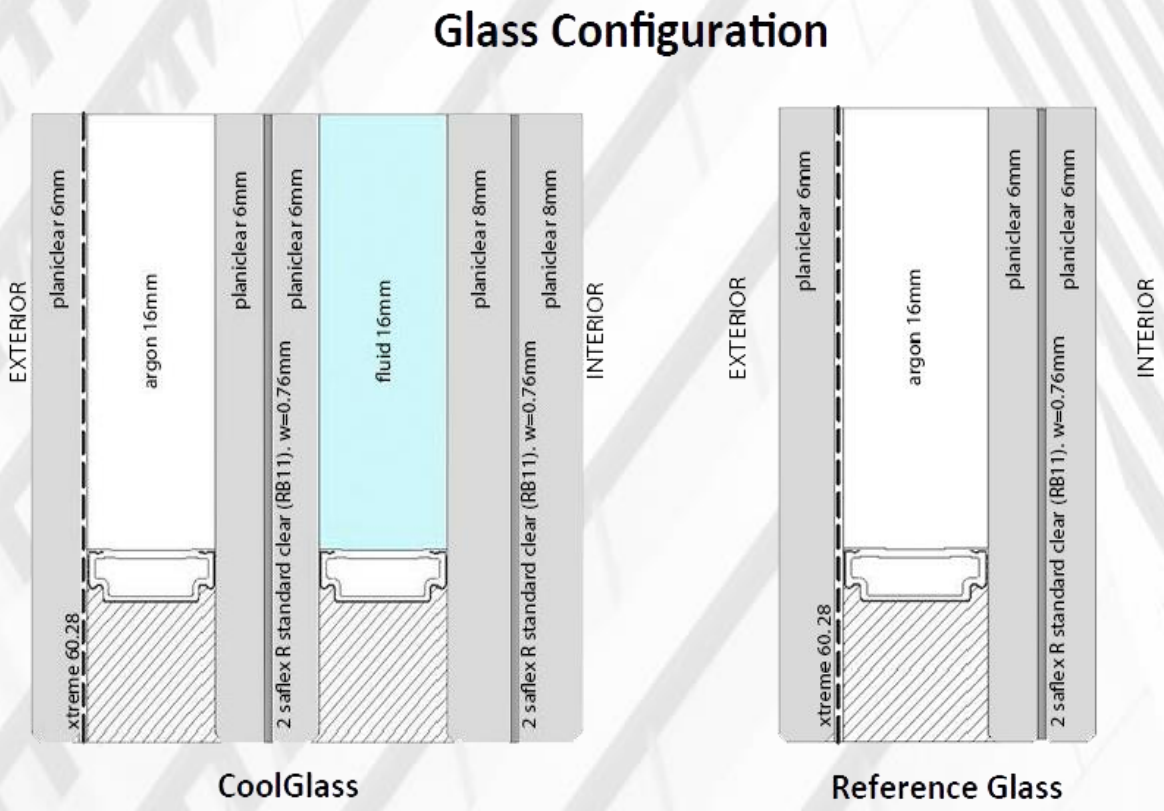
NEWSLETTER
Issue 2.2, November 2017

Horizon 2020 Research and Innovation Action – InDeWaG Project

InDeWaG Demonstrational Mock-up - Madrid

Configuration

The approach of InDeWaG project is to enable maximum use of daylight by a transparent glass facade and at the same time meet nearly zero energy performance standards. The main objective of the Spanish demonstrator is to validate the strategy of "energy rejection" through a CoolGlass envelope in order to achieve nZEB. CoolGlass is a triple glazing using highly reflective coating (Xtreme 60.28) positioned close to outermost glass pane aiming at minimizing the energy absorption. The concept of CoolGlass is to eliminate internal heat loads by circulating cool water through the water chamber facing indoors. This cool isothermal envelope allows insulating the building from outer climate conditions. The reference glass to which CoolGlass performance will be compared is a standard double glazing having the same reflective coating (Xtreme 60.28) deposited on the outermost glass pane.



The outer 16mm chamber of the Coolglass is filled with argon while the inner 16mm chamber is filled with circulating water. A water pump is connected to the inlet of the "CoolGlass" water chamber, whereas the "CoolGlass" outlet pipe carries the water to a heat exchanger. The heat exchanger consists of a shell (a large pressure vessel) with a bundle of tubes inside it. A fluid flows through the tubes (the tube side) and the other one flows outside the tubes, but inside the shell (the shell side). Heat is transferred from one fluid to the other through the tube walls.

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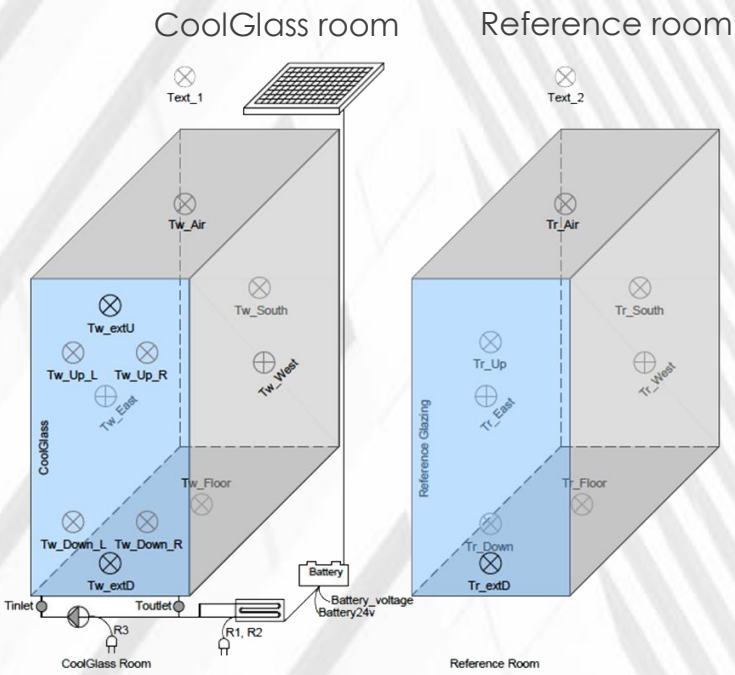
Mock-up design

The main strategy of this mock up is to reject solar energy by means of the CoolGlass module and achieve high levels of comfort in the interior of the cabin:

- For cooling down the interior of the cabin, the Peltier cooling device (powered by a battery charged by a PV panel) will serve cool water to the secondary circuit.
- For heating the interior of the cabin, an electric resistance wrapped around the circulator (powered by a battery charged by a PV panel) will provide hot water to the secondary circuit.



The mock-up is an autonomous mobile prototype consisting of a steel tube structure with dimensions 1.5 m x 1.0 m, mounted on rotating wheels with brakes and anti-tip buttress. Three of its facades, the floor and the roof are formed by opaque enclosures made of sandwich panel (aluminum sheet + 100mm of extruded polystyrene insulation). The main façade is composed of two glazings: Reference glazing (1x0.5m) and CoolGlass (1x0.5m), connected to its corresponding circulator. The total dimensions of the mock-up are 1.85 m height and 1.26 m width. The unitized module has solar panels on the roof that power the water circulation pump.

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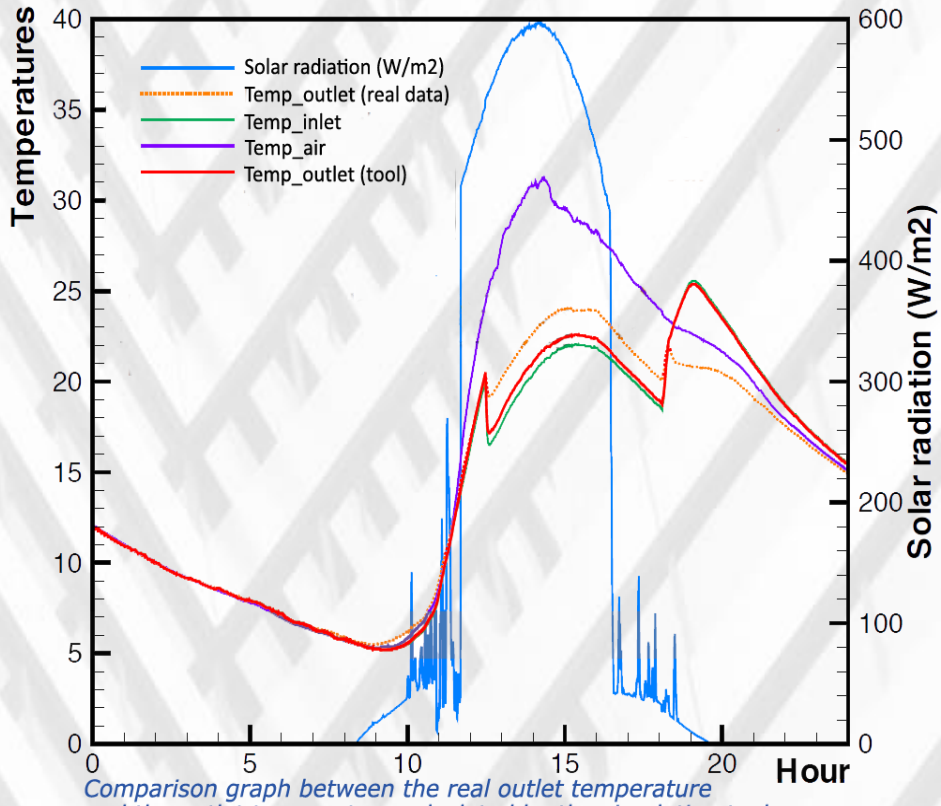
Objectives

The main objectives of the Spanish demonstrator are:

- To evaluate differences between isolated glazing and glazing integrated in an insulated room.
- Measurements for energy demand during the whole year.
- Comparison of thermal performances between the Reference Glazing and CoolGlass Module.
- Validation of nearly zero energy strategy based on a Peltier Cooler device and electric resistance powered by photovoltaic panels.
- Overheating evaluation of different surface finishes: White box and black box.
- Validation by means of real data of mathematical models for internal solar distribution.



Comparison graph between the real outlet temperature and the outlet temperature calculated by the simulation tool

One of the major objectives of InDeWaG is to expand state of the art building simulation software with additional modules that can calculate the dynamic thermal behaviour of WFG.

The mock-up is equipped with several temperature probes to monitor both exterior and interior temperatures and heat exchanger temperatures. The initial data gathered from the sensors (displayed on the graph above for 20th of September) shows that the outlet temperature follows similar curve as the one calculated by the simulation tool, when the input parameters in it are set the same as the real measured values. Despite the shape of the graphs being almost identical there is an average mismatch of 1.5 °C between the real data and the model. The explanation of this deviation is imperfection of the insulation of the mock-up. But nevertheless the initial results are promising and validate the results from the simulations and the calculation tools used to predict the behavior of the water flow glazing.

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This project has been funded by the European Commission under Horizon 2020 the EU Framework programme for research and innovation, Call - H2020-EE-2015-1-PPP. The project type is Innovation Action Project, Grant agreement number: 680441, InDeWaG - Industrial Development of Water Flow Glazing Systems.This document does not represent the opinion of the European Union, and the European Union is not responsible for any use that might be made of its content.

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PROJECT INFORMATION

Acronym: InDeWaG
Grant number: 680441

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