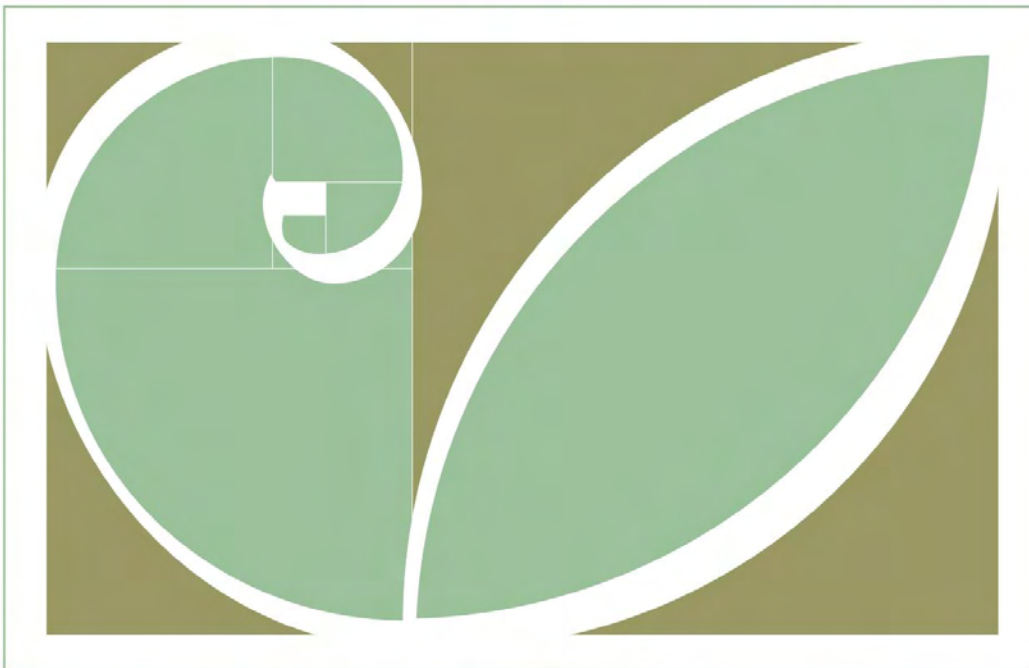

US Air Force High Performance Green Buildings



Interim Implementation Actions and Metrics (LEED v2.2)

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PROJECT A-5 WORKING DRAFT (FEB 2009)

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Introduction

Successfully implementing high performance green design objectives requires a holistic approach to siting, design, construction, maintenance and operations. Decisions and system selections should be made after understanding the impact on the facility as a whole; a compartmentalized design approach will fail to achieve a High Performance Green Building.

The following Interim Implementation Actions and Metrics outline central issues common to all new construction projects and align with the US Air Force High Performance Green Building Scorecard; USGBC LEED® credits referenced herein are v2.2.

High performance green design objectives identified herein shall be implemented and tracked regardless of the facility acquisition process employed. As part of the Project record, designers shall prepare "Project High Performance Green Design Analysis" which incorporates the US Air Force High Performance Green Building Scorecard. The Project High Performance Green Design Analysis shall address each design objective and discuss how that objective is incorporated into the project; address why other features were not included; address the cost of sustainable features; address synergies between high performance green features; and clearly describe anticipated construction-phase high performance green design features. At each Project phase, the US Air Force High Performance Green Building Scorecard shall be reflective of objectives currently being met and those anticipated in subsequent Project phases.

In addition to the mandatory high performance green design objectives identified herein, each Project shall identify and incorporate additional USGBC LEED® credits so as to achieve minimum LEED® Silver rating.

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Project Phases and Critical Considerations

Requirements and Management Plan (RMP)

The development of a Requirements and Management Plan (RMP) for each Project should be standard operating procedure; a RMP outlines requirements and contains draft elements of the Project Management Plan (PMP). Sustainable design goals need to be identified and included in the RMP and progress measured at each Project phase.

Planning / Pre-Design

Site Selection, Scope Definition and Budgeting: Project site selection, scope definition and budgeting are critical factors that contribute positively to success or present additional difficulties that must be solved. Project site selection should maximize future mission flexibility and comply with the Installation Master Plan goals. In practice, this means avoiding green-field sites and select infill sites or building reuse wherever possible. This practice also minimizes ecological damage and preserves resources by making best use of existing infrastructure. In many cases, from an overall sustainability perspective, it is preferred to renovate an existing facility than to construct a completely new facility.

AF Building Commissioning: Processes are outlined in the following section. For Projects that have already been programmed and funded, implement Fundamental Commissioning of the Building Energy Systems (Energy and Atmosphere, Prerequisite 1).

USGBC LEED Online Data Format: To standardize data entry and to simplify database searches use the following conventions when entering Project information in the USGBC LEED online forms. In the Project Summary section, for:

- “Owner Name” enter “USAF”
- “Project Address” enter “Installation Name AFB” (example, Barksdale AFB, Langley AFB)
- “Project Name” enter “Project Name (FYXX)”
- “Organization” enter owning MAJCOM
- When queried “Is Project Confidential?” enter “No” unless Project has been classified

Schematic Design

Include the entire team on working through an integrated design approach for the project. Each facility will have unique features and it is important for the decision makers, design team and other stakeholders to evaluate priorities, costs versus benefits tradeoffs and sustainable goals for the building. This integrated approach is also known as building optimization.

Building optimization includes reviewing entire building systems, their relationship to one another and long-term operations and maintenance lifecycle costs. This type of systems approach draws on strengths from each design discipline and includes user input in terms of how the building will be operated, how it will be maintained and where things can be done differently. The project team places a premium on efficient use of space, flexibility, systems analysis and other design tools to optimize the design while saving energy and reducing the environmental impact of the building. Sustainable principles also contribute to an increase in occupant comfort and health, which increases employee productivity and in turn allows for better business conditions.

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Site Sustainability

Achieve Pre-Development Hydrology. Projects with a footprint greater than 5,000 square feet shall use site planning, design, construction, and maintenance strategies to maintain or restore predevelopment hydrology with regards to temperature, rate, volume [quantity], and duration of flow.

Achieve Pre-Development Hydrology Implementation: Attention to site development issues affecting stormwater is required; look at strategies to reduce the Project footprint (building and impervious surfaces) and means to increase water infiltration. Consider pervious paving materials, stormwater harvesting, green roofs, bioswales/vegetated filter strips, retention ponds and clustering development to reduce paved surfaces.

Associated USGBC LEED® Credits: None, however the goal and intent closely aligns with requirements established in Sustainable Sites Credit SS6.1, Stormwater Management (Quantity Control) and Sustainable Sites Credit SS6.2, Stormwater Management (Quality Control).

Construction Activity Pollution Prevention. Reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation.

Construction Activity Pollution Prevention Implementation: Create and implement an Erosion and Sedimentation Control (ESC) plan for all construction activities associated with the Project. The Plan shall describe measures implemented to accomplish the following objectives: prevent loss of soil during construction by stormwater runoff and/or wind erosion (including protecting topsoil by stockpiling for future reuse); prevent sedimentation of storm sewer or receiving streams; prevent polluting the air with dust and particulate matter.

Associated USGBC LEED® Credits: Sustainable Sites Prerequisite 1, Construction Activity Pollution Prevention.

Stormwater Design, Quantity Control. Limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, and managing stormwater runoff.

Stormwater Design Implementation: When Project scope includes site work, employ design and construction strategies that reduce the amount of storm water runoff. Consider pervious paving materials, stormwater harvesting, green roofs, bioswales/vegetated filter strips, retention ponds and clustering development to reduce paved surfaces.

Associated USGBC LEED® Credits: Sustainable Sites Credit SS6.1, Stormwater Management (Quantity Control).

Stormwater Design, Quality Control. Limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, eliminating sources of contaminants and removing pollutants from stormwater runoff.

Stormwater Design, Quality Control Implementation: Put in place a stormwater management plan that reduces impervious cover, promotes infiltration and captures and treats the stormwater runoff from 90-percent of the average annual rainfall using acceptable best management practices

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(BMP). Federal policy or directive requirements for stormwater quality control do not align precisely with the USGBC LEED® credit; however, the goals and intent are the same. The Air Force considers this best practice and will implement in High Performance Green Facilities.

Associated USGBC LEED® Credits: Sustainable Sites Credit SS6.2, Stormwater Management (Quality Control).

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Water Efficiency

Water Efficient Landscaping, Reduce by 50%. Limit or eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the Project site, for landscape irrigation.

Water Efficient Landscaping, Reduce by 50% Implementation: When Project scope includes site work, investigate the use of water efficient landscape and irrigation strategies, including water reuse and recycling, with the goal of reducing potable water use by a minimum of 50-percent over that consumed by conventional means (plant species and plant densities). Specify EPA's WaterSense-labeled products or other water conserving products. Investigate use of high efficiency irrigation, drip irrigation, alternate planting selection, alternate site design, etc.

Associated USGBC LEED® Credits: Water Efficiency Credit WE1.1, Water Efficient Landscaping (Reduce by 50-percent).

Water Use Reduction, 20% Reduction. Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems. Per EPA Act Sec 109, when potable water is used to improve a building's energy efficiency, employ lifecycle cost effective water conservation measures.

Water Use Reduction, 20% Reduction Implementation: Employ strategies that in aggregate use a minimum of 20-percent less potable water than the baseline calculations for typical water usage. Investigate methods to reduce potable water consumption including the use of ultra-low flow fixtures, waterless urinals, captured rainwater, etc. Specify EPA's WaterSense-labeled products or other water conserving products. Refer to the Federal Energy Management Program (FEMP) publication *Domestic Water Conservation Technologies* (located at <http://www1.eere.energy.gov/femp/pdfs/22799.pdf>) for useful design and planning information.

Associated USGBC LEED® Credits: Water Efficiency Credit WE3.1, Water Use Reduction (20-percent).

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Energy & Atmosphere

Achieve “Designed to Earn the Energy Star” Rating. Achieve the “Designed to Earn Energy Star” rating.

Achieve “Designed to Earn Energy Star” Rating Implementation: The “Designed to Earn the Energy Star” program is administered by the Environmental Protection Agency (EPA); analysis of the design shall be accomplished using the “Target Finder” program and achieve a rating of 75 or higher. Results of the “Target Finder” analysis shall be submitted to the EPA for review; once accepted by the EPA they will provide the Architect of Record an electronic file with the “Designed to Earn the Energy Star” graphic. The Contractor shall place this graphic in the title block on all construction drawings and on the cover of all Contract Documents. Complete “Designed to Earn the Energy Star” information and requirements can be found at the EPA Energy Star website at:

www.energystar.gov/index.cfm?c=new_bldg_design.new_bldg_design_benefits

Associated USGBC LEED® Credits: None

Solar Hot Water Heater System – minimum 30% Demand. Reduce reliance on transmitted/transported power sources used for creating hot water and provide minimum 30-percent of the hot water demand for the facility using a solar hot water heater system.

Solar Hot Water Heater System – minimum 30% Demand Implementation: Investigate life-cycle cost effectiveness of using solar hot water heater system to provide minimum 30-percent of the hot water demand for the facility (note that this will likely have up-front cost impact and must be investigated/validated during Project programming phase). Default should be inclusion of Solar Hot Water System in the Project unless documented it is not life cycle cost effective; document and maintain information in the Project record.

Associated USGBC LEED® Credits: None; however there may be synergy with Energy and Atmosphere Credit EA2, On-Site Renewable Energy. This LEED® credit is based on a reduction in building annual energy cost by employing various on-site renewable energy systems. There is not a direct correspondence between solar hot water production and reduced energy cost but a linkage can be made by demonstrating energy savings produced by the solar hot water system in terms of percentage of annual energy cost. The minimum threshold for this LEED® credit is 2.5% of the building annual energy cost.

Install Advance Metering. Install advanced utility metering including electrical, natural gas, water and steam (as applicable) to allow consumption tracking and performance optimization.

Install Advance Metering Implementation: Requirement is to install advanced utility metering for electrical, natural gas, water and steam (as applicable) systems. During facility operation, additional requirements for tracking and recording consumption come into effect; advanced metering will assist in gathering data for input into EPA’s *Portfolio Manager* (or other tool) to track and assess energy and water consumption within individual buildings (this tool can be used across an entire building portfolio as well). Performance goal is for the building to be within 10% of the original design energy target. *Portfolio Manager* is used to benchmark building energy

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performance, assess energy management goals over time, and identify strategic opportunities for savings and recognition opportunities. Refer to EPA's instructions and use guidelines.

Associated USGBC LEED® Credits: None.

Reduction in Fossil Fuel-Generated Energy Consumption. Buildings shall be designed so that the fossil fuel-generated energy consumption of the buildings is reduced.

Reduction in Fossil Fuel-Generated Energy Consumption Implementation: This is a placeholder Implementation Action. DOE has not completed rulemaking for means/measures.

Associated USGBC LEED® Credits: None.

Data Center Energy Consumption. Comply with performance standards, construction and operations specifications, best practices, and benchmarks established in DOE/EPA Data Center Program.

Data Center Energy Consumption Implementation: This is a placeholder Implementation Action. DOE and EPA have not completed rulemaking for means/measures.

Associated USGBC LEED® Credits: None.

Reduce Energy Consumption Levels by at Least 30%. Achieve increased level of energy performance above baseline model to reduce environmental and economic impacts associated with excessive energy use. Achieve minimum 30-percent improvement over baseline building energy consumption levels using the Department of Energy (DOE) calculations contained in CFR Title 10 Part 433.

Background: There are two competing energy reduction measures directed towards federal agencies – these measures are contained in the MOU and EAct. The MOU requires agencies to “...reduce the energy cost budget by 30 percent compared to the baseline building ” and EAct requires agencies to “...achieve energy consumption levels...that are at least 30 percent below the levels of the baseline building...” The Air Force has determined that meeting the EAct 30-percent energy consumption level reduction will assure compliance with the MOU 30-percent energy cost budget requirement, but not vice versa. Therefore, AF energy reduction implementation will be via compliance with the public law requirements in EAct and the CFR.

Reduce Energy Consumption Levels by at Least 30% Implementation: Perform whole building energy simulation using the Building Performance Rating Method in ASHRAE 90.1 Appendix G.

Energy efficiency calculations for Federal facilities have been established by the Department of Energy (DOE) in CFR Title 10 Part 433. Mandated minimum is 30-percent improvement over baseline building energy consumption levels using the Performance Rating Method found in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1–2004, Energy Standard for Buildings Except Low-Rise Residential Buildings, **EXCEPT** the formula for calculating the Performance Rating in paragraph G1.2 is changed (for federal Agencies) to read:

“Percent improvement = 100 x (Baseline building consumption - Proposed building consumption) / (Baseline building consumption - Receptacle and process loads)”

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If it is determined through life-cycle cost analysis that the 30-percent improvement cannot be achieved, successive life-cycle cost analyses at 5-percent lower levels shall be completed to determine an achievable improvement. Any improvement less than 30-percent requires higher level AF Headquarters notification and concurrence; AF policy is that Project scope shall be reduced if necessary to meet mandated sustainability goals. Document and maintain the efficiency improvement percentage in the Project record.

Once the CFR calculation has been performed and percent improvement determined, perform second calculation using USGBC LEED® Energy and Atmosphere Prerequisite 2, Minimum Energy Performance *and* LEED® Energy and Atmosphere, Credit EA1 (Optimize Energy Performance) calculations. It must be noted that this second calculation does not require additional whole building energy simulation modeling.

It cannot be over-emphasized that that LEED® EA1 credit calculation is similar to the CFR Title 10 Part 433 calculation; the critical difference is that the CFR calculation removes receptacle and process loads while the LEED® calculation does not.

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 2, Minimum Energy Performance *and* Energy and Atmosphere Credit EA1, Optimize Energy Performance (as noted).

Fundamental Commissioning of the Building Energy Systems. Fundamental Commissioning requirements as defined by USGBC LEED® are covered by broader Air Force Building Commissioning activities (refer to Innovation/Process section).

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 1, Fundamental Commissioning of the Building Energy Systems.

Minimum Energy Performance. Refer to “Reduce Energy Consumption Levels by at Least 30%”; for detailed discussion and Implementation actions. Once CFR calculation has been performed and percent improvement determined, perform second calculation using USGBC LEED® Energy and Atmosphere Prerequisite 2, Minimum Energy Performance *and* LEED® Energy and Atmosphere, Credit EA1 (Optimize Energy Performance) calculations.

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 2, Minimum Energy Performance.

Fundamental Refrigerant Management. Eliminate the use of ozone depleting compounds during and after construction.

Fundamental Refrigerant Management Implementation: Zero use of CFC-based refrigerants in new HVAC&R systems is allowed; when reusing existing HVAC&R equipment, complete a comprehensive CFC phase-out conversion prior to Project completion.

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 3, Fundamental Refrigerant Management.

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Optimize Energy Performance. Refer to “Reduce Energy Consumption Levels by at Least 30%” for discussion and Implementation actions. Once CFR calculation has been performed and percent improvement determined, perform second calculation using USGBC LEED® Energy and Atmosphere Prerequisite 2, Minimum Energy Performance *and* LEED® Energy and Atmosphere, Credit EA1 (Optimize Energy Performance) calculations.

Associated USGBC LEED® Credits: Energy and Atmosphere Credit EA1, Optimize Energy Performance.

Enhanced Commissioning. Enhanced Commissioning requirements, as defined by USGBC LEED®, may be covered by broader Air Force Building Commissioning activities (refer to Innovation/Process section).

Associated USGBC LEED® Credits: Energy and Atmosphere Credit EA3, Enhanced Commissioning.

Enhanced Refrigerant Management. Eliminate the use of ozone depleting compounds and support early compliance with the Montreal Protocol.

Ozone Depleting Compounds Implementation: Zero use of CFC-based refrigerants; select refrigerants and HVAC&R systems that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. Federal policy or directive requirements for refrigerant management do not align precisely with the USGBC LEED® credit; however, the goals and intent are the same. The Air Force considers this best practice and will implement in High Performance Green Facilities.

Associated USGBC LEED® Credits: Energy and Atmosphere Credit EA4, Enhanced Refrigerant Management.

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Materials and Resources

Preferential use of EPA-designated Recovered Materials Products. Make preferential product/item selections from sources containing recycled content; primary selection should be made from EPA-designated products. Additionally, make preferential selection on products/items with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the Project.

Preferential use of EPA-designated Recovered Materials Products Implementation: Preferential use of products made with recovered materials is established in the Utilization Resource Conservation and Recovery Act (RCRA) Section 6002; the EPA is required to designate products that are or can be made with recovered materials, and to recommend practices for buying these products. Once a product is designated, federal Agencies are required to purchase it with the highest recovered material content level practicable. EPA has published and maintains the *Comprehensive Procurement Guidelines (CPG)* to assist in product/item selections. Detailed information on the EPA *Comprehensive Procurement Guidelines (CPG)* can be found at: www.epa.gov/cpg/

EPA has designated, or is proposing to designate, products in the following eight categories:

- Construction Products
- Landscaping Products
- Non-paper Office Products
- Paper and Paper Products
- Park and Recreation Products
- Transportation Products
- Vehicular Products
- Miscellaneous Products

Project Teams shall review and edit contract requirements as necessary so they include provisions for selection and use of recovered and recycled-content products; make specific reference to materials and items listed in the *Comprehensive Procurement Guidelines (CPG)*. Additionally, the requirement for federal agencies to use and to make preferential selection from products with recovered and recycled content extends into facility operations and maintenance.

Associated USGBC LEED® Credits: None, however the goal and intent closely aligns with requirements established in Materials and Resources Credit MR4.1, Recycled Content 10% (Post-Consumer + 1/2 Pre-Consumer).

Preferential use of USDA-designated Biobased Materials Products. Make preferential product/item selections from USDA-designated biobased products.

Preferential use of USDA-designated Biobased Materials Products Implementation: The USDA defines biobased products as "*commercial or industrial products (other than food or feed) that are composed in whole or in significant part of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials*" Preferential acquisition and use of biobased products has been codified in the FAR and in the Federal Biobased Products Preferential Purchasing Program (FB4P) under authority of the Farm Security and Rural Investment Act of 2002, Section 9002. Project Teams shall review and edit contract requirements as necessary so they include provisions for selection and use of USDA-designated biobased products including, but not limited to:

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- Penetrating lubricants
- Roof coatings
- Water tank coatings
- Adhesive and mastic removers
- Plastic insulating foam
- Composite panels
- Fluid-filled transformers
- Carpets
- Wood and concrete sealers

To qualify for preferential use, USDA-designated biobased products must also be reasonably available, meet performance standards, and be reasonably priced. Additionally, the requirement for federal agencies to use and to make preferential selection from USDA-designated products extends into facility operations and maintenance. Further information and references on the USDA Biobased Products Program can be found at: www.biopreferred.gov

Associated USGBC LEED® Credits: None, however the goal and intent closely aligns with requirements established in Materials and Resources Credit MR6, Rapidly Renewable Materials and Materials and Resources Credit MR7, Certified Wood.

Environmentally Preferable Products. Make preferential product/item selections from products that have a lesser or a reduced effect on human health and the environment over their lifecycle when compared with competing products or services that serve the same purpose.

Environmentally Preferable Products Implementation: A number of standards and ecolabels are readily available in the marketplace to assist in making environmentally preferable decisions. Project Teams shall review and edit contract requirements as necessary so Projects incorporate use of environmentally preferable products. Further information and references can be found in the Federal Green Construction Guide at: www.wbdg.org/design/greenspec.php

Associated USGBC LEED® Credits: None.

Storage & Collection of Recyclables. Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Storage & Collection of Recyclables Implementation: Provide an easily accessible area that is dedicated to the collection and storage of non-hazardous materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics and metals. Include, and designate, this space at all design stages. Coordinate the size and functionality of the recycling areas with the anticipated collection services to maximize effectiveness. Consider employing cardboard balers, aluminum can crushers, recycling chutes and collection bins at individual workstations to further enhance the recycling program. Coordinate with Installation wide service contract providers and obtain sufficient collection services.

Associated USGBC LEED® Credits: Materials and Resources Prerequisite 1, Storage & Collection of Recyclables.

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Construction Waste Management, Divert 50% from Disposal. Divert construction and demolition debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back into the manufacturing process. Redirect reusable materials to appropriate sites.

Construction Waste Management, Divert 50% from Disposal Implementation: During the Project planning stage, identify local recycling and salvage operations that could process site related waste. Develop and implement a construction waste management plan to recycle or salvage at least 50-percent construction, demolition and land clearing waste, excluding soil and hazardous materials. Prepare construction documents so that construction waste management plan is mandatory provision; during construction, ensure plan is followed and goals achieved.

Associated USGBC LEED® Credits: Materials and Resources Credit MR2.1, Construction Waste Management, Divert 50% from Disposal.

Recycled Content 10% (Post-Consumer + 1/2 Pre-Consumer). AF construction projects shall actively seek to increase the demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

Recycled Content 10% (Post-Consumer + 1/2 Pre-Consumer) Implementation: Establish Project goal for the use of recycled content materials; select products and identify suppliers that will help achieve this goal. During construction, ensure selected products are installed. Note that this requirement is complementary to meeting preferential product/item selection from EPA *Comprehensive Procurement Guidelines (CPG)*. Project teams are advised this LEED® credit distinguishes between pre-consumer and post-consumer content, whereas the EPA *CPG* refers only to post-consumer content and “recovered materials” content; and this LEED® credit measures recycled content percentage based on cost while the EPA *CPG* measures recycled content based on weight. The goal and intent of this LEED® credit closely aligns with higher requirements for the preferential product/item selections from sources containing recycled content and is to be incorporated in Air Force Projects.

Associated USGBC LEED® Credits: Materials and Resources Credit MR4.1, Recycled Content 10% (Post-Consumer + 1/2 Pre-Consumer).

Rapidly Renewable Materials. Reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

Rapidly Renewable Materials Implementation: Establish Project goal for the use of rapidly renewable materials; select products and identify suppliers that will help achieve this goal. Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork. During construction, ensure selected products are installed. The goal and intent of this LEED® credit closely aligns with higher requirements for the preferential product/item selections of rapidly renewable products and is to be incorporated in Air Force Projects.

Associated USGBC LEED® Credits: Materials and Resources Credit MR6, Rapidly Renewable Materials.

Certified Wood. Encourage environmentally responsible forest management.

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Certified Wood Implementation: Establish Project goal for the use of certified wood including, but not limited to structural framing and general dimensional framing, flooring, sub-flooring, wood doors and wood trim. Select products and identify suppliers that will help achieve this goal. During construction, ensure selected products are installed. The goal and intent of this LEED® credit closely aligns with higher requirements for the use of certified wood products and is to be incorporated in Air Force Projects even if total quantities do not meet LEED® thresholds.

Associated USGBC LEED® Credits: Materials and Resources Credit MR7, Certified Wood.

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Indoor Environmental Quality

Establish Moisture Control Strategy. Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage, minimize mold contamination, and reduce health risks related to moisture.

Establish Moisture Control Strategy Implementation: Moisture control is an often overlooked issue but failing to properly address this topic can lead to significant health-related concerns and needless waste of the building's heating and cooling energy. Refer to the National Institute of Standards and Technology (NIST) publication *Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use* (located at <http://www.fire.nist.gov/bfrlpubs/build05/art007.html>) for useful design and planning information. This study predicts potential annual heating and cooling energy cost savings ranging from 3-percent to 36-percent if properly implemented.

Recent work by the Corps of Engineers (COE) on Building Air Tightness Performance Requirements also addresses this issue; the COE has set requirements for air barrier material(s) to have an air permeance not to exceed 0.004 cfm / sf at 0.3" wg [0.02 L/s.m² @ 75 Pa] when tested in accordance with ASTM E 2178. This requirement shall be incorporated in Air Force Projects.

In Project documents, establish Building Air Tightness requirements to fully incorporate performance measures and required remediation measures if performance is not initially obtained. Discuss these requirements at all project design and construction meetings including pre-bid and kickoff. During construction, ensure designed measures are properly installed and tested.

Building Air Tightness Performance Requirements: Design and construct the building envelope with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components of each envelope assembly on construction documents and detail the joints, interconnections and penetrations of the air barrier components. Clearly identify the boundary limits of the building air barriers, and of the zone or zones to be tested for building air tightness on the drawings. Trace a continuous plane of air-tightness throughout the building envelope and make flexible and seal all moving joints.

Associated USGBC LEED® Credits: None

Minimum IAQ Performance. Establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of occupants.

Minimum IAQ Performance Implementation: Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates per ASHRAE 62.1, *Ventilation for Acceptable Indoor Air Quality*. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize energy efficiency and occupant health.

Associated USGBC LEED® Credits: Indoor Environmental Quality Prerequisite.1, Minimum IAQ Performance.

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Environmental Tobacco Smoke (ETS) Control. Minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).

Environmental Tobacco Smoke (ETS) Control Implementation: Prohibit smoking in the building and locate any exterior designated smoking areas at least 25-feet away from entries, outdoor air intakes and operable windows.

Associated USGBC LEED® Credits: Indoor Environmental Quality Prerequisite 2, Environmental Tobacco Smoke (ETS) Control.

Construction IAQ Management Plan, During Construction and Before Occupancy. Reduce indoor air quality problems by addressing issues during construction/renovation work *and* before facility occupancy in order to help sustain the comfort and well-being of construction workers and building occupants.

Construction IAQ Management Plan, During Construction and Before Occupancy Implementation: Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases which at a minimum includes: following the recommended Control Measures of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) *IAQ Guidelines for Occupied Buildings under Construction*; protecting stored on-site or installed absorptive materials from moisture damage and replacing all air filtration media immediately prior to occupancy.

After construction and prior to occupancy, meet USGBC LEED® Indoor Environmental Quality Credit EQ3.2, Construction IAQ Management Plan (Before Occupancy) requirements by either conducting a building air flush-out or perform air quality testing and demonstrate that contaminants maximum concentrations are not exceeded. Federal policy or directive requirements address flush-out and do not align precisely with the USGBC LEED® credit; however, the goals and intent are the same. The Air Force considers this best practice and will implement in High Performance Green Facilities.

Associated USGBC LEED® Credits: Indoor Environmental Quality Credit EQ3.1, Construction IAQ Management Plan (During Construction) *and* Indoor Environmental Quality Credit EQ3.2, Construction IAQ Management Plan (Before Occupancy).

Low-Emitting Materials. Reduce the quantity of indoor air contamination that are odorous, irritating and/or harmful to the comfort and well-being of construction workers and building occupants.

Low-Emitting Materials Implementation: In Project documents, specifically call attention to the requirement for low-emitting products/items. Make preferential selections from products/items with low pollutant emissions with specific attention to adhesives & sealants, paints & coatings, carpet-systems, composite wood & agrifiber products and furnishing selections. During construction, verify specified materials are installed. Many manufacturers are already addressing the concern with harmful/irritating emissions and making changes to their products.

Associated USGBC LEED® Credits: Indoor Environmental Quality Credits EQ4.1, Low-Emitting Materials- Adhesives & Sealants; EQ4.2, Low-Emitting Materials- Paints & Coatings; EQ4.3, Low-Emitting Materials- Carpet Systems *and* EQ4.4, Low-Emitting Materials- Composite Wood & Agrifiber Products.

US Air Force High Performance Green Buildings Interim Implementation Actions and Metrics (reference LEED v2.2)

Controllability of Systems, Lighting. Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms, conference rooms) to promote the productivity, comfort and well-being of building occupants.

Controllability of Systems, Lighting Implementation: Design the facility with occupant controls for lighting. Strategies to consider include lighting controls, task lighting and daylighting. Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the facility. Consider use of automatic lighting dimming controls to reduce artificial lighting levels when adequate natural daylight is present. Federal policy or directive requirements for controllability of lighting systems do not align precisely with the USGBC LEED® credit; however, the goals and intent are the same. The Air Force considers this best practice and will implement in High Performance Green Facilities.

Associated USGBC LEED® Credits: Indoor Environmental Quality Credits EQ6.1, Controllability of Systems (Lighting).

Thermal Comfort, Design. Provide a comfortable thermal environment that supports the productivity and well-being of facility occupants.

Thermal Comfort, Design Implementation: Design HVAC systems and the facility envelope to meet requirements of ASHRAE Standard 55, *Thermal Comfort Conditions for Human Occupancy*. Evaluate air temperature, radiant temperature, air speed and relative humidity in an integrated fashion.

Associated USGBC LEED® Credits: Indoor Environmental Quality Credits EQ7.1, Thermal Comfort (Design).

Daylight & Views, Daylight 75% of Spaces. Provide for the facility occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas.

Daylight & Views, Daylight 75% of Spaces Implementation: Daylight levels may be determined by glazing factor calculation, daylight simulation model or through daylight measurements. Achieving daylight and views for building occupants should be a high priority goal in all Projects but may be difficult to effect due to some mission function. As an absolute minimum, Projects should not create windowless offices or windowless regularly occupied spaces unless specifically required by mission-related tasks. In cases where security considerations or mission-related tasks would prohibit windows for views, the integrated Project team must still investigate scenarios allowing natural daylighting into these spaces. Additionally, the Project design should provide daylight redirection and/or glare control devices and automatic dimming controls or accessible manual lighting controls. Creation of windowless offices or windowless regularly occupied spaces may happen only after obtaining concurrence from higher level Command; document and maintain this information in the Project record.

Associated USGBC LEED® Credits: Indoor Environmental Quality Credit EQ8.1, Daylight and Views (Daylight 75% of Spaces).

US Air Force High Performance Green Buildings Interim Implementation Actions and Metrics (reference LEED v2.2)

Innovation/Processes

Integrated Planning/Design Team. Use a collaborative, integrated planning and design process that: initiates and maintains an integrated Project team in all stages; works holistically to resolve issues; considers best approach to achieving sustainable performance goals for siting, energy, water, materials, and indoor environmental quality along with other comprehensive design goals and ensures incorporation of these goals throughout the design and lifecycle of the building.

Integrated Planning/Design Team Implementation: requires assembly of integrated Project delivery team gathered at initial Project planning stage. The team must establish goals for Project siting, energy usage, water conservation, indoor environmental quality and materials use. The team must integrate requirements in OMB Publication A-11, Section 7, Exhibit 300: *Capital Asset Plan and Business Case Summary* and must consider all stages of the building's lifecycle, including deconstruction.

Associated USGBC LEED® Credits: None.

Project Case Study Entered in High Performance Federal Buildings Database. The High Performance Federal Buildings Database is sponsored by the U.S. Department of Energy, Federal Energy Management Program (FEMP); it seeks to improve building performance measuring methods by collecting data on various factors including energy, materials, and land use. The AF supports the widest dissemination of sustainable design practices and believes open communication will lead to rapid adoption and implementation. To support this goal, all AF projects will be entered into the database.

Project Case Study Entered in High Performance Federal Buildings Database Implementation: There are three steps in the process: the first is to register and open an account with FEMP; the second is to enter the Project information and the third is a FEMP review and public posting. The FEMP website is at: <http://femp.buildinggreen.com/>

Associated USGBC LEED® Credits: None.

AF Building Commissioning. Building commissioning activities constitute quality assurance; commissioning is an integrated process for achieving, validating and documenting performance of the building and its systems relative to the design intent and Project requirements. Building commissioning recognizes the integrated nature of all building systems' performance, which impact sustainability, workplace productivity, occupant safety, health and security. A holistic approach will safeguard Air Force interests and investments by implementing solutions that best represent and meet long term efficiency and functionality goals while meeting mission requirements; improve facility operations; optimize value received for each construction dollar spent and improve Indoor Environmental Quality (IEQ).

Because all building systems are integrated, a deficiency in one or more components can result in suboptimal operation and performance among other components. Remedying these deficiencies can result in a variety of benefits including:

- Improved building occupant productivity
- Lower utility bills through energy savings
- Increased occupant satisfaction
- Enhanced environmental/health conditions and occupant comfort

US Air Force High Performance Green Buildings Interim Implementation Actions and Metrics (reference LEED v2.2)

- Improved system and equipment function
- Improved building operation and maintenance
- Increased occupant safety
- Better facility documentation
- Shortened occupancy transition period
- Significant extension of equipment/systems life cycle

The Air Force is establishing three broad tiers of commissioning activities tailored to the size and complexity of the building and its system components: 'AF Fundamental Commissioning'; 'AF Enhanced Commissioning' and 'AF Commissioning for HVAC&R Start-up and Turnover' (applicable only to Projects consisting of HVAC&R system upgrades). All buildings shall be commissioned at either the 'AF Fundamental Commissioning' level or the 'AF Enhanced Commissioning' level. The transition threshold between AF Fundamental Commissioning and AF Enhanced Commissioning is established when:

Primary Facility cost is \$10M and over
AND/OR

Project is identified at the Customer Project Requirement (CPR) stage based on systems cost, anticipated return on investment, commissioning costs, AF priorities, and subjective measures.

AF Fundamental Commissioning Implementation: Begin commissioning processes in the Planning/Pre-Design stage; processes listed below comply with both federal agency requirements and the LEED® prerequisite criteria.

1. Designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
 - a. The CxA shall have documented commissioning authority experience in at least two building projects.
 - b. The individual serving as the CxA shall be independent of the project's design and construction management, though they may be employees of the firms providing those services. The CxA may be a qualified employee of the government.
 - c. The CxA shall report results, findings and recommendations directly to the government.
 - d. For projects smaller than 50,000 gross square feet, the CxA may include qualified persons on the design or construction teams who have the required experience.
2. Ensure CxA participation in all design charrettes. The Government shall fully document Project Requirements and the design team shall develop the Basis of Design (BOD). The CxA shall review these documents for clarity and completeness. The Government and the design team shall be responsible for updates to their respective documents.
3. Develop and incorporate commissioning requirements into the construction documents.
4. Develop and implement a commissioning plan.
5. Verify the installation and performance of the systems to be commissioned.
6. Complete a summary commissioning report.

At a minimum, the following core building systems shall be commissioned.

- Heating, ventilating, air conditioning, and refrigeration (HVAC&R) systems and associated controls (mechanical and passive)
- Domestic hot water systems and associated controls

US Air Force High Performance Green Buildings Interim Implementation Actions and Metrics (reference LEED v2.2)

- Renewable energy (wind, solar, etc.) systems and associated controls
- Life safety systems and associated controls
- Lighting and daylighting systems and associated controls
- Emergency power and uninterruptable power systems and associated controls
- Electrical systems, including service switch gear, switchboards, distribution panel boards, transformers, motor control centers, power monitoring and metering, transient voltage surge suppressors, variable speed drives, grounding and ground fault systems, overcurrent protective devices and low voltage busway

Additional systems should be added to the core building systems list when:

The individual system estimated cost is \$500,000 and over

AND/OR

The system is identified in Customer Project Requirement (CPR) design analysis

Possible additional systems include but are not limited to:

- Building automation systems
- Plumbing systems, including domestic water supply, metering, domestic hot water, irrigation, stormwater, water treatment, and process water pumping and mixing systems
- Equipment sound control systems
- Vertical transport systems
- Laboratory pressurized air and vacuum systems
- Security and access control systems
- Information and communications systems, including voice and data
- Building envelope
- Public address/paging systems

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 1, Fundamental Commissioning of the Building Energy Systems.

AF Enhanced Building Commissioning Implementation: Begin commissioning processes in the Planning/Pre-Design stage; processes listed below comply with federal agency requirements, LEED® Energy and Atmosphere Prerequisite 1 criteria and LEED® Energy and Atmosphere Credit 3, “Enhanced Commissioning” criteria.

1. Prior to the start of the construction documents phase, engage an independent Commissioning Authority (CxA) to lead, review, and oversee the completion of all commissioning process activities. The CxA shall, at a minimum, perform Tasks 2, 3 and 6. Other team members may perform Tasks 4 and 5.
 - a. The CxA shall have documented commissioning authority experience in at least two building projects.
 - b. The individual serving as the CxA shall be independent of the project's design and construction management. The CxA may be a qualified employee of the government.
 - c. The CxA shall report results, findings and recommendations directly to the Government.
 - d. This requirement has no deviation for project size.
2. Ensure CxA participation in all design charrettes. The Government shall fully document Project Requirements and the design team shall develop the Basis of Design (BOD). The CxA shall review these documents for clarity and completeness.

US Air Force High Performance Green Buildings Interim Implementation Actions and Metrics (reference LEED v2.2)

The Government and the design team shall be responsible for updates to their respective documents.

3. Develop and incorporate commissioning requirements into the construction documents.
4. Develop and implement a commissioning plan. Include provisions for the resolution of outstanding commissioning related issues identified at the 10-month building operation review.
5. Verify the installation and performance of systems identified to be commissioned.
6. Complete a summary commissioning report.
7. Perform commissioning design review in conjunction with all design reviews and back-check comment resolution in the subsequent design submission.
8. Review contractor submittals applicable to systems being commissioned. These reviews shall be concurrent with designer reviews.
9. Develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
10. Verify that the requirements for training operating personnel and building occupants are completed.
11. Review building operation within 10-months after substantial completion.

At a minimum, the following core building systems shall be commissioned.

- Heating, ventilating, air conditioning, and refrigeration (HVAC&R) systems and associated controls (mechanical and passive)
- Domestic hot water systems and associated controls
- Renewable energy (wind, solar, etc.) systems and associated controls
- Life safety systems and associated controls
- Lighting and daylighting systems and associated controls
- Emergency power and uninterruptible power systems and associated controls
- Electrical systems, including service switch gear, switchboards, distribution panel boards, transformers, motor control centers, power monitoring and metering, transient voltage surge suppressors, variable speed drives, grounding and ground fault systems, overcurrent protective devices and low voltage busway
- Building automation systems
- Plumbing systems, including domestic water supply, metering, domestic hot water, irrigation, stormwater, water treatment, and process water pumping and mixing systems
- Equipment sound control systems
- Vertical transport systems
- Laboratory pressurized air and vacuum systems
- Security and access control systems
- Information and communications systems, including voice and data
- Building envelope
- Public address/paging systems

Additional systems should be added when:

The individual system estimated cost is \$500,000 and over
AND/OR

The system is identified in Customer Project Requirement (CPR) design analysis

Associated USGBC LEED® Credits: Energy and Atmosphere Prerequisite 1, Fundamental Commissioning of the Building Energy Systems *and* Energy and Atmosphere Credit EA3, Enhanced Commissioning.

**US Air Force High Performance Green Buildings
Interim Implementation Actions and Metrics (reference LEED v2.2)**

LEED® Accredited Professional. Having LEED accredited professionals on the team will support and encourage design integration and aligns with the integrated team goal.

LEED® Accredited Professional Implementation: At least one principal participant of the Project team shall be a LEED® accredited professional. Federal policy or directive requirements do not align precisely with the USGBC LEED® credit; however, the goals and intent are the same. The Air Force considers this best practice and will implement in High Performance Green Facilities

Associated USGBC LEED® Credits: Innovation & Design Process Credit ID2, LEED Accredited Professional.

END

PROJECT A-5 WORKING DRAFT (FEB 2009)