iCLIMABUILT

Functional and advanced insulating and energy harvesting and storage materials across climate adaptive building envelopes

Volume 2

Project Overview

iclimabuilt's goal is to create an open access ecosystem for developing, upscaling and testing innovations in building envelope materials and technical systems via its 9 Pilot Lines (PLs) to reach Nearly Zero Energy Buildings (nZEB) balance.

Through the iclimabuilt project a cross-domain business ecosystem combining the capabilities of different experts, building the connection between suppliers and users, based on the cooperation within interdisciplinary entities to support new product development/upscaling and testing, satisfy customer needs based on a case-by-case assessment of the underlying barriers of each technology, and eventually incorporate the next round of innovations in building envelope materials and technical systems will be formed.

27	14	10	48
Partners	Countries	Work Packages	Months

Project Overview

iclimabuilt will support the translation of research results into innovations and will help small high-tech firms to scale up and cope with the continuous rising of technological complexity by providing a **Single-Entry-Point** for necessary infrastructures and tools to test, validate and upscale new technological solutions.

iclimabuilt will do so with the aim to accelerate the development of additional leading-edge technology by focusing on:

- **Materials Development**
- **Design and Assembly of Technical Systems**
- **Monitoring and Characterization Strategies to Support Decision-Making**
- **Dissemination and Exploitation Activities**
- **Refined and Expedited Access to Financing Solutions**

An open innovation test bed for building envelope materials

Partners

National Technical University of Athens/R-NanoLab
Eurecat- Technology Centre of Catalonia
Technical University of Dresden
SINTEF
Norwegian University of Science and Technology
Research Institutes of Sweden
INEGI – Institute of Science and Innovation
Innovation in Research and Engineering Solutions
University of Strathclyde
Granta Design
Hamburg University of Technology
Stratagem Energy
Fraunhofer Institute for Solar Energy Systems
Polytechnic University of Turin
Technological Institute of Aragon
Cidetec
E2ARC Architecture Research for Cities
AiDEAS
TEGnology
Fenx
European Research Center for Design and Materials Technologies
Bergamo Tecnologie
Open Source Management
Rubitherm Technologies GmbH
University of Birmingham
BioG3D
Leipzig University of Applied Sciences

INEGI

Multifunctional composite sandwiches

INEGI, in the scope of the iCLIMABUILT project, aims to develop new mult-ifunctional composite sandwiches (MCS) with enhanced thermal/energy efficiency and acoustic performance, to be used as structural lightweight modular panels for construction.

INEGI's pilot line for the composite panels' production consists of a vacuum-assisted system with a processing movable worktable and a fixed thermo-ventilated oven. Different updates are being considered to increase the diversity of materials used for MCS production and to improve process monitoring and control.

Steps are also being taken towards the introduction of new functionalities to these MCS panels, by combining materials developed and produced within other iCLIMABUILT pilot lines. Furthermore, the properties of these hybrid MCS panels will be adapted to different climatic zones, according to the needs of several Living Labs where the materials will be tested.

INEGI's work in the ICLIMABUILT project started in April 2021 and the most promising material combinations are now being analysed to obtain MCS panels aligned with a "nearly zero-energy, zero-emission" vision.

Omniphobic coating pilot

Cidetec Nanosurface Unit, located in Cidetec Surface Institute, has proven experience on omniphobic slippery surfaces, which resulted on a publication about a formulation to process coatings with anti-dirt contamination functionality versus fluids and solid dust. Moreover, Cidetec patented ionogel technology (EP 16382668 8). By combining a covalently anchored cross linked polymer coating and nonvolatile lubricants in an appropriate manner, a single phase ionogel coating can be formed. The physico-chemical properties and functionality of the resulting coating can be adjusted by adding tailored functional groups to both building blocks. In particular, wettability of these versatile coatings may be tailored, reaching high repellency to fluids i.e. omniphobicity. It is growing in interest in several sectors due to the omniphobic coatings can provoke an increment of lifetime, productivity or yield and a reduction of time and cost of maintenance of the devices or objects where are applicated.

In iClimabuilt project, Cidetec hosts a relevant omniphobic coating pilot line. It is focused on development, optimization and up-scale of omniphobic coatings with self-cleaning functionality that previously have been developed at laboratory scale. In the most of cases, it is difficult to reproduce 100 % the properties achieved at small scale to high volume production. To achieving the objectives of Cidetec in iClimabuilt project will allow to increase the production and improve the reliability and reproducibility of process obtention of omniphobic coating.

In the first stages of the project, an analysis of functionality based on the application substrate and targets to adjust the production process and chemistry of omniphobic deposition has been performed. Moreover, in order to scout the benefits of omniphobic coatings in the applications some trials were performed. As can be observed in the picture, the obtained results were very promising.

Omniphobic coating pilot

In the framework of Iclimabuilt project, CIDETEC has developed a pilot line that allows to coat automatically surfaces of different morphologies and sizes with omniphobic coatings. The pilot line has three main elements: (i) a room for the preparation of the formulations (ii) a 19 m2 paint booth that contains the other main element of the painting system, which is the (iii) robot that is equipped with a Dürr painting system. The paint booth allows to control the temperature and relative humidity and prevents the formation of an explosive atmosphere. The robotic paint booth allows us to apply, under conditions equal to those used in the industry, both commercial coatings such as paints or lacquers, as well as formulations that we develop in the CIDETEC laboratories. To do this, CIDETEC has equipped the robot with a system that allows to paint samples with small quantities. On the other hand, to apply commercial coatings or formulations prepared at CIDETEC and that are in a more advanced state of development, CIDETEC has equipped the painting system with two 5-liters pressurized tanks. With this configuration we can paint from surfaces of a few square centimeters to surfaces greater than one square meter in conditions and with processing parameters very similar to those used by a company on a day-to-day basis, losing a minimum amount of formulation or paint.
Within the framework of the project, the use of this painting system from the initial stages of the project will reduce the time needed to obtain the prototypes for validation. Before this paint system was available, we developed the formulations in the laboratory and applied them with small-scale laboratory methods. Now from the initial stages of the project we can know the behavior of the coatings developed at CIDETEC and optimize their properties for application in the industry and thus reduce the time needed to obtain the demonstrator for validation. It could also be the case that a coating was developed during a project that gave very good results on a laboratory scale and then, for whatever reason, could not be applied on an industrial scale. With this system, we would detect this problem much earlier than if we did not have this painting system. Moreover, manual application of coatings always presents more uncertainty than coatings applied with the paint robot. With this system and same process parameters, we will always obtain the same coatings with the same properties.

CIDETEC in iclimabuilt

CIDETEC is a private organization for applied research founded in 1997 that seeks to contribute value to companies by harnessing, generating and transferring technological knowledge. Located in the Donostia - San Sebastián site of Gipuzkoa's Scientific and Technological Park, CIDETEC is comprised of three international technological reference institutes in energy storage, surface engineering and nanomedicine. Surface Engineering institute has a building with 4,000 m2 dedicated to laboratories and pilot plants. The work of the Surface Engineering Institute is guided by sustainable development and the need to obtain surfaces and materials that feature certain properties. At this institute, we cover the whole value chain, from the characterisation of bulk and surface properties to the design of tailor-made materials and treatments to obtain specific properties and the design and industrial scale-up of different coating and surface modification techniques.

TEGnology

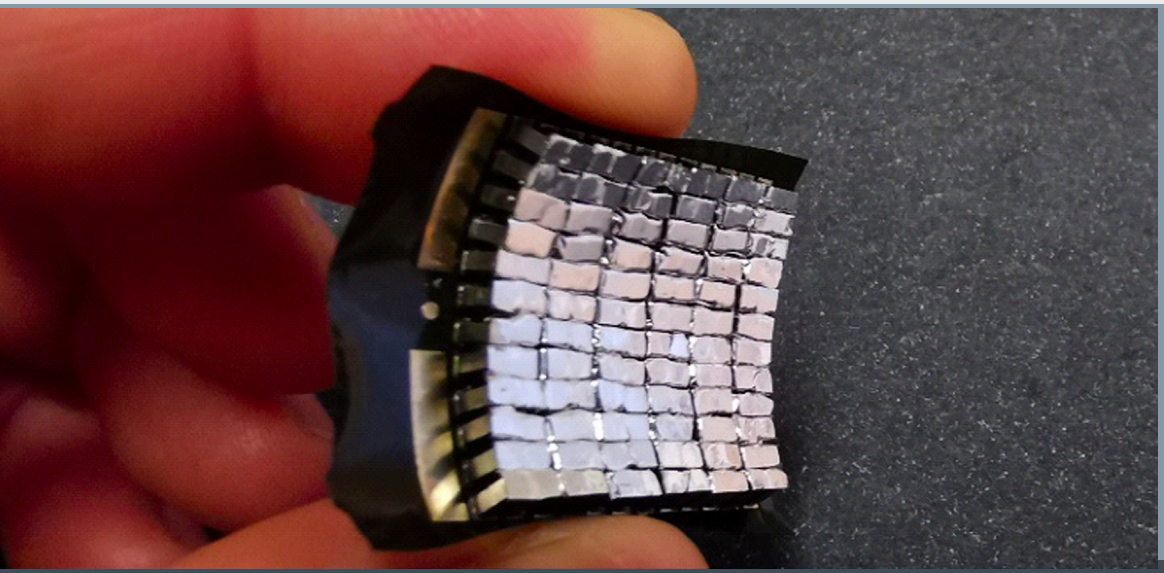
First prototype of flexible thermoelectric

The first prototype of flexible thermoelectric generation (TEG) modules was manufactured by TEGnology during the Pilot Line phase in the iClimabuilt project. The prototype is a proof of concept of the new module design and the manufacturing processes.

The preliminary tests indicate that the module generates nearly twice as much power as the conventional TEGs with ceramic substrates. Further characterizations are ongoing. The manufacturing process is largely compatible to the existing semiconductor industry and therefore is up scalable.

The prototype is based on several years research and development activities. We will consolidate the supply chain in the next step and commercialize the new module.

The work was carried out by Hao Yin, Morten Rafael Jeppesen, Jörg Rehder and Flemming Bjørn Hansen in TEGnology, with the support from partners, including SINTEF and University of Strathclyde, which are in the iClimabuilt consortium.



Color Characterization of innovative BIPV modules

The appearance of BIPV modules depends on the position and direction of the observer, on the component's optical properties as well as on the lighting conditions by the sky (i.e. light intensity, spectrum and polarization from different regions of the sky dome).

In large construction projects, it is common practice to use mock-ups to analyze the appearance of building facades. This is an expensive process, which could be replaced by efficient visualization tools. These tools, however, must capture the optical features of innovative BIPV components.

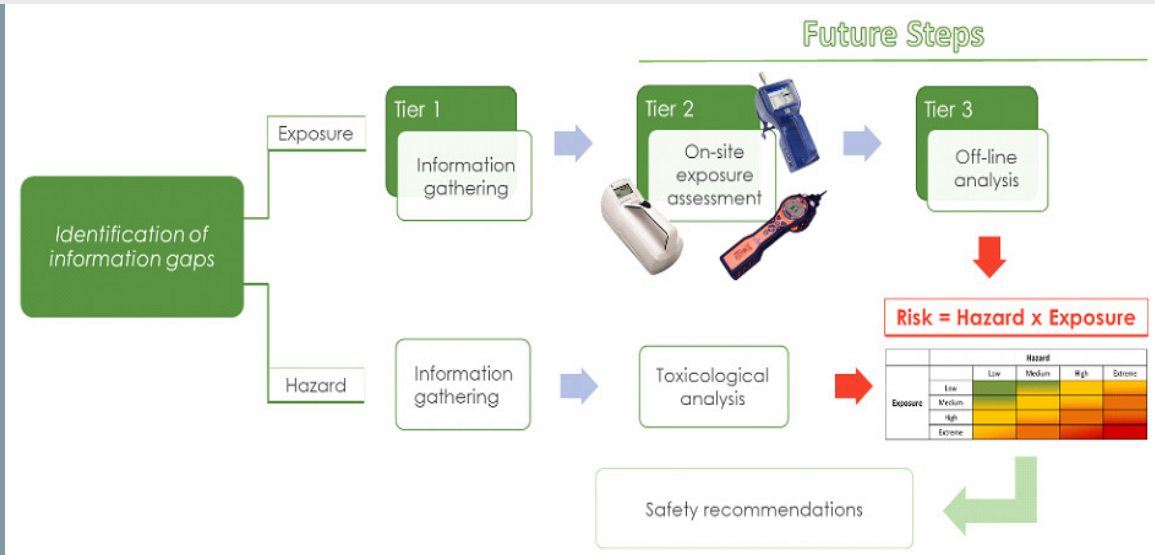
Within the Iclimabuilt-Project, Fraunhofer ISE measures the color coordinates of innovative BIPV modules for different positions of the camera and under different sky conditions.

The measurements were carried out with an LMK-color camera during the 3rd and the 30th of March, 2021, and synchronized with onsite records of spectral weather data. Measured data can be applied to calibrate and validate material models of BIPV materials, which can then be used by visualization tools.

IRES

Preliminary risk assessment of the iclimabuilt materials

In the "iclimabuilt" project framework, IRES is responsible for the Risk Assessment of the materials developed in the project. The objective of the Risk Assessment is to identify any hazards involved within the "iclimabuilt" technologies, minimize potential health and safety issues and put in place a Safer-by-Design approach. In this context, IRES performed a preliminary screening of the materials handled across all the project Pilot Lines and provided a Hazard Banding, based on the ISO/TS 12901-2:2014 methodology and the COSHH e-tool by HSE. The Exposure potential of the different manufacturing processes utilised by the Pilot Lines was also evaluated. The combination of the Hazard assessment with the Exposure potential led to the Risk Prioritization of the Pilot Lines. Moreover, IRES provided case-specific recommendations at Pilot Line partners separately, concerning Occupational Safety. This project task was implemented from August 2021 to February 2022, in cooperation with the "iclimabuilt" Pilot Line partners. In the upcoming months, a higher Tier of Risk Assessment will be performed by IRES to the Pilot Lines indicated by the Risk Prioritization, including on-site examination where required. Therefore, detailed insights on the potential health risks will be obtained, resulting in more targeted recommendations and mitigation actions, to reduce exposure and enhance safety across the "iclimabuilt" technologies.



Aerogels

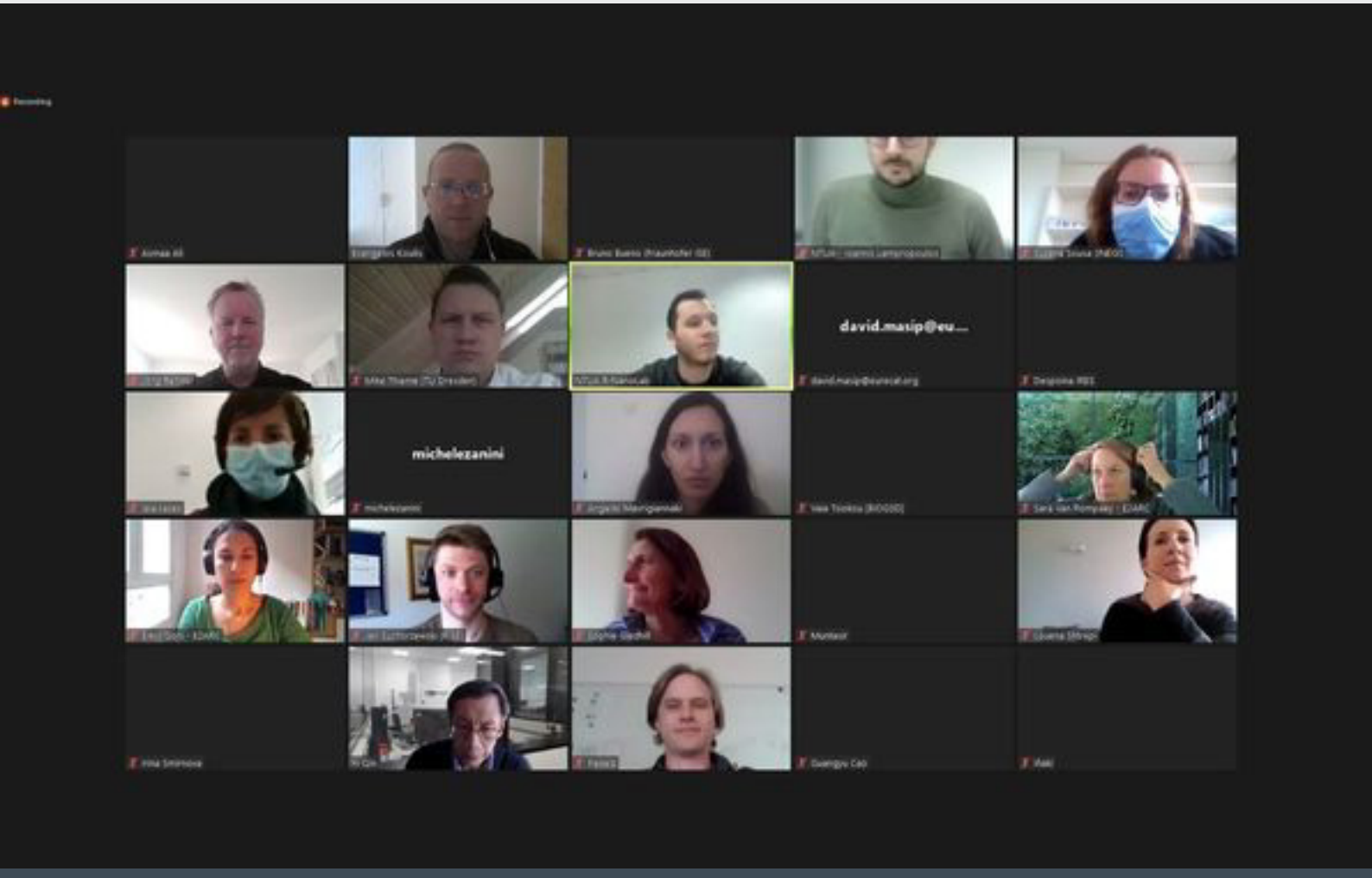
Aerogels, known as lightweight and high-insulation materials, can improve the properties of nearly zero energy buildings. Our pilot line aims for a large-scale production plant to produce 1500 L aerogel particles per year. In this project, we deliver these specific materials to the partners, to develop new insulation materials. The scale-up of our manufacturing plant enables the possibility of large-scale aerogel productions to compete with conventional insulation materials.

The production of aerogels contains 4 steps: dissolution of precursor, gelation, solvent exchange from water to ethanol and supercritical drying with CO2. In this product, we scale-up our existing plant in each of these steps. The crucial step during aerogel production is the supercritical drying of the prepared gels, which has to be carried out in batch processes. To reach the planned production rates, a 64 L autoclave is implemented in our manufacturing process. Using an individual generated software additionally to the automatized plant, the supercritical drying can be performed completely automatized. For the next months, different drying experiments will be performed and first aerogels will be produced with our new equipment.

Additionally to the scale-up of the supercritical drying step, scale-up of the other manufacturing steps starts.

12M progress meeting

Between the 21st - 22nd of March the iClimabuilt Project (Functional and advanced insulating and energy harvesting/storage materials across climate adaptive building envelopes) had the chance to hold the 12M Progress Meeting. The meeting was led by National Technical University of Athens as Project Coordinator. During the meeting, all 27 consortium partners from all over Europe had the chance to showcase the progress in their respective tasks while also providing information regarding the activities to be performed in the coming period.



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