OPAQUE FAÇADE SYSTEMS CAN BE INTELLIGENT TOO!

What makes an intelligent façade?

Its ability to modify autonomously and reversibly some behaviours, thanks to an external control system which optimises the performance under different weather conditions.

Technologies applied on transparent façades are already in use and well developed. The most widespread dynamic behaviour in envelopes is the **autonomous control of solar thermal gains and natural lighting, through intelligent glass systems and mobile shading elements.**

But what about the rest of the building envelope?

Intelligent opaque components could play a relevant role in the building performance.

Traditional airtight thermal insulation is designed to optimise the performance for average annual conditions.

- It blocks the heat exchange under all climatic conditions and building uses
- It is not possible to take advantage of the outdoor climatic conditions to enhance indoor comfort or reduce cooling and heating demand

The heat flow can only be controlled opening and closing windows.

- The energy demand is not optimised according to thermal comfort
- It also allows for noise and pollution to come in
- Most of the times it depends on people's presence and individual behaviour

An intelligent opaque façade should automatically change, allowing or blocking heat exchange between indoors and outdoors, according to the specific condition occurring in that moment.

What if the opaque façade worked as a removable coat for the building?

Over the past few years many concepts of intelligent opaque façades have emerged. Many studies and simulations suggest that these concepts can effectively reduce thermal consumption, while also increasing the internal comfort.

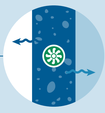
There are several solutions to control heat exchange between the internal and external environments.

1. Air exchange control through façade components

The air is moved by fans that change the pressure between inside and outside, taking advantage by the temperature in the ventilation chamber.

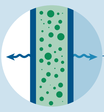
CHANNELS ON THE FAÇADE (PARIETODYNAMIC)

THE FAÇADE MATERIAL ITSELF (PERMEODYNAMIC)



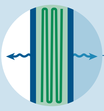
2. Heat flow control through dynamic insulation

The façade insulation can adjust its internal configuration, changing the transfer of heat (thermal transmittance) through elements accordingly.



GAS-FILLED PANELS

CLOSED-LOOP DYNAMIC INSULATION



MOVABLE MULTI-LAYER PANELS

3. Solar absorptance control through mobile coatings

The cladding can modify its geometrical shape and also that of the ventilation chamber, to control solar absorptance and consequent thermal gain. This solution works better when combined with a dynamic insulation.

MOBILE COATINGS, ON VENTILATED FAÇADES

Indoor Outdoor Internal façade configuration

Which solution is best for... ?

Heat control solution type	Noise insulation	Air pollution insulation	Durability	Cooling demand reduction	Heating demand reduction
NATURAL VENTILATION	★	★	★★★	★★	★
PARIETODYNAMIC	★	★★★	★★	★★	★★
PERMEODYNAMIC	★★★	★★★	★	★★	★★
GAS-FILLED PANELS	★★	No air exchange	★★	★★★	★★★
CLOSED-LOOP DYNAMIC INSULATION	★★	No air exchange	★★	★★★	★★★
MOVABLE MULTI-LAYER PANELS	★	No air exchange	★★	★★★	★★★
MOBILE COATINGS	No noise insulation	No air exchange	★★	★	★★★

Combining intelligent opaque façades with adaptive transparent façades and other bioclimatic strategies could eliminate the demand for heating and cooling!

Credits: Eurac Research / Other sources: Juaristi, M.; Gómez-Acebo, T.; Monge-Barrio, A. "Qualitative analysis of promising materials and technologies for the design and evaluation of Climate Adaptive Opaque Façades". Build. Environ. 2018, 144, 482–501

BUILD UP is an initiative managed by the European Commission's European Climate Environment and Infrastructure Executive Agency (CINEA)