Buildings to save energy with mesh and management

Much of our building stock was designed and built before global warming, environmental protection and recycling became foremost in our minds and behaviours. It represents around 40% of energy consumption and 36% of CO_2 emissions

Revamping building envelopes, making façades and roofs more energy-efficient, is a key measure in retrofitting existing stock. Combined with a smart energy management system, building envelopes can slash energy consumption while improving indoor comfort.

One expert who has been working at the heart of this topic is Gonzalo Pinto Quijano, an architect specialising in sustainable buildings at Acciona. As part of the EU project BRESAER, he has helped design and test a pioneering lightweight structural mesh to boost the energy-performance building façades cool.

The mesh is a key component of a broader energy management system for residential and non-residential buildings in different climatic zones.

What is innovative about the BRESAER project?

The project's key innovation is the BRESAER system as a whole: the newly designed building envelope along with a building energy management platform for the retrofit of both residential and non-residential buildings. The system is modular and flexible, allowing it to adapt to different climatic conditions and architectural constraints. This is what sets BRESAER apart from existing retrofit methods.

The core component is a lightweight structural mesh, which was designed and developed as part of the project. It underpins the whole system and allows other components to be easily integrated.

How are the results shaping up?

We're on track although the design of the mesh was extremely challenging. We have a demo site where we test the mesh and the whole system in real-life conditions. It's located in a lecture building at the University of Burgos, northern Spain. In fact, we've nearly finished the retrofitting there and then we'll start to collect data and monitor performance. We've every reason to believe that this will match our projections and we expect all our targets will be achieved within the timeframe set out at the beginning of the project. We'll be testing primary energy savings, comfort, CO_2 emissions, costs, and the payback period.

In addition to a real-life demo site, the project features virtual demo sites. How does this work?

As we do the tests at the real-life demo site, we check the results against simulations that we're running at four different sites in other European climatic zones: Ankara in Turkey, Bucharest in Romania, Oslo in Norway, and Tartu in Estonia. This will help us grasp the feasibility of this kind of intervention and determine the replicability potential. The selected buildings are existing occupied buildings that take part in other current or concluded EU research projects.

The process is carried out by implementing the envelope system at model level in these four real buildings, adjusting the specifications of the developed solutions to the specific requirements of the virtual pilots. A simulation-based process compares energy consumption and indoor comfort before and after the “virtual retrofitting”.

Although the results obtained from these simulations in the virtual demos are not real measured data and cannot be considered as an immutable truth, they constitute a very powerful tool to gauge the replicability potential of the BRESAER system elsewhere and in different climatic zones.

Do the same tech solutions work in different climates/different-use buildings?

This question, in fact, links with the previous one. The results obtained from the “virtual demos” indicate that, in general, the payback of the BRESAER system is close to our target of about 7 years for most of the 4 virtual demonstrators analysed. However, this would only be achieved if the technology solutions are chosen and tweaked according to the specific climate and the use of the building in question. The results clearly show how the system needs to adapt.

In other words, there is no a single configuration of the BRESAER system that is optimal for all buildings and, in fact, that's the beauty of the system.

Can you walk through the main components of the system? And are they available and operational?

The retrofit tools are intended to assist designers, architects and building owners in selecting and assessing the system with regard to a specific target building. The tools are fully available for download and/or free use at the project's webpage by any interested stakeholder.

Basically, there are three tools, developed to guide and support the implementation and market uptake of BRESAER system, with complementary and different uses: **BRES-DES** is a web-based estimation tool that provides a series of technological combinations and energy saving estimates, based on a series of conditions specified by the user. It is intended for use in the early design stages of an energy retrofit using our system for building envelopes. Through this tool, we aim to help retrofit designers and stakeholders to advance their projects and obtain design suggestions and energy saving estimates, starting from existing data.

BRESAER geocluster is a web-based tool to visualise the potential of the system on a map of Europe. The tool enables the user to get an indication of the energy saving potential and the investment cost of different BRESAER envelope configurations for all geoclusters in Europe. Furthermore, single aspect information related to building stock, climate and costs is given by the tool to help the user to indicate the potential impact and applicability of the project's concept.

BRESAER BIM tool assists designers in assessing and configuring the system for a specific target building. The tool consists of two parts: CAD software with additions to support the BRESAER system, and an analysis tool launched from the CAD software. Currently the BIM tool is available as a Revit plugin.

What has been the reaction, have these tools been used already?

It is still too early to make a final assessment about user acceptance of the tools as the project has not yet ended. However, they have sparked much interest among external beta testers who have used them. So far, we're pleased with initial acceptance and confident in the tools' potential to be adopted by a range of building stakeholders.

By Mark Thompson