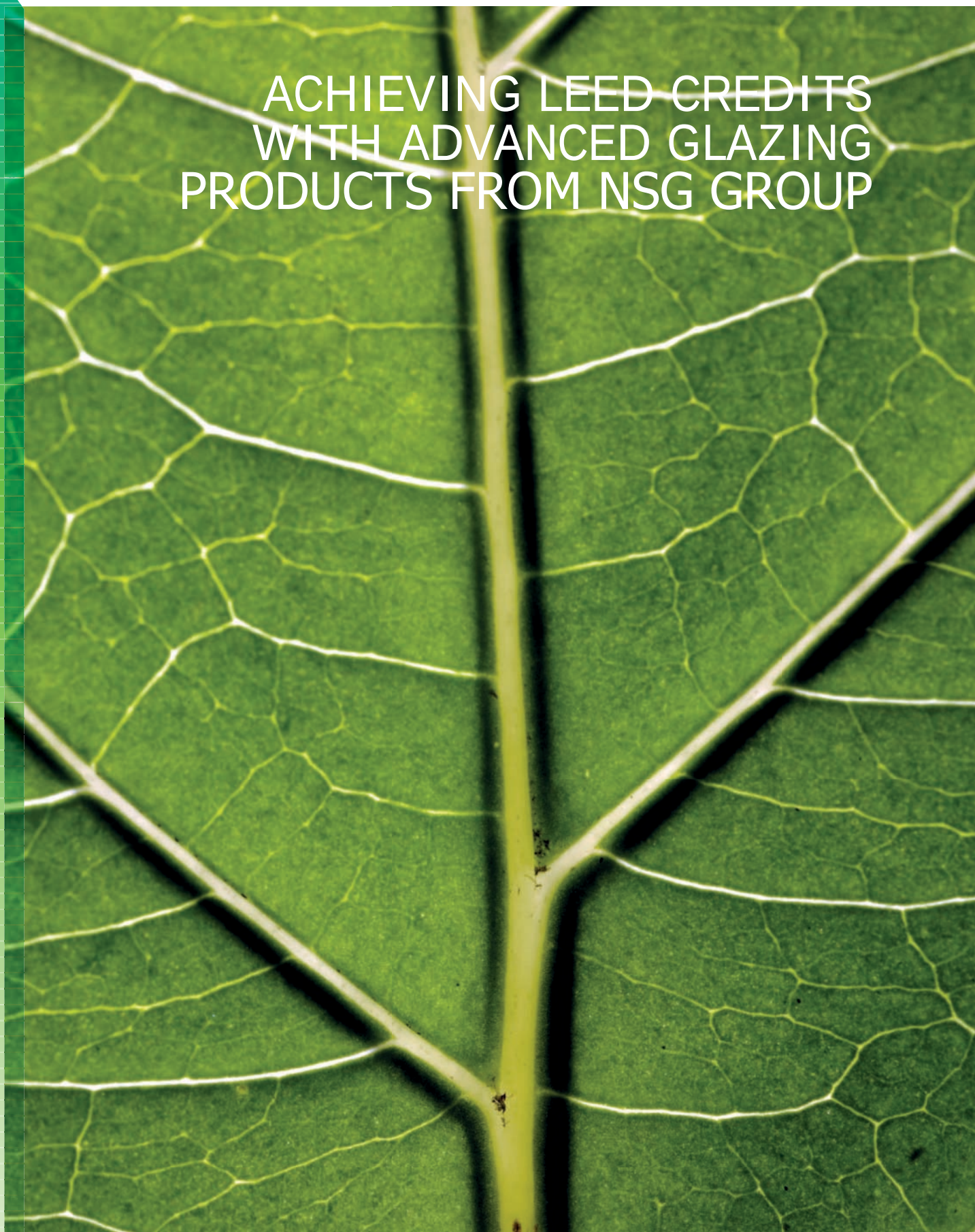
NSG GROUP

ACHIEVING LEED CREDITS WITH ADVANCED GLAZING PRODUCTS FROM NSG GROUP



LEED IS ONE OF THE MOST PROMINENTLY RECOGNIZED ARCHITECTURAL STANDARDS IN GREEN OR SUSTAINABLE BUILDING DESIGN ADMINISTERED BY THE U.S. GREEN BUILDING COUNCIL (USGBC). IN THIS PUBLICATION, WE DESCRIBE HOW NSG GROUP PRODUCTS CAN HELP IN ACHIEVING LEED CERTIFICATION BY CATEGORY.

ENERGY & ATMOSPHERE CATEGORY

EA Credit 1: Optimize energy performance 1 - 10 points

Intent: Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impact associated with excessive energy use.

Requirements: Generate a 10% improvement in the proposed buildings performance rating for new buildings, or a 5% improvement in the proposed building's performance rating for major renovations.

Most NSG Group glass products can provide substantial energy savings and significantly influence the awarding of points for this category by reducing demand on regulated energy systems.

In cold climates, low-emissivity glass prevents heat escaping the building, while still allowing solar heat to enter it. Glass with the lowest u-factor (the measure of heat loss expressed as W/m²K, which is the rate of heat loss in Watts per square metre per degree Kelvin temperature difference between inside and outside) will provide the best insulation. Furthermore, in cold but sunny climates, glass achieving the highest passive solar heat gain (the proportion of solar radiation transmitted through the glass by all means) will help to reduce further the need for heating the inside of a building.

We have a range of low-emissivity glasses to cover all levels of requirements.

Pilkington **Energy Advantage™** is an on-line coated glass which offers good thermal insulation performance. It is one of the clearest of the low-e technologies. It allows solar infrared heat to easily pass through the glazing and provides thermal insulation by reducing heat loss.

Although it can be used in monolithic form, it will provide the highest thermal insulation when used in an IGU, achieving a u-factor of 0.29 when used in a standard double IGU (6 mm lites with argon airspace, low-e coating on the number 2 surface). At the same time it will provide the highest degree of passive solar heat gain, free energy from the sun.

Pilkington **Energy Advantage™** low-e coatings applied to the number one and four surfaces can significantly reduce the center-of-glass u-factor. This low-e 4th surface technology can achieve a u-factor of 0.23, offering superior thermal insulation. Low-e coatings on the first and fourth surfaces can reduce the center-of-glass u-factor by 45%, compared to an IGU with two panes of standard clear glass.

In cold weather conditions, the coating on the number 2 surface reduces room heat (heat generated inside a building) from transferring across the airspace toward the outside. By adding the second low-e coating to the number 4 surface, the thermal insulation is further improved.

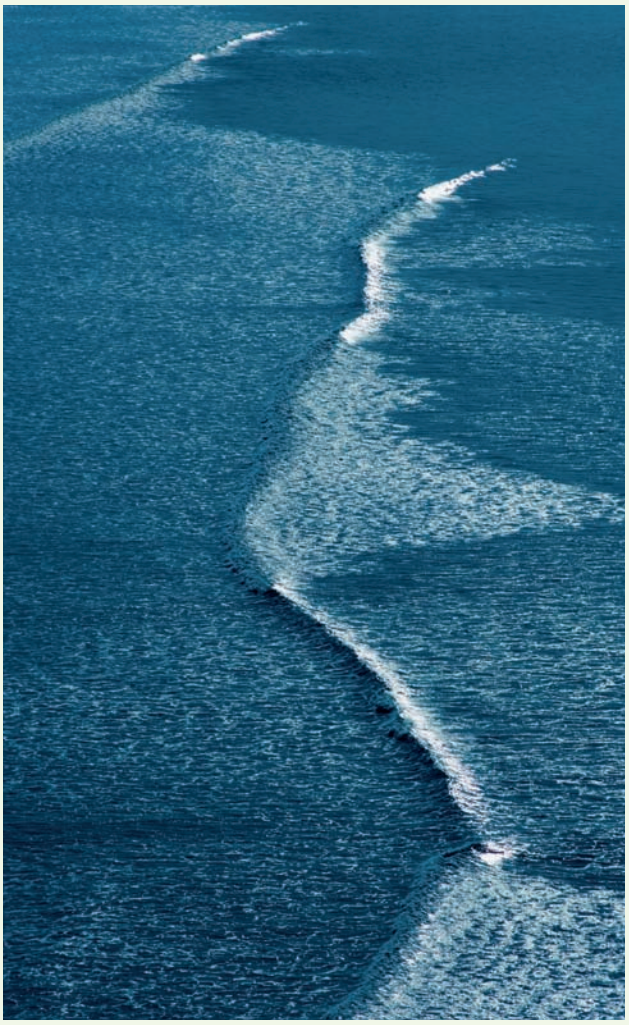
The choice of glass combination will depend on the performances required, as well as the building location, orientation and area of glass.

Balancing historical preservation with modern comfort and environmental requirements can be challenging. As historical buildings were constructed at a time when energy efficiency was not a concern, bringing them up to today's standard could sometimes mean compromising their integrity.

Pilkington **Spacia™**, World Architecture News 2011 Product of the Year, is the world's first commercially available vacuum glazing; it offers the thermal performance of a conventional double IGU with a low-e coating. Despite being no thicker than a single pane of glass it has a u-factor as low as 0.2 Btu/hr.sqft°F in a 6 mm construction. It allows fitting replacement windows that are more in keeping with the original design, as well as it may even allow the use of the original frames if these are in a reasonable or repairable condition.

In warm climates, solar control glass minimizes heat entering the building, while still letting an abundance of natural daylight in. The best energy-efficient glazing combines solar control and thermal insulation in an IGU to enhance the performance, by reducing heat gain from direct solar radiation into the building due to the lower u-factor, conduction and convection gains through the IGU from the hot outside environment to the air-conditioned inside.

The combination of solar control and low-emissivity in an IGU will help to reduce air-conditioning loads, save energy and reduce CO_2 emissions. This can be achieved by either using a single product which provides both solar control and low-emissivity in an IGU, or using a solar control product and a separate low-e product in an IGU.



EA Credit 2: Onsite renewable energy 1 - 7 points

Intent: To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.

Requirements: Use onsite renewable energy systems (solar, wind, geothermal, low impact hydro). Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building's annual energy cost ranging from a renewable energy percentage of 1% for 1 point to as much as 7 points for sites having 13% or greater renewable energy usage.

Solar panels can be used to harness solar energy and supply buildings with electricity and heat. Glass is an integral and important element of most solar technologies currently available.

We offer a wide range of high-tech glass products, which can be used in all of the leading solar technologies, including thin film photovoltaics, crystalline silicon photovoltaics, concentrated solar power applications and solar thermal collectors.

NSG **TEC™** is a group of products, including a comprehensive range of TCO (Transparent Conductive Oxide) coated glass, optimized to suit a variety of thin film photovoltaic technologies.

Pilkington **Optiwhite™** extra-clear low-iron range of glass may also be used as cover plates for thin film and crystalline silicon photovoltaic modules, as well as in solar thermal collectors. Due to their very high light transmittance (up to 92%) and solar transmittance (solar direct transmittance of up to 91%), the products are very often used in concentrated solar power applications too.

Pilkington **Sunplus™** low-iron rolled range of glass is used extensively for the cover glass in crystalline silicon photovoltaic modules and in solar thermal collectors.

Many NSG Group products are considered "spectrally selective" as defined by the U.S. Department of Energy, achieving a Light to Solar Heat Gain Ratio (LSG) of 1.25 or higher. Products such as Pilkington **EverGreen™**, Pilkington **Solar-E™** EverGreen and Pilkington **Eclipse Advantage™** EverGreen allow more daylight than as solar energy into a building.

Pilkington **Solar-E™** and Pilkington **Eclipse Advantage™** are on-line coated solar control glasses with low-emissivity properties too. They can achieve solar heat coefficient (SHGC) gains ranging down to 26% and a u-factor of 27% in a standard double IGU.

Pilkington **Eclipse™** and Pilkington High Performance tinted glasses, such as Pilkington **Arctic Blue™**, are performance solar control products. To provide thermal insulation, they have to be combined in an IGU with a low-emissivity glass such as Pilkington **Energy Advantage™**.

MATERIALS & RESOURCES CATEGORY

MR Credit 4: Recycled content 1 - 2 points

Intent: To increase demand for building products that incorporate recycled content materials, thereby reducing impacts from extraction and processing of virgin materials.

Requirements: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (for 1 point) and 20% (for 2 points), based on cost, of the total value of the materials in the project.

Post-consumer glass is a highly recyclable material that can be re-used or repurposed into a variety of products. It can be used to manufacture glass containers to items as diverse as concrete counter tops and landscaping material. However, it cannot be utilized in the float glass manufacturing process. Even the smallest impurity can compromise the product quality and manufacturing process. Therefore, float glass manufacturing cannot utilize recycled glass as defined by the LEED standard and is not eligible for points under MR Credit 4.

The NSG Group does make active use of cullet to improve quality and environmental performance. Cullet consists of bits of broken glass generated from edge trimmings and any unused glass. Cullet is generated from the manufacturing process and reintroduced into the float furnace. It makes up approximately 20% of the batch materials used to manufacture float glass. The use of cullet is essential to the product quality and improves the melting efficiency of other readily abundant substances we use to make our products, such as silica sand. This is a reduction of the amount of energy we use, which results in reductions of emissions from the extraction, transportation of raw materials, and the manufacturing process.

MR Credit 5: Regional materials 1 - 2 points

Intent: To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Requirements: Use building materials or products that have been extracted, harvested or recovered as well as manufactured within 500 miles of the project site for a minimum of 10% (1 point) or 20% (2 points) based on cost of the total materials value. If only a fraction of a product or material is extracted, harvested or recovered and manufactured locally, then only that % (by weight) can contribute to the regional value.

The NSG Group provides products to numerous fabricators with locations throughout North America, capable of providing a manufacturing point within 500 miles. Our glass manufacturing plants are located in Lathrop, California; Ottawa, Illinois; Rossford, Ohio; and Laurinburg, North Carolina. Contact us for more information.

INDOOR ENVIRONMENTAL QUALITY CATEGORY

IEQ Credit 8.1: Daylight
1 point

IEQ Credit 8.2: Views
1 point

Daylight Intent: To provide building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Views Intent: Achieve direct line of sight to the outdoor environment via vision glazing between 30 inches and 90 inches above the finished floor for building occupants in 90% of all regularly occupied spaces.

Requirements: Achieve daylight luminance levels in 75% or more of regularly occupied spaces. Achieve direct line of sight to the outdoor environment via vision glazing between 30 inches and 90 inches above the finished floor for building occupants in 90% of all regularly occupied spaces.

Increased glazed areas can help to improve indoor environmental quality. We offer several glass products with high light transmittance to maximize daylight.

Pilkington **OptiView™** is our low reflective glass which provides crisp, clear views with no visual distortion. It offers a superior light transmittance of 92% in 6 mm. Furthermore, the Pilkington **OptiView™** coating provides emissivity properties that provide a u-factor comparable to that of a laminated insulated glass unit with our thermal performance low-e, Pilkington **Energy Advantage™**.

Pilkington **Optiwhite™** is our extra-clear low-iron glass that offers high light transmittance and clarity of view; its light transmittance is 91% in 6mm.

Furthermore, our low-e glasses also offer medium-to-high light transmittance in addition to their low u-factor as stated earlier (see also Energy & Atmosphere Category - EA Credit 1: Optimize energy performance 1-10 points).

The use of Pilkington **Activ™** in vertical glazing, rooflights and skylights can help to ensure high levels of daylight transmittance, by providing an external glass surface free from dirt for longer periods than in the case of ordinary glass. At the same time condensation is reduced.

Our range of fire-resistant products, Pilkington **Pyrostop®** help to provide a protected, yet comfortable and versatile state-of-the-art glazed building environment, founded on daylighting and clear vision complying with relevant fire safety regulations, avoiding non-transparent solid roofs, doors and partitions which block out views and natural light.

Pilkington flat glass products, including:

- Pilkington **Optifloat™** Clear and tints
- Pilkington **Arctic Blue™**
- Pilkington **EverGreen™**
- Pilkington **SuperGrey™**
- Pilkington **Eclipse Advantage™** Clear and tints
- Pilkington **Eclipse™** Gold and Sunset Gold
- Pilkington **Solar-E™** Clear and tints
- Pilkington **Energy Advantage™** low-e glass
- Pilkington **Mirropane™** one way mirror
- Pilkington **Activ™** self-cleaning glass
- Pilkington **OptiView™** low reflective glass
- Pilkington **Optiwhite™** low iron glass
- Pilkington **Pyrostop®** fire resistant glass
- Pilkington **Planar™**
- Pilkington **Profilit™**
- Pilkington **TEC™** glass
- Pilkington **Spacia™**
- Pilkington Texture Glass

These product have daylight transmissions ranging from 92% down to 8%, when single glazed. As outdoor daylight (no direct sun) is in the 1,000 to 2,500 fc range, even the lowest transmission (darkest) glass (Pilkington **SuperGrey™**), in large sizes, can meet the minimum requirement with 8% of 1000 or 80 fc luminance.

All the Pilkington flat glass products listed above are capable of meeting IEQ Credit 8.2 for "..direct line of sight to the outdoor environment via vision glazing...in 90% of all regularly occupied areas."

ABOUT LEED

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System provides a set of standards for the design, construction, and operation of high performance green buildings.

LEED was developed to define "green building" by establishing a common standard of measurement and recognize environmental leadership in the building industry through a certification process of buildings on a point-system for specific building projects. While LEED does not certify specific building (glass) products, it does recognize that the selection of products play a significant role in fulfilling LEED point requirements.

For more information on LEED
please visit www.usgbc.org/leed

ABOUT NSG GROUP

The mission of the NSG Group is to be the global leader in innovative high performance glass and glazing solutions, contributing to energy conservation and generation, working safely and ethically.

Founded in 1918, Nippon Sheet Glass Co., Ltd. acquired the leading UK-based glass manufacturer Pilkington plc in June 2006. Today, the NSG Group has combined sales of over $6 billion, with manufacturing operations in 29 countries and sales in 130 countries, employing some 29,300 people worldwide. The Group is one of the world's leading manufacturers of glass and glazing systems in three major business areas; Building Products, Automotive and Specialty Glass.

For more information about NSG Group
please visit www.nsg.com

For more information on the products described in this document, please consult our "Architectural Product Catalog", or visit our website www.pilkington.com/na

To find out about the key properties of our products in single glazing and Insulating Glass Units please visit www.pilkingtoncalculators.com.

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