DEFENSE LOGISTICS AGENCY
HEADQUARTERS
8725 JOHN J. KINGMAN ROAD
FORT BELVOIR, VIRGINIA 22060-6221

DEC 04 2012

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Defense Logistics Agency (DLA) Sustainability and Energy Efficiency Policy

This memorandum consolidates and incorporates referenced requirements (Attachments 1-7) for implementing sustainable design and development (SDD) concepts in the execution of all DLA Military Construction (MILCON), and Sustainment, Restoration, & Modernization (SRM) projects and minor construction projects that exceed 25% of the current replacement value. This memorandum supersedes the prior policy memorandum (DLA Sustainable Design and Development Policy, May 5, 2011). The goal of this policy is to reduce the environmental impact and total ownership cost of new and renovated facilities by reducing energy, water usage, maintenance requirements, and resources needed to provide safe, healthy, and environmentally sustainable facilities. All aspects of these referenced policies are to be implemented no later than January 31, 2013 for all project designs that are less than 35% as of this date. DLA Installation Support (DS) Site Directors are to incorporate this guidance during replacement or restoration of equipment, devices or structural elements that alter, replace or repair equipment covered by these policies effective December 15, 2012 and thereafter.

Policy exceptions require demonstration that the energy conservation measures (ECM) is not cost effective within a 10-year payback. If the required ECM is cost effective between 10 and 15 years, Site Directors may approve, but will require DS-Installation Management (DS-I) approval to exempt or not implement. A building's ECM with a greater than 15-year payback requires DS-I approval to implement due to the length of the payback period. An analysis must be included with any request for policy exemption; the analysis should demonstrate the closest option to the requirement that is within the Site Director's 15-year approval and the option that meets the 10-year payback period that requires implementation. All Site Directors must get approval in writing for any SDD non-compliance exception from the DS-I Staff Director.

All future projects shall incorporate sustainable development concept and principles, as detailed in the latest edition of Unified Facilities Criteria (UFC) 4-030-01, *Sustainable Development,* and the additional guidance within this memo. An exception may be granted by DS-I if it is demonstrated that the requirement is not cost effective or feasible using a life cycle cost analysis (LCCA). If it is determined that a requirement is not LCCA effective, then the highest level of cost effectiveness that is feasible for that requirement will be accomplished.

Any renewable energy project (renewable energy systems defined as solar hot water or solar thermal, solar electric or photovoltaic, solar indoor or outdoor lighting, wind turbines, fuel cells, geothermal, biomass, hydroelectric, ground coupled heat pump systems, and other Department of Energy (DOE) defined alternative Energy options) that has a 15 year payback or less will be implemented. Renewable energy projects with 25-year paybacks may be

implemented with the Site Director's approval. For projects with 15-25-year paybacks, the Site Director may approve but will require DS-I approval to be exempt from execution. For renewable energy projects with a greater than 25-year payback, DS-I approval is required to implement due to the length of payback period. A General Officer or SES level signature from the funding organization is also required. Under request for exemption to the policy, the analysis sent with the request should show the closest option to the requirement that is within the Site Director's 25-year approval and meets the 15-year payback, if such options exist. If such options do not exist, the lowest payback option available must be provided.

All DLA roof replacement projects must give consideration to solar integrated roof (SIR) systems. Consideration means that an LCC analysis will be performed on an SIR system for each applicable project. Implementation or exemption of implementation of an SIR system will be based on the payback periods described in the previous paragraph.

The majority of current DLA MILCON projects will replace, modernize, and construct fuels infrastructure. These projects do not directly align with the Leadership in Energy and Environmental Design – New Construction (LEED – NC) rating system for certification by the U.S. Green Building Council (USGBC). Design of these projects will include applicable SDD practices, as outlined in the LEED – NC rating guidance, for sustainable siting, energy and water conservation, air quality preservation, material recycling, and construction waste recovery by complying with 40% better than the current ASHRAE standard 90.1 and meeting a minimum of 10 points in Water Efficiency and Energy and Atmosphere points per LEED – NC and a minimum of 35 points overall for fuels infrastructure projects.

For all other DLA projects that are LEED – NC certifiable, DS-I will provide specific direction in the design authorization for the rating level that is required to achieve for any specific project. All projects will be at the minimum standard of LEED Silver with 15 Water Efficiency and Energy and Atmosphere points and 40% better than the current ASHRAE standard 90.1. The direction from DS-I per project will specify whether the project will be certified and registered by the USGBC. Additional renewable energy production efforts specific to a facility may be directed, such as solar roofs, solar water heating, and/or transpired walls (solar walls).

The following attachments are applicable:

DLA MILCON SDD Implementation Attainment Levels (Attachment 1):

The attached DLA MILCON Implementation Attainment Levels is a table showing typical DLA project categories and the sustainable design effort required to attain.

DLA MILCON SDD Implementation Typical Design Authorization Direction (Attachment 2):

The attached DLA MILCON SDD Implementation Typical Design Authorization Direction shows examples of the standard directions in DLA design authorizations, corresponding to these SDD levels.

DLA Specific Energy Design Standards (Attachment 3):

The attached DLA Specific Design Standards cover outdoor lighting, exit signs, vending machines and vender site requirements to be used for all replacement, renovation or new construction projects or for vending equipment installed or operated in DLA facilities, and the requirement to use waterless urinals in all major renovations and new construction projects.

a. Energy Policy for Photoluminescent Fire Exit (Attachment 3a)

This attachment states that with all new build or retrofit/remodel will incorporate photoluminecent exit signs.

b. DLA Vending Equipment Policy (Attachment 3b)

This attachment explains that all Vending machines must be in the top 25% of energy efficiency, must be delamped or have occupancy sensors. The vending machines must be programed to be off during non-duty hours, if they do not contain perishable items.

DLA Scope of Work Energy Design Standards (Attachment 4):

The attached DLA Scope of Work Energy Design Standards will be used by design engineers for all replacement, renovation or new construction projects when making minimum specification requirements for equipment and systems installed in DLA facilities.

USACE ECB 2010-14, 2011-1 (Attachment 5):

This DLA SDD policy includes both USACE ECB 2010-14 and ECB 2011-1, as together they help define energy and sustainability requirements.

ECB 2010-14 requires both an increase in the energy consumption savings from 30% to 40% below the consumption of a baseline building compared to ASHRAE Standard 90.1 2007, and also requires the additional 10% energy savings option to achieve a total of 50% energy consumption savings compared to ASHRAE Standard 90.1 2007 for Design Build projects unless it is demonstrated to not be life cycle cost effective. This DLA standard is to be applied to all major construction projects and all minor construction projects that exceed 25% of the replacement value, and shall increase the energy consumption savings from 30% to 40% below the consumption of a baseline building compared to ASHRAE Standard 90.1 2010 where United States Army Corps of Engineers, Naval Facilities Engineering Command, Air Force Center for Engineering and the Environment or Air Force Civil Engineer Support Agency is the construction agent unless it is demonstrated to not be life cycle cost effective.

ECB 2011-1 requires an LCCA on energy related design decisions of major systems and features that will exceed 1% of the Programmed Amount in cost. This LCCA shall be documented as part of design analysis and/or basis of design files and kept available for review. ECB 2011-1 is also intended to enhance conformance with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings and states that all Military Construction Army projects will comply with the Department of Defense Sustainable Buildings Policy and the Department of the Army Sustainable Design and Development Policy Update based on a phased implementation plan based on program year.

DOE Guidelines for Selecting Cool Roofs (Attachment 6):

Cool Roofs will be evaluated on all new or major renovation projects. Exceptions are for northern climates or where it is demonstrated that the extra cost for the cool roof will exceed a

10-year payback. Submit Cool Roof policy exception requests and supporting documentation to the Director of Installation Support.

Limitation on Use of Fiscal Year 2012 Funds for LEED Gold or Platinum (Attachment 7):

The National Defense Authorization Act 2012 states that the Department of Defense will not go above LEED Silver unless it is demonstrated to be life cycle cost effective and a waiver decision is obtained from the OSD AT&L.

Incorporation of sustainable design and development practices in DLA facilities will help DLA meet federal energy efficiency requirements, reduce energy consumption and improve life-cycle facilities costs. DS-I's partnership with all DLA entities and construction agents is vital to accomplish these objectives. We value others expertise in achieving DLA's energy reduction goals, and welcome any comments to improve our DLA energy efficiency policy and design standards.

Points of contact for this action are Mr. Don Juhasz, DS-IE, (703) 767-3537, DSN 427-3537, or email don.juhasz@dla.mil, and Mr. Mike Van Dam, DS-IE, (703) 767-2766, DSN 427-2766, or email mike.vandam@dla.mil.

DAVID RODRIGUEZ
Director
DLA Installation Support

Attachments
As stated

DISTRIBUTION:
DLA LAND AND MARITIME
DLA TROOP SUPPORT
DLA AVIATION
DLA ENERGY
DLA DISPOSITION SERVICES
DLA DISTRIBUTION
DS SITE/STAFF DIRECTORS

Defense Logistics Agency
Military Construction Program
Sustainable Design and Development Implementation
Attainment Levels

Type of Project	Sustainable Design and Development (SDD) Attainment Level*
Fuel Infrastructure	
Hydrant Fuel Systems	Motors and pumps in the top 5% energy efficiency available.
Pumphouses Load/Unload Facilities	Minimum LEED - NC points of 35 & minimum of 10 energy/ atmosphere & water Points with a minimum of 40**%** better than current version of ASHRAE Std 90.1
Storage Tanks Pipelines	Motors and pumps in the top 5% energy efficiency available.
Operations Buildings Piers and Waterfront Facilities Other Fuel Facilities	Minimum LEED - NC points of 35 & minimum of 12 energy/ atmosphere & water Points with a minimum of 40% better than current version of ASHRAE Std 90.1
Public Safety Facilities Administrative Buildings Physical Fitness Facilities	Minimum LEED *Silver/Gold/Platinum – NC Certifiable & minimum of 15 energy/ atmosphere & water Points with a minimum of 40% better than current ASHRAE Std 90.1
General Purpose Warehouses Entry Control Points Other Depot Storage/Operations Fac.	Minimum LEED - NC points of 40 & minimum of 15 energy/ atmosphere & water Points with a minimum of 40% better than current version ASHRAE Std 90.1

***DLA Minimum LEED Attainment Levels**
FY 2011 - 2014 LEED Silver
Leed Gold/Platinum Based on demonstrate of life cycle effectiveness
Requires waiver from OSD AT&L if above LEED Silver certification level

Defense Logistics Agency
Military Construction Program
Sustainable Design and Development (SDD) Implementation
Typical Design Authorization Direction

Minimum LEED Points of 35 or 40 points with minimum of 10, 12 or 15 points combined in the energy/atmosphere & water areas and a minimum of 40% better than the current ASHRAE STD 90.1:

"Consistent with UFC 4-030-01, *Sustainable Development*, the construction agent shall maximize the use of sustainable design concepts in the design and construction of this facility, particularly regarding sustainable siting, water and energy conservation, air quality preservation, material recycling/reuse, and construction waste recovery. The cost of implementing this direction shall be included in requested design and construction cost estimates."

LEED–NC Certifiable & the "%" required better than the current ASHRAE STD 90.1:

Certification and Registration by U.S. Green Building Council:

"The construction agent shall design this facility to attain a [SILVER, GOLD, or PLATINUM] level as defined in Version 3.0 of the Leadership in Energy and Environmental Design – New Construction (LEED – NC) rating system. This rating level shall be certified and registered by the U.S. Green Building Council. The facility will be designed to meet "X%" better than the current ASHRAE STD 90.1. The cost of implementing this direction shall be included in requested design and construction cost estimates."

Non Facility Fuel Support Systems: – Motors and pumps will be rated in the top 5% of energy efficiency available or have Energy Star ® rating.

Date: 04/25/2011

ATTACHMENT 2

Defense Logistics Agency
Specific Energy Savings Design Standards

Outdoor Lighting:

All outdoor lighting (Security and Safety) will consider the use of motion sensors. Project engineers will consult with physical security specialists and safety on all security lighting projects to ensure that the proposed projects do not create vulnerabilities or hazards and meet UFC/DoD security standards. Outdoor lighting projects with payback thresholds of 10-years or less require implementation. When considering the use of motions sensors, consideration/analysis will include the need to upgrade camera systems compatibility, cost limitations, mission and regulatory requirements. Solar powered lighting with a 25-years or less payback will be considered in outdoor lighting projects with the appropriate application of these fixtures is at the discretion of the DLA Installation Support Site Director.

DLA Exit Sign Policy, August 5, 2010:

The referenced DLA Exit Sign Policy applies to all DLA facilities. The DLA photo luminescent exit sign design policy shall be fully incorporated in all DLA new build or retrofit/remodel designs effective immediately. Specific design guidelines are listed in the August 5, 2010 policy letter, "DLA Installation Support Energy Policy for Fire Exits." A copy is provided with this attachment.

DLA Vending Machine Policy, July 13, 2010:

The referenced DLA Vending Machine Policy applies to all DLA funded facilities and sites where any vender uses utilities from a DLA facility or site. This referenced policy is to be provided to all venders that use utilities from a DLA facility or site. All vending machines are required to be Federal Energy Management Program (FEMP) designated or ENERGY STAR®-qualified products. The vending machines are to be in the upper 25% of their class in energy efficiency for their class of vending machines that are currently available on the market. Additional policy guidance and requirements are detailed in the July 13, 2010 policy letter, "DLA Installation Support Energy Policy for all Vending Machines." A copy is provided with this attachment.

Use Of Waterless Urinals:

Executive Order 13514 requires a reduction of water consumption intensity by 2% annually thru FY2020 or 26% by the end of FY2020. Regardless of the USACE rescinding the requirement via a memo from the ACSIM dated March 28, 2011, DLA's current Sustainable Design Standards for water reduction/efficiency minimum standards will continue with the requirement for waterless urinals in all new construction and major renovations projects as one of many water reduction/efficiency opportunities.

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AUG - 5 2010

IN REPLY REFER TO DLA Installation Support

MEMORANDUM FOR DLA INSTALLATION SUPPORT SITE DIRECTORS

SUBJECT: Defense Logistics Agency (DLA) Installation Support Energy Policy for Fire Exits

This memorandum provides direction on implementing the requirements of the Energy Policy Act of 2005, EO 13423, Energy Security and Independence Act of 2007, EO 13514, and the National Defense Authorization Act of 2009 and 2010 as they pertain to DLA meeting federal energy and utility reduction goals and efficiencies. This memorandum applies to fire exit sign designs in new build or retrofit/remodel designs.

Photoluminescent exit signs are an ideal component of energy efficient office building, warehouse, school, or hospital designs. These exit signs conserve electric power and reduce installation costs while meeting all safety code requirements.

Photoluminescent exit signs are available with a red or green background. DLA facility designs are recommended to use these exit signs as a replacement for "over the door" electrically powered exit signs or as floor level exit signs. Install photo luminescent exit signs in accordance with (Unified Facilities Criteria) UFC 3-600-01 and NFPA (National Fire Protection Association) 101 Life Safety Code (2009 Edition). The exit signs shall be listed in accordance with ANSI/UL (American National Standards Institute/ Underwriter Laboratory) 924 "Standards for Emergency Lighting and Equipment". The required external illumination source (light fixture) shall have power to the fixture at all times during building occupancy (primary building power, back-up emergency power or battery power) and will not be manually switch operated. The light will be illuminated and or the area illuminated whenever there is occupancy of the area serviced by the egress light fixture and the exit sign or when the power to the building is interrupted or disconnected.

Photoluminescent exit sign design policy shall be fully incorporated in new build or retrofit/remodel designs effective immediately.

Incorporation of sustainable practices and equipment in DLA facilities will help DLA meet federal energy efficiency requirements and reduce unnecessary utility consumption. Additional questions or clarifications on this policy are to be addressed to DLA Chief Fire Protection Engineer.

Navin Mehta
Chief Fire Protection Engineer
DLA Installation Support

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IN REPLY
REFER TO DES-I

JUL 13 2010

MEMORANDUM FOR DLA ENTERPRISE SUPPORT SITE DIRECTORS

SUBJECT: Defense Logistics Agency (DLA) Enterprise Support (DES) Energy Policy for all Vending Machines that Consume Utilities on or in DLA Responsible Sites or Facilities

This memorandum provides direction on implementing the requirements of the Energy Policy Act of 2005, EO 13423, Energy Security and Independence Act of 2007, EO 13514, and the National Defense Authorization Act of 2009 and 2010 as they pertain to DLA meeting federal energy and utility reduction goals and efficiencies. This memorandum applies to all vending machines and vending sites that consume utilities regardless of ownership or legal basis authorizing the activity and whether they are located indoors or outdoors.

All vending machines are required to be Federal Energy Management Program (FEMP) designated or ENERGY STAR®-qualified products. The vending machines are to be in the upper 25% of their class in energy efficiency for their class of vending machines that are currently available on the market. The equipment requirement for FEMP-designated or ENERGY STAR®-qualified products also applies to all vending sites where food is prepared or dispensed and the vending site(s) is/are authorized to use utilities provided or paid by DLA. All equipment and appliances including vending machines will bear the FEMP-designated or ENERGY STAR® label as evidence of conforming to federal requirements. Incandescent lighting is prohibited in vending machines, appliances or for use at any vending site as not complying with FEMP-designated or ENERGY STAR®-qualified.

All vending machines will either be de-lamped (including any ballast) or include an occupancy/motion sensor control that illuminates the lighting only when someone is present. All non-perishable products vending machines that use refrigeration or temperature controls (such as liquid products or soda products) will have compressor controls that inhibit the operation of the compressor during non-standard duty hours (will operate no more than 12 hours a day unless there are two or three shifts following each other in which case and additional six hours of operation may be added for each additional shift). The compressors will be programmed to be off on weekends and holidays and when there are no scheduled activities or only security personnel will be present. One machine only per complex or installation may operate its compressor to maintain normal chilled temperatures 24/7 when security personnel are required to be on duty 24/7. As an option, occupancy/motion sensors controls can be installed to operate anytime personnel are present but must lock out the compressors in an off condition after any 60 minutes of inactivity until activated again by approaching personnel. All vending machines can be programmed to operate their compressors during established duty hours (but no more than.

12 hours per day unless a second or third shift is normal for every duty day). Exceptions to this policy must be sought in writing through the DES-D to DES-I

It is encouraged that vending machines that have been de-lamped in order to comply with this policy, attach a sign to the vending machine that educates any potential customer that the lights have been removed to reduce energy consumption. It is also encouraged that consideration be given to occupancy/motion sensor controls with automatic scheduled compressor controls. Perishable food/treat item vending machines are exempt from the compressor control requirements of this policy but must meet energy star and de-lamping/lighting control requirements as do all vending machines and vending sites.

All site directors are to complete an inventory by October 29, 2010 of the quantities of vending machines and vending sites currently operating that consume or use utilities provided or paid for by DLA. The inventory will be coded as one of the following four categories: (1) Vending Machine with no refrigeration or cooling (2) Vending Machine Refrigeration/cooling - non-perishable (3) Vending Machine Refrigeration-perishable or (4) Vending site (for prepared foods or non-vending machine provided products). The inventories are to be provided to DES-I and provisions of this memo are to be fully implemented by January 31 2011.

Emphasizing sustainable practices and equipment in all DLA facilities will help DLA meet federal energy efficiency requirements and reduce unnecessary utility consumption. Additional questions or clarifications on this policy are to be addressed to DES-I.

THOMAS M. LAFFEY
Colonel, USAF
Director, DLA Enterprise Support

DLA SCOPE OF WORK ENERGY DESIGN STANDARDS to meet EPACT 2005 & EISA 2007.
(To meet 2015 goals all NEW & RENOVATION projects must include higher efficiency equipment than existing and overall reduce energy density by a minimum of 40% compared to the current ASHRAE Std 90.1 2010.

CMT NO.	REFERENCE	DESCRIPTION/COMMENTS
1	Lighting Indoors	Use T-5 high efficiency, T-8 HO or LED lamps (4100K, or higher K, Minimum CRI 70). Design all to IES stds. T-5 or T-8 shall be driven by instant start electronic ballasts unless approved otherwise by DS-I. U-tubes are fragile, expensive and require an exception to policy from DS-I. All indoor lighting fixtures are to be controlled by an occupancy sensor or lighting controls. In high bay areas use prismatic daylights unless demonstrated to not be cost effective. For entrance and perimeter lights, use with photo cell and motion sensors. No 8 ft, U-tube fixtures, or incandescent bulbs or HID'S. Exception to requirement for motion sensor controlled is granted for one fixture per room in Child Care facilities that may be hand switch controlled.
2	Light Switching	Lighting in large areas (cafeterias, conference areas, maintenance areas) will provide motion sensor switching for partial area lighting for small use areas, when entire facility is not needed or in use. Occupancy and light level sensor setting time shall be 5-10 minutes. Where day lighting is available, additional dimming are shut off controls with be installed to turn off or dim ambient lighting when their is adequate (per lighting standards) natural or day lighting.
3	LED Exit Signs	Use Glow in the Dark Florescent non-powered Exit signs. Egress emergency lighting shall be via battery power ballast (florescent fixtures) or battery backup (non florescent lighting) in one fixture per room and end of each hallway with 20 minute minimum rating.
4	Motors	Use energy efficient motors that meet the "NEMA Premium" efficiency standards only; Variable speed motor systems and & BAS controls may be required for Ground Coupled Heat Pumps (GCHP).
5	Outside lighting	After consultation with physical security and safety specialists, install photocells control and motion sensors on all outside of buildings, parking lots and street lighting. Use of induction or LED lamps shall be used unless demonstrated to not be life cycle cost effective (exceptions to be approved by DS-I). No external lights on the building except over entrances and walkways.
6	Occupancy Sensors	Install occupancy sensors to control all area lighting (break areas, conference rooms, bathrooms, offices, halls & stairwells, and other). Ceiling Mount sensors are best except for individual offices where switch mounted are applicable. Lights off nights, weekends and when unoccupied is the requirement. Exception is one fixture per room in Child Care Facilities is to be direct switched. Occupancy sensor setting time shall be 5-10 minutes. here day lighting is available, additional dimming are shut off controls with be installed to turn off or dim ambient lighting when their is adequate (per lighting standards) natural or day lighting.
7	Water Heaters	Water heaters shall be 92 % min. and boilers shall be condensing technology; electronic ign.; exhaust via plastic pipe/ manuf design guide; Water source heat pump water heating is preferred, where GCHP heat transfer is available as part of the waste heat cycle when cooling a facility. Use waste heat from boilers or cooling towers to heat domestic hot water when these systems are used. Perform a LCCA for potential solar water heating.
8	Metering (All buildings) All Utilities	Smart Gas, electric and water meters will be installed to Public Service Commission (PSC) stds . All utilities shall be metered and installed to utility company standards. USACE metering specs are required.
9	Infrared Heating and heating	High bay/K SPAN and maintenance areas will be heated by condensing style or inline gas fired type infrared Heating systems capable of exhaust via plastic pipe. Exhaust through walls not roofs is desirable. Use of automated set backs for non occupied times are 45 degrees F maximum for maintenance and warehouses and 55 degrees F maximum for admin areas. All heating equip shall have electronic ignition. Solar walls for make up air are encouraged to lower cost and neg air pressures.
10	Insulated windows	Functional insulated windows with low E technology glass, min 2 layers and inert gas filled, with 20 year replacement if seal breaks, shall be used Glass thickness and tempering as applicable to meet design loads. Window performance U 0.36 maximum. Life long coating with no painting required on site. Composite material frames preferred or means to break thermal bridges from aluminum framed units must be provided and detailed before use of aluminum frame windows is authorized.
11	Insulation R-Factor	Insulation values for roof (R 60) and walls (R 38) shall be used as the starting point for cost effectiveness. Lower roof R values are permitted down to R38 where Cool roof applications of the minimum allowable design SRI values are applied based on climatic zone or where higher than R38 is not cost effective. Insulated metal panels, polyiso boards and/or combinations thereof are preferred for roofs and walls. For cavity walls, polyiso board and polyurethane spray foam are preferred within the cavities with polyurethane spray foam preferred in between metal studs on the interior face of the sheathing. For all masonry cavity walls polyiso board is preferred within the cavity with either polyiso board or polyurethane spray foam preferred for the interior masonry wall surface. Min heavy grade commercial wrap coating shall have edges sealed and fastened on 6 inch centers for total surface. All Building envelopes, must have an air and vapor barrier and shall meet applicable blower door tes of .025 cfm/psi.
12	General/Design Review	Designs shall consider all energy saving devices and most efficient product in order to conform to the Energy Policy Act of 2005, Energy Independence and Security Act of 2007 & latest exe orders on energy, and adhere to LCCA standards. To ensure compliance, all HVAC and Lighting Design shall be reviewed at 60% design completion with the Site Energy Manager and facility support team members All new buildings long wall should face the south direction and have ~ two foot of shading above each window level based on longitude.
13	Shower/kit heat recovery	Do not use Drain water heat recovery systems unless demonstrated to be Life cycle cost effective.
14	Faucet, shower heads, Urinal, & Water Closets	Use .5 gpm aerator faucets, low flow shower heads, .3 or less gpf water closets and waterless urinals. Use preferred non touch sensor detection faucets.
15	HVAC controls & automation	All building controls shall be compatible, connected and communicate with the existing installation wide wireless, building automation system.
16	HVAC-GCHP's and heating of vestibules and fire safety stairwells	Gas Fired Heating units shall be 92 % min AFUE. GSHP or hybrid heating/cooling systems shall be considered for all buildings. Radiant heating and cooing is the preferred method to heat and cool as compared to forced air systems. EER for air coupled heat pumps minimum shall be 16. Chiller systems will be a minimum of 8 COP. Use Melink intelligent exhaust hoods, or functional equal, to reduce HVAC energy loss. Vestibules will be designed to have no piping and require no heating or cooling. These area conditioning will be maintained by natural infiltration from the conditioned spaces. Existing vestibules will not be air conditioned and heating setting will not exceed 40F. Stairwells for fire escape will not have any addition air conditioning and heating should not be supplemented above 40F.
17	Traffic Signals	Only LED traffic sign bulbs shall be used.
18	Sky Lighting/	Diffused day lighting skylight solution with a 10 year no leak warranty using lighting sensors to harvest natural light is encouraged to include skylights with prismatic structures or highly insulating polycarbonate multi wall sheets .

App. By:Don Juhasz, PE, CEM Director Energy Resource Management (August 22, 2012)

US Army Corps of Engineers®

ENGINEERING AND CONSTRUCTION BULLETIN

No. 2010-14 **Issuing Office: CECW-CE** **Issued: 28 June 2010**

Subject: Improving building performance through enhanced requirements for energy performance and select LEED credits

References:

a. Army Memorandum dated 12 May 2010 addressing Constructive Use of FY 2010 and Future Bid Savings
b. U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) NC rating tool v2.2 and 2009/v3
c. ANSI/ASHRAE/IESNA Standard 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings

Applicability: Directive

1. The purpose of this ECB is to establish new requirements for enhanced energy performance and select LEED credits for all MCA projects, effective as noted below.

2. To enhance the energy performance of buildings, Paragraph 5.9.2 of the design-build (D-B) RFP Wizard will be modified to increase the energy consumption savings from 30% to 40% below the consumption of a baseline building compared to ASHRAE Standard 90.1. Also included in the RFP Wizard will be an option for an additional 10% energy savings for a total of 50% energy consumption savings compared to ASHRAE Standard 90.1.

As a reminder, unless a specific document version or date is indicated in the RFP Wizard, the 2007 version of ASHRAE 90.1 should be used in the energy consumption savings calculations, which is consistent with the Applicable Criteria in Paragraph 4 of the RFP Wizard.

For design-bid-build (D-B-B) contracts, all buildings are to achieve an energy consumption that is at least 40% below the consumption of a baseline building meeting the requirements of ASHRAE 90.1. The designer may design a building to achieve greater than 40% reduction if this can be accomplished within the authorized program amount.

3. Select LEED credits which must be included in solicitation requirements are:

A. WE 1 Water Efficient Landscaping – No potable water used for irrigation. Applicable to all projects.
B. WE 3 Water Use Reduction – At least 30% reduction. Applicable to all projects.
C. EA 1 Optimize Energy points that correspond to energy use reduction indicated in paragraph 2 of this ECB.
D. EA 3 Enhanced Commissioning – Improved O & M (training, manuals and follow-up). Applicable to all buildings with LEED Silver requirement.

E. EQ 7.1 Thermal Comfort Design – Improved indoor environment. Applicable to all buildings with LEED Silver requirement.

4. This directive is effective for D-B projects with release of RFPs in 4th quarter FY 2010 and beyond and those D-B projects whose RFPs were not yet "locked" in the Wizard as of the date these changes take effect in the Wizard (June 18, 2010). For D-B-B projects, this directive takes effect for all projects at 35% design or less as of July 1, 2010. Code T adapt-build projects which use existing adapt-build models are considered to be beyond the 35% stage of design. COSs are expected to update their existing adapt-build models with the new requirements and have these models available for use starting FY11 3rd quarter.

5. These changes have been incorporated into the RFP Wizard as of June 18, 2010.

6. HQUSACE POCs are Daniel Carpio, CECW-CE, 202-761-4227, or Joanne Qualey, CECW-CE, 202-761-8900. For LEED credits, technical assistance on a reimbursable basis can be provided by Ms. Judith Milton, Savannah District, 912-652-5441 or Ms. Jeanette Fiess, Seattle District, 206-764-3655.

JAMES C. DALTON, P.E.
Chief, Engineering and Construction
Directorate of Civil Works

PATRICIA A. RIVERS, P.E.
Chief, Programs Management Division
Directorate of Military Programs

US Army Corps of Engineers

ENGINEERING AND CONSTRUCTION BULLETIN

No. 2011-1 **Issuing Office:** CECW-CE **Issued:** 19 Jan 2011 **Expires:** 19 Jan 2013

Subject: High Performance Energy and Sustainability Policy

Applicability: Directive and Guidance

References:

a. Engineering and Construction Bulletin (ECB) 2010-14, 28 Jun 2010, Subject: Improving Building Performance through Enhanced Requirements for Energy Performance and Selected LEED Credits

b. Memorandum of Understanding (MOU), 06 Mar 06, *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings*

c. Memorandum, DUSD (I&E), 25 Oct 10, subject: Department of Defense Sustainable Buildings Policy

d. Memorandum, ASA (IE&E), 27 Oct 10, subject: Sustainable Design and Development Update (Environmental and Energy Performance)

e. U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) NC rating tool v2.2 and 2009/v3

1. The purpose of this Engineering and Construction Bulletin (ECB) is to implement new policies and procedures into the Military Construction, Army (MCA) program. This ECB is effective when issued and, together with ECB 2010-14 (Reference a), defines the Energy and Sustainability performance requirements for projects in the various phases of the Planning, Programming, Budgeting, and Execution process. ECB 2010-14 was intended to start the process by taking advantage of the good bid environment to fund additional energy enhancements for projects that were already authorized and appropriated. After the FY13 Program, ECB 2010-14 will no longer be applicable.

2. National energy security and sustainability concerns continue to drive construction programs to build higher performance buildings than ever before. Building more energy efficient and sustainable facilities is a mission objective of the US Army. We must continue to implement improved energy standards and sustainability objectives that are cost effective over the life of our facilities, installations, and infrastructure to meet energy security and independence goals.

3. Project Delivery Teams (PDT) are authorized and encouraged to aggressively enhance the energy and sustainability performance of our projects. Project features referenced by Attachment A that accomplish this objective whether programmed or incorporated by change during design or construction are to be considered technical requirements and not User Requested Changes. The PDT should be aware of how these features affect the scope of projects

that have a congressionally approved DD1391, as well as how they affect the PDR/3086 process for projects under design.

4. PDTs are to perform a Life Cycle Cost Analysis (LCCA) on energy-related design decisions of major systems and features that will exceed 1% of the Programmed Amount (PA) in cost. This Life Cycle Cost Analysis shall be documented as part of design analysis and/or basis of design files and kept available for review.

5. This ECB is intended to enhance conformance with the *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings* (Reference b) which continues to be in effect. See also *High Performance and Sustainable Buildings Guidance* issued by Office of Management and Budget in December 2008 for further information.

6. All MCA projects will comply with the Department of Defense Sustainable Buildings Policy (Reference c) and the Department of the Army Sustainable Design and Development Policy Update (Reference d) pursuant to the following implementation plan by program year:

a. **Guidance for All Program Years**: Studies by the Department of Energy in conjunction with our own Construction Engineering Research Laboratory have shown the energy and sustainability enhancements listed in Attachment A to be consistently cost effective for multiple facility types and climatic regions. Therefore, project teams are to incorporate as many of these enhancements as practicable at the discretion of the PDT as a mandatory change without further approval necessary, provided the following conditions are met. The PDT is responsible for selecting a comprehensive suite of enhancements that work in concert to achieve a low energy consumption facility as a whole and with respect to the facility type and climatic region of the site.

(1) No energy enhancement can result in the project exceeding the total of any unit attribute (such as Square Feet, Linear Feet, etc,) of any line item within the Primary Facility portion of an approved DD Form 1391.

(2) For projects in Planning: Energy enhancements that affect the scope of a DD Form 1391 should be addressed in the Project Definition Report (PDR) and coordinated with HQUSACE and HQDA.

(3) For projects in Design: If the Current Working Estimate (CWE) with energy enhancements added exceeds the authorized Programmed Amount (PA), per existing guidance, the PDT must identify bid options. These options shall not include the required Energy Enhancements listed in Attachment A.

(4) For projects in Construction: Energy and sustainability enhancements referenced in Attachment A may be incorporated into the project by the PDT using funds available. If additional funding is required, the PDT shall submit the requested change to Headquarters with a supporting LCCA. If the change is authorized, update the Design Analysis to include the Life Cycle Cost Analysis (LCCA) to document the change.

(5) Energy and sustainability enhancements not referenced in Attachment A are to be considered User Requested Changes and follow the approval process already established.

If the installed feature exceeds 1% of the Programmed Amount (PA) request should be supported by a LCCA documented in the design analysis and/or basis of design. The LCCA shall show the enhancements will either reduce source Green House Gas (GHG) emissions or pay for themselves within the life cycle of the facility or both.

b. **FY11 and Prior Year Programs**: ECB 2010-14 (Reference a) continues to apply. For clarification, note that the use of the Bid Option to achieve 50% better energy savings as described in ECB 2010-14 is not automatically included by use of the RFP wizard, but needs to be included manually in the CLIN table added to each new RFP. This option shall be listed after all base options. If the Current Working Estimate (CWE) exceeds the Program Amount (PA) the approval must be obtained from HQDA prior to advertising. Likewise, HQDA approval must still be obtained to Award in excess of PA per existing guidance. HQDA will continue to have the final decision regarding Below or Above Threshold Reprogrammings. When performing Site Selection and Master Planning activities, teams are encouraged to review the requirements of the SDD policy (Reference d) as well as local Renewable Energy availability data from the Department of Energy's National Renewable Energy Laboratory (NREL) at http://www.nrel.gov/. Use this information to generate future development plans with respect to energy and sustainability.

c. **FY12 Program:** ECB 2010-14 (Reference a) continues to apply to the FY12 MCA program; specifically, applicable projects are to be designed to achieve energy performance 40% better than as prescribed in ASHRAE 90.1-2007. Further, an Option to achieve 50% better shall be included in the CLIN table added to each new RFP. Headquarters has worked with DA to adjust the allowable square footage shown on the current DD Form 1391s to accommodate some energy and sustainability strategies such as thicker exterior walls. These adjustments in allowable square footage will not change current PA or early gross square-footage based CWE. If the final approved DD Form 1391s reflect this change the PDT is expected to incorporate these energy enhancements; e.g. include the additional wall thickness and insulation as a design requirement. The additional square footage authorized shall not be used for any other purpose than to increase energy and sustainability performance.

d. **FY13 Program**: Design projects to fully comply with the SDD policy (Reference d) and include energy enhancements from Attachment A, as appropriate to the project site and facility type. The PA and square footage will be adjusted by DA after the 3086 review to incorporate energy enhancements in Attachment A to fully comply with the SDD policy. Installations have opportunities to gain better financial efficiency and other benefits by consolidating the renewable energy requirements of multiple buildings into a larger-scale "central plant" type projects. Therefore, the SDD policy (Reference d) contains language in Paragraph 5.b that allows an exemption to installing renewable energy systems on each building per ASHRAE 189.1 in favor of aggregating the requirements installation-wide or program-wide. Centralized Renewable Energy plants used to meet consolidated renewable requirements of ASHRAE 189.1 are not required to be built concurrently in FY13, but may be planned to be executed in FY15 to allow for the additional master planning and design required. Additional energy enhancements, such as renewable energy systems, that can be easily separable from the base design may be included as contract options or alternates.

PDTs, the Centers of Standardization, HQUSACE will work together to determine the best acquisition strategy to maximize energy innovation. The use of Waiver requests to the Standard Designs is encouraged if necessary to facilitate innovation.

e. **FY 14 program**: The renewable energy components of the SDD policy (Reference d) will begin to be addressed by aggregating the requirements of multiple facilities into larger scale renewable energy projects to the extent practical and that funding allows. Installations are encouraged to seek partnerships with the private sector, including using power purchase agreements (PPA), enhanced-use leases (EUL), energy savings performance contracts (ESPC), and utilities energy service contracts (UESCs) as vehicles to optimize renewable energy sources and leverage Federal, State, and local utility incentives. USACE will continue to pursue low energy models and will issue additional guidance.

f. **FY 15 Program and beyond:** Starting with the FY 15 Program, all projects will be planned and programmed to achieve the renewable energy component of ASHRAE 189.1 (per Paragraph 5(b) of Reference d) either within each project's scope or by a consolidated renewable energy solution for an aggregate of multiple project requirements.

7. Sustainability Certification:

a. All MCA projects meeting the Minimum Program Requirements (MPR) for the Leadership in Energy and Environmental Design (Reference e) program shall be planned, designed, and built to be certified at the SILVER level or higher from the Green Building Certification Institute (GBCI)

(1) Projects previously registered under LEED 2.2 may continue to pursue the version 2.2 points and seek USGBC certification under LEED 2.2 scoring at the discretion of the PDT, subject to GBCI approval.

(2) Any project not registered under 2.2 shall register and seek certification with GBCI under LEED NC/MR version 2009/3.0 or later.

(3) At its discretion, the PDT may pursue achieving Gold level certification and is authorized to seek certification at the highest attainable level of certification within available funding provided that doing so continues to reduce the total cost of ownership over the life cycle of the facility.

(4) In accordance with the Department of Defense Sustainable Buildings Policy (Reference c) at least 40% of the minimum points required for Silver level certification shall be earned in any combination of these credit categories:

(a) SS 7.1 Heat Island Effect, Non-Roof

(b) SS 7.2 Heat Island Effect, Roof

(c) SS 8 Light Pollution Reduction

(d) WE 1.1 Water Efficient Landscaping - Reduce Potable Water Use by 50%

(e)	WE 1.2	Water Efficient Landscaping - No Potable Use or No Irrigation
(f)	WE 2	Innovative Wastewater Technologies
(g)	WE 3	Water Use Reduction
(h)	EA 1	Optimize Energy Performance
(i)	EA 2	On-Site Renewable Energy
(j)	EA 3	Enhanced Commissioning
(k)	EA 5	Measurement & Verification
(l)	EA 6	Green Power
(m)	IEQ 1	Outside Air Delivery Monitoring
(n)	IEQ 8.1	Daylight & Views - Daylight 75% of Spaces
(o)	ID 1.1-1.5	Innovative Design, if achieved for energy and/or water savings
(p)	RP 1.1-1.4	Regional Priorities, if achieved for energy and/or water savings

(5) In addition to the prerequisites, the following LEED-NC/NR credits shall be included in all MCA projects where applicable:

(a)	SS 6.1	Stormwater Design, Quantity Control
(b)	SS 6.2	Stormwater Design, Quality Control
(c)	WE 1	Water Efficient Landscaping: No potable water used for irrigation.
(d)	WE 3	Water Use Reduction: earn at least two points under this credit
(e)	EA 1	Optimize Energy: earn at least 15 points under this credit
(f)	EA 3	Enhanced Commissioning
(g)	EA 5	Measurement and Verification
(h)	MR 2	Construction Waste Management
(i)	MR 4	Recycled Content
(j)	IEQ 3.1	Construction IAQ Management Plans
(k)	IEQ 3.2	Construction IAQ Management Plans
(l)	IEQ 7.1	Thermal Comfort Design

b. Army Family Housing projects may be certified at the LEED for Homes SILVER level or higher from the GBCI or Energy Star Qualified New Homes, or will be designed to achieve energy consumption levels 45% below the baseline set by International Energy Conservation Code (IECC) 2009.

c. The definitions and guidance on the LEED minimum program requirements are provided in a document, titled Supplemental Guidance, available on the USGBC website (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2102)

d. Projects not falling within the scope of the LEED program will be designed and built to incorporate the maximum LEED components or equivalent sustainable design features available as allowed by project scope. If such a project is of a significant size, has high visibility or public interest, the use of alternative standards and certification systems available to the project is encouraged, such as Green Globes or Host Nation programs.

8. A request for an exemption through HQ USACE may be made for any specific requirement included herein or by reference that the PDT determines would adversely affect mission performance, security requirements, health, safety, or welfare. The exemption shall only apply to the specific requirements in conflict. Any approved exemptions to this policy shall be documented with reference to the specific requirement in conflict and included in the project documentation.

9. Reporting and documentation of Energy and SDD performance: New energy enhancements above our current standard design or criteria included in a solicitation, or incorporated through the modification process, must be reported to HQUSACE. A list of these enhancements, and any associated costs and Life Cycle Cost Analyses available will be kept to further our knowledge about the costs associated with these enhancements, and to answer inquiries about the Army's progress towards the Energy mandates and requirements that will come from HQDA, OSD, and Congress. The District (through the MSC) will submit to their Regional Integration Team (RIT) a list of new energy enhancements with the estimated costs shown on a new tab of an updated Current Working Estimate (CWE) worksheet and include a brief descriptive justification with pertinent design details. All projects shall report the following information, at a minimum:

a. LEED credits earned, with percentage in Water and Energy

b. Gross percentage of anticipated energy savings versus baseline

c. Gross percentage of anticipated water savings versus baseline

10. The Headquarters USACE point of contact is Eric Mucklow, at 202-761-0522 or eric.mucklow@usace.army.mil. The Army Program Manager is Gary Skusek, 202-761-5749.

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ATTACHMENT A
VIABLE ENERGY AND SUSTAINABILITY ENHANCEMENTS

The following enhancements may be considered viable for a wide range of building types and climactic regions. From these, a comprehensive suite of enhancements may be selected that work in concert to achieve a low energy consumption facility as a whole and with respect to the facility type and climatic region of the site. These enhancements are to be implemented by the PDT as practicable with respect to the project's scope, schedule, and existing conditions.

The list below contains only brief descriptions representing strategies and design criteria that enhance the energy performance or sustainability of facilities. It is assumed members of the design team will be familiar with these concepts. More in-depth guidance regarding specific criteria and implementation information can be found by consulting the *Energy and Water Conservation Design Guide (for Sustainment, Restoration and Modernization (SRM) and MILCON Projects)* on the Whole Building Design Guide site at http://www.wbdg.org/references/pa_dod_energy.php

1. Optimize building orientation (East-West Axis with Passive Solar shading geometry)
2. Tight construction with Infiltration less than .15 cfm per square foot of exterior envelope area at 75 PA
3. Added insulation to high performance 'Passivhaus' levels (See the Building Envelope section of the *Energy and Water Conservation Design Guide* referred to above for minimum R/U values per climatic zone)
4. Design detailing to avoid thermal bridges that allow heat to bypass insulation
5. Windows: Triple-pane, Energy Star, with low-E coatings appropriate to climatic zone.
6. Lighting: lower lighting consumption to average 0.75W/ft2 or less. To achieve this performance, consider the following:
    a. Low maintenance, low wattage-per-lumen technologies, e.g. SSL/LED fixtures
    b. Occupancy, Vacancy, and Daylighting sensors for active ambient light control
    c. Increase vertical glazing by 50% over standard designs
    d. Increase Skylight to Floor Area (SFA) fraction to 3% over corridors, admin areas and office areas
    e. Use digital multi-zone lighting controls with individually addressable fixtures
7. 'Cool Roof' finishes where cooling load exceeds heating (e.g. Climate Zones 1-5)
8. Top Tier Energy Star or FEMP rated appliances and equipment
9. Demand/user controlled High Efficiency HVAC equipment per ASHRAE 189.1
10. Optimize HVAC zones with respect to user schedules and occupancy
11. Include Energy Recovery Ventilation (ERV) systems with >75% efficiency

12. Dedicated Outside Air System (DOAS) for ventilation with heat recovery for assembly and heat/fume generating activities

13. Indirect Evaporative Pre-Cooling (IEPC or IDEC) for Dry Climates (Climate Zones *x*B)

14. HVAC equipment efficiency ratings (e.g. COP) that exceed ASHRAE 189.1 (C) requirements

15. High Efficiency condensing boilers with >90% efficiency and/or incorporate Ground-Source Heat Pump technology

16. NEMA MG1 Premium Efficiency/ Electronically Commutated Motors (ECM) motors

17. Variable Air Volume (VAV) or hydronic distribution; consider:

    a. radiant heating systems, especially in maintenance bays, and

    b. "Radiant" cooling systems in ceilings

18. Measurement and Verification (M&V) systems

19. On-site Renewable Energy elements:

    a. Transpired Solar Collectors in Climate Zones 2A to 8.

    b. SSL/LED parking and street lighting; site-specific light distribution patterns

    c. Prepackaged pole-mounted solar site lighting solutions

    d. Include 30% demand solar water heating in areas where the average sun exposure is equal or greater than 4.0 kWh/m^2 per day according to the National Renewable Energy Lab (http://www.nrel.gov/gis/solar.html) in accordance with the SDD policy (Reference d.)

20. Maximum flow rates for plumbing fixtures per ASHRAE 189.1

    a. Dual-flush toilets

    b. Waterless Urinals: urinals that use either no water or no potable water (e.g. may use harvested rainwater or reclaimed greywater)

21. Stormwater management: Meet local codes and Low Impact Development (LID) best practices (e.g. pervious pavement, rainwater harvesting, swales, bioretention ponds)

See the Whole Building Design Guide (http://www.wbdg.org/) and the USACE Centers of Standardization website at https://eportal.usace.army.mil/sites/COS/Pages/Default.aspx for more information about these technologies. As projects progress, PDT members may find peers who have shared their success stories and share your own on the Energy Hall of Fame website at https://www.us.army.mil/suite/page/639754 (AKO login required.)

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

Guidelines for Selecting Cool Roofs

July 2010

Prepared by the Fraunhofer Center for Sustainable Energy Systems for the U.S. Department of Energy Building Technologies Program and Oak Ridge National Laboratory under contract DE-AC05-00OR22725. Additional technical support provided by Lawrence Berkeley National Laboratory and the Federal Energy Management Program.

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Table of Contents

Introduction

Cool roofs can help many building owners save money while protecting the environment. This guidebook has been created to help you understand how cool roofs work, what kinds of cool roof options are available, and how to determine if cool roofing is appropriate for your building. If you are planning a new building or replacing or restoring an existing roof, cool roofs should be considered as an energy efficiency option. Cool roof products exist for virtually every kind of roof.

Just as wearing light-colored clothing can help keep a person cool on a sunny day, cool roofs use solar-reflective surfaces to maintain lower roof temperatures. Traditional dark roofs can reach temperatures of 150ºF (66ºC) or more in the summer sun. A cool roof under the same conditions could stay more than 50°F (28ºC) cooler, Figure 1.

Figure 1: Dark vs. Cool Roof Surface Temperatures

A dark roof (left) becomes much hotter than a cool white roof (right) on a sunny afternoon.

Why Use Cool Roofs

A cool roof can be desirable to a building owner for several reasons. Cool roofs can

- reduce energy bills by decreasing air conditioning needs,
- improve indoor thermal comfort for spaces that are not air conditioned, and
- decrease roof operating temperature, which may extend roof service life.

In many cases, cool roofs cost about the same as non-cool alternatives. The energy cost savings you can realize from a cool roof depends on many factors, including local climate; the amount of insulation in your roof; how your building is used; energy prices; and the type and efficiency of your heating and cooling systems.

Cool roofs can also provide benefits to the environment. Cool roofs can

- reduce local air temperatures, which improves air quality and slows smog formation;
- reduce global warming by reflecting more sunlight back into space;
- reduce peak electric power demand, which can help prevent power outages; and
- reduce power plant emissions, including carbon dioxide, sulfur dioxide, nitrous oxides, and mercury, by reducing cooling energy use in buildings.

Policymakers may issue regulations requiring cool roofs to provide these benefits to society.

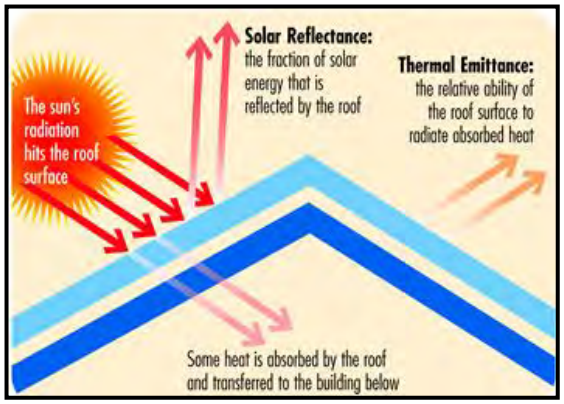
What Is a Cool Roof

Cool roofs are roofs that are designed to maintain a lower roof temperature than traditional roofs while the sun is shining. Sunlight is the primary factor that causes roofs to become very hot.

How Cool Roofs Work

Cool roofs have surfaces that reflect sunlight and emit heat more efficiently than *hot* or *dark roofs*, keeping them cooler in the sun. In contrast, *hot roofs* absorb much more solar energy than *cool roofs*, making them hotter. *Solar reflectance* and *thermal emittance* are the two key material surface properties that determine a roof's temperature, and they each range on a scale from 0 to 1. The larger these two values are, the cooler the roof will remain in the sun.

Figure 2: Roof Surface Properties



Typical dark roofs can absorb 90% or more of incoming solar energy, while cool roofs may absorb less than 50%. *Image Source: CRRC*

Since most dark roofs absorb 90% or more of the incoming solar energy, the roof can reach temperatures higher than 150°F (66ºC) when it's warm and sunny. Higher roof temperatures increase the heat flow into the building, causing the air conditioning system to work harder and use more energy in summertime. In contrast, light-colored roofs absorb less than 50% of the solar energy, reducing the roof temperature and decreasing air conditioning energy use.

Reducing the roof's temperature with a cool roof can also increase the need for heating during heating seasons. Later sections of this report show you how to evaluate the resulting cost savings for your building.

Solar Reflectance is the fraction of sunlight that a surface reflects. Sunlight that is not reflected is absorbed as heat. Solar reflectance is measured on a scale of 0 to 1. For example, a surface that reflects 55% of sunlight has a solar reflectance of 0.55. Most dark roof materials reflect 5 to 20% of incoming sunlight, while light-colored roof materials typically reflect 55 to 90%. Solar reflectance has the biggest effect on keeping your roof cool in the sun.

Thermal Emittance describes how efficiently a surface cools itself by emitting thermal radiation. Thermal emittance is measured on a scale of 0 to 1, where a value of 1 indicates a perfectly efficient emitter. Nearly all nonmetallic surfaces, like the unwrapped potato in Figure 3, have high thermal emittance, usually between 0.80 and 0.95, that helps them cool down. Bare, shiny metal surfaces, like aluminum foil, have low

Figure 3: Understanding Thermal Emittance

Potato skins (left), like most roofing materials, have high thermal emittance. A potato wrapped in foil (right) stays warmer longer since its aluminum surface has low thermal emittance. *Image Source: Wikipedia, Free Clipart Images*

thermal emittance, which helps them stay warm. A bare metal surface that reflects as much sunlight as a white surface will stay warmer in the sun because it emits less thermal radiation.

Solar Reflectance Index (SRI) is another metric for comparing the "coolness" of roof surfaces[1]. It is calculated[i] from solar reflectance and thermal emittance values. The higher the SRI, the cooler the roof will be in the sun. For example[ii], a clean black roof could have an SRI of 0, while a clean white roof could have an SRI of 100. Dark roofs usually have an SRI less than 20.

What Qualifies as a Cool Roof

Typical minimum cool roof requirements are shown in Table 1, and this is what we mean by "cool roof" throughout this document. A roof can qualify as cool in one of two ways. The first way is by meeting or exceeding both the minimum solar reflectance and thermal emittance values. The alternative way is to meet or exceed the minimum SRI requirement. This allows some roofs that have a low thermal emittance and a high solar reflectance (or vice versa) to still qualify as a cool roof.

Table 1: Typical Minimum Cool Roof Requirements, California Energy Commission[2]

Roof Type		Solar Reflectance [3-year aged]	AND	Thermal Emittance [new or aged]	OR	Solar Reflectance Index (SRI) [3-year aged]
Low sloped		0.55		0.75		64
Steep sloped		0.20		0.75		16

Cool roof requirements depend on the roof's slope. Low sloped roofs have a pitch of 9.5° or less (2:12 rise over run), while steep sloped roofs have a pitch greater than this. Requirements are usually less stringent for steep sloped roofs. Some heavier roofs – such as those with concrete pavers, ballast, or vegetation – also have less stringent cool roof standards. The weight of these roofs causes them to heat up more slowly, and during the night some of that stored heat is returned to the outdoor environment.

Others use different cool roof definitions. For example, the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) program currently uses minimum aged SRI values of 78 and 29 for low and steep sloped cool roofs, respectively[iii]. The U.S. Department of Energy (DOE) has decided to implement cool roofs on all its buildings whenever practicable[3]. The DOE uses the low sloped cool roof definition shown in Table 2 and defines steep sloped cool roofs as those with a 3-year aged SRI of 29 or greater. The ENERGY STAR® program specifies minimum solar reflectance (low slope: 0.65 initial, 0.50 aged; steep slope: 0.25 initial, 0.15 aged) and does not consider thermal emittance. To satisfy local building

[i] A spreadsheet that calculates SRI is offered at http://coolcolors.lbl.gov/assets/docs/SRI Calculator/SRI-calc10.xls.
[ii] For these examples we assume the clean black roof has a solar reflectance of 0.05 and a thermal emittance of 0.90, and the clean white roof has a solar reflectance of 0.80 and thermal emittance of 0.90.
[iii] SRI 78 can be achieved by a roof with a solar reflectance of 0.77 and thermal emittance of 0.20. A less reflective (0.64) but more emissive roof (0.90) also achieves SRI 78. SRI 29 could be achieved with a solar reflectance of 0.28 and emittance of 0.90.

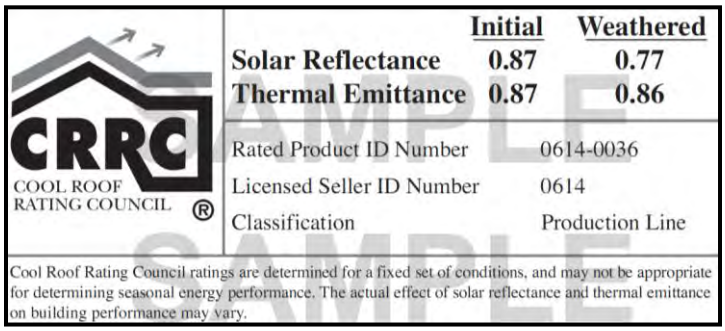
codes or to meet rebate program requirements, be sure to find and use the appropriate cool roof definition.

Reading Cool Roof Product Labels

To help consumers compare the cool aspects of roof materials and coatings, the Cool Roof Rating Council (CRRC) manages a system for independently evaluating and documenting their properties. Roof products that are tested to CRRC methods receive a performance label, Figure 4, showing the measured solar reflectance and thermal emittance values. **NOTE: Any roofing product that is tested by a CRRC accredited laboratory can be listed in the CRRC directory. Being listed does not imply that a product is cool.**

Because roof material surface properties can change over time due to soiling and weathering, values are measured and reported for both initial and three-year weathered conditions. The label in Figure 4 shows this product's solar reflectance has dropped from 0.87 to 0.77 after three years. Most weathering or soiling occurs during the first year or two, and then values tend to stabilize. Tested product data are published online[iv] by the CRRC.

Figure 4: A CRRC Product Label

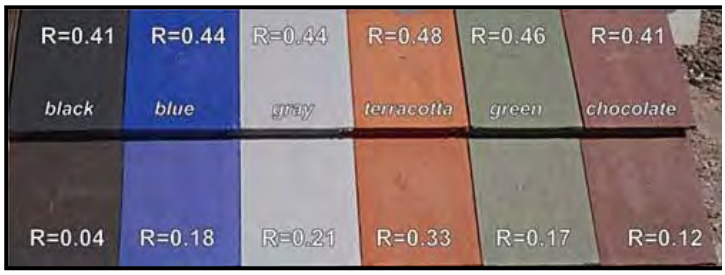


Weathered solar reflectance values should be used when evaluating roof energy cost savings. *Image Source: CRRC*

Not All Cool Roofs Are White

Although white materials tend to be very good solar reflectors, colored roofing materials, like those shown in Figure 5, can also be made to reflect more sunlight. More than half of the sunlight reaching the earth is invisible to the human eye, and this invisible sunlight heats the roof. A colored surface that reflects much of the invisible sunlight is a called a *cool dark color*, or *cool color*. A cool dark color reflects more sunlight than a similar-looking conventional dark color, but less than a light-colored surface. For example, a conventional dark colored surface might reflect 20% of incoming sunlight, a cool dark colored surface, 40%; and a light-colored surface, 80%.

Figure 5: Cool Dark Colors



Cool-colored tiles (top row) look just like conventionally colored tiles but have higher solar reflectance (R). *Image Source: American Rooftile Coatings and Lawrence Berkeley National Laboratory*

[iv] http://www.coolroofs.org/codes_and_programs.html

Heat Gains, Heat Losses, and Thermal Insulation

Heat flows naturally from a warmer space to a colder space. Heat that flows into the building is called *heat gain,* while heat that flows out of the building is called *heat loss*. When too much heat gain (loss) occurs, your air conditioning system (heating system) operates to keep the space comfortable. A large amount of heat can be gained (or lost) through a building's roof. Cool roofs reduce heat gains throughout the year. This can save you energy on cooling, but it can also increase the energy you need for heating. Often, the annual cooling energy cost savings is substantially higher than the heating penalty.

Thermal insulation can greatly reduce the amount of heat lost or gained through a roof system. Even though cool roofs reduce solar heat gains, they are never a substitute for using sufficient thermal insulation. Insulation reduces heat losses and heat gains through the roof in ways a reflective surface cannot. For more information about the importance of thermal insulation, see these DOE resources: Residential Insulation Fact Sheet[v] and Commercial Buildings: Walls and Roofs.[vi]

Types of Cool Roofs

Roof systems are made of one or more material layers. The surface exposed to the sun is the one that determines if a roof is cool or not. Different roofing systems present different surface options. By selecting the right surface, you can usually make your new or existing roof cool. Here are some common roof systems along with a description of how their surfaces can be made cool. To learn more about these and other roof systems, check with the National Roofing Contractors Association.[vii]

Cool Roof Coatings contain white or special reflective pigments that reflect sunlight. Coatings are like very thick paints that can protect the roof surface from ultra-violet (UV) light and chemical damage, and some offer water protection and restorative features as well. Coatings can extend a roof's service life as long as the roof is still in good condition, Figure 6. More than 500 different cool roof coatings are available, and products exist for most roof types. Manufacturers also coat some roof surfacing materials (membranes, metals, granules, etc.) at the factory to make them more reflective.

Low Sloped Roofs

Single-ply Membranes are pre-fabricated sheets that are rolled onto the roof and attached with mechanical fasteners, adhered with chemical adhesives, or held in place with ballast (gravel, stones, or pavers). Some kinds of membranes, like TPO[viii] and PVC[ix], are typically white and

[v] http://www.ornl.gov/sci/roofs+walls/insulation/
[vi] http://www1.eere.energy.gov/buildings/commercial/walls.html
[vii] http://www.nrca.net/consumer/roofsystems.aspx
[viii] TPO stands for thermoplastic polyolefin.
[ix] PVC stands for polyvinyl chloride.

reflect sunlight well. Others, like EPDM[x], are typically black, and must be formulated differently or coated to make them reflective.

Built-Up Roofs consist of a base sheet, fabric reinforcement layers, and a protective surface layer that is traditionally dark. The surface layer can be made in a few different ways, and each has cool options. One way involves embedding mineral aggregate (gravel) in a flood coat of asphalt. By substituting reflective marble chips or gray slag for dark gravel you can make the roof cool. A second way built-up roofs are finished is with a mineral surfaced sheet. These can be made cool with reflective mineral granules or with a factory-applied coating. Another surface option involves coating the roof with a dark asphaltic emulsion. This type can be made cool by applying a cool coating directly on top of the dark emulsion.

Modified Bitumen Sheet Membranes are composed of one or more layers of plastic or rubber material with reinforcing fabrics, and are surfaced with mineral granules or with a smooth finish. A modified bitumen sheet can also be used to surface a built-up roof, and this is called a "hybrid" roof. Modified bitumen surfaces can be pre-coated at the factory to make them cool.

Spray Polyurethane Foam roofs are constructed by mixing two liquid chemicals together that react and expand to form one solid piece that adheres to the roof. Since foams are highly susceptible to mechanical, moisture, and UV damage, they rely on a protective coating. These coatings are traditionally reflective and offer cool roof performance.

Figure 6:
Two Cool Roof Installations

A cool coating is applied to a dark roof (top), and a cool single-ply membrane roof is unrolled (bottom). *Image Source: DIY Advice*

Steep Sloped Roofs

Shingled Roofs consist of overlapping panels made from any of numerous materials. Fiberglass asphalt shingles, commonly used on homes, are coated with granules for protection. Cool asphalt shingles are use specially coated granules that provide better solar reflectance. While it is possible to coat existing asphalt shingles to make them cool, this is not normally recommended or approved by shingle manufacturers. Other shingles are made from wood, polymers, or metals and these can be coated at the factory or in the field to make them more reflective. Metal shingles are described in the *Metal Roofs* section that follows.

[x] EPDM stands for ethylene propylene diene M-class, a kind of synthetic rubber.

Tile Roofs can be made of clay, slate, or concrete. Clay and slate tiles come from the ground, so their colors differ depending on the earth's composition. Some varieties will naturally be reflective enough to achieve cool roof standards. Tiles can be also be glazed to provide waterproofing or coated to provide customized colors and surface properties. These surface treatments can transform tiles with low solar reflectance into cool roof tiles.

Low and Steep Sloped Roofs

Metal Roofs are available with natural metallic finishes, oven-baked paint finishes, or granular coated surfaces. Usually, unpainted metals are good solar reflectors but poor thermal emitters so they rarely satisfy low slope cool roof requirements, though some may still have a high enough SRI to count as a cool roof[xi]. Paint applied at the factory or in the field can increase a metal roof's solar reflectance and thermal emittance, allowing it to achieve cool roof status. Alternatively, cool reflective coatings can be applied as with low sloped metal roofs.

Should You Use a Cool Roof

In this section, we discuss the key factors outlined in Table 2 that can help you determine if a cool roof is appropriate for your project.

Table 2: Key Factors for Deciding on a Cool Roof

Key Factors	Questions
Project Requirements	What kinds of roof or repair options are appropriate for your building?
Regulation	Is a cool roof required by code for your building? Is a cool roof encouraged by voluntary programs?
Economics	How much more will a cool roof cost? Is there a rebate or tax incentive available? What cost savings can you expect from a cool roof?
Other Considerations	Are there ordinances that restrict roof appearance / color? Are cool roof products available? How will a cool roof affect roof durability?

Project Requirements

It is best to begin by determining the most appropriate roof systems or repair/maintenance methods for your building. For existing roofs, the three main options are to coat the roof, re-cover the roof with a new waterproofing surface, or tear off the existing roof and replace it with a new roof. If your roof is in poor condition or near the end of its life, it is usually best to re-cover, replace, or retrofit the roof. In some cases it is possible to build a second roof on top of an existing old roof, but this depends on building codes and the structural integrity of your roof. If,

[xi] Suppose a metal roof has an aged solar reflectance of 0.70 and a thermal emittance of only 0.10. Although the emittance is below the Table 1 requirements, the reflectance might be high enough to make up for it using the alternative SRI requirement. Using the SRI calculator, you find that this roof has an SRI of 60. This is high enough (SRI>16) to be cool for a steep-slope application, but too low (SRI>64) for a low-slope application.

instead, your roof is in moderate condition and needs only minor repairs, a coating can be used after any repairs have been made.

For new or replacement roofs, you should talk with your roofing contractor or consultant to decide which roof types make sense for your building. Knowing which roof types to consider will make it easier to determine if a cool roof makes sense.

Is Cool Roof Required or Encouraged

In some regions, cool roofs are required by legislation. Voluntary programs may also encourage building owners to pursue cool roofs. For example, irrespective of climate, cool roofs qualify for 1 point under the USGBC's LEED-NC 2009, Sustainable Sites Credit. When cool roofs are optional yet encouraged, the decision should be considered carefully as cool roofs do not perform equally well everywhere.

On the web, the CRRC maintains a list[xii] of state codes, industry standards, and voluntary programs for cool roofs. Check with your roofing contractor and your local building authority, as these programs may change.

Cool Roof Economics

Roof cost should be evaluated using a lifecycle approach. This means taking into account the upfront costs as well as the ongoing savings and expenses incurred throughout the roof's service lifetime. Other non-cost considerations are shown in Table 3. Roof lifetime, expected maintenance (regular roof inspections, repairs, and recoatings), disposal, and replacement costs should be evaluated for each viable roof option. Table 4 shows the range of benefits and costs you can expect to encounter for cool roofs.

Table 3: Non-cost Considerations

Factor	Notes
Voluntary Programs	Some programs encourage cool roofs, even when they may not be the best choice
Comfort	In unconditioned spaces like warehouses, cool roofs can maintain cooler indoor temperatures
Durability	Cool roofs may degrade slower and last longer than similar non-cool roofs, but more data are needed to establish this benefit
Maintenance	Some cool roofs in hot, humid environments may be more susceptible to mold or algae growth; this can be cleaned off

[xii] http://www.coolroofs.org/codes_and_programs.html

Table 4: Cool vs. Hot Roofs, Typical Expected Savings and Premiums

	Cool vs. Hot Roof	Notes
Upfront Savings (Costs)	$/ft^2 roof area	
Installed Cost	(0.00-0.75)	Material cost premium. As shown in Tables 5 & 6, most cool options have only a slight cost premium or none at all.
Rebates	0.00-0.20	Rebates are available in select locations, check here: http://www.coolroofs.org/codes_and_programs.html.
HVAC Downsizing	0.00-0.07	Reductions in peak cooling capacity tend to be modest, and are only possible when cool roofing coincides with HVAC replacement and reductions enable use of smaller AC systems.
Annual Savings (Costs)	$/ft^2/yr roof area	
Cooling Energy	0.00-0.13	Varies by location, insulation levels, HVAC equipment and efficiency, and utility rates. Estimate energy cost savings with the Roof Savings Calculator: http://www.roofcalc.com. Snow on roofs can reduce the heating energy penalty.
Heating Energy	(0.00-0.03)	

How Much More Will It Cost

A cool roof need not cost more than a non-cool roof. Major roof costs include upfront installation (materials & labor) and ongoing maintenance (repair, recoating, and cleaning).

Materials & Labor

The installed costs of a roof can vary depending on several factors, including its type, size, complexity, method of attachment, and building location. Nevertheless, in cases where new roof surfaces need to be installed, cool roof options are usually similar in cost or slightly more expensive than similar non-cool alternatives (see Table 5). Slightly higher upfront costs occur mostly in colored roofs that require specialty reflective pigments. Manufacturers must research, develop, and test cool products, and this can also lead to higher prices. The labor required to install or coat cool roofs is about the same as for non-cool roofs.

On the other hand, converting a roof that is in good condition into a cool roof can cost more (see Table 6). For instance, if you want to coat your new dark roof just to make it a cool roof, the additional cost can be significant. More often, roofs are coated to extend their lifetimes. If you are already planning to coat your roof, then using a cool coating instead of a dark one will probably cost about the same. Notice that the cost of coating a roof cool depends on the existing roof's surface. Rough surfaced roofs, like those covered in granules, have more surface area, and require more coating material to achieve the desired thickness. If the existing roof is not already cool, it may require one extra coating to ensure full coverage.

Typical, approximate installed roof cost premiums for different cool roof options are given in Tables 5 and 6. The premiums equal the additional cost you can expect to pay for a cool product. For example, if you are planning to install a mineral-surfaced modified bitumen roof, the table indicates you might expect to pay $0.50/ft^2 more for a cool roof with the same kind of surface. Since costs vary widely by location, check with your roofing contractor or estimator for more accurate cost comparisons.

Table 5: Roof Surfaces, Cool Alternatives, and Approximate Price Premiums*

Roof	Typical Non-Cool Surface	Cool Alternative	Price Premium ($/ft^2)
Built-Up Roof	Mineral aggregate embedded in flood coat	Light-colored aggregate, like marble chips, gray slag	0.00
	Asphaltic emulsion	Field applied coating on top of emulsion	0.80-1.50
	Mineral surfaced cap sheet	White mineral granules	0.50
Metal§	Unpainted metal	May already be cool	0.00
		Factory applied white paint	0.20
	Painted metal	Cool-colored paint	0.00-1.00+
Modified Bitumen	Mineral surfaced cap sheet	Factory applied coating, white mineral granules	0.50
	Gravel surface in bitumen	Light colored gravel	0.00
	Metallic foil	May already be cool	0.00
		Field applied coating	0.80-1.50
	Asphalt coating	Field applied coating on top of asphaltic coating	0.80-1.50
Shingles§	Mineral granules	White granules	0.00
		Cool-colored granules	0.35-0.75
Sprayed Polyurethane Foam	Liquid applied coating	Most coatings are already cool to protect the foam	0.00
	Aggregate	Light colored aggregate	0.00
Thermoplastic Membranes	White, colored, or dark surface	Choose a white or light colored surface	0.00
Thermoset Membranes	Dark membrane, not ballasted (adhered or mechanically attached)	Cool EPDM formulation	0.10-0.15
		Factory cool ply or coating on dark EPDM	0.50
Tiles§	Non-reflective colors	Clay, slate: naturally cool	0.00
		Cool colored coatings	0.00

***Premiums are the extra cost, per square foot of roof area, of installing the cool roof option as compared with the corresponding non-cool option. Premiums are based on achieving the minimum cool roof characteristics described in Table 1. Values are approximate, and are based on discussions with roofing contractors, manufacturers, wholesalers, and RSMeans cost data.**
§These roofs may be used in steep slope applications where cool roof requirements are less stringent. Uncoated metal roofs normally meet requirements for steep slope, but not for low slope. Premiums for shingles & tiles are based on steep slope requirements. All other premiums are based on low slope requirements.

Table 6: Making an Existing Roof Cool, Approximate Price Premiums*

Roof	Maintenance Option	Cool Alternative	Price Premium ($/ft^2)
Smooth Dark Surface	Leave roof as-is	Apply cool coating	1.25-2.40
	Apply restorative dark coating (asphalt, bitumen, colored coating, etc.)	Apply cool coating instead	0.00-1.70
Rough Dark Surface	Leave roof as-is	Apply cool coating	1.45-2.75
	Apply restorative dark coating (asphalt, bitumen, colored coating, etc.)	Apply cool coating instead	0.00-1.90
Old Light or Cool Surface	Leave roof as-is	Apply maintenance coat (single coat)	0.80-2.00
	Apply restorative dark maintenance coating (asphalt, bitumen, colored coating, etc.)	Apply cool maintenance coating (single coat)	0.00-1.45
Any Roof	Replace roof	Replace with cool roof	See Table 5

***Premiums are the extra cost, per square foot of roof area, of installing the cool roof option as compared with the corresponding non-cool option. Premiums are based on achieving the minimum cool roof characteristics described in Table 1. Values are approximate, and are based on discussions with roofing contractors, manufacturers, wholesalers, and RSMeans cost data.**

Maintenance of cool roofs is similar to non-cool roofs. Dirtying of roofs reduces solar reflectance. Although annual cleaning can restore up to 90% of initial reflectance, the energy cost savings alone does not warrant the cost[4]. If you do clean your roof, be sure to follow the manufacturer's cleaning recommendations, since improper cleaning (e.g., power washing, harsh chemicals) could damage your roof.

In warm, moist locations, cool roof surfaces can be more susceptible to algae or mold growth than hot roofs. This is not a major problem, but it can look bad and reduce the roof's reflectance. Some roof coatings include special chemicals that prevent mold or algae growth, and these can last for a few years.

In cold climates, roofs can accumulate moisture through condensation, and this may eventually lead to material degradation. Moisture control in cold climates is an important part of any roof's design. It is possible, though not yet proven, that cool roofs might be more susceptible to accumulating moisture than dark roofs of the same design. This phenomenon is discussed in more detail in the precautions section, and can be avoided using proper design techniques.

How Much Will You Save

Cool roofs can save money in several ways, including energy savings, rebates and incentives, HVAC equipment downsizing, and extended roof lifetime.

Energy Savings from reducing cooling loads are achieved each year, reducing building operating costs. Climate, roof reflectance, insulation levels, utility rates, and HVAC equipment efficiency all affect the expected savings. Web-based calculation tools make it easier for building owners predict the yearly energy and cost savings associated with cool roofs. Later, we will show you where to find and how to use one such tool to predict savings.

Rebates and Incentives **for cool roofs** are offered by some utilities and agencies. To find out if there are any programs in your location, visit the CRRC website[xiii] and check with your roofing contractor. Currently, certain kinds of residential cool roof projects are eligible for a Federal Tax Credit of 30% of materials, up to $1,500[5]. Nonresidential building rebate programs can be more complicated, and may also include other efficiency measures besides cool roofs. Contact the rebate program agencies to determine the probable savings associated with a cool roof rebate.

HVAC Equipment Savings may be achieved when a cool roof reduces peak cooling loads significantly enough to reduce the air conditioning capacity needed. At best, the associated savings are modest ($0.03-0.07/ft^2 of cool roof area), and can only be realized when HVAC equipment is being replaced at the same time as the roof. Be aware that downsizing HVAC equipment could lead to insufficient cooling capacity if the cool roof becomes excessively dirty or is later replaced with a dark roof.

[xiii] http://www.coolroofs.org/codes_and_programs.html.

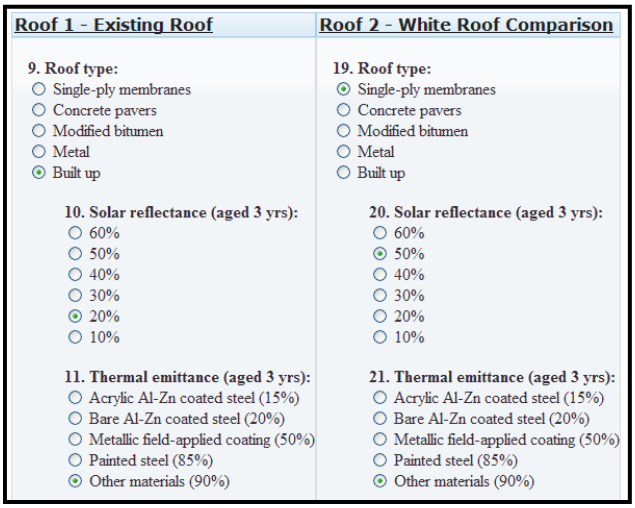
Extended Roof Lifetime is one possible advantage of using cool roofs. Roofs wear out and fail for many reasons, and some are linked to temperature. For example, higher temperatures can speed up material degradation. Cool roofs maintain a lower average temperature, so, in principle, this could slow heat-related degradation. Furthermore, several metal roof manufacturers believe that cooler roof temperatures slow color fading. In cases where heat-related degradation is the main reason for roof failure, it is plausible that a cool roof could be more durable and outlast a similar dark roof. More study is required to quantify these effects. Damage caused by other sources, like mechanical impacts, will not be avoided by using a cool roof. Today, manufacturers offer similar warranties for both cool and non-cool roofs.

Online Tools to Predict Energy Savings

The Roof Savings Calculator[xiv] is a simple and free online tool that allows users to calculate annual energy savings associated with choosing a cool roof instead of a dark roof. A portion of the interface is shown in Figure 7.

To use this tool, you will need to answer a few basic questions about your building and two proposed roofs. The results will show you how much energy savings you can expect to achieve by choosing a cool roof versus a dark- or less-cool roof, or by converting your existing roof to a cool roof. Several key factors affect the amount of energy you can save.

Figure 7: Roof Savings Calculator

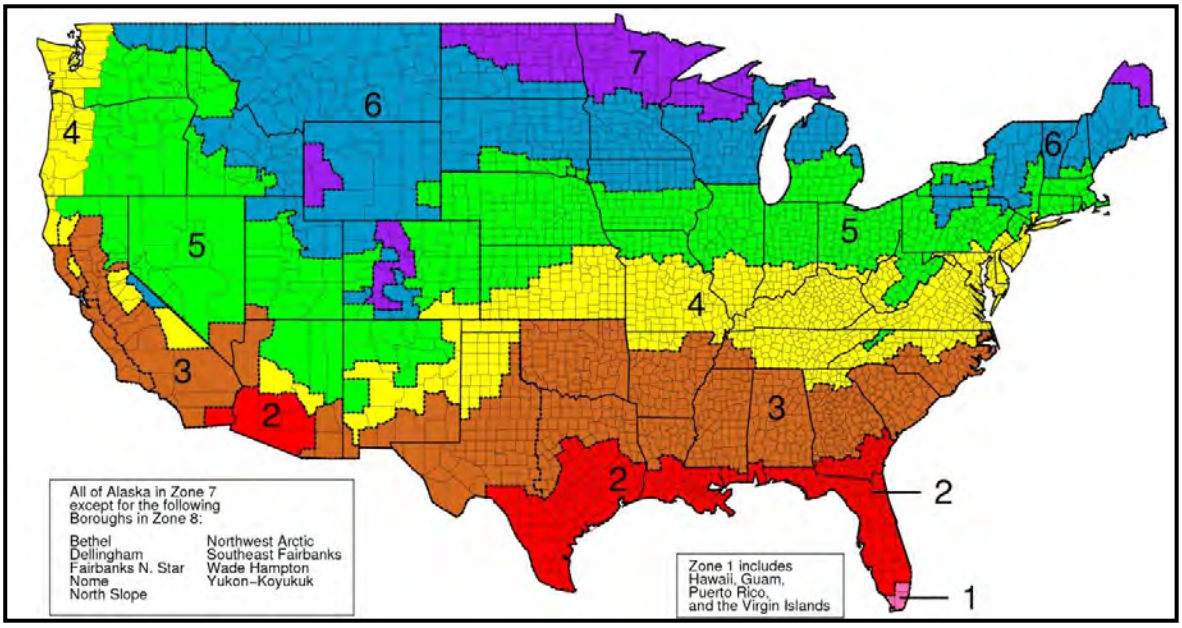


This online calculator lets users estimate the energy-savings from using a cool roof in place of a dark one.

Climate has the biggest impact on energy savings. Cool roofs achieve the greatest cooling savings in hot climates (Climate Zones 1-3; see Figure 8) but can increase energy costs in colder climates due to reduced beneficial winter time heat gains. The DOE Cool Roof Calculator takes into account your local climate when you select the state and a city nearest your building.

[xiv] http://www.roofcalc.com

Figure 8: U.S. Climate Zones



These 8 climate zones in the US represent a wide range of weather conditions. Cool roofs are recommended most strongly for buildings in Zones 1-3, where cooling loads are most significant. *Image Source: U.S. DOE*

Solar Reflectance and Thermal Emittance values of the roof surface help determine its temperature. Most roofs are not washed frequently, so we recommend using aged values to predict energy savings. If aged values for your roof are unknown, you can estimate the aged solar reflectance based on the initial solar reflectance by using this formula[xv]:

Aged Reflectance = 0.7 x (Initial Reflectance – 0.2) + 0.2

Some materials retain solar reflectance better than others, so use *measured* aged values whenever possible. Using initial values for thermal emittance is fine, since these values tend to change less over time.

Insulation reduces heat flow through the roof. A well-insulated roof will benefit less from a cool roof than a poorly insulated roof. Recent energy codes recommend R-20 insulation for nonresidential buildings in all U.S. climate zones, except for Climate Zone 1 (which is R-15). If you don't know your roof's insulation, you can use R-20 for a conservative savings estimate if your building was constructed in the past 15 years.

Utility Rates & Fuel Types vary by location and by customer. This tool allows you to specify what type of fuel you use for heating and cooling, as well as the price you pay. By clicking on the ? buttons, you can find recent average utility rates for your state.

[xv] For example, if a roof material has an initial solar reflectance of **0.80**, using the equation you can predict that the expected aged reflectance is **0.62** as shown here**:** **Aged Reflectance** = 0.7*(**0.80**-0.2) + 0.2 = **0.62**

Equipment Efficiency affects savings as well. Buildings with less efficient HVAC equipment will save more energy with cool roofs. If you plan to replace your inefficient HVAC equipment soon after replacing the roof, be sure to input the updated efficiency values.

Results are obtained after entering the above information and clicking the "Calculate" button. A calculation routine will predict your annual energy cost savings per square foot of roof area. *Cooling Savings* and *Heating Savings (penalty)* are presented, along with *Net Energy Savings (penalty)*. Heating penalties are usually smaller than cooling savings, so most locations will yield a net energy cost savings for cool roofs.

Hypothetical Example 1: Roof Coating Comparison[xvi]
Suppose your building has a 20,000 ft^2 roof that is in reasonable condition, and you want to coat the roof to make it last five years longer. Your roofing contractor gives you two proposals: one for a dark coating and one for a cool coating. If the cool coating costs $0.10 *more* per square foot, is it worth it to spend the extra **$2,000** ($0.10/ft^2 x 20,000ft^2) to have a cool roof?

1. Begin by using the Roof Savings Calculator to compare the two roofs. Suppose you find that the cool roof lowers the cooling bill by $0.06/$ft^2$ and increases the heating bill by $0.02/$ft^2$. On average, you will save $0.04/$ft^2$ (= $0.06/$ft^2$ – $0.02/$ft^2$) on energy.
2. Next, calculate annual energy cost savings by multiplying the net savings by the roof area (20,000ft^2). Each year you would save $800 on energy costs (= $1,200 cooling – $400 extra for heating). Since the coating lasts five years, you would expect to save $4,000 (= $800/yr x 5 yr) on energy over the life of the coating.
3. Finally, to find the simple net savings, subtract the premium (if any) for the cool roof. In this case, the cool roof was $2,000 more, so the net savings would be $2,000 = (= $4,000 saved – $2,000 extra). In this case, the cool roof looks like the better investment.

Note: even though the cool roof saves money, the net savings would only cover a small fraction of the *total* coating installation.

Table 7: Example 1 – Simple Cool Coating Comparison

	Incremental Benefit or Cost	Roof Area	Years		Lifetime Benefit or Cost
Extra Upfront Cost	$0.10/$ft^2$	**x20,000 ft^2**	**n/a**	=	-$2,000
Cooling Energy Savings	$0.06/ ft^2/yr		**x5 yr**	=	+$6,000
Heating Energy Penalty	$0.02/ ft^2/yr			=	-$2,000
			Lifetime Savings:		**$2,000**

[xvi] Costs used in these examples are for illustrative purposes only and do not represent actual costs.

Hypothetical Example 2: Roof Re-cover or Replacement
Suppose that the same roof has come to the end of its useful life and you must replace it. You are evaluating a dark and a white membrane, each with a 15-year warranty. As before, the cool option costs $0.10/ft^2 more than the dark membrane, and the cooling savings and heating penalty are the same as Example 1. This time, the predicted simple net savings ($10,000) are much larger because the new roof lasts three times longer than the coating in Example 1.

Table 8: Example 2 – Simple Roof Replacement Comparison

	Incremental Benefit or Cost	Roof Area	Years		Lifetime Benefit or Cost
Extra Upfront Cost	$0.10/ft^2		**n/a**	=	-$2,000
Cooling Energy Savings	$0.06/ ft^2/yr	**x20,000 ft^2**	**x15 yr**	=	+$18,000
Heating Energy Penalty	$0.02/ ft^2/yr			=	-$6,000
			Lifetime Savings:		**$10,000**

Cool Roof Selection and Applications

If you decide to consider a cool roof, these notes can help you select and install the right option for your building. The decision to make your existing roof a cool roof usually means deciding to coat the roof, replace the roof, or build another roof on top of the existing roof. If your roof is in good condition; has relatively few, easy-to-repair leaks; and has at least five years of expected service life, a cool coating may be a good option.

Note that the main reason for coating a roof is to extend its service life, and the energy savings alone will not normally provide sufficient financial reason to coat a roof to make it cool. If your roof is in poor condition, or is approaching the end of its service life, a roof re-covering (adding a new membrane) or replacement (removal of the existing roof, and installation of a new one) is the likely option. Roof re-covering or replacement gives you the opportunity to select any kind of roofing system and cool roof option you desire.

Above all, your roof must protect the building from the effects of weather, so be sure to select a roof system that will do this well. A durable roof is the result of the combined efforts of the building owner, specifier, manufacturer, and contractor. Insist that your installer follow all manufacturer installation procedures. Asking the right questions and being involved can help safeguard your investment. The following application notes will help guide you through this process.

Roof Coatings can be rolled, brushed, or sprayed onto most kinds of roofs. Any leaks or problems with the roof membrane must be repaired before coating the roof. If you plan to coat your roof, selecting the right coating for your particular roof is the most important thing you can do – cool roof or not. **NOTE: Roof coatings are not the same as exterior paints.** Ordinary paints are not designed to last on roof surfaces and will not provide protection. Three major kinds of coatings include acrylic, silicone, and urethanes, and cool roof formulations are

available for each, Table 9. Aluminized asphaltic emulsions provide a glossy finish for some roof types, but fall short of meeting cool roof standards for low sloped roofs.
Coating quality varies widely by manufacturer. Improper coating installation can produce coatings that flake off or wear out faster than they should. Insist that the installer follow the manufacturer's recommended installation procedures, especially regarding weather condition restrictions during application and minimum coating thickness.

Table 9: Roof Coating Types Available in Cool Options[6]

Coating Type	Properties	Cost
Acrylic	Water based, easy to handle, good adhesion to most roof types, most commonly used reflective coating, cures by evaporation, reasonably strong, very sensitive to weather	Moderate
Silicone	Solvent based, typically used for spray polyurethane roofs, weather very well, weaker tensile strength, good water resistance	More expensive
Urethane	Solvent based, 3-10 times stronger than acrylic, greater adhesion to most roof types than acrylic, most cure with exposure to air, less sensitive to weather, more difficult to work with	More expensive

Roof Replacement or **New Construction** gives you an opportunity to select from many cool roof options. In some cases an existing roof must be removed and a new roof installed in its place. In other cases, it may be possible to build a second roof atop an existing roof, though this depends on your roof's condition and local building codes. Regardless of how the roof is installed or replaced, here are some notes about cool roof options.

Single-Ply Membranes come in several types. TPO and PVC membranes are usually white and reflective, and do not require additional formulations or cool coatings. EPDM membranes are black, but can also be produced in white or cool colors. Durable cool EPDM options use black EPDM that is pre-coated with a reflective coating or laminated with a reflective material. The designer should consider membrane durability, since all membranes are not equally durable[xvii].

Roof membranes that are attached with chemical adhesives must reach and maintain a minimum temperature to bond properly. To compensate for reduced surface temperatures, cool roofs that are chemically adhered might require warmer outdoor temperatures during installation to bond properly. Make sure your contractor follows the recommended installation procedures.

Built-Up Roofs can be surfaced in three ways, and each has a cool option. First, light-colored aggregate, such as marble chips, can replace the dark mineral aggregate commonly used with hot bituminous flood coat surfacing. It is usually impractical to coat a gravel-surfaced built-up roof with a cool coating. Doing so requires the removal of the non-embedded gravel, which may affect the roof's fire rating. Second, reflective aluminum pigments can be added, at some cost, to

[xvii] Although roofing manufacturers' warranties can provide useful information about expected roof longevity, they may not necessarily tell the entire story. For example, while manufacturers may offer up to a 30-year material warranty, this usually does not cover the seams, where premature failure can occur.

an asphalt-coated smooth surface, however these have a low thermal emittance and are not cool. To make this surface cool requires an additional cool coating. Finally, cap sheets with white mineral granules can be substituted for those with dark mineral surface, also at a small premium.

Modified Bitumen roofs should have protective coatings to provide heat resistance, ultraviolet resistance, and fire resistance. SBS modified roofs[xviii] must be coated to prevent rapid ozone and UV degradation. APP modified roofs[xix] may be left unsurfaced, but this is not recommended because irregular surface cracks can develop that lead to premature aging. The protective surfacing layer can be made of aggregate, mineral, metal foil laminate, or smooth surfaced with a liquid coating. If a large amount of protective granules fall off, recoating becomes necessary.

Metal Roofs are often coated with Fluoropolymer- or Silicone-Polyester based paints, and many colors can achieve cool roof performance. Some manufacturers offer cool colors almost exclusively, since lower surface temperatures reduce color fading and cost premiums for the reflective pigments are modest. Unpainted metal roofs tend to have a high reflectance but a low thermal emittance, which prevents them from being considered cool in low slope applications.

Spray Polyurethane Foam roofs are typically coated and periodically re-coated with reflective coatings to protect the foam from UV and water damage. As with membrane roofs, there are many suitable cool roof coatings for spray foam roofs, with acrylic being the most common. Some slightly pitched foam roofs cannot be white according to building appearance ordinances, so gray or tan colors may be used instead.

Asphalt Shingles are not typically coated in the field and doing so may void the manufacturer's warranty. If you have asphalt shingles and wish to make your roof cool, you may need to replace the shingles with reflective shingles. In such cases, it may be more cost effective to wait until the shingles reach the end of their service life before replacing them with cool shingles. Other shingles, like those made from wood, polymer, or metal, can be coated to achieve cool roof status.

Tile Roofs may retain their color or not with aging depending on the type of tile. The color of clay tiles depends on naturally occurring chemicals and minerals in the clay. The surface of clay tiles may be altered by glazing the tiles during the manufacturing process. Concrete tiles can receive a surface coating after being produced, or color can be dispersed throughout the tile as it is produced (color through). The color of roofing slate depends on its chemical and mineral makeup. *Weathering* slate exhibits color changes as it weathers, while *permanent* or *unfading* slate retains its color with weathering. Selecting cool roof tiles that retain their surface properties can yield better lifetime energy savings.

Cool Roof Maintenance As a cool roof becomes dirty from pollution, foot traffic, wind-deposited debris, ponded water, and mold or algae growth, its reflectance will decrease, leading

[xviii] SBS stands for Styrene Butadiene Styrene. SBS modified bitumen roofs have a flexible, rubber-like quality.
[xix] APP stands for Atactic Polypropylene. APP modified bitumen roofs have a more rigid, plastic-like quality.

to higher temperatures. Especially dirty roofs may perform substantially worse than product labels indicate. Dirt from foot traffic may be minimized by specifying designated walkways or by limiting access to the roof. Steep sloped roofs have less of a problem with dirt accumulation because rainwater can more easily wash away dirt and debris. Some cool roof surfaces are "self-cleaning" which means they shed dirt more easily and may better retain their reflectance. Cleaning a cool roof can restore solar reflectance close to its installed condition. Always check with your roof manufacturer for the proper cleaning procedure, as some methods may damage your roof. While it is generally not cost effective to clean a roof just for the energy savings, roof cleaning can be integrated as one component of your roof's routine maintenance program. It is therefore best to estimate energy savings based on weathered solar reflectance values rather than clean roof values.

Precautions & Considerations

Although cool roofs have been used successfully for many years, their use is growing and cool roofs are now being installed in a wider range of climates. There are some important questions about the durability of cool roof systems in certain applications.

Condensation, Moisture, and Ice

Designing a roof that can withstand and control moisture is essential since uncontrolled moisture could cause damage to the roof or the building. The following considerations illustrate how cool roofs handle moisture differently than dark roofs.

Ponding occurs when water, typically from rain, accumulates in pools on the roof. This happens when a roof has insufficient slope (caused by poor design or damage) or drain blockage. It takes longer for ponded water to evaporate from a cool roof due to its lower temperature. If your cool roof cannot tolerate ponding, it may be necessary to inspect the roof more frequently to prevent damage or leaks.

Moisture from the indoor air can also condense *within* roof materials. If allowed to accumulate over months or years, moisture could damage those materials. Ordinarily, heat from the sun dries out building materials during the daytime and throughout the summer. In consistently hot climates, like Phoenix, AZ (Climate Zones 1-3 in Figure 8), there is little risk for this kind of moisture build-up.[7] In colder climates, like Chicago or Alaska (Climate Zones 5-8 in Figure 8), there is less heat available to dry out the roof and more opportunities for condensation to occur. Without proper design, both dark and cool roofs can accumulate moisture in colder climates. Cool roofs maintain lower temperatures than dark roofs, and so they may provide less heat to dry out moisture. Potentially, this could make a cool roof more susceptible to moisture accumulation when used in colder climates. While this issue has been observed in both cool and dark roofs in cold climates,[8] the authors are not aware of any data that clearly demonstrate a higher occurrence in cool roofs. The potential for persistent moisture levels to arise in different roof designs and climates is the subject of ongoing research.

Mind Your Surroundings

Cool roofs must be considered in the context of your surroundings. It is relatively easy to specify a cool roof and predict energy savings, but some thinking ahead can prevent other headaches. Ask this question before installing a cool roof: *Where will the reflected sunlight go?*

A bright, reflective roof could reflect light and heat into the higher windows of taller neighboring buildings. In sunny conditions, this could cause uncomfortable glare and unwanted heat for you or your neighbors. Excess heat caused by reflections increases air conditioning energy use, negating some of the energy saving benefits of the cool roof.

Zero Net Energy Buildings

Zero Net Energy Buildings produce as much energy as they consume on an annual basis, using on-site renewable energy sources like electricity-producing solar photovoltaic (PV) panels and solar thermal collectors for water heating. Typically, zero net energy buildings consume very little energy to begin with, and are highly air sealed and insulated. Consequently, adding cool, reflective roof surfaces to extremely well insulated roofs will not produce significant energy savings.

Roof-mounted solar panels absorb sunlight to produce electricity and/or heat. Like dark roofs, these become hot in the sun and can increase the building's air conditioning demand. Roofs that are largely covered by traditional PV panels may suffer from increased will not benefit much from a reflective coating beneath the panels. Thin film PV modules, which can be integrated into roofing materials, can achieve an effective solar reflectance that meets cool roof requirements for steep sloped roofs[9]. In cases where solar panels cover only part of the roof, it may be beneficial to install a cool roof on the exposed portions of the roof.

Resources

Additional information about cool roof benefits, applications, incentives, and policy can be found at the organizations and links listed below.

Energy & Cost Savings Calculator

Roof Savings Calculator
http://www.roofcalc.com

Industry Associations

Asphalt Roofing Manufacturers Association
750 National Press Building
529 14th Street, NW
Washington, DC 20045
Phone: (202) 207-0919
http://www.asphaltroofing.org

Center for Environmental Innovation in Roofing
816 Connecticut Ave., NW, 5th Floor
Washington, DC 20006
Phone: (866) 928-2347
http://www.roofingcenter.org

Cool Metal Roofing Coalition
680 Andersen Drive
Pittsburgh, PA 15220
Phone: (412) 922-2772
http://www.coolmetalroofing.org

Metal Building Manufacturers Association
1300 Sumner Ave.
Cleveland, OH 44115-2851
Phone: (216) 241-7333
http://www.mbma.com

Metal Construction Association
4700 W. Lake Avenue
Glenview, IL 60025
Phone: (847) 375-4718
http://www.metalconstruction.org

Metal Roofing Alliance
E. 4142 Hwy 302
Belfair, WA 98528
Phone: (360) 275-6164
http://www.metalroofing.com

National Roofing Contractors Association
10255 W. Higgins Road, Suite 600
Rosemont, IL 60018-5607
Phone: (847) 299-9070
http://www.nrca.net

Reflective Roof Coating Institute
400 Admiral Boulevard
Kansas City, MO 64106
Phone: (816) 221-1297
http://www.therrci.org

Roof Coating Manufacturers Association
750 National Press Building
529 14th Street, NW
Washington, DC 20045
Phone: (202) 207-0919
http://www.roofcoatings.org

Roof Consultants Institute
1500 Sunday Drive, Suite 204
Raleigh, North Carolina 27607
Phone: (800) 828-1902 or (919) 859-0742
http://www.rci-online.org

Single Ply Roofing Industry
411 Waverley Oaks Road, Suite 331B
Waltham, MA 02452
Phone: (781) 647-7026
http://www.spri.org

Tile Roofing Institute
230 East Ohio St., Suite 400
Chicago, IL 60611
Phone: (312) 670-4177
http://www.tileroofing.org

Material & Product Ratings

Cool Roofing Materials Database
Lawrence Berkeley National Labs
http://eetd.lbl.gov/CoolRoofs

Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612
Phone: (866) 465-2523 or (510) 485-7175
http://www.coolroofs.org

ENERGY STAR Reflective Roof Products
1200 Pennsylvania Ave., NW
Washington, DC 20460
Phone: (888) 782-7937
http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

Cool Roof Research Groups

Lawrence Berkeley National Laboratory
Heat Island Group
http://eetd.lbl.gov/HeatIsland

Oak Ridge National Laboratory
Building Envelopes Program
http://www.ornl.gov/sci/roofs+walls

Other Resources

Consumer Energy Center
California Energy Commission
http://www.consumerenergycenter.org/coolroof

Flex Your Power
Cool Roofs Product Guide
http://www.fypower.org/com/tools/products_results.html?id=100123

U.S. Department of Energy
Federal Energy Management Program
http://www1.eere.energy.gov/femp/features/cool_roof_resources.html

End Notes

[1] ASTM Standard E1980. 2001. "Standard practice for calculating solar reflectance index of horizontal and low-sloped opaque surfaces." ASTM International, West Conshohocken, PA.
[2] California Energy Commission. 2008. "2008 Building energy efficiency standards for residential and nonresidential buildings." December.
[3] Chu, Steven. 2010. "Installation of cool roofs on Department of Energy buildings." Memorandum from the Secretary of Energy. U.S. Department of Energy. June.
[4]Bretz, S.E. and H. Akbari. "Long-term performance of high-albedo roof coatings." *Energy and Buildings*. 25(1997)159-167.
[5] Environmental Protection Agency (EPA). 2010. Cool roof tax credit. http://tinyurl.com/ko5ued.
[6] Leonard, J. 2008. Featured Focus: Roof Coatings. Journal of Architectural Coatings. 2008. Jan/Feb. pp.10-22.
[7] Bludau, C., D. Zirkelbach, and H.M. Kuenzel. 2009. Condensation problems in cool roofs. *Interface, the Journal of RCI.* Vol. XXVII, No.7.
[8] Hutchinson, T. 2009. "Cool roofing challenging what's cool." *Eco-structure*. http://www.eco-structure.com/cool-roofing/challenging-whats-cool.aspx.
[9] Kriner. S. 2009. "Thin film photovoltaics & their impact on a commercial building's cooling load." Canadian Roofing Contractor & Design. Jan/Feb. http://www.sarnafilus.com/thin-film-photovoltaics.pdf.

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

MAY 09 2012

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, ENERGY AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY (ENERGY, INSTALLATIONS AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS, ENVIRONMENT AND LOGISTICS)
DIRECTOR, DEFENSE CONTRACT MANAGEMENT AGENCY
DIRECTOR, DEFENSE COMMISSARY AGENCY
DIRECTOR, DEFENSE INTELLIGENCE AGENCY
DIRECTOR, DEFENSE LOGISTICS AGENCY (DES-D)
DIRECTOR, MISSILE DEFENSE AGENCY
DIRECTOR, NATIONAL GEOSPATIAL AGENCY
DIRECTOR, NATIONAL SECURITY AGENCY
DIRECTOR, TRICARE MANAGEMENT AGENCY
DIRECTOR, WASHINGTON HEADQUARTERS SERVICE

SUBJECT: Limitation on Use of Fiscal Year 2012 Funds for Leadership in Energy and Environmental Design Gold or Platinum Certification

Section 2830(b)(1) of the National Defense Authorization Act for Fiscal Year 2012 (Public Law 112-81) (Attachment 1) prohibits the obligation or expenditure of funds authorized to be appropriated or otherwise made available for fiscal year 2012 for achieving any Leadership in Energy and Environmental Design (LEED) gold or platinum certification for DoD facilities. The law allows the Secretary of Defense to waive the prohibition if a cost-benefit analysis results in demonstrated payback and the Secretary notifies Congress at least 30 days before the obligation of funds.

By limiting the expenditure of appropriated funds for facilities to achieve LEED gold and platinum certifications, Congress intends to make sure the Department pursues higher standards only when the extra investment can be expected to deliver a reasonable return. This legislation should not prevent the Department from pursuing innovation and constructing highly efficient, sustainable buildings. The legislation requires the Department to be very deliberate about any decision to exceed a LEED silver standard. A DoD Component may obtain a waiver to pursue a higher level of certification if it can document that the higher level provides a demonstrated payback for the energy improvements or sustainable design features.

DoD Components must submit waiver requests to the Deputy Under Secretary of Defense (Installations & Environment) (DUSD(I&E)) for approval by the Under Secretary of Defense for Acquisition, Technology, and Logistics. Waiver requests must include the congressional

notification package which consists of a signed request to DUSD(I&E) from the Military Department's assistant secretary for installations, a draft notification to Congress, a life-cycle cost analysis of the decision to pursue LEED gold or platinum, and a demonstration of the payback for the energy improvements or the sustainable design features. More detailed requirements for the waiver package are included at Attachment 2. LEED gold and platinum certifications shall be permitted, and not require a waiver and notification, if achieving such a certification imposes no additional cost to the Department of Defense.

Military Construction project baseline requirements must not require anything higher than LEED silver certification. Features required to reach gold or platinum certification must be treated as betterments or enhancements, and justified by separate economic analysis. A list of frequently asked questions is provided at Attachment 3 for further clarification of this policy.

If you have further questions, my point of contact is Lt Col Keith Welch, at 703-604-1831, keith.welch@osd.mil.

Dorothy Robyn
Deputy Under Secretary of Defense
(Installations and Environment)

Attachments:
As stated

cc:
Office of General Counsel of the Department of Defense

Attachment 1: H.R. 1540, Section 2830

SEC. 2830. REPORT ON ENERGY-EFFICIENCY STANDARDS AND PROHIBITION ON USE OF FUNDS FOR LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN GOLD OR PLATINUM CERTIFICATION.

(a) Report Required-

(1) IN GENERAL- Not later than June 30, 2012, the Secretary of Defense shall submit to the congressional defense committees a report on the energy-efficiency and sustainability standards utilized by the Department of Defense for military construction and repair.
(2) CONTENTS OF REPORT- The report shall include a cost-benefit analysis, return on investment, and long-term payback for the following design standards:
    (A) American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) building standard 189.1-2011.
    (B) ASHRAE building standard 90.1-2010.
    (C) Leadership in Energy and Environmental Design (LEED) silver, gold, and platinum certification, as well as the LEED volume certification.
    (D) Other American National Standards Institute accredited standards.
(3) ADDITIONAL CONTENTS OF REPORT- The report shall also include a copy of Department of Defense policy prescribing a comprehensive strategy for the pursuit of design and building standards across the Department that include specific energy-efficient standards and sustainable design attributes for military construction based on the cost-benefit analysis, return on investment, and demonstrated payback required by subparagraphs (A), (B), (C), and (D) of paragraph (2).

(b) Prohibition on Use of Funds for LEED Gold or Platinum Certification-

(1) PROHIBITION- No funds authorized to be appropriated by this Act or otherwise made available for the Department of Defense for fiscal year 2012 may be obligated or expended for achieving any LEED gold or platinum certification.
(2) WAIVER AND NOTIFICATION- The Secretary of Defense may waive the limitation in paragraph (1) if the Secretary submits a notification to the congressional defense committees at least 30 days before the obligation of funds toward achieving the LEED gold or platinum certification.
(3) CONTENTS OF NOTIFICATION- A notification shall include the following:
    (A) A cost-benefit analysis of the decision to obligate funds toward achieving the LEED gold or platinum certification.
    (B) Demonstrated payback for the energy improvements or sustainable design features.
(4) EXCEPTION- LEED gold and platinum certifications shall be permitted, and not require a waiver and notification under this subsection, if achieving such certification imposes no additional cost to the Department of Defense.

Attachment 2: Waiver Package Requirements

The following items will be required in Component waiver requests.

a) DoD Component, sponsor
b) Installation
c) Construction Agent
d) Project Number from 1391
e) Project Description from 1391
f) Programmed Amount ($M), at Appropriation
g) Fiscal Year of Appropriation (yyyy)
h) Estimated total project cost to achieve LEED silver certification
i) LEED certification (designed)
j) Estimated total project cost to achieve designed LEED certification
k) Total project cost at award
l) Waiver Request Date (mmddyyyy)
m) Justification for Waiver
n) Cost-Benefit Analysis

Attachment 3: Frequently Asked Questions (FAQs)

Q1: May a DoD Component still pursue LEED gold or platinum certification without a waiver as long as the total cost of the project does not exceed the Programmed Amount authorized by Congress?
A1: No. A waiver will most likely be required. If a DoD Component wishes to pursue LEED gold or platinum certification using funds authorized in the NDAA for FY2012 or otherwise appropriated in FY2012 and the additional measures needed to achieve the higher certification will cause the total project cost to exceed the cost required to achieve LEED silver, the Component must first get a waiver regardless of whether or not the cost remains below the original Programmed Amount. If the Component plans to argue that measures needed to achieve LEED gold or platinum certification will not increase the total project cost, the Component must take measures during the acquisition process to clearly prove its case.

Q2: May a DoD Component spend additional money to design and construct a building to LEED gold or platinum standards, as long as it does not spend any additional money to pursue actual certification through the US Green Building Council?
A2: No. Section 2830 is intended to make sure a decision to spend additional money in pursuit of a higher LEED standard is made only after a thorough and reasoned contemplation of return on that additional investment. It is not designed merely to prevent obtaining a paper certificate.

Q3: If a design or construction contractor believes it is in its best interest to pursue LEED gold or platinum certification to enhance its resume, may it do so as long as it alone bears the additional costs and no appropriated funds are expended?
A3: Yes. Section 2830(b)(4) states "LEED gold or platinum certification shall be permitted, and not require a waiver and notification under this subsection, if achieving such certification imposes no additional cost to the Department of Defense." In this case, it will be very important for the DoD Component to carefully document decisions and costs during the procurement process so that, if asked, it will be clear that no additional appropriated funds were expended and that government officials in no way influenced the contractor's decision.

Q4: If money was appropriated prior to FY2012, but has not been obligated or expended yet, can that money be used in 2012 to pursue LEED Gold or Platinum certification without a waiver?
A4: Yes. The prohibition and waiver requirement apply to money authorized or appropriated in FY2012. Nevertheless, careful consideration should be given to whether pursuing Gold or Platinum certification is justified.

Q5: Does the limitation on LEED certification beyond Silver apply to the FY12 MILCON program year only? For FY12 MILCON projects of any funding type?
A5: The limitation applies to funds authorized or appropriated in FY2012. Prior year appropriations are not affected. The limitation applies to incrementally funded projects where the first increment of funding is FY2012. For incrementally funded projects where FY2012 is not the first increment of funding, the prohibition will not apply.

Q6: Does the limitation on LEED certification beyond Silver apply to FY12 funding for other than MILCON projects?
A6: Yes.

Q7: At what point in the project must the DoD Component submit the waiver request?
A7: The Component seeking the waiver should allow a minimum of 90 days for OSD staffing and congressional notification.

Q8: What documentation must accompany the waiver request?
A8: The waiver package must include a signed request to DUSD(I&E) from the DoD Component's Assistant Secretary for Installations, Installation Support Director, or equivalent, a draft notification to Congress, a thorough justification of the decision to pursue LEED gold or platinum, including a life-cycle cost analysis and a demonstration of the payback expected for the energy improvements or the sustainable design features. Ultimately, the DoD Component must demonstrate that the decision to pursue a higher LEED standard was not frivolous or arbitrary, but based on sound reasoning.

Q9: Who approves the waiver request?
A9: The USD(AT&L) approves a waiver request on behalf of the Secretary of Defense and provides notification to Congress.

portfolio standards, current renewable energy technology options, energy auditing, and options to reduce energy consumption;

(2) improve consistency among energy managers throughout the Department in the performance of their responsibilities;

(3) create opportunities and forums for energy managers to exchange ideas and lessons learned within each military department, as well as across the Department of Defense; and

(4) collaborate with the Department of Energy regarding energy manager training.

(b) ISSUANCE OF POLICY.—Not later than 180 days after the date of the enactment of this Act, the Secretary of Defense shall issue the training policy for Department of Defense energy managers. In creating the policy, the Secretary shall consider the best practices and certifications available in either the military services or in the private sector.

(c) BRIEFING REQUIREMENT.—Not later than 180 days after the date of the enactment of this Act, the Secretary of Defense, or designated representatives of the Secretary, shall brief the Committees on Armed Services of the Senate and House of Representatives regarding the details of the energy manager policy.

SEC. 2830. REPORT ON ENERGY-EFFICIENCY STANDARDS AND PROHIBITION ON USE OF FUNDS FOR LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN GOLD OR PLATINUM CERTIFICATION.

(a) REPORT REQUIRED.—

(1) IN GENERAL.—Not later than June 30, 2012, the Secretary of Defense shall submit to the congressional defense committees a report on the energy-efficiency and sustainability standards utilized by the Department of Defense for military construction and repair.

(2) CONTENTS OF REPORT.—The report shall include a cost-benefit analysis, return on investment, and long-term payback for the following design standards:

(A) American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) building standard 189.1-2011.

(B) ASHRAE building standard 90.1-2010.

(C) Leadership in Energy and Environmental Design (LEED) silver, gold, and platinum certification, as well as the LEED volume certification.

(D) Other American National Standards Institute accredited standards.

(3) ADDITIONAL CONTENTS OF REPORT.—The report shall also include a copy of Department of Defense policy prescribing a comprehensive strategy for the pursuit of design and building standards across the Department that include specific energy-efficient standards and sustainable design attributes for military construction based on the cost-benefit analysis, return on investment, and demonstrated payback required by subparagraphs (A), (B), (C), and (D) of paragraph (2).

(b) PROHIBITION ON USE OF FUNDS FOR LEED GOLD OR PLATINUM CERTIFICATION.—

(1) PROHIBITION.—No funds authorized to be appropriated by this Act or otherwise made available for the Department

of Defense for fiscal year 2012 may be obligated or expended for achieving any LEED gold or platinum certification.

(2) WAIVER AND NOTIFICATION.—The Secretary of Defense may waive the limitation in paragraph (1) if the Secretary submits a notification to the congressional defense committees at least 30 days before the obligation of funds toward achieving the LEED gold or platinum certification.

(3) CONTENTS OF NOTIFICATION.—A notification shall include the following:

(A) A cost-benefit analysis of the decision to obligate funds toward achieving the LEED gold or platinum certification.

(B) Demonstrated payback for the energy improvements or sustainable design features.

(4) EXCEPTION.—LEED gold and platinum certifications shall be permitted, and not require a waiver and notification under this subsection, if achieving such certification imposes no additional cost to the Department of Defense.

Subtitle D—Provisions Related to Guam Realignment

SEC. 2841. CERTIFICATION OF MEDICAL CARE COVERAGE FOR H-2B TEMPORARY WORKFORCE ON MILITARY CONSTRUCTION PROJECTS ON GUAM.

(a) MANAGEMENT OF WORKFORCE HEALTH CARE.—Subject to subsection (b), the Secretary of the Navy may not award any additional Navy or Marine Corps construction project or associated task order on Guam associated with the Record of Decision for the Guam and CNMI Military Relocation dated September 2010 if the aggregate of the number of employees holding a visa described in section 101(a)(15)(H)(ii)(b) of the Immigration and Nationality Act (8 U.S.C. 1101(a)(15)(H)(ii)(b); known as "H–2B workers") to support such relocation exceeds 2,000 until the Secretary of the Navy certifies to the congressional defense committees that a system of health care for the H–2B workers is available.

(b) SYSTEM OF HEALTH CARE.—The health care system required to be certified in subsection (a) shall—

(1) include a comprehensive medical plan for the H–2B workers;

(2) include comprehensive planning and coordination with contractor-provided healthcare services and with Guam's civilian and military healthcare community; and

(3) access local healthcare assets to help meet the health care needs of the H–2B workers.

(c) ELEMENTS OF MEDICAL PLAN.—The comprehensive medical plan referred to in subsection (b)(1) shall—

(1) address significant health issues, injury, or series of injuries in addition to basic first responder medical services for H–2B workers;

(2) provide pre-deployment health screening at the country of origin of H–2B workers, ensuring—

(A) all major or chronic disease conditions of concern are identified;

(B) proper immunizations are administered;