innovations



From this



To this



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# Key Innovations

Throughout the project the partners have maintained a focus on the end game:

Real life **Case Studies**



To show real life **applications**



# Key Innovations

## INTERIOR PARTITION WALL



### INTERIOR PARTITION WALL

Currently, the most common interior partitions are made of brick. Not only is achieving adequate acoustic insulation with brick complex, but the need to use water in their construction necessitates very long installation times.

## WINDOWS



### WINDOWS

Due to lower structural requirements, window profiles can now be made of wood, aluminium, PVC and polyurethane.

## CURTAIN WALL SYSTEM



### CURTAIN WALL SYSTEM

Curtain wall façades incorporate aluminium profiles that support large glass panels.

## MULTI-LAYERED FAÇADE



### MULTI-LAYERED FAÇADE

Over the past few years, the construction industry has begun to use this type of façade as a replacement for traditional brick and mortar. Once assembled, these layered façades meet the same insulation and protection requirements of traditional façades.

# Work Development

Analysis of requirements

Development of materials

Design of products

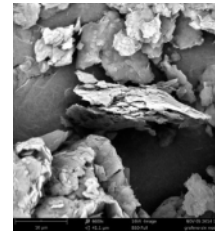
Development of products

Testing

Implementation

LCCA and monitoring

## Selection of different BIO-materials

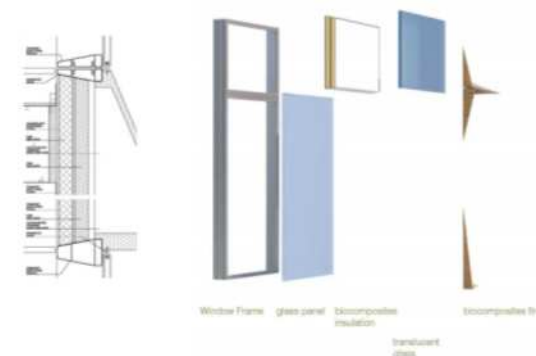


Multi-layered Wall – Build-up

## Product design requirements



Curtain Wall – Build-up



## Standard & Market requirements

- *Spanish Building code*
- *Estonian Building code*
- *German Building code*
- *EN-13830*
- *Environmental market requirements*
- *Key market aims*

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# Work Development

Analysis of requirements

Development of materials

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Implementation

LCCA and monitoring

- Multifunctional coating
- Fibrous foam wallboard
- Interior Partition Thermoset biopolymer profiles
- Multi-layer façade Thermoset biopolymer profiles
- Curtain Wall Thermoset biopolymer profiles
- Thermoplastic FR sheets non-PLA compounds
- FR, low-VOC bio- adhesives
- Thermoplastic FR PLA compounds
- FR cork insulation
- Exterior cladding panel



# Work Development

Analysis of requirements

Development of materials

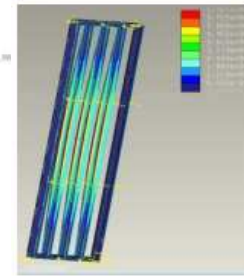
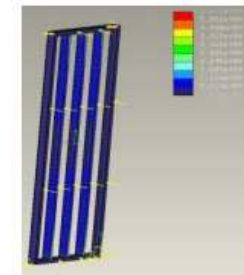
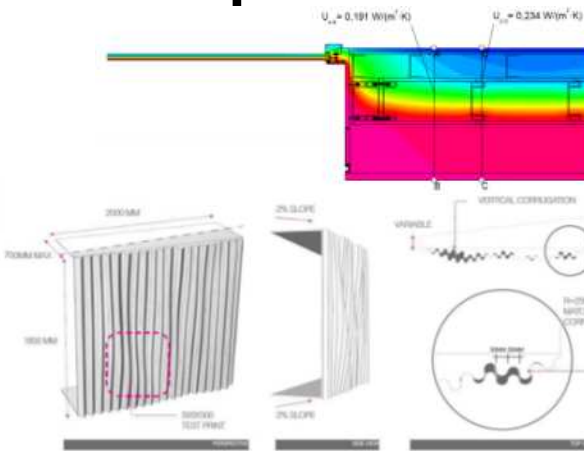
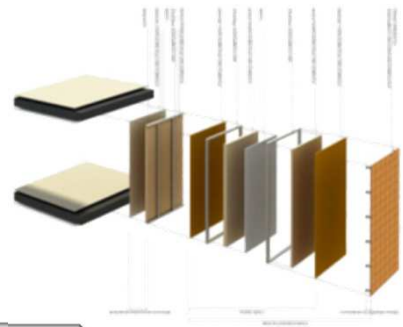
**Design of products**

Development of products

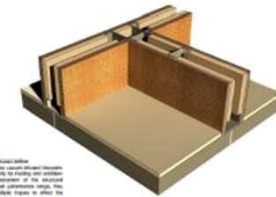
Testing

Implementation

LCCA and monitoring



- System design: Interior Partition
- System design: Multi-layer facade
- System design: Curtain wall façade



# Work Development

Analysis of requirements

Development of materials

Design of products

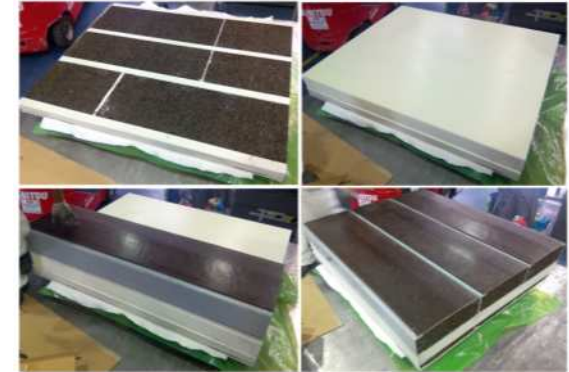
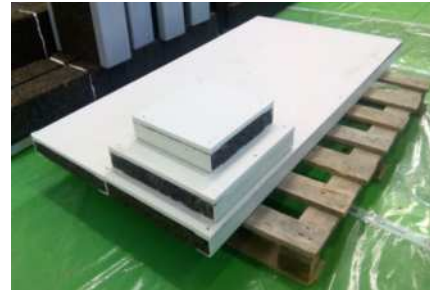
**Development of products**

Testing

Implementation

LCCA and monitoring

## Lab-Scale Prototypes for testing



## Scale-up of Manufacturing processes



# Work Development

Air permeability, Water tightness, Fire resistance, Thermal behavior, Wind load resistant....

Analysis of requirements

Development of materials

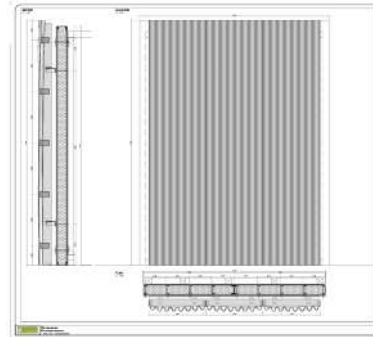
Design of products

Development of products

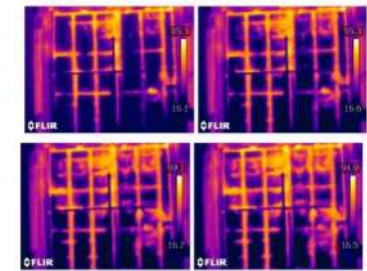
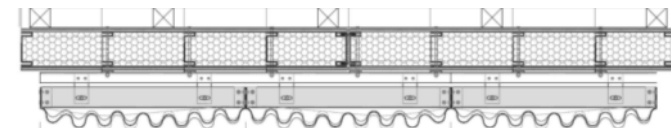
Testing

Implementation

LCCA and monitoring



PRODUCT	TESTS						
	Water-tightness of joints	Wind load resistance	Resistance to vertical loads, horizontal loads, hard body and soft body impact	Airborne noise transmission	Thermal behaviour	Reaction to fire	Fire resistance
EUROPEAN STANDARD	EN 12865:2002	ETAG 034 – ER4 – Safety in use	ETAG 034– ER4 – Safety in USE	EN ISO 140-3:1995	EN ISO 10077-2:2008	EN 13501-1) (Test under EN 13823, classification SBI)	1364-3 and EN 1364-4). Classification is regulated in the EN 13501 series of standards
SAMPLE DIMENSIONS	3.200X4.300 mm (same sample could be used for all tests)			3.000x2.775 mm	No sample needed (only simulations)	1.500x1.000x500mm	3.000x3.000mm



All test have been successfully passed



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# Work Development

## Design of the Structure of the Demo buildings

Analysis of requirements

Development of materials

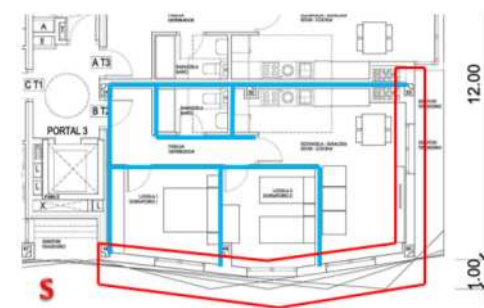
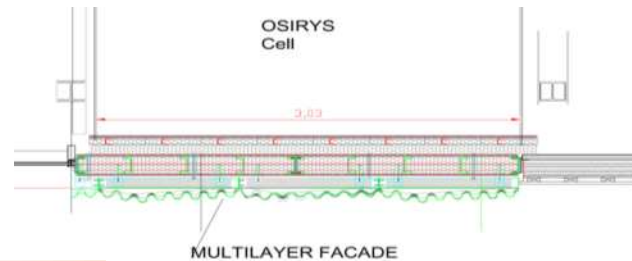
Design of products

Development of products

Testing

Implementation

LCCA and monitoring



# Work Development

Analysis of requirements

Development of materials

Design of products

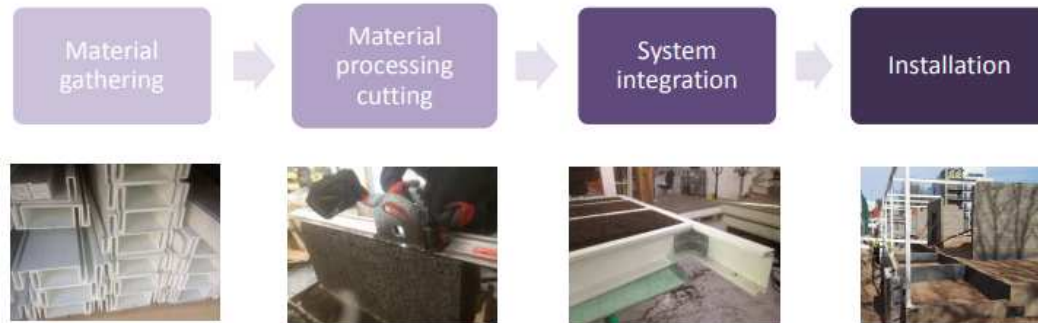
Development of products

Testing

Implementation

LCCA and monitoring

## Pre-assembly of all the systems



# Work Development

Analysis of requirements



Development of materials



Design of products



Development of products

## Manufacturing of the external cladding system

Testing



Implementation



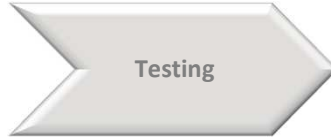
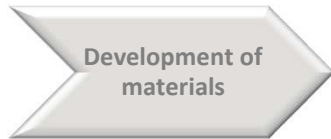
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# Work Development

## Kubik & San Sebastian Demos



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# Work Development

## Tartu Demo

Analysis of requirements

Development of materials

Design of products

Development of products

Testing

Implementation

LCCA and monitoring



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# Work Development

Analysis of requirements

Development of materials

Design of products

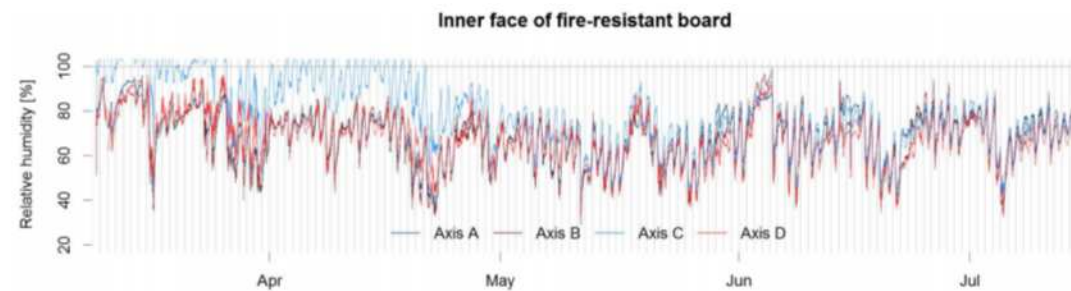
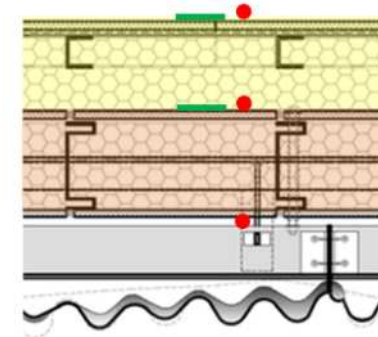
Development of products

Testing

Implementation

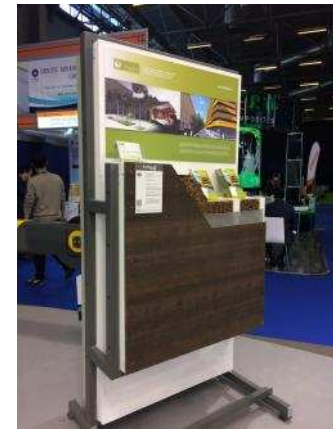
LCCA and Monitoring

Monitoring of the three demonstrators in different climatic areas.



# Achievements

- ✓ New eco-innovative materials to create a façade identity have been developed.
- ✓ The good indoor environmental quality of the materials has been validated.
- ✓ Process up-scaling has been demonstrated.
- ✓ We have designed the constructive elements (multilayer façade, curtain wall, window and partition system) to fulfil all requested standards and integrate in the buildings.
- ✓ Lab-scale prototypes and real scale prototypes have been manufactured.
- ✓ Have been demonstrated that the systems fulfill all the requirements with the testing of prototypes: mechanical safety, acoustic insulation, air permeability, thermal insulation, fire safety...



# Achievements

- ✓ Three demo buildings have been defined:
  - ✓ KUBIK experimental building (Spain)
  - ✓ Two new buildings with different climates: San Sebastian (Spain), Tartu (Estonia)
    - San Sebastian: 1 flat of 50m<sup>2</sup> in a 7 floors new residential building
    - Tartu: new public building for sports of 275m<sup>2</sup>
- ✓ Installation of the systems in the demo buildings
- ✓ Monitoring: IAQ, Thermal performance



# What has been demonstrated at the end of the project? (TRL:7)

## Keys for market penetration

- The **technical viability** of using bio-based materials on constructive elements to be applied in different European climates, assuring more comfortable buildings regarding energy efficiency and IEQ. → *Reliability*
- Demo buildings will be a **showcase** for the developed novel materials → *Benefits must be proved*
- Creation of a **façade identity** by using eco-innovative materials that allow → *differentiation*

## Educate perception

- Design process has considered the possibility of combining the different new elements with traditional systems to **facilitate market penetration.**
- Partner companies will be **ready to launch** novel innovative products for construction into the market.



# Thank you for your attention

<http://osirysproject.eu>



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