

Daylight and glazing requirements in new constructions

Minimum glazing surface for genuinely sustainable buildings

Glazed surfaces in buildings play a pivotal role to ensure the design and construction of genuinely sustainable buildings. The use of glass in constructions delivers economic, environmental and social objectives, all of which are central when defining sustainable buildings. In order to support a shift towards the design of genuinely sustainable buildings, **Glass for Europe calls on national and local decision makers to adapt thermal regulations and local urban planning regulations, to include minimum glazed surfaces in new constructions and major renovations.**

Thanks to continuous innovations, glazing solutions have achieved very high levels of energy performance while their environmental impacts throughout the life-cycle have been minimized. At the same time, **glazed surfaces in buildings maintain their distinctive feature (i.e. transparency), which allows them to provide to occupants of buildings both access to natural daylight and a visual connection with the external environment.** The positive effects of daylight and views to the outside world on human beings are widely researched and acknowledged: they improve comfort and sensations of well-being for occupants while providing a healthier indoor environment.

In order to sustain the development of genuinely sustainable buildings, Glass for Europe believes that building regulations and construction codes should adapt alongside improvements to construction materials and should build on scientific evidence to provide better places for building occupants. For this reason, Glass for Europe calls for

- ▶ **the inclusion of minimal glazed surface requirements within thermal regulations**
- ▶ **the deletion of outdated maximum glazed surfaces requirements¹ from local urban planning regulations**

Today, some European countries have already introduced a daylight factor and minimal glazing requirements within their national construction regulations. Glass for Europe welcomes the pioneering initiatives of countries such as France which requires a minimum 16% of glazed area for new residential constructions². Nevertheless, there is still room for improvements since data show that between 20 and 30% of glazed surface would be the optimum for residential buildings depending on local climate.

1. Larger windows to design healthier and more comfortable buildings

Nowadays, people spend 80% of their lifetime within buildings whereas humans' quality of life strongly depends on daylight. Because humans are outdoor animals, **daylight plays a fundamental role in the body-clock synchronisation and the maintenance of a stable circadian rhythm.** All this considered, it is clear that access to daylight is vitally important and that concerns over occupants' health and well-being should predominate when setting requirements in the design of buildings. As

¹ These requirements are based on the outdated assumption that glass is a weak point in buildings generating excessive heat losses in colder climates and overheating in warmer climates. This is no longer the case with readily available energy-efficient glazing solutions. Today, glass products provide the best energy balance of all building materials thus these outdated limitations need to be suppressed.

² Ratio: glazed surface compared to living surface.

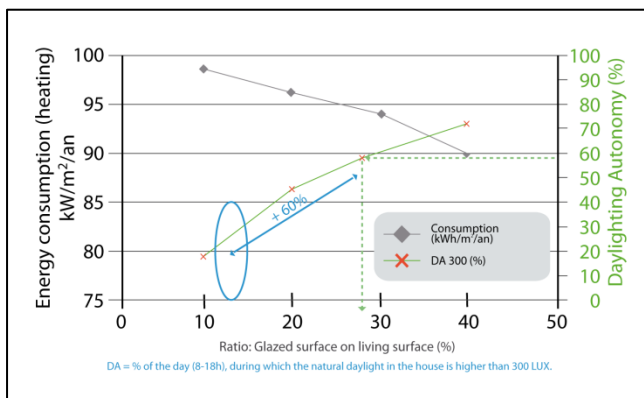
demonstrated by a recent study from the *American Academy of Sleep Medicine* for example, workers without access to natural daylight *reported poorer scores than their counterparts on quality of life measures related to physical problems and vitality, as well as poorer outcomes on measures of overall sleep quality, sleep efficiency, sleep disturbances and daytime dysfunction.*³

There is a vast scientific literature on the benefits of natural daylight into buildings and views to the outside world. Studies in hospitals, schools and offices found the following:

- in healthcare buildings: patients with access to natural daylight leave the hospital sooner, are less exposed to risk of post-operative depression and need less pain relief⁴.
- in schools: students in buildings exposed to natural daylight achieve better scores, are calmer and more focused⁵.
- in offices: the absence of windows has been connected to higher stress levels and increased absenteeism due to sick leave⁶.

The same benefits (i.e. well-being, quality of life, health benefits etc.) are expected in residential buildings since homes are the places to provide rest and sleep.

2. Larger windows to improve energy efficiency in buildings



Energy and thermal simulations in different climate zones have demonstrated that enlarging the area of the external envelope occupied by high-performing windows **contributes to reducing the overall energy consumption of buildings.** As a matter of fact, in many existing low energy buildings across Europe, glass already plays an indispensable role in achieving high energy performance standards.

Modern glazing solutions are becoming more energy efficient than the opaque fabric, as they provide free solar heat gains (g value) while guaranteeing high thermal insulation (U value). As a result, enlarging high performing glazed surfaces can contribute to reducing energy consumption from both heating and cooling. In addition, if properly oriented, windows improve the daylight autonomy, thus lowering the need for artificial lighting⁷. The above simulation suggests that, depending on the local climate, between 20 and 30% of glazed surfaces compared to the floor ratio is the optimum to guarantee a good level of daylight autonomy and energy performance⁸. It is therefore no surprise that the highest energy efficient and most sustainable buildings recently built across Europe have larger glazed surfaces than average⁹.

³ American Academy of Sleep Medicine, "Study links workplace daylight exposure to sleep, activity and quality of life." ScienceDaily. <http://tinyurl.com/ngqhi3z>

⁴ David Strong Consulting, *The distinctive benefits of glazing: the social and economic contributions of glazed areas to sustainability in the build environment*, 2012. <http://tinyurl.com/kez68ny>

⁵ Ibidem.

⁶ Ihab M.K. Elzeyadi, Ph.D., *LEED Daylighting-Bias and Biophilia: Quantifying the Impact of Daylighting on Occupants Health*, School of Architecture & Allied Arts - University of Oregon, Eugene, USA <http://tinyurl.com/ocfk7cw>

⁷ Studies of newly constructed Nearly-Zero Energy Buildings show that artificial lighting becomes one of the biggest source of energy consumption in buildings when the building's daylight autonomy has been neglected. BPIE, *Principles for nearly Zero-Energy Buildings*, 2011. <http://tinyurl.com/ob95s58>

⁸ Saint-Gobain's internal study. Simulation of thermal performance and glazed areas in residential buildings.

⁹ Glass for Europe, *The smart use of glass in sustainable buildings*, 2013. <http://tinyurl.com/pd7ozx3>



3. 3. Larger windows to reduce buildings' environmental footprint

Glass is a sustainable material and contributes to minimizing the environmental footprint of buildings. The flat glass manufacturing process requires low quantities of water and generates very little waste. Inevitably, it has a cost in terms of energy use and CO₂ as the melting process requires the furnace to be heated to temperatures as high as 1650°C. Nevertheless, CO₂ generated during the manufacturing phase is more than compensated by the CO₂ saved by replacing inefficient glazing with high-performing windows. In addition, windows hold the smallest environmental footprint across all LCA indicators compared to other parts of the building envelope¹⁰.

Technical recommendations on glazing in residential buildings

Glazing ratios in buildings are intended to optimize energy performance, to guarantee access to daylight and to improve natural ventilation in order to ensure the comfort and well-being of occupants, while reducing the overall environmental footprint. Below are listed key four principles that should guide architects and specifiers:

- ▶ A minimum of 20% of glazed surface compared to the floor area for residential buildings
- ▶ Multilateral glazing with different orientations to ensure access to natural daylight throughout the day
- ▶ Roof skylight windows to add more natural light and improve ventilation
- ▶ Interior glazing to allow natural light to flow throughout the building

Glass for Europe is the trade association for Europe's flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire building glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG-Group, Saint-Gobain Glass Industry and Siseçam-Trakya Cam, and works in association with national partners gathering thousands of building glass processors and transformers all over Europe.

¹⁰CIRCE, UNESCO, uniTwin, Tecnalia, Technical analysis in support of development of EU Ecolabel and GPP criteria for Office Buildings

