SIPA
Structural Insulated Panel Association

Green Building with SIPs



What is Green Building?

Green building is the practice of minimizing the impact a building has on the natural environment. Although there are numerous theories and rating systems proposing how this can be accomplished, they all share several clear goals:

- ***Reduced Energy Consumption –*** Energy is in high demand, and the processes used to generate energy often produce carbon dioxide emissions. Decreasing energy and fossil fuel use in buildings is important to prevent large-scale climate change.
- ***Material and Resource Conservation –*** Green designers and builders select building materials and methods that reduce the amount of natural resources required to construct a building.
- ***Healthy Indoor Environment –*** With people spending 90% of their time indoors, buildings should create a safe environment for occupants, free from mold, volatile organic compounds (VOCs) or other harmful airborne pollutants.
- ***Water Conservation –*** Water-saving systems limit the use of this important natural resource and prevent water pollution that can damage natural ecosystems.
- ***Site Planning –*** Careful site and infrastructure development will minimize water and air pollution.

Why is Green Building Important?

The construction and operation of buildings has a significant impact on the environment. Buildings account for 39% of total U.S. energy consumption and 38% of carbon dioxide emissions.[1] Green buildings use less energy, reducing carbon dioxide emissions and playing an important role in combating global climate change.

Buildings also use a tremendous amount of natural resources to construct and operate. Constructing green buildings that use these resources more efficiently, while minimizing pollution that can harm renewable natural resources, is crucial to a sustainable future.

There are economic benefits to green buildings as well. Energy-efficient buildings cost less to operate. Studies have shown that healthy indoor environments can actually improve employee and student productivity.

[1] *Buildings and the Environment: A Statistical Summary. U.S. Environmental Protection Agency Green Building Workgroup, December, 2004.*

Green Lexicon

Sustainability – In the context of green building, the term refers to the Earth's ability to sustain its ecological processes. To be sustainable, the Earth's resources must be used at a rate at which they can be replenished. Sustainable buildings strive to meet the present needs without compromising the ability to meet those needs in the future.[2]

Indoor Air Quality (IAQ) – Indoor air pollution in homes or commercial buildings usually comes from sources that release gasses or chemicals inside the building. Inadequate ventilation can increase pollutant levels to the point where both short-term irritation and long-term symptoms may develop.[3]

Carbon Footprint – A measure of the impact our activities have on climate change. A building's carbon footprint measures the amount of greenhouse gases produced through burning fossil fuels for electricity, heating, etc.[4]

Life Cycle Assessment (LCA) – The evaluation of the environmental impact of a particular product that takes into account its entire life cycle, from raw material extraction through production, operation, and demolition.

Renewable Energy – Energy generated from resources that are naturally replenished, such as solar, wind, tides, and geothermal energy.

Volatile Organic Compounds (VOCs) – Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.[5]

HERS Index – A scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2006 International Energy Conservation Code) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy-efficient it is.

International Energy Conservation Code (IECC) – Building code established by the International Code Council (ICC) that gives minimum design and construction requirements for energy efficiency. The IECC is a model code that is used by many local code jurisdictions.

ENERGY STAR for Homes – ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to promote energy-efficient homes to potential homebuyers through the recognizable ENERGY STAR label. All ENERGY STAR homes have third party verification that demonstrates a minimum of 15% energy savings over the 2004 IECC.

[2] *http://www.arch.wsu.edu/09%20publications/sustain/defnsust.htm*
[3] *http://www.epa.gov/iaq/ia-intro.html*
[4] *http://www.carbonfootprint.com/carbonfootprint.html*
[5] *http://www.epa.gov/iaq/voc.html*

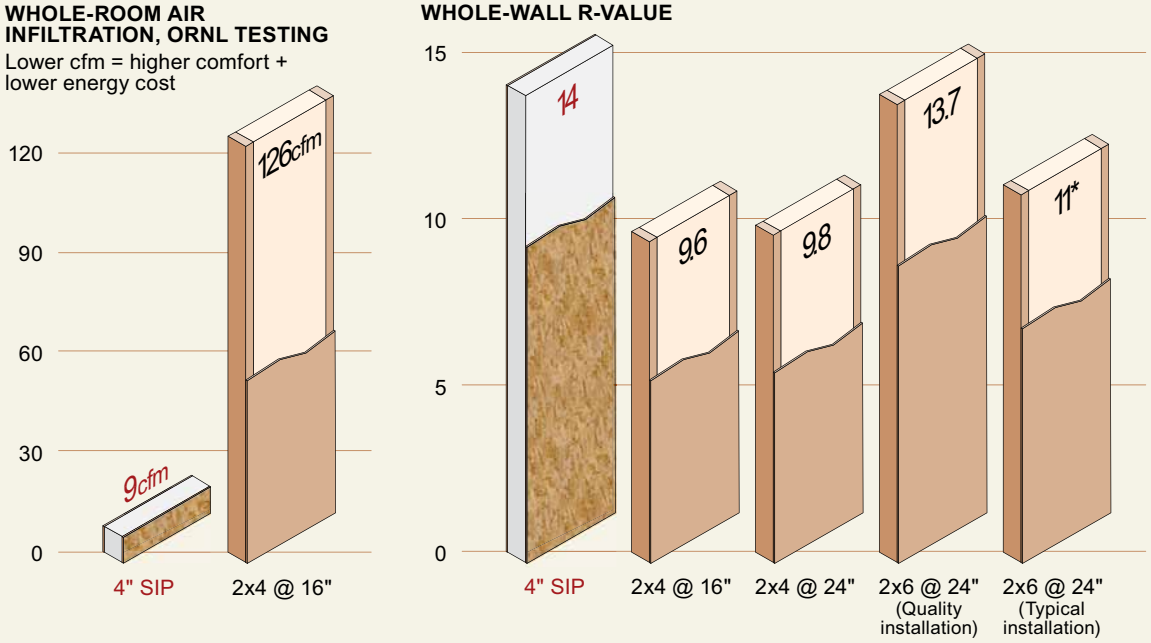
Green Building with SIPs

Structural insulated panels (SIPs) *are one of the most airtight and well insulated building systems available, making them an inherently green product. An airtight SIP building will use less energy to heat and cool, allow for better control over indoor environmental conditions, and reduce construction waste.*

SIPs Save Energy

Building with SIPs creates a superior building envelope with high thermal resistance and minimal air infiltration.

- Oak Ridge National Laboratory (ORNL) Whole-wall R-value studies show that a 4-inch SIP wall (nominal) rated at R-14 outperforms a 2x6 stick framed wall with R-19 fiberglass insulation.[6]
- ORNL blower door tests reveal that a SIP test room is 15 times more airtight than its stick framed counterpart with fiberglass insulation.[7]
- Up to 40% of a home's heat loss is due to air leakage.[8]



** Tests show that in the "worst case commonly found of procedures for installing batt insulation" the performance drops to R-11.*

Figure courtesy of APA.

- SIPs have demonstrated amazingly low blower door test results when properly sealed. Based on the reliable performance of SIPs, ENERGY STAR for Homes chose to eliminate the required blower door test for SIP homes to meet ENERGY STAR standards.

[6] *Kosny, Jan, et al. Whole-Wall Rating/Label for Structural Insulated Panels: Steady-State Thermal Analysis. Oak Ridge National Laboratory, 1999.*
[7] *Petrie, T.W. and Jeff Christian. Heating and Blower Door Tests of the Rooms for the SIPA/Reiker Project. Oak Ridge National Laboratory, 2002.*
[8] *http://www.toolbase.org/Home-Building-Topics/Energy-Efficiency/energy-efficiency-tips*

Burnside's Inn (residence), Dexter, MI

4,010 sq. ft.
0.86 ACH50
HERS Index of 37 (includes solar)

63%

more energy-efficient than 2006 IECC

Energy House III, Elk River, MN

5,219 sq. ft.
0.45 ACH50
HERS Index of 48

52%

more energy-efficient than 2006 IECC

ORNL ZEH5, Lenoir City, TN

2,600 sq. ft.
1.65 ACH50
HERS Index of 45 (includes solar)

55%

more energy-efficient than 2006 IECC

SIPs Save Resources

The major components of SIPs, foam and oriented strand board (OSB), take less energy and raw materials to produce than other structural building systems. SIPs are also fabricated in a controlled environment, allowing for greater efficiency than site-built framing. The NAHB estimates that the construction of a 2000 sq. ft. home produces 7,000 lbs. of waste.[9] SIPs have the ability to drastically reduce the waste generated during construction by using advanced optimization software and automated fabrication technology to ensure the most efficient use of material.

- **OSB** is manufactured from fast growing, underutilized, and often less expensive wood species grown in carefully managed forests. The OSB production process uses small wood chips and highly automated machinery, making OSB a very efficient use of raw materials.
  - *About 85-90 percent of a log can be used to make high quality structural panels, and the remainder – bark, saw trim, and sawdust – can be converted into energy, pulp chips or bark dust.[10]*

- **EPS** is a lightweight insulation composed mostly of air. Only 2% of EPS is plastic.[11] Over the lifetime of a house, the EPS insulation used in SIPs will save many times the energy embodied in the petroleum used to make EPS (see Life Cycle Analysis for more info).[12]
  - *It takes 24% less energy to produce EPS than fiberglass insulation of equivalent R-value.[13]*
  - *Scrap EPS generated during the manufacturing process can be recycled into new EPS products.*

[9] *http://www.oikos.com/esb/46/sitewaste.html*
[10] *Product Guide: Oriented Strand Board. APA–The Engineered Wood Association, 2000.*
[11] *Building a Better Environment with EPS. European Manufacturers of EPS, 2002.*
[12] *Building a Better Environment with EPS. European Manufacturers of EPS, 2002.*
[13] *http://www.epsmolders.org/5.html*

Indoor Air Quality

A SIP home or commercial building allows for better control over indoor air quality because the airtight building envelope limits incoming air to controlled ventilation. Controlled ventilation filters out contaminants and allergens, and also allows for incoming air to be dehumidified, reducing the possibility for mold growth.

There are a variety of ventilation strategies that can be used to provide fresh air to airtight homes. These vary by climate, but are relatively inexpensive and operate on automatic control systems without the need for homeowner action.

SIPs do not contain any VOCs or other harmful chemicals that can affect occupant health. The components used to make SIPs (foam, OSB, and adhesive) meet some of the most stringent standards for indoor air quality.

- EPS uses pentane, a non-CFC blowing agent that dissipates shortly after production. EPS has no offgassing and many EPS manufacturers are GREENGUARD certified.[14]
- SIP homes have qualified under the American Lung Association's Health House® program that has stringent standards for indoor air quality.[15]
- The adhesives used in SIP production do not contain any measurable amounts of VOCs that can be harmful to occupants.[16]
- The oriented strand board (OSB) used in SIPs has often been inaccurately associated with the formaldehyde emissions that occur in fiber board and other composite products using urea-formaldehyde adhesives. The phenolic formaldehyde adhesives used in OSB have only trace amounts of formaldehyde in the finished product that do not jeopardize a home's indoor environment or pose any health risks.
    - The OSB used in SIPs meets the requirements for a low-emitting material under the LEED for New Construction rating system because it does not contain any urea-formaldehyde adhesives.[17]
    - Tests of OSB panels fresh from production revealed formaldehyde offgassing of less than 0.1 parts per million (ppm), declining near zero as the panels age. To put this in perspective, there is more formaldehyde naturally occurring in many foods, such as apples and onions, or the human blood (3 ppm), than in a home built with SIPs.[18]
    - OSB easily meets many of the nation's leading formaldehyde emissions standards, such as U.S. HUD Manufactured Housing Standard and the California Air Resource Board (CARB) Air Toxic Control Measure for Composite Wood Products.[19]

[14] *http://www.epsmolders.org/5.html*
[15] *Heathers Home - http://www.ferriercustomhomes.com/live_test/services/custom_homes/projects/Heathers%20Home/statistics/*
[16] *Miller, Gloria B. Product Stewardship Letter from Rohm and Haas. November 21, 2008.*
[17] *EQ Credit 4.4, LEED for New Construction version 2.2*
[18] *Emery, John A. Structural Wood Panels and Formaldehyde. APA–The Engineered Wood Association, April 2002.*
[19] *Facts on Structural Wood Panel Formaldehyde Emissions, APA–The Engineered Wood Association. February 2008.*

Life Cycle Analysis

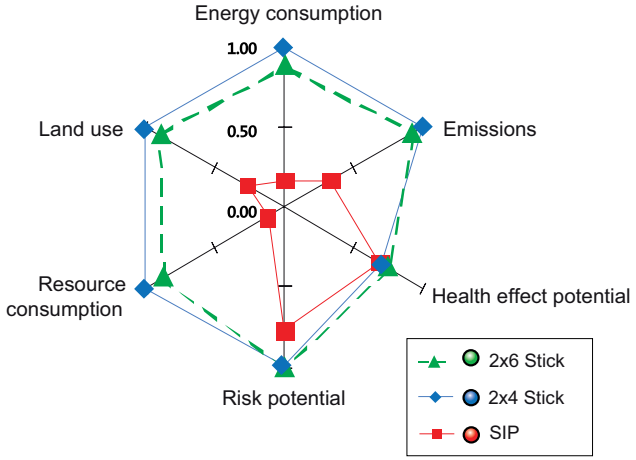
Life cycle analysis (LCA) is the evaluation of the environmental impact of a particular product that takes into account its entire life cycle, from raw material extraction through production, operation, and demolition.

In a market where “greenwashing” has become prevalent, the emerging field of LCA is the only way to truly gauge the environmental impact of a building material through a comprehensive analysis that judges all aspects of a material’s interaction with the environment.

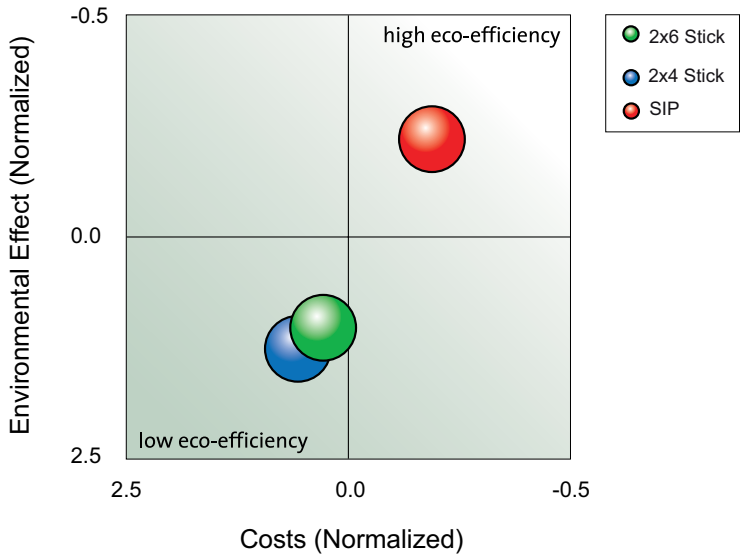
For example, many products save energy for homeowners. But how much energy do they save compared to how much energy was invested in producing and transporting the product? Are the carbon dioxide emissions prevented by the product greater than any harmful pollutants generated in the production process? Does the recycled product take more energy to create than a new product? These are the questions that LCA asks to determine the true ecological footprint.

A comparative LCA study conducted by BASF Corporation reveals that SIPs have a significantly lower environmental impact than conventional wood framing and fiberglass insulation. Not only do SIPs save energy, they also help decrease carbon emissions, water pollution, deforestation, damage to natural habitats, and emissions of other ozone harming gases.

Overall ecological footprint results by insulation system. 1.0 = worst position (the lower the score, the higher the eco-efficiency)



Eco-Efficiency Analysis results for the construction and 60-year use of the walls and roof of 1,100-square-foot, ranch-style, slab-on-grade home, located in the northeastern U.S.



Highlights from the BASF Ecoefficiency Analysis of Residential Insulation Systems[20]

- ***Energy Consumption –*** The heating and cooling of a home uses significantly more energy than the production of both SIP and wood frame systems. Because SIPs are energy-efficient, the life cycle energy consumption is much lower.
- ***Resource Consumption –*** Not only do SIPs save resources in production, but the airtight and well insulated building envelope cuts the amount of natural gas, oil and other resources used in heating and energy generation.
- ***Land Use –*** SIPs use less forest acreage to produce than conventional wood framing. The land affected by electricity generation and natural gas production is also considered in this calculation. By cutting the energy needed to heat and cool a home, SIPs limit land and ecosystem damage.
- ***Emissions –*** Energy used for heating and cooling is the largest contributor to air emissions. An energy-efficient SIP envelope reduces carbon dioxide emissions that cause global warming, as well as other toxic chemicals that can cause acid rain and ozone depletion. SIPs are also lighter and use less fuel to transport than conventional wood framing materials.
- ***Water and Solid Waste Emissions –*** SIPs use less wood to produce, thereby creating less water pollution that is a byproduct of the wood harvesting and production process. Factory fabrication limits onsite construction waste, which is the primary contributor of solid waste for structural systems.

BASF
The Chemical Company

[20] *Available at: http://www.highperformancecommunity.com/index.php?mode=sustainability&section=analysis*

Green Building Rating Systems

Green building rating systems *help architects and builders by providing guidelines for green buildings and third party evaluations. Rating systems typically assign point values for different measures that reduce the building's environmental impact and require a minimum amount of points to be certified as a green building.*

In recent years, rating systems have proliferated and serve as an important tool in separating green building from ***"greenwash,"*** *or unsubstantiated green marketing. Many state and local municipalities have made certification mandatory for publicly funded buildings.*

LEED for Homes **NAHB Green Building Program** **Builders Challenge** **LEED for New Construction**

LEED for Homes

The Leadership for Energy and Environmental Design (LEED) for Homes program is the latest adaptation of the popular LEED rating system administered by the U.S. Green Building Council (USGBC). LEED for Homes was developed to provide both a national metric for measuring the environmental impact of homes and a widely recognizable brand for homebuyers.

The LEED family of rating systems is known for its rigorousness, and the LEED for Homes program is no exception. The USGBC claims that LEED for Homes targets the top 25 percent of green homes in the U.S.

How It Works

LEED for Homes is based on a nationwide network of accredited Providers that are responsible for home certification. The first step to applying for LEED certification is to contact a Provider prior to designing and building the home. Providers employ Green Raters that conduct field inspections and also offer consulting services during the design phase of the project. A list of accredited Providers can be found on the USGBC website (www.usgbc.org).

An integrated design process is an essential part of the LEED for Homes program. The builder applying for certification is responsible for identifying the project team and facilitating communication between team members, such as the architect, HVAC engineer, and landscape professional.

LEED for Homes provides defined goals and processes for all team members to evaluate potential design challenges and offer solutions. This approach ensures the interoperability of systems in a high-performance home. Accountability forms are used to verify the participation of team members in the design process.

Once the home design is complete, the LEED for Homes Provider or Green Rater will conduct an estimate of how the home will score on the rating system. Four levels of certification are offered depending on the amount of points earned: Certified, Silver, Gold, and Platinum. Based on the preliminary evaluation, the builder may wish to include additional green technologies to meet the desired goal.

The Green Rater conducts two onsite inspections of the home, one during construction, usually just prior to drywall installation, and another when the home is completed. During the final inspection, the Green Rater conducts the required blower door test, duct leakage test, and other performance tests. The rater is also responsible for verifying that all the green measures in the preliminary evaluation have been successfully installed in the home.

The final step in the certification process is submitting the appropriate paperwork to the LEED for Homes Provider, who will review the documentation and certify the project. The builder receives a certificate from the USGBC and the home can be marketed as LEED for Homes certified.

How do SIPs Score?

It is important to note that the below table is meant for reference only. Actual project scoring will depend on the individual rater, builder, and other factors.

EA – Energy and Atmosphere

PERFORMANCE PATH

EA 1: Optimize Energy Performance *Maximum 34 Points*	Using the Performance Pathway, the home is awarded points based on overall energy performance, measured by a HERS Index. A home's HERS Index is calculated by a certified energy rater and takes into account the insulation, results from a blower door test, HVAC, lighting, and other relevant information. LEED points are allocated on a scale ranging from 0 points for ENERGY STAR and 34 points for a net zero energy home. Homes must meet ENERGY STAR requirements as a prerequisite for this credit.

PRESCRIPTIVE PATH

EA 2.1: Insulation *Maximum 2 points*	Builders must install insulation that meets or (exceeds) there requirements of the 2004 International Energy Conservation Code (IECC), and are given points for exceeding this standard. SIPs are listed as an exception to this requirement, and must alternately pass a visual inspection using the ENERGY STAR SIP Visual Inspection Form.
EA 3: Air Infiltration *Maximum 3 points*	Well sealed SIP homes have a proven track record of achieving extremely low levels of air infiltration. Homes are awarded points based on their blower door test results, with a maximum of 3 points possible.

MR – Materials and Resources

MR 1.4 Framing Efficiencies *Maximum 3 points*	The project is given one point for each SIP system used: walls, roofs, and floors. If SIP floors are not used, points can be earned by using other material-efficient framing techniques, such as spacing floor joists greater than 16" o.c.
MR 2.2 Environmentally Preferable Products *Maximum 1 point*	SIP homes qualify for 0.5 points if two of the three building components (wall, roof, or floor) use Forest Stewardship Council (FSC) certified OSB.
MR 3.2 Construction Waste Reduction *Maximum 3 points*	Using prefabricated SIPs decreases the amount of onsite construction waste, helping builders qualify for waste reduction points. Waste reduction points are given on a scale ranging from 0 to 3 depending on the amount of waste generated per square foot of the home.

NAHB Green Building Program

The National Association of Homebuilders (NAHB) developed a comprehensive set of Model Green Homebuilding Guidelines in 2005. These guidelines served as a template for local home builders associations to create regional green building programs. More recently, the NAHB has created a national green building program based on the guidelines, including an online Green Scoring Tool available at www.nahbgreen.org.

How It Works

The online scoring tool leads the user through the guidelines and asks them to select the green features that will be incorporated into the home. A report is generated of the builder's score and the builder gives this report to an Accredited Verifier. The verifier will conduct both a rough inspection and a final inspection before signing the report. The signed report is reviewed by the NAHB Research Center and the builder is issued a certificate stating the home's compliance with the program's guidelines.

The NAHB will charge a $150 certification fee for evaluating the report and issuing the certificate. This does not include the cost of the verifier.

Homes qualify as one of three levels based on a points system: Bronze, Silver and Gold. To qualify, the home must meet a certain level of points in each of the following categories: Site Design, Resource Efficiency, Energy Efficiency, Water Efficiency, Indoor Air Quality, Maintenance, and Global Impact.

How do SIPs Score?

It is important to note that the below table is meant for reference only. Actual project scoring will depend on the individual rater, builder, and other factors.

Resource Efficiency

Section 2.1.6B *6 Points*	SIP walls qualify as a panelized wall system.
Section 2.1.6C *6 Points*	SIP roofs qualify as a panelized roof system.
Section 2.6.2 *4 Points*	If the SIPs used in the project are made of OSB certified under an approved forestry certification program, builders will receive points for using certified wood materials.

Energy Efficiency

PERFORMANCE PATH

Section 3.2.1 *Maximum 100 Points*	Using the Performance Path, the home is awarded points based on overall energy performance, measured by energy modeling analysis. Homes must be 40% more efficient than the 2003 IECC to get the full 100 points.

PRESCRIPTIVE PATH

Section 3.3.1A *8 Points*	Homes using SIPs are awarded 8 points for increased effective R-value.
Section 3.3.1B	Using SIPs will not automatically meet the air sealing requirements of 3.3.1B, but a complete SIP building envelope installed per industry standards will satisfy the majority of the required air sealing measures.

Indoor Environmental Quality

Section 5.2.2 *Maximum 10 Points*	Project is awarded points for providing controlled ventilation at a rate of 7.5 cfm per person. This is consistent with SIP industry practice.

Builders Challenge

The U.S. Department of Energy (DOE) launched the Builders Challenge in 2008 to increase the number of energy-efficient homes. This multifaceted program encourages builders to construct more energy-efficient homes while promoting the advantages of energy saving homes to homebuyers.

At the center of the program is the EnergySmart Home Scale, or E-Scale, that measures the energy efficiency of a home. The scale is based on the popular HERS Index, a metric used by ENERGY STAR and the Residential Energy Services Network (RESNET). To meet the Builders Challenge, a home must score 70 on the E-scale, making it 30% more efficient than the 2006 IECC. The DOE sees the E-Scale as an easy-to-understand tool that will help homebuyers make smart energy decisions.

How It Works

To participate in the Builders Challenge, homebuilders must first register online and pledge to construct a number of energy-efficient homes. Participating builders receive marketing tools and a listing on the Builders Challenge website.

Once a home is completed, the builder has several certification options, all of which involve third party verification. The DOE has issued climate-specific prescriptive guidelines that outline the energy-efficient measures required to meet the E-scale score of 70. Unlike other rating systems, these are prescriptive guidelines in the true sense—the project must meet or exceed all of them or will not be certified.

Alternately, the completed home may be rated by a certified HERS rater, and the home's E-scale score will correspond with the HERS rating. Finally, a home can be certified by meeting the requirements of another participating green building program, such as EarthCraft House.

Onsite third-party verifiers will also ensure the builder has followed the Builders Challenge Quality Criteria, a short building design and HVAC best practice guide. Passing ENERGY STAR's Thermal Bypass Checklist is required of all Builders Challenge homes through the Quality Criteria, giving a clear advantage to SIP homes that do not have complicated interfaces between conditioned and unconditioned space.

When the certification process is complete, the builder will receive an E-scale document showing the homeowner their estimated energy savings.

How do SIPs Score?

The building envelope is a crucial element in meeting the energy efficiency requirements of the Builders Challenge. A well insulated and airtight SIP building envelope will make meeting the requirement of 30% energy savings much easier.

Builders choosing the prescriptive option will have to provide a minimum of R-15 wall insulation, R-40 roof insulation, and achieve whole house air infiltration results lower than 5 ACH50. Testing done at Oak Ridge National Laboratory shows that SIPs easily exceed all these requirements in real world situations.

SIPs also give builders an advantage in meeting the Quality Criteria. It is required that all Builders Challenge homes pass an inspection for air barrier and insulation integrity following the ENERGY STAR Thermal Bypass Checklist. A complete SIP building envelope eliminates many of the concerns for gaps or compression in cavity insulation materials.

LEED for New Construction

The Leadership for Energy and Environmental Design (LEED) for New Construction is the flagship of the LEED body of rating systems administered by the U.S. Green Building Council (USGBC). LEED for New Construction provides guidelines for the design and construction of high-performance commercial, institutional and high-rise residential buildings.

Initiatives that require or provide incentives for LEED certification have been adopted by 166 localities and 31 state governments as of November 2008. With many school districts and higher educational institutions jumping on the LEED bandwagon as well, the LEED for New Construction rating system is a driving force in the green building movement.

How It Works

Projects certified under the rating system must meet a total points minimum by accumulating points in the following categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Innovation and Design Process. Buildings must also meet prerequisites in each category. Four levels of certification are available, based on the total number of points awarded: Certified, Silver, Gold, and Platinum.

To apply for LEED for New Construction certification, the project must first be registered with the Green Building Certification Institute (www.gbci.org). All documentation is submitted online. Once the project is registered, the project team identifies operational improvements and equipment upgrades that will earn points under the rating system. These improvements are submitted along with supplementary materials to verify their implementation, including building performance data to demonstrate energy efficiency.

The GBCI's evaluation of LEED for New Construction submittals typically takes place in two phases. A design review that analyzes design related credits is followed by a commissioning of the building once it is substantially completed.

How do SIPs Score?

It is important to note that the below table is meant for reference only. Actual project scoring will depend on the individual rater, builder, and other factors.

EA – Energy and Atmosphere

EA 1: Optimize Energy Performance

Maximum 19 Points

The project can be awarded up to 19 points for total energy savings, determined by whole building energy modeling according to ANSI/ASHRAE/IESNA Standard 90.1-2004, Appendix G. Alternately, certain types of commercial buildings can qualify for energy efficiency points by complying with several listed prescriptive standards.

By reducing the amount of energy needed for heating and cooling, SIPs contribute to overall energy savings. Space heating and cooling account for 44% of energy use in commercial buildings.[21]

MR – Materials and Resources

MR 7: Certified Wood

1 Point

If 50% of the wood products used in the building are Forest Stewardship Council (FSC) certified, 1 point will be awarded. SIPs are available with FSC certified OSB facings from some manufacturers.

EQ – Indoor Environmental Quality

EQ 4.1: Low Emitting Materials: Adhesives and Sealants

1 Point

The structural adhesives used in SIP production meet the requirements for low emitting materials defined in EQ Credit 4.1. All adhesives and sealants used on the interior of the building must meet the requirements to earn the credit.

EQ 4.4: Low Emitting Materials: Wood and Agrifiber Products

1 Point

The OSB used in SIPs meets the requirement that composite wood products used on the interior of the building (defined as inside of the weatherproofing system) shall contain no added urea-formaldehyde resins.

[21] *Energy Information Administration. http://www.eia.doe.gov/kids/energyfacts/uses/commercial.html*

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