

Template for Sustainable Design Standards

Purpose

The following template consists of sample sustainable design standards for incorporation into design guidelines or architectural/engineering standards at individual DOE sites. The purpose of this template is to provide high level, global standards that will enhance sustainable construction if used at DOE sites.

The template is limited to cost-neutral or low cost standards that should become normal practice. DOE sites are welcome to adapt all or portions of the entries into site-specific design standards, or sites can re-write as construction specifications, i.e., “shall” or “will” replaces “consider” and “should.”

Excluded from this template are specifications specific to energy efficiency and conservation since it is assumed that all sites already have viable energy standards.

Contents

This template contains entries on the following topics organized (but not numbered) in Construction Specification Institute Master Format

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Division 1 GENERAL REQUIREMENTS

a. Reference Documents

FEMP Energy Efficiency Product Recommendations
(<http://www.eren.doe.gov/femp.procurement/begin.html>)

Sustainable Design Resource Guide (AIA)

US Environmental Protection Agency, Environmentally Preferable Purchasing guidelines (www.epa.gov/oppt/epp)

Leadership in Energy and Environmental Design Reference Guide, US Green Building Council

Passive Solar Heating Analysis, ASHRAE

DOE Facilities Solar Design Handbook, DOE AD-0006/1

DOE sustainable design website <http://www.pnl.gov/doesustainable design/>

DOE-FEMP *The Business Case for Sustainable Design in Federal Facilities*,
<http://www.eere.energy.gov/femp/techassist/pdf/bcsddoc.pdf>

GSA *Real Property Sustainable Development Guide*,
<http://www.policyworks.gov/org/main/mp/gsa/home.html>

Whole Building Design Guide, <http://www.wbdg.org>

Advanced Building Guidelines, <http://www.newbuildings.org>

Departmental Energy and Utilities Management, DOE Order 430.2A, US Department of Energy, April 15, 2002.

Green Label Plus, Carpet and Rug Institute, http://www.carpet-rug.com/News/040614_GLP.cfm

Guidelines for Specification Integrity, The International Association of Lighting Designers, March 2000,
<http://www.iald.org/Menu/consumerinfo.htm>

- b. The use of petroleum should be minimized and eliminated wherever possible. Every reasonable opportunity to reduce petroleum consumption by using alternate energy sources and biobased materials should be pursued.

- c. The use of materials with biobased and recycled content and that are reusable or at least recyclable should be maximized. Reasons for not using biobased/recycled products should be included in the design documentation.
- d. Building heating, cooling, and power should utilize solar, geothermal, wind, and bioenergy resources if at all practical.
- e. Buildings should not be developed on prime farmland as defined by the American Farmland Trust, land providing habitat for endangered species, or land that was previously public parkland.
- f. Buildings should be sited at least five feet above the 100 year flood plain, and at least 100 feet away from wetlands.
- g. Premium parking for mass transit/ car pools should be provided.
- h. All buildings should be designated nonsmoking.
- i. Energy conserving, energy efficient, and Energy Star products should be selected for facilities. Refer to <http://www.eren.doe.gov/femp/produrement/begin.html>.
- j. In cold climates, driveways, parking, entrances and loading docks should be located on the south side of buildings when practical to help avoid snow and ice build-up.
- k. Buildings should be oriented with the long side on the east-west axis to maximize winter solar gain and minimize summer solar gain.

Division 2 SITEWORK

- a. Disturbance of vegetation for excavation and construction should be limited to 40 feet from the building perimeter, and five feet beyond primary roadway curbs, walkways, and main utility branch trenches.
- b. Loss of soil during construction from storm water runoff and/or wind erosion should be avoided by implementing EPA's Storm Water Management of Construction Activities best practices, EPA-832-R-92-005, as a minimum.
- c. Mature stands of native vegetation should be retained to provide energy-conserving shade and wind protection, and reduce landscaping maintenance costs.

- d. Construction, demolition, and land clearing debris should be salvaged and reused. Materials that cannot be reused should be recycled if possible. Reasons for not reusing or recycling should be included in the design documentation.
- e. Bins should be provided on the construction site for separation and temporary storage of all demolition and waste materials for onsite reuse, recycling, offsite salvage, and landfilling.
- f. The following materials removed from a site should be considered for salvage/reuse/recycle.
 - i. Concrete – clean concrete, concrete with rebar, or asphalt concrete. Crush and grade for reuse as rip rap, aggregate, sub-base, or fill. Neutralize alkalinity if reused in landscaping.
 - ii. Metals – steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass or bronze, ductwork, framing, roofing, siding, flashing, piping and rebar. Salvage structural steel; separate metals for recycling.
 - iii. Clean Fill – earth, rocks, and gravel.
 - iv. Wood – clean dimensional wood, wood pallets, engineered wood products including plywood, particle board, joists. Sort by type and size for salvage. Wood unsuitable for salvage shall be sent for recycle into particle board or other products, or chipped and shredded for use as ground cover, mulch, compost, pulp or process fuel. Do not chip or shred stained, painted or treated wood.
 - v. Cardboard – corrugated paper, packaging. Place in designated containers for recycling.
 - vi. Masonry – brick, ceramic tile, CMU. Salvage whole bricks and blocks. Crush pieces for reuse as ground cover, sub-base or fill.
 - vii. Gypsum Board. Grind up and use as soil amendment. Do not reuse painted gypsum board.
 - viii. Carpet and Pad. Place in designated containers for recycling.
 - ix. Building Components and Fixtures – doors, windows, cabinets, hardware, electrical and plumbing fixtures. Salvage, or crush porcelain components for fill.
- g. Landscaping should conform to concepts published in Executive Order 13148 Greening the Government Through Leadership in Environmental Management (April 21, 2000).
- h. Landscaping water demand should be limited by specifying high efficiency irrigation technology, planting for xeriscape, recycling gray water, and/or using captured rainwater. Reasons for not specifying water conservation should be included in the design documentation.

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- i. Night sky light pollution should be limited by using exterior fixtures that direct light only to the structure or walkway to be lit.
- j. Vegetation that will shade buildings should be included. Deciduous trees should be used in cold climates for shading in summer and allowing heat gain in winter.

Division 3 CONCRETE

- a. Fly ash or blast furnace slag should be used in concrete unless pouring in temperatures where slower curing presents a problem.

Division 5 METALS

- a. Cold formed steel members should contain 75% or more recycled content; wide flange or structural shapes should contain 50% or more recycled content.
- b. Vendor submittals should provide certification of recycled content of metals.

Division 6 WOOD AND PLASTICS

- a. Endangered species of wood should not be used; consult Forest Stewardship Council Guidelines for certified wood-based materials or Woodworker's Alliance for current sustainable products.
- b. Wood products containing formaldehyde or manufactured boards using CFC/HCFC as a blowing agent should not be used.
- c. Lumber waste should be recycled.
- d. Plastics should contain recycled content.
- e. Vinyl, PVC-based products should be avoided due to release of dioxin, a known human carcinogen, during manufacture and improper disposal.
- f. Laminated paperboard and structural fiberboard should contain recycled content.

Division 7 THERMAL AND MOISTURE PROTECTION

- a. Board products that use CFC/HCFC as a blowing agent should not be used.
- b. Waterproofing, damp-proofing, or water repellent products that use VOCs as the carrier for water proofing agents should not be used.
- c. Insulation fill with biobased/recycled content should be used. Reasons for not using biobased/recycled products should be included in the design documentation.

- d. If the building will require more seasonal cooling than heating, high albedo/Energy Star roofing should be used. Reasons for not using high-albedo roofing shall be included in the design documentation.
- e. VOCs in asphalt tile adhesives should be limited to 50 g/l.
- f. VOCs in single ply roof membrane adhesives should be limited to 250 g/l.
- g. Roofing tile with recycled content should be used.

Division 9 FINISHES

- a. Both interior and exterior finish materials, sealants, and adhesives should be specified to reduce the use of VOCs, especially on interior surfaces.

Limit VOCs in interior flat coatings to 150 grams per liter.

Limit VOCs in interior non-flat coatings to 50 g/l.

Limit VOCs in exterior flat coatings to 200 g/l.

Limit VOCs in exterior non-flat coatings to 100g/l.

Limit VOCs in anti-corrosive gloss, semi-gloss, and flat coatings to 250 g/l.

Limit VOCs in indoor carpet and carpet adhesives to 50 g/l.

Limit VOCs in carpet pad adhesives to 50 g/l

Limit VOCs in outdoor carpet adhesives to 150 g/l

Limit VOCs in wood flooring adhesives to 100 g/l

Limit VOCs in rubber floor adhesives to 60 g/l

Limit VOCs in subfloor adhesives to 50 g/l

Limit VOCs in ceramic tile adhesives to 65 g/l

Limit VOCs in dry wall and panel adhesives to 50 g/l

Limit VOCs in cove base adhesives to 50 g/l

Limit VOCs in structural glazing adhesives to 100 g/l

- b. Wall or horizontal surface coverings made with PVC or vinyl should not be used.
- c. Interior wood products made with formaldehyde should not be used.
- d. Wall coverings, flooring and carpeting with recycled content, and/or that are recyclable, and are made from rapidly renewable resources should be used. Reasons for not using these products should be included in the design documentation.
- e. Ceiling paint or ceiling tiles with 0.9 or higher reflectance value should be used in lighted work areas to reduce the need for artificial lighting.

- f. Paints with at least 20% recycled content should be used.
- g. Carpeting that is reconditioned, made from rapidly renewable resources, or has recycled content of at least 70% should be used.
- h. Evaluation of materials should also consider the toxicity of the manufacturer's required preparation, and the potential for use of low-toxicity cleaning products during service.
- i. Chlorine based materials should be avoided.
- j. Solution dyed yarn carpet should be considered to minimize color fading and reduce water pollution.

Division 13 SPECIAL CONSTRUCTION

- a. Fire suppression systems with CFC, HCFC, or Halon content should not be used.

Division 15 MECHANICAL SYSTEMS

- a. Building areas should be separated into HVAC system zones with like requirements and exposures (i.e. interior offices from perimeter spaces). Areas with special temperature or humidity requirements should have separate HVAC zones.
- b. Buildings over 20,000 sq. ft. should be modeled for HVAC system loads using computer simulation tools.
- c. Renewable sources of energy should be used in place of nonrenewable sources if economically practical. Solar energy and ground source loop heating and cooling in particular should be considered on all new construction. Reasons for not using renewable sources shall be included in the design documentation.
- d. Low flow fixtures (1992 Energy Policy Act) and waterless urinals should be used. Reasons for not using these products shall be included in the design documentation.
- e. Flow control devices should be installed (unless otherwise dictated by the project criteria) on all water closets, sinks and lavatories. Devices shall limit water closet flow to 1.6 gallons per flush, urinals to 1.0 gallons per minute, and regular lavatories to 1.5 gallons per minute.

- f. Lavatory faucets should be equipped with automatic, sensor-operated shut-off valves.
- g. Water discharged from processes that require high quality water should be considered for reuse in systems where residual quality is sufficient for proper operation.
- h. Continuous measurement systems should be installed per the US DOE's International Performance Measurement and Verification Protocol for
 - CO2
 - Lighting
 - Constant and variable motor loads
 - Variable frequency drive operation
 - Chiller efficiency at variable loads
 - Cooling load
 - Air and water economizer and heat recovery cycles
 - Air distribution static pressures and ventilation air volumes
 - Boiler efficiencies
 - Building specific process energy efficiency systems and equipment
 - Indoor water risers and outdoor irrigation systems.
- i. Gas meters should be installed in all buildings having gas service. Separately sub meter large process gas loads.
- j. Install water meters in all buildings with water service. Large water use systems such as cooling towers or irrigation systems should be sub-metered separately.
- k. All new buildings with services should be commissioned according to the DOE Building Commissioning Guide, Model Commissioning Plan and Guide Specifications. See also ASHRAE Guideline 1, The HVAC Commissioning Guideline.
- l. Systems to be commissioned should include HVAC, plumbing, compressed air, specialty gas, fuel oil, and natural gas.
- m. A Commissioning Plan should be developed as part of the contract documents for a project. The Commissioning Plan describes responsibilities, procedures and tasks throughout the Commissioning process. It also describes the functional performance tests that will be performed during the acceptance phase of the project.

- n. Minimum commissioning effort of mechanical and control systems should include
- development of procedure for verification of system performance testing
 - thorough inspection of construction and installation
 - development of maintenance criteria and procedures including sequence of operation
 - pre-functional performance testing
 - final functional performance testing
 - system balancing
 - documentation of commissioning and validated as-built documentation
 - operator training.

Division 16 ELECTRICAL

- a. Incandescent lighting with the exception of low-wattage accent lighting in display areas should not be used.
- b. LED exit lights should be used.
- c. High pressure sodium or other “non-white” lighting should not be used inside a regularly occupied building.
- d. Natural daylighting should be used to illuminate office spaces.
- e. Indirect/direct combination suspended lighting should be used for high quality, non-glare, non-shadow lighting in ambient, circulation, and general purpose areas. Under shelf or desktop T8 or T5 fluorescent or compact florescent lamps should be used to augment ambient lighting for task areas. Ceiling-recessed fixtures should be avoided.
- f. Occupancy sensors should be installed in interior offices, rest rooms, and conference rooms.

GLOSSARY

Commissioning - A process of ensuring that all building systems are installed and perform interactively according to the design intent, the systems are efficient and cost effective and meet the owner's operational needs, and the installation is adequately documented and that the Operators are adequately trained.

CFC/HCFC - Chlorofluorocarbons/Hydrochlorofluorocarbons are often used as refrigerants in building equipment that deplete the stratospheric ozone layer.

Gray water - Wastewater from lavatories, showers, washing machines and other building activities that do not involve human waste or food processing.

High Albedo - Generally light colored materials with a reflectance, or ratio of reflected electromagnetic energy to incoming electromagnetic energy, of at least 30%.

HVAC - Heating, ventilating, and/or air conditioning (cooling) systems in a building.

LED - Light emitting diodes are very small, filament-less bulbs illuminated by movement of electrons in a semiconductor material, requiring less energy than incandescent bulbs.

Light Pollution - Excessive nighttime exterior lighting of a building or property from which the glare hinders the view of the night sky.

PVC - Polyvinyl chloride is a component of many plastic products. Vinyl chloride gas used to make polyvinyl chloride is a known carcinogen often released during the manufacturing process, and can be released upon improper disposal of PVC.

Rapidly Renewable - Materials that can be planted and harvested in less than a ten year cycle such as bamboo, cotton, linoleum, and wool.

VOCs - Volatile organic compounds that react in atmospheric photochemical reactions to contribute to indoor and outdoor air pollution. Defined in Environmental Protection Agency 40 CFR 51.100.

Xeriscape - Landscaping using as little irrigation as possible by incorporating native or low-water vegetation.

