



Frequently Asked Questions

Energy saving glazing solutions and a low carbon economy

GLASS FOR EUROPE
Building, Automotive, Solar-Energy Glass

Pictures of page 14 are a courtesy of AGC Glass Europe.





Come and **take a look into the world of glass**

Light, comfort, wellbeing and style are well-known benefits of today's windows, glass building façades and construction materials. Advanced technologies in windscreens and windows for cars and other transport provide safety, security and comfort. Glass actually offers a lot more with significant benefits in terms of energy savings, energy-efficiency, recycling, resource efficiency, etc.

Come and discover how energy saving glazing solutions and advanced glass technologies contribute to Europe's move towards a sustainable low carbon economy. Take a look into the world of glass.

Table of **contents**

Why is energy saving so important?	3
What role can Europe's buildings play?	4
What role can glass play in reducing energy consumption in buildings?	5
What are the glazing solutions available and how do they work?	6
What about double glazing and triple glazing?	7
Is energy-efficient glazing of any real use in the South of Europe?	8
What should glazed areas be in new constructions?	9
What is the pay-back period or return on investment of upgrading glazing?	10
Beyond glazing, how else can glass contribute to sustainable buildings?	11
Is glass also playing a role in the development of cleaner cars and transport?	12
What is the life cycle impact of energy efficient glass?	13
Is the glass manufacturing process energy-efficient?	14
How can energy efficiency investments help the EU economy?	15
How can policy makers help?	16

Why is **energy saving so important**?

Today Europe faces a triple challenge in the field of energy policy as it seeks to ensure the security of its energy supply, address climate change and deal with fluctuating energy costs. **The most secure energy is saved energy**, and reducing energy consumption can provide effective and low cost solutions to many of Europe's energy and climate challenges by:

- **Cutting the CO_2 emissions** caused by energy generation
- **Reducing Europe's dependence on energy imports**, which are set to rise to 70% of EU energy consumption by 2020
- **Avoiding negative economic impacts** caused by steadily rising energy prices

If Europe meets its target of a 20% reduction in energy consumption by 2020, this would amount to an annual reduction of some 780 million tonnes of CO_2 emissions. Beyond this horizon, the European Commission committed in the road map towards a Low Carbon Economy to reducing energy consumption in buildings by 88 to 91% by 2050. This would require a tripling of Europe's buildings deep renovation rate therefore **a much more ambitious approach will have to be at the heart of Europe's efforts to save energy if these targets are to be achieved.**

The most secure energy is saved energy.
Europe needs a much more ambitious energy-efficiency policy to triple the renovation rate of Europe's buildings.

44% of all energy consumed in the EU is used in buildings.
A greater emphasis on the existing building stock is essential.

What role can **Europe's buildings play**?

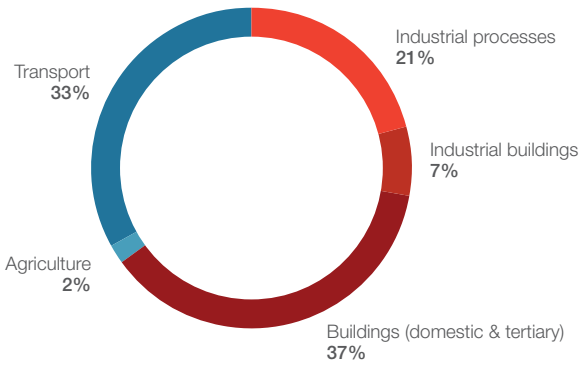
44% of all energy consumed in the EU is used in buildings, domestic, tertiary or industrial buildings.[1] Making new and existing buildings as energy efficient as possible can therefore make a significant contribution to reducing CO_2 emissions while **conserving valuable energy resources**. Most buildings we occupy today were constructed at a time when energy efficiency was not such a major concern and as a result, a huge amount of energy is used for heating, cooling and lighting. Given that existing buildings are replaced at a rate of about 1% per annum, **a greater emphasis on the existing building stock is essential** for Europe's policy to produce permanent CO_2 emission reductions.

The technology and know-how to reduce energy consumption from buildings is there. The legal framework is being adapted and the recast EU Energy Performance of Buildings Directive, if properly implemented in the Member States, will make it mandatory to use energy-efficient, cost-optimal solutions each time a building component is replaced.

What is missing now is the political impetus and subsequent measures for Europe to triple the renovation rate of existing buildings. Improving the energy performance of buildings is a cost-effective way of fighting climate change and improving energy security, while also creating jobs.

These jobs, particularly in the building sector are inherently local jobs such as assemblers, installers, etc. and Europe should not under-estimate the economic potential of investing in energy efficiency in buildings.

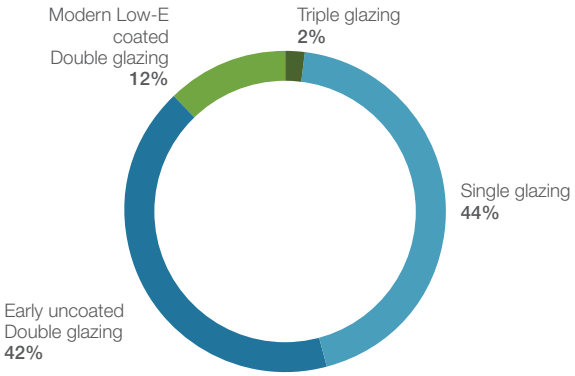
Share of total EU energy consumption



[1] European Commission – 'EU Energy and Transport in Figures – Statistical Pocket Book 2010' – 2010. It is commonly assumed that a quarter of the industry energy consumption is actually used for industry buildings.

What role can glass play in **reducing energy consumption in buildings**?

Glazing type distribution in the EU



Using advanced glazing solutions can significantly reduce the need for heating and cooling in buildings, thereby reducing energy consumption and associated CO_2 emissions. Independent studies[2] show that **savings of more than 100 million tonnes of CO_2** could be achieved annually if all Europe's buildings were fitted with advanced energy saving glass.

On the basis of these findings, the EU could achieve around one third of the energy saving targets for buildings identified in the 2006 "Action Plan for Energy Efficiency" simply by **promoting the use of energy saving glazing**.

The potential for improving the glazed facades and windows of Europe's building is enormous. A recent study on glazing type distribution in the EU building stock[3] reveals that:

- **44% of the windows in Europe's buildings are still single glazed**.
- Less than 15% of Europe's windows contain energy-saving glass whereas these solutions have been available on the market for over 20 years!
- Early uncoated double glazing is still used in a vast number of buildings. Although their energy performance is limited compared to solutions available nowadays, they are too often regarded as efficient by poorly informed property owners.

Savings of more than 100 million tonnes of CO_2 could be achieved annually with the use of energy efficient glass.

[2] TNO Built Environment and Geosciences – Potential impact of low-Emissivity glazing on energy and CO_2 savings in Europe – TNO Report 2008-D-R1240/B – November 2008.

[3] TNO Built Environment and Geosciences – Glazing type distribution in the EU building stock – TNO Report TNO-60-DTM-2011-00338 – February 2011.

Coated glass products considerably reduce energy demand and can become net contributors of energy in buildings.

What are the glazing solutions available and how do they work?

Low-Emissivity Glass

Low-Emissivity (Low-E) glass is specially treated with a transparent coating. The coating reflects heat back into the building, thereby reducing the heat loss through the window. It also reduces the heat transfer from the warm (inner) pane of glass to the cooler (outer) pane, thus further lowering the amount of heat that escapes from the window. These properties thus reduce the demand for energy in order to heat the building.

In addition, the coating allows large amounts of free solar energy to enter the building, thereby heating it passively. Low-E insulating glazing can therefore be a **net contributor of energy in buildings.**

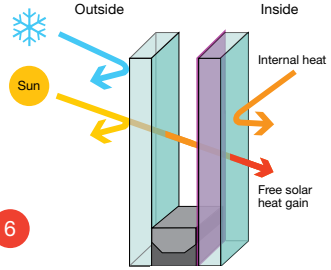
Other innovations such as triple glazing products can offer additional improvements in the window's insulating properties while the use of low-iron glass can increase light transmittance and free solar-heat gain. These technologies offer additional benefits in terms of energy efficiency.

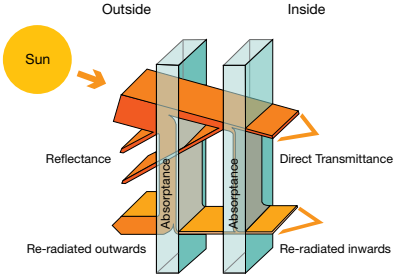
Solar Control Glass

Solar control glass is a high performance coated product that reflects and radiates away a large degree of the sun's heat while allowing daylight to pass through a window or façade. The indoor space stays bright and much cooler than would be the case if normal glass were used.

Solar control glass incorporates invisible layers of special materials which have the dual effect of allowing sunlight in, while repelling solar heat.

This technology is particularly beneficial in warmer southern climates **where it can help to reduce the load on a building's air conditioning system, thus reducing energy demand**, while maintaining a comfortable working environment. In addition, solar control glass units are typically double glazed and therefore combine both Low-E and solar control properties, to maximize insulation in cooler periods and solar control properties in summer.





Triple glazing helps achieve extra energy savings and is essential to nearly-zero energy buildings.
Triple glazing becomes more economic.

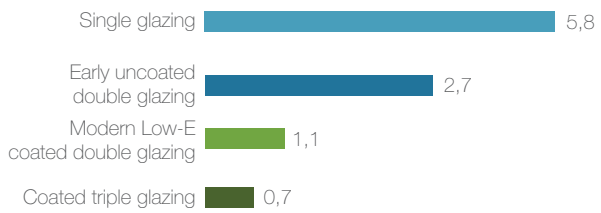
What about **double glazing and triple glazing?**

This is a very legitimate question but there is no one-size fits all answer as it will depend on a number of parameters including the building or house itself, its location, the insulation of the rest of the building envelope, etc. Tailor-made advice from professionals is always required. The following can however be said.

First of all, there is no such thing as standard double glazing. Double glazed windows installed from the 70s to the late 80s after the first series of petroleum crises helped achieved energy-saving at the time but are now completely outdated.

Double-glazing units now readily available in European markets are equipped with coating, such as Low-Emissivity coatings and / or Solar-control coatings.

Glazing insulation performances: U_g value



Coatings increase considerably the insulation performance of the double-glazed units **but they also allow free solar-heat gains**. Buildings equipped with early uncoated double glazed windows or glazed facades can therefore be upgraded with Low-E glazing, which can be between 2.5 to 5 times more efficient.

Triple glazing is even more efficient and helps achieve extra energy savings. The 'U value' of coated triple glazing units usually reaches 0.7, which is over 8 times more efficient that single glazing (U value of 5.8) and nearly 4 times more efficient than early basic double glazing; (the lower the U value, the better the insulation).

In general terms, **coated triple glazing is an essential component of 'nearly-zero energy buildings'**, which is to become the standard for all new buildings in the EU by 2020. High performance triple glazing has become the 'norm' in Scandinavian countries in recent years, and it is now enjoying rapid growth in Germany, where it now represents nearly 40% of the glass market.

As a result of its wider use in these countries, triple glazing has become more economic. Studies[4] also show that significant additional energy savings can be achieved in the central parts of Europe with cold winters such as the UK, Poland, France, Benelux, etc. thanks to the installation of triple glazing on the most exposed orientations of buildings, in combination with Low-E double glazing on the south facades.

[4] TNO Built Environment and Geosciences – Potential impact of low-Emissivity glazing on energy and CO_2 savings in Europe – TNO Report 2008-D-R1240/B – November 2008.

Is energy-efficient glazing of any **real use in the South of Europe**?

Yes. Even in the warmest regions of Europe, heating in winter is often necessary. It is true however that **preventing over-heating in summer is the main challenge** for most types of building. Thanks to solar-control coatings, glazing can play a role in preventing over-heating in buildings and therefore **reduce the use of air-conditioning**,[5] which is a major consumer of energy in Southern Europe.

In addition, solar-control glazing most often comes in double glazed units, which provides insulation in winter. Solar-control and Low-Emissivity properties can be combined into a glazing unit thus further **contributing to insulation from both cold and heat depending on the season**.

This most often provides the best energy saving balance since free solar heat gains are only limited during a few winter months and are compensated by reduced loads on air-conditioning units for the most part of the year. Up-grading to energy-efficient glazing in Southern Europe is thus an efficient way of increasing indoor comfort while making substantial energy savings.

Preventing over-heating in summer is the main challenge
to reduce the use of air-conditioning.
Solar-control glass provides the best energy saving balance.

[5] TNO Built Environment and Geosciences – Impact of solar control glazing on energy and CO_2 savings in Europe -TNO Report 2007-D-R0576/B – July 2007.

What should glazed areas be in **new constructions?**

The influence of glazing on the energy performance of a building is only one of several factors which will determine the area of glazing chosen by an architect.

Traditionally, glazing was regarded as the "weak point" of the building envelope. This was because single glazing or uncoated double glazing had a relatively high heat loss compared to other parts of the building fabric. Modern glazing solutions however, with their coatings and inert gas fillings, can reduce heat loss to levels approaching those of the opaque fabric. But, unlike the opaque components, glass allows free solar heat to enter the building. In most cases, the gains exceed the losses and so **large windows become net contributers of energy**.

In situations where architects wish to avoid solar gain, designers have the option to use glass with a solar control coating to reject unwanted heat. Since these coatings also have low emissivity properties, large areas of glazing can be used without excessive heat losses and demands on the air conditioning system.

Glazing also allows **daylight to enter into buildings**. The larger the glazed area, the lower will be the need for artificial lighting. This is a particularly valuable benefit of glazing, as electricity is the most expensive and carbon intensive form of energy in many countries. Daylight also makes buildings more comfortable and pleasant places. It contributes to building occupants' well-being, health and productivity.

Many green building certifications, such as the Active House concept,[6] include specifications on 'daylight factor' and 'direct sunlight availability'. Some countries, such as France, even go further in imposing minimum surfaces of glazed areas within new constructions.[7]

It is therefore no surprise that **many architects specialising in low-energy consumption buildings promote large glazed areas** and that these glazed buildings and houses regularly win 'green awards'.

Thanks to these unique properties of modern glazing, architects now have a **new-found freedom to incorporate large areas of glazing** as they wish into their designs, knowing there will not be any negative impact on the energy performance of a building.

Unique abilities to limit heat loss, control solar gain and admit daylight. Modern glass liberates design!

[6] The Active House Concept developed building specifications for 'buildings that give more than they take': www.activehouse.info

[7] Since 2005, the French Thermal Regulation imposes minimum glazed areas for new constructions in proportion to the overall surface. Last year, this minimum surface was in fact increased by 30% to reach a minimum of one sixth of the overall built surface.

Compared to the lifetime energy savings, payback periods are short.
Choosing high performance glass is the most cost-optimal choice.

What is the pay-back period or **return on investment of upgrading glazing**?

Calculating the return on investment of upgrading complete windows is difficult as it depends on the type of glazing initially in place, the energy source and fluctuations in prices, the energy needs, the energy-efficiency of other components of the building envelope, etc. It must also take account of potential financial incentives or fiscal rebates which are often granted when choosing best performing glazing.[8] Depending on all these various parameters, **the payback period of replacing complete windows can range between 3 to 9 years and the situation varies between countries**. It is clear anyhow that compared to the lifetime energy savings - a window stays in a building for 25 to 30 years on average - the **payback period is much shorter**, while providing the added benefit of long-lasting energy bill and CO_2 savings.

That being said, what is all the more important is that **the incremental cost of installing high performance glazing when a building's windows are replaced is relatively small**. Indeed, when installing replacement windows, a large proportion of the costs results from the framing materials and most substantially from the cost of labour to assemble and install the windows on-site. The incremental cost of choosing high-performance glass compared to ordinary glazing is therefore a very minor proportion of the overall installed cost. As a consequence, when windows are being replaced, **choosing high-performance glass is the most rationale and cost-optimal choice**.

A simple tool has been developed in the UK to simulate **the savings in the energy bill**, which can be expected from upgrading windows.[9] As a simple illustration, this tool shows that for a traditional detached house in the UK heated with gas, upgrading from single glazing to an 'A-rated window'[10] equipped with Low-E coated double glazing generates savings in the range of 570 EUR annually. Choosing less efficient windows would mean lower savings and reduced financial incentive.

This energy saving calculator is only an indicative tool and each situation needs to be assessed individually.

Finally, the choice of high-performance glazing must also be seen as a **property investment**. With the introduction of mandatory Energy Performance Certificates for buildings, building owners and purchasers now have a means of expressing and understanding a building's energy performance. This has facilitated a growing recognition that the most **energy efficient buildings have higher inherent value and greater marketability**, particularly in today's competitive property market.

[8] EuroACE - Making Money Work for Buildings: Financial and Fiscal Instruments for En¬ergy Efficiency in Buildings - September 2010.
[9] GGF Energy Saving Calculator: http://www.ggf.co.uk/carbonCalculator.aspx
[10] In the UK, windows are rated according to their energy performance by way of the BFRC scheme, British Fenestration Ratings Council. Glass for Europe would like to see such a window energy label to be generalised throughout Europe in order to provide meaningful and understandable information to consumers on the performance of different windows.

Beyond glazing, how else can **glass contribute to sustainable buildings**?

Glass plays an important role in the generation of solar power by way of two technologies: solar thermal and photovoltaic.

Photovoltaic technologies are used to convert solar energy directly into electricity. There are many different technologies available to suit various requirements and they can come in various shapes and colours offering flexibility for design integration and building integrated applications (BIPV). The most common photovoltaic technology is based on crystalline silicon solar cells. In this application glass acts as a protective outer layer, while transmitting the solar light to the photovoltaic cells interconnected underneath. In another technology called 'thin films', transparent conductive coated glass not only allows light through to the photoactive films, but also conducts the generated electricity out of the modules.

Solar thermal collectors are intended to collect heat which is then used to supply hot water or heat exchangers, for domestic or industrial applications. There are various kinds of solar thermal collectors but most require a flat glass cover, or glazing, which serves not only to protect the panel while letting the sunlight through, but also to prevent cooling of the panel from exposure to cold air.

Thanks to high-tech glass, the properties of solar-energy technologies are optimised. Indeed, extra-clear glass and mirrored glass can also be used to produce electricity from the sun at utility scale in Concentrated Solar Power systems (CSPs).

High-tech glass enhance the efficiency of solar-energy technologies: photovoltaic panels and solar thermal collectors.

Is glass also **playing a role in the development of cleaner cars and transport**?

As a supplier to car makers, the glass industry is aware of its responsibility to offer automotive glazing solutions which help reduce vehicles' energy consumption and the overall environmental footprint of road transport.

One essential method of improving vehicles' energy efficiency is to reduce their overall weight. Nowadays, the average glass content in a vehicle represents only 3% by mass.[11] If this figure is relatively low, it is thanks to **the glass industry's efforts to reduce glass windshields and windows weight** while increasing safety and security for passengers. In addition, glass is now incorporated as a structural component thus limiting the need to recourse to heavier materials to guarantee the structural integrity of vehicles. Glass components can therefore increase in size in order to accommodate newer aerodynamic designs. In parallel, technologies are being developed to reduce even further the weight of glass in vehicles.[12]

Another way of reducing fuel consumption and extending the range of electric vehicles is to limit the need for air-conditioning. The glass industry has developed solar control glazing which provides not only good visibility and durability but also minimizes solar heat entrance inside vehicles exposed to the sun. Its use can considerably lower the need to air-condition vehicles' cabins or at least to reduce its load. In this way, **solar control glass in vehicles helps save between 2 and 4% of gasoline,**[13] **improves passengers' comfort and contributes to cleaner cars**.

Last but not least, **automotive glass is dismantled, processed and recycled** at the end of vehicles' lives. In line with legal requirements, systems are in place and being constantly improved to achieve higher recycling rates.

Constant efforts to reduce weight. Solar control glass helps save energy, improves passengers' comfort and contributes to cleaner cars.

[11] N. Kanari, J.-L. Pineau, and S. Shallari - End-of-Life Vehicle Recycling in the European Union – 2003.

[12] In fact, the glass industry believes that it should soon be able to reduce automotive glass weight by 10kg. It is commonly assumed that a lightening of 10kg of an average family car could reduce the vehicles' CO_2 emissions by 0.8 g/km.

[13] B. Taxis-Reischl & Fa. Behr - Energieverbrauch Klimaanlagen und Wege zur Verbrauchsreduzierung - 1997.

What is the **life cycle impact of energy efficient glass**?

The process of manufacturing flat glass for building applications inevitably has a cost in terms of CO_2 emitted. However this is **more than compensated for by the CO_2 saved** by replacing single glazing with energy efficient glazing. According to a detailed study undertaken in 2005,[14] the manufacture of 1m² of low-E double glazing leads to the **emission of 25 kg of CO_2**, and this has subsequently been further reduced by the introduction of new manufacturing technologies in recent years. On the other hand, 91 kg of CO_2 per year are saved by replacing one square metre of single glazing with low-E double glazing. The **CO_2 emitted during production is thus offset after only 3.5 months' use**.

At the level of the European Union (EU 25), the total CO_2 emitted by buildings is 765 million tonnes CO_2 per year. By comparison, the manufacture of architectural glass only releases 4.6 million tonnes per year. Considering the **potential savings of 100 million tonnes** of CO_2 per year through the use of energy-saving glass, CO_2 linked to glass production would quickly be outweighed even if additional production was required.

Glass is also a **recyclable product**. Even at the end of the lifecycle of the window this valuable resource is not lost and can be recycled. This recycled glass, when melted again to produce new glass products, helps further reduce the CO_2 emitted by manufacturing facilities.[15]

The CO_2 emitted during production is offset after only 3,5 months' use of energy-efficient windows.
Glass is a recyclable product so resources are not lost.

[16] GEPVP – Energy & environmental benefits from advance double glazing in EU buildings – March 2005.
[17] Recycling glass enables the industry to re-use cullet for the production process. One tonne of cullet saves 0.23 tonnes CO_2 (less energy needed for melting) and 1 tonne of raw material.)

Is the glass **manufacturing process energy-efficient**?

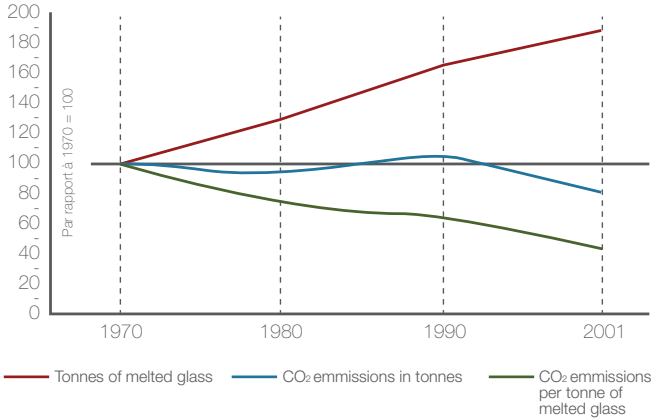
Glass manufacturing requires energy since glass furnaces need to be heated to temperatures of 1600 C° at which point raw materials melt to become glass. Because of this rule of material physics, energy accounts for the largest share of manufacturing costs. In this context, **reducing energy consumption is an economic imperative and constant goal of all glass manufacturers.** In fact, studies have shown that the glass industry has been able to reduce energy consumption by 55% between 1970 and 2000 while production was on the rise.

Today, Europe's glass manufacturers continue to invest and apply best available techniques in all installations. They carry energy audits and have taken commitments to reduce energy consumption even further. That being said, without major technological breakthrough, improvements will remain limited hence glass manufacturers' investments in extensive research programmes.

The carbon content of final glass products is also heavily affected by the geographical location of manufacturing installations. Glass is a relatively heavy product, which is not convenient to transport over long distances. For this reason, importing glass from outside Europe inherently means importing glass with a much higher carbon content. **Maintaining energy-efficient glass manufacturing installations in Europe is thus to the benefit of Europe**.

It is all the more important that installations can then recycle glass, which contributes to further lowering energy consumption in manufacturing and to preserving natural resources.[17]

The glass industry is committed to energy-efficiency of its products and their manufacturing for one obvious reason: throughout its lifecycle, **energy-efficient glass is a CO_2 saving product!**



Source: GEVP and Energy Report UE 9287 "Fourth Energy Audit"

Reducing energy consumption is an economic imperative for glass manufacturers.

How can **energy efficiency** investments **help the EU economy**?

A major study of the impact of energy efficiency on job creation[18] found that investments in energy efficiency could also offer an **important job creation potential**. This is because the manufacturing and installing of energy efficiency measures is a relatively labour intensive activity. This work is, by its nature, local and accessible to people who traditionally suffer the highest rates of unemployment.

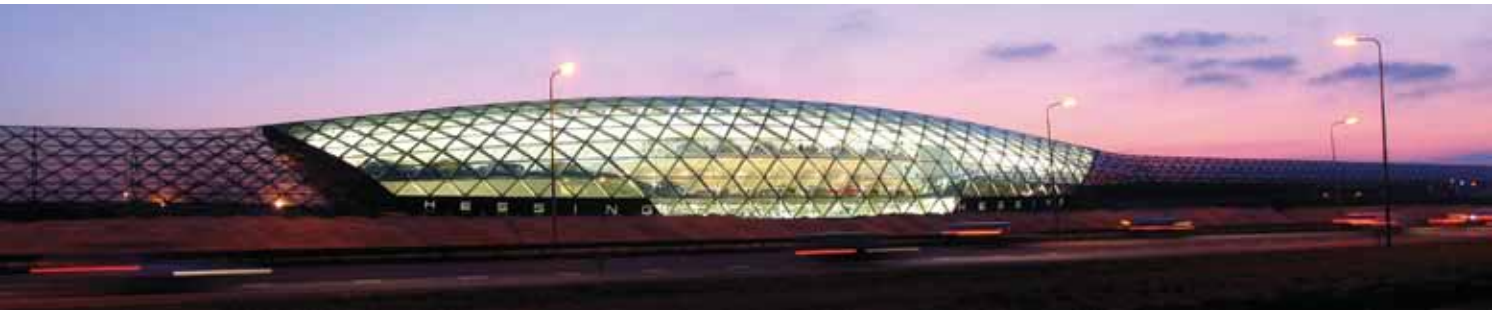
The study also found that where energy savings are cost effective, the result is that consumers divert expenditure from energy into the general consumption sector. Overall these effects accounted for direct employment gains of up to 60 person years of employment per £1 million spent and an additional 70 person years of employment in the wider economy.

Improving the energy efficiency of residential property can also help address **fuel poverty**. Those with the lowest incomes are increasingly vulnerable to rising energy prices due to the bad energy performance of housing. Promoting energy efficiency upgrades can help to ease this burden on society.

More globally, Europe's investments in energy-efficient buildings will boost investment in Research and Development and in manufacturing capacities of energy-efficiency industries. It will contribute to **maintaining Europe's industrial lead** in the worldwide race for sustainable production and green product development.

Investing in energy efficiency offers an important job creation potential and helps address fuel poverty.
Maintaining Europe's lead in green product development.

[18] Association for the Conservation of Energy - Energy efficiency and jobs: UK issues and case studies – May 2000.



How can **policy makers help**?

The right policies and legislation are essential in order to drive Europe towards a low energy, low carbon economy. To ensure that real progress is made in the coming years, EU and national policy makers need to prioritise energy efficiency and commit to concrete actions to **promote the uptake of energy saving technologies**, including energy efficient glazing products.

Glass for Europe calls for the following actions:

- An ambitious energy efficiency policy, with a focus on buildings and ways to triple their renovation rate.
- Proper implementation of the recast **Energy Performance of Buildings Directive**, including ambitious definitions of cost-optimal components and standards.
- Introduction of an **energy labelling scheme for windows** to provide a signal to consumers, to promote the most energy-efficient windows and to create a vehicle on which Member States can base incentives schemes.
- **Encourage and require the use of energy efficient glazing** for new construction and for the retrofitting of existing buildings.
- Provide **economic and fiscal incentives** to promote better uptake of energy efficient glass and create growth and jobs as part of the European Economic Recovery Plan.
- Carry out **information and communication campaigns** to raise citizens' awareness on the benefits of energy saving solutions.
- Provide market-based **incentives to car makers using energy efficient glass** technologies

About **Glass for Europe**

Glass for Europe is the trade association for Europe's manufacturers of flat glass. Flat glass is the material that goes into a variety of end-products and primarily in windows and façades for **buildings**, windscreens and windows for **automotive and transport** as well as glass covers, connectors and mirrors for **solar-energy** equipments. It is also used in smaller quantities for other applications such as furniture, appliances, electronics, etc.

Glass for Europe has four members: **AGC Glass Europe**, **NSG Group**, **Saint-Gobain Glass** and **Sisecam-Trakya Cam** and works in association with **Guardian**. Altogether, these five companies represent 90% of Europe's flat glass production.

Glass products not only provide light, comfort, style, security and safety, they are also **essential to energy-efficient buildings, houses and transport**. Windows containing high-performance glass such as low-e insulating glass, which helps keep warmth in, and solar-control glass, which reflects unwanted heat away, help reduce energy consumption. Solar-energy glass helps enhance the production of a renewable sources of energy. Better use of building glass alone could help reduce Europe's CO_2 – emissions by 100 million tonnes annually hence Glass for Europe's plea for an ambitious and robust European energy-efficiency policy.

www.**glassforeurope**.com

AGC GLASS UNLIMITED

NSG GROUP

SAINT-GOBAIN GLASS

ŞİŞECAM

in association with

GUARDIAN





GLASS FOR EUROPE aisbl/ivzw
Rue Belliard 199/33, B-1040 Brussels - T. +32 (2) 538.43.77 - F. +32 (2) 280.02.81
info@glassforeurope.com - www.glassforeurope.com