

LEED Green Building Rating System and the DELTA House

Growing concern for the environment has caused a rise in what has come to be called “green building.” The United States Green Building Council has been developing over the past 4 years the “Leadership in Energy and Environmental Design,” or LEED green building rating system, with the purpose of accelerating the implementation of green building practices and establishing a standard for the certification of environmentally conscious buildings. The rating system is based on credits awarded in 6 categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design. There are 4 LEED Certification Levels (Certified, Silver, Gold, and Platinum) awarded based on the total credits captured. A total of 69 credits are possible, and at least 26 points are required to receive Certification, 33 for Silver Certification, 39 for Gold, and 52 for Platinum. Currently there are only 59 LEED accredited projects worldwide under the 1.0 and 2.0 standards and only 2 of these are platinum certified.

One of the main goals of the DELTA Project is to focus on the conservation of natural resources by having minimal impact on the environment. Becoming LEED accredited would tie in directly with three of the 4 E’s that describe the focus of the project: Energy and Efficiency, Environment and Health, and Education. Based on the current plans for the DELTA house a platinum level certification is possible, and we hope to become one of the first projects to be certified under LEED 2.1 to this level worldwide and the first residential house ever accredited. The following is a description of the categories that make up the LEED rating system, and a summary of the credits required for certification; and an analysis of the points we predict the DELTA Project can obtain.

- 1. Sustainable Sites 20%:** The purpose of this category is to encourage the selection of a site that will pose minimal impact in the environment. During the site selection process already developed sites, and sites within close proximity of mass transportation are favored over the development of a virgin site. This category also encompasses the impact of the project after construction. Therefore, light pollution, heat island effects, and storm water management issues must be addressed. The following are the credits that make up this category:

Points possible for DELTA Project (10 points):

- Erosion & Sedimentation Control (Required): In order to meet this requirement the sediment and erosion control plan must meet the guidelines outlined in the United States Environmental Protection Agency (EPA) Document No. EPA 832/R-92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3, or the local erosion and sedimentation control standards, depending which one is more stringent. The purpose of this credit is to prevent loss of soil during construction by storm water runoff and/or wind erosion, prevent sedimentation of storm sewers, and to prevent the pollution of the air with dust and particulate matter. (LEED 2.1 Reference Guide)

- Site Selection (1 point): The intent of this credit is to avoid the development of prime farmland, parkland, the habitat for endangered species, or any other inappropriate sites, this reducing the environmental impact of the building. (LEED 2.1 Reference Guide)
- Alternative Transportation: Public Transportation Access (1 point): When selecting the site, public transportation access should be taken into consideration. This credit is awarded for building located within ½ mile of a commuter rail or subway station or ¼ mile of two or more public or campus bus lines. (LEED 2.1 Reference Guide)
- Alternative Transportation: Bicycle Storage & Changing Rooms (1 point): This credit is awarded for providing in residential projects covered bicycle storage facilities for 15% or more of building occupants. This is to encourage use of alternative transportation and to reduce pollution. (LEED 2.1 Reference Guide)
- Alternative Transportation: Parking Capacity (1 point): To meet the requirements of this credit the parking capacity for the building should not exceed minimum local zoning requirements and preferred parking should be provided for carpools capable of serving 5% of building occupants. (LEED 2.1 Reference Guide)
- Reduced Site Disturbance: Development Footprint (1 point): This point is awarded by reducing the development footprint and exceeding local zoning requirements for open space by 25% or for areas without zoning requirements an open space area should be designated equal to the development footprint. (LEED 2.1 Reference Guide)
- Storm Water Management: Rate and Quantity (1 point): The requirement of this credit is met by implementing a storm water management plan to decrease storm water runoff. (LEED 2.1 Reference Guide)
- Storm Water Management: Treatment (1 point): By eliminating storm water runoff and constructing a site storm water treatment system this credit can be met. The Best Management Practices in Chapter 4, Part 2 (Urban Runoff) of the EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, January 1993 should be implemented. (LEED 2.1 Reference Guide)
- Heat Island Effect: Non-Roof (1 point): The intent of this credit is to reduce heat islands (thus increasing impervious surfaces) to decrease impact on human and wildlife habitat. (LEED 2.1 Reference Guide)
- Heat Island Effect: Roof (1 point): Reduce heat islands by having an Energy Star compliant roof or a vegetated roof. (LEED 2.1 Reference Guide)
- Light Pollution Reduction (1 point): Meet or lower the recommended light levels suggested by the Illuminating Engineering Society of North America (IESNA) *Recommended Practice Manual: Lighting for Exterior Environments*. (LEED 2.1 Reference Guide)

Points that may not be possible (2 points):

- Urban Redevelopment (1 point): This point is awarded to projects that are located within an existing minimum development density of 60,000 square feet per acre. (LEED 2.1 Reference Guide)
- Reduced Site Disturbance: Protect or Restore Open Space (1 point): This credit is to ensure the conservation of natural areas and restore damaged areas. On greenfield sites site disturbance should be limited to 40 feet beyond the building perimeter and on previously developed sites a minimum of 50 % of the site area should be restored by replacing impervious surfaces with vegetation. (LEED 2.1 Reference Guide)

Points not possible or not applicable to the DELTA project (2 points):

- Brownfield Redevelopment (1 point): This credit is awarded for building in a site that has been documented as being contaminated by means of ASTM E1903-97 Phase II Environmental Site Assessment or a site classified as a brownfield. (LEED 2.1 Reference Guide)
- Alternative Transportation: Alternative Fuel Vehicles (1 point): To meet the requirements of this credit, alternative fuel vehicles for 3% of building occupants and preferred parking for these vehicles or alternative-fuel refueling stations must be provided. (LEED 2.1 Reference Guide)

- 2. Water Efficiency 7%:** Increased concerns for water availability in the future have caused a move towards water conservation measures. The purpose of this category is to promote water use efficiency and the reduction of water consumption. To meet the requirements of these credits potable water use must be reduced. The use of alternative water sources such as rainwater, the implementation of a grey water recycling system, the use of water efficient landscaping, and an on-site biological wastewater treatment system is recommended to meet the various credit requirements. Furthermore, the overall consumption of water can be greatly reduced by installing water conserving plumbing fixtures such as low-flow toilets and faucet aerators. The following are the credits that make up this category:

Points possible for DELTA Project (4 points):

- Water Efficient Landscaping (1 point): Reduce by 50%: Reduce potable water use for irrigation by 50% by using recycled or collected rain water or through the use of a high-efficiency irrigation system. (LEED 2.1 Reference Guide)
- Innovative Wastewater Technologies (1 point): Reduce the amount of wastewater generated by using low water fixtures and compost toilets by 50 % or treat all wastewater generated on site to tertiary standards. (LEED 2.1 Reference Guide)
- Water Use Reduction: 20% Reduction (1 point): Minimize the amount of potable water used by 20% from the baseline case for the building by employing water conservation strategies. (LEED 2.1 Reference Guide)
- Water Use Reduction: 30% Reduction (1 point): Increase water efficiency by reducing the amount of potable water used by 30% from the baseline case for the building. (LEED 2.1 Reference Guide)

Points that may not be possible (1 point):

- Water Efficient Landscaping (1 point): No Potable Use or No Irrigation: Use no potable water for irrigation needs or do not install a permanent irrigation system and use drought resistant plants. (LEED 2.1 Reference Guide)

Points not possible or not applicable to the DELTA project (0 points):

- 3. Energy & Atmosphere 25%:** The great environmental impact of the extraction, refinement, power generation, and distribution of fossil fuels, has recently provoked a campaign towards the use of “green power.” To meet the requirements for these credits the reduction of energy loads and the use of renewable energy and green power is needed. Furthermore, this category also encompasses the overall building design which will ultimately determine which HVAC equipment is needed and reduce energy consumption. The following are the credits that make up this category:

Points possible for DELTA Project (9 points):

- Fundamental Building Systems Commissioning (Required): Form a team of individuals not directly involved in the project to review building design and to ensure that building systems are installed and operate as planned. (LEED 2.1 Reference Guide)
- Minimum Energy Performance (Required): Design the building to meet the ASHRAE/IESNA Energy Standard 90.1-1999 or the local energy code depending on which one is stricter. (LEED 2.1 Reference Guide)
- CFC Reduction in HVAC&R Equipment (Required): Make sure that no CFC-based refrigerants are used in the HVAC&R system to reduce ozone depletion. (LEED 2.1 Reference Guide)
- Renewable Energy: 5% (1 point): Use alternative sources of energy such as solar, wind, geothermal, etc. to supply 5% of the building’s energy needs. (LEED 2.1 Reference Guide)
- Renewable Energy: 10% (1 point): Make use of renewable sources of energy to supply 10% of the building’s energy needs. (LEED 2.1 Reference Guide)
- Renewable Energy: 20% (1 point): Meet 20% of the building’s energy needs by using renewable energy. (LEED 2.1 Reference Guide)
- Additional Commissioning (1 point): Implement a team to review building design and verify that the building is constructed and operates as it was planned. (LEED 2.1 Reference Guide)
- Ozone Depletion (1 point): Use HVAC and refrigeration equipment that do not contain Halons or HCFCs. (LEED 2.1 Reference Guide)
- Measurement & Verification (1 point): Implement a metering system to monitor the building’s energy and water consumption at all times. (LEED 2.1 Reference Guide)
- Green Power (1 point): Supply at least 50% of the building’s energy by signing a contract for renewable energy for at least two years from sources defined by the Center for Resource Solutions. (LEED 2.1 Reference Guide)

- Optimize Energy Performance (2 points): Maximize energy performance of the building by reducing the amount of energy needed by 20 % using energy efficient systems. (LEED 2.1 Reference Guide)

Points that may not be possible (2 points):

- Optimize Energy Performance (2 points): Maximize energy performance of the building by reducing the amount of energy needed by 30 % using energy efficient systems. (LEED 2.1 Reference Guide)

Points not possible or not applicable to the DELTA project (6 points):

- Optimize Energy Performance (6 points): Maximize energy performance of the building by reducing the amount of energy needed by 40-60% using energy efficient systems. (LEED 2.1 Reference Guide)

- 4. Materials & Resources 19%:** One of the principles of green building design is to decrease impact on the environment. Therefore, the choice in building materials becomes an important aspect in the design process because of the processing and transportation that goes into their production. To meet the requirements for this category involves choosing local certified materials that will reduce the environmental impacts associated with the delivery of materials. Another strategy for reducing the environmental impacts is to recycle materials from old buildings and implement an effective construction waste management program to divert most of the waste that goes into landfills. The following are the credits that make up this category:

Points possible for DELTA Project (9 points):

- Storage & Collection of Recyclables (Required): Develop a convenient recycling system for the building to recycle paper, corrugated cardboard, glass, plastics and metals. (LEED 2.1 Reference Guide)
- Construction Waste Management: Divert 50% (1 point): Develop a plan to divert at least 50% of the waste from construction by recycling and salvaging materials. (LEED 2.1 Reference Guide)
- Resource Reuse: Specify 5% (1 point): Use salvaged or refurbished materials for at least 5% of the building materials needed. (LEED 2.1 Reference Guide)
- Recycled Content: Specify 5% (p.c. + ½ p.i.) (1 point): Use materials that have a recycled content to make up at least 5% of the materials for the project. (LEED 2.1 Reference Guide)
- Recycled Content: Specify 10% (p.c. + ½ p.i.) (1 point): Use materials that have a recycled content to make up at least 10% of the materials for the project. (LEED 2.1 Reference Guide)
- Local/Regional Materials: 20% Manufactured Locally (1 point): Use materials that have been manufactured locally (within a 500 mile radius) for at least 20% of the building materials. (LEED 2.1 Reference Guide)
- Local/Regional Materials: of 20% in MRc5.1, 50% Harvested Locally (1 point): Use materials that have been manufactured locally (within a 500 mile radius) for at least 50% of the building materials. (LEED 2.1 Reference Guide)

- Rapidly Renewable Materials (1 point): Make use of materials that are rapidly renewable such as bamboo or linoleum flooring, etc. (LEED 2.1 Reference Guide)
- Certified Wood (1 point): Use wood that has been certified by the Forest Stewardship Council. (LEED 2.1 Reference Guide)
- Resource Reuse: Specify 10% (1 point): Use refurbished materials to meet at least 10% of the building materials needed. (LEED 2.1 Reference Guide)

Points that may not be possible (1 point):

- Construction Waste Management: Divert 75% (1 point): Develop a plan to divert at least 75% of all waste generated in construction from landfill by recycling and salvaging materials.

Points not possible or not applicable to the DELTA project (3 points):

- Building Reuse: Maintain 75% of Existing Shell (1 point): Reuse at least 75% of an already existing building on the site for the project. (LEED 2.1 Reference Guide)
- Building Reuse: Maintain 100% of Shell (1 point): Reuse 100% of an already existing building shell on site. (LEED 2.1 Reference Guide)
- Building Reuse: Maintain 100% Shell & 50% Non-Shell (1 point): Maintain 100% of the building shell and at least 50% of the non-shell of an already existing building on site. (LEED 2.1 Reference Guide)

5. Indoor Environmental Quality 22%: One of the most important aspects to take into consideration in the design process is the overall indoor environmental quality due to the influence this can have on health and the overall quality of life. To meet the requirements for this category the materials chosen should release as few and the least amount of contaminants into the environment. Furthermore, day-lighting, views, and thermal comfort need to be taken into consideration in the design. The following are the credits that make up this category:

Points possible for DELTA Project (15 points):

- Minimum IAQ Performance (Required): Meet the ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality to ensure the comfort of the occupants. (LEED 2.1 Reference Guide)
- Environmental Tobacco Smoke (ETS) Control (Required): Prohibit smoking in the building or provide designated smoking areas designed to eliminate ETS from the building. (LEED 2.1 Reference Guide)
- Carbon Dioxide (CO₂) Monitoring (1 point): Install a system to monitor carbon dioxide levels in the building at all times. (LEED 2.1 Reference Guide)
- Ventilation Effectiveness (1 point): Design the ventilation of the building to ensure effective delivery and mixing of fresh air and to meet ASHRAE Standard 129-1997. (LEED 2.1 Reference Guide)
- Construction IAQ Management Plan: During Construction (1 point): Develop an Indoor Air Quality Management plan to insure indoor air quality and prevent problems due to the construction process. (LEED 2.1 Reference Guide)

- Construction IAQ Management Plan: Before Occupancy (1 point): Develop an Indoor Air Quality Management plan to insure indoor air quality and prevent problems due to the construction process before occupancy by performing a building flush-out. (LEED 2.1 Reference Guide)
- Low-Emitting Materials: Adhesives & Sealants (1 point): Use adhesives and sealants that meet the VOC limits delineated by the South Coast Air Quality Management District Rule #1168 and the Bay Area Air Quality Management District Regulation 8, Rule 5. (LEED 2.1 Reference Guide)
- Low-Emitting Materials: Paints (1 point): Use paints that do not exceed the VOC emission limits in the Green Seal's Standard GS-11 Requirements. (LEED 2.1 Reference Guide)
- Low-Emitting Materials: Carpet (1 point): Carpets in the building should at least meet the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program requirements. (LEED 2.1 Reference Guide)
- Low-Emitting Materials: Composite Wood (1 point): Use wood that does not contain any urea-formaldehyde resin to ensure indoor air quality. (LEED 2.1 Reference Guide)
- Indoor Chemical & Pollutant Source Control (1 point): Design building to prevent the exposure of occupants to harmful chemicals that are used in the building. (LEED 2.1 Reference Guide)
- Controllability of Systems: Perimeter (1 point): Provide controls for thermal, ventilation and lighting systems for the occupants for regularly occupied areas. (LEED 2.1 Reference Guide)
- Controllability of Systems: Non-Perimeter (1 point): Provide controls for thermal, ventilation and lighting systems for each individual occupant. (LEED 2.1 Reference Guide)
- Thermal Comfort: Comply with ASHRAE 55-1992 (1 point): Meet the ASHRAE Standard 55-1992 for thermal comfort, to provide a thermally comfortable environment for the building occupants. (LEED 2.1 Reference Guide)
- Thermal Comfort: Permanent Monitoring System (1 point): Use a system to monitor the temperature and humidity inside the building at all times to ensure thermal comfort. (LEED 2.1 Reference Guide)
- Daylight & Views: Daylight 75% of Spaces (1 point): Provide daylight and a connection to the outdoor for the building occupants in at least 75% of all spaces used for critical visual tasks. (LEED 2.1 Reference Guide)
- Daylight & Views: Views for 90% of Spaces (1 point): Provide daylight and a connection to the outdoor for the building occupants in at least 90% of all spaces used for critical visual tasks. (LEED 2.1 Reference Guide)

Points that may not be possible (0 points):

Points not possible or not applicable to the DELTA project (0 points):

6. Innovation & Design Process 7%: The focus of this category is to reward innovation in design and strategies taken to exceed performance beyond that required. In addition, a point is awarded by hiring a LEED accredited

professional to oversee the project and provide guidance in the application and certification process. The following are the credits that make up this category:

Points possible for DELTA Project (5 points):

- Innovation in Design (1-4 points): These credits are awarded for exceeding the guidelines and for implementing cutting edge technology to reduce the overall impact to the environment. (LEED 2.1 Reference Guide)
- LEED Accredited Professional (1 point): Incorporate a LEED professional as part of the project team to oversee design and documentation processes.

Points that may not be possible (0 points):

Points not possible or not applicable to the DELTA project (0 points):

Totals: Points possible – 52

Points that may not be possible – 6

Points not possible – 11

LEED has become a catalyst for change in the building industry in the past 4 years and sustainable building has become the new trend. With the goal of making the DELTA Project a showcase of present and future technologies, the acquisition of LEED certification would be representative of new environmental technology. Furthermore, it would ensure a healthy and comfortable environment for the DELTA house occupants while minimizing the project's impact on the environment. The DELTA Project can then as a result become a leader in environmental innovation.