

## **DOES IT MAKE CENTS OR SENSE TO BUILD GREEN?**

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## Does it make Cents or Sense to Build Green?

Buildings may be designed, built, operated and maintained in a way that makes use of our natural resources: without destroying the ecological balance of the building site itself, without destroying the ecological balance of the areas from which the required natural resources are taken and without destroying the areas through which these natural resources are transported. Sustainability is the watchword and foundation of a modern-day movement dedicated to promoting the use of environmentally responsible building practices and materials that will not only lessen the scarring of our planet's surface but which will also reduce the amount of carbon molecules from fossile fuels (oil and coal) that man is sending up into our atmosphere which contributes to global warming.

Those supporting the efforts to sustain ourselves in ways where we do not contribute to global warning, are members of this modern-day movement which, in the United States, was somewhat formalized in 1993 with creation of the United States Green Building Council (USGBC). The U.S. Green Building Council is a non-profit, non-government private trade organization promoting sustainability in how buildings are designed, built and operated. The USGBC developed the Leadership in Energy and Environmental Design (LEED) rating system for a number of building applications and also sponsors Greenbuild, an annual international building conference that promotes the green building industry, environmentally responsible materials, sustainable architectural techniques and enabling public policy.

This paper intended to emphasis, punctuate and spotlight the rising unarguable notion that major "earth-shaking" changes are absolutely necessary in the way we live and do business if we are to pass on this land of ours to those coming behind us in as good or better condition as when we found it.

The vision of the USGBC is to create a sustainable built environment within a generation. Its membership includes corporations, builders, universities, government agencies, and other nonprofit organizations. Since UGSBC's founding, the Council has grown to more than 15,000 member companies and organizations. It has developed a comprehensive family of LEED® green building rating systems and a network of 72 local chapters, affiliates, and organizing groups.

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To answer the question of whether or not building green make cents or just plain sense, I've taken the time to outline the opportunities currently available to developers interested in partnering with the government so it will be crystal clear why building green can be a strategy that will set a development proposal apart from all the rest in the competition for granted funds and tax credits.

Initially, building green generally costs more than conventional construction but a proposal with a higher LEED rating may be the overriding reason for a project to be approved for construction and receive millions of dollars in HUD grant funds and federal tax credits.

The green building designs, materials, and techniques themselves can help determine if there is an increase in net operating income for a real estate investment beyond that which might be expected using conventional development methods.

Green building is the practice of increasing the efficiency with which buildings use resources — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better site design, construction, operation, maintenance, and removal.[1]

The Leadership in Energy and Environmental Design (LEED) rating system for new construction is a guide to lead you through the investigatory process of what it means to build green and how a developer can earn high LEED ratings. LEED is the most popular guide for green building in the United States. It was developed and is continuously being modified by workers in the green building industry.

LEED was created to define "green building" by establishing a common standard of measurement, promote integrated whole-building design practices, recognize environmental leadership in the building industry, stimulate green competition and raise consumer awareness of green building benefits that can transform the building market.

The LEED for Homes Rating System measures the overall performance of a home in eight categories:

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1. Innovation & Design Process (ID) Special design methods, unique regional credits, measure not currently addressed in the Rating System and exemplary performance levels.
2. Location and Linkage (LL) The placement of homes in socially and environmentally responsible ways in relation to the larger community.
3. Sustainable Sites (SS) The use of the entire property to minimize the projects impact on the site.
4. Water Efficiency (WE) Water efficient practices both indoor and outdoor.
5. Energy & Atmosphere (EA) Energy efficiency, particularly in the building envelope and heating and cooling design.
6. Materials & Resources (MR) Efficient utilization of materials, selection of environmentally preferable materials, and minimization of water during construction.
7. Indoor Environmental Quality (EQ) Improvement of indoor air quality by reducing the creation of and exposure to pollutants.
8. Awareness & Education (AE) The education of homeowner, tenant, and/or building manager about the operation and maintenance of the green features of a LEED home.

The LEED for Home Rating System works by requiring a minimum level of performance through prerequisites and rewarding improved performance in each of the above categories. The level of performance is indicated by four performance tiers – Certified, Silver, Gold and Platinum – according to the number of points earned.

LEED for Homes Certification Levels	LEED for Homes Points Required
Certified	45-59
Silver	60-74
Gold	75-89
Platinum	90-136
Total Available Points	136

LEED certified buildings use key resources more efficiently when compared to conventional buildings which are simply built to code. LEED certified buildings provide healthier work and living environments, which contribute to higher productivity and improved employee health and comfort. The USGBC has also compiled a long list of benefits of implementing a LEED strategy which ranges from improving air and water quality to reducing solid waste. The fundamental reduction in environmental impacts in addition to all of the economic and occupant benefits goes a long way in making a case for green building. It is also important to note that these benefits are reaped by anyone who comes into contact with the project including owners, occupants and society as a whole.

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Green buildings generally cost more both to design and to construct when compared to conventional buildings. The cost of designing a LEED certified building is higher for several reasons. One reason is that sustainable construction principles may not be well understood by the design professionals undertaking the project. This could require time to be spent on research. Some of the finer points of LEED certification (especially those which demand a higher-than-orthodox standard of service from the construction team) could possibly lead to misunderstandings between the design team, construction team, and client, which could result in delays. Also, there may be a lack of abundant availability of manufactured building components which meet LEED standards.

Pursuing LEED certification for a project is an added cost in itself as well. This added cost comes in the form of USGBC correspondence, LEED design-aide consultants, and the hiring of the required Commissioning Authority (all of which would not necessarily be included in an environmentally responsible project unless it were also seeking LEED certification). These higher initial costs can in many cases be effectively mitigated by the savings incurred over time due to the lower-than-industry-standard operational costs which are typical of a LEED certified building.

Additionally, economic payback may come in the form of employee productivity gains incurred as a result of working in a healthier environment. Studies have suggested that an initial upfront investment of 2% extra will yield over ten times the initial investment over the life cycle of the building.<sup>[3]</sup>

Although the deployment of the LEED Standard has raised awareness of Green Building practices, its scoring system is skewed toward the ongoing use of fossil fuels. More than half of the available points in the Standard support efficient use of fossil fuels, while only a handful are awarded for the use of sustainable energy sources. Further the USGBC has stated support for the 2030 Challenge, an effort that has set a goal of using no fossil fuel greenhouse gas emitting energy to operate by 2030.<sup>[4]</sup>

The concepts of sustainable development and sustainability are integral to green building which can lead to 1) reduced operating costs by increasing productivity and using less energy and water, 2) improved public and occupant health due to improved indoor air quality, and 3) reduced environmental impacts by, for example, lessening storm water runoff and the heat island effect. Practitioners of green building often seek to achieve not only ecological but aesthetic harmony between a structure and its surrounding natural and built environment, although the appearance and style of sustainable buildings is not necessarily distinguishable from their less sustainable counterparts.

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In a recent white paper by the Leonardo Academy comparing LEED certified existing buildings vs. data from BOMA's Experience Exchange Report of 2007 demonstrated LEED certified existing buildings achieved superior operating cost savings in 63% of the buildings surveyed. The savings ranged from \$4.94 to \$15.59 per square foot of floor space, with an average savings of \$6.68 per year and a median savings of \$6.07.<sup>[12]</sup>

The overall cost of LEED certification and implementation ranged from \$0.00 to \$6.46 per square foot of floor space, with an average of \$2.43 per square foot. This demonstrates that implementation is not prohibitive especially in comparison to cost savings.<sup>[12]</sup>

### **THE INNOVATION AND DESIGN PROCESS**

Under the LEED **Integrated Project Planning** section, it is mandatory that a preliminary rating for a potential project be submitted as a prerequisite for which no points are awarded. The second prerequisite is that an Integrated Project Team be identified with profiles of their academic credentials and design expertise. Thirdly the rating entity must be professionally credentialed with respect to LEED for home rating applications. Fourthly and perhaps most time consuming and costly is the prerequisite that a project must evolve as a result of design charrettes. The word charrette refers to any collaborative session in which a group of designers draft a solution to a design problem. While the structure of a charrette varies, depending on the design problem and the individuals in the group, charrettes often take place in multiple sessions in which the group divides into sub-groups. Each sub-group then presents its work to the full group as material for future dialogue. Such charrettes serve as a way of quickly generating a design solution while integrating the aptitudes and interests of a diverse group of people. Think of charrette as a fancy term for workshop.

In addition to these four elements of the Innovation and Design Process referred to as being Integrated Project Planning, the building must be oriented on the site in way where the use of solar energy can be maximized. The building must be designed so that all of the following requirements are met:

- The glazing area on the north and south facing walls of the building is at least 50% greater than the sum of the glazing area on the east and west facing walls.
- The east-west axis of the building is within 15 degrees of due east-west.
- The roof has a minimum of 450 square feet of south facing area that is oriented appropriately for solar applications.
- At least 90% of the glazing on the south facing wall is completely shaded (using shading, overhangs etc.) at noon on June 21 and unshaded at noon on December 21.

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With one point for each major element except for the prerequisite of submitting a preliminary rating, a total of 4 points can be awarded in this first section of the rating checklist.

Prior to construction the project team must identify all moderate and high-risk durability issues for the building enclosure. As an example, if part of the building is underground, there is always the risk that moisture will seep through construction joints in concrete walls or between the cold joint that generally exists between the top of a spread footing and the bottom of concrete walls. For each risk identified, specific measures must be formulated to neutralize those risks and these measures must be incorporated in the drawings, specifications, and scope of work statements as appropriate. An example of such a list is as follows:

<b>INDOOR MOISTURE CONTROL MEASURES</b>	
<i>Location or Equipment</i>	<i>Required Moisture Control Measure</i>
Tub, showers and spa areas	Use non-paper faced backer board on walls.
Kitchen, bathroom and laundry areas	Use water-resistant flooring - no carpet
Entryway (within three feet of door)	Use water-resistant flooring - no carpet
Water heater in or over living space	Install drain and drain pan.
Clothes washer in or over living space	Install drain pan or single supply valve
Conventional clothes dryer	Exhaust directly to outdoors.
Condensing clothes dryer	Install drain and drain pan.

In addition to identifying and creating a checklist of these risks and the methods planned to mitigate those risks, during construction, the builder must have a quality control management system in place to ensure installation of the durability insuring measures.

Credits are awarded under this section only if a certified third party inspection force verifies that each measure listed on the durability check list was fully implemented. A total of three points may be awarded for this third party certified inspection.

Under the **Innovative or Regional Design** section of the checklist, a total of four points can be awarded to a builder who can come up with four new innovations that contribute to the green building effort which are not already included in the LEED rating system.

### **LOCATION AND LINKAGES**

Under the **Site Selection** section, two points can be award for not developing buildings, structures, roads or parking areas on portions of sites that meet any of the following criteria:

- Land whose elevation is at or below the 100 year floodplain as defined by FEMA.
- Land that is identified as habitat for any species on federal or state threatened or endangered lists.
- Land within 100 feet of any water or wetlands.

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- Land that prior to acquisition for the project was public parkland.
- Land that contains prime soils, unique soils or soils of state significance. Sites that are previously developed however are exempt from this requirement.

Under the **Preferred Locations** section, a total of four points can be awarded for projects considered edge development, infill or ones build on previously developed land. One point is awarded if you can site your building so that at least 25% of its perimeter borders previously developed land. Two additional points can be awarded if 75% of the site borders previously developed land. One additional point can be awarded if you build on a previously developed lot.

It is the intent of the **infrastructure** section to encourage building developments that are served by or are near existing roads, sewers, water supplies, natural gas and electrical service lines. One point can be awarded for lots that are within ½ mile of existing water and sewer service lines. For large developments these lines must be within ½ mile of the center of the development.

Under the **Community Resources** section one point can be awarded for building near basic community services. Two points can be awarded for building near extensive community resources and three points can be awarded for building near outstanding community resources. The LEED checklist identifies the differences between basic, extensive and outstanding community resources but essentially the more things there are to do, the more places to go and the closer you are to public transportation, the more points can be awarded.

The intent of the **Access To Open Space** section is to provide open spaces to encourage walking, physical activity and time spent outdoors. A developer can be award one point if a location is selected within ½ mile of a publicly accessible or community based open space that is at least ¼ acre in size. Open spaces must consist of predominantly softscapes such as soil, grass, shrubs and trees.

### **SUSTAINABLE SITES**

Under the **Site Stewardship** section there is a prerequisite that an erosion control plan be devised, implemented and maintained during the construction process. At a minimum this plan must include:

- Stockpile and protect disturbed topsoil from erosion for re-use.
- Control the path and velocity of runoff with silt fencing or comparable measures.
- Protect on-site storm sewer inlets, streams and lakes with straw bales, silt fencing, silt sacks, rock filters or comparable measures.
- Provide swales to divert surface water from hillsides.



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- If soils in a sloped area 25% or greater are disturbed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.

To earn one point a builder must minimize disturbance to the site by meeting the following:

- Where a site is not previously developed, a tree protection plan must be devised with no disturbance zones marked on the plan and in the field.
- Leave undisturbed at least 40% of the buildable lot area, not including the area under the roof. Only softscapes can be counted toward this credit. Projects cannot receive credit for preserving pre-existing hardscapes such as driveways.
- Where the site has been previously developed, delineate no disturbance zones and rehabilitate the lot by undoing any previous soil compaction and remove existing invasive plants.
- Where the site has been previously developed, build on site with a lot area of less than 1/7 of an acre, or with housing density for the project that is equal to or greater than 7 units per acre. For multi-family buildings, the average lot size shall be calculated as the total lot size divided by the number of units.

Under the **Landscaping** section there is a prerequisite that no invasive plants be incorporated into the landscaping. A maximum seven points may be awarded. Two points are earned for a basic landscape design. Three points can be earned if a design limits the use of conventional turf to 20% or less of the designed softscape area. Two points can be earned for the use of drought tolerant plants. Six points are earned by developments that can reduce overall irrigation demand by at least 20%.

The intent of the section on **Local Heat Island Effects** is to award a maximum of one point to landscape designs that lessen the creation of hot spots out of doors. Trees or other plantings must be located to provide shading for at least 50% of sidewalks, patios and driveways within 50 feet of the home. Shading should be calculated for noon on June 21, when the sun is directly overhead, based on five year's growth.

Light colored materials or vegetation should be used for at least 50% of sidewalks, patios and driveways within 50 feet of the home. Acceptable strategies include the use of white concrete, gray concrete, open pavers and any material with a solar reflectance index of at least 29. Shading hardscapes around the home can reduce irrigation needs as well as temper the home's outdoor environment and reduce cooling loads.

Under the **Surface Water Management** section of the checklist a maximum of seven points can be awarded for site features that minimize erosion and runoff from the home site. Four of these points may be granted for designing a **permeable lot** so that at least 70% of the exterior is either permeable or designed to capture water runoff for filtration on the site. Areas that can

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be counted toward the minimum includes vegetative landscape, permeable paving and impermeable surfaces that are designed to direct all runoff toward a filtration feature.

PERMEABILITY TABLE	
% of Buildable Lot That is Permeable (Does not include area under the roof)	Points
70 - 79%	1
80 - 89%	2
90 - 99%	3
100%	4

One additional point can be awarded for the design and installation of either one of the following **permanent erosion control measures**. If portions of the lot are located on a steep slope, use terracing and retaining walls to decrease water velocity. On level land one point can be earned for planting one tree, four 5-gallon shrubs, or 50 square feet of native groundcover per 500 square feet of disturbed lot area (including area under the roof).

A maximum of two additional points can be earned by **managing runoff from the roof**. One of these points can be earned by installing permanent stormwater controls such as vegetated swales, on-site rain gardens, a dry well or rain water cistern. A half of a point can be earned if a vegetative roof covers 50% of the roof area and a whole point can be earned if the entire roof is covered with vegetation.

There is a section in the checklist dealing with **Nontoxic Pest Control**. The intent of this section is to recognize and award as many as two points to those homes designed to minimize the need for poisons for control of insects, rodents and other pests. A half of a point can be awarded to each of the following measures with a maximum of two points.

- Keep all wood siding, trim and structures at least 12 inches above the soil level. The code generally requires 8 inches.
- Seal all external cracks, joints, penetrations, edges and entry points with caulking. Where openings cannot be caulked, install rodent and corrosion-proof screens. Protect exposed foundation insulation with moisture-resistant, pest-proof cover such as fiber cement board or galvanized insect screen.
- Include no wood-to-concrete connections or if they are needed, separate the wood from the concrete by the use of metal or plastic fasteners or dividers.
- Install landscaping so that all parts of mature plants will be at least 24 inches from the home.

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- In areas marked “moderate to heavy” through “very heavy” on the termite infestation probability map, implement one or more of the following measures for as much as one half point each. California is identified on this map as having a “very heavy probability” of termite infestation.
  - Treat all cellulosic material (wood framing) with a borate product to a minimum of 3 feet above the foundation.
  - Install a sand or diatomaceous earth barrier.
  - Install a steel mesh barrier termite control system.
  - Install non-toxic termite bait system
  - Use noncellulosic (not wood or straw) wall structure such as metal.
  - Use solid concrete foundation walls or masonry wall with top course of solid block bond beam or concrete-filled block.

Limiting conventional turf and installing native plants can help reduce the need for fertilizers and pesticides that contain toxic chemicals. Keeping plants away from the home makes it unnecessary to irrigate close to the home and risk leaking moisture into the home’s foundation.

Making use of compact development patterns to conserve land and promote community livability, transportation efficiency and walkability is the intent of the **Compact Development** section. Two points can be awarded for moderate density developments with an average housing density of seven or more dwelling units per acre of buildable land. A single home on 1/7 of an acre qualifies.

Three points are awarded to high density developments when housing density is 10 or more dwelling units per acre. Four points go to those very high-density developments with 20 or more dwelling units per acre. Green building is all about reducing the impact of development on the land so the more dwellings you can place on a given piece of ground, the less ground is needed to accommodate living units.

### **WATER EFFICIENCY**

Under the water efficiency portion of the checklist there are three sections dealing with water reuse, irrigation systems and indoor water use. A maximum of five points can be earned for reusing water. Four points may be granted for reducing overall irrigation demand and six points can be awarded for indoor use of very high efficiency fixtures.

**Water reuse** can be accomplished through use of a rainwater harvesting system and or installing a graywater reuse system for landscape irrigation. Graywater may be collected from the clothes washer, showers and some combination of faucets and other sources estimated to

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exceed 5,000 gallons per year. As an alternative, the plumbing may be designed so that irrigation system water demand is supplied by municipal recycled water.

The **Irrigation System** section awards a maximum of three points for a **high efficiency irrigation system** and an additional one point if the system is **inspected in operation by a green building licensed professional**.

Ways in which high efficiency systems may earn one point with a maximum of three are:

- Install an irrigation system designed by an EPA Water Sense certified professional.
- Design and install an irrigation system with head-to-head coverage.
- Install a central shut off valve.
- Install a submeter for the irrigation system.
- Use drip irrigation for at least 50% of landscape planting beds to minimize evaporation.
- Create separate zones for each type of bedding areas based on watering needs.
- Install a timer that activates the valves for each watering zone at the best time of day to minimize evaporative losses and obeying local regulations on water use.
- Install pressure regulating devices to maintain optimal pressure and prevent misting.
- Use high efficiency nozzles.
- Use heads with check valves in them.
- Install a moisture sensor controller or rain delay controller that receives radio, pager or Internet signals to direct the irrigation system to replace only the moisture that the landscape has lost because of heat and wind.

To get one point for the certified inspection, the observer must see all of the following:

- All spray heads are operating and delivering water only to intended areas.
- Any switches or shut off valves are working properly.
- Any timers or controllers are set properly.
- Any irrigation systems are located at least two feet from the home.
- Irrigation spray does not hit the home.

In lieu of all above opportunities to gain points, all four available points can be gained by engaging a landscape professional, biologist or other qualified professional designer who can reduce the overall irrigation demand by 60% or more. The manner in which these calculations are made are too highly technical to address in this summary however specifics are available beginning on page 50 of the January 2008 LEED checklist.

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The **Indoor Water Use** section of the checklist is intended to award a maximum of six points for minimizing the indoor demand for water through the use of water efficient fixtures and fittings. As many as three points may be awarded for **high efficiency** fixtures and fittings while as many as six points can be awarded for **very high efficiency** fixtures and fittings.

One point can be earned under the **high efficiency** category for each of the following:

- The average flow rate for all lavatory faucets must be < 2.0 gpm.
- The average flow rate for all showers must be < 2.0 gpm per stall.
- The average flow rate for all toilets must be <1.3 gpf or toilets must be dual-flush and meet requirements of ASME A112.1914 or toilets must meet the U.S. EPA WaterSense specification and be certified and labeled accordingly.

Two points can be awarded under the **very high efficiency** category for each of the following:

- The average flow rate for all lavatory faucets must be < 1.5 gpm or lavatory faucets must meet the U.S. EPA WaterSense specification.
- The average flow rate<sup>4</sup> for all showers must be < 1.75 gpm per stall.
- The average flow rate for all toilets must be < 1.1 gpf.

Low flow showerheads and faucets will reduce the demand for hot water resulting in lower energy use demands.

## **ENERGY AND ATMOSPHERE**

This is by far and away the most significant portion of the LEED checklist wherein a total of thirty-eight points may be awarded through either a prescriptive approach to gain energy and atmosphere credits or by achieving the performance levels of ENERGY STAR for homes. I have elected to work through the prescriptive approach since it will allow me to learn and better understand the role of each individual building element in the overall energy conservation effort.

The intent of the **Insulation** section is to award a maximum of two points for designing and installing insulation that minimizes heat transfer and thermal bridging. As a prerequisite, basic insulation must be installed that meets or exceeds the R-value requirements listed in Chapter 4 of the 2004 International Energy Conservation Code. To receive one LEED point insulation must be enhanced to levels that exceed the R value requirements in Chapter 4 of the Energy Conservation Code by at least 5%. An additional point is awarded for insulation that meets the Grade I specifications set by the National Home Energy Rating Standards.

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The **Air Infiltration** portion of the checklist seeks to award a maximum of three points to those dwelling units that minimize energy consumption caused by uncontrolled air leakage into and out of conditioned spaces. As a prerequisite (for which no points are awarded) the dwelling unit must meet the air leakage requirements shown in the following table under Reduced Envelope Leakage and must be tested by a certified energy rater.

AIR LEAKAGE REQUIREMENTS (IN ACH 50)				
LEED CRITERIA	Zone 1-2	Zone 3-4	Zone 5-7	Zone 8
Reduced Envelope Leakage	7.00	6.00	5.00	4.00
Greatly Reduced Envelope Leakage	5.00	4.25	3.50	2.75
Minimal Envelope Leakage	3.00	2.50	2.00	1.50

The number of Air Changes Per Hour (ACH) are induced under a pressure of 50 Pascals (which is less than three quarters of one hundredth of a pound per square inch of pressure). California is in four different climate zones with the central coast being in Zone 4. So, the goal of homes along the central coast (where I live) must not exceed 6 air changes per hour under 50 Pascals to meet the minimum air leakage prerequisites. To earn two points the dwelling must not have more than 4.25 air changes per hour. To earn the full three points for minimal envelope leakage the number of air changes per hour must not exceed 2.5.

Natural air leakage through the envelope contributes to the overall ventilation rate of a home. From a health perspective, it is important to not under ventilate a home. From an energy perspective, it is also important not to over ventilate.

Air infiltration accounts for up to 40% of the energy losses of a wood framed structure. Heat is carried by air leaking through thousands of cracks, openings, and joints between all the pieces of the building shell. Major culprits include framing connections, wall, floor & roof intersections, shrinkage of wood and caulking, and poor installation of components and sealants. A typical new wood frame home has between 1.75 and 3 air changes per hour (ACH50) and after some years it's often between 5 and 10 ACH50 as the wood shrinks and sealants deteriorate. Old wood frame homes commonly have 10 to 20 ACH50.

It is the intent of the **Windows** section of the checklist to maximize the energy performance of windows. Energy Star® is a voluntary partnership between the U.S. Department of Energy (DOE) and the fenestration industry to promote sales of energy-efficient windows, doors and skylights. The program establishes three climate regions with one recommended product designation for each region. As a prerequisite for consideration as a LEED certified building, at a minimum, good windows must be used. In Sand Diego and Carmel, California where I live (the Energy Star South Central Climate Area,) good windows must have a U-factor of less than 0.55

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and a Solar Heat Gain Coefficient (SHGC) less than 0.35. To be awarded two points in California, enhanced windows must be used with a U-factor rating of less than 0.35 and a SHGC of less than 0.35. To get the maximum of three available points awarded, the windows would have to be considered exceptional with a U-factor of less than 0.32 and a SHGC of less than 0.30. The National Fenestration Rating Council (NFRC) is a nonprofit public/private collaboration that provides contractors and homeowners with a standardized energy-performance rating system for fenestration products. It provides accurate information to measure and compare energy performance of windows, doors and skylights. According to the NFRC website, <[www.nfrc.org](http://www.nfrc.org)> windows are rated in the following ways. U-factor measures how well a product prevents heat from escaping. The **rate of heat loss** is indicated in terms of the U-factor (U-value) of a window assembly. U-Factor ratings generally fall between 0.20 and 1.20. The **insulating value** is indicated by the R-value, which is the inverse of the U-value. The lower the U-value, the greater a window's resistance to heat flow and the better its insulating value. R-Value is a measure of a product's ability to resist the transfer of thermal energy. The inverse of U-factor ( $R=1/U$ ), R-value is expressed in units of hr-sq. ft  $^{-2}$ F/Btu. A high R-value window has greater resistance to heat-flow and a higher insulating value than one with a low R-value.

Solar Heat Gain Coefficient (SHGC) measures how well a product blocks heat caused by sunlight. The SHGC is the fraction of incident solar radiation admitted through a window (both directly transmitted and absorbed) and subsequently released inward. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits in the house. Visible Transmittance (VT) measures how much light comes through a product. The visible transmittance is an optical property that indicates the amount of visible light transmitted. VT is expressed as a number between 0 and 1. The higher the VT, the more light is transmitted.

Air Leakage (AL) is indicated by an air leakage rating expressed as the equivalent cubic feet of air passing through a square foot of window area (cfm/sq ft). Heat loss and gain occur by infiltration through cracks in the window assembly. The lower the AL, the less air will pass through cracks in the window assembly. Condensation Resistance (CR) measures the ability of a product to resist the formation of condensation on the interior surface of that product. The higher the CR rating, the better that product is at resisting condensation formation. CR is expressed as a number between 0 and 100.

In a typical house, over 40% of the annual energy budget is consumed by heating and cooling.<sup>1</sup> Proper selection of windows and doors can thus significantly affect how much money is spent or saved every year on keeping homes bright and comfortable.

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A maximum of three points is available for award in the **Heating and Cooling Distribution System** section of the checklist. The intent of this section is to award points to those systems that minimize energy consumption due to thermal bridges and/or leaks in the heating and cooling distribution conduits.

In Forced Air Systems, as a prerequisite, air duct leakage must be limited to areas outside the air-conditioned envelope. For **reduced distribution losses**, Duct leakage must be <4.0 cfm at 25 Pascals per 100 square feet of conditioned floor area. No ducts are allowed in exterior walls unless sufficient insulation is added to meet the overall insulation requirement for the wall itself. At least R-6 insulation must be used around ducts in unconditioned spaces.

Two points are awarded for **greatly reduced distribution system losses** when duct leakage is <3.0 cfm at 25 Pascals per 100 square feet of conditioned floor area. The maximum of three points are award for **minimal distribution losses** when any one of the following requirements are met:

- Duct leakage < 1.0 cfm at 25 Pascals
- Locate the air-handler unit and all ductwork within the conditioned unit.
- Locate the air-handler and all ductwork visibly within conditioned spaces.

In Non-ducted HVAC Systems (Hydronic Systems) at least R-3 insulation around distribution pipes must be used in unconditioned spaces as a prerequisite to achieving **reduced distribution loss** status. To achieve greatly reduced distribution loss status and be awarded two points, the boiler and distribution pipes must be entirely within the conditioned space. To gain the last available point, and minimal distribution loss status, an outdoor reset control must be installed that modulates distribution water temperature based on outdoor air temperatures.

Under the **Space Heating and Cooling Equipment** section, only half of the available points are available to dwellings that have no cooling equipment. As a prerequisite the system must be designed and sized using the ACCA Manual J, the ASHRAE 2001 Handbook of Fundamentals or an equivalent computation procedure. Secondly equipment must meet the requirements of the Energy Star for Homes national builder option package. Lastly an Energy Star labeled programmable thermostat must be installed except for heat pumps and hydronic systems. To gain a credit of one half of one point (for houses without cooling equipment) and reach a **high efficiency level**, you must use equipment better than that described in the Energy Star Builder Option Package. To gain 50% of the 4 credits normally available to houses without cooling equipment, you must employ a system that is substantially better than the Energy Star Builder Option Package (a heat pump as a minimum) and any piping carrying water must have R-4 insulation.



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Under the **Water Heating** section of the checklist a total of six points is available for award. There are no prerequisites. Two credits are given for designing one of three optional systems all of which are considered to be **efficient hot water distribution systems**. One is a **structured plumbing system** with a demand-controlled circulation loop insulated to at least R-4. The length of the circulation loop must be less than 40 linear feet in one story homes. Branch lines from the loop must be less than 10 feet long and a maximum of ½” nominal diameter. Push bottom control in each full bathroom and kitchen with an automatic pump shut off. **The central manifold distribution system** must have a trunk no more than six feet long and insulated to at least R-4. No branch from the central manifold may exceed 20 feet long or be greater than ½” in diameter. A third option is the **compact design of a conventional system** wherein no branch line from the water heater to any fixture may exceed 20 feet and branch lines must be a maximum of ½” nominal diameter.

An additional one point (1/2 point for houses without cooling systems) is awarded when the domestic hot water piping has R-4 insulation installed to even adequately insulate the 90-degree bend. Up to three full points is additionally available for designing and installing energy efficient water heating equipment as the following table indicates. In this table EF refers to the Energy Factors for equipment from various manufacturers. The abbreviation CAE refers to Combined Annual Efficiency. The annual DHW load refers to the annual Domestic Hot Water load. As an aside, it is interesting to note that solar water heaters only require about 11 square feet of solar panel space per person to supply up to 80% of the hot water needed during the summer months and as much as 40% of the energy required during the winter months even in colder climates.

HIGH EFFICIENCY WATER HEATING EQUIPMENT		
Type & Efficiency Requirement	Description	Points
Gas Water Heaters		
EF > 0.53 (80 gallon)	High efficiency storage water heater	1
EF > 0.57 (60 gallon)	High efficiency storage water heater	1
EF > 0.61 (40 gallon)	High efficiency storage water heater	1
EF > 0.8	Storage or tankless water heater	2
CAE > 0.8	High efficiency storage water heater	2
Electric Water Heaters		
EF > 0.89 (80 gallon)	High efficiency storage water heater	1
EF > 0.92 (50 gallon)	High efficiency storage water heater	1
EF > 0.93 (40 gallon)	High efficiency storage water heater	1
EF > 0.99	Tankless water heater	2
EF > 2.0	Heat pump water heater	3

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Solar water heaters (backup)		
> 40% of annual DHW load	With preheat tank	2
> 60% of annual DHW load	With preheat tank	3

Reducing energy consumption associated with interior and exterior **Lighting** is subject of interest to the LEED checklist for which a total of three points may be awarded. As a prerequisite at least four Energy Star labeled light fixtures or Energy Star labeled compact fluorescent light bulbs (CFLs) must be installed in high-use rooms such as the kitchen, dining room, living room, family room and hallways. One and a half credits can be awarded for **improved lighting systems**. The half credit is issued for indoor lighting when an additional three Energy Star labeled light fixtures are installed indoors. The full one point credit is given for exterior lighting with motion sensor controls or photovoltaic cells.

The two ways to earn the three possible credits is to install one of the **advanced lighting packages**. The first option is to install the Energy Star Advanced Lighting Package using only Energy Star labeled fixtures. The Advanced Lighting Package consists of a minimum of 60% Energy Star qualified hard-wired fixtures and 100% Energy Star qualified ceiling fans (if any), The second option is to install Energy Star labeled lamps in 80% of the fixtures throughout the home. Energy Star labeled CFLs are acceptable. All ceiling fans must be Energy Star labeled. By improving the lighting efficiency you may reduce cooling loads and the energy consumption associated with air-conditioning.

The intent of the **Appliance** section of the checklist is to make point awards to those reducing appliance energy consumption. There are no prerequisites. A maximum of two points can be gained by employing the following equipment. You can earn a point for installing an Energy Star labeled refrigerator. You get a half a point for Energy Star labeled ceiling fans if you place one in the living or family room and one per bedroom. You can earn a half point by using an Energy Star labeled dishwasher that uses 6.0 gallons or less per cycle. A half point is awarded for an Energy Star labeled clothes washer.

A full one point can be awarded by installing a clothes washer with a modified energy factor (MEF) > 2.0 and a water factor (WF) < 5.5.

The largest number of credits available under the Energy and Atmosphere portion of the LEED checklist is the section dealing with **Renewable Energy**. It is the intent of this section to encourage the reduction of non-renewable energy sources (coal, oil, natural gas) by encouraging installation and operation of renewable electric generation systems. There are no prerequisites

As many as ten credits can be awarded to those who design and install a renewable electricity generation system. One point is awarded for every 3% of the annual reference electrical load

## Does it make Cents or Sense to Build Green?

met by the system. The annual reference electric load is defined as the amount of electricity that a typical home would consume in a year. The annual reference electric load must be determined using the procedures specified in the 2006 Mortgage Industry National Home Energy Rating Standards (HERS) Guidelines.

For example if the annual reference electric load was 10,000 KWh and the annual electricity supplied by the renewable energy system was 1,800 KWh, this would be 18% of the reference load. With one point being awarded for each 3% drop in the use of non-renewable energy, you divide 18% by 3 and you get 6 points earned.

The last sub-section of the Energy and Atmosphere portion of the checklist deals with **Residential Refrigerant Management**. The idea is to select and test air conditioning refrigerants to ensure proper performance of cooling equipment and minimize contributions to ozone depletion and global warming. There is a prerequisite that a refrigerant charge test be accomplished to determine if they're any leaks and that the proper charge is being used. The one available credit can be earned by doing one of the following things.

- Do not use refrigerants.
- Install a HVAC system with non-HCFC refrigerant. (e.g., R-410a)
- Install a HVAC system with a refrigerant that complies with an equation so complicated I have no idea how to unravel it or explain it

## **MATERIALS AND RESOURCES**

In the **Material-Efficient Framing** section there is a prerequisite that waste developed from cutting framing materials be limited to 10% in order to conserve and optimize the use of framing materials. A total of five points may be earned in the following ways. By detailing framing documents, showing each framing member, one point may be earned. A point can also be earned by making up a cut list and lumber order that corresponds to and can be tracked directly to the framing plans. Three points may be earned by implementing any combination of measures in the following chart.

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EFFICIENT FRAMING MEMBERS	
Measure	Points
Precut framing packages	1
Open web floor trusses	1
Structural insulated panel (SIP) walls	1
SIP roof	1
SIP floors	1
Stud spacing greater than 16" O.C.	1
Ceiling joists spacing greater than 16" O.C.	0.5
Floor joint spacing greater than 16" O.C.	0.5
Roof rafter spacing greater than 16" O.C.	0.5
Implement any 2 of the following"	0.5
●Size headers for actual loads	
●Use ladder blocking or drywall clips	
●Use-stud corners	

You may also fabricate the framing offsite earning four points by using either of the following alternatives to on-site framing:

- Panelized construction. Wall, roof and floor components are delivered to the job site prefabricated.
- Modular, prefabricated construction. All principal sections are delivered to the job site as prefabricated modules.

Reduced framing can reduce the number and size of thermal breaks and increase the amount of insulation installed, leading to better energy performance.

In the **Environmentally Preferable Products** section there is a prerequisite that a written effort be made to purchase tropical wood certified by the Forest Stewardship Council (FSC). A species of wood is considered tropical for the purposes of this prerequisite if it is grown in a country that lies between the Tropics of Cancer and Capricorn.

For California developments this prerequisite seems to work contrary to one of the expressed intents of this section, which is to increase the demand for materials extracted, processed and manufactured in the region of the project. I have no idea why green building concepts encourage the use of tropical wood but I intend to find out. Basically this section lists scores of products a developer may use to earn a half a point each for a total of 8 credit points. The list is too long and forgettable to recite but any designer will have to go through this list and be certain these products are used.

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The intent of the **Waste Management** section is to reduce the amount of waste generated in the building process to a level below that which occurs in normal construction activities. A total of three points may be earned by complying with provisions outlined. As a prerequisite, an investigation must be launched into the options of limiting hauling of waste to the dump. One method would be to decrease the amount of waste you generate. Another option is to find a use for the materials you normally haul to the dump.

Three points may be earned for reducing the amount of waste hauled to landfills by either of two methods. If you can generate 2.5 pounds or less of net waste per square foot of conditioned floor area you can earn three points. As an alternative you can divert 25% of your waste that normally would go to a landfill to some other recipient who could make use of it. The use of products with reclaimed or recycled content reduces both the production of new materials and the burden on landfills.

### **INDOOR ENVIRONMENTAL QUALITY**

A total of twenty-one points can be earned in this portion of the checklist intended to improve the overall quality of a home's indoor environment by including an approved bundle of air quality measures. As a minimum a project must achieve at least a six-point rating. The first element in this section deals with completing all the requirements of the **Energy Star Indoor Air Package (IAP)**, which is worth thirteen points.

A maximum of two points are available for **Combustion Venting** intended to minimize the leakage of combustion gases into the occupied space of a home. As a prerequisite no unvented combustion appliances such as gas fired decorative logs are allowed. A carbon monoxide monitor must be installed on each floor. All fireplaces and woodstoves must have doors. Space and water heating equipment that involves combustion must be designed and installed with closed combustion air and exhaust ducting, power-vented exhaust or must be located in a detached utility building or open-air facility.

To earn the two points you can either refrain from installing a fireplace or woodstove or you can earn one point for using better than conventional building techniques or two points for using the best practice techniques as described in the checklist.

One point is available for following **Moisture Control** guidelines that build in added protection against mold and other moisture damage not covered by managing roof water runoff and by building walls and foundations that include drainage elements, flashing details, air sealing, foundation drain tile, water proof coatings and proper grading. Controlling indoor moisture levels provide comfort, reduce the risk of mold and increase the durability of the home.

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To earn the point available you must install dehumidification equipment with sufficient capacity to maintain a relative humidity at or below 60%. This must be achieved through one of the following:

- Additional dehumidification systems.
- A central HVAC system equipped with additional controls to operate in dehumidification mode.

In hot and humid climates, dehumidification can reduce the energy demands associated with air conditioning.

Under the **Outdoor Ventilation** section the intention is to award a maximum of three points to those dwellings where occupant exposure to indoor pollutants is minimized by ventilating with outdoor air in an *enhanced outdoor ventilation system*. As a prerequisite *a basic outdoor air ventilation* system must be installed that complies with ASHRAE Standard 62.2-2007 or a number of alternatives listed in the checklist. Natural air leakage through the building envelope contributes to the overall ventilation rate of a home, and from a health perspective, it is important not to under ventilate a home. From an energy perspective, it is important not to over ventilate. The way to earn two points is to install a system that provides heat transfer between the incoming outdoor air stream and the exhaust air stream to conserve energy. Having third party performance testing and certification earn the other point.

Under the **Local Exhaust** section of the Indoor Environment Quality portion of the checklist, an effort is made to encourage the reduction of moisture and exposure to indoor pollutants while a person is in the kitchen and bathroom. As a prerequisite you have to have a local exhaust fan in every bathroom and kitchen. The exhaust air must be vented to the outdoors and not into attics or other unused spaces. Bathroom fans must be labeled Energy Star.

In order to receive one of the two available credits, an enhanced local exhaust system must be installed in every bathroom to control the use of the local exhaust fan. At least one of the following measures must be taken:

- Install an occupancy sensor that turns on the fan automatically.
- Install an automatic humidistat controller.
- Install an automatic timer to operate the fan for a timed interval after occupant leaves the room.
- Install a continuously operating exhaust fan.

To gain the remaining one point available the system has to be inspected and certified by a third qualified party.

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**Distribution of Space Heating and Cooling** is an element in the checklist that rewards those who provide appropriate distribution of space heating and cooling devices in the home to improve thermal comfort and energy performance. For forced air systems the prerequisite is to perform a room-by-room load calculation (using ACCA Manuals J and D, the ASHRAE Handbook of Fundamentals) and install ducts accordingly. For non-ducted HVAC systems, only the calculations have to be made and the ductless system installed.

To earn one of the three points available for **forced air systems**, ensure that every room (except baths, kitchens, closets, pantries and laundry rooms) has adequate return air flow through the use of multiple returns or transfer grilles. Either size the opening to one square inch per cubic feet per minute or demonstrate that the pressure differential between closed rooms and adjacent spaces with return is no greater than 2.5 Pascals (0.01 inch w.c.). In order to gain the remaining two points the forced air system must be tested by a third party to show it is working within plus or minus 15% of approved designed criteria.

To earn one point for **non-ducted HVAC Systems**, the system must be designed with flow control valves on every radiator. To earn the other two points, install at least two distinct zones with independent thermostat controls.

A maximum of two points can be awarded under the **Air Filtering** section. The intent is to reduce particulate matter from the air supply system. As a prerequisite, **good filters** must be used with a minimum efficiency reporting value (MERV) greater than 8. Air handlers must maintain adequate pressure and airflow. Air filter housings must be airtight to prevent bypass or leakage. In order to gain one point of credit **better filters** must be installed that have a MERV greater than 10. To earn the full two points, the best filters must be installed with a MERV greater than 13. The choice of an air filter should be made during or prior to duct design to ensure adequate airflow. Filters with a high MERV can create a large pressure drop that should be accommodated during the design process.

**Contaminant Control** is a section seeking to reduce occupant's and construction worker's exposure to indoor airborne contaminants through source control and removal. There are no prerequisites and a total of four credit points are available for award.

One point can be gained under the **Indoor Contaminant Control During Construction** portion by temporarily sealing all permanent ducts, vents, and pipes immediately after installation to minimize contamination inside these vessels during construction. Under the **Indoor Contaminant Control** section one point each (with maximum of two points) can be awarded for completing any one of the following measures:

## Does it make Cents or Sense to Build Green?

- Design and install permanent walk-off mats at each entry so that you can scrape the soles of your shoes clean with the debris falling through a grate which can be removed for cleaning the catching basin.
- Design a shoe removal and storage space near the primary entryway, separated from living areas. This space may not have wall-to-wall carpeting, and it must be large enough to accommodate a bench and at least two pairs of shoes per bedroom.
- Install a central vacuum system with exhaust to the outdoors. Ensure that the exhaust is not near any ventilation air intake.

One additional point may be earned for performing a ***Preoccupancy Air Flush*** with fresh air prior to occupancy but after all phases of construction is completed. The entire home must be flushed for 48 hours keeping all windows open and exhaust fans working.



The **Radon Protection** section of the checklist has a prerequisite for construction in ***High Risk Areas*** if a home is in EPA Radon Zone 1. If your house is in Santa Barbara or Ventura county for example you must design and build the house with radon-resistant construction techniques as prescribed by EPA, the International Residential Code, Washington State Ventilation and Indoor Air Quality Code, or some equivalent code or standard. One credit point can be awarded if the home is in a ***Moderate Risk Area*** outside EPA Radon Zone 1 and the house is designed and built in accordance with the above standards. Radon-resistant construction does not guarantee that occupants will not be exposed to radon. The surgeon General and EPA recommend that every home in the country be tested for radon. Information about radon testing is available at the EPA Web site at ([www.epa.gov/radon/radontest.html](http://www.epa.gov/radon/radontest.html)).

The National Research Council has published a report, entitled: "Health Effects of Exposure to Radon: BEIR VI, *Committee on Health Risks of Exposure to Radon (BEIR VI)*". This report by the National Academy of Sciences (NAS) confirms that **radon is the second leading cause of lung cancer in the U.S.** and that it is a **serious public health problem**. The study fully supports EPA estimates that radon causes about 15,000 to 19,000 lung cancer deaths per year.

In California, Santa Barbara and Ventura Counties are in Zone 1 and have a predicted average indoor radon screening level greater than 4 pCi/L (pico curries per liter). These areas have the highest potential for dangerous level of indoor radon. As you can see by the map below, about half of California is in Radon Zone 2 with a predicted average indoor radon screening level between 2 and 4 pCi/L. The least vulnerable areas are in the northern part of the state



## Does it make Cents or Sense to Build Green?

	<b>Zone 1</b> counties have a predicted average indoor radon screening level greater than 4 pCi/L (pico curies per liter) ( <b>red zones</b> )	<b>Highest Potential</b>
	<b>Zone 2</b> counties have a predicted average indoor radon screening level between 2 and 4 pCi/L ( <b>orange zones</b> )	<b>Moderate Potential</b>
	<b>Zone 3</b> counties have a predicted average indoor radon screening level less than 2 pCi/L ( <b>yellow zones</b> )	<b>Low Potential</b>

Under the **Garage Pollutant Protection** section of the checklist, a maximum of three points are available to encourage reduction of occupant exposure to indoor pollutants originating from an adjacent garage. As a prerequisite there can be no HVAC in the garage. Place all air handling equipment and ductwork outside the fire-rated envelope of the garage.

Two points are available for **minimizing pollutants from the garage** by tightly sealing shared surfaces between the garage and air conditioned spaces including all of the following:

- In conditioned space above the garage
  - Seal all penetrations.
  - Seal all connecting floor and ceiling joist bays and...
  - Paint walls and ceiling since carbon monoxide can penetrate unfinished drywall through diffusion.
- In conditioned spaces next to the garage
  - Weather-strip all doors.
  - Place carbon monoxide detectors in adjacent rooms that share a door with the garage.
  - Seal all penetrations,
  - Seal all cracks at the base of the walls.

One additional point can be earned by installing an **Exhaust Fan in The Garage** that is rated for continuous operation and designed to be operated in one of the following ways. Non-ducted exhaust fans must be 70 cubic feet per minute (cfm) and ducted fans must be 100 cfm or greater.

- The fan must run continuously, or
- The fan must be designed with an automatic timer control linked to an occupant sensor, light switch, garage door opening-closing mechanism, carbon monoxide sensor or equivalent. The time must be set to provide at least three air changes each time the fan is turned on.

All three points can be earned if you have a detached garage or no garage at all.

## Does it make Cents or Sense to Build Green?

### **AWARENESS AND EDUCATION**

One half of the last major portion of the LEED checklist deals with **Education of the Homeowners or Tenants** to enhance the probability they will be encouraged to maintain the performance of the home during their occupancy. The prerequisites require the developer to create an operation and maintenance manual or binder that includes a completed checklist of the LEED for Homes features and how to operate them. In addition there must be a one-hour walkthrough of the home featuring an introduction to all the installed equipment and how to maintain it.

One point of credit may be earned for conducting **Enhanced Training** consisting of at least two more hours of training conducted in the walkthrough manner or by attending training classes in LEED building techniques held outside the home.

The other available point can be earned by doing something to promote **Public Awareness** about LEED for Homes by conducting at least three of the following activities:

- Hold an advertised open house lasting at least four hours on at least four weekends in which you have at least four stations where visitors can review the specifics of at least four LEED for Homes features.
- Publish a website with at least two pages that provides detailed information about the features and benefits of LEED for Homes.
- Generate a newspaper article on the LEED for Homes project.
- Display LEED for Homes signage measuring six square feet or more, on the exterior of the home or building.

The last half of the Awareness and Education portion of the checklist deals with **Education of the Building Manager** for multifamily buildings (more than five units). With no prerequisites, a credit of one point can be earned by providing the building manager with a detailed building owner's manual containing manufacturer's detailed operational instruction and repair procedures, tests reports and general information on usage of all devices in the home. The manager must receive guidance on the kind of cleaning materials to use, how to set the landscaping irrigation controller for example and how to maintain all the equipment in the building with special emphasis on the details of the mechanical and plumbing items in each unit. In short the building manager must be taught everything he needs to know in order to be a good care keeper of the building and grounds.

### **SUMMARY AND RECONCILIATION OF THE QUESTION**

When the project is complete and all the credit points have been granted, a developer can see what certification level he has achieved. Before doing this research on what it really means to build green, I never really paid too much attention to or even understood the meaning of

## Does it make Cents or Sense to Build Green?

advertising statements I would see alongside the roadside touting the energy efficiency ratings of homes for sale in a new subdivision. I was attracted to the logos and pricing but any energy conservation data had little meaning to me.

<b>LEED FOR HOMES CERTIFICATION LEVELS</b>	
Name of Level	Points Required
<b>CERTIFIED</b>	<b>45 - 59</b>
<b>SILVER</b>	<b>60 - 74</b>
<b>GOLD</b>	<b>75 - 89</b>
<b>PLATINUM</b>	<b>90 - 136</b>
Total Available Points	136

Now, with a good basic understanding of the LEED for Homes rating system, I'm going to be looking at these new subdivision homes and looking for their LEED certification levels. Certified, Silver, Gold and Platinum now mean something very significant and important to me and, as a licensed realtor, I'm now a lot better prepared to explain the importance of these various levels to my clients.

Finally, its time to answer the question Does Building Green Makes Cents of Just Plain Cents? I investigated forty-one green building techniques and have noted the ones I feel will increase the net operating income of a real estate developer while in most cases enhancing the marketability of his residential products. Of the 41 areas 30 were money savers or marketability enhancers. This means over 70% of the green building techniques outlined in the LEED's for Home rating system not only make sense but following these techniques will put cold hard cash in the pockets of individual homebuilders and real estate development companies. The results of my findings can be found on the following page.

## Does it make Cents or Sense to Build Green?

DOES IT MAKE CENTS OR SENSE?			
AREAS OF INVESTIGATION	MAKES CENTS	MAKES SENSE	REASONS
<b>INNOVATION AND DESIGN PROCESS</b>			
Integrated Project Planning	X	X	Enhances probability of gaining funding
Durability Management Process	X	X	Enhances optimal building life
Innovative or Regional Design	X	X	Aids in competition for project approval
<b>LOCATION AND LINKAGES</b>			
Leed Neighborhood Development	X	X	Saves money by not having to fight protestors
Site Selection	X	X	Saves money by not having to fight protestors
Preferred Location	X	X	Edge and Infill sites are closer to utilities- saves \$
Infrastructure	X	X	Building close to roads & services is cheaper
Community Resources	X	X	Building close to resources enhances marketability
Access to Open Space	X	X	Enhances marketability
<b>SUSTAINABLE SITES</b>			
Site Stewardship	0	X	No savings but makes sense
Landscaping	X	X	Reduces irrigation cost by 20%
Local Heat Island Effects	0	X	No market driven savings but makes sense
Surface Water Management	0	X	No calculable savings
Non-Toxic Pest Control	N/A	N/A	Not a part of Jan 2008 LEEDS checklist
Compact Development	X	X	High Density lessens unit costs
<b>WATER EFFICIENCY</b>			
Water Reuse	X	X	Decreases irrigation water expenses
Irrigation System	X	X	Decreases irrigation water expenses
Indoor Water Use	X	X	Decreases potable water expenses
<b>ENERGY AND ATMOSPHERE</b>			
Insulation	X	X	Decreases energy expenses
Air Infiltration	X	X	Decreases energy expenses
Windows	X	X	Decreases energy expenses
Heating and Cooling Distribution System	X	X	Decreases energy expenses
Heating and Cooling Equipment	X	X	Decreases energy expenses
Water Heating	X	X	Decreases energy expenses
Lighting	X	X	Decreases energy expenses
Appliances	X	X	Decreases energy expenses
Renewable Energy	X	X	Decreases energy expenses

## Does it make Cents or Sense to Build Green?

Residential Refrigerant Management	0	X	No discernable savings
<b>MATERIALS AND RESOURCES</b>			
Material-Efficient Framing Environmentally Preferable Products	X	X	Decreases building expenses
Waste Management	0	X	No discernable savings
<b>INDOOR ENVIRONMENTAL QUALITY</b>			
Energy Star with Indoor Air Package	0	X	Energy cost savings
Combustion Venting	0	X	No discernable savings
Moisture Control	X	X	Increases longevity of building
Local Exhaust		X	No discernable savings
Distribution of Space Heating and Cooling		X	Energy cost savings
Air Filtering	0	X	No discernable savings
Contaminant Control	0	X	No discernable savings
Radon Protection	X	X	Could save lives
Garage Pollutant Protection	0	X	No discernable savings
<b>AWARENESS AND EDUCATION</b>			
Education of Homeowner or Tenant	X	X	Ensures proper care which extends life of bldg.
Education of Building Manager	X	X	Ensures proper care which extends life of bldg.



Report By: Alex Hale

