From passive to active: Face lifting facades

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The biggest current innovation in façade design stems from a modular façade with smart materials that act as an active skin to make old buildings energy efficient.

Today, newly built houses are designed to be as energy efficient as possible. This is good news for the planet and for homeowners' wallets – but what about the older houses?

Poorly insulated buildings from the 1950s to the 1990s are the focus of the European MeeFS project. It is developing innovative façades with integrated modular technologies to either cool, ventilate or heat the building wrapped within.

The upgrade will incorporate carefully chosen modules to transform the façade from a passive barrier to an active skin, explains Roberto Suárez Sierra, project partner from AST Ingeneria, based in Gijón, Spain, where he is a mechanical engineer and co-founder of the company.

The key component of the proposed system is the insulating structural grill, which covers the façade and hosts active modules such as shadow devices for windows and balconies or photovoltaic panels.

Development of the structural grill required a new approach, with a focus on composite materials that could bear the heavy load of the added modules, explains Frank Chauzu, director at CQFD Composites, based in Wittenheim, France. The researchers had a specific wish list for material properties.

"The material had to be mechanically resistant, durable, not too sensitive to corrosion and the outdoor elements," says Chauzu, "And in addition, the material had to have good thermal insulation properties."

Finding a material that ticked all the boxes was not straightforward. Aluminium is a near fit, but lacks suitable thermal properties. Foam is a great insulator, but a bit too floppy for the job.

The team settled on a thermoplastic composite, explains Frank, that "unites the mechanical properties, the durability and weak thermal conductivity." The material is compliant with fire safety standards and can be easily recycled. It is also estimated to have up to 2.5 times less environmental impact than more traditional materials such as aluminium.

To keep the solution affordable, the idea is to centralise production of the façade panels with integrated modules in a factory. "Our effort is focused on being the standard cost-effective market solution," says Suárez Sierra. The cost of installation should be offset by energy bills savings , sooner rather than later.

An expert in this field, Michael Krause, group manager of building systems and services at the Fraunhofer Institute for Building Physics IBP in Stuttgart, Germany, warns however against getting too bogged down in only measuring the benefit of retrofitting in terms of how many years of energy bill savings it takes to offset the cost of installation.

"You can't just look at the payback time," he says, "you also have to look at the other benefits, such as a much better indoor climate, better comfort for the building tenants, less condensation on walls. It's added value."

Artem Holstov, PhD student in the School of Civil Engineering & Geosciences in Newcastle University, UK, is developing so-called

hygromorph materials for building façades which can change shape depending on the humidity or moisture in the environment.

"Façade design attracts much research interest," he says, "The greatest energy savings can be achieved when using a combination of a good passive design, adaptive systems and renewable energy harvesting technologies. This allows integration of multiple functions into the building skin, including the structural and thermal envelope, into one elegant building element."

For Holstov, the retrofitting of conventional buildings using these smart adaptive technologies is "the biggest current innovation in façade design."

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