Sewanee Green+ Building Design Guide

This Design Guide is intended as a working outline for designers and contractors that work at Sewanee. Accordingly, as a working document, various components may be periodically updated.

This Guide is jointly the responsibility of Physical Plant Services (PPS) and the Office of Environmental Stewardship and Sustainability (OESS).

It is the responsibility of the designers to verify and confirm any questions regarding this Guide with Physical Plant Services.

Green+ Building Design Guide

I. Purpose

This Guide was created to provide guidance for future construction and renovation projects. The Guide is a template for architects, engineers, designers and contractors, as well as Sewanee end-users and administrators, that provides a guide and standards that embody Sewanee's philosophy for its built environment, as well as supporting its historical heritage requirements. Drawing from the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) standards, the Guide provides basic goals for the renovation, design, and construction phases of a building's lifecycle. For each of these phases, the Guide offers a road map for the creation and maintenance of the built environment that embodies Sewanee's philosophy of a healthy and productive learning atmosphere and our desire for a sustainable future. The Guide includes expectations for site management, water usage, HVAC and lighting, indoor environmental quality, materials choice and usage, and waste management, and affords flexibility to adapt these goals to the needs of any building project.

Energy efficiency and conservation are important in programming, designing, and planning for operations and maintenance of campus facilities. All projects must include a detailed energy model and exploration of opportunities to increase the efficiency and decrease the overall use of energy use of facilities under consideration. All projects must also include discussion of potential renewable energy applications (including solar photovoltaic, solar hot water heating, geothermal, or other relevant options) to offset facility energy use.

a. Designers – This guide sets forth in the broadest terms the sustainable goals that are expected to be achieved by the designer in the fulfillment of a design contract. It is a working tool that is based on Sewanee's philosophy and proved procedures/best practices in the spirit of achieving sustainable designs. This tool is a reference to the designers and is not intended to conflict with the owner/architect agreement or building codes.

b. Contractor – The contractor should use this manual as a reference to understand the expectations of the University in the administration of the project. The Guide provides a reference to the contractor and is not intended to conflict with the owner/contractor agreement or building codes.
c. Campus Community – This guide is intended as a reference tool identifying to the campus community Sewanee's philosophy and commitment to sustainable building designs and practices.

II. Process

a. Programming –Sustainability is a primary goal of all projects. This approach is the most cost-effective way to achieve integrated sustainable design. A representative from the OESS will be invited to all design review meetings. This phase will confirm energy goals, create a preliminary LEED checklist, and determine renewable energy integration goals.
b. Prior to proceeding on the Schematic Design, the design team will submit an Owner's Project Requirements documents for review and approval. Similarly, a Basis of Design document will be submitted for review and approval. The definitions of these documents are the same as defined by LEED and ASHRAE.
c. Schematic Design – Throughout the schematic design phase, sustainability issues will be discussed and various options presented by the design team for consideration by the campus. A preliminary Energy Model will be developed by the entire Design team and used to compare design alternatives for mechanical, electrical and envelope systems and to generate a concise life cycle cost analysis report of options. Sustainable options will be weighed with budget and schedule constraints during this phase. Materials for reuse will be evaluated whether on the project site of other campus locations. The OESS will review documents of the Schematic Design and provide comments. All comments will be answered in writing by the Design team.
d. Design Development Phase – The Energy Model will be finalized and adjustments made to design options. The OESS will review documents of the DD phase and provide comments. All comments will be answered in writing by the Design team.
e. Construction Documents – In this phase, implementation of sustainable design features are set forth in detail. The design team will work to make sure that sustainable building features are clearly communicated in the project documents so that contractors' bids reflect true costs of implementation.
f. Value engineering – The OESS will participate in any value engineering process.
g. Construction – During construction, the architect and design team will continue to assist in emphasizing the importance of sustainability to the contractor. The project team must develop a solid waste management plan that details how construction and

demolition wastes will be handled in a manner that reduces landfill wastes and emphasizes reuse, recycling, and reclamation.

h. Commissioning – All significant projects will be "commissioned" by a commissioning agent contracted directly by Sewanee.

Most projects will be designed to achieve a LEED certification, typically either Silver or Gold. The following checklist is adopted from the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) standards. This Guide requires a number of the optional LEED credits be mandatory as indicated in the table below:

LEED ™ Project Checklist	Sewanee: The University of the South		
	Sustainable Sites	**Points Available: 25**	**Sewanee Standard**
Prereq 1	Construction Activity Pollution Prevention	Required	
Credit 1	Site Selection	1	This point should be possible when developing anywhere on campus.
Credit 2	Development Density & Community Connectivity	5	Sometimes Sewanee context does not meet requirements (1 point was earned on Snowden).
Credit 3.1	Alternative Transportation: Public Transportation Access	6	Usually Sewanee context does not meet requirements.
Credit 3.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1	This point should be possible for many campus projects.
Credit 3.3	Alternative Transportation: Low Emitting and Fuel Efficient Vehicles	3	
Credit 3.4	Alternative Transportation: Parking Capacity	2	Often at least one point is achievable.
Credit 4.1	Site Development: Protect or Restore Habitat	1	
Credit 4.2	Site Development: Maximize Open Space	1	This point should be possible when developing anywhere on campus.
Credit 5.1	Stormwater Design: Quantity Control	1	MUST Achieve
Credit 5.2	Stormwater Design: Quality Control	1	MUST Achieve

Credit 6.1	Heat Islands Effect: Non-Roof	1	
Credit 6.2	Heat Islands Effect: Roof	1	
Credit 7	Light Pollution Reduction	1	Difficult to achieve for dorms; usually achievable for other buildings.
	Water Efficiency	**Points Available: 10**	**Sewanee Standard**
Prereq 1	Water Use Reduction	Required	
Credit 1	Water Efficient Landscaping	4	MUST Achieve
Credit 2	Innovative Wastewater Technologies	2	
Credit 3	Water Use Reduction	4	4 points is the goal for every project
	Energy & Atmosphere	**Points Available: 35**	**Sewanee Standard**
Prereq 1	Fundamental Commissioning of Building Energy Systems	Required	
Prereq 2	Minimum Energy Performance	Required	
Prereq 3	Fundamental Refrigerant Management	Required	
Credit 1	Optimize Energy Performance	19	MUST strive for at least 10 points on this credit.
Credit 2	On-Site Renewable Energy	7	See renewable energy section of Sewanee Green Building Standards.
Credit 3	Enhanced Commissioning	2	If requested by PPS
Credit 4	Enhanced Refrigerant Management	2	MUST Achieve
Credit 5	Measurement & Verification	3	MUST Achieve
Credit 6	Green Power	2	Rarely taken
	Materials & Resources	**Points Available: 14**	**Sewanee Standard**
Prereq 1	Storage & Collection of Recyclables	Required	
Credit 1.1	Building Reuse: Maintain Existing Walls, Floors and Roof	2	
Credit 1.2	Building Reuse: Maintain Interior Nonstructural Elements	2	
Credit 2	Construction Waste Management	2	MUST Achieve
Credit 3	Material Reuse	2	MUST Achieve

Credit 4	Recycled Content	2	Project must acquire at least one point.
Credit 5	Regional Materials	2	MUST Achieve
Credit 6	Rapidly Renewable Materials	1	
Credit 7	Certified Wood	1	MUST Achieve
	Indoor Environmental Quality	**Points Available: 15**	**Sewanee Standard**
Prereq 1	Minimum IAQ Performance	Required	
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required	
Prereq 3	Minimal Acoustical Performance	Required	
Credit 1	Outdoor Air Delivery Monitoring	1	
Credit 2	Increase Ventilation	1	
Credit 3.1	Construction IAQ Management Plan: During Construction	1	MUST Achieve
Credit 3.2	Construction IAQ Management Plan: Before Occupancy	1	
Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1	MUST Achieve
Credit 4.2	Low-Emitting Materials: Paints and Coatings	1	MUST Achieve
Credit 4.3	Low-Emitting Materials: Flooring Systems	1	MUST Achieve
Credit 4.4	Low-Emitting Materials: Composite Wood and Agrifiber Products	1	MUST Achieve
Credit 5	Indoor Chemical & Pollutant Source Control	1	MUST Achieve
Credit 6.1	Controllability of Systems: Lighting	1	MUST Achieve
Credit 6.2	Controllability of Systems: Thermal Comfort	1	MUST Achieve
Credit 7.1	Thermal Comfort: Design	1	MUST Achieve
Credit 7.2	Thermal Comfort: Verification	1	MUST Achieve
Credit 8.1	Daylight & Views: Daylight	1	MUST Achieve
Credit 8.2	Daylight & Views: Views	1	MUST Achieve
	Innovation in Design	**Points Available:**	**Sewanee Standard**

		6	
Credit 1	Innovation in Design: Building as Community Education	5	MUST achieve at least 2 points.
Credit 2	LEED Accredited Professional	1	MUST Achieve
	Regional Priority	Points Available: 4	Sewanee Standard
Credit 1	Regional Priority	4	

The following sections cover additional requirements:

Building and Energy Model*

For all significant projects, the Energy Model required by LEED will be developed by the design team prior to schematic design to optimize the site, building envelope, and HVAC system concept. The Energy Model will be developed using an individual with proven expertise in the practice (often a third-party modeler not employed by the Architect or Mechanical Engineer). The Owner (PPS and OESS), Architect, Mechanical and Electrical engineers will be full participants in the process and will reach consensus on the design concepts.

The following checklist of possibilities should be considered for optimizing the design:

BUILDING ENVELOPE

1. Elongate the building on the east/west axis and use external shading devices such as roof overhangs, fins, shades and awnings, and vegetation to shade windows
2. Locate spaces requiring the most light and HVAC along the south face of the building and less-used spaces along the north face. Use a layout with a longer, narrower footprint to allow a greater percentage of daylighted space.
3. Reduce glazing on the east/west façades
4. Use longer, more narrow footprint to allow greater daylighting
5. Use light wells and light shelves (that bounce daylight deeper into buildings)
6. Use insulated skylights (aerogel)
7. Use super-tight building envelope with an excellent UA to minimize infiltration and heat transfer (doors, thermal bridges, glazing, etc.).
8. Require a blower door test during construction to locate undetected leaks.
9. Earth-protected space (partially buried, berms, etc.)
10. Optimize window shape and placement
11. External shading at windows: sunscreens, shaded/fritted glazing, moveable blinds, etc.
12. Advanced glazing systems: low emissivity, argon-filled, double/triple, etc. (e.g. normally use glazings with a visual transmittance in the range of 0.4- 0.65 and associated SHGC of

0.2-0.3). (Dynamic glazings whose optical properties can be electronically changed in minutes by a factor of 10 are becoming commercially available).
13. Optimal insulation (including ground floor perimeter slab)
14. Eliminate thermal bridging
15. Optimize use of solar (passive heating, overhangs, directions, angles, exterior shutters, etc.) Passive solar heating requires south-facing glass and thermal mass, overhangs (different for different facades), and bare, medium-dark floors.
16. Optimize massing
17. Roof/wall color (selection of skin materials to reflect/absorb solar energy)
18. Wing walls (exterior vertical wall partitions placed perpendicular to adjoining windows to enhance ventilation through windows…being researched at the Florida Solar Energy Center)
19. Landscape plans that contribute to energy and water conservation

HVAC

The HVAC design will include the following considerations:

1. Optimize use of ventilation/exhaust fans, windows and stack effect for nighttime cooling
2. Use ceiling fans when appropriate to allow higher thermostat settings
3. Where appropriate, all spaces with exhaust systems will have the fans controlled by an occupancy sensor.
4. Recover heat/enthalpy from exhaust air when economically feasible. Use dedicated OSA system (DOAS) if advantageous.
5. Use very high efficiency natural gas condensing hot water boilers and domestic water heaters
6. Consider radiant heating
7. Oversize ducts a little to prevent excessive pressure drops
8. Use of some type of manual override system that allows occupants to get heating or cooling manually during a period that is scheduled for unoccupied. This allows for more aggressive scheduling of building operating times.
9. Reduce air and water pressure drops and increase ΔT's
10. Use variable air volume with VSDs for AHUs (when applicable)
11. Limit airflow during start-up
12. Use variable flow pumping with VSDs
13. Use variable speed condenser and cooling tower fans
14. Design VAV boxes for very low minima or shutoff (use occupancy sensors to trigger shutoff)
15. Use occupancy sensors for setting back individual spaces and controlling HVAC

16. Use CO_2 sensors to reduce excessive ventilation for all spaces designed for high people density
17. Consider airside economizers
18. Optimize pipe and duct insulation
19. Use underfloor air distribution to improve ventilation effectiveness, reducing OSA requirement, and to reduce fan horsepower
20. Use chilled beams
21. Use energy recovery ventilators (packaged heat wheel systems)
22. Pay special attention to specifying and executing air duct sealing

The Energy Model and Loads Calculations will be used to optimize the design of HVAC systems, including:

1. Reduce cooling and heating loads in all categories including envelope, lighting, ventilation, people, plug loads, etc.
2. Calculation of peak heating and cooling loads with zero safety factors
3. Comparing alternative system types to determine the optimal system for the building
4. Optimal sequences of operation for lowest overall energy usage
5. Determination of feasibility of connecting building to the central chilled water plant
6. Consideration of geothermal heatpump systems

Domestic Water and Water Heating

1. Optimize domestic water heating type considering instantaneous, very high efficiency, heatpump, thermal solar, etc.
2. Size system using standard method or Sewanee method, whichever is smaller
3. Minimize flow at water fixtures: shower heads, faucets, urinals, water closets, dual-flush using models listed in Appendix A
4. Consider rainwater capture and use
5. Optimize pipe insulation
6. All showers and lavatory faucets will have low flow ratings as follows:
   a. Shower head: 1.75 gpm
   b. Faucet: 0.5 gpm
7. All toilets will have 1.2 gpm flushometer valves
8. No building landscaping will have irrigation (except during grow-in period)

Lighting and Electrical

1. Use optimum lamps and high performance ballasts. All four foot fluorescent lamps shall be 25Watt, T8. No halogen or incandescent lamps shall be used. Decorative lampposts shall be campus standard type.

2. Lighting control systems like occupancy sensors, daylighting controls, photocells, dimming, shall be considered for every lamp.
3. Design lighting to footcandles in IES standards.
4. Use task lighting to minimize built-in lighting systems.
5. Use nightlights for dorm bathrooms.
6. Use *premium efficiency* electrical motors

APPENDIX A

I. Building Orientation, Site, and Envelope Considerations

The following checklist of possibilities should be considered:

II. Other Sustainability Ideas for Consideration

1. Student participation: design input, shower head selection, laundry policies, room items policies, etc.
2. Policies for room energy users: microwaves, refrigerators, hair dryers, TVs, other (minimize internal equipment loads)
3. Provide smart power-strips
4. PV solar
5. Building integrated solar (BIPV) including in skylights, curtain walls, etc.
6. Laundry optimization: cold water washing, front load washers, moisture sensing dryers, clothes-drying racks, etc. – refer to new laundry manual (in development)
7. Real-time energy use display
8. Food prep and cooking whole food in kitchen
9. Vegetable garden near kitchen
10. Air hand dryers
11. Plan for vehicle traffic for loading for arrival, moving out
12. Environmentally sensitive personal care products policy
13. For a building with no AC use BAS to operate ventilation/exhaust dampers, windows, & blinds: BAS responds according to windspeed and direction, indoor and outdoor temperatures, and CO_2 sensors
14. Provide hydration stations in lieu of vending machines.