

Going Beyond LEED®: Achieving Sustainable Design with Advanced Fire Rated Glass Systems

By SAFTIFIRST Fire Rated Glazing Solutions

Abstract: This white paper provides readers with an understanding of how today's advanced fire rated glass systems contribute to LEED® and sustainable design as a whole. The discussion includes an explanation of the principles of sustainable design and the current LEED-NC Rating System and identifies the innovations in fire rated glass technology that are aligned with these goals. Charts and project photos will be used for increased understanding and retention. This white paper also includes a LEED scorecard and other reference materials that architects can readily use.

Introduction

Fire rated glass has come a long way from the days when only small panes of wired glass were used in very limited applications. Today's clear, fire rated glass and framing products go as far as meeting the stringent wall standard (ASTM E-119), enabling wall-to-wall and floor-to-ceiling expanses of glass rated for up to 2 hours. As a result, fire rated glass and framing systems now play a much more prominent role in daylighting and overall sustainable building design. It is used to maximize light penetration deep within the building, increase the opportunities for shared artificial lighting and provide greater visual access between occupancies and stairwells. All of this while still meeting the fire rated requirements of the application.

Fire rated glass also adds a new dimension to the concepts of sustainable design by virtue of the product's intended use: passive fire protection. By limiting the spread of fire, smoke, and the effects of radiant heat, fire rated glazing preserves building components and materials, resulting in the preservation of environmental resources related to the raw materials and energy necessary to the reconstruction and renovations required due to fire damage.

Before we look at the many ways in which fire rated glazing systems align with current LEED principles and ratings, let's briefly review sustainable design basics.

Sustainable Design Explained

Sustainable design refers to the design and construction of buildings in a way that meets the needs of today without compromising the needs of the future. Often the focus is limited to environmental impacts, but true sustainable design considers the economic and social aspects of the design in addition to the environmental impacts and looks to balance this "triple bottom line." Sustainable building design is a holistic look at the entire building process.

Determining exactly what qualifies as sustainable design can be difficult and subjective. The most widely used rating system in the U.S. is the LEED-NC (Leadership in Energy and Environmental Design - New Construction) Rating System developed by the U.S. Green Building Council (USGBC).

In addition to LEED, there are green building codes, such as the International Code Council's 2012 International Green Construction Code (IGCC) and also green building standards (ASHRAE Standard 189.1). For the most part, all of these green building assessment tools are very similar, though specific criteria vary. They all consider the following aspects of building design and construction: energy efficiency, water use, material use and selection, the building site, and the interior environment. However, sustainable design encompasses many elements not included in LEED or other green building codes and standards. It is important to look beyond just LEED when evaluating sustainable attributes of buildings and building products. A better tool for evaluating sustainable design may be found in the *Principles of High Performance School Buildings*¹ developed by the Sustainable Buildings Industry Council (<http://www.sbicouncil.org>). These principles of high performance, sustainable building design are:

- Environmentally responsive site planning
- Energy efficient building shell
- Thermal comfort
- Energy analysis
- Renewable energy
- Water efficiency
- Safety and security
- Daylighting
- Commissioning
- Environmentally preferable materials and products
- High performance HVAC
- High performance electric lighting
- Life cycle cost analysis
- Acoustic comfort
- Superior indoor air quality
- Visual comfort

This framework of principles of high performance buildings provides consideration of several elements not covered in LEED-NC that are important to sustainable design. These include durability, life cycle cost, waste avoidance, environmental life cycle assessment, visual comfort, safety and security.

Deciphering The LEED™ Rating System

The LEED-NC Rating System is continually evolving. First released in 2004, the current version is LEED 2009. This version was significantly reorganized from the previous version (LEED 2.2). Presently LEED is undergoing another revision cycle with significant changes anticipated. The next version of LEED, to be named LEED v4, is expected to be released in the late summer or fall of 2013. Because of the wide variation between the drafts and the controversy associated with many of the provisions, especially in the Materials & Resources section, it is not possible to predict what the final version will look like. As a result, this white paper is based on the specific criteria found in LEED 2009. However, though the specific criteria are likely to vary from those found in LEED 2009, the basic principles will remain.

¹ From "High Performance School Buildings, Resource and Strategy Guide" published by Sustainable Buildings Industry Council.

Figure 1 shows the percentage of points in each of the various credit categories in LEED 2009. The points needed for each level of certification are shown in Figure 2. The more “green” the building, the higher number of points earned.

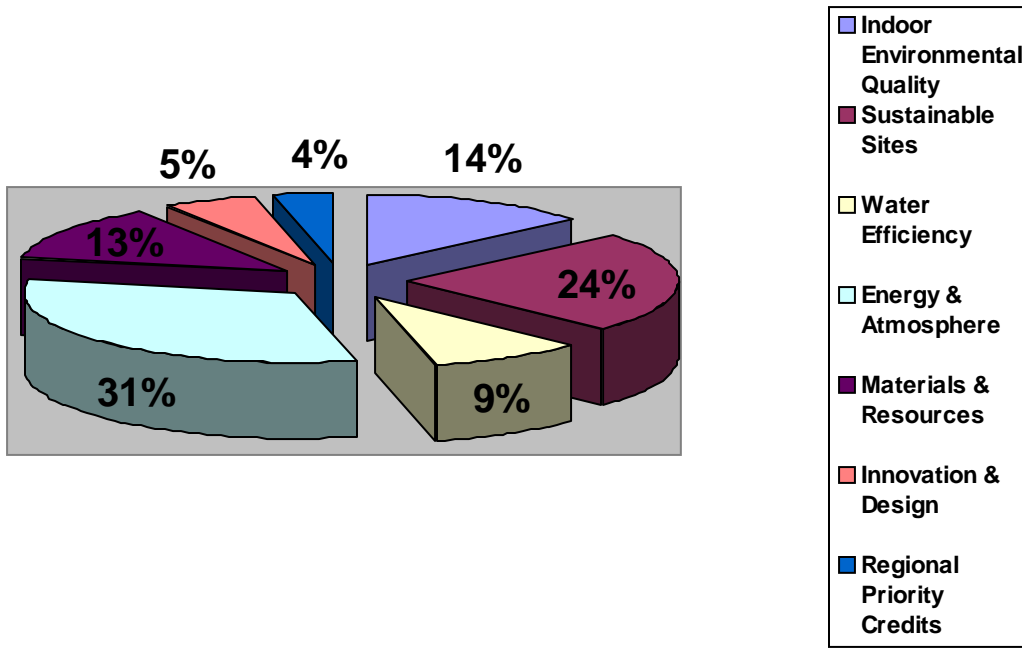


Figure 1: LEED 2009 Categories

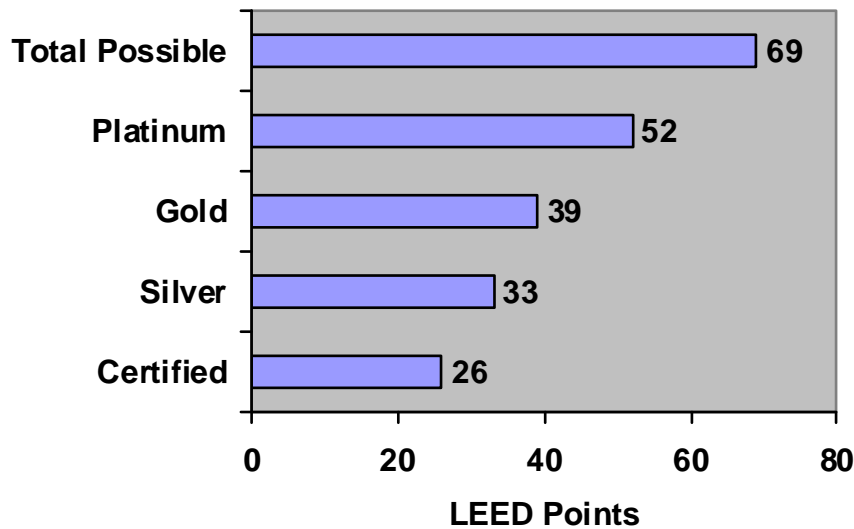


Figure 2: LEED 2009 Certification Levels

It is important to recognize that the credits in the LEED rating system are focused on assessing the building as a whole. For example, in the calculation for the Recycled Content credit, the percent recycled content value of all building materials containing recycled content is compared to the total cost of all building materials on the project. As a result, no one product or material alone can earn LEED credit points². Rather building products can contribute toward earning LEED points on a project.

Now that we have covered the principles of sustainable design and LEED-NC, we can discuss how today's fire rated glass and framing products contribute to achieving these goals.

Fire Rated Glass Systems and Applicable LEED-NC Credits

Fire rated glass and framing systems can be used as part of a strategy to earn points in several credit categories. These are described in more detail below based on the credits in the LEED 2009 for New Construction (LEED-NC) rating system. Credits in other LEED rating systems are similar to those found in LEED-NC.

Energy & Atmosphere

Within this category there are is prerequisite and one credit, both related to energy use, where SAFTIFIRST's products can contribute toward.

- *Prerequisite 2 – minimum energy performance* – SAFTIFIRST's products can be part of a strategy to help achieve the required energy performance because of their daylighting properties. Specifically, SuperLite products have the option of being insulated and provided in low-e or energy performance make-ups.
- *Credit 1 - Optimize energy performance* – SAFTIFIRST's products can be used as part of a strategy (including energy performance glazing and passive solar designs) that further reduces the amount of energy consumed by the building. SuperLite II-XL and GPX Framing assemblies have NFRC (National Fenestration Ratings Council) certifications for U-Factor, Solar Heat Gain Coefficient and Condensation Resistance. In addition, because this credit also includes interior lighting energy demands, the use of SAFTIFIRST's products as part of a daylighting strategy can help improve energy performance. Using fire rated glass can help maximize light penetration, even from artificial lighting, by extending light transmittance into areas where opaque walls were often the norm.

² Certified wood is the only product that can earn 1 point under Materials & Resource Credit 7 (LEED 2009).



To meet property line and energy performance requirements, NFRC Certified SuperLite II-XL and GPX Assemblies from SAFTI FIRST were used for the windows and glass balconies on all 32 floors in the south-facing elevation. (Project: Sapphire Towers in San Diego, CA. Architect: AVR Associates. Glazier: Starline Windows)

Materials & Resources

There are several credits within Materials & Resources that relate to SAFTIFIRST's products.

- *Credits 2.1 and 2.2 – construction waste management* – this credit awards points based on construction waste diverted from the landfill, and waste avoidance is not recognized. SAFTIFIRST's products are supplied to the construction site in the exact quantities needed (no waste), however should a product be damaged in transit, both the glass and the metal framing systems can be recycled. The products are delivered on wood pallets or in shipping boxes made from recycled materials. Furthermore, this packaging can be recycled.
- *Credits 4.1 and 4.2 – recycled content materials* – this credit awards points for using materials that contain recycled content. The credit evaluates all building materials on the project. Metal portions of glass framing systems contain recycled content that can contribute. Steel used in the GPX framing system contains approximately 30% by weight pre-consumer recycled content. Aluminum used in the GPX framing system contains approximately 25% by weight pre-consumer recycled content. Keep in mind that their total contribution must be weighed against other materials used on the project.

- *Credits 5.1 and 5.2 – regional materials* – this credit recognizes that portion of materials that have both a raw material source and manufacturing facility within 500 miles of the building project site. Products manufactured in a facility that is within 500 miles of a building project site can include that percent (by weight) of the raw materials that are also within 500 miles of the project site toward the calculation of the total regionally located content in all building materials. All products manufactured by SAFTIFIRST are made in Merced, CA. The primary raw material used in SAFTIFIRST’s glass products, sand, is sourced from less than 70 miles from the plant. All projects in California and those located in some cities in Nevada and Arizona may qualify for this credit if it is within 500 miles of the Merced facility.

It is important to note that in other green building programs (such as the International Green Construction Code (IGCC) and ASHRAE 189.1 *Standard for High-Performing Green Buildings*), the distance (500 miles) is adjusted if transport of the product occurs by rail or water. Typically the distance by rail or water is multiplied by 0.25 and added to the distance traveled by truck, and the sum must be no more than 500 miles.

Indoor Environmental Quality

- *Credit 4 – low-emitting materials* – this credit strives to minimize the amount of volatile organic compounds (VOC) in the indoor air of the building. SAFTIFIRST’s glass products meet the intent of eliminating VOC’s from the indoor environment when used as interior walls, though there is no direct recognition of this attribute in current versions of LEED. Other green building programs, such as the IGCC, have recognized glass and metal products as inherently non-emitting materials.
- *Credit 8 – daylight and views* – this credit awards points for providing daylighting and views to the outdoors. Glass can be an integral part of a strategy to provide both daylight and views while still providing sound control, security, and privacy. SAFTIFIRST’s glass products provide the benefits of interior daylighting in areas not normally glazed, such as corridors and stairwells.



SuperLite II-XL in GPX Framing was used in this 2-hour stairwell to enable views to the outdoors and allow natural daylight to penetrate further in the building. (Project: David Eccles School of Business at the University of Utah. Architect: MHTN Architects. Glazier: Mollerup Glass)

- *Credit 1 – Innovation in Design - up to 5 points:* this credit awards points for either going above and beyond existing LEED credits or for innovative credits. Each Innovation credit is worth 1 point.
- The Cradle to Cradle (C2C) certification for products is a recognized innovation credit. PYRAN[®] Platinum products' C2C certification means that they can contribute toward the 2.5% of the total materials cost threshold required for this credit.
- Acoustic design is another potential area for Innovation in LEED-NC and is part of the LEED for Schools Rating System. The criteria in LEED for Schools IEQ Credit 9: Enhanced Acoustical Performance credit requires that the building shell, classroom partitions and other core learning space partitions to meet the Sound Transmission Class (STC) requirements of ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, and windows meet an STC rating of at least 35. All of the SuperLite II-XL, SuperLite X-90 and PYRAN Platinum L products meet these STC requirements.



When Middlebury College replaced unsafe wired glass used in these doors, they chose C2C Silver Certified PYRAN Platinum F by SAFTI FIRST. (Project: Middlebury College in Middlebury, VT. Glazier: Desabrais Glass)



High Tech Middle School in Chula Vista, CA chose SuperLite II-XL 45 in HM Framing by SAFTI FIRST for the fire protective openings in this 1 hour corridor. SuperLite II-XL 45 also has an STC 40 rating, providing sound attenuation benefits in addition to clear views and fire protection. (Project: High Tech Middle School in Chula Vista, CA; Architect: Studio E Architects; Glazier: Vision Systems Inc.)

Fire Rated Glass Systems and Sustainable Design

As mentioned earlier, any meaningful discussion of “green design” must go beyond what is covered in the current LEED-NC Rating System. This section describes some of the high performance sustainable design principles related to fire rated glass systems.

Energy Efficient Building Shell, Thermal Comfort and Energy Analysis

An energy efficient building envelope is a key component in sustainable building design. Achieving an energy efficient building envelope includes consideration of both the insulating value of materials as well as potential solar impacts. SAFTIFIRST has NFRC certified glass and framing assemblies (see section “*Credit 1 - Optimize energy performance*”). Additionally, several of SAFTIFIRST’s SuperLite glass products have the option of incorporating low-e and energy performance coatings.

Safety and Security

Safety and security are two aspects of sustainable design that are not covered by the LEED rating systems. Fire-resistant construction and resistance to impacts and wind-borne debris promote occupant health and safety. All of SAFTIFIRST’s glass, framing and PYRAN® Platinum products protect against fire. Along with its multiple fire ratings, SuperLite II-XL can be manufactured to provide resistance to severe impacts such as ballistic, hurricane and blasts.

Another aspect of safety and security involves vision and lines of sight. Design guidelines issued by the Safer School Design Initiative, Crime Prevention Through Environmental Design and the National Clearinghouse for Educational facilities all recommend lines of sight that maximize visibility and foster positive social interaction. All of SAFTIFIRST’s fire rated glass and framing options help ensure visibility in corridors, stairwells and other closed-off areas where attack is prone to occur.



SAFTI FIRST supplied 76 fire and hurricane window/wall systems rated up to 60 minutes for the individual units and 120 min. fire and hurricane rated assemblies for the lobby area (shown above). The system meets ASTM E-119/NFPA 251/UL263 for fire and TAS 201, TAS 202 and TAS 203, ASTM E-1196, ASTM E-330, ASTM E-1886, ASTM E-283-99, ASTM E-331-00, AAMA 1304-02 for hurricane. Blue-green tint was also applied to the glass as a decorative element. (Project: Las Olas Beach Club in Ft. Lauderdale, FL. Architect: The Sieger Suarez Architectural Partnership. Contract Glazier: RC Aluminum)



This private office is protected by fire and ballistic rated SuperLite II-XL in GPX Framing. The system meets ASTM E-119/NFPA 251/UL263 for fire and Level 3 for ballistic and Level 1 for attack. The GPX Framing also has a cherry wood veneer finish. (Project: Private Office in San Francisco, CA)

Stairwells, which are typically closed-off from view and hard to illuminate, are given a make-over using SuperLite II-XL in GPX Framing. This area is bathed in natural light and is completely transparent thanks to fire rated glazing. (Project: Pomona College in Pomona, CA. Architect: Eherlich Architects. Glazier: Vision Systems Inc.)



Daylighting and Visual Comfort

The introduction of daylight in buildings provides several benefits. Good daylighting allows for light penetration deep into the space while avoiding glare and direct solar lighting on work surfaces. Glass has good potential as a daylighting strategy. In general glass, provides light transmittance, and

providing fire rated glazing in areas that would often be opaque allows for deeper penetration of sunlight and visual access.

Visual comfort can include both views to outdoor spaces as well as avoidance of glare. SuperLite products that incorporate patterns or films are good candidates for controlling or avoiding glare.



To meet property line requirements while allowing natural daylight into the lobby, SAFTI FIRST supplied SuperLite II-XL 60 IGU in custom CW Framing. The top units were sandblasted to reduce glare and create a soft-filtered lighting effect for visual comfort. (Project: Jewish Home for the Aged in San Francisco, CA. Architect: Herman Coliver Locus Architecture. Glazier: Guarantee Glass)

Environmentally Preferable Materials and Products

Some aspects of environmentally preferable materials are captured in the *Materials & Resources* section of LEED. However, there are a number of attributes that LEED does not consider that relate directly to SAFTIFIRST's products, including: life cycle assessment (LCA), abundance of raw materials, sustainable measures in acquisition or manufacture, and non-toxic (not made of toxic materials). The C2C certification of PYRAN[®] Platinum products is based on life cycle assessment of the product. Glass is made from some of the most abundant materials on earth, and most of the products do not include toxic materials.

Acoustic Comfort

Acoustic comfort is another important element in sustainable designs. High Sound Transmission Class (STC) values provide superior acoustic insulation. The STC values for SAFTIFIRST's glass products range from 28 to 33 for SuperLite I, I-XL, I-W and PYRAN[®] Platinum products and 40 to 44 for SuperLite II-XL products. The criteria in LEED for Schools requires that windows in the building shell, classroom, partitions and other core learning space partitions to meet an STC rating of at least 35. Many

of the SAFTIFIRST's glass products readily meet these criteria. Furthermore, SuperLite glass products can be customized to achieve higher STC ratings as needed.

Summary

It is important to recognize the value of the holistic approach taken by the principles of high performance design to achieve a truly sustainable building. As this white paper has demonstrated, SAFTIFIRST's fire rated glazing systems can contribute towards meeting the principles of both LEED-NC and sustainable building design in various ways. Using fire rated glass and framing systems that are proudly made in the USA, designers can incorporate clear views and daylight in spaces where opaque, fire rated building materials have been the norm.

Lastly, never hesitate to seek the manufacturer's expertise when you have product or design questions. SAFTIFIRST is the only single-source manufacturer – not distributor – of fire resistive glass and framing systems manufactured in the USA. With over 30 years of experience in advanced fire rated glazing and framing technology, we can help you understand your options and choices to ensure that you have the best suited, code-compliant solution for your project.

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