

# PROJECT FINAL REPORT

**Grant Agreement number: 605891**

**Project acronym: HIFIVENT**

**Project title: High durability and fire performance wood plastic composites (WPC) for ventilated facades.**

**Funding Scheme: SME-2013-1 Research for the benefit of specific groups (in particular SMEs)**

**Period covered: from 2013/10/01 to 2016/03/31**

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<sup>1</sup> Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

## 4.1 Final publishable summary report

### 4.1.1 Executive Summary (1page)

HIFIVENT project started in 1st of October of 2013 and concluded in 31st of March of 2016.

During this period, the main objectives of the project has been achieved with minor deviations in terms of personnel effort, resources and time.

A complete study of the feasibility of using WPC based composites for the construction of a ventilated façade has been carried out in several steps:

1.- Modification of raw materials: Natural fibers and Nanoparticles has been modified in the first period of the project in other to improve the durability and the fire performance of the composite.

2.- Compounding: Different approaches were followed based on the interest of the companies for the formulation of the compounds. Two types of natural fibers were selected (TMP and rice husks) and polypropylene was used as main plastic component, taking into consideration PVC as reference material.

3.- A complete study of the durability, fire performance and mechanical properties of the formulations (more than 60) was done and 5 formulations were selected for upscaling.

4.- The procesability and the recyclability of the compounds were also studied and some modifications in the formulations were necessary for the production of good quality profiles.

5.- Based on the standard of reference for ventilated facades (ETAG 034) the viability of using WPC was studied based on mechanical and thermal simulations. Different alternatives were proposed based on wood, aluminum and WPC structural profiles and WPC cladding. A design of the WPC ventilated façade was proposed.

6.- The proposed design and components has been characterized according to ETAG 034 and EN 15534. A very good results were obtained for the most important parameters: fire reaction performance (B-s2,d0) and wind load test (3000 Pa for suction and pressure).

In parallel to the developments, a market analysis, life cycle analysis, business plan and commersialitation roadmap of the system has been carried out.

#### 4.1.2 Project context and objectives (not exceeding 4 pages).

Retrofitting is currently one of the major activities within the construction sector in Europe. The majority of actions are related to either recovering aged facades or solving insulation deficiencies. In these cases, ventilated facades are considered one of the most efficient systems.

Wood is a sustainable material that can be used for ventilated facades, but it lacks the necessary durability for outdoor exposition and intensive maintenance is required. This drawback can be addressed by new technological materials which combine durable polymers with high contents of wood (Wood Plastic Composites/WPCs). WPCs offer better thermal and acoustic isolation than aluminium and better durability than wood, however other problems arise that have to be addressed like for example their poor fire performance.

**HIFIVENT project develops a new family of WPC compounds, especially suitable for ventilated facades** by facing the challenges of their fire performance and durability issues.

HIFIVENT project has joint experienced European companies in the field of natural fibres, flame retardant nanoparticles, WPC compounding, WPC construction products as well as ventilated facades specialist (respectively BAVE, PROLABIN & TEFARM, BEOLOGIC, PLASTICOS ESCANERO and UXAMA). Additionally, those companies have been assisted by three relevant Research Institutions: Fraunhofer-WKI, Università degli Studi di Perugia and TECNALIA Research & Innovation (Project coordinator).

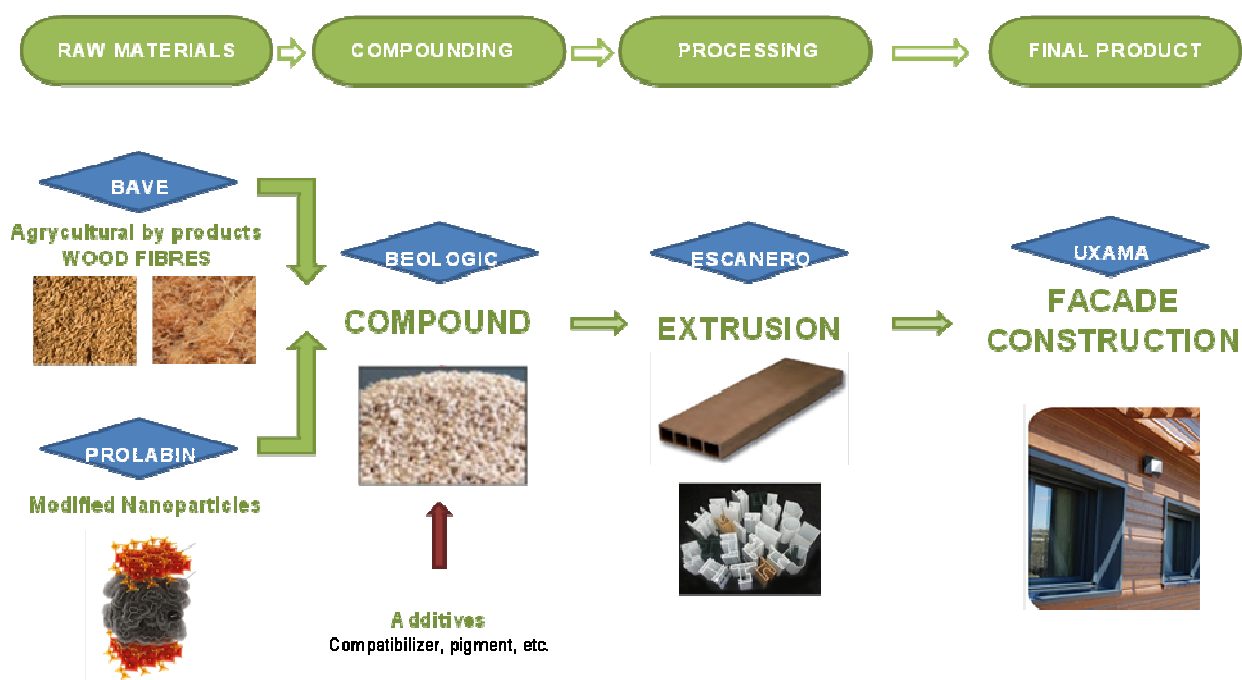


Figure. Concept of HIFIVENT project.

### Project Objectives

#### *Scientific objectives*

Use of nanotechnology to improve mechanical and fire properties of composites.

- Flexural stiffness and strength: at least 10% higher than current commercial WPCs.
- Reducing the amount of traditional fire retardant (never halogenated) in at least a 50%.

- Fire performance of ventilated façade in a reaction to fire test, *Euroclass* B-s3,d0

Improve mechanical performance of WPC by using long fibres for structural parts: 10% increase in stiffness and strength compared to traditional WPCs.

Wood fibre modification to improve weatherability: Good surface aspect after 2000 hours in accelerated weathering conditions (UV light + water spray) and 30% lower water absorbance and dimensional change than for traditional WPCs.

### ***Industrial objectives***

HIFIVENT aims to develop a ventilated facade system easy for assembly (reduction of 30-50% in weight with respect to ceramic and stone) that fulfils the following properties:

- Watertightness of joints (EN 12865:2002)= 2.000A
- Wind load resistance (ETAG 034)= 3000 Pa (Pressure) – 2.500 (Suction)
- Airborne noise transmission (EN ISO 140-3:1995)= 40 dB
- Thermal Behavior (EN ISO 10077-2:2008)= 2 W/m<sup>2</sup>·K
- Reaction to fire (EN 13501-1)= B-s3,d0

### ***Social/Environmental objectives***

This project contributes to the development of sustainable production patterns in the field of construction. It increases the use of non-hazardous materials and uses leading edge technologies developing more effective and lower embodied energy materials.

HIFIVENT promote better indoor quality due to the application of the ventilated façade system and Improvement on citizen's safety by reducing the risks caused by the fire in buildings.

Development of eco-friendly and fully recyclable system (facing and structure): Reduction of fossil fuel resources through the usage of biomass based fibres. Maximum of 40% of polymer (recycled origin) and natural fibre content equal or higher than 40%.

#### **4.1.3 Relevant contact details**

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