LIMITING AND ADAPTING GLAZED FACADES

HAZARD

HEAT

IMPLEMENTATION STEP

CONSTRUCTION

RENOVATION

AREA OF ACTION

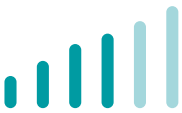
ENVELOPE

COSTS

€ € €

low **medium** high

LEVEL OF SKILL



medium

Because they are the weakest point in a building's thermal insulation in both summer and winter, glazed façades need special attention. Their poor insulation allows heat to penetrate the building in summer and escape in winter. The transparency of glazing is considered a major inconvenience during the summer, because by allowing the sun's rays to pass through, glass surfaces play a major role in heating up the interior of the building.

IMPACTS

Limiting, carefully orientating and adapting glazed surfaces helps to reduce the penetration of heat and solar radiation into the building, and thus to maintain thermal comfort for occupants in summer.

Improving the design of glazed areas reduces the need for cooling systems, such as air conditioning, thus diminishing the environmental impact of the building. The energy savings achieved are likely to bring down the building's energy bill.

INSTALLATION GUIDE

To improve thermal comfort in buildings, it is essential to :

- **Limit glazed surfaces**, particularly on the east and west façades, which are the most exposed in summer, and position openings to minimise solar gain in summer and maximise it in winter (south façade). This measure can only be implemented on new builds or major renovations.
- **Insulate glazed façades**, using double or triple glazing to minimise heat exchange by conduction and convection.

Solar film coatings can be used on glass surfaces. When sunlight hits a surface, some of it is absorbed and converted into heat. Solar films act by filtering part of the sunlight, including ultraviolet (UV) and infrared (IR) rays. As a result, they reduce the amount of solar energy that penetrates indoor and consequently the heat in the interior space, helping to maintain thermal confort for occupants.

Another option is to use special glass that reduces solar gain, such as low-emissivity glass (which limits the sun's rays in both summer and winter) or smart glass that darkens and lightens to control the penetration of the sun (e.g. thermochromic glass that reacts to changes in temperature, electrochromic glass that changes colour on command, either manually or automatically, or photochromic glass that adapts to changes in light intensity).

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Example of a building with too much glass (Paris, France)

WEAK POINTS AND STRONG POINTS

⊕ While solar radiation is a major nuisance in summer, it's a great help for passive heating in winter. That's why it's advisable to choose flexible solutions to limit solar gain, such as sun protection devices or smart glass.

⊖ Transparent and reflective walls pose a danger to birds, which can't see them and can be injured by hitting the building. To avoid collisions, high-contrast markings or a blurring mask can be applied to glass surfaces.

⊕ When choosing glazing, you should also consider other factors such as sound insulation, the amount of natural light to ensure the well-being of occupants, and the possibility of creating a draught to create natural ventilation.

MALADAPTATION

Maladaptation can result from the following:

Creation of a rebound effect

Always start by limiting the surface area of glass walls, and then adapt it as best as possible, rather than opting for a high number of walls fitted with low solar gain glass or smart technologies. This approach avoids causing an undesirable rebound effect. However, an excessive reduction in glazed surfaces limits the opportunities for passive cooling, in particular the possibility of establishing effective natural ventilation.

Increased environmental footprint

The production of low solar gain or smart glass tends to involve more complex manufacturing processes, more intensive chemical and energy processes, the use of special technologies, and increased consumption of resources, potentially resulting in a bigger environmental footprint than for conventional glass. However, it's important to note that the exact environmental impact depends on a number of factors, including the materials used, manufacturing methods, energy sources, transport distances and other sustainability considerations. To correctly assess the specific environmental footprint of these different types of glazing would mean taking into account the whole life cycle, including production, use and end of life, as well as the specific characteristics of each glazing option and local conditions.

MONITORING INDICATORS

MONITOR MY ACTIONS FOR CLIMATE CHANGE ADAPTATION

+/− : Quantitative indicator ★ : Qualitative indicator

INDICATORS OF MEANS	INTERPRETATION
+/− Percentage of glazed surface area (%)	Balance between providing natural light and preventing rooms from overheating in summer
+/− Percentage of glass walls that can control the penetration of solar radiation (%)	To be maximised

INDICATORS OF RESULTS	INTERPRETATION
+/− Comparison between the temperature of rooms with glass walls and a control situation* without glass walls (°C)	Temperature without glass walls < that of control situation*
+/− Comparison between the temperature of rooms with adapted glass walls and a control situation* (°C)	Temperature with adapted glass walls < that of control situation*
+/− Comparison between energy consumption for cooling with improved insulation and inertia of opaque walls and that of a control situation* (kWh)	Energy consumption dedicated to cooling with improved insulation and inertia of opaque walls < that of control situation*

**The control situation is defined by the parameters set to isolate the influence of the adaptive action (similar conditions: weather, time of measurement, space, etc.).*

TOOL

● *Cerema* has designed the RITE tool (Risque d'Inconfort Thermique d'Été - **Risk of Thermal Discomfort in Summer**) to rapidly evaluate the indoor summer comfort of new buildings and renovations in response to climate change. Easy to use by all actors in the building sector, *RITE* has so far only been developed for residential housing.

FIND OUT MORE

Agence Régionale de l'Environnement et des Nouvelles Energies d'Île-de-France, Institut pour la Conception Écoresponsable du Bâti (ICEB) (2014), *Les guides bio-tech: Confort d'été passif*

Cerema (2023), *Evaluation du Risque d'Inconfort Thermique d'été face au changement climatique.*

Guide Bâtiment Durable (2014), *Optimiser l'architecture pour limiter les besoins*

Institut national de Santé Publique du Québec (2009), *Mesures de lutte aux îlots de chaleur urbain*

Credits: Ooshot - Xavier Alexandre Pons

REAL-LIFE EXAMPLE

BNP PARIBAS REAL ESTATE

BNP PARIBAS REAL ESTATE

BUILDING: METAL 57
BOULOGNE BILLANCOURT
SURFACE AREA: 37,000 M²
USE: OFFICES AND SERVICES
COST: 600€/M² OF GLAZING

In 2022, BNP Paribas Real Estate delivered a building complex offering offices and service areas. To preserve the industrial heritage of the site, 50% of the building has been renovated. A new adjoining building has also been delivered. To preserve the building, electrochromic glass has been installed to the north and east of the renovated section. This glazing changes tinted according to the light, while maintaining transparency. It provides visual comfort and solar protection equivalent to that of closed blinds. On the south side, the facade was cladded with micro-perforated zinc (20% voids) to let in natural light. More generally, the project has been designed to optimise the ratio of glazed to opaque surfaces. The building envelope provides excellent thermal insulation, limits solar gain in summer and ensures an abundance of natural light (the interior streets create light wells). Electrochromic facades can be installed in the same way as conventional facades, with the exception of the need to run and connect power cables in the structure. They are also very easy to maintain, and eliminate the need to install and maintain blinds. These glazings are expensive because they are technically upgraded. A laminated component reacts to a low electrical current, causing the tint to change. Although consumption is very low, this type of glazing requires a power supply, potentially a source of vulnerability in the event of network damage. Nevertheless, this type of glazing reduces the need for air conditioning and allows less heat loss. They are a great solution to the seasonal contradiction: letting in the sun's rays in winter and protecting against its heat in summer! Finally, the transparency preserves the view of the outside, making the spaces more pleasant and conducive to the well-being of the occupants.

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