Edition Date: May 4, 1999

THE GREEN RIDER

The purpose of the Green Rider is to provide information on the Environmental Protection Agency's (EPA) programs that promote environmentally and economically sound building practices and energy efficiency. The Green Rider requires the offeror to document the evaluations of green practices and product selections to determine why specific concepts were or were not chosen.

Incorporating green concepts into a building can require a significant amount of time to research all of the environmental building programs. To assist the offerors, detailed information on each of these programs is provided in the Green Programs informational packet.

The framework for this green rider comes from *EPA's Architecture, Engineering, and Planning Guidelines* (Appendix D - Design Guidelines):

Environmentally Conscious Design

EPA's objective is to foster environmentally conscious design in its facilities. To that end, consideration must include, but shall not be limited to, the following:

- Site planning that is environmentally based
- Facility designs that reflect environmental as well as energy conscious concept
- Material selection based on low energy consumption both in the production and in transportation to the site
- Material selection based on using indigenous materials and refraining from using ecologically sensitive materials
- Material selection based on reducing hazardous chemicals within the buildings due to off-gassing of material
- Material selection based on the products' life cycle energy use and cost
- Ecologically sensitive use of water on the grounds of facilities and within the facilities
- Sensitive use of HVAC components to reduce pollution, conserve energy, and maintain the appropriate quality for the interior environment
- Concepts that focus on recycling of materials and use of recycled materials.

Environmentally Preferred Products

Environmentally Preferred Products have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose. All federal procurement officials are required by Executive Order 13101 and the Federal Acquisition Regulation (FAR) to assess and give preference to those products and services that are environmentally preferable. The Building for Environmental and Economic Sustainability (BEES) software can easily compute life cycle cost assessments very quickly for a wide range of building

products. (Additional information on calculating life cycle cost assessments is provided in the Green Programs information packet). BEES analyzes concrete, roofing material, exterior wall material, insulation, sheathing, and floor covering. The software weighs all of the economic and environmental costs associated with each product. The offeror must document the environmental benefits of building products selected. If the offeror does not use Environmentally Preferred Products, the rational must be documented.

Comprehensive Procurement Guidelines

US EPA's Comprehensive Procurement Guidelines (CPG) contain detailed information on the recycled content of numerous building materials. The guidelines recommend recycled content levels for each material. Procuring agencies are required by Executive Order 13101 to purchase material with the highest recovered material content level practical. The following exceptions to the CPG are allowed:

- The cost of the recommended product is unreasonable
- Inadequate competition exists
- Items are not available within a reasonable period of time
- Items do not meet the solicitation's performance standards.

The offeror must document the recycled content or other environmental benefit of the building materials. If a building material does not meet the CPG requirements for one or more of the reasons listed above, documentation must be provided. The documentation must clearly state which exemption is used, the rational for using an exemption, and the environmental benefit or recycled content of the product selected.

Energy Conservation

Energy conservation is an economically and environmentally sound practice. When viewed over the lifetime of the building, energy conservation can save a significant amount of money. Executive Order 12902 requires federal agencies to greatly increase their energy efficiency. Energy conservation shall be considered for all products that consume energy or increase the heating and cooling needs of a building. A life cycle assessment shall be done for all mechanical systems as required in the SFO. Many specific energy conservation measures are required in the SFO and should be incorporated into a building-wide energy conservation plan. Energy Star's new Purchasing Tool Kit provides an energy calculator for many products, and it should be considered when products are evaluated. Energy conservation measures must be documented by the offeror.

Water Conservation

Similar to energy conservation, water conservation becomes economically desirable when considering costs over the lifetime of the building. Executive Order 12902 requires federal agencies to implement all cost-effective water conservation measures. Water conservation shall

be considered (as specified in the SFO) for all products that use water. Water conservation measures must be documented by the offeror.

Natural Landscaping

Natural Landscaping is the use of native plants in landscaping. Native plants require less watering and use fewer pesticides and fertilizers. The SFO mandates the use of hardy, indigenous plants. The use of natural landscaping also has a number of economic advantages. They include, but are not limited to:

- Reduced costs of landscape installation
- Reduced expenses for stormwater management facilities
- Reduced needs for irrigation water
- Reduced costs of maintenance (while not maintenance free, natural landscaping requires less time and money for ongoing maintenance than conventional landscapes).

The offeror must document the use of natural landscaping.

Solar Applications – President's Million Solar Roofs

Decisions regarding solar applications should be considered by a life cycle cost analysis. While the initial costs of solar applications may be considerable, their operation and maintenance are minimal. During their lifetime, they provide free energy to the building during daylight hours. The offeror must provide documentation to explain why solar applications were or were not used.

Construction Debris Recycling

Most construction debris can be recycled or reused rather than landfilled. Recycling and reusing helps conserve natural resources and can save money, so it is strongly recommended whenever feasible. Documentation of construction debris recycling or reusing is strongly encouraged.

Indoor Air Quality

EPA's Facilities Manual: Architecture, Engineering, and Planning Guidelines, Appendix B, contains detailed requirements concerning indoor air quality. Product selection and construction should limit indoor air pollutants to the greatest extent possible. The effects of building materials on indoor air quality shall be documented according to the requirements of Section B.1.2.3 of *EPA's Facilities Manual*. Upon completion, it must be documented that the building has met indoor air quality standards.

Leadership in Energy and Environmental Design (LEED™)

The LEED Green Building™ Rating System is a consensus-based, market-driven building rating system based on existing proven technology that evaluates environmental performance from a "whole building" perspective over a building's life cycle. LEED™ is intended to be a definitive standard for what constitutes a "green building." The building must obtain, at a minimum, the LEED Building Gold™ certification by earning at least 71% (31) of the available criteria points. The offeror must provide supporting documentation that demonstrates its participation in the LEED™ Rating System (e.g., a notebook detailing how the building earned LEED™ criteria points).

Overall Documentation of Green Building Concepts

In cooperation with GSA and EPA, the offeror must prepare a document for publication that outlines green aspects of the building. The document will summarize environmental concepts used in the building and discuss difficulties encountered and solutions developed. By requiring documentation, EPA and GSA can evaluate their green building recommendations to determine which practices are most beneficial. Additionally, all federal agencies must report their Greening the Government accomplishments to the President. The scope of the reporting requirements includes improvements in waste prevention and recycling (Executive Order 13101), reduction in ozone depleting substances (Executive Order 12843), and energy efficiency and water conservation (Executive Order 12902). In order to meet our reporting requirements for these Executive Orders, the offeror must provide documentation, as described above, on the following programs:

- Environmentally Preferred Products
- Comprehensive Procurement Guidelines
- Energy Conservation
- Water Conservation
- Natural Landscaping
- Indoor Air Quality
- Leadership in Energy and Environmental Design (LEED™).

GREEN PROGRAMS
INFORMATION PACKET

SUPPORTING THE GREEN RIDER ATTACHMENT TO THE SOLICITATION FOR OFFERS

Developed by:
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Solid Waste & Pollution Prevention Branch
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EXECUTIVE SUMMARY

The purpose of the Green Programs Information Packet is to provide supplementary information for the Green Rider. This Information Packet is designed to make it easy for offerors to evaluate the construction materials and practices that use green concepts and help the Environmental Protection Agency (EPA) and other federal agencies meet the mandates of Executive Orders, initiatives, and voluntary programs. Most green concepts are not rocket science but promote economical building practices, especially when viewed over the lifetime of the facility.

The framework for the Green Rider and this Information Packet comes from *EPA's Architecture, Engineering, and Planning Guidelines* (Appendix D - Design Guidelines):

Environmentally Conscious Design

EPA's objective is to foster environmentally conscious design in its facilities. To that end, consideration must include, but shall not be limited to, the following:

- Site planning that is environmentally based
- Facility designs that reflect environmental as well as energy conscious concepts
- Material selection based on low energy consumption both in the production and in transportation to the site
- Material selection based on using indigenous materials and refraining from using ecologically sensitive materials
- Material selection based on reducing hazardous chemicals within the buildings due to off-gassing of material
- Material selection based on the products' life cycle energy use.
- Ecologically sensitive use of water within the facilities
- Sensitive use of HVAC components to reduce pollution, conserve energy, and maintain the appropriate quality for the interior environment
- Concepts that focus on recycling of materials.

TABLE OF CONTENTS

INTRODUCTION:
EPA GREEN BUILDINGS VISION AND POLICY STATEMENT

In order to maintain leadership in environmental protection, EPA must lead by example. Through sustainable design and construction of EPA facilities we will model responsible environmental behavior and help create the framework within which the building industry as a whole can shift toward practices which will promote "Green Buildings."

Green Buildings are structures that incorporate the principles of sustainable design—design in which the impacts of a building on the environment will be minimal over the lifetime of that building. Green Buildings incorporate principles of energy and resource efficiency, practical applications of waste reduction and pollution prevention, good indoor air quality and natural light to promote occupant health and productivity, and transportation efficiency in design and construction, and during use and reuse.

Agency facilities, both new and existing, should serve as models for a healthy workplace with minimal environmental impacts. To achieve this goal, EPA will utilize both innovative "state of the art" technologies and a holistic approach to design, construction, renovation and use. EPA will work with the private sector to identify opportunities for innovation and to help create markets for both products and design concepts. Important considerations in the design, construction and use of EPA owned and leased facilities include the following:

- Site planning that utilizes resources naturally occurring on the site such as solar and wind energy, natural shading, native plant materials, topography and drainage
- Location and programs to optimize use of existing infrastructure and transportation options, including the use of alternative work modes such as telecommuting and teleconferencing
- Use of recycled-content and environmentally preferable construction materials and furnishings, consistent with EPA Procurement Guidelines
- Minimization of energy and materials waste throughout the building's lifecycle, from design through demolition or reuse
- Design of the building envelope for energy efficiency
- Use of materials and design strategies to achieve optimal indoor environmental quality, particularly including light and air, to maximize health and productivity
- Operation systems and practices which support an integrated waste management system.
- Recycling of building materials at demolition
- Management of water as a limited resource in site design, building construction and building operations
- Utilization of solar and other renewable technologies where appropriate.

Implementation of these ideas is discussed in detail in the Green Programs Information Packet. The Information Packet provides information on EPA requirements (see Attachment 1) and numerous important considerations. EPA's green building programs are mandated by Executive Orders 13101 and 12902 (see Attachments 2 and 3).

Evaluation of tradeoffs will be an important component of the design of Green Buildings. Where the goals of a Green Building are contradictory (for example increased ventilation vs. increased energy efficiency), the tradeoffs will have to be evaluated in a holistic framework to achieve long-term benefits for the environment. Also, the physical considerations must be balanced with other policy objectives such as environmental justice, particularly with regards to site location. We anticipate that there may not always be single answers to recurring building issues, but we will adopt a consistent approach to evaluating all buildings for sustainable design considerations.

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ENVIRONMENTALLY PREFERRED PRODUCTS

Environmentally Preferable Purchasing (EPP) ensures that environmental considerations are included in purchasing decisions, along with traditional factors, such as product price and performance. The Environmentally Preferable Purchasing Program provides guidance for federal agencies to facilitate purchases of goods and services that pose fewer burdens on the environment.

The federal government is committed to minimizing the environmental impact of the products and services that it purchases. Spending $200 billion annually, the federal government can apply its purchasing power to create a demand for products and services that have a reduced impact on the environment.

In order to identify and show a preference for "environmentally preferable" products and services, President Clinton has called upon EPA to issue guidance for executive agencies to use when purchasing goods and services. "Environmentally preferable" products and services have a lesser or reduced effect on human health and the environment when compared to other products and services that serve the same purpose.

Overview

The proposed guidance includes a set of seven general guiding principles designed to help executive agencies begin the process of identifying and purchasing environmentally preferable products and services. The proposed guidance also recommends implementation activities for executive agencies, such as issuing policy directives and applying the principles to pilot acquisitions.

Principle #1: Pollution Prevention

Consideration of environmental preferability should begin early in the acquisition process and be rooted in the ethic of pollution prevention that strives to eliminate or reduce, up front, potential risks to human health and the environment. Purchasers should consider a product or service's environmental impact at the time when they are deciding to purchase it. This approach allows for up-front elimination or reduction of potential risks to human health and the environment.

Principle #2: Multiple Attributes

A product or service's environmental preferability is a function of multiple environmental attributes. A specific product or service may have a number of environmental impacts in both natural resource consumption and toxic effects. Targeting a single environmental attribute can obscure other environmental impacts that might cause equal or greater damage.

Principle #3: Life-cycle Perspective

Environmental preferability should reflect life-cycle considerations of products and services to the extent feasible. Environmental impacts can occur at any time during the life cycle of a service or product such as during raw materials acquisition, product manufacturing, packaging and transportation, distribution, use, maintenance, or disposal. Purchasers should consider various stages of a product or service's life cycle in evaluating its environmental preferability.

Principle #4: Magnitude of Impact

Environmental preferability should consider the scale (global versus local) and temporal aspects (reversibility) of the impacts. Environmental preferability should reflect both the magnitude and the permanence of a product or service's environmental impact. Purchasers should consider the geographic scale and the degree to which an impact is reversible when determining environmental preferability.

Principle #5: Local Conditions

Environmental preferability should be tailored to local conditions where appropriate. The magnitude and permanence of the environmental impacts of products and services will depend on where and how these products and services are used. Purchasers should factor in local conditions, such as natural resource availability, when evaluating products and services.

Principle #6: Competition

Environmental attributes of products or services should be an important factor or subfactor in competition among vendors, when appropriate. Environmental performance is one of many factors considered in purchasing and should serve as a basis for competition among vendors in the marketplace. This kind of competition will also foster continuous improvement in the environmental performance of products and services in the marketplace.

Principle #7: Product Attribute Claims

Agencies need to examine product attribute claims carefully. Executive agencies should pay close attention to the environmental claims made by providers of products and services. Relying on several information sources rather than just one will provide the most accurate assessment of a product or service's environmental performance.

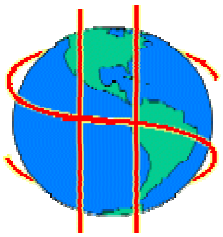
For Additional Information

The Environmentally Preferable Purchasing Program maintains a website with additional information at http://www.epa.gov:80/opperspd/epp.

Additional sources further detailing case studies and voluntary industry standards used by the Environmentally Preferable Purchasing Program are provided in Attachment 4. EPA's new Research Triangle Park Laboratory Facility required the use of recycled building material as part of an EPP Program. The minimum recycled content of 19 building products used in the facility is summarized in Attachment 5. These levels provided adequate competition while maximizing use of recycled material.

BEES

BUILDING FOR ENVIRONMENTAL AND ECONOMIC SUSTAINABILITY



The BEES (Building for Environmental and Economic Sustainability) software implements a rational, systematic technique for balancing the environmental and economic performance of building products. The technique is designed to be practical and flexible. The Windows-based software, aimed at designers, builders, and product manufacturers, includes actual environmental and economic performance data for a number of building products.

BEES measures the environmental performance of building products by using the environmental life-cycle assessment approach specified in the latest versions of ISO 14000 draft standards. All stages in the life of a product are analyzed: raw material acquisition, manufacturing, transportation, installation, use, and recycling and waste management.

Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. Environmental and economic performances are combined into an overall performance measure.

Even the most environmentally conscious building designer or building product manufacturer will ultimately weigh environmental benefits against economic costs. To satisfy their customers, manufacturers and designers need to develop and select building products with an attractive balance of environmental and economic performance.

BEES can perform an analysis of all building products incorporated in the construction/design of a building that correspond to the building products identified in the following table.

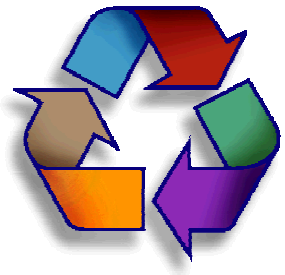
Group	Building Product
Foundation	0% Fly Ash Content Slab on Grade
Foundation	15% Fly Ash Content Slab on Grade
Foundation	20% Fly Ash Content Slab on Grade
Basement Construction	0% Fly Ash Content Basement Wall
Basement Construction	15% Fly Ash Content Basement Wall
Basement Construction	20% Fly Ash Content Basement Wall
Superstructure	0% Fly Ash Content Beams
Superstructure	15% Fly Ash Content Beams
Superstructure	20% Fly Ash Content Beams
Superstructure	0% Fly Ash Content Columns
Superstructure	15% Fly Ash Content Columns
Superstructure	20% Fly Ash Content Columns
Superstructure	Oriented Strand Board Roof Sheathing

Group	Building Product
Superstructure	Plywood Roof Sheathing
Exterior Closure	Brick & Mortar Exterior Wall
Exterior Closure	Stucco Exterior Wall
Exterior Closure	R-13 Cellulose Wall Insulation
Exterior Closure	R-11 Fiberglass Wall Insulation
Exterior Closure	R-15 Fiberglass Wall Insulation
Exterior Closure	R-12 Mineral Wool Wall Insulation
Exterior Closure	Oriented Strand Board Wall Sheathing
Exterior Closure	Plywood Wall Sheathing
Roofing	Asphalt Shingle Roof Covering
Roofing	Clay Tile Roof Covering
Roofing	Fiber Cement Shingle Roof Covering
Roofing	R-30 Cellulose Ceiling Insulation
Roofing	R-30 Fiberglass Ceiling Insulation
Roofing	R-30 Mineral Wool Ceiling Insulation
Interior Finishes	Ceramic Tile with Recycled Glass Floor Covering
Interior Finishes	Linoleum Floor Covering
Interior Finishes	Vinyl Composition Tile Floor Covering
Site Improvements	0% Fly Ash Content Driveways and Sidewalks
Site Improvements	15% Fly Ash Content Driveways and Sidewalks
Site Improvements	20% Fly Ash Content Driveways and Sidewalks

The BEES software can easily compute life cycle cost assessments very quickly and easily for these building products. Since the offeror must document the environmental benefits of building products selected, BEES is a very useful tool.

Attachment 6 contains the BEES diskettes, user manual, and instructions for installation

COMPREHENSIVE PROCUREMENT GUIDELINES



The U.S. Environmental Protection Agency's Comprehensive Procurement Guidelines (CPG) are a key component of the government's "buy-recycled" program. Today, more and more products are made from recycled materials—from the carpeting and insulation used in office buildings, to the reams of office paper purchased each day. Buying recycled helps "close the recycling loop" by putting the materials we collect through recycling programs back to good use as products in the marketplace.

At the Web site http://www.epa.gov/cpg, you will find all you need to know about the CPG and about EPA's Recovered Materials Advisory Notices (RMANs), which recommend recycled-content levels for CPG items.

The Comprehensive Procurement Guideline (CPG) program is part of EPA's continuing effort to promote the use of materials recovered from solid waste. Buying recycled-content products ensures that the materials collected in recycling programs will be used again in the manufacture of new products.The CPG program is authorized by Congress under Section 6002 of the Resource Conservation and Recovery Act (RCRA) and Executive Order 13101.
EPA is required to designate products that are or can be made with recovered materials, and to recommend practices for buying these products. Once a product is designated, procuring agencies are required to purchase it with the highest recovered material content level practicable.

In 1995, EPA issued the first CPG which covered EPA's original 5 procurement guidelines and added 19 products. A CPG update (CPG II), published in November of 1997, designated an additional 12 items. CPG III, designating 19 more items, was proposed in August 1998 and is expected to be finalized in late 1998.

Executive Order 13101

Entitled Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition, Executive Order (E.O.) 13101 was signed on September 14, 1998. This Order replaces E.O. 12873 and reinforces the federal government's buy-recycled efforts. E.O. 13101 establishes a process for amending the CPG originally promulgated under E.O. 12873. E.O. 13101 requires EPA to amend the CPG every 2 years, or as appropriate. The Order also requires EPA to issue RMANs concurrent with the CPG amendments, and to update them periodically.

EPA also issues guidance on buying recycled-content products in Recovered Materials Advisory Notices (RMANs). The RMANs recommend recycled-content ranges for CPG products based on current information on commercially available recycled-content products. RMAN levels are updated as marketplace conditions change.

While directed primarily at executive branch agencies, CPG and RMAN information is helpful to everyone interested in purchasing recycled-content products. Resources about Buying Recycled Products provide information on the Office of Solid Waste publications for government procurement officials on such topics as the federal comprehensive procurement guidelines, buying recycled-content products, and lists of recycled product manufacturers and suppliers.

Resources for Buying Recycled Products

As part of its continuing program to promote the use of products containing recovered materials, EPA issues CPGs and RMANs each year. The CPG is the basis of the federal government buy-recycled program and designates products containing recovered materials for government agencies to purchase. Federal, state, and local government agencies or their contractors that purchase more than $10,000 a year worth of these products must evaluate the feasibility of purchasing these designated products. The following exceptions to the CPG are allowed:

- The cost of the recommended product is unreasonable
- Inadequate competition exists
- Items are not available within a reasonable period of time
- Items do not meet the solicitation's performance standards.

If a building material does not meet the CPG requirements for one or more of the reasons listed above, documentation must be provided. The product designations are organized into eight product categories. The RMANs provide recommendations for purchasing the products designated in the CPG.

Along with the CPG and RMANs published each year, EPA publishes eco-purchasing fact sheets, lists of manufacturers or vendors of the designated products, and technical background and supporting documents that provide more detailed information about each of the designated items. Through use of the guidelines and related information, the federal government hopes to expand its use of products containing recovered materials and to help develop markets for them in other sectors of the economy. Additional resources are provided in Attachment 7.

The products currently designated in the CPG can be found in Attachments 8 and 9. Please note that the entire CPG list may not be applicable to all construction activities, *Construction Products* must be considered while designing and procuring products for inclusion in new construction. Additionally, the products designated in the *Transportation Products, Park and Recreation Products*, and *Landscaping Products* categories may also fall within the realm of new construction.

ENERGY CONSERVATION
ENERGY STAR

Energy Star is a voluntary partnership between the U.S. Department of Energy, the U.S. Environmental Protection Agency, product manufacturers, local utilities, and retailers. Partners help promote energy efficient products by labeling with the Energy Star logo and educating consumers about the benefits of energy efficiency. By choosing Energy Star-labeled products, you'll keep your utility bills down, and help the environment at the same time. The energy considerations must include a life cycle analysis which includes the initial cost, the operation cost, the maintenance costs, the secondary impact costs (residual heat generated which must be overcome by air conditioning), and the disposal cost. While most of Energy Star's programs are geared at homeowners or upgrading existing commercial buildings, their recommendations are equally applicable to new buildings. Specific energy saving measures of individual products are discussed in Attachments 10, 11, and 12. Additionally, a systematic building wide approach to increasing energy efficiency is summarized in Attachment 13. Information on Energy Star Partners can be found in Attachment 14.

Background of Energy Star Buildings

Energy Star Buildings is a voluntary partnership between U.S. organizations and the U.S. Environmental Protection Agency (EPA) to promote energy efficiency in buildings. Organizations that join the partnership follow a proven, cost-effective strategy to save money by reducing the total energy consumption of their buildings. EPA provides participants in Energy Star Buildings with unbiased technical information, customized support services, public relations assistance, and access to a broad range of resources and tools.

U.S. organizations can save $130 billion by 2010 if they take advantage of available, low-cost energy-efficiency opportunities. Most businesses use energy inefficiently, which results in higher energy bills than necessary. By becoming more energy efficient, participating organizations save energy and thus reduce their energy costs while preventing pollution.

Strategy

Like any business decision, the key to successful energy-efficiency upgrades is a well-planned strategy. Energy Star Buildings offers a comprehensive action plan to help you plan, implement, and communicate whole-building efficiency improvements for your organization.

Plan and Benchmark
The first step toward energy savings is to develop an action plan for upgrading your facilities. Energy Star Buildings provides you with tools to set achievable goals and forecast energy savings.

Integrated Approach
The Energy Star Buildings integrated systems approach takes advantage of a building's system interactions to reduce energy consumption. By following this upgrade approach, your organization could realize energy savings of 30 percent or more, whether your facilities include a small retail store or large office buildings. Details of the integrated approach are provided in Attachment 13.

Communicate Your Success
The partnership offers many public relations resources – including strategies, samples, publicity, events, and customized support – to assist you in spreading the word about your energy-efficiency successes both within your organization and among your customers and community.

Accomplishments

As of November 1998…
- 3,000 organizations are participating in the Energy Star Buildings and Green Lights® Partnership
- Cumulatively, they have prevented 35.5 billion pounds of carbon dioxide (CO_2) from being released into the atmosphere as a result of their energy-efficiency upgrades
- This is equal to removing the pollution from 3.5 million cars, or planting 4.9 million acres of trees annually
- And, if that weren't enough, these organizations are saving $593 million in energy bills each year.

Federal Energy Management Program

The mission of the Federal Energy Management Program (FEMP) is to reduce the cost of Government by advancing energy efficiency, water conservation, and the use of solar and other renewable energy.

FEMP accomplishes its mission by creating partnerships, leveraging resources, transferring technology, and providing training and support. Each of these activities is directly related to achieving not only the goals set forth in law and Executive Order, but also those which are inherent in sound management of Federal financial and personnel resources.

The Federal Energy Management Program is a customer-focused organization providing services to other Federal agencies. When FEMP succeeds at its mission, agencies have the skills, the means, and the initiative to undertake projects to use energy and water more efficiently.

In the process of achieving FEMP's mission, it is necessary to provide technical assistance for project identification, alternative methods of financing projects, technical support and training necessary to successfully implement projects, and transfer of knowledge about successful projects to encourage others to achieve additional progress toward the goals.

Additional information on FEMP is available at http://www.eren.doe.gov/femp. Executive Order 12902 which mandates energy efficiency can be found in Attachment 3.

WATER CONSERVATION

Water conservation measures can save millions of Federal dollars

Estimates indicate that Federal-sector expenditures for water and sewer run between $0.5 billion and $1 billion annually, and that the Federal Government could save as much as $240 million per year by installing water conservation measures. Expenditures and potential savings will increase as the cost of water continues to rise. Rates have already increased 100% to 400% in major cities during the past 10 years, and this trend is expected to continue.

The Energy Policy Act of 1992 (EPAct) requires Federal agencies to implement all cost-effective life-cycle water conservation measures with payback periods of less than 10 years. Executive Order 12902, "Energy and Water Efficiency in Federal Facilities," further directs agencies to identify conservation opportunities and install cost-effective conservation measures (see Attachment 3). The U.S. Department of Energy's (DOE's) Federal Energy Management Program (FEMP) is working with Federal agencies to help achieve these goals.

What kinds of projects involve water conservation?

A variety of water conservation technologies and techniques can be used to save water and associated energy costs. They include:

- Water-efficient plumbing fixtures (ultra low-flow toilets and urinals, waterless urinals, low-flow and sensored sinks, low-flow showerheads, and water-efficient dishwashers and washing machines) (see Attachment 15 for detailed information)
- Methods to reduce water use associated with irrigation and landscaping (water-efficient irrigation systems, irrigation control systems, low-flow sprinkler heads, and xeriscape)
- Graywater and process recycling systems that recycle or reuse water
- Methods to reduce water use in heating, ventilating, and air-conditioning equipment.

Other conservation options may also involve leak detection and repair, industrial process improvements, and changing the way fixtures and equipment are operated and maintained.

What services does FEMP provide for water conservation projects?

The Federal Energy Management Program (FEMP) provides technical support to Federal facility managers to help identify opportunities for successful water conservation projects. FEMP's technical assistance program offers a range of services, which include project and financing assistance, software tools, and training.

Project Assistance and Project Financing Assistance

For site-specific projects, FEMP can help plan and develop projects, leverage resources, and provide information on water efficiency technologies. As part of the project-screening process, FEMP has

developed WATERGY, a spreadsheet model that uses water/energy relationship assumptions to estimate potential water and associated energy savings at a facility or building.

The FEMP Water Conservation Program also supports Federal agency use of alternative financing mechanisms. These include Energy Savings Performance Contracting and utility contracts for water conservation projects.

FEMP water conservation projects

FEMP is joining with various Federal agencies, water utilities, equipment manufacturers, and others to work on water conservation projects. Project goals include improving water and energy efficiency, demonstrating water-saving technologies and financing mechanisms for water projects, and reducing environmental impacts.

Case Study: Denver Federal Center

FEMP is working with DOE's National Renewable Energy Laboratory, the General Services Administration, the Bureau of Reclamation, the U.S. Environmental Protection Agency, several manufacturers, and the Denver Water Department (the local utility) to:

- Improve energy and water efficiency
- Deploy U.S.-manufactured water technologies
- Reduce life-cycle costs and improve reliability
- Establish a showcase site to demonstrate technologies and operating practices of water conservation.

Other benefits to Federal agencies

Because of the large amount of energy used to heat, treat, and pump water, significant energy savings result from water conservation projects. In addition to saving water and energy, FEMP's water conservation projects include conservation education, awareness, and support. FEMP strives to work with its partners to communicate the results of projects to Federal agencies, and to identify new potential water conservation projects and partnerships at other Federal facilities.

For more information about FEMP's Water Conservation Program, please contact

FEMP Help Desk
(800) DOE-EREC (363-3732)
Internet: http://www.eren.doe.gov/femp

Federal Energy Management Program, EE-90
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

NATURAL LANDSCAPING

Recently, a new look in landscaping, commonly known as natural landscaping, has been gaining enthusiastic acceptance across the country. Natural landscaping is an aesthetically exciting, ever- changing tapestry of hardy, primarily native plantings well adapted to the local climate and soil. It provides a cost-effective alternative to conventional turf grass lawns. In a 1994 Executive Memorandum, federal agencies are required to use environmentally beneficial landscaping (see Attachment 16).

Benefits of Natural Landscaping

Economic Benefits:

- Reduced costs of landscape installation
- Reduced expense for stormwater management facilities
- Virtually eliminates the need to use water for irrigation (see Attachment 17 for EPA's xeriscape requirements for using vegetation requiring minimal watering)
- While not maintenance free, natural landscaping requires less time and money for ongoing maintenance than conventional landscapes

Environmental Benefits:

- Minimizes the environmentally detrimental effects of pesticides and fertilizers
- Reduces emission of air pollutants from lawn-maintenance equipment
- Reduces noise pollution
- Reduced soil erosion
- Improved water quality

Because regional geological histories and climate vary greatly and are basic to implementing natural landscaping, natural landscaping in each region must be tailored to those unique conditions. Therefore, landscape planners will need to obtain local information in order to understand their specific natural conditions and native vegetation. However, the basic principles and benefits of natural landscaping apply anywhere.

What is Natural Landscaping?

Natural landscaping applies to a wide array of landscaping techniques that help retain natural landscape features, including wetlands, woodlands and natural drainage features. For example, natural landscaping site design incorporates natural drainage features such as swales and vegetated "filter strips" in contrast to storm sewers and artificial drainage channels. Beneficial landscaping is another term in current use that embraces both native and natural landscaping. Beneficial landscaping also includes the use of shading and windbreaks, which reduce heating and cooling needs for buildings.

In returning to a more natural landscape, we will be returning those plants which evolved under our conditions of climatic stress, which require less maintenance and coddling and provide environmental, economic and aesthetic benefits.

How Can Natural Landscaping be Used?

Almost everyone can use natural landscaping. There is no rigid set of rules that dictates how much or what qualifies as natural landscaping or when it is appropriate. The concept embraces a range of opportunities for property owners and managers. Any effort that increases the amount of area devoted to natural landscaping will be of some benefit. It will largely be up to property owners, local officials, planners, engineers, and landscape professionals, to determine where, what kind, and how much.

Native plants can be used in various ways in the landscape

- **Native plants as one part of the landscaping material:**
  Existing or new building sites can use native trees, shrubs and grasses instead of the "exotic" plants typically marketed by nurseries. Native grasses and ground covers may partially replace turf areas. Natural landscaping on commercial properties provides environmental benefits and a distinctive appearance to the building site. Native vegetation used in "ornamental" ways in landscape design can create unusual and attractive effects.

- **Native plants as the principal landscaping material:**
  With careful planning, native plants can constitute the primary landscaping material in new development sites and sites that are being re-landscaped. This approach may be particularly appropriate for office campuses, public facilities and parks, institutions, and clustered residential development. It can realize major environmental improvements and cost savings.

- **Using more vegetation and less concrete and asphalt:**
  The excessive use of concrete, asphalt and other impervious materials in our landscapes causes several environmental problems. It accelerates stormwater runoff and creates flooding and erosion conditions for communities along streams. It results in higher temperatures in urban environments, making the out-of-doors less pleasant and increasing the need for air conditioning. Increasing the use of vegetation -- especially native vegetation -- in our landscaping can reduce damage from stormwater runoff, reduce temperatures, reduce energy costs, improve water quality, and increase wildlife habitat.

Strategies for increasing the amount of permeable surfaces include: reducing street widths, reducing setbacks between buildings and streets, designing smaller parking lots which include island vegetation, and clustering development on part of a site. Unused paved areas can be "unpaved" and natural landscaping installed.

Additional Information

The information on Natural Landscaping was provided by the U.S. EPA's Great Lakes National Program Office. Extensive information is available on their website at http://www.epa.gov/grtlakes/greenacres.

There are several special situations where the natural landscaping approach should be considered. See Attachment 18 for more information.

MILLION SOLAR ROOFS

Million Solar Roofs is an initiative to install solar energy systems on one million U.S. buildings by 2010. It was announced by President Clinton on June 26, 1997 in his speech before the United Nations Session on Environment and Development. This effort includes three types of solar technology -- photovoltaics that produce electricity from sunlight, solar thermal panels that produce heat for domestic hot water, for space heating or for heating swimming pools, and solar thermal walls to precondition recirculated building air, outside air, or ventilation air. Information on these three solar technologies can be found in Attachments 19, 20, and 21.

The program is designed to bring together partners in the building industry, other federal agencies, local and state governments, utilities, the solar energy industry, financial institutions and non-governmental organizations to remove market barriers to solar energy use and develop and strengthen local demand for solar energy products and applications. The Million Solar Roofs Initiative will bring together the resources of the Federal government with key national businesses and organizations and focus them on building a strong market for solar energy applications on buildings.

Goals

The three principal goals of the Initiative are:

- Reduce greenhouse gas and emissions using clean energy from the sun. In 2010, with one million solar energy roofs in place, the Initiative would reduce carbon emissions in an amount equivalent to the annual emissions from 850,000 cars
- Create high-tech jobs in the solar energy industry. By 2010, approximately 70,000 new jobs could be created as a result of the increased demand for photovoltaic, solar water heating and related solar energy systems
- Keep the U.S. solar energy industry competitive. By increasing the domestic market for solar energy, increasing domestic production and reducing the unit cost for solar energy systems, the Initiative will enable U.S. companies to retain their competitive edge in the worldwide market. By 2005, the photovoltaic market alone is expected to exceed $1.5 billion worldwide.

Role of the Federal Government

The Federal sector represents approximately 0.5% of the U.S. building inventory with its 500,000 buildings. These half-million buildings require the Federal government to spend over $3 billion each year for heating, cooling, lighting and powering the operations. During the past twenty years, actions have been taken to reduce that energy bill through energy efficiency investments and the application of renewable energy (including solar) systems on new and existing Federal buildings.

President Clinton has committed the Federal government to install solar electric and solar thermal energy systems on 20,000 Federal buildings by 2010. The U.S. Department of Energy's Federal Energy Management Program will assist Federal agencies to meet that commitment.

The Federal Energy Management Program recently established umbrella contracts with energy service companies to purchase energy efficiency services for Federal buildings. These “Super Energy Savings Performance Contracts” enable all Federal agencies to improve the efficiency of their buildings through cost effective partnerships with the private sector. The next round of procurements will put in place almost $200 million in contracts, which will use private financing to install solar energy systems at Federal facilities and enable Federal agencies to support the Million Solar Roofs Initiative. In addition, the General Services Administration has developed and implemented streamlined procurement procedures for Federal agencies to obtain solar energy systems. The Department of Defense has already installed many solar energy systems on its buildings, including solar hot water systems on Navy housing and a solar space heating system on an Army aviation maintenance facility.

Additional Information

Comprehensive information on the Million Solar Roofs initiative can be found on the Department of Energy’s website at http://www.eren.doe.gov/millionroofs.

The answers to ten frequently asked questions about solar roofs are provided in Attachment 22. A summary of EPA Region 10’s laboratory’s solar project is provided in Attachment 23.

CONSTRUCTION DEBRIS RECYCLING

Estimates by EPA indicate that one-quarter to one-third of the total waste stream consists of construction and demolition (C&D) debris. Recycling and reusing this debris saves money and helps conserve natural resources.

Construction debris is excess material generated during construction projects. Unlike municipal solid waste, the type, amount, and form of construction debris generated varies according to the nature of the activity from which it is generated.

Of the materials found in C&D debris, the following can be readily recycled or reused:

- waste metals
- corrugated cardboard
- concrete
- asphalt
- brick
- wood
- gypsum wallboard
- dirt and fines.

A survey of local C&D processors confirmed that C&D recycling, as an industry, is inherently local. The high cost of transporting C&D debris and processed or used materials dictates that sources, processors, and markets be located within a 25 to 60 mile radius to be economically viable.

Facts about C&D Recycling:

- 70-90% of the material from construction sites is recyclable
- Wood, drywall and cardboard compromise 60-80% of a builder's waste stream.
- As much as 30% of the waste in a job site dumpster can be non-construction waste from recent move-ins and drive by dumping.

Additional Information

Contact *C & D Debris Recycling* magazine, a bimonthly publication at http://www.intertec.com/pubs/cdeb.htm

The above information from EPA Region 3 is located at http://www.epa.gov/reg3wcmd/other_waste.htm.

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INDOOR AIR QUALITY

Most people are aware that outdoor air pollution can damage their health but may not know that indoor air pollution can also have significant effects. EPA studies of human exposure to air pollutants indicate that indoor air levels of many pollutants may be 2-5 times, and on occasion more than 100 times, higher than outdoor levels. These levels of indoor air pollutants are of particular concern because it is estimated that most people spend as much as 90% of their time indoors.

Over the past several decades, our exposure to indoor air pollutants is believed to have increased due to a variety of factors, including the construction of more tightly sealed buildings, reduced ventilation rates to save energy, the use of synthetic building materials and furnishings, and the use of chemically formulated personal care products, pesticides, and household cleaners. For more detailed information on factors affecting indoor air quality and indoor air pollutants, see Attachment 24.

In recent years, comparative risk studies performed by EPA and its Science Advisory Board have consistently ranked indoor air pollution among the top five environmental risks to public health. EPA, in close cooperation with other Federal agencies and the private sector, is actively involved in a concerted effort to better understand indoor air pollution and to reduce people's exposure to air pollutants in offices, homes, schools and other indoor environments where people live, work, and play.

New Buildings

New office buildings need to be built with strict guidelines to reduce pollutants that affect indoor air quality. Detailed indoor air quality requirements are contained in Appendix B of *EPA's Architecture, Engineering, and Planning Guidelines*. According to the guidelines, "the most effective means of indoor air pollution control is to eliminate, reduce, or contain the sources of indoor air pollution. Evidence must be provided that this strategy has been applied to every aspect of the building design, construction requirements, and operational requirements" (Section B.1.1.1.1). Outdoor and indoor pollutant sources must be considered. During construction, many materials may contribute to poor indoor air quality. Particular attention should be paid to the following materials:

- Adhesives
- Sealants
- Caulking
- Wood preservatives and finishes
- Pesticides
- Fungicides
- Carpet
- Carpet padding
- Paints
- Insulations: thermal, fire and acoustic
- Wood paneling
- Gaskets
- Composite wood products such as particle board, cardboard, wafer board, chipboard, etc
- Glazing compounds
- Control joint fillers
- Floor coverings
- Wall coverings
- Ceiling tiles, panels
- Furniture
- Systems furniture.

Additionally, "The design of the HVAC system shall minimize conditions conducive to microbial growth, chemical contamination, and particulate matter releases, and distribution of such within the building."

The new EPA laboratory at Regional Triangle Park incorporated multiple policies to ensure good indoor air (see Attachment 25). EPA and the Architecture and Engineering firm worked to eliminate as many indoor air quality contaminants as possible. They accomplished this by:

- specifying materials with minimal contaminants of concern that also met functional and cost requirements,
- establishing appropriate installation sequences to prevent indoor air quality contaminants from being absorbed into the building,
- requiring extensive indoor air quality testing before building occupancy, and
- incorporating design features to eliminate specific indoor air quality hazards following building occupancy

Attachment 25 further explains these accomplishments and includes definitions of low VOC content levels for construction material and maximum indoor air concentration standards.

U.S. GREEN BUILDING COUNCIL
GREEN BUILDING RATING SYSTEM:
LEED™ "LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN"

The U.S. Green Building Council is the only balanced nonprofit consensus coalition of the building industry, promoting the understanding, development, and accelerated implementation of "Green Building" policies, programs, technologies, standards and design practices. Since its formation in 1993, the U.S. Green Building Council has filled a vital need in the U.S. building industry, becoming the center for debate and action on environmental issues facing the industry's multiple interests. The Council's membership is open and balanced; it is comprised of leading and visionary representation from all segments of the building industry including product manufactures, environmental groups, building owners, building professionals, utilities, city government, research institutes, professional societies and universities.

This type of representation provides a unique integrated platform of carrying out important programs and activities. Through the committee-based organization, the U.S. Green Building Council is endeavoring to move the green building industry forward with market-based solutions, such as a green building rating system. A complete description of LEED™ is provided in Attachment 26.

A Green Building Rating System: Leadership in Energy and Environmental Design

The LEED Green Building™ Rating System is a priority program of the U.S. Green Building Council. It is a voluntary, consensus-based, market-driven building rating system based on existing proven technology that evaluates environmental performance from a "whole building" perspective over a building's life cycle. LEED™ is intended to be a definitive standard for what constitutes a "green building."

The U.S. Green Building Council's LEED Green Building™ Rating System is based on accepted energy and environmental principles and strikes a reasonable balance between known effective practices and emerging concepts. Unlike other rating systems currently in existence, the development of the LEED Green Building™ Rating System has been open to public scrutiny and has involved the participation of virtually all segments of the building industry including product manufacturers, environmental groups, building owners, utilities, state and local governments, research institutions, professional societies and colleges and universities.

LEED™ is a self-certifying system designed for rating new and existing commercial, institutional, and high-rise residential buildings. It is a feature-oriented system where credits are awarded for satisfying each criteria. Different levels of green building certification will be awarded to applicants that earn two thirds of the available credits and meet all prerequisites. The system is designed to be comprehensive in scope, yet simple in operation.

LEED™ Green Building Rating System Criteria

Eligibility
All commercial buildings as defined by standard building codes are eligible for consideration as a LEED™ Building. Commercial occupancies include, but are not limited to: offices, retail and service establishments, institutional buildings (libraries, schools, museums, churches, etc.), hotels and residential buildings of four or more habitable stories. Residential buildings, three habitable stories or less and occupied buildings more than 3 years old as of January 1, 1998, will be covered under separate USGBC rating systems.

LEED™ Green Building Rating System Credits

Applicants must meet all of the Prerequisites as well as score the requisite number of points in the desired LEED Building™ category.

A total of **44 credits**, plus **4 bonus credits** are available. Bonus credits may be counted toward certification. In addition, the USGBC will present an award for the "Green Building of the Year" for the LEED Building™ with the highest score of the year.

LEEDs Rating Criteria

A total of **44 credits**, plus **4 bonus credits** is available. Bonus credits may be counted toward certification.

1. LEED Building Platinum™: for buildings that earn 81% (35) or more of the available credits.
2. LEED Building Gold™: for buildings that earn 71-80% (31-34) of the available credits.
3. LEED Building Silver™: for buildings that earn 61-70% (27-30) of the available credits.
4. LEED Building Bronze™: for buildings that earn 50-60% (22-26) of the available credits.

Prerequisites - All buildings must comply with the following prerequisites:

Asbestos Avoidance or Management
Building Commissioning
Elimination of CFC's
Energy Efficiency
Erosion Control
Indoor Air Quality
Smoking Ban
Storage & Collection of Occupant Recyclables
Thermal Comfort
Water Conservation
Water Quality--Lead

Credit Categories

Building Materials	(7 Credits)	Occupant Recycling Equipment	(1 Credit)
Construction Waste Management	(2 Credits)	Ozone Depletion/CFCs	(2 Credits)
Energy	(10 Credits)	Siting	(3 Credits)
Existing Building Rehabilitation	(2 Credits)	Transportation	(3 Credits)
Indoor Air Quality	(3 Credits)	Water Conservation	(4 Credits)
Landscaping	(3 Credits)	Water Quality	(2 Credits)

ACCOUNTABILITY AND REPORTING

The purpose of the Green Programs Information Packet is to provide details on EPA's programs that promote environmentally and economically sound building practices and energy efficiency. The Green Rider requires the offeror to document the evaluations of green practices and product selections to determine why specific concepts were or were not chosen. By requiring documentation, EPA and GSA can evaluate their green building recommendations to determine which practices are most beneficial. Additionally, all federal agencies must report to the President their Greening the Government accomplishments. The scope of the reporting requirements includes improvements in waste prevention and recycling (Executive Order 13101), reduction in ozone depleting substances (Executive Order 12843), and energy efficiency and water conservation (Executive Order 12902).

Life Cycle Assessment

Selection of building products is based on performance and cost factors. Most important, all building products must perform their necessary functions. When multiple products will perform the necessary function, selection is based on cost factors. A cost analysis of a product that only compares initial costs does not account for any future cost of operation and maintenance. A life cycle cost assessment includes all of the costs associated with a product during the entire life of the building. To calculate a life cycle cost, add the costs of the following:

- initial cost of the product
- installation of the product
- operation of the product for the lifetime of the building (including energy costs, water costs, labor costs, and costs due to increased heating and cooling loads)
- maintenance of the product for the lifetime of the building (including replacement costs)

Material selection and energy and water conservation issues should be evaluated by life cycle assessments, as detailed below. Documentation of life cycle analyses should be submitted to GSA within 30 days of a decision being made.

Environmentally Preferred Products

Environmentally Preferred Products have a lesser or reduced affect on human health and the environment when compared to other products and services that serve the same purpose. All federal procurement officials are required by Executive Order 13101 and the Federal Acquisition Regulation (FAR) to assess and give preference to those products and services that are environmentally preferable. The Building for Environmental and Economic Sustainability (BEES) software can easily compute life cycle cost assessments very quickly and easily for a wide range of building products. The offeror must document the environmental benefits of building products selected. If the offeror does not use Environmentally Preferred Products, the rational must be documented.

Comprehensive Procurement Guidelines

US EPA's Comprehensive Procurement Guidelines (CPG) contain detailed information on the recycled content of numerous building materials. The guidelines recommend recycled content levels for each material. Procuring agencies are required by Executive Order 13101 to purchase material with the highest recovered material content level practical. The following exceptions to the CPG are allowed:

- The cost of the recommended product is unreasonable
- Inadequate competition exists
- Items are not available within a reasonable period of time
- Items do not meet the solicitation's performance standards

The offeror must document the recycled content or other environmental benefit of the building materials. If a building material does not meet the CPG requirements for one or more of the reasons listed above, documentation must be provided. The documentation must clearly state which exemption is used, the rational for using an exemption, and the environmental benefit or recycled content of the product selected.

Energy Conservation

Energy conservation is an economically and environmentally sound practice. When viewed over the lifetime of the building, energy conservation can save a significant amount of money. Executive Order 12902 requires federal agencies to greatly increase their energy efficiency. Energy conservation shall be considered for all products that consume energy or increase the heating and cooling needs of a building. Many specific energy conservation measures are required in the SFO and should be incorporated into a building-wide energy conservation plan. The offeror should provide documentation of energy conservation measures. Attachments 10, 11, and 12 provide examples of life cycle assessments.

Water Conservation

Similar to energy conservation, water conservation becomes economically desirable when considering costs over the lifetime of the building. Executive Order 12902 requires federal agencies to implement all cost-effective water conservation measures. Water conservation shall be considered (as specified in the SFO) for all products that use water. The offeror should provide documentation of water conservation measures. See Attachment 15 for examples of life cycle assessments of water conserving measures.

Natural Landscaping

Natural Landscaping is the use of native plants in landscaping. Native plants require less watering and use fewer pesticides and fertilizers. The SFO mandates the use of hardy, indigenous plants. The offeror must document the use of natural landscaping.

Solar Applications – President's Million Solar Roofs

Decisions regarding solar applications should be considered by a life cycle cost analysis. While the initial costs of solar applications may be considerable, their operation and maintenance are minimal. During their lifetime, they provide free energy to the building during daylight hours. The offeror must provide documentation to explain why solar applications were or were not used.

Construction Debris Recycling

Most construction debris can be recycled or reused rather than landfilled. Recycling and reusing helps conserve natural resources and can save money, so it is strongly recommended whenever feasible. Documentation of construction debris recycling or reusing is strongly encouraged

Indoor Air Quality

EPA's Facilities Manual: Architecture, Engineering, and Planning Guidelines, Appendix B contains detailed requirements concerning indoor air quality. Construction should limit indoor air pollutants to the greatest extent possible. The effects of building materials on indoor air quality should be documented according to the requirements of Section B.1.2.3 of *EPA's Facilities Manual*. Upon completion, it must be documented that the building has met indoor air quality standards.

Leadership in Energy and Environmental Design (LEED™)

The LEED Green Building™ Rating System is a consensus-based, market-driven building rating system based on existing proven technology that evaluates environmental performance from a "whole building" perspective over a building's life cycle. LEED™ is intended to be a definitive standard for what constitutes a "green building." The building must obtain, at a minimum, the LEED Building Gold™ certification by earning at least 71% (31) of the available criteria points. The offeror must provide supporting documentation that demonstrates its participation in the LEED™ Rating System (e.g., a notebook detailing how the building earned LEED™ criteria points).

Overall Documentation of Green Building Concepts

In cooperation with GSA and EPA, the offeror must prepare a document for publication that outlines green aspects of the building. The document will summarize environmental concepts used in the building and discuss difficulties encountered and solutions developed. By requiring documentation, EPA and GSA can evaluate their green building recommendations to determine which practices are most beneficial. Additionally, all federal agencies must report their Greening the Government accomplishments to the President. The scope of the reporting requirements includes improvements in waste prevention and recycling (Executive Order 13101), reduction in ozone depleting substances (Executive Order 12843), and energy efficiency and water conservation (Executive Order 12902). In order to meet our reporting requirements for these Executive Orders, the offeror must provide documentation, as described above, on the following programs:

- Environmentally Preferred Products
- Comprehensive Procurement Guidelines
- Energy Conservation
- Water Conservation
- Natural Landscaping
- Indoor Air Quality
- Leadership in Energy and Environmental Design (LEED™).

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ATTACHMENT 1

EPA FACILITIES MANUAL, VOLUME 1
ARCHITECTURE, ENGINEERING, AND PLANNING GUIDELINES:
SECTION 1 - GENERAL PLANNING AND DESIGN DATA

February 1998

1.5.9 ENVIRONMENTAL DESIGN REQUIREMENTS

The facility shall be designed to conserve energy, to avoid the use of construction materials insensitive to the environment, to efficiently utilize water, to promote effective recycling, to be free of radon, to have excellent indoor air quality, and to avoid the use of ozone-depleting chemicals.

1.5.9.1 GENERAL

The architectural and engineering design of the facility shall use proven methods, strategies, and technologies exhibiting respect for, and protection of, the environment. These methods, strategies, and technologies include the selection of site, materials, and construction systems that prevent infiltration of radon; to the extent possible, the use of recycled construction materials and construction materials produced with minimal expenditure of energy; and use of insulation, fire protection, and refrigeration systems that avoid use of chlorofluorocarbons (CFCs) and other ozone-depleting chemicals. The facility shall also be designed to promote the use of natural light and to afford optimum use of energy-efficient lighting systems (e.g., ballasts, task lighting). The facility shall be designed to meet the requirements of the EPA Internal Pollution Prevention Program. All EPA buildings should be designed to meet ecological design criteria, which include maximum use of natural light, Green Lighting, light fixtures operated by sensors, recycled material, and other devices that save energy without jeopardizing safety. This section of the project-specific manual should state that the facility design must meet the requirements of the following Executive Orders and Memorandum: Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements; Executive Order 12873, Federal Acquisition, Recycling and Waste Prevention; Executive Order 12902, Energy Efficiency and Water Conservation at Federal Facilities; Executive Order 12843, Procurement Requirements and Policies for the Federal Agencies for Ozone-Depleting Substances; Executive Order 12845, Requiring Agencies to Purchase Energy Efficient Computer Equipment; the presidential memorandum on environmentally beneficial landscaping; or any subsequent or superseding Executive Order relating to the protection of the environment.

1.5.9.2 ENERGY-CONSCIOUS DESIGN

Fundamental design decisions related to energy conservation shall be made during the planning stages. The new design shall utilize passive design techniques to minimize heating and cooling loads. These techniques include:

- Siting of facilities in relation to sun path, wind, and vegetation.
- Efficient design of building form and envelope in response to climate.

- Reducing cooling load through use of daylighting.

- The use of natural but controlled daylighting shall be maximized to the extent that it does not conflict with other EPA energy conservation objectives. EPA values natural light and considers it part of a good working environment. The building organization and design concept shall consider bringing natural light into personnel spaces.
- Size, number, and location of windows shall be determined on the basis of need for natural light and ventilation and of other energy considerations. All windows in heated or air-conditioned spaces shall be double-glazed, insulated windows. Low E glass should be used for all exterior windows. Laboratory windows shall be fixed-pane, nonoperative windows. In an air-conditioned building where office windows are operative, these windows must have a removable operating handle.
  - Reducing solar heat gains through proper design of solar-shading devices combined with proper selection and location of building materials. Laboratory windows in particular are sensitive to solar gain and should be shaded on the exterior from direct rays with efficient devices.
  - HVAC systems designed for an integrated, energy-conserving facility. In addition, the new facility shall meet energy efficiency standards set by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE 90-1, 1989) for new buildings. The building design, and all construction features (materials and methods of installation, including mechanical and electrical systems) shall provide concepts that will reflect reduced energy consumption.

1.5.9.3 CONSTRUCTION MATERIALS

EPA wishes to take a very active role in the selection of the materials used in the project and during the construction process. In this regard, the design professional, in close coordination with EPA, shall carefully examine the environmental sensitivity of materials and products specified for construction and build-out for the new facility. EPA will encourage minimal use of products that are insensitive to the environment during and after manufacture.

1.5.9.3.1 MATERIALS TO BE AVOIDED AND/OR NOT USED

These materials are as follows:

- Insulation containing CFCs and other refrigerants harmful to the environment.
- Products that off-gas chemical pollutants and whose presence is hazardous (e.g., formaldehyde-treated materials, especially materials containing urea-formaldehyde). (See also EPA/400/1-91/033, Building Air Quality: A Guide for Building Owners and Facility Managers, December 1991.)
- Products that are not biodegradable when repaired or removed.
- Products that contain asbestos.
- Lead-containing plumbing, lead-based solder, lead-soldered tanks and valves. These should not be used for potable drinking water supplies. Drinking water plumbing products (faucets, values, fittings, piping, etc.) shall be prohibited from use in EPA facilities unless they bear the National Sanitation Foundation (NSF) standard 61 certifying mark indicating compliance with USEPA Safety Drinking Water Act.

1.5.9.3.2 MATERIALS TO USE

Materials must meet the following requirements:

- Interior architectural systems must be made of nontoxic materials and components and be free of asbestos, lead-based paints, and toxic fumes. (See the SFO's *EPA Facilities Manual, Volume 4, Facility Safety, Health, and Environmental Management*.)

- Materials should minimize the depletion of natural resources and should not require a high energy input to produce.
- Sanitation finishes shall be nonpermeable, noncorrosive, easily cleaned, and easily maintained.

1.5.9.3.3 RECYCLED CONSTRUCTION MATERIALS

Under Section 6002 of the Resource Conservation and Recovery Act (RCRA), EPA has set guidelines, which apply to federal, state, and local procuring agencies using appropriated federal funds, for purchasing items composed of the highest practicable percentage of recovered materials. EPA wishes its facility to follow the guidelines, Procurement of Building Insulation Products Containing Recovered Materials, 40 CFR Part 248, February 17, 1989, and Cement and Concrete Containing Fly Ash, 40 CFR Part 249, January 28, 1983, within the constraints of cost and required technical performance.

1.5.9.3.4 BUILDING SHELL MATERIALS

The external treatment and materials utilized shall be of proven long-term durability and require minimum maintenance. The quality of materials shall be consistent with the image and dignity appropriate to a U.S. agency. Material selection should be based on an anticipated 100-year life cycle.

1.5.9.4 RECYCLING

The facility shall be designed to support an aggressive solid waste management plan. The facility design shall properly locate, and provide for, spaces that facilitate the collection, separation, compaction, storage, and shipment of all recyclable materials. General office space, freight elevator area, shipping and storage area, and loading docks shall be designed with this important activity in mind.

1.5.9.5 RADON ABATEMENT

EPA seeks to limit the presence of radon and radon daughters in the new facility. Site geological surveys shall be carefully examined to obtain predictive radon infiltration data from subgrade geological structures. Building materials, such as concrete aggregate and stone, shall be selected from sources with low probabilities of radioactivity. The level of activity in any area of the building shall not exceed 4 picocuries per liter (pCi/L) of air. In areas known to have high radon in structures, buildings shall be designed to include preventive techniques such as caulking of all joints between concrete slab and walls below grade, caulking of all pipe penetrations, and venting of all nonoccupied spaces below grade.

1.5.9.6 ELECTROMAGNETIC FIELDS

EPA seeks to limit the presence of electromagnetic fields (EMFs) in close proximity to people within the new facility. Prudent avoidance is required in the routing of electrical power. EPA recommends that the routing of power throughout the facility be well away from people and offices; for instance, elevator electrical chases and other electrical chases should be located away from offices and on exterior walls.

1.5.9.7 WATER CONSERVATION

EPA requires that the design of new facilities minimize water consumption through the use of water-saving measures. The facility design shall make use of gray-water recycling where feasible, flow-restricting spray nozzles for faucets and showers, and low-flow flushments for fixtures, and shall optimize the sizing of all plumbing systems.

1.5.9.8 OZONE DEPLETION PROTECTION

Any contribution to depletion of the ozone layer of the geosphere by the use of CFCs will be discouraged. EPA requires that selection of materials and processes using CFCs be consistent with the guideline goals related to Protection of Stratosphere Ozone, 40 CFR Part 82, August 1988.

1.5.9.8.1 CHLOROFLUOROCARBONS

Current recommendations, guidelines, and requirements shall be reviewed and addressed.

1.5.9.8.2 REFRIGERANTS

Equipment in an EPA facility may use any significant new alternatives policy (SNAP) approved refrigerant with zero ozone depletion potential for electrically driven screw or centrifugal chiller designs. (See Chapter 7 of *EPA Facilities Manual, Volume 4, Facility Safety, Health, and Environmental Management*.) In addition, a design professional shall specify which portable refrigerant reclamation/recycling unit is used with each refrigeration system, excluding water-cooled centrifugal chillers. Ventilation requirements for the chiller plant(s), new or existing, shall comply with ASHRAE standard 15-1991, Safety Standard for Mechanical Refrigeration.

1.5.9.8.3 HALON

Use of halon for fire protection systems is prohibited. To obtain the most current list of alternatives approved under SNAP, call the Stratospheric Ozone Protection Hotline at 1-800-296-1996 or access the associated Internet site at http://www.epa.gov/docs/ozone/title6/snap/snap.html.

1.5.9.8.4 INSULATION

All work shall be done in accordance with EPA's recommended uses of hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) in replacing CFC-based insulation. (See also Chapter 7 of *EPA Facilities Manual, Volume 4, Facility Safety, Health, and Environmental Management*.)

1.5.9.9 INDOOR AIR QUALITY REQUIREMENTS

Refer to Appendix B of the *EPA Facilities Manual, Volume 1, Architecture, Engineering, and Planning Guidelines* for the indoor air quality requirements.

SECTION 16 - ELECTRICAL REQUIREMENTS

16.5 INTERIOR LIGHTING SYSTEM

16.5.2 LIGHTING CONTROLS

Switches shall be provided to control lighting in all areas. Large rooms (more than 200 square feet) shall have multiple switching to reduce the lighting level by approximately half.

16.5.2.1 DAYLIGHT-LEVEL SENSORY CONTROLS

In building areas (except laboratories) that are larger than 200 square feet and that will have a large contribution of natural daylight, daylight-level sensory controls shall be used to control lighting levels.

16.5.2.2 BUILDING AUTOMATION SYSTEMS

In buildings with building automation systems (BAS), the BAS (in addition to light switches) shall control overall building lighting. Each floor shall be a separate control zone with appropriate subzoning of each floor for special functions.

16.5.2.3 OCCUPANCY SENSORS

Occupancy sensors shall be provided (in addition to switches) to control lighting in offices and smaller rooms, bath and locker areas, and conference rooms.

16.5.3 LAMPS AND BALLASTS

Electrical discharge lamps and high-intensity discharge (HID) lamps should be the primary lamps considered in the selection of the illumination concept. The lighting system shall use, to the maximum extent feasible, energy-efficient fixtures with electronic high-frequency ballasts, T-8 fluorescent lamps, and high-quality light reflectors and lenses. The use of filament light sources should be kept to an absolute minimum (i.e., only in spaces that do not have a need for high levels of illumination, that are normally occupied only for short durations, and for which discharge lamps are not suitable). Where fluorescent lamps will be utilized, these lamps shall be of the T-8 type to conserve energy.

16.5.3.1 INDOOR HID LIGHTING

In using HID lighting indoors, the required color rendition shall be carefully considered from both visual and health safety perspectives.

16.5.3.2 BALLASTS

All ballasts to be used on this project shall be of the energy-saving type (electronic high-frequency ballasts shall be used in all possible locations).

16.5.3.3 LIGHT FIXTURE SELECTION

The selection of light fixtures should involve careful consideration of the quality of construction, ease of maintenance, ease of relamping, efficiency, illumination characteristics, mounting technique, and special purpose characteristics (e.g., vaporproof, explosion-proof, elimination of radio frequency interferences).

16.5.5 ENERGY CONSERVATION

EPA seeks to minimize energy use dedicated to electric lighting and the resulting cooling loads through proper use of natural lighting in the facility. In effect, it seeks a well-integrated lighting system for its new buildings that makes optimum use of both natural and artificial lighting sources and balances the buildings' heating and cooling needs. A lighting-power budget shall be determined, in conformance with ASHRAE 90, and strictly adhered to in the design of the lighting for each facility. This budget may be exceeded in laboratory areas and in shops where a higher level of illumination is required because of the type of work being performed.

16.5.6 GREEN LIGHTS

All design of lighting for EPA facilities shall be in accordance with the EPA Green Lights Program.

ATTACHMENT 2

EXECUTIVE ORDER 13101:
GREENING THE GOVERNMENT THROUGH WASTE PREVENTION, RECYCLING, AND FEDERAL ACQUISITION

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Solid Waste Disposal Act, Public Law 89-272, 79 Stat. 997, as amended by the Resource Conservation and Recovery Act (RCRA), Public Law 94-580, 90 Stat. 2795, as amended (42 U.S.C. 6901-6907), section 301 of title 3, United States Code, and in order to improve the Federal Government's use of recycled products and environmentally preferable products and services, it is hereby ordered as follows:

PART 1--PREAMBLE

Section 101. Consistent with the demands of efficiency and cost effectiveness, the head of each executive agency shall incorporate waste prevention and recycling in the agency's daily operations and work to increase and expand markets for recovered materials through greater Federal Government preference and demand for such products. It is the national policy to prefer pollution prevention, whenever feasible. Pollution that cannot be prevented should be recycled; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner. Disposal should be employed only as a last resort.

Sec. 102. Consistent with policies established by the Office of Federal Procurement Policy (OFPP) Policy Letter 92-4, agencies shall comply with executive branch policies for the acquisition and use of environmentally preferable products and services and implement cost-effective procurement preference programs favoring the purchase of these products and services.

Sec. 103. This order creates a Steering Committee, a Federal Environmental Executive (FEE), and a Task Force, and establishes Agency Environmental Executive (AEE) positions within each agency, to be responsible for ensuring the implementation of this order. The FEE, AEEs, and members of the Steering Committee and Task Force shall be full-time Federal Government employees.

PART 2--DEFINITIONS

For purposes of this order:

Sec. 201. “Environmentally preferable” means products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product or service.

Sec. 202. “Executive agency” or “agency” means an executive agency as defined in 5 U.S.C. 105. For the purpose of this order, military departments, as defined in 5 U.S.C. 102, are covered under the auspices of the Department of Defense.

Sec. 203. “Postconsumer material” means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. “Postconsumer material” is a part of the broader category of “recovered material.”

Sec. 204. “Acquisition” means the acquiring by contract with appropriated funds for supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract.

Sec. 205. “Recovered materials” means waste materials and by-products that have been recovered or diverted from solid waste, but such term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process (42 U.S.C. 6903 (19)).

Sec. 206. “Recyclability” means the ability of a product or material to be recovered from, or otherwise diverted from, the solid waste stream for the purpose of recycling.

Sec. 207. “Recycling” means the series of activities, including collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use in the form of raw materials in the manufacture of new products other than fuel for producing heat or power by combustion.

Sec. 208. “Waste prevention” means any change in the design, manufacturing, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they are discarded. Waste prevention also refers to the reuse of products or materials.

Sec. 209. “Waste reduction” means preventing or decreasing the amount of waste being generated through waste prevention, recycling, or purchasing recycled and environmentally preferable products.

Sec. 210. “Life cycle cost” means the amortized annual cost of a product, including capital costs, installation costs, operating costs, maintenance costs, and disposal costs discounted over the lifetime of the product.

Sec. 211. “Life cycle assessment” means the comprehensive examination of a product's environmental and economic aspects and potential impacts throughout its lifetime, including raw material extraction, transportation, manufacturing, use, and disposal.

Sec. 212. “Pollution prevention” means “source reduction” as defined in the Pollution Prevention Act of 1990 (42 U.S.C. 13102), and other practices that reduce or eliminate the creation of pollutants through: (a) increased efficiency in the use of raw materials, energy, water, or other resources; or (b) protection of natural resources by conservation.

Sec. 213. “Biobased product” means a commercial or industrial product (other than food or feed) that utilizes biological products or renewable domestic agricultural (plant, animal, and marine) or forestry materials.

Sec. 214. “Major procuring agencies” shall include any executive agency that procures over $50 million per year of goods and services.

PART 3--THE ROLES AND DUTIES OF THE STEERING COMMITTEE, FEDERAL ENVIRONMENTAL EXECUTIVE, TASK FORCE, AND AGENCY ENVIRONMENTAL EXECUTIVES

Sec. 301. Committees, Executives, and Task Force. (a) Steering Committee. There is hereby established a Steering Committee on Greening the Government through Waste Prevention and Recycling ("Steering Committee"). The Steering Committee shall be composed of the Chair of the Council on Environmental Quality (CEQ), the Federal Environmental Executive (FEE), and the Administrator for Federal Procurement Policy (OFPP). The Steering Committee, which shall be chaired by the Chair of the CEQ, is directed to charter a Task Force to facilitate implementation of this order, and shall provide the Task Force with policy direction in such implementation.

(b) Federal Environmental Executive. A Federal Environmental Executive, Environmental Protection Agency, shall be designated by the President. The FEE shall chair the Task Force described in subsection (c), take all actions necessary to ensure that the agencies comply with the requirements of this order, and generate a biennial report to the President.

(c) Task Force. The Steering Committee shall charter a Task Force on Greening the Government through Waste Prevention and Recycling ("Task Force"), which shall be chaired by the FEE and composed of staff from the major procuring agencies. The Steering Committee, in consultation with the agencies, shall determine the necessary staffing and resources for the Task Force. The major procuring agencies shall provide, to the extent practicable and permitted by law, resources and support to the Task Force and the FEE, upon request from the Steering Committee. The Task Force shall have the duty of assisting the FEE and the agencies in implementing this order, subject to policy direction provided by the Steering Committee. The Task Force shall report through the FEE to the Chair of the Steering Committee.

(d) Agency Environmental Executives (AEEs). Within 90 days after the date of this order, the head of each major procuring agency shall designate an AEE from among his or her staff, who serves at a level no lower than the Assistant Secretary level or equivalent, and shall notify the Chair of CEQ and the FEE of such designation.

Sec. 302. Duties.

(a) The Federal Environmental Executive. The FEE, working through the Task Force, and in consultation with the AEEs, shall:

(1) Develop a Government-wide Waste Prevention and Recycling Strategic Plan ("Strategic Plan") to further implement this order. The Strategic Plan should be initially developed within 180 days of the date of this order and revised as necessary thereafter. The Strategic Plan should include, but is not limited to, the following elements:

(a) direction and initiatives for acquisition of recycled and recyclable products and environmentally preferable products and services;

(b) development of affirmative procurement programs;

(c) review and revision of standards and product specifications;

(d) assessment and evaluation of compliance;

(e) reporting requirements;

(f) outreach programs to promote adoption of practices endorsed in this order; and

(g) development and implementation of new technologies that are of environmental significance.

(2) Prepare a biennial report to the President on the actions taken by the agencies to comply with this order. The report also may incorporate information from existing agency reports regarding Government-wide progress in implementing the following Executive Orders: 12843, Procurement Requirements and Policies for Federal Agencies for Ozone Depleting Substances; 13031, Federal Alternative Fueled Vehicle Leadership; 12845, Requiring Agencies to Purchase Energy Efficient Computer

Equipment; 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements; 12902, Energy Efficiency and Water Conservation at Federal Facilities; and 12969, Federal Acquisition and Community Right-to-Know.

(3) In coordination with the Office of Federal Procurement Policy, the Environmental Protection Agency (EPA), the General Services Administration (GSA), and the Department of Agriculture (USDA), convene a group of acquisition/procurement managers and environmental State, and local government managers to work with State and local governments to improve the Federal, State, and local governments' use of recycled products and environmentally preferable products and services.

(4) Coordinate appropriate Government-wide education and training programs for agencies.

(5) Establish committees and work groups, as needed, to identify, assess, and recommend actions to be taken to fulfill the goals, responsibilities, and initiatives of the FEE. As these committees and work groups are created, agencies are requested to designate appropriate personnel in the areas of procurement and acquisition, standards and specifications, electronic commerce, facilities management, pollution prevention, waste prevention, recycling, and others as needed to staff and work on these initiatives. An initial group shall be established to develop recommendations for tracking and reporting requirements, taking into account the costs and benefits of such tracking and reporting. The Steering Committee shall consult with the AEEs before approving these recommendations.

(b) Agency Environmental Executives. The AEEs shall:

(1) translate the Government-wide Strategic Plan into specific agency and service plans;

(2) implement the specific agency and service plans;

(3) report to the FEE on the progress of plan implementation;

(4) work with the FEE and the Task Force in furthering implementation of this order; and

(5) track agencies' purchases of EPA-designated guideline items and report agencies' purchases of such guideline items to the FEE per the recommendations developed in subsection 302(a)(5) of this order. Agency acquisition and procurement personnel shall justify in writing to the file and to the AEE the rationale for not purchasing such items, above the micropurchase threshold (as set out in the Office of Federal Procurement Policy Act at 41 U.S.C. 428), and submit a plan and timetable for increasing agency purchases of the designated item(s).

(6) one year after a product is placed on the USDA Biobased Products List, estimate agencies' purchases of products on the list and report agencies' estimated purchases of such products to the Secretary of Agriculture.

PART 4--ACQUISITION PLANNING, AFFIRMATIVE PROCUREMENT PROGRAMS, AND FEDERAL FACILITY COMPLIANCE

Sec. 401. Acquisition Planning. In developing plans, drawings, work statements, specifications, or other product descriptions, agencies shall consider, as appropriate, a broad range of factors including: elimination of virgin material requirements; use of biobased products; use of recovered materials; reuse of product; life cycle cost; recyclability; use of environmentally preferable products; waste prevention (including toxicity reduction or elimination); and ultimate disposal. These factors should be considered in acquisition planning for all procurement and in the evaluation and award of contracts, as appropriate. Program and acquisition managers should take an active role in these activities.

Sec. 402. Affirmative Procurement Programs.

(a) The head of each executive agency shall develop and implement affirmative procurement programs in accordance with section 6002 of RCRA (42 U.S.C. 6962) and this order and consider use of the procurement tools and methods described in 7 U.S.C. 5909. Agencies shall ensure that responsibilities for preparation, implementation, and monitoring of affirmative procurement programs are shared between

the program personnel and acquisition and procurement personnel. For the purposes of all purchases made pursuant to this order, EPA, in consultation with such other executive agencies as appropriate, shall endeavor to maximize environmental benefits, consistent with price, performance, and availability considerations, and constraints imposed by law, and shall adjust solicitation guidelines as necessary in order to accomplish this goal.

(b) Agencies shall establish affirmative procurement programs for all EPA-designated guideline items purchased by their agency. For newly designated items, agencies shall revise their internal programs within 1 year from the date the EPA designated the new items.

(c) Exclusive of the biobased products described in section 504, for the EPA-designated guideline items, which are contained in 40 CFR part 247, and for all future designated guideline items, agencies shall ensure that their affirmative procurement programs require 100 percent of their purchases of products to meet or exceed the EPA guideline unless written justification is provided that a product is not available competitively within a reasonable time frame, does not meet appropriate performance standards, or is only available at an unreasonable price. Written justification is not required for purchases below the micropurchase threshold. For micropurchases, agencies shall provide guidance regarding purchase of EPA-designated guideline items. This guidance should encourage consideration of aggregating purchases when this method would promote economy and efficiency.

(d) Within 90 days after the date of this order, the head of each executive agency that has not implemented an affirmative procurement program shall ensure that the affirmative procurement program has been established and is being implemented to the maximum extent practicable.

Sec. 403. Federal Facility Compliance.

(a) Within 6 months of the date of this order, the Administrator of the EPA shall, in consultation with the Federal Environmental Executive, prepare guidance for use in determining Federal facility compliance with section 6002 of RCRA and the related requirements of this order.

(b) EPA inspections of Federal facilities conducted pursuant to RCRA and the Federal Facility Compliance Act and EPA “multi-media” inspections carried out at Federal facilities will include, where appropriate, evaluation of facility compliance with section 6002 of RCRA and any implementing guidance.

(c) Where inspections of Federal facilities are carried out by authorized States pursuant to RCRA and the Federal Facility Compliance Act, the Administrator of the EPA will encourage those States to include evaluation of facility compliance with section 6002 of RCRA in light of EPA guidance prepared pursuant to subsection (a), where appropriate, similar to inspections performed by the EPA. The EPA may provide information and technical assistance to the States to enable them to include such considerations in their inspection.

(d) The EPA shall report annually to the Federal Environmental Executive on the results of inspections performed by the EPA to determine Federal facility compliance with section 6002 of RCRA not later than February 1st for those inspections conducted during the previous fiscal year.

PART 5--STANDARDS, SPECIFICATIONS, AND DESIGNATION OF ITEMS

Sec. 501. Specifications, Product Descriptions, and Standards. When developing, reviewing, or revising Federal and military specifications, product descriptions (including commercial item descriptions), and standards, executive agencies shall consider recovered materials and any environmentally preferable purchasing criteria developed by the EPA, and ensure the criteria are complied with in developing or revising standards. Agencies shall report annually to the FEE on their compliance with this section for incorporation into the biennial report to the President referred to in section 302(a)(2) of this order.

(a) If an inconsistency with section 6002 of RCRA or this order is identified in a specification, standard, or product description, the FEE shall request that the Environmental Executive of the pertinent agency advise the FEE as to why the specification cannot be revised or submit a plan for revising it within

60 days.

(b) If an agency is able to revise an inconsistent specification but cannot do so within 60 days, it is the responsibility of that AEE to monitor and implement the plan for revising it.

Sec. 502. Designation of Items that Contain Recovered Materials. In order to expedite the process of designating items that are or can be made with recovered materials, the EPA shall use the following process for designating these items in accordance with section 6002(e) of RCRA.

(a) The EPA shall designate items that are or can be made with recovered material, by promulgating amendments to the Comprehensive Procurement Guideline (CPG). The CPG shall be updated every 2 years or as appropriate after an opportunity for public comment.

(b) Concurrent with the issuance of the CPG, the EPA shall publish for comment in the Federal Register Recovered Materials Advisory Notices that present the range of recovered materials content levels within which the designated items are currently available. These levels shall be updated periodically, after opportunity for public comment, to reflect changes in market conditions.

(c) Once items containing recovered materials have been designated by the EPA in the CPG, agencies shall modify their affirmative procurement programs to require that, to the maximum extent practicable, their purchases of products meet or exceed the EPA guidelines unless written justification is provided that a product is not available competitively, not available within a reasonable time frame, does not meet appropriate performance standards, or is only available at an unreasonable price.

Sec. 503. Guidance on Acquisition of Environmentally Preferable Products and Services.

(a) The EPA shall develop guidance within 90 days from the date of this order to address environmentally preferable purchasing. The guidance may be based on the EPA's September 1995 Proposed Guidance on the Acquisition of Environmentally Preferable Products and Services and comments received thereon. The guidance should be designed for Government-wide use and targeted towards products and services that have the most effect. The guidance may also address the issues of use of the technical expertise of nongovernmental entities and tools such as life cycle assessment in decisions on environmentally preferable purchasing. The EPA shall update this guidance every 2 years, or as appropriate.

(b) Agencies are encouraged to immediately test and evaluate the principles and concepts contained in the EPA's Guidance on the Acquisition of Environmentally Preferable Products and Services through pilot projects to provide practical information to the EPA for further updating of the guidance. Specifically:

(1) These pilot projects shall be focused around those product and service categories, including printing, that have wide use within the Federal Government. Priorities regarding which product and service categories to pilot shall be developed by the individual agencies and the EPA, in consultation with the OFPP, the FEE, and the appropriate agency procurement executives. Any policy disagreements shall be resolved by the Steering Committee.

(2) Agencies are encouraged to use all of the options available to them to determine the environmentally preferable attributes of products and services in their pilot and demonstration projects, including the use of technical expertise of nongovernmental entities such as labeling, certification, or standards-developing organizations, as well as using the expertise of the National Institute of Standards and Technology.

(3) Upon request and to the extent practicable, the EPA shall assist executive agencies in designing, implementing, and documenting the results of these pilot and demonstration projects.

(4) The EPA, in coordination with other executive agencies, shall develop a database of information about these projects, including, but not limited to, the number and status of pilot projects, examples of agencies' policy directives, revisions to specifications, solicitation procedures, and grant/contract policies that facilitate adoption of environmentally preferable purchasing practices, to be integrated on a commonly available electronic medium (e.g., Internet Web site). These data are to be

reported to the FEE.

(c) Executive agencies shall use the principles and concepts in the EPA Guidance on Acquisition of Environmentally Preferable Products and Services, in addition to the lessons from the pilot and demonstration projects, to the maximum extent practicable, in identifying and purchasing environmentally preferable products and services and shall modify their procurement programs as appropriate.

Sec. 504. Designation of Biobased Items by the USDA. The USDA Biobased Products Coordination Council shall, in consultation with the FEE, issue a Biobased Products List.

(a) The Biobased Products List shall be published in the Federal Register by the USDA within 180 days after the date of this order and shall be updated biannually after publication to include additional items.

(b) Once the Biobased Products List has been published, agencies are encouraged to modify their affirmative procurement program to give consideration to those products.

Sec. 505. Minimum Content Standard for Printing and Writing Paper. Executive agency heads shall ensure that their agencies meet or exceed the following minimum materials content standards when purchasing or causing the purchase of printing and writing paper:

(a) For high speed copier paper, offset paper, forms bond, computer printout paper, carbonless paper, file folders, white wove envelopes, writing and office paper, book paper, cotton fiber paper, and cover stock, the minimum content standard shall be no less than 30 percent postconsumer materials beginning December 31, 1998. If paper containing 30 percent postconsumer material is not reasonably available, does not meet reasonable performance requirements, or is only available at an unreasonable price, then the agency shall purchase paper containing no less than 20 percent postconsumer material. The Steering Committee, in consultation with the AEEs, may revise these levels if necessary.

(b) As an alternative to meeting the standards in sections 505(a), for all printing and writing papers, the minimum content standard shall be no less than 50 percent recovered materials that are a waste material byproduct of a finished product other than a paper or textile product that would otherwise be disposed of in a landfill, as determined by the State in which the facility is located.

(c) Effective January 1, 1999, no executive branch agency shall purchase, sell, or arrange for the purchase of, printing and writing paper that fails to meet the minimum requirements of this section.

Sec. 506. Revision of Brightness Specifications and Standards. The GSA and other executive agencies are directed to identify, evaluate, and revise or eliminate any standards or specifications unrelated to performance that present barriers to the purchase of paper or paper products made by production processes that minimize emissions of harmful byproducts. This evaluation shall include a review of unnecessary brightness and stock clause provisions, such as lignin content and chemical pulp requirements. The GSA shall complete the review and revision of such specifications within 6 months after the date of this order, and shall consult closely with the Joint Committee on Printing during such process. The GSA shall also compile any information or market studies that may be necessary to accomplish the objectives of this provision.

Sec. 507. Procurement of Re-refined Lubricating Oil and Retread Tires.

(a) Agencies shall implement the EPA procurement guidelines for re-refined lubricating oil and retread tires. Fleet and commodity managers shall take immediate steps, as appropriate, to procure these items in accordance with section 6002 of RCRA. This provision does not preclude the acquisition of biobased (e.g., vegetable) oils.

(b) The FEE shall work to educate executive agencies about the new Department of Defense Cooperative Tire Qualification Program, including the Cooperative Approval Tire List and Cooperative Plant Qualification Program, as they apply to retread tires.

PART 6--AGENCY GOALS AND REPORTING REQUIREMENTS

Sec. 601. Agency Goals.

(a) (1) Each agency shall establish either a goal for solid waste prevention and a goal for recycling or a goal for solid waste diversion to be achieved by January 1, 2000. Each agency shall further ensure that the established goals include long-range goals to be achieved by the years 2005 and 2010. These goals shall be submitted to the FEE within 180 days after the date of this order.

(2) In addition to white paper, mixed paper/cardboard, aluminum, plastic, and glass, agencies should incorporate into their recycling programs efforts to recycle, reuse, or refurbish pallets and collect toner cartridges for remanufacturing. Agencies should also include programs to reduce or recycle, as appropriate, batteries, scrap metal, and fluorescent lamps and ballasts.

(b) Agencies shall set goals to increase the procurement of products that are made with recovered materials, in order to maximize the number of recycled products purchased, relative to non-recycled alternatives.

(c) Each agency shall set a goal for increasing the use of environmentally preferable products and services for those products and services for which the agency has completed a pilot program.

(d) Agencies are encouraged to incorporate into their Government Performance Results Act annual performance plans the goals listed in subsections (a), (b), and (c) above, starting with the submittal to the Office of Management and Budget of the plan accompanying the FY 2001 budget.

(e) Progress on attaining these goals should be reported by the agencies to the FEE for the biennial report specified in section 302(a)(2) of this order.

PART 7--APPLICABILITY AND OTHER REQUIREMENTS

Sec. 701. Contractor Applicability. Contracts that provide for contractor operation of a Government-owned or -leased facility and/or contracts that provide for contractor or other support services at Government-owned or -operated facilities awarded by executive agencies after the date of this order, shall include provisions that obligate the contractor to comply with the requirements of this order within the scope of its operations.

Sec. 702. Real Property Acquisition and Management. Within 90 days after the date of this order, and to the extent permitted by law and where economically feasible, executive agencies shall ensure compliance with the provisions of this order in the acquisition and management of Federally owned and leased space. The GSA and other executive agencies shall also include environmental and recycling provisions in the acquisition and management of all leased space and in the construction of new Federal buildings.

Sec. 703. Retention of Funds.

(a) The Administrator of General Services shall continue with the program that retains for the agencies the proceeds from the sale of materials recovered through recycling or waste prevention programs and specifying the eligibility requirements for the materials being recycled.

(b) Agencies in non-GSA managed facilities, to the extent permitted by law, should develop a plan to retain the proceeds from the sale of materials recovered through recycling or waste prevention programs.

Sec. 704. Model Facility Programs. Each executive agency shall establish a model demonstration program incorporating some or all of the following elements as appropriate. Agencies are encouraged to demonstrate and test new and innovative approaches such as incorporating environmentally preferable and bio-based products; increasing the quantity and types of products containing recovered materials; expanding collection programs; implementing source reduction programs; composting organic materials when feasible; and exploring public/private partnerships to develop markets for recovered materials.

Sec. 705. Recycling Programs.

(a) (1) Each executive agency that has not already done so shall initiate a program to promote cost-effective waste prevention and recycling of reusable materials in all of its facilities. The recycling programs implemented pursuant to this section must be compatible with applicable State and local recycling requirements.

(2) Agencies shall designate a recycling coordinator for each facility or installation. The recycling coordinator shall implement or maintain waste prevention and recycling programs in the agencies' action plans.

(b) Executive agencies shall also consider cooperative ventures with State and local governments to promote recycling and waste reduction in the community.

Sec. 706. Review of Implementation. The President's Council on Integrity and Efficiency shall request that the Inspectors General periodically review agencies' implementation of this order.

PART 8--AWARENESS

Sec. 801. Training.

(a) Within 180 days of the date of this order, the FEE and OFPP should evaluate the training courses provided by the Federal Acquisition Institute and the Defense Acquisition University and recommend any appropriate curriculum changes to ensure that procurement officials are aware of the requirements of this order.

(b) Executive agencies shall provide training to program management and requesting activities as needed to ensure awareness of the requirements of this order.

Sec. 802. Internal Agency Awards Programs. Each agency shall develop an internal agency-wide awards program, as appropriate, to reward its most innovative environmental programs. Among others, winners of agency-wide awards will be eligible for the White House Awards Program.

Sec. 803. White House Awards Program. A Government-wide award will be presented annually by the White House to the best, most innovative programs implementing the objectives of this order to give greater visibility to these efforts so that they can be incorporated Government-wide. The White House Awards Program will be administered jointly by the FEE and the CEQ.

PART 9--REVOCATION, LIMITATION, AND IMPLEMENTATION

Sec. 901. Executive Order 12873 of October 20, 1993, is hereby revoked.
Sec. 902. This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law by a party against the United States, its agencies, its officers, or any other person.

Sec. 903. The policies and direction expressed in the EPA guidance to be developed pursuant to section 503 of this order shall be implemented and incorporated in the Federal Acquisition Regulation within 180 days after issuance of the guidance.

(Presidential Sig.) William J Clinton
THE WHITE HOUSE,
September 14, 1998.

Note: this executive order can also be found on the Web at
http://www.mgmtconcepts.com/Publications/presid.txt

ATTACHMENT 3

EXECUTIVE ORDER 12902
ENERGY EFFICIENCY AND WATER CONSERVATION AT FEDERAL FACILITIES

– Summary –

- Establishes energy savings requirement of 30% by the year 2005 compared to fiscal year 1985.
- Requires increases in energy efficiency in agency industrial facilities by at least 20% by the year 2005 compared to fiscal year 1990.
- Requires agencies to implement all cost-effective water conservation measures.
- Directs agencies to conduct prioritization surveys to establish priorities for conducting comprehensive energy audits within 18 months.
- Directs agencies to develop and implement a 10-year plan to conduct or obtain comprehensive facility audits based on the prioritization surveys.
- Requires DOE to develop a program to significantly increase the use of solar and other renewable energy sources.
- Obligates agencies to designate buildings to showcase the best energy and water efficiency and renewable energy technologies to the public.
- Requires that DOE and all Federal agencies identify and remedy procurement barriers.
- Compels agencies to purchase products in the top 25% of their class for energy efficiency.

– Complete Text –

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the Energy Policy and Conservation Act (Public Law 94-163, 89 Stat. 871, 42 U.S.C. 6201 et seq.) as amended by the Energy Policy Act of 1992 (Public Law 102-486, 106 Stat. 2776) and section 301 of title 3, United States Code, I hereby order as follows:

PART 1 - DEFINITIONS

For the purposes of this order:

Section 101. The "Act" means the Federal energy management provisions of the Energy Policy and Conservation Act, as amended by the Energy Policy Act of 1992.

Sec. 102. The term "comprehensive facility audit" means a survey of a building or facility that provides sufficiently detailed information to allow an agency to enter into energy or water savings performance contracts or to invite inspection and bids by private upgrade specialists for direct agency-funded energy or water efficiency investments. It shall include information such as the following:

(a) the type, size, energy use, and performance of the major energy using systems and their interaction with the building envelope, the climate and weather influences, usage patterns, and related environmental concerns;

(b) appropriate energy and water conservation maintenance and operating procedures;

(c) recommendations for the acquisition and installation of energy conservation measures, including solar and other renewable energy and water conservation measures; and

(d) a strategy to implement the recommendations.

Sec. 103. The term "cost-effective" means providing a payback period of less than 10 years, as determined by using the methods and procedures developed pursuant to 42 U.S.C. 8254 and 10 CFR 436.

Sec. 104. The term "demand side management" refers to utility-sponsored programs that increase energy efficiency and water conservation or the management of demand. The term includes load management techniques.

Sec. 105. The term "energy savings performance contracts" means contracts that provide for the performance of services for the audit, design, acquisition, installation, testing, operation, and, where appropriate, maintenance and repair, of an identified energy or water conservation measure or series of measures at one or more locations.

Sec. 106. The term "agency" means an executive agency as defined in 5 U.S.C. 105. For the purpose of this order, military departments, as defined in 5 U.S.C. 102, are covered under the auspices of the Department of Defense.

Sec. 107. The term "Federal building" means any individual building, structure, or part thereof, including the associated energy or water-consuming support systems, which is constructed, renovated, or purchased in whole or in part for use by the Federal Government and which consumes energy or water. In any provision of this order, the term "Federal building" shall also include any building leased in whole or in part for use by the Federal Government where the term of the lease exceeds 5 years and the lease does not prohibit implementation of the
provision in question.

Sec. 108. The term "Federal facility" means any building or collection of buildings, grounds, or structure, as well as any fixture or part thereof, which is owned by the United States or any Federal agency or which is held by the United States or any Federal agency under a lease-acquisition agreement under which the United States or a Federal agency will receive fee simple title under the terms of such agreement without further negotiation. In any provision of this order, the term "Federal facility" shall also include any building leased in whole or in part for use by the Federal Government where the term of the lease exceeds 5 years and the lease does not prohibit implementation of the provision in question.

Sec. 109. The term "franchising" means that an agency would provide the services of its employees to other agencies on a reimbursable basis.

Sec. 110. The term "gainsharing" refers to incentive systems that allocate some portion of savings resulting from gains in productivity to the workers who produce those gains.

Sec. 111. The term "industrial facilities" means any fixed equipment, building, or complex for the production of goods that uses large amounts of capital equipment in connection with, or as part of, any process or system, and within which the majority of energy use is not devoted to the heating, cooling, lighting, ventilation, or to service the hot water energy load requirements of the building.

Sec. 112. The term "life cycle cost" refers to life cycle cost calculated pursuant to the methodology established by 10 CFR 436.11.

Sec. 113. The term "prioritization survey" means a rapid assessment that will be used by an agency to identify those facilities with the highest priority projects based on the degree of cost effectiveness and to schedule comprehensive facility audits prior to project implementation. The prioritization survey shall include information such as the following:

(a) the type, size, energy and water use levels of the major energy and water using systems in place at the facility; and

(b) the need, if any, for acquisition and installation of cost-effective energy and water conservation measures, including solar and other renewable energy resource measures.

Sec. 114. The term "shared energy savings contract" refers to a contract under which the contractor incurs the cost of implementing energy savings measures (including, but not limited to, performing the audit, designing the project, acquiring and installing equipment, training personnel, and operating and maintaining equipment) and in exchange for providing these services, the contractor gains a share of any

energy cost savings directly resulting from implementation of such measures during the term of the contract.

Sec. 115. The term "solar and other renewable energy sources" includes, but is not limited to, agriculture and urban waste, geothermal energy, solar energy, and wind energy.

Sec. 116. The term "utility" means any person, State, or agency that is engaged in the business of producing or selling electricity or engaged in the local distribution of natural gas or water to any ultimate consumer.

PART 2 - INTERAGENCY COORDINATION

Sec. 201. Interagency Coordination. The Department of Energy ("DOE") shall take the lead in implementing this order through the Federal Energy Management Program ("FEMP"). The Interagency Energy Policy Committee ("656 Committee") and the Interagency Energy Management Task Force ("Task Force") shall serve as forums to coordinate issues involved in implementing energy efficiency, water conservation, and solar and other renewable energy in the Federal sector.

PART 3 - AGENCY GOALS AND REPORTING REQUIREMENTS FOR ENERGY AND WATER EFFICIENCY IN FEDERAL FACILITIES

Sec. 301. Energy Consumption Reduction Goals.

(a) Each agency shall develop and implement a program with the intent of reducing energy consumption by 30 percent by the year 2005, based on energy consumption per-gross-square-foot of its buildings in use, to the extent that these measures are cost-effective. The 30 percent reductions shall be measured relative to the agency's 1985 energy use. Each agency's implementation program shall be designed to speed the introduction of cost-effective, energy-efficient technologies into Federal facilities, and to meet the goals and requirements of the Act and this order.

(b) Each agency shall develop and implement a program for its industrial facilities in the aggregate with the intent of increasing energy efficiency by at least 20 percent by the year 2005 as compared to the 1990 benchmark, to the extent these measures are cost-effective, and shall implement all cost-effective water conservation projects. DOE, in coordination with the 656 Committee, shall establish definitions and appropriate indicators of energy and water efficiency, and energy and water consumption and costs, in Federal industrial facilities for the purpose of establishing a base year of 1990.

Sec. 302. Energy and Water Surveys and Audits of Federal Facilities.

(a) Prioritization Survey. Each agency responsible for managing Federal facilities shall conduct a prioritization survey, within 18 months of the date of this order, on each of the facilities the agency manages. The surveys shall be used to establish priorities for conducting comprehensive facility audits.

(b) Comprehensive Facility Audits. Each agency shall develop and begin implementing a 10-year plan to conduct or obtain comprehensive facility audits, based on prioritization surveys performed under section 302(a) of this order.

(1) Implementation of the plan shall ensure that comprehensive facility audits of approximately 10 percent of the agency's facilities are completed each year. Agencies responsible for managing less than 100 Federal facilities shall plan and execute approximately 10 comprehensive facility audits per year until all facilities have been audited.

(2) Comprehensive audits of facilities performed within the last 3 years may be considered current for the purposes of implementation.

(3) "No-cost" audits, such as those outlined in section 501(c) of this order, shall be utilized to the extent practicable.

(c) Exempt Facilities. Because the mission within facilities exempt from the energy and water reduction requirements under the Act may not allow energy efficiency and water conservation in certain

operations, actions shall be taken to reduce all other energy and water waste using the procedures described in the Act and this order. Each agency shall develop and implement a plan to improve energy and water efficiency in such exempt facilities. The prioritization surveys are intended to allow agencies to refine their designation of facilities as "exempt" or "industrial," so that only individual buildings in which industrial or energy-intensive operations are conducted remain designated as "exempt" or "industrial." Within 21 months of the date of this order, each agency shall report to FEMP and to the Office of Management and Budget ("OMB") the redesignations that the agency is making as a result of the prioritization surveys. Agencies may seek exemptions for their facilities pursuant to the Energy Policy and Conservation Act, as amended.

(d) Leased Facilities. Agencies shall conduct surveys and audits of leased facilities to the extent practicable and to the extent that the recommendations of such surveys and audits could be implemented under the terms of the lease.

Sec. 303. Implementation of Energy Efficiency and Water Conservation Projects.

(a) Implementation of New Audit Recommendations. Within 1 year of the date of this order, agencies shall identify, based on preliminary recommendations from the prioritization surveys required under section 302 of this order, high priority facilities to audit and shall complete the first 10 percent of the required comprehensive facility audits. Within 180 days of the completion of the comprehensive facility audit of each facility, agencies shall begin implementing cost-effective recommendations for installation of energy efficiency, water conservation, and renewable energy technologies for that facility.

(b) Implementation of Existing Audits. Within 180 days of the date of this order, agencies shall begin to implement cost-effective recommendations from comprehensive audits of facilities performed within the past 3 years, for installation of energy efficiency, water conservation, and renewable energy technologies.

Sec. 304. Solar and Other Renewable Energy. The goal of the Federal Government is to significantly increase the use of solar and other renewable energy sources. DOE shall develop a program for achieving this goal cost-effectively and, within 210 days of the date of this order, submit the program to the 656 Committee for review. DOE shall lead the effort to assist agencies in meeting this goal.

Sec. 305. Minimization of Petroleum-Based Fuel Use in Federal Buildings and Facilities. All agencies shall develop and implement programs to reduce the use of petroleum in their buildings and facilities by switching to a less-polluting and nonpetroleum-based energy source, such as natural gas or solar and other renewable energy sources. Where alternative fuels are not practical or cost-effective, agencies shall strive to improve the efficiency with which they use the petroleum. Each agency shall survey its buildings and facilities that utilize petroleum-based fuel systems to determine where the potential for a dual-fuel capability exists and shall provide dual-fuel capability where cost-effective and practicable.

Sec. 306. New Space.

(a) New Federal Facility Construction. Each agency involved in the construction of a new facility that is to be either owned by or leased to the Federal Government shall:

(1) design and construct such facility to minimize the life cycle cost of the facility by utilizing energy efficiency, water conservation, or solar or other renewable energy technologies;

(2) ensure that the design and construction of facilities meet or exceed the energy performance standards applicable to Federal residential or commercial buildings as set forth in 10 CFR 435, local building standards, or a Btu-per-gross-square-foot ceiling as determined by the Task Force within 120 days of the date of this order, whichever will result in a lower life cycle cost over the life of the facility;

(3) establish and implement, within 270 days of the date of this order, a facility commissioning program that will ensure that the construction of such facilities meets the requirements outlined in this section before the facility is accepted into the Federal facility inventory; and

(4) utilize passive solar design and adopt active solar technologies where they are

cost-effective.

(b) New Leases For Existing Facilities. To the extent practicable and permitted by law, agencies entering into leases, including the renegotiation or extension of existing leases, shall identify the energy and water consumption of those facilities and seek to incorporate provisions into each lease that minimize the cost of energy and water under a life cycle analysis, while maintaining or improving occupant health and safety. These requirements may include renovation of proposed space prior to or within the first year of each lease. Responsible agencies shall seek to negotiate the cost of the lease, taking into account the reduced energy and water costs during the term of the lease.

(c) Government-Owned Contractor-Operated Facilities. All Government-owned contractor-operated facilities shall comply with the goals and requirements of this order. Energy and water management goals shall be incorporated into their management contracts.

Sec. 307. Showcase Facilities.

(a) New Building Showcases. When an agency constructs at least five buildings in a year, it shall designate at least one building, at the earliest stage of development, to be a showcase highlighting advanced technologies and practices for energy efficiency, water conservation, or use of solar and other renewable energy.

(b) Demonstrations in Existing Facilities. Each agency shall designate one of its major buildings to become a showcase to highlight energy or water efficiency and also shall attempt to incorporate cogeneration, solar and other renewable energy technologies, and indoor air quality improvements. Selection of such buildings shall be based on considerations such as the level of nonfederal visitors, historic significance, and the likelihood that visitors will learn from displays and implement similar projects. Within 180 days of the date of this order, each agency shall develop and implement plans and work in cooperation with DOE and, where appropriate, in consultation with the General Services Administration ("GSA"), the Environmental Protection Agency ("EPA"), and other appropriate agencies, to determine the most effective and cost-effective strategies to implement these demonstrations.

Sec. 308. Annual Reporting Requirements.

(a) As required under the Act, the head of each agency shall report annually to the Secretary of Energy and OMB, in a format specified by the Secretary and OMB after consulting with the 656 Committee. The report shall describe the agency's progress in achieving the goals of this order.

(b) The Secretary of Energy shall report to the President and the Congress annually on the implementation of this order. The report should provide information on energy and water use and cost data and shall provide the greatest level of detail practicable for buildings and facilities by energy source.

Sec. 309. Report on Full Fuel Cycle Analysis. DOE shall prepare a report on the issues involved in instituting life cycle analysis for Federal energy and product purchases that address the full fuel cycle costs, including issues concerning energy exploration, development, processing, transportation, storage, distribution, consumption, and disposal, and related impacts on the environment. The report shall examine methods for conducting life cycle analysis and implementing such analysis in the Federal sector and shall make appropriate recommendations. The report shall be forwarded to the President for review.

Sec. 310. Agency Accountability. One year after the date of this order, and every 2 years thereafter, the President's Management Council shall report to the President about efforts and actions by agencies to meet the requirements of this order. In addition, each agency head shall designate a senior official, at the Assistant Secretary level or above, to be responsible for achieving the requirements of this order and shall appoint such official to the 656 Committee. The 656 Committee shall also work to ensure the implementation of this order. The agency senior official and the 656 Committee shall coordinate implementation with the Federal Environmental Executive and Agency Environmental Executives established under Executive Order No. 12873.

PART 4 - USE OF INNOVATIVE FINANCING AND CONTRACTUAL MECHANISMS

Sec. 401. Financing Mechanisms. In addition to available appropriations, agencies shall utilize innovative financing and contractual mechanisms, including, but not limited to, utility demand side management programs, shared energy savings contracts, and energy savings performance contracts, to meet the goals and requirements of the Act and this order.

Sec. 402. Workshop for Agencies. Within a reasonable time of the date of this order, the Director of OMB, or his or her designee, and the Task Force shall host a workshop for agencies regarding financing and contracting for energy efficiency, water efficiency, and renewable technology projects. Based on the results of that meeting, the Administrator, Office of Procurement Policy ("OFPP"), shall assist the Administrator of General Services and the Secretary of Energy in eliminating unnecessary regulatory and procedural barriers that slow the utilization of such audit, financing, and contractual mechanisms or complicate their use. All actions that are cost-effective shall be implemented through the process required in section 403 of this order.

Sec. 403. Elimination of Barriers. Agency heads shall work with their procurement officials to identify and eliminate internal regulations, procedures, or other barriers to implementation of the Act and this order. DOE shall develop a model set of recommendations that will be forwarded to the Administrator of OFPP in order to assist agencies in eliminating the identified barriers.

PART 5 - TECHNICAL ASSISTANCE, INCENTIVES, AND AWARENESS

Sec. 501. Technical Assistance.

(a) To assist Federal energy managers in implementing energy efficiency and water conservation projects, DOE shall, within 180 days of the date of this order, develop and make available through the Task Force:

(1) guidance explaining the relationship between water use and energy consumption and the energy savings achieved through water conservation measures;

(2) a model solicitation and implementation guide for innovative funding mechanisms referenced in section 401 of this order;

(3) a national list of companies providing water services in addition to the list of qualified energy service companies as required by the Act;

(4) the capabilities and technologies available through the national energy laboratories; and

(5) an annually-updated guidance manual for Federal energy managers that includes, at a minimum, new sample contracts or contract provisions, position descriptions, case studies, recent guidance, and success stories.

(b) The Secretary of Energy, in coordination with the Administrator of General Services, shall make available through the Task Force, within 180 days of the date of this order:

(1) the national list of qualified water and energy efficiency contractors for inclusion on a Federal schedule; and

(2) a model provision on energy efficiency and water conservation, for inclusion in new leasing contracts.

(c) Within 180 days of the date of this order, the Administrator of General Services shall:

(1) contact each utility that has an area-wide contract with GSA to determine which of those utilities will perform "no-cost" audits for energy efficiency and water conservation and potential solar and other renewable energy sources that comply with Federal life cycle costing procedures set forth in Subpart A, 10 CFR 436;

(2) for each energy and water utility serving the Federal Government, determine which of those utilities offers demand-side management services and incentives and obtain a list and description of those services and incentives; and

(3) prepare a list of those utilities and make that list available to all Federal property

management agencies through the Task Force.

(d) Within 18 months of the date of this order, the Administrator of General Services, in consultation with the Secretary of Energy, shall develop procurement techniques, methods, and contracts to speed the purchase and installation of energy, water, and renewable energy technologies in Federal facilities. Such techniques, methods, and contracts shall be designed to utilize both direct funding by the user agency, including energy savings performance contracting, and utility rebates. To the extent permitted by law, the Administrator of OFPP shall assist the Administrator of General Services and the Secretary of Energy by eliminating unnecessary regulatory and procedural barriers that would slow the implementation of such methods, techniques, or contracts or complicate their use.

(e) Agencies are encouraged to seek technical assistance from DOE to develop and implement solar and other renewable energy projects.

(f) DOE shall conduct appropriate training for Federal agencies to assist them in identifying and funding cost-effective projects. This training shall include providing software and other technical tools to audit facilities and identify opportunities. To the extent that resources are available, DOE shall work with utilities and the private sector to encourage their participation in Federal sector programs.

(g) DOE, in coordination with EPA, GSA, and the Department of Defense ("DOD"), shall develop technical assistance services for agencies to help identify energy efficiency, water conservation, indoor air quality, solar and other renewable energy projects, new building design, fuel switching, and life cycle cost analysis. These services shall include, at a minimum, a help line, computer bulletin board, information and education materials, and project tracking methods. Agencies shall identify technical assistance needed to meet the goals and requirements of the Act and this order and seek such assistance from DOE.

(h) The Secretary of Energy and the Administrator of General Services shall explore ways to stimulate energy efficiency, water conservation, and use of solar and other renewable energy sources and shall study options such as new building performance guidelines, life cycle value engineering, and designer/builder incentives such as award fees. The studies shall be completed within 270 days of the date of this order. The OFPP will issue guidance to agencies on life cycle value engineering within 6 months of the completion of the studies.

(i) The Secretary of Energy and the Administrator of General Services shall develop and distribute through the Task Force a model building commissioning program within 270 days of the date of this order.

(j) The lists, guidelines, and services in this section of the order shall be updated periodically.

Sec. 502. Retention of Savings and Rebates.

(a) Within a reasonable time after the date of this order, the Director of OMB, along with the Secretary of Energy, the Secretary of Defense, and the Administrator of General Services, to the extent practicable and permitted by law, shall develop guidelines and implement procedures to allow agencies, in fiscal year 1995 and beyond, to retain utility rebates and incentives received by the agency and savings from energy efficiency and water conservation efforts as provided in section 152 of the Energy Policy Act of 1992 and 10 U.S.C. 2865 and 2866.

Sec. 503. Performance Evaluations. To recognize the responsibilities of facility managers, designers, energy managers, their superiors, and, to the extent practicable and appropriate, others critical to the implementation of this order, heads of agencies shall include successful implementation of energy efficiency, water conservation, and solar and other renewable energy projects in their position descriptions and performance evaluations.

Sec. 504. Incentive Awards. Agencies are encouraged to review employee incentive programs to ensure that such programs appropriately reward exceptional performance in implementing the Act and this order. Such awards may include monetary incentives such as Quality Step Increases, leave time awards and productivity gainsharing, and nonmonetary and honor awards such as increased authority, additional resources, and a series of options from which employees or teams of employees can choose.

Sec. 505. Project Teams/Franchising.

(a) Agencies are encouraged to establish Energy Efficiency and Environmental Project Teams

("Project Teams") to implement energy efficiency, water conservation, and solar and other renewable energy projects within their respective agencies. DOE shall develop a program to train and support the Project Teams, which should have particular expertise in innovative financing, including shared energy savings and energy savings performance contracting. The purpose of the program is to enable project teams to implement projects quickly and effectively in their own agencies.

(b) Agencies are encouraged to franchise the services of their Project Teams. The ability to access the services of other agencies' teams will foster excellence in project implementation through competition among service providers, while providing an alternative method to meet or exceed the requirements of the Act and this order for agencies that are unable to devote sufficient personnel to implement projects.

Sec. 506. FEMP Account Managers. FEMP shall develop a customer service program and assign account managers to agencies or regions so that each project may have a designated account manager. When requested by an agency, the account manager shall start at the audit phase and follow a project through commissioning, evaluation, and reporting. The account manager shall provide technical assistance and shall have responsibility to see that all actions possible are taken to ensure success of the project.

Sec. 507. Procurement of Energy Efficient Products by Federal Agencies. (a) "Best Practice" Technologies. Agencies shall purchase energy-efficient products in accordance with the guidelines issued by OMB, in consultation with the Defense Logistics Agency ("DLA"), DOE, and GSA, under section 161 of the Energy Policy Act of 1992. The guidelines shall include listings of energy-efficient products and practices used in the Federal Government. At a minimum, OMB shall update the listings annually. DLA, DOE, and GSA shall update the portions of the listings for which they have responsibility as new products become available and conditions change.

(1) Each agency shall purchase products listed as energy-efficient in the guidelines whenever practicable, and whenever they meet the agency's specific performance requirements and are cost-effective. Each agency shall institute mechanisms to set targets and measure progress.

(2) To further encourage a market for highly-energy-efficient products, each agency shall increase, to the extent practicable and cost-effective, purchases of products that are in the upper 25 percent of energy efficiency for all similar products, or products that are at least 10 percent more efficient than the minimum level that meets Federal standards. This requirement shall apply wherever such information is available, either through Federal or industry-approved testing and rating procedures.

(3) GSA and DLA, in consultation with DOE, other agencies, States, and industry and other nongovernment organizations, shall provide all agencies with information on specific products that meet the energy-efficiency criteria of this section. Product information should be made available in both printed and electronic formats.

(b) Federal Market Opportunities. DOE, after consultation with industry, utilities, and other interested parties, shall identify advanced energy-efficient and water-conserving technologies that are technically and commercially feasible but not yet available on the open market. These technologies may include, but are not limited to, the advanced appliance technologies referenced in section 127 of the Energy Policy Act of 1992. DOE, in cooperation with OMB, GSA, DOD, the National Institute of Standards and Technology ("NIST"), and EPA, shall issue a "Federal Procurement Challenge" inviting each Federal agency to commit a specified fraction of their purchases within a given time period to advanced, high-efficiency models of products, provided that these anticipated future products can meet the agency's energy performance, functionality, and cost requirements.

(c) Accelerated Retirement of Inefficient Equipment. DOE, in consultation with GSA and other agencies, shall establish guidelines for the cost-effective early retirement of older, inefficient appliances and other energy and water-using equipment in Federal facilities. Such guidelines may take into account significant improvements in energy efficiency and water conservation, opportunities to down-size or otherwise optimize the replacement equipment as a result of associated improvements in building envelope,

system, or industrial process efficiency and reductions in pollutant emissions, use of chlorofluorocarbons, and other environmental improvements.

(d) Review of Barriers. Each agency shall review and revise Federal or military specifications, product descriptions, and standards to eliminate barriers to, and encourage Federal procurement of, products that are energy-efficient or water conserving.

PART 6 - WAIVERS

Sec. 601. Waivers. Each agency may determine whether certain requirements in this order are inconsistent with the mission of the agency and seek a waiver of the provision from the Secretary of Energy. Any waivers authorized by the Secretary of Energy shall be included in the annual report on Federal energy management required under the Act.

PART 7 - REVOCATION, LIMITATION, AND IMPLEMENTATION

Sec. 701. Executive Order No. 12759, of April 17, 1991, is hereby revoked, except that sections 3, 9, and 10 of that order shall remain effective and shall not be revoked.

Sec. 702. This order is intended only to improve the internal management of the executive branch and is not intended to, and does not create, any right to administrative or judicial review, or any other right or benefit or trust responsibility, substantive or procedural, enforceable by a party against the United States, its agencies or instrumentalities, its officers or employees, or any other person.

Sec. 703. This order shall be effective immediately.

WILLIAM J. CLINTON
THE WHITE HOUSE,
March 8, 1994.

Note: this executive order can also be found on the Web at
http://www.eren.doe.gov/femp/aboutfemp/exec12902.html

ATTACHMENT 4

ENVIRONMENTALLY PREFERABLE PURCHASING PROGRAM

Additional Sources

Green Building Aspects of the New EPA Laboratory at Research Triangle Park:
Specific environmental considerations provided by Hellmuth, Obata + Kassabaum, Inc., the architecture and engineering firm that designed the laboratory at Research Triangle Park. Recommendations are given for numerous building materials and practices.
http://www.hok.com/sustainabledesign/database/database.html

Case Studies

Pollution Prevention Information Clearinghouse
The following sources can be obtained from the Pollution Prevention Information Clearinghouse at http://www.epa.gov:80/opptintr/library/ppicdist.htm

- **Leading By Example**:
  Two case studies documenting how the Environmental Protection Agency effectively incorporated environmental features into new buildings. The new buildings are at Research Triangle Park and Federal Triangle. The required minimum recycled content of materials used at the Research Triangle Park Laboratory are summarized in Attachment 5.

- **Paving the Road to Success:**
  The Department of Defense Parking Lot Renovation was a 5-year $5 million renovation contract at several Washington, DC area facilities. This case study demonstrates the feasibility of including environmentally preferable purchasing principles into federal contracts.

- **Pollution Prevention and Finance**:
  Green Light's Economics: Graphic Design Considers a Lighting Upgrade

Voluntary Standards Network

EPA Standards Network Fact Sheet: ISO 14000:
International Environmental Management Standards
EPA/625/F-97/004, (6pp) March 1998

ISO 14000 Resource Directory:
The directory also provides a listing of resources that can be used to obtain additional information relating to ISO 14000 standards
EPA/625/R-97/003, (35pp) October 1997

ATTACHMENT 5

ENVIRONMENTALLY PREFERABLE PURCHASING PROGRAM

RESEARCH TRIANGLE PARK LABORATORY FACILITY

Required Minimum Recycled Content of Materials

Material or Product	Recommended Recycle Content
Asphaltic Concrete Paving	25% by weight
Reinforcing Steel in Concrete	60% recycled scrap steel
Reinforcing Bars in Precast Concrete	60% recycled steel
Concrete Unit Masonry	50% recycled content
Reinforcing Bars in Concrete Unit Masonry	60% recycled steel
Framing Steel	30% recycled steel
Fiberglass Batt Insulation	20% recycled glass cullet
Fiberglass Board Insulation	20% recycled glass cullet
Mineral Wool Insulation	75% recycled material (slag)
Mineral Wool Fire Safing Insulation	75% recycled material by weight (slag)
Gypsum Board	10% recycled or synthetic gypsum
Facing Paper of Gypsum Board	100% recycled newsprint including post consumer waste
Mineral Fiber Sound Attenuation Blankets	75% recovered materials by weight (slag)
Steel Studs, Runners, and Channels	60% recycled steel
Acoustic Panel Ceilings	60% recycled material by weight
Ceiling Suspension Systems	60% recycled material
Rubber Floor Tiles	90-100% recycled materials
Hydromulch	100% recycled materials
Structural Fiberboard	80-100% recycled content

Note: 60% recycled steel represents the average recycled content for the US steel industry. Use of US manufactured steel will meet this requirement.

ATTACHMENT 6

BEES SOFTWARE

The BEES program is provided on two floppy disks located in the back cover of this Information Packet.

System Requirements

BEES runs on Windows 95 personal computer with a 486 or higher microprocessor, 32 Megabytes or more of RAM, and at least 10 Megabytes of available disk space.

Installing BEES

To install BEES, insert Disk 1 and double click on the "setup.exe" files. Follow the instructions provided by the setup program. After installation, double click on the "Bees_10.exe" file to run the program.

Users Manual

The software provides a tutorial for first-time users. A technical manual provided by the National Institute of Standards, is also available on-line. It can be found at
http://fire.nist.gov/bfrlpubs/build98/PDF/b98062.pdf

ATTACHMENT 7

COMPREHENSIVE PROCUREMENT GUIDELINE RESOURCES

BUY-RECYCLED SERIES

This attachment provides abstracts of the fact sheets and other nonregulatory, informational resources relevant to the Comprehensive Procurement Guidelines. Recent Federal Register notices, fact sheets, technical background documents, and supporting documents can be found on the Internet at <www.epa.gov/cpg>.

HOW TO ORDER PUBLICATIONS

All publications are available at no charge from EPA. To order a publication, call the RCRA Hotline at 800 424-9346 (TDD 800 553-7672) or, in the Washington, DC, area, call 703 412-9810 (TDD 703 412-3323). When ordering, please mention the order numbers. You also can order documents via e-mail by sending a request to <rcra-docket@epamail.epa.gov> or via regular mail by writing to RCRA Information Center (5305W), U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460-0002 (this address is for mailing purposes only). Finally, many of these documents are available on the Internet through EPA's Office of Solid Waste Web site at www.epa.gov/osw.

FOR MORE INFORMATION

For a more comprehensive list of solid and hazardous waste publications, order the Catalog of Hazardous and Solid Waste Publications, Eleventh Edition (EPA530-B-98-001) from the RCRA Hotline or the RCRA Information Center.

1997 BUY-RECYCLED SERIES

A series of fact sheets discussing the Comprehensive Procurement Guidelines, which require federal, state, and local agencies and government contractors using appropriated federal funds to give preference to buying products made from recovered materials. The publications also describe Recovered Materials Advisory Notices, which recommend recycled-content levels for such purchases. Handy tables are included that list the specific recovered material content to look for when purchasing products covered under the guidelines. Case studies and sources for additional information also are included.

Construction Products: Structural fiberboard, laminated fiberboard, rock wool insulation, fiberglass insulation, cellulose insulation (loose-fill and spray-on), perlite composite board insulation, rigid foam insulation (plastic rigid foam, polyisocyanurate/polyurethane), foam-in-place insulation, glass fiber reinforced insulation, phenolic rigid foam insulation, floor tiles (heavy duty/commercial use), patio blocks, polyester carpet fiber face, latex paint (consolidated, reprocessed), and shower and restroom dividers and partitions.
11/15/1997 Order Number: EPA530-F-97-035

Landscaping Products: Hydraulic mulch (paper, wood/paper), yard trimmings compost, garden hose, soaker hose, lawn and garden edging.
11/15/1997 Order Number: EPA530-F-97-034

Non-Paper Office Products: Recycling containers and waste receptacles, plastic desk-top accessories, binders, plastic trash bags, toner cartridges, printer ribbons, and plastic envelopes.
11/15/1997 Order Number: EPA530-F-97-033

Pallets (Miscellaneous Products): Wood, plastic, and paperboard pallets.
11/15/1997 Order Number: EPA 530-F-97-031

Park and Recreation Products: Playground surfaces, running tracks, and plastic fencing.
11/15/1997 Order Number: EPA530-F-97-032

Transportation Products: Traffic cones, traffic barricades, parking stops, and traffic control devices.
11/15/1997 Order Number: EPA530-F-97-036

Vehicular Products: Re-refined oil, retread tires, and engine coolants.
11/15/1997 Order Number: EPA530-F-97-037

1996 BUY-RECYCLED SERIES: PAPER PRODUCTS

This document discusses the Comprehensive Procurement Guideline, which requires federal agencies and their contractors to give preference to buying certain items made from recovered materials, including some paper products. The document also describes Recovered Materials Advisory Notices, which recommend recycled-content levels for such purchases. An easy-to-use table lists the specific recovered-material content to look for when purchasing paper products covered under the guideline. Sources for additional information also are included. Paper products covered include printing and writing fiber (cotton fiber, text and cover, papeteries, offset, reprographic, forms bond, tablet, envelope, supercalendered, machine finished groundwood, check safety, coated, carbonless, file folders, dyed filing products, index and card stock, pressboard, and tags and tickets), newsprint, commercial sanitary tissue products (bathroom tissue, paper towels, paper napkins, facial tissue, and general purpose industrial wipers), paperboard and packaging products (corrugated containers, solid fiber boxes, folding cartons, industrial paperboard, miscellaneous, padded mailers, carrierboard, and brown papers), and miscellaneous paper products such as tray liners.
04/15/1996 Order Number: EPA530-F-96-014

GENERAL BUY-RECYCLED RESOURCES

Environmental Fact Sheet: EPA Expands Comprehensive Procurement Guidelines (CPG)

This fact sheet discusses items that must contain recycled content when purchased by government agencies and contractors. It discusses 12 new products added to the CPG: consolidated and reprocessed latex paint, shower and restroom dividers and partitions, channelizers, delineators, flexible delineators, parking stops, plastic fencing, garden and soaker hoses, lawn and garden edging, plastic envelopes, printer ribbons, and pallets. The fact sheet also helps purchasers understand the government's guidelines for buying recycled products.
11/15/1998 Order Number: EPA530-F-97-049

Environmental Fact Sheet: EPA Guideline for Purchasing Building Insulation Containing Recovered

Materials

This fact sheet, which refers to EPA's guideline issued February 17, 1989, recommends that procuring agencies use minimum-content standards for the amount of recovered materials in insulation products. An EPA standards table is included.
06/15/1991 Order Number: EPA530-SW-91-044

Environmental Fact Sheet: EPA Guideline for Purchasing Cement and Concrete Containing Fly Ash

This fact sheet, which refers to EPA's guideline issued January 28, 1983, recommends that coal fly ash is not to exceed a maximum ratio of water to cementitious material (e.g., w/c+f, where w, c, and f represent weights of water, Portland cement, and fly ash, respectively.)
01/15/1992 Order Number: EPA530-SW-91-086

Environmental Fact Sheet: EPA Guideline for Purchasing Paper and Paper Products

This fact sheet, which refers to EPA's guideline issued June 22, 1988, recommends that procuring agencies review paper specifications to remove subtle barriers for purchasing paper containing recovered materials. Minimum standards tables are included.
06/15/1991 Order Number: EPA530-SW-91-046

Environmental Fact Sheet: EPA Guideline for Purchasing Re-Refined Lubricating Oil

This fact sheet, which refers to EPA's guideline issued June 30, 1988, recommends that procuring agents not require lubricating oils containing re-refined oil meet any performance standard higher than that required of virgin lubricating oil. American Petroleum Institute and military specifications are included.
06/15/1991 Order Number: EPA530-SW-91-043

Environmental Fact Sheet: EPA Guideline for Purchasing Retread Tires

This fact sheet refers to EPA's guideline, issued November 17, 1988, for purchasing retread tires. It covers recommended retread preference, obtaining retreading services, purchasing retread tires, federal regulation of retread tires, and principal federal procuring agencies.
06/15/1991 Order Number: EPA530-SW-91-045

Environmental Fact Sheet: EPA Issues Comprehensive Procurement Guideline

A listing of the government's guidelines for recycled-product purchasing. It includes 24 products that must contain recycled content when purchased by government agencies and contractors. The fact sheet also describes ways to create, promote, and evaluate an effective buy-recycled program.
04/15/1995 Order Number: EPA530-F-95-010

Environmental Fact Sheet: Municipal Solid Waste Prevention in Federal Agencies

This fact sheet highlights waste prevention opportunities in federal agencies. It explains the principles of waste prevention and provides examples of successful federal programs.
10/15/1992 Order Number: EPA530-F-92-016

Environmental Fact Sheet: Purchasing and Maintaining Retread Passenger Tires

This fact sheet describes how fleet managers and vehicle operators can help reduce the quantity of scrap tires generated annually through waste prevention, proper tire maintenance, and tire retreading. It includes tips for proper tire maintenance.
09/15/1995 Order Number: EPA530-F-95-019

WasteWise Tip Sheet: Buying or Manufacturing Recycled Products

Defines "buying recycled" and recycled content terms. Discusses the benefits of buying or manufacturing goods with recycled content. Addresses how the purchase of recycled products and recovered raw materials fits into EPA's WasteWise program. Lists types of products available with recycled content. Treats cost and quality of recycled products and recovered raw materials. Cites sources of additional information.
01/15/1994 Order Number: EPA530-F-94-005

WasteWise Update (Issue #6: Remanufactured Products: Good as New)

Focuses on remanufactured products. Assists WasteWise partners in becoming knowledgeable about the variety of remanufactured goods available and introduces issues to consider when purchasing them. Lists remanufacturing trade associations and related businesses. Includes furniture, toner cartridges, copiers, medical sensors, street lights, and tires.
01/15/1997 Order Number: EPA530-N-97-002

WasteWise Update (Issue #8: Closing the Loop)

Explores the purchase and manufacture of recycled-content products. Dispels common myths about buying recycled and offers "getting started" tips from veteran WasteWise partners. In addition, provides suggestions on how to track the purchase of recycled-content products. Includes special feature that discusses government purchasing issues.
12/15/1997 Order Number: EPA530-N-97-008

WasteWise Update (Issue #9: Building Supplier Partnerships)

Contains spotlight section on government purchasing. Consists of tips and advice for local and state governments on starting and maintaining a successful environmental purchasing program. Includes success stories and a list of publications and Internet resources.
04/15/1998 Order Number: EPA530-N-98-003

LISTS OF MANUFACTURERS AND SUPPLIERS

Construction Products Containing Recovered Materials

A list of manufacturers and suppliers of building insulation, plastic rigid foam insulation, structural fiberboard and laminated paperboard, cement and concrete with coal fly ash, cement and concrete with granulated blast furnace slag, carpet, floor tiles, patio blocks, shower and restroom dividers, and reprocessed and consolidated latex paint. Information such as the company names, address, contact name, phone number, and fax number are included. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-014

Landscaping Products Containing Recovered Materials

Lists manufacturers and suppliers of recovered-content landscaping products (hydraulic mulch, yard trimmings compost, garden and soaker hoses, and lawn and garden edging). It includes each company's name, address, contact person, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-012

Mills That Manufacture Printing and Writing Paper, Computer Paper, Office Paper, Envelopes, Bristols, and Coated Printing and Writing Papers, Using Recovered Paper

A list of mills that use recovered paper to manufacture printing and writing paper, computer paper, office paper, envelopes, bristols, and coated printing and writing papers. Arranged alphabetically by corporate name, the listings include a main address, contact person, phone number, fax number, and recycled-content brands manufactured, including paper grade, and total, preconsumer, and postconsumer recovered paper content.
10/15/1997 Order Number: EPA530-B-97-008

Mills That Produce Newsprint Containing Postconsumer Recovered Paper

A list of mills that produce newsprint containing postconsumer recovered paper, arranged alphabetically by corporate name. The listings include a main address, contact person, phone number, fax number, and total and postconsumer recovered-paper content of products. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-010

Mills That Produce Tissue Products Containing Postconsumer Recovered Paper

A list of tissue mills that use postconsumer recovered paper. The listings are arranged alphabetically by corporate name, and include a main address, contact person, phone number, fax number, and total and postconsumer recovered-paper content of products. The document also
includes a list of definitions. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-009

Miscellaneous Products (Pallets) Containing Recovered Materials

A list of manufacturers and suppliers of miscellaneous products (pallets) that contain recovered materials. It includes company names, address, contact name, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an
endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-007

Non-Paper Office Products Containing Recovered Materials

This document lists manufacturers and suppliers of non-paper office products (office recycling containers and office waste receptacles, plastic desktop accessories, toner cartridges, binders, plastic trash bags, printer ribbons, and plastic envelopes) containing recovered materials. It
includes company name, address, contact person, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-011

Park and Recreation Products Containing Recovered Materials

This document lists manufacturers and suppliers of park and recreation products (playground surfaces, running tracks, and plastic fencing) that contain recovered materials. It includes company name, address, contact name, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-006

Transportation Products Containing Recovered Materials

A list of manufacturers and suppliers of transportation products (traffic barricades, traffic cones, parking stops, and traffic control devices) containing recovered materials. It includes company name, address, contact name, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-013

Vehicular Products Containing Recovered Materials

A list of manufacturers and suppliers of vehicular products (re-refined lubricating oils, retread tires, and engine coolants) containing recovered materials. It includes company name, address, contact name, phone number, and fax number. The listings are based on information provided by the manufacturer and do not represent an endorsement by EPA.
10/15/1997 Order Number: EPA530-B-97-005

ORDERING PUBLICATIONS

To order a publication, call the RCRA Hotline or send an e-mail to rcra-docket@epamail.epa.gov.

Phone: You can call the RCRA Hotline, Monday through Friday, 9 a.m. to 6 p.m., eastern time. The national toll free number is 800 424-9346, TDD 800 553-7672 (hearing impaired); in Washington, DC, the number is 703 412-9810, TDD 703 412-3323.

Fax: 703 603-9234 or

Mail to: RCRA Information Center (RIC) Office of Solid Waste (5305W) U.S. Environmental Protection Agency 401 M Street, SW, Washington DC 20460-0002.

ATTACHMENT 8

COMPREHENSIVE PROCUREMENT GUIDELINES DESIGNATED PRODUCTS

A key component of the CPG program is EPA's list of designated products and the accompanying recycled-content recommendations. EPA has already designated or is proposing to designate the products listed below. EPA also published final or proposed recycled-content recommendations for each item. All proposals, designations, and recommendations are published in the *Federal Register*.

The CPG Web site contains a brief description for each of the designated products listed below. You also can view EPA's recommended recycled content range and a list identifying manufacturers, vendors, and suppliers for each item. The proposed products are listed for informational purposes only. Additional information on the proposed products is available in the CPGIII and RMAN III *Federal Register* notices.

CONSTRUCTION PRODUCTS

Designated:	Proposed:
Building insulation products Carpet Cement and concrete containing: -Coal fly ash -Ground granulated blast furnace slag Consolidated and reprocessed latex paint Floor tiles Laminated paperboard Patio blocks Shower and restroom dividers/partitions Structural fiberboard	Carpet backing Carpet cushion Flowable fill Railroad grade crossings/surfaces

LANDSCAPING PRODUCTS

Designated:	Proposed:
Garden and soaker hoses Hydraulic mulch Lawn and garden edging Yard trimmings compost	Food waste compost Landscaping timbers and posts (plastic lumber)

NON-PAPER OFFICE PRODUCTS

Designated:	Proposed:
Binders (paper, plastic covered) Office recycling containers Office waste receptacles Plastic desktop accessories Plastic envelopes Plastic trash bags Printer ribbons Toner cartridges	Plastic binders (solid) Plastic clipboards Plastic clip portfolios Plastic file folders Plastic presentation folders

PAPER AND PAPER PRODUCTS

Designated:	Proposed:
Commercial/industrial sanitary tissue products Miscellaneous papers Newsprint Paperboard and packaging products Printing and writing papers	None at this time

PARK AND RECREATION PRODUCTS

Designated:	Proposed:
Plastic fencing Playground surfaces Running tracks	Park and recreational furniture Playground equipment

TRANSPORTATION PRODUCTS

Designated:	Proposed:
Channelizers Delineators Flexible delineators Parking stops Traffic barricades Traffic cones	None at this time.

VEHICULAR PRODUCTS

Designated:	Proposed:
Engine coolants Re-refined lubricating oils Retread tires	None at this time.

MISCELLANEOUS PRODUCTS

Designated:	Proposed:
Pallets	Sorbents Awards and plaques Industrial drums Mats Signage Strapping and stretch wrap

ATTACHMENT 9

COMPREHENSIVE PROCUREMENT GUIDELINES
CONSTRUCTION PRODUCTS

This attachment provides detailed information for the following construction products covered by the Comprehensive Procurement Guidelines.

CONSTRUCTION PRODUCTS

Designated:	Proposed:
Building insulation products Carpet Cement and concrete containing: -Coal fly ash -Ground granulated blast furnace slag Consolidated and reprocessed latex paint Floor tiles Laminated paperboard Patio blocks Shower and restroom dividers/partitions Structural fiberboard	Carpet backing Carpet cushion Flowable fill Railroad grade crossings/surfaces

Insulation made from recovered materials is available for thermal insulating applications. The product is available in several forms including rolls, loose-fill, and spray foam. Insulation also can include a range of recovered materials such as glass, slag, paper fiber, and plastics. One manufacturer grinds postconsumer glass bottles into a substitute for the sand used in glass fibers. Others use slag for rock wool or old newspaper for cellulose insulation.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing building insulation as shown in the table on the following page.

Product Specifications:

In 1993, the American Society for Testing and Materials (ASTM) issued a standard for the composition of cullet used in the manufacture of fiberglass insulation, D 5359, "Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber." EPA recommends that procuring agencies reference this specification in Invitations for Bid and Requests for Proposals.

Product Information:

The CPG web site (http://www.epa.gov/cpg) provides an up-to-date list of manufacturers and suppliers of building insulation containing recovered materials.

Technical Background Documents:

Technical background information on building insulation was published in the Federal Register in 1989 in 40 CFR Part 248, page 7327. You can view this document at the RCRA Docket in Arlington, Virginia. To obtain the address of the Docket and make an appointment, call 703 603-9230.

EPA's Recommended Recovered Materials Content Levels for Building Insulation[1]

Product	Material	Postconsumer Content (%)	Total Recovered Materials Content (%)
Rock Wool	Slag	–	75
Fiberglass	Glass Cullet	–	20-25
Cellulose Loose-Fill and Spray-On	Postconsumer Paper	75	75
Perlite Composite Board	Postconsumer Paper	23	23
Plastic Rigid Foam, Polyisocyanurate/ Polyurethane:			
Rigid Foam	–	–	9
Foam-in-Place	–	–	5
Glass Fiber Reinforced	–	–	6
Phenolic Rigid Foam	–	–	5
Plastic, Non-Woven Batt	Recovered and/or Postconsumer Plastics	–	100

[1]The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

EPA designated recycled-content polyester carpet for light- and moderate-wear applications. Recycled fiber polyester carpet is manufactured from PET recovered soda bottles.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing carpeting as shown in the table below.

EPA's Recommended Recovered Materials Content Levels for Carpet[1]

Product	Material	Postconsumer Content (%)	Total Recovered Materials Content (%)
Polyester Carpet Face Fiber	PET	25-100	25-100

[1]EPA recommends that, based on the recovered materials content levels shown in the table above, procuring agencies establish minimum content standards for use in purchasing polyester carpet for light- and moderate-wear applications. This recommendation does not include polyester carpet for use in heavy-wear or severe-wear applications; however, procuring agencies are encouraged to evaluate the suitability of polyester carpet in these applications. These recommendations do not preclude a procuring agency from purchasing carpet made of other materials such as nylon, wool, or polypropylene.

Product Specifications:

EPA recommends that procuring agencies use the U.S. General Services Administration's (GSA's) contract GS-27F-5069-C, Federal Supply Schedule 72, Part I, Section A, to purchase polyester carpet containing recovered materials and that agencies currently limiting carpet materials to nylon, wool, or other materials consider adding polyester, where appropriate, to enable them to procure carpet containing recovered materials.

Product Information:

The CPG web site (http://www.epa.gov/cpg) provides an up-to-date list of manufacturers and suppliers of carpet containing recovered materials.

Technical Background Documents

These background documents include EPA's product research on recovered-content carpeting as well as a more detailed overview of the history and regulatory requirements of the CPG process.

Coal fly ash and ground granulated blast furnace (GGBF) slag are recovered materials that are readily available in some areas for use as ingredients in cement or concrete. Coal fly ash is a byproduct of coal burning at electric utility plants. It is called "fly" ash because it is transported from the combustion chamber by exhaust gases. Slag is a byproduct of iron blast furnaces. The slag is ground into granules finer than Portland cement and can be used as an ingredient in concrete. The level of coal fly ash in concrete typically ranges from 15 to 35 percent of total cementitious material, but can reach 70 percent for use in massive walls, girders, road bases, and dams. The level of GGBF slag usually ranges from 25 to 50 percent.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends that procuring agencies prepare or revise their procurement programs for cement and concrete or for construction projects involving cement and concrete to allow the use of coal fly ash or GGBF slag, as appropriate. EPA does not recommend that procuring agencies favor one recovered material over the other. Rather, EPA recommends that procuring agencies consider the use of both recovered materials and choose the one that meets their performance requirements, consistent with availability and price considerations. EPA also recommends that procuring agencies specifically include provisions in all construction contracts to allow for the use, as optional or alternate materials, of cement or concrete that contains coal fly ash or GGBF slag where appropriate.

Due to variations in coal fly ash, GGBF slag, cement, strength requirements, costs, and construction practices, EPA is not recommending recovered materials content levels for cement or concrete containing coal fly ash or GGBF slag. EPA is, however, providing the following information about recovered materials content:

- Replacement rates of coal fly ash for cement in the production of blended cement generally do not exceed 20 to 30 percent, although coal fly ash blended cements may range from 0 to 40 percent coal fly ash by weight, according to American Society for Testing and Materials (ASTM) C 595, for cement Types IP and I(PM). Fifteen percent is a more accepted rate when coal fly ash is used as a partial cement replacement as an admixture in concrete.

- According to ASTM C 595, GGBF slag can replace up to 70 percent of the Portland cement in some concrete mixtures. Most GGBF slag concrete mixtures contain between 25 and 50 percent GGBF slag by weight. EPA recommends that procuring agencies refer, at a minimum, to ASTM C 595 for the GGBF slag content appropriate for the intended use of the cement and concrete.

Product Specifications:

The following recommendations address guide materials, state, and contract specifications; performance standards; mix design; and quality control.

Guide Specifications:

EPA recommends that procuring agencies ensure that their guide specifications do not inappropriately or unfairly discriminate against the use of coal fly ash or GGBF slag in cement and concrete. EPA further recommends that procuring agencies revise their guide specifications to require that contract specifications for individual construction projects or products allow for the use of coal fly ash or GGBF slag, unless the use of these materials is technically inappropriate for a particular construction application.

Materials Specifications:

EPA recommends that procuring agencies use the existing voluntary consensus specifications referenced on the following page for cement and concrete containing GGBF slag.

State Specifications:

EPA recommends that procuring agencies consult other agencies with established specifications for coal fly ash or GGBF slag to benefit from their experience. Procuring agencies can consult the Federal Highway Administration, which maintains a database of state highway agency material specifications. The states of Alabama, Connecticut, Florida, Georgia, Illinois, Indiana, Maryland, Michigan, North Carolina, North Dakota, Ohio, Pennsylvania, South Carolina, Virginia, and West Virginia and the District of Columbia have adopted specifications that allow the use of GGBF slag in one or more applications. If needed, procuring agencies can obtain these specifications from the respective state transportation departments and adapt them for use in their programs for cement and concrete, as appropriate.

Contract Specifications:

EPA recommends that procuring agencies that prepare or review "contract" specifications for individual construction projects revise those specifications to allow the use of cement and concrete containing coal fly ash or GGBF slag as optional or alternate materials for the project, where appropriate, consistent with the agencies' performance and price objectives.

Performance Standards:

EPA recommends that procuring agencies review and, if necessary, revise performance standards relating to cement or concrete construction projects to insure that they do not arbitrarily restrict the use of coal fly ash or GGBF slag, either intentionally or inadvertently, unless the restriction is justified on a job-by-job basis: (1) to meet reasonable performance requirements for the cement or concrete, or (2) because the use of coal fly ash or GGBF slag would be inappropriate for technical reasons. EPA recommends that this justification be documented based on specific technical performance information. Legitimate documentation of technical infeasibility for coal fly ash or GGBF slag can be for certain classes of applications, rather than on a job-by-job basis. Procuring agencies should reference such documentation in individual contract specifications to avoid

extensive repetition of previously documented points.
Procuring agencies should, however, be prepared to submit such documentation to analysis by interested persons, and should have a review process available in the event of disagreements.

Recommended Specifications for Cement and Concrete Containing Recovered Materials

Cement Specifications	Concrete Specifications
ASTM C 595, "Standard Specification for Blended Hydraulic Cements."	ASTM C 618, "Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
ASTM C 150, "Standard Specification for Portland Cement."	ASTM C 311, "Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete."
AASHTO M 240, "Blended Hydraulic Cements."	ASTM C 989, "Ground Granulated Blast-Furnace Slag for Use in Concrete Mortars."
–	AASHTO M 302, "Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars."
–	American Concrete Institute Standard Practice ACI 226.R1, "Ground Blast-Furnace Slag as a Cementitious Constituent in Concrete."

Mix Design:
In concrete mix design specifications that specify minimum cement content or maximum water, the cement ratios could potentially unfairly discriminate against the use of coal fly ash or GGBF slag. Such specifications should be changed in order to allow the partial substitution of coal fly ash or GGBF slag for cement in the concrete mixture, unless technically inappropriate. Cement ratios can be retained, as long as they reflect the cementitious characteristics that coal fly ash or GGBF slag can impart to a concrete mixture (e.g., by considering Portland cement plus coal fly ash or Portland cement plus GGBF slag as the total cementitious component).

Quality Control:
Nothing in the RMAN should be construed to relieve the contractor of responsibility for providing a satisfactory product. Cement and concrete suppliers are already responsible both for the quality of the ingredients of their product and for meeting appropriate performance requirements, and will continue to be under the RMAN. Nothing in EPA's recommendations should be construed as a shift in normal industry procedures for assigning responsibility and liability for product quality. Procuring agencies should expect suppliers of blended cement, coal fly ash or GGBF slag, and concrete to demonstrate

(through reasonable testing programs or previous experience) the performance and reliability of their product and the adequacy of their quality control programs. Procuring agencies should not, however, subject cement and concrete containing coal fly ash or GGBF slag to any unreasonable testing requirements.

In accordance with standard industry practice, coal fly ash and GGBF slag suppliers should be required to provide to users a statement of the key characteristics of the product supplied. These characteristics may be stated in appropriate ranges. Other characteristics should be requested as needed by the procuring agency.

Agencies desiring a testing or quality assurance program for cements, blended cements, or coal fly ash should contact the U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39180.

Product Information:

The CPG web site (http://www.epa.gov/cpg) identifies manufacturers and suppliers of cement and concrete containing recovered materials.

Technical Background Documents

Technical background information on cement and concrete containing coal fly ash was published in the Federal Register in 1983 in 40 CFR Part 249, pages 4230 to 4253. You can view this document at the RCRA Docket in Arlington, Virginia. To obtain the address of the Docket and make an appointment, call 703-603-9230.

construction products

REPROCESSED AND CONSOLIDATED LATEX PAINTS

Reprocessed paint is postconsumer latex paint that has been sorted by a variety of characteristics including type (i.e., interior or exterior), light and dark colors, and finish (e.g., high-gloss versus flat). Reprocessed paint is available in various colors and is suitable for both interior and exterior applications. Consolidated paint consists of postconsumer latex paint with similar characteristics (e.g., type, color family, and finish) that is consolidated at the point of collection. Consolidated paint is typically used for exterior applications or as an undercoat.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing reprocessed and consolidated latex paint for specified uses as shown in the table below.

EPA's Recommended Recovered Materials Content Levels for Reprocessed and Consolidated Latex Paints[1]

Product	Postconsumer Content (%)	Total Recovered Materials Content (%)
Reprocessed Latex Paint		
• White, Off-White, Pastel Colors	20	20
• Grey, Brown, Earthtones, and Other Dark Colors	50-99	50-99
Consolidated Latex Paint	100	100

[1]EPA's recommendations apply to reprocessed latex paints used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood, and metal surfaces, and to consolidated latex paints used for covering graffiti, where color and consistency of performance are not primary concerns.

EPA's recommendation does not preclude agencies from purchasing paints manufactured from other, non-latex materials, such as oil-based paints. It simply recommends that procuring agencies, when purchasing latex paints, purchase these items made from postconsumer recovered materials when these items meet applicable specifications and performance requirements.

Product Specifications:

EPA recommends that procuring agencies use the U.S. General Services Administration's (GSA's) specification TT-P-2846, Paint, Latex (Recycled with Post-Consumer Waste). This specification applies to interior, exterior, and interior/exterior latex paints intended for use on wallboard, concrete, stucco, masonry, and wood.

GSA specification TT-P-2846 requires high content levels (50 to 90 percent postconsumer paint). EPA recommends that procuring agencies refer to the requirements and quality assurance provisions in TT-P-2846 when purchasing reprocessed latex paint containing lower levels of postconsumer paint (e.g., whites, off-whites, and pastel colors).

Product Information:

The CPG web site (http:/www.epa.gov/cpg) identifies manufacturers and suppliers of consolidated and reprocessed latex paint containing recovered materials.

Floor tiles for heavy duty or commercial specialty applications can contain up to 100 percent postconsumer rubber. They are made from used truck and airline tires. Floor tiles containing 90 to 100 percent recovered plastic are also readily available. Patio blocks made from 90 to 100 percent recovered plastic and 90 to 100 percent postconsumer rubber are used in garden walkways and trails.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing floor tiles and patio blocks as shown in the table below.

EPA's Recommended Recovered Materials Content Levels for Floor Tiles and Patio Blocks[1]

Product	Material	Postconsumer Content (%)	Total Recovered Materials Content (%)
Patio Blocks	Rubber or Rubber Blends	90-100	–
	Plastic or Plastic Blends	–	90-100
Floor Tiles (heavy duty/commercial use)	Rubber	90-100	–
	Plastic	–	90-100

[1]The recommended recovered materials content levels are based on the dry weight of the raw materials, exclusive of any additives such as adhesives, binders, or coloring agents. EPA's recommendation does not preclude procuring agencies from purchasing floor tiles or patio blocks manufactured from another material. It simply recommends that procuring agencies, when purchasing floor tiles or patio blocks made from rubber or plastic, purchase these items made from recovered materials. Recommendations for floor tiles are limited to heavy-duty/commercial-type applications only.

EPA clarified in the Federal Register (FR) at 62 FR 60995, November 13, 1997, that the use of floor tiles with recovered materials content might be appropriate only for specialty purpose uses (e.g., raised, open-web tiles for drainage on school kitchen flooring). Such specialty purpose uses involve limited flooring areas where grease, tar, snow, ice, wetness or similar substances or conditions are likely to be present. Thus, EPA has no recovered materials content level recommendations for floor tiles made with recovered materials for standard office or more general purpose uses.

Product Information:

The CPG web site (http:www.epa.gov/cpg) identifies manufacturers and suppliers of floor tiles and patio blocks containing recovered materials.

Structural fiberboard is a panel made from wood, cane, or paper fibers matted together which is used for sheathing, structural, and insulating purposes. Laminated paperboard is made from one or more plies of kraft paper bonded together and is used for decorative, structural, or insulating purposes. Examples of these products include building board, insulating formboard, sheathing, and acoustical and non-acoustical ceiling tile.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing structural fiberboard and laminated paperboard as shown in the table below.

EPA's Recommended Recovered Materials Content Levels for Structural Fiberboard and Laminated Paperboard[1]

Product	Material	Postconsumer Content (%)	Total Recovered Materials Content (%)
Structural Fiberboard	–	–	80-100
Laminated Paperboard	Postconsumer Paper	100	100

[1]The recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

Product Specifications:

EPA recommends that procuring agencies use American Society for Testing and Materials (ASTM) Standard Specification C 208 and ANSI/AHA specification A194.1. EPA further recommends that, when purchasing structural fiberboard products containing recovered paper, procuring agencies should do the following:

- Reference the technical requirements of ASTM C 208, "Insulating Board (Cellulosic Fiber), Structural and Decorative."
- Permit structural fiberboard products made from recovered paper where appropriate.
- Permit products, such as floor underlayment and roof overlay, containing recovered paper.

In addition, EPA recommends that procuring agencies review their specifications for insulating products and revise them as necessary to obtain the appropriate "R"-value without unnecessarily precluding the purchase of products containing recovered materials.

Product Information:

The CPG web site (http://www.epa.gov/cpg) identifies manufacturers and suppliers of structural fiberboard and laminated paperboard containing recovered materials.

Shower and restroom dividers/partitions are made of 20 to 100 percent recovered plastic or steel. They are used to separate individual shower, toilet, and urinal compartments in commercial and institutional facilities. EPA's designation specifically covers shower and restroom dividers/partitions containing recovered plastic or steel.

Recommended Recovered Materials Content Ranges:

EPA's RMAN recommends recycled-content levels for purchasing shower and restroom dividers/partitions as shown in the table below.

EPA's Recommended Recovered Materials Content Levels for Shower and Restroom Dividers/Partitions Containing Recovered Plastic or Steel[1]

Material	Postconsumer Content (%)	Total Recovered Materials Content (%)
Steel	16	20-30
Plastic	20-100	20-100

[1]EPA's recommendation does not preclude agencies from purchasing shower and restroom dividers/partitions manufactured from another material such as wood. It simply recommends that procuring agencies, when purchasing shower and restroom dividers/partitions made from plastic or steel, purchase these items made from recovered materials when these items meet applicable specifications and performance requirements.

Product Specifications:

EPA recommends that procuring agencies use the following specifications when procuring shower and restroom dividers/partitions:

- The American Institute of Architects (AIA) has issued guidance for specifying construction materials, including plastic and steel dividers/partitions. The AIA guidance is known throughout the construction industry as the "Masterspec" and is available through the U.S. General Services Administration.
- U.S. Army Corps of Engineers' Guide Specification CEGS-10160, "Toilet Partitions."

Product Information:

The CPG web site (http://www.epa.gov/cpg) identifies manufacturers and suppliers of shower and restroom dividers/partitions containing recovered materials.

ATTACHMENT 10

ENERGY STAR

ENERGY EFFICIENCY AND RENEWABLE ENERGY NETWORK (EREN)
CONSUMER ENERGY INFORMATION: EREC FACT SHEETS

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Energy Efficient Lighting

The quantity and quality of light around us determine how well we see, work, and play. Light affects our health, safety, morale, comfort, and productivity.

Lighting also directly affects our economy. As a nation, we spend about one-quarter of our electricity budget on lighting, or more than $37 billion annually. Yet much of this expense is unnecessary. Technologies developed during the past 10 years can help us cut lighting costs 30% to 60% while enhancing lighting quality and reducing environmental impacts.

This publication is an introduction to lighting technology and discusses how you can save energy while maintaining good light quality and quantity. Specifically, you will learn about:

- Lighting principles and definitions
- Types of lighting and how each works
- Energy-efficient lighting options, including daylighting, for new or retrofit applications.

Lighting Principles and Terms

To choose the best lighting options, you should understand basic lighting terms. This section explains terminology used in the industry, which will help you better understand the potentially confusing language you could hear in a lighting store.

Illumination

A lumen is a measurement of light output from a lamp, often called a tube or a bulb. All lamps are rated in lumens. For example, a 100-watt incandescent lamp produces about 1750 lumens.

The distribution of light on a horizontal surface is called its illumination. Illumination is measured in footcandles. A footcandle of illumination is a lumen of light distributed over a 1-square-foot (0.09-square-meter) area.

The amount of illumination required varies according to the difficulty of a visual task. Ideal illumination is the minimum footcandles necessary to allow you to perform a task comfortably and proficiently without eyestrain. The Illuminating Engineering Society says that illumination of 30 to 50 footcandles is adequate for most home and office work. Difficult and lengthy visual tasks--like sewing for extended periods of time--require 200 to 500 footcandles. Where no seeing tasks (i.e., tasks whose speed and accuracy of completion are affected by quality and quantity of light) are performed, lighting systems need to provide only security, safety, or visual comfort. In these situations, 5 to 20 footcandles of illumination are required.

Another lighting term you will hear is efficacy. This is the ratio of light output from a lamp to the electric power it consumes and is measured in lumens per watt (LPW).

Lighting Uses

Experts divide lighting uses into three categories: ambient, task, and accent lighting. Ambient lighting provides security and safety, as well as general illumination for performing daily activities. The goal of task

lighting is to provide enough illumination so that tasks can be completed accurately but not provide so much light that entire areas are illuminated. Accent lighting illuminates walls so they blend more closely with naturally bright areas like ceilings and windows.

Light Quality

Light quality describes how well people in a lighted space can see to do visual tasks and how visually comfortable they feel in that space. Light quality is important to energy efficiency because spaces with higher quality lighting need less illumination. High-quality lighting is fairly uniform in brightness and has no glare.

For example, direct intense sunlight streaming through the windows of a room with chocolate brown carpets and dark wall paneling will likely give too much contrast in brightness. The pupils of your eyes will constantly adjust to the differing brightnesses. Making this area visually comfortable would involve using lots of artificial lighting with a high illumination level.

On the other hand, in a pale-colored room bathed in soft light, you can hardly tell where the light is coming from because no one area of the room appears much brighter than another. The walls, ceiling, floor, and work surfaces are relatively the same light hue. People can perform tasks faster and with fewer mistakes with this type of high-quality lighting. Also, lighting such a room requires far less artificial lighting than the previous example.

Glare

Eliminating glare (i.e., excessive brightness from a direct light source) is essential to achieving good lighting quality. Types of glare include direct glare, reflected glare, and veiling reflections.

Direct glare results from strong light from windows or bright lamps shining directly into your eyes. Reflected glare is caused by strong light from windows or lamps that is reflected off a shiny surface into your eyes. Veiling reflection is a special type of reflected glare that can obscure contrasts and reduce task clarity. Veiling reflections occur when light is reflected into your eyes from a work surface, such as a printed page or a computer screen.

Light Color and Color Rendering

Lamps are assigned a color temperature (according to the Kelvin temperature scale) based on their "coolness" or "warmness." The human eye perceives colors as cool if they are at the blue-green end of the color spectrum, and warm if they are at the red end of the spectrum.

Cool light is preferred for visual tasks because it produces higher contrast than warm light. Contrast is the brightness difference between different parts of the visual field, which is the expanse of space you can see at a given instant without moving your eyes. Warm light is preferred for living spaces because it is more flattering to skin tones and clothing.

Keep in mind, though, that artificial light sources vary widely in their color rendering indexes (CRI). The CRI is a measurement of a light source's ability to render colors the same as sunlight does. For example, incandescent lamps are rated at a CRI of 100 (nearly equal to sunlight) while some high-pressure sodium lamps have a CRI of 22, which means they render colors very poorly.

However, a light's color-rendering ability is not related to whether it is a cool or warm color. For example, blue light from the northern sky, white light at noon, and red light from a sunset all have perfect color rendering (a CRI of 100) because our eyes are designed to read the colors of objects illuminated by sunlight.

Types of Lighting

There are four basic types of lighting: incandescent, fluorescent, high-intensity discharge, and low-pressure sodium.

Incandescent lighting is the most common type of lighting used in residences. Fluorescent lighting is used primarily in commercial indoor lighting systems, while high-intensity discharge lighting is used only for outdoor lighting applications. Low-pressure sodium lighting is used where color rendering is not important, such as highway and security lighting. These lighting types vary widely in their construction, efficiency, color characteristics, and lamp life.

Incandescent

Incandescent lamps are the least expensive to buy but the most expensive to operate. Incandescent light is produced by a tiny coil of tungsten wire that glows when it is heated by an electrical current.

Incandescent lamps have the shortest lives of the common lighting types. They are also relatively inefficient compared with other lighting types. However, significant energy and cost savings are possible if you select the right incandescent lamp for the right job. The three most common types of incandescent lights are standard incandescent, tungsten halogen, and reflector lamps.

Standard incandescent

Known as the "A-type light bulb," these lamps are the most common yet the most inefficient light source available. Larger wattage bulbs have a higher efficacy than smaller wattage bulbs. Note that a larger wattage lamp or bulb may not be the most energy- or cost-effective option, depending on how much light is needed. "Long- life" bulbs, with thicker filaments, are a variation of these A-type bulbs. Although long-life bulbs last longer than their regular counterparts, they are less energy efficient.

Tungsten halogen

This newer type of incandescent lighting achieves better energy efficiency than do standard A-type bulbs. It has a gas filling and an inner coating that reflect heat. Together, the filling and coating recycle heat to keep the filament hot with less electricity. These lamps are considerably more expensive than standard incandescents and are primarily used in commercial applications: theater, store, and outdoor lighting systems.

Reflector lamps

Reflector lamps (Type R) are designed to spread light over specific areas. They are used mainly indoors for stage/theater and store applications, as well as floodlighting, spotlighting, and downlighting. Parabolic aluminized reflectors (Type PAR) are used for outdoor floodlighting. The ellipsoidal reflector (Type ER) focuses the light beam about 2 inches (5 centimeters) in front of its enclosure and is designed to project light down from recessed fixtures. Ellipsoidal reflectors are twice as energy efficient as parabolic reflectors for recessed fixtures.

Fluorescent

The light produced by a fluorescent tube is caused by an electric current conducted through mercury and inert gases. Fluorescent lighting is used mainly indoors (both for ambient and task lighting) and is about 3 to 4 times as efficient as incandescent lighting. Fluorescent lamps last about 10 times longer than incandescents. But, to gain the most efficiency, you should install fluorescents in places where they will be on for several hours at a time.

Fluorescent lights need ballasts (i.e., devices that control the electricity used by the unit) for starting and circuit protection. Ballasts consume energy. You can increase the energy savings for existing fluorescent lighting by relamping (e.g., replacing an existing lamp with one of a lower wattage), replacing ballasts, and replacing fixtures with more efficient models.

Tube fluorescent

These lamps are the next most popular lamps after A-type incandescent lamps. The two most common types are 40-watt, 4-foot (1.2-meter) lamps and 75-watt, 8-foot (2.4-meter) lamps. Tubular fluorescent fixtures and lamps are preferred for ambient lighting in large indoor areas because their low brightness creates less direct glare than do incandescent bulbs.

Compact fluorescent

Compact fluorescent lamps (CFLs) are the most significant lighting advance developed for homes in recent years. They combine the efficiency of fluorescent lighting with the convenience and popularity of incandescent fixtures. CFLs can replace incandescents that are roughly 3 to 4 times their wattage, saving up to 75% of the initial lighting energy. Although CFLs cost from 10 to 20 times more than comparable incandescent bulbs, they last 10 to 15 times as long. This energy savings and superior longevity make

CFLs one of the best energy efficiency investments available.

When introduced in the early- to mid-1980s, CFLs were bulky, heavy, and too big for many incandescent fixtures. However, newer models with lighter electronic ballasts are only slightly larger than the incandescent lamps they replace.

CFLs come in integral and modular designs. Integral CFLs have a ballast and a lamp in a single disposable unit. Modular designs feature a separate ballast that serves about five lamp replacements before it wears out.

High-Intensity Discharge

High-intensity discharge (HID) lamps provide the highest efficacy and longest service life of any lighting type. They are commonly used for outdoor lighting and in large indoor arenas.

HID lamps use an electric arc to produce intense light. They also require ballasts, and they take a few seconds to produce light when first turned on because the ballast needs time to establish the electric arc.

The three most common types of HID lamps are mercury vapor, metal halide, and high-pressure sodium. HID lamps and fixtures can save 75% to 90% of lighting energy when they replace incandescent lamps and

fixtures. Significant energy savings are also possible by replacing old mercury vapor lamps with newer metal halide or high-pressure sodium lamps.

Mercury vapor-the oldest type of HID lighting; it is used primarily for street lighting. Mercury vapor lamps provide about 50 lumens per watt. They cast a very cool blue/green white light. Most indoor mercury vapor lighting in arenas and gymnasiums has been replaced by metal halide lighting, which has better color rendering and efficiency.

Metal halide lamps are similar in construction and appearance to mercury vapor lamps. The addition of metal halide gases to mercury gas within the lamp results in higher light output, more lumens per watt, and better color rendition than from mercury gas alone. Metal halide lamps are used to light large indoor areas such as gymnasiums and sports arenas, and for outdoor areas such as car lots or anywhere that color rendition is important.

High-pressure sodium lighting is becoming the most common type of outdoor lighting. It provides 90 to 150 lumens per watt, an efficiency exceeded only by low-pressure sodium lighting. High-pressure sodium lamps are also reliable and have long service lives. Their color is a warm white, and their color rendition ranges from poor to fairly good depending on design and intended use.

Low-Pressure Sodium

Low-pressure sodium lamps work somewhat like fluorescent lamps. They are the most efficient artificial lighting, have the longest service life, and maintain their light output better than any other lamp type. Low-pressure sodium lighting is used where color is not important because it renders all colors as tones of yellow or gray. Typical applications include highway and security lighting.

Energy Efficiency with Lighting

Lighting accounts for 20% to 25% of all electricity consumed in the United States. An average household dedicates 5% to 10% of its energy budget to lighting, while commercial establishments consume 20% to 30% of their total energy just for lighting.

In a typical residential or commercial lighting installation, 50% or more of the energy is wasted by obsolete equipment, inadequate maintenance, or inefficient use.

Saving lighting energy requires either reducing electricity consumed by the light source or reducing the length of time the light source is on. This can be accomplished by:

- Lowering wattage, which involves replacing lamps or entire fixtures
- Reducing the light source's on-time, which means improving lighting controls and educating users to turn off unneeded lights
- Using daylighting, which reduces energy consumption by replacing electric lights with natural light
- Performing simple maintenance, which preserves illumination and light quality and allows lower initial illumination levels

Replacing Lamps and Fixtures

Relamping means substituting one lamp for another to save energy. You can decide to make illumination higher or lower when relamping. But be sure that the new lamp's lumen output fits the tasks performed in the space and conforms to the fixture's specifications.

When relamping an entire store or office, first test the new lamps in a small area to ensure adequate illumination, occupant satisfaction, and compatibility of the new lamp and the old fixture.

Matching replacement lamps to existing fixtures and ballasts can be tricky, especially with older fixtures. Buying new fixtures made for new lamps produces superior energy savings, reliability, and longevity compared with relamping.

Relamping incandescent fixtures

Much has been learned about fixture design since the energy crises of the 1970s. Many indoor fixtures trap a significant portion of light inside the fixture, while many outdoor fixtures tend to disperse much of their light beyond the intended area, which causes light pollution.

New incandescent fixtures are designed to push all their light out into the room. Others use smaller tungsten halogen lamps. Advances in indoor fixture design include brighter reflectors and better reflecting geometry.

Many incandescent lamps are mismatched to their tasks. Some have excessive wattages, creating unnecessarily high illumination. This can be corrected by using lamps with smaller wattage.

Some existing incandescent lamps may not be the best type of lamp for their application. A-type light bulbs can often be replaced with improved lamp designs, such as reflectors or tungsten halogen lamps. And, for energy savings of 60% to 75%, many incandescent lamps can be replaced by CFLs.

When used in recessed fixtures, standard A-type lamps and reflector lamps waste energy and their light gets trapped. To save energy, you could replace a 150-watt standard reflector with a 75-watt ellipsoidal reflector (ER). Remember, though, that ER lamps are less efficient at delivering light from shallow fixtures, so use reflectors or parabolic reflectors for these purposes.

You can also replace standard A-type lamps with CFLs in spaces where lights are needed for long periods of time. A standard 18-watt CFL replaces a 75-watt A-type lamp. CFLs are also packaged in the same glass reflector lamps as incandescent lamps. Use CFLs packaged as ellipsoidal reflectors (type-ER) in recessed fixtures. Use reflector (R) or parabolic reflector (PAR) CFLs for flood and spotlighting. New CFL fixtures have built-in electronic ballasts and polished metal reflectors.

Relamping fluorescent fixtures

Although fluorescent lamps are generally energy efficient, there are new, even more efficient lamps that use better electrodes and coatings than do older fluorescent lamps. They produce about the same lumen output with substantially lower wattage.

Common 40-watt and 75-watt lamps can be replaced with energy-saving lamps of 34 watts and 60 watts, respectively. Energy-saving lamps for less-common fluorescent fixtures are also available.

If you need to replace the ballasts in your fluorescent fixtures, consider using one of the improved varieties. These fluorescent ballasts, called improved electromagnetic ballasts and electronic ballasts, raise the efficiency of the fixture 12% to 30%.

The new electromagnetic ballasts reduce ballast losses, fixture temperature, and system wattage. Because they operate at cooler temperatures, they last longer than standard electromagnetic ballasts.

Electronic ballasts operate at a very high frequency that eliminates flickering and noise. They are even more efficient than improved electromagnetic ballasts. Some electronic ballasts even allow you to operate the fluorescent lamp on a dimmer switch, which usually is not recommended with most fluorescents.

Improving Lighting Controls

Lighting controls are devices for turning lights on and off or for dimming them. The simplest type is a standard snap switch. Other controls are photocells, timers, occupancy sensors, and dimmers.

- Snap switches, located in numerous convenient areas, make it easier for people in large, shared spaces to turn off lights in unused areas.
- Photocells turn lights on and off in response to natural light levels. Photo-cells switch outdoor lights on at dusk and off at dawn, for example. Advanced designs gradually raise and lower fluorescent light levels with changing daylight levels.
- Mechanical or electronic time clocks automatically turn on and off indoor or outdoor lights for security, safety, and tasks such as janitorial work.
- Crank timers, which are spring-driven and similar to old oven timers, limit lights to short durations where the need for light is brief.
- Occupancy sensors activate lights when a person is in the area and then turn off the lights after the person has left. They are popular for areas used infrequently, such as warehouses. They also offer security advantages over continuous lighting: when lights suddenly come on, they startle intruders and alert residents and neighbors to motion in the area.
- Dimmers reduce the wattage and output of incandescent and fluorescent lamps. Dimmers also increase the service life of incandescent lamps significantly. However, dimming incandescent lamps reduces their lumen output more than their wattage. This makes incandescent lamps less efficient as they are dimmed. Dimming fluorescents requires special dimming ballasts and lamp holders, but does not reduce their efficiency.

Fluorescent Lamp Disposal

All fluorescent lights contain small amounts of mercury, and some compact fluorescent lamps with magnetic ballasts contain small amounts of short-lived radioactive material. Because of these hazardous materials, you should not toss burned-out lamps into the trash. Find out if there is a recycling program for them in your community (they are becoming more common) or dispose of them with other household hazardous wastes such as batteries, solvents, and paints at your community's designated drop-off point or during a designated day when you can put such materials with your curbside trash pickup.

Daylighting

Daylighting means using daylight for indoor lighting. Modern buildings designed for daylighting typically use 40% to 60% less electricity for lighting needs than do conventional buildings.

Sunlight and daylight are free and readily accessible. However, using sunlight without causing glare and without overheating a building can be difficult. Glare can be avoided by using window sills, walls, louvers, reflective blinds, and other devices to reflect light deep into the building. Be careful to locate windows and skylights away from the sun's direct rays to avoid overheating. For example, placing skylights on the north slope of your roof rather than on the southern exposure may reduce heat transfer. In addition, look for windows with new selective glazings that transmit the most visible light while excluding the most solar heat.

For more information on daylighting and windows, contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC--see Source List).

Lighting Maintenance

Maintenance is vital to lighting efficiency. Light levels decrease over time because of aging lamps and dirt on fixtures, lamps, and room surfaces. Together, these factors can reduce total illumination by 50% or more, while lights continue drawing full power. The following basic maintenance suggestions can help prevent this.

- Clean fixtures, lamps, and lenses every 6 to 24 months by wiping off the dust. However, never clean an incandescent bulb while it is turned on. The water's cooling effect will shatter the hot bulb.
- Replace lenses if they appear yellow.
- Clean or repaint small rooms every year and larger rooms every 2 to 3 years. Dirt collects on surfaces, which reduces the amount of light they reflect.
- Consider group relamping. Common lamps, especially incandescent and fluorescent lamps, lose 20% to 30% of their light output over their service life. Many lighting experts recommend replacing all the lamps in a lighting system at once. This saves labor, keeps illumination high, and avoids stressing any ballasts with dying lamps.

Optimizing Energy Efficiency and Lighting Quality

When making changes designed to increase the energy efficiency of lighting, it often pays to redesign the building's entire lighting system. This can improve lighting quality, make visual tasks easier, and save 50% or more on energy costs.

Often, you can reduce light levels without reducing light quality by following these procedures.

- Redesign visual tasks. For example, use a better printer with darker printing.
- Reduce light levels where there are no visual tasks. Provide the minimum light necessary for safety, security, and aesthetics.
- Reduce light levels for visual tasks where those levels are currently excessive.

If you want to cut energy consumption from lighting while enhancing light quality, consider the following.

- Establish ambient illumination at minimum acceptable levels.
- Provide task lighting at the optimal level depending on the difficulty of visual tasks. For example, sewing requires more light than cooking.
- Increase the efficiency of lamps, ballasts, and fixtures.
- Improve light quality by reducing glare and brightness contrast.
- Use daylighting where possible and practical.

Better Light, Less Cost

Using just a few of these ideas will help lower your electricity costs from lighting and make your home or workplace more comfortable and efficient.

Source List

There are many groups that can provide you with more information on energy-efficient lighting. The following are just a few of the organizations that can assist you.

Illuminating Engineering Society of North America (IESNA)
345 East 47th Street
New York, NY 10017
(212) 705-7913
IES is a technical society dealing with the art, science, and practice of illumination.

Lawrence Berkeley National Laboratory
Windows and Daylighting Group
Mail Stop 90311 Building 90, Room 3026
Berkeley, CA 94720
(510) 486-5605
Lawrence Berkeley National Laboratory is among America's foremost authorities on daylighting.

The National Lighting Bureau (NLB)
2101 L Street NW, Suite 300
Washington, DC 20037
(202) 457-8437
The NLB provides information and publications on energy management of lighting and offers the publication, Getting the Most From Your Lighting Dollar.

Rensselaer Polytechnic Institute
Lighting Research Center
110 8th Street Troy, NY 12180
(518) 276-8716
The Lighting Research Center provides scientists and educators with in-depth publications on the topic of lighting, including The Lighting Pattern Book for Homes.

Rocky Mountain Institute (RMI)
1739 Snowmass Creek Road
Snowmass, CO 81654
(970) 927-3851
Fax: (970) 927-3428
RMI is a nonprofit research and educational organization that fosters the efficient, sustainable use of resources, and publishes a series of Home Energy Briefs on a variety of topics.

For more information on energy-efficient lighting, daylighting, and other topics, contact:

The Energy Efficiency and Renewable Energy Clearinghouse (EREC)

P.O. Box 3048
Merrifield, VA 22116
(800) DOE-EREC (363-3732)
Fax: (703) 893-0400
This free service provides general and technical information to the public on a wide spectrum of energy efficiency and renewable energy topics.

Reading List

Advanced Lighting Guidelines: 1993, U.S. Department of Energy. Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA22161.

Buildings that Save Money with Efficient Lighting, published for local government agencies. Produced for the U.S. Department of Energy (publication number DOE/CH10093-212), by the National Renewable Energy Laboratory, Document Distribution Center, 1617 Cole Boulevard, Golden, CO 80401, 1993.

Concepts and Practices of Architectural Daylighting, F. Moore, Van Nostrand Reinhold Co., 1991.

"Energy-Efficient Lighting for the Home," Home Energy, pp. 53-60, November/December 1994.

"Energy-Efficient Lighting, Naturally," Popular Science, pp. 44-47, August 1990.

"Fluorescent Lamps--A Bright New Recyclable," Resource Recycling, pp. 71-78, March 1992.

Lighting Efficiency Applications, 2nd Edition, A. Thumann, The Fairmont Press, 1992.

Windows and Daylighting, U.S. Department of Energy. Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, 1994.

Energy Efficient Windows

Windows bring light, warmth, and beauty into buildings and give a feeling of openness and space to living areas. They can also be major sources of heat loss in the winter and heat gain in the summer. In 1990 alone, the energy used to offset unwanted heat losses and gains through windows in residential and commercial buildings cost the United States $20 billion (one-fourth of all the energy used for space heating and cooling). However, when properly selected and installed, windows can help minimize a home's heating, cooling, and lighting costs. This publication describes one option—energy-efficient windows—available for reducing a home's heating and cooling energy requirements.

Controlling Air Leaks

When air leaks around windows, energy is wasted. Energy is also transferred through the centers, edges, and frames of windows. Eliminating or reducing these paths of heat flow can greatly improve the energy efficiency of windows. Several options are available to reduce air leaks around windows; the least expensive options are caulking and weatherstripping, followed by replacing window frames.

Caulking and Weatherstripping

Caulks are airtight compounds (usually latex or silicone) that fill cracks and holes. Before applying new caulk, old caulk or paint residue remaining around a window should be removed using a putty knife, stiff brush, or special solvent. After old caulk is removed, new caulk can then be applied to all joints in the window frame and the joint between the frame and the wall. The best time to apply caulk is during dry weather when the outdoor temperature is above 45° Fahrenheit (7.2° Celsius). Low humidity is important during application to prevent cracks from swelling with moisture. Warm temperatures are also necessary so the caulk will set properly and adhere to the surface.

Weatherstripping is a narrow piece of metal, vinyl, rubber, felt, or foam that seals the contact area between the fixed and movable sections of a window joint. It should be applied between the sash and the frame, but should not interfere with the operation of the window. For more information on caulking and weatherstripping, contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC).

Replacing Window Frames

The type and quality of the window frame usually affect a window's air infiltration and heat loss characteristics. Many window frames are available—all with varying degrees of energy efficiency. Some of the more common window frames are fixed-pane, casement, double- and single-hung, horizontal sliding, hopper, and awning.

When properly installed, fixed-pane windows are airtight and inexpensive and can be custom designed for a wide variety of applications. But, because they cannot be opened, fixed-pane windows are unsuitable in places where ventilation is required.

Casement, awning, and hopper windows with compression seals are moderately airtight and provide good ventilation when opened. Casement windows open sideways with hand cranks. Awning windows are similar to casement windows except that their hinges are located at the tops of the windows instead of at the sides. Hopper windows are inverted versions of awning windows with their hinges located at the bottom. Windows with compression seals allow about half as much air leakage as double-hung and horizontal sliding windows with sliding seals.

Double-hung windows have top and bottom sashes (the sliding sections of the window) and can be opened by pulling up the lower sashes or pulling down the upper sash. Although they are among the most popular type of window, double-hung windows can be inefficient because they are often leaky. Single- hung windows are somewhat better because only one sash moves. Horizontal sliding windows are like double-hung windows except that the sashes are located on the left and right edges rather than on the tops and bottoms. Horizontal sliding windows open on the side and are especially suitable for spaces that require a long, narrow view. These windows, however, usually provide minimal ventilation and, like double-hung windows, can be quite leaky.

Reducing Heat Loss and Condensation

Manufacturers usually represent the energy efficiency of windows in terms of their U-values (conductance of heat) or their R-values (resistance to heat flow). If a window's R-value is high, it will lose less heat than one with a lower R-value. Conversely, if a window's U-value is low, it will lose less heat than one with a higher U-value. In other words, U-values are the reciprocals of R-values (U-value = 1/R-value). Most window manufacturers use R-values in rating their windows.

Usually, window R-values range from 0.9 to 3.0 (U-values range from 1.1 to 0.3), but some highly energy-efficient exceptions also exist. When comparing different windows, you should ensure that all U-or R-values listed by manufacturers: (1) are based on current standards set by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), (2) are calculated for the entire window, including the frame, and not just for the center of the glass, and (3) represent the same size and style of window.

The following five factors affect the R-value of a window:

- The type of glazing material (e.g., glass, plastic, treated glass)
- The number of layers of glass
- The size of the air space between the layers of glass
- The thermal resistance or conductance of the frame and spacer materials
- The "tightness" of the installation (i.e., air leaks – see previous discussion).

Layers of Glass and Air Spaces

Standard single-pane glass has very little insulating value (approximately R-1). It provides only a thin barrier to the outside and can account for considerable heat loss and gain. Traditionally, the approach to improve a window's energy efficiency has been to increase the number of glass panes in the unit, because multiple layers of glass increase the window's ability to resist heat flow.

Double- or triple-pane windows have insulating air- or gas-filled spaces between each pane. Each layer of glass and the air spaces resist heat flow. The width of the air spaces between the panes is important, because air spaces that are too wide (more than 5/8 inch or 1.6 centimeters) or too narrow (less than ½ inch or 1.3 centimeters) have lower R-values (i.e., they allow too much heat transfer). Advanced, multi-pane windows are now manufactured with inert gases (argon or krypton) in the spaces between the panes because these gases transfer less heat than does air.

Multi-pane windows are considerably more expensive than single-pane windows and limit framing options because of their increased weight.

Frame and Spacer Materials

Window frames are available in a variety of materials including aluminum, wood, vinyl, and fiberglass. Frames may be primarily composed of one material, or they may be a combination of different materials such as wood clad with vinyl or aluminum-clad wood. Each frame material has its advantages and disadvantages.

Though ideal for strength and customized window design, aluminum frames conduct heat and therefore lose heat faster and are prone to condensation. Through anodizing or coating, the corrosion and electro-galvanic deterioration of aluminum frames can be avoided. Additionally, the thermal resistance of aluminum frames can be significantly improved by placing continuous insulating plastic strips between the interior and exterior of the frame.

Wood frames have higher R-values, are not affected by temperature extremes, and do not generally promote condensation. Wood frames do require considerable maintenance in the form of periodic painting or staining. If not properly protected, wood frames can swell, which leads to rot, warping, and sticking.

Vinyl window frames, which are made primarily from polyvinyl chloride (PVC), offer many advantages. Available in a wide range of styles and shapes, vinyl frames have moderate to high R-values, are easily customized, are competitively priced, and require very low maintenance. While vinyl frames do not possess the inherent strength of metal or wood, larger-sized windows are often strengthened with aluminum or steel reinforcing bars.

Fiberglass frames are relatively new and are not yet widely available. With some of the highest R-values, fiberglass frames are excellent for insulating and will not warp, shrink, swell, rot, or corrode. Unprotected fiberglass does not hold up to the weather and therefore is always painted. Some fiberglass frames are hollow; while others are filled with fiberglass insulation.

Spacers are used to separate multiple panes of glass within the windows. Although metal (usually aluminum) spacers are commonly installed to separate glass in multi-pane windows, they conduct heat. During cold weather, the thermal resistance around the edge of a window is lower than that in the center; thus, heat can escape, and condensation can occur along the edges. To alleviate these problems, one manufacturer has developed a multi-pane window using a 1/8-inch-wide (0.32 centimeters-wide) PVC foam separator placed along the edges of the frame. Like other multi-pane windows, these use metal spacers for support, but because the foam separator is secured on top of the spacer between the panes, heat loss and condensation are reduced. Several window manufacturers now sandwich foam separators, nylon spacers, and insulation materials such as poly-styrene and rockwool between the glass inside their windows.

Conclusion

Different combinations of frame style, frame material, and glazing can yield very different results when weighing energy efficiency and cost. For example, a fixed-pane window is the most air-tight and the least expensive; a window with a wood frame is likely to have less conductive heat loss than one with an aluminum frame; double-pane, low-e window units are just as efficient as triple-pane untreated windows, but cost and weigh less.

No one window is suitable for every application. Many types of windows and window films are available that serve different purposes. Moreover, you may discover that you need two types of windows because of the directions that your windows face and your local climate. To make wise purchases, first examine your

heating and cooling needs and prioritize desired features such as daylighting, solar heating, shading, ventilation, and aesthetic value.

Source List

The following resources provide more information on energy-efficient windows.

American Architectural Manufacturers Association (AAMA)
2700 River Road, Suite 118
Des Plaines, IL 60018
(708) 202-1350
Developed a testing procedure [AAMA 1503] for measuring the thermal transmission properties of aluminum-, vinyl-, and wood-framed windows.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
(404) 636-8400
ASHRAE's Handbook of Fundamentals contains tables citing heat transfer, light transmittance, and shading properties for various window types and materials.

For information about many kinds of energy efficiency and renewable energy topics, contact:

The Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
(800) DOE-EREC (363-3732)
Fax: (703) 893-0400
Email: doe.erec@nciinc.com
EREC provides free general and technical information to the public on the many topics and technologies pertaining to energy efficiency and renewable energy.

National Fenestration Rating Council (NFRC)
962 Wayne Avenue, Suite 750
Silver Spring, MD 20910
(301) 589-6372
Developed the Procedure for Determining Fenestration Product Thermal Properties (NFRC 100-91). These procedures are now being used in NFRC's window certification and efficiency labeling programs, which have already been adopted by three states.

National Wood Window and Door Association
1400 East Touhy Avenue
Des Plaines, IL 60018-3305
(708) 299-5200
Issues seals of approval for manufacturers of wood-framed windows.

U.S. Department of Energy (DOE)
Building Systems and Materials Division
EE-421

1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-9214
Developed the WINDOW computer program, which aids window manufacturers and building designers in optimizing the thermal and daylighting performance of window systems. For their certification and labeling programs, the NFRC uses the WINDOW computer program and DOE-supported research and testing to determine the thermal and optical properties of windows.

Vinyl Window and Door Institute
355 Lexington Avenue
New York, NY 10017
(212) 351-5400
Developed performance standards and certification program for manufacturers of vinyl-framed windows.

Reading List

"No Pane, No Gain (Window Technology: Part One)," Popular Science, pp. 92–98,June 1993.

"Through the Glass Darkly," Popular Science, pp. 80&3150;87, July 1993.

Advances in Glazing Materials for Windows

Until recently, clear glass was the primary glazing material used in windows. Although glass is durable and allows a high percentage of sunlight to enter buildings, it has very little resistance to heat flow. During the past two decades, though, glazing technology has changed greatly.

Research and development into types of glazing have created a new generation of materials that offer improved window efficiency and performance for consumers. While this new generation of glazing materials quickly gains acceptance in the marketplace, the research and development of even more efficient technologies continues.

Current Options that Increase a Window's Energy Efficiency

Manufacturers usually represent the energy efficiency of windows in terms of their U-values (conductance of heat) or their R-values (resistance to heat flow). If a window's R-value is high, it will lose less heat than one with a lower R-value. Conversely, if a window's U-value is low, it will lose less heat than one with a higher U-value. In other words, U-values are the reciprocals of R-values (U-value = 1/R-value).

Usually, window R-values range from 0.9 to 3.0 (and U-values range from 1.1 to 0.3), but some highly energy-efficient exceptions also exist. When comparing different windows, you should ensure that all U- or R-values listed by manufacturers: (1) are based on current standards set by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), (2) are calculated for the entire window, including the frame, and not just for the center of the glass, and (3) represent the same size and style of window.

Today, several types of advanced glazing systems are available to help control heat loss or gain. The advanced glazings include double- and triple-pane windows with such coatings as low-emissivity (low-e), spectrally selective, heat-absorbing (tinted), or reflective; gas-filled windows; and windows incorporating combinations of these options.

Low-e Glazings

Low-e glazings have special coatings that reduce heat transfer through windows. The coatings are thin, almost invisible metal oxide or semiconductor films that are placed directly on one or more surfaces of glass or on plastic films between two or more panes. The coatings typically face air spaces within windows and reduce heat flow between the panes of glass.

When applied inside a double-pane window, the low-e coating is placed on the outer surface of the inner pane of glass to reflect heat back into the living space during the heating season. This same coating will slightly reduce heat gain during the cooling season.

Low-e films are applied in either soft or hard coats. Soft-coat low-e films degrade when exposed to air and moisture, are easily damaged, and have a limited shelf life, so they are carefully applied by manufacturers in insulated multiple-pane windows. Hard low-e coatings, on the other hand, are more durable and can be used in add-on (retrofit) applications. But the energy performance of hard-coat low-e films is slightly poorer than that of soft-coat films. Windows manufactured with low-e films typically cost about 10% to 15% more than regular windows, but they reduce energy loss by as much as 30% to 50%.

Although low-e films are usually applied during manufacturing, retrofit low-e window films are also widely available for do-it-yourselfers. These films are inexpensive compared to total window replacements, last 10 to 15 years without peeling, save energy, reduce fabric fading, and increase comfort.

Spectrally Selective Coatings
Spectrally selective (optical) coatings are considered to be the next generation of low-e technologies. These coatings filter out from 40% to 70% of the heat normally transmitted through clear glass, while allowing the full amount of light to be transmitted. Spectrally selective coatings can be applied on various types of tinted glass to produce "customized" glazing systems capable of either increasing or decreasing solar gains according to the aesthetic and climatic effects desired.

Computer simulations have shown that advanced glazings with spectrally selective coatings can reduce the electric space cooling requirements of new homes in hot climates by more than 40%. Because of the energy-saving potential of spectrally selective glass, some utilities now offer rebates to encourage its use.

Heat-Absorbing Glazings
Another technology uses heat-absorbing glazings with tinted coatings to absorb solar heat gain. Some heat, however, continues to pass through tinted windows by conduction and reradiation. But inner layers of clear glass or spectrally selective coatings can be applied with tinted glass to further reduce this heat transfer. Heat-absorbing glass reflects only a small percentage of light and therefore does not have the mirror-like appearance of reflective glass.

Gray- and bronze-tinted windows reduce the penetration of both light and heat into buildings in equal amounts (i.e., not spectrally selective) and are the most common tint colors used. On the other hand, blue- and green-tinted windows offer greater penetration of visible light and slightly reduced heat transfer compared with other colors of tinted glass. When windows transmit less than 70% of visible light, plants inside could die or grow more slowly. In hot climates black-tinted glass should be avoided because it absorbs more light than heat.

Reflective Coatings
Like black-tinted coatings, reflective coatings greatly reduce the transmission of daylight through clear glass. Although they typically block more light than heat, reflective coatings, when applied to tinted or clear glass, can also slow the transmission of heat. Reflective glazings are commonly applied in hot climates in which solar control is critical; however, the reduced cooling energy demands they achieve can be offset by the resulting need for additional electrical lighting.

Tomorrow's Options for More Efficient Windows

"Superwindows" now coming on the market can attain high thermal resistance by combining multiple low-e coatings; low-conductance gas fills; barriers between panes, which reduce convective circulation of the gas fill; and insulating frames and edge spacers.

Also, optical properties such as solar transmittance can be customized for specific climate zones. The heat from even a small amount of diffuse winter sunlight will convert these super-windows into net suppliers of energy. This first generation of superwindows now available have a center-of-glass R-value of 8 or 9, but have an overall window R-value of only about 4 or 5 because of edge and frame losses.

Also under development are chromogenic (optical switching) glazings that will adapt to the frequent changes in the lighting and heating or cooling requirements of buildings. These "smart windows" will be separated into either passive or active glazing categories.

Passive glazings will be capable of varying their light transmission characteristics according to changes in sunlight (photochromic) and their heat transmittance characteristics according to ambient temperature swings (thermochromic). Active (electrochromic) windows will use a small electric current to alter their transmission properties. Both types should be on the market within 2 to 5 years.

Conclusion

No one type of glazing is suitable for every application. Many materials are available that serve different purposes. Moreover, consumers may discover that they need two types of glazing for a home because of the directions that the windows face and the local climate. To make wise purchases, consumers should first examine their heating and cooling needs and prioritize desired features such as daylighting, solar heating, shading, ventilation, and aesthetic value.

Source List

The following organizations and publications provide more information on advances in glazing technology.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
(404) 636-8400
ASHRAE's "Handbook of Fundamentals" contains tables citing heat transfer, light transmittance, and shading properties for various window types and materials.

National Fenestration Rating Council (NFRC)
1300 Spring Street, Suite 120
Silver Spring, MD 20910
(301) 589-6372
NFRC developed procedures now being used in window certification and efficiency labeling programs.

Lawrence Berkeley Laboratory
90-311
Berkeley, CA 94720
(510) 486-4040
Distributes the WINDOW computer program, which was developed by the U.S. Department of Energy to help window manufacturers and building designers optimize the thermal and daylighting performance of windows.

Reading List

"Low-E Glass—Why the Coating Is Where It Is," Energy Design Update, pp. 5-7, March 1990.
"The Elusive Benefits of Low-E and Gas-Filled Windows," Energy Design Update, pp. 7-9, June 1990.
"Through the Glass Darkly," Popular Sc4ience, pp. 80-87, July 1993.

Automatic and Programmable Thermostats

General Thermostat Operation

A common misconception associated with thermostats is that a furnace works harder than normal to warm the space back to a comfortable temperature after the thermostat has been set back, resulting in little or no savings. This misconception has been dispelled by years of research and numerous studies. The fuel required to reheat a building to a comfortable temperature is roughly equal to the fuel saved as the building drops to the lower temperature. You save fuel between the time that the temperature stabilizes at the lower level and the next time heat is needed. So, the longer your house remains at the lower temperature, the more energy you save.

Another misconception is that the higher you raise a thermostat, the more heat the furnace will put out, or that the house will warm up faster if the thermostat is raised higher. Furnaces put out the same amount of heat no matter how high the thermostat is set—the variable is how long it must stay on to reach the set temperature. In the winter, significant savings can be obtained by manually or automatically reducing your thermostat's temperature setting for as little as four hours per day. These savings can be attributed to a building's heat loss in the winter, which depends greatly on the difference between the inside and outside temperatures. For example, if you set the temperature back on your thermostat for an entire night, your energy savings will be substantial. By turning your thermostat back 10° to 15° for 8 hours, you can save about 5% to 15% a year on your heating bill—a savings of as much as 1% for each degree if the setback period is eight hours long. The percentage of savings from setback is greater for buildings in milder climates than for those in more severe climates. In the summer, you can achieve similar savings by keeping the indoor temperature a bit higher when you're away than you do when you're at home.

Thermostats with Automatic Temperature Adjustment

To maximize your energy savings without sacrificing comfort, you can install an automatic setback or programmable thermostat. They adjust the temperature setting for you. While you might forget to turn down the heat before you leave for work in the morning, a programmable thermostat won't! By maintaining the highest or lowest required temperatures for four or five hours a day instead of 24 hours, a programmable thermostat can pay for itself in energy saved within four years.

Programmable thermostats have features with which you may be unfamiliar. The newest generation of residential thermostat technologies is based on microprocessors and thermistor sensors. Most of these programmable thermostats perform one or more of the following energy control functions:

- They store and repeat multiple daily settings, which you can manually override without affecting the rest of the daily or weekly program.
- They store six or more temperature settings a day.
- They adjust heating or air conditioning turn-on times as the outside temperature changes.

Most programmable thermostats have liquid crystal temperature displays. Some have back-up battery packs that eliminate the need to reprogram the time or clock in case of a power failure. New programmable thermostats can be programmed to accommodate life style and control heating and cooling systems as needed

Types of Automatic and Programmable Thermostats

There are five basic types of automatic and programmable thermostats:

- electromechanical
- digital
- hybrid
- occupancy
- light sensing

Most range in price from $30 to $100, except for occupancy and light sensing thermostats, which cost around $200.

Electromechanical (EM) thermostats, usually the easiest devices to operate, typically have manual controls such as movable tabs to set a rotary timer and sliding levers for night and day temperature settings. These thermostats work with most conventional heating and cooling systems, except heat pumps. EM controls have limited flexibility and can store only the same settings for each day, although at least one manufacturer has a model with separate settings for each day of the week. EM thermostats are best suited for people with regular schedules.

Digital thermostats are identified by their LED or LCD digital readout and data entry pads or buttons. They offer the widest range of features and flexibility, and digital thermostats can be used with most heating and cooling systems. They provide precise temperature control, and they permit custom scheduling.

Hybrid systems combine the technology of digital controls with manual slides and knobs to simplify use and maintain flexibility. Hybrid models are available for most systems, including heat pumps.

Occupancy thermostats maintain the setback temperature until someone presses a button to call for heating or cooling. They do not rely on the time of day. The ensuing preset "comfort period" lasts from 30 minutes to 12 hours, depending on how you've set the thermostat. Then, the temperature returns to the setback level. These units offer the ultimate in simplicity, but lack flexibility. Occupancy thermostats are best suited for spaces that remain unoccupied for long periods of time.

Light sensing heat thermostats rely on the lighting level preset by the owner to activate heating systems. When lighting is reduced, a photocell inside the thermostat senses unoccupied conditions and allows space temperatures to fall 10° below the occupied temperature setting. When lighting levels increase to normal, temperatures automatically adjust to comfort conditions. These units do not require batteries or programming and reset themselves after power failures. Light sensing thermostats are designed primarily for stores and offices where occupancy determines lighting requirements, and therefore heating requirements.

Choosing a Programmable Thermostat

Because programmable thermostats are a relatively new technology, you should learn as much as you can before selecting a unit. When shopping for a thermostat, bring information with you about your current unit, including the brand and model number. Also, ask these questions before buying a thermostat:

- Does the unit's clock draw its power from the heating systems's low-voltage electrical control circuit instead of a battery? If so, is the clock disrupted when the furnace cycles on and off? Battery-operated back-up thermostats are preferred by many homeowners.
- Is the thermostat compatible with the electrical wiring found in your current unit?

- Are you able to install it yourself, or should you hire an electrician or a heating, ventilation, and air conditioning (HVAC) contractor?
- How precise is the thermostat?
- Are the programming instructions easy to understand and remember? Some thermostats have the instructions printed on the cover or inside the housing box. Otherwise, will you have to consult the instruction booklet every time you want to change the setback times?

Most automatic and programmable thermostats completely replace existing units. These are preferred by many homeowners. However, some devices can be placed over existing thermostats and are mechanically controlled to permit automatic setbacks. These units are usually powered by batteries, which eliminates the need for electrical wiring. They tend to be easy to program, and because they run on batteries, the clocks do not lose time during power outages.

Other Considerations

The location of your thermostat can affect its performance and efficiency. Read the manufacturer's installation instructions to prevent "ghost readings" or unnecessary furnace or air conditioner cycling. Place thermostats away from direct sunlight, drafts, doorways, skylights, and windows. Also make sure your thermostat is conveniently located for programming.

Some modern heating and cooling systems require special controls. Heat pumps are the most common and usually require special setback thermostats. These thermostats typically use special algorithms to minimize the use of backup electric resistance heat systems. Electric resistance systems, such as electric baseboard heating, also require thermostats capable of directly controlling 120 volt or 240 volt line-voltage circuits. Only a few companies manufacture line-voltage setback thermostats.

A Note for Heat Pump Owners

When a heat pump is in its heating mode, setting back a conventional heat pump thermostat can cause the unit to operate inefficiently, thereby canceling out any savings achieved by lowering the temperature setting. Maintaining a moderate setting is the most cost-effective practice. Recently, however, some companies have begun selling specially designed setback thermostats for heat pumps, which make setting back the thermostat cost effective. In its cooling mode, the heat pump operates like an air conditioner; therefore, manually turning up the thermostat will save you money.

A Simpler Way to Control Your Environment

The best thermostat for you will depend on your life style and comfort level in varying house temperatures. While automatic and programmable thermostats save energy, a manual unit can be equally effective if you diligently regulate its setting—and if you don't mind a chilly house on winter mornings. If you decide to choose an automatic thermostat, you can set it to raise the temperature before you wake up and spare you some discomfort. It will also perform consistently and dependably to keep your house at comfortable temperatures during the summer heat, as well.

Source List

The Energy Efficiency and Renewable Energy Clearinghouse (EREC)
P.O. Box 3048
Merrifield, VA 22116
(800) 363-3732
Fax: (703) 893-0400
E-mail: doe.erec@nciinc.com
EREC provides free general and technical information to the public on the many topics and technologies pertaining to energy efficiency and renewable energy.

Reading List

"Electronic Thermostats," Radio-Electronics, June 1992.

"Energy Saving Thermostats," Consumer Reports, October 1993."

"New Electronic Thermostats Save Money," Consumers Digest, January 1989.

"Smart Thermostats for Comfort and Conservation," March 1994, EPRI Journal.

ATTACHMENT 11

ENERGY STAR – EXIT SIGNS

As a nation, we spend about $1 billion annually to operate all the exit signs in buildings in the United States. By the year 2000, companies could be saving 800 million kilowatts of electricity per year through the use of Energy Star-labeled exit signs. That's a total savings of almost $70 million each year.

Most energy is generated by burning fossil fuels such as coal, oil, or natural gas, adding millions of tons of carbon dioxide, sulfur dioxide, and nitrogen oxide to the atmosphere. These harmful gases pollute the air we breathe and contribute to smog, acid rain, and global climate change.

Light Emitting Diodes (LED)

When it comes to exit signs for your business, now there's a better way out. The light emitting diode, or LED, meets electrical code requirements in most applications, uses minimal amounts of electricity and lasts up to 50 years. Old-fashioned exit signs typically use two 20-watt incandescent light bulbs, which cost about $35 a year to operate and require replacement every 9,000 hours. For signs left on around the clock, that's about once a year. Although there are other options that save money, like compact fluorescent fixtures, LED's are the winners for cost savings and avoiding the inconvenience of replacing the lamps.

Life Cycle Cost Comparison

Lamp Type	Lamp Life (hours)	1-Year Annual Operating Cost	5-Year* Life Cycle Cost
2 20-Watt T-6 Incandescents	9,000	$35.00	$290.00
2 face LED system 4 Watts per face	438,000	**$3.00**	**$125.00**

*5-year cost includes initial purchase of sign, replacement lamps and electricity costs at 10 cents per kilowatt-hour.

To learn how to obtain rebates on LED exit signs for new construction or renovations, contact your local Energy Use Advisor. Or, visit http://www.lrc.rpi.edu/LtgTrans/exits.

ATTACHMENT 12

FEDERAL ENERGY MANAGEMENT PROGRAM
ENERGY EFFICIENCY AND RENEWABLE ENERGY

Why Agencies Should Buy Efficient Products

- Section 161 of the Energy Policy Act of 1992 (EPACT) encourages energy-efficient federal procurement. Executive Order 12902 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy efficiency, while saving taxpayer dollars.

Energy-Efficient Large Electric Chiller

Efficiency Recommendation (a)				
	Recommended		Best Available	
Product Type	Full Load (b), (c) kW/ton	IPLV (d) kW/ton	Full-load kW/ton	IPLV kW/ton
Centrifugal	0.60 or less	0.56 or less	0.48	0.42
Rotary Screw	0.65 or less	0.59 or less	0.6	0.52

(a) This Recommendation covers chillers between 175 and 1600 tons. No reciprocating chillers met the given efficiency levels. Recommendations are planned for lower tonnage electric chillers, as well as gas-engine and absorption chillers.
(b) Values are based on ARI standard reference conditions.
(c) Full-load efficiency is measured at peak load conditions as described in ARI Standard 550-92.
(d) Integrated Part-Load Value (IPLV) is a weighted average of efficiency measurements at various part-load conditions as described in ARI Standard 92.

Where to Find Energy-Efficient Chillers

The General Services Administration (GSA) has a Basic Ordering Agreement (BOA) which offers a streamlined procurement method for chillers. The minimum efficiencies listed in the BOA specification are identical to those given in this Recommendation. For more information, call GSA at the number listed (see "Federal Supply Source").

For chillers purchased through commercial sources, the BOA can still be used as a valuable specification aid, as can the referenced ARI and ASHRAE guides (see "For More Information").

Buyer Tips

The decision to specify chiller efficiency using the full-load or part-load (IPLV) recommended level depends upon the application. Full-load is appropriate where chiller loads are relatively constant; IPLV is preferred for highly variable loads, the more common situation. Some buyers may want to select a chiller based on a weighted average efficiency over the expected actual load range. This efficiency figure is known as the applied part load value (APLV).

An Energy Savings Performance Contract (ESPC) is an innovative method of financing a new chiller with payments based on energy cost savings, both from the chiller itself, as well as from other associated energy conservation measures. For more information, call the FEMP Help Desk at (800) 363-3732.

Environmental Tips

Refrigerants with ozone-destroying chlorofluorocarbons (CFCs) were common in older chillers but are no longer used in new equipment. The 1992 signing of the Montreal Protocol banned the production of CFCs in the U.S., beginning in 1996. Much of today's equipment uses hydrochlorofluorocarbon (HCFC) refrigerants, which have a much lower ozone-depleting effect. There are also many energy-efficient chillers on the market that use hydrofluorocarbon (HFC) refrigerants, with no ozone-depleting effect. When purchasing an HCFC chiller, buyers can request that the manufacturer conduct leak testing before shipment; leakage of 1% annually is considered good for new equipment (consult Green Seal, listed in "For Additional Information").

Owners and operators of chillers with CFCs are faced with three options: 1) they can continue to operate their chillers with CFCs, which exposes them to the high cost of obtaining the refrigerant from a dwindling reclaimed supply; 2) they can convert the chillers to use a non-CFC refrigerant, which usually results in some loss in cooling capacity (see "Sizing," below); or 3) they can replace the equipment with a new chiller(s), which requires a substantial capital outlay. These options should be evaluated using life-cycle cost analysis (call the FEMP Help Desk at (800) 363-3732 to obtain LCC analysis materials). It is important when considering the continued operation of chillers with CFCs to assess the process of refrigerant recovery, followed by recycling or reclamation, and to factor in the likely substantial increase in the cost of obtaining replacement CFCs.

When retiring an older chiller that contains CFCs or HCFCs, the Clean Air Act requires that the refrigerant be recovered on-site by a certified technician. For compliance information, contact the EPA Stratospheric Ozone Information Hotline at (800) 296-1996.

Early Replacement

Many facility managers are opting for early replacement of existing chillers with high efficiency units using non-CFC refrigerants. Good candidates for "early retirement" are CFC-based chillers with poor efficiencies or histories of high maintenance cost. Energy cost savings can add to the environmental benefits of non-CFC refrigerants. For example, replacing a 500-ton CFC chiller (0.85 kW/ton efficiency) with an efficient (0.60 kW/ton) non-CFC chiller can save $15,000/year, assuming a conservative 6¢/kWh. Demand charge savings may almost double this figure in some cases. In addition, many utilities offer financial incentives for efficient chiller replacements.

Sizing

When replacing a chiller, careful attention to appropriate sizing is critical to achieving maximum energy savings. Many existing units are oversized; an oversized chiller not only costs more to purchase, it also leads to substantial energy losses from excessive cycling. Use the referenced ASHRAE calculation procedure (see “For More Information”) to properly determine the cooling load. It is often cost-effective to combine a chiller replacement with other measures to reduce cooling load, which permits specification of smaller equipment (see “Integrated Chiller Retrofits,” below).

Replacing a single chiller with two or more smaller chillers to meet varying load requirements may be cost-effective. “Parallel staging” of multiple chillers is a common method of meeting peak load conditions in larger installations. Multiple chillers also provide redundancy for routine maintenance and equipment failure. For many typical facilities, sizing one chiller at one-third and another chiller at two-thirds of the peak load will enable most cooling conditions to be met at relatively high chiller part-load efficiencies. It may also be desirable to optimize the staged units for different conditions. For example, one chiller could be optimized for peak efficiency at summer conditions (85°F condensing water) and the other chiller could be optimized for peak efficiency at winter conditions (75°F condensing water).

Integrated Chiller Retrofits

An "integrated chiller retrofit" can provide enormous energy savings. It combines the chiller replacement, or a refrigerant change-out, with other energy conservation measures that can reduce the cooling load, as well as measures that increase the efficiency of the cooling system itself. Examples of cooling system efficiency improvements are control system upgrades and cooling tower capacity increases. Cooling load reduction measures include tightening of the building envelope, and retrofitting of the lighting system (to provide as much or more effective light while generating less heat). The additional cost of these and other load reduction measures can be significantly offset by the savings from the downsized chiller they make possible. Lawrence Berkeley National Laboratory’s “Cool $ense” project provides good guidance on integrated chiller retrofits (see “For Additional Information”).

The first step in implementing an integrated chiller retrofit is a preliminary energy audit to assess the savings potential of various efficiency measures. These pre-screening audits can often be provided by energy service companies, architecture and engineering firms, or utilities. FEMP can also provide this technical support, on a sub-contracted, reimbursable basis. For information, contact FEMP’s Technical Assistance Team at (202) 586-1505.

Chiller Cost-Effectiveness Example			
Performance	Base Model (a)	Recommended Level	Best Available
Centrifugal Chiller - 500 tons			
Full Load Efficiency (kW/ton)	0.68	0.60	0.48
Annual Energy Use	680,000 kWh	600,000 kWh	480,000 kWh
Annual Energy Cost	$40,800	$36,000	$28,800
Lifetime Energy Cost	$535,000	$470,000	$375,000
Lifetime Energy Cost Savings (b)	–	**$65,000**	**$160,000**
Rotary Screw Chiller - 250 tons			
IPLV Efficiency (kW/ton)	0.78	0.59	0.52
Annual Energy Use	390,000 kWh	295,000 kWh	260,000kWh
Annual Energy Cost	$23,400	$17,700	$15,600
Lifetime Energy Cost	$305,000	$230,000	$205,000
Lifetime Energy Cost Savings (b)	–	**$75,000**	**$100,000**

(a) The efficiency of a base model is just sufficient to meet the current ASHRAE Standard 90.1.
(b) Lifetime Energy Cost is the sum of the discounted value of annual energy costs, based on average usage and an assumed chiller life of 23 years. Future electricity price trends and a discount rate of 4.1% are based on federal guidelines (effective from April, 1998 to March, 1999).

Cost-Effectiveness Assumptions

Annual energy use for the centrifugal chiller example is based on 2,000 equivalent full-load hours per year for a 500 ton chiller. The rotary screw chiller example uses a 250 ton machine operating for 4,000 hours per year at 50% of rated load at part-load (IPLV) efficiencies, since rotary chillers are often installed in applications with variable load conditions. The assumed electricity price is 6¢/kWh, the 1996 federal average electricity price in the U.S. This average cost figure does not incorporate the disproportionately large portion of demand costs that chillers usually contribute. Therefore, the cost savings figures are conservative.

Metric Conversion
1 ton (cooling capacity) = 12,000 Btu/h
= 3.517 kW

Understanding the Cost-Effectiveness Table

In the example shown above, a 500-ton centrifugal chiller with an efficiency of 0.60 kW/ton is cost-effective if its purchase price is no more than $65,000 above the price of the Base Model. The Best Available centrifugal model, with an efficiency of 0.48 kW/ton, is cost-effective if its price is no more than $160,000 above the price of the Base Model. Similarly, the example 250-ton Recommended and Best

Available rotary screw chillers are cost-effective if their respective purchase prices are no more than $75,000 and $100,000 above the price of the Base Model.

How Do I Perform a Life-Cycle Cost Analysis for My Situation?

The basic formula for estimating a chiller's annual energy use multiplies the system capacity (in tons) by the relevant efficiency (full-load or IPLV) by the annual number of equivalent full- or part-load operating hours. The resultant annual kWh figure can then be multiplied by the average cost per kWh for electricity, yielding the annual energy cost:

Annual Energy Cost = Capacity * Efficiency * Operating Hours * Electricity Rate.

For full life-cycle cost (LCC) analysis, this annual energy cost should then be multiplied by the regional electricity Uniform Present Value (UPV) factor for the estimated lifetime of the equipment, and then added to the initial cost of the chiller (or present value of the chiller's financed cost). A Uniform Present Value factor is the multiplier that incorporates a discount rate, as well as any projected fuel or resource price changes, and allows the simple estimation of life-cycle costs or benefits (given a fixed annual cost or benefit figure and an expected product lifetime).

Life Cycle Cost = (Annual Energy Cost * Uniform Present Value Factor) + Initial Cost.

A manual with the appropriate UPV factors ("Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis - April, 1998"), as well as an LCC analysis guidebook (NIST Handbook 135, "Life-Cycle Costing Manual for the Federal Energy Management Program") and software (BLCC) are all available through the FEMP Help Desk, at (800) 363-3732.

A large proportion of chiller energy costs are often attributable to kW demand charges. To incorporate demand and ratchet charges into the cost estimation of chiller options, the ERATES software is also available from the FEMP Help Desk.

Energy-Efficient Commercial Unitary Air Conditioner

Efficiency Recommendation		
Product Type and Size (a)	Recommended EER (b)	Best Available EER (b)
Air-Source 65-135 Mbtu/h	10.3 or more	13.5
Air-Source 135-240 Mbtu/h	9.7 or more	11.5
Air-Source more than 240 Mbtu/h	10.0 or more	11.7
Water-Source 65-135 Mbtu/h	11.5 or more	12.5
Water-Source more than 135 Mbtu/h	11.0 or more	11.0

(a) Electric air- and water-cooled split system and single package units with capacity over 65,000 Btuh are covered here. For smaller units, see "How to Buy an Energy-Efficient Residential Central Air Conditioner."
(b) EER, or Energy Efficiency Ratio, is the cooling capacity (in Btu/ hour) of the unit divided by its electrical input (in watts) at standard (ARI) conditions of 95°F for air-cooled equipment, and 85°F entering water for water-cooled models.

How to Select an Energy-Efficient Commercial Air Conditioner

DOE is working with the Defense Logistics Agency (DLA) and the General Services Administration (GSA) to identify products in the supply system that meet these Efficiency Recommendations, and to include additional energy-efficient products. For a contractor-supplied air conditioner, specify an EER that meets the recommended level.

Sizing

Oversizing of air conditioners, besides raising purchase cost, will increase energy use, reduce humidity removal, and shorten product life, all due to excessive on-off cycling ("short-cycling"). The required air conditioner capacity should be determined based on the referenced ASHRAE calculation procedure (see "For Additional Information").

Heating Options

Commercial unitary air conditioners can usually be purchased with several options for heating, including a gas or oil furnace, hot water or steam coils, or electric resistance heating. Heat pump models are also available (see "Energy-Efficient Commercial Heat Pump"), and will always use less energy than electric resistance.

Technology Options

Water-source models, usually employing small cooling towers, are generally more efficient than air-source air conditioners, but their first cost and maintenance requirements are greater. In larger applications with multiple units, water-source models may be cost-effective, but cooling tower energy (pumps and fans) must be considered in the selection analysis. Economizers use controllable dampers to provide "free" cooling by letting outside air cool the space when the outdoor temperature or enthalpy is below that of the building's return air. Economizers can decrease energy consumption substantially, but only if they are controlled and maintained properly, which they frequently are not.

Installation and Maintenance

Proper installation and maintenance of commercial packaged air conditioners is essential for effective and efficient operation. ACEEE's "Guide to Energy-Efficient Commercial Equipment" provides good guidance in this area (see "For More Information"). Duct losses are a major source of energy waste and comfort problems; make sure ducts are well-sealed.

Environmental Tips

Refrigerants with ozone-destroying chlorofluorocarbons (CFCs) were used many years ago in commercial unitary air conditioners, but most equipment on the market today uses HCFC refrigerants, which have a much lower ozone-depleting effect. In the future, air conditioners with ozone-safe refrigerants are expected to be more widely available. When retiring an air conditioner that contains CFCs or HCFCs, the Clean Air Act requires that the refrigerant be recovered on-site by a certified technician. For compliance information, contact the EPA Stratospheric Ozone Information Hotline at (800) 296-1996.

Air Conditioner Cost-Effectiveness Example (120 Mbtu/hour - 10 tons)

Performance	Base Model (a)	Recommended Level	Best Available
Energy Efficiency Ratio (EER)	8.9	10.3	13.5
Annual Energy Use	20,200 kWh	17,500 kWh	13,300 kWh
Annual Energy Cost	$1,210	$1,050	$800
Lifetime Energy Cost (b)	$12,200	$10,600	$8,100
Lifetime Energy Cost Savings	–	**$1,600**	**$4,100**

(a) The efficiency (EER) of the Base Model is just sufficient to meet current U.S. DOE national appliance standards.
(b) Lifetime Energy Cost is the sum of the discounted value of annual energy costs based on average usage and an assumed air conditioner life of 15 years. Future electricity price trends and a discount rate of 4.1% are based on federal guidelines (effective from April, 1998 to March, 1999).

Cost-Effectiveness Assumptions

Annual energy use in this example is based on the standard DOE test procedure for a model with 1,500 equivalent full-load hours per year. The assumed electricity price is 6¢/kWh, the 1996 federal average electricity price in the U.S.

Using the Cost-Effectiveness Table

In the example shown above, an air conditioner with an EER of 10.3 is cost-effective if its purchase price is no more than $1,600 above the price of the Base Model. The Best Available model, with an EER of 13.5, is cost-effective if its price is no more than $4,100 above the price of the Base Model.

Energy Efficient Commercial Heat Pump

Efficiency Recommendation				
Product Type and Size (a)	Recommended		Best Available (b)	
	EER (c)	COP (d)	EER (c)	COP (d)
Air-Source 65-135 Mbtu/h	10.1 or more	3.2 or more	11.7	3.5
Air-Source 135-240 Mbtu/h	9.3 or more	3.1 or more	10.5	3.3
Water-Source 65-135 Mbtu/h	13.0 or more	4.5 or more	15.0	5.0

(a) Electric air- and water-cooled split system and single package units with capacity over 65,000 Btuh are covered here. For smaller units, see "How to Buy an Energy-Efficient Residential Air-Source Heat Pump."
(b) The best available EER and best available COP may apply to different models.
(c) EER, or Energy Efficiency Ratio, is the cooling capacity (in Btu/hour) of the unit divided by its electrical input (in watts) at standard (ARI) conditions of 95°F for air-cooled equipment, and 85°F entering water for water-cooled models.
(d) COP (Coefficient of Performance) is the heating capacity (in Btu) of the unit divided by its electrical input (also in Btu) at standard (ARI) conditions of 47°F dry bulb and 43°F wet bulb temperature for air-cooled equipment, and 70°F entering water for water-source models.

How to Select an Energy-Efficient Heat Pump

DOE is working with the Defense Logistics Agency (DLA) and the General Services Administration (GSA) to identify products in the supply system that meet these Efficiency Recommendations, and to include additional energy-efficient products. For a contractor-supplied heat pump, specify an EER and COP that meet the recommended level.

When to Choose a Heat Pump

Heat pumps operate very inefficiently at sub-freezing temperatures, so should be avoided as stand-alone heating systems in cold climates. However, they will always offer energy savings over straight electric resistance heating coupled with an air conditioner. In climates with mild winters, heat pumps may provide cost-effective heating when compared with gas or oil furnaces, depending on relative utility costs.

Sizing

Oversizing of heat pumps, besides raising purchase cost, will increase energy use, reduce humidity removal, and shorten product life, all due to excessive on-off cycling ("short-cycling"). The required heat pump capacity should be determined based on the referenced ASHRAE calculation procedure (see "For Additional Information").

Technology Options

Water-source models are generally more efficient than air-source heat pumps, especially in heating mode, but their first cost and maintenance requirements are greater. In larger applications with multiple units, water-source models may be cost-effective, but cooling tower energy (pumps and fans) must be considered in the selection analysis. Economizers use controllable dampers to provide "free" cooling by letting outside air cool the space when the outdoor temperature or enthalpy is below that of the building's return air. Economizers can decrease energy consumption substantially, but only if they are controlled and maintained properly, which they frequently are not.

Installation and Maintenance

Proper installation and maintenance of commercial packaged heat pumps is essential for effective and efficient operation. ACEEE's "Guide to Energy-Efficient Commercial Equipment" provides good guidance in this area (see "For More Information"). Duct losses are a major source of energy waste and comfort problems with heat pumps; make sure ducts are well-sealed. Choosing and setting controls properly is also important to preventing energy losses; careful attention should be paid to minimizing operation of electric resistance heating.

Environmental Tips

Refrigerants with ozone-destroying chlorofluorocarbons (CFCs) were used many years ago in heat pumps, but most equipment on the market today uses HCFC refrigerants, which have a much lower ozone-depleting effect. In the future, heat pumps with ozone-safe refrigerants are expected to be more widely available. When retiring a heat pump that contains CFCs or HCFCs, the Clean Air Act requires that the refrigerant be recovered on-site by a certified technician. For compliance information, contact the EPA Stratospheric Ozone Information Hotline at (800) 296-1996.

Heat Pump Cost-Effectiveness Example
(120 Mbtu/hour - 10 tons)

Performance	Base Model (a)	Recommended Level	Best Available
EER / COP	8.9 / 3.0	10.1 / 3.2	11.7 / 3.5
Annual Energy Use	37,800 kWh	34,300 kWh	30,500 kWh
Annual Energy Cost	$2,300	$2,100	$1,800
Lifetime Energy Cost (b)	$23,000	$21,000	$18,000
Lifetime Energy Cost Savings	–	**$2,000**	**$5,000**

(a)The efficiency (EER and COP) of the Base Model is just sufficient to meet current U.S. DOE national appliance standards.

(b) Lifetime Energy Cost is the sum of the discounted value of annual energy costs based on average usage and an assumed heat pump life of 15 years. Future electricity price trends and a discount rate of 4.1% are based on federal guidelines (effective from April, 1998 to March, 1999).

Cost-Effectiveness Assumptions

Annual energy use in this example is based on the standard DOE test procedure for a model with 1,500 equivalent full-load heating and cooling hours per year. The assumed electricity price is 6¢/kWh, the 1996 federal average electricity price in the U.S.

Using the Cost-Effectiveness Table

In the example shown above, a heat pump with an EER of 10.1 and a COP of 3.2 is cost-effective if its purchase price is no more than $2,000 above the price of the Base Model. The Best Available model, with an EER of 11.7 and a COP of 3.5, is cost-effective if its price is no more than $5,000 above the price of the Base Model.

What if my Electricity Price, Capacity, or Load Hours are different?

Estimating Lifetime Energy Costs for different conditions can be difficult with heat pumps. For assistance, contact Lawrence Berkeley National Laboratory (see "For Additional Information").

For Additional Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-Recommended efficient federal procurement, including the latest versions of these recommendations.
  Phone: (800) 363-3732
  www.eren.doe.gov/femp/procurement
- American Council for an Energy-Efficient Economy (ACEEE) publishes the *Guide to 550-Energy-Efficient Commercial Equipment*, which includes a chapter on HVAC systems, as well as a listing of chiller models that meet this Recommendation.
  Phone: (202) 429-0063
  http://aceee.org
- ASHRAE publishes the *Cooling and Heating Load Calculation Manual*.
  Phone: (800) 527-4723
  http://www.ashrae.org
- Air-Conditioning & Refrigeration Institute (ARI) publishes standards and directories of chillers and other air-conditioning equipment.
  Phone: (703) 524-8800
  http://www.ari.org
- E SOURCE publishes the *Electric Chillers Buyer's Guide*.
  Phone: (303) 440-8500
  http://www.esource.com
- Green Seal certifies chillers that meet this recommendation's energy efficiency guidelines, as well as other environmental criteria.
  Phone: (202) 588-8400
  http://www.greenseal.org
- Lawrence Berkeley National Laboratory's "Cool $ense" Web site has a variety of resources for helping combine building retrofits with chiller replacements.
  http://eetd.lbl.gov/coolsense

- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
  Phone: (202) 484-0880
- Consortium for Energy Efficiency (CEE) provides information on utility programs promoting energy-efficient commercial air conditioners that meet this recommendation.
  Phone: (617) 589-3949
  http://www.ceeformt.org
- Air-Conditioning and Refrigeration Institute (ARI) publishes the *ARI Applied Directory* and the *ARI Unitary Directory*, which include monthly updated listings of commercial packaged air conditioners.
  Phone: (703) 534-8800
  http://www.ari.org
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) publishes the *Cooling and Heating Load Calculation Manual*.
  Phone: (800) 527-4723
  http://www.ashrae.org
- Consortium for Energy Efficiency (CEE) provides information on utility programs promoting energy-efficient commercial heat pumps that meet this recommendation.
  Phone: (617) 589-3949
  http://www.ceeformt.org
- American Council for an Energy-Efficient Economy (ACEEE) publishes the *Guide to Energy-Efficient Commercial Equipment*, which includes a chapter on HVAC systems, as well as a listing of heat pump models that meet this Recommendation.
  Phone: (202) 429-0063
  http://aceee.org
- Air-Conditioning and Refrigeration Institute (ARI) publishes the *ARI Applied Directory* and the *ARI Unitary Directory*, which include monthly updated listings of commercial packaged heat pumps.
  Phone: (703) 524-8800
  http://www.ari.org

ATTACHMENT 13

ENERGY STAR
ENERGY STAR BUILDINGS UPGRADE MANUAL

The Energy Star Buildings Upgrade Manual is a guide for Energy Star Buildings Partners to use in planning and implementing profitable energy-efficiency upgrades in their facilities. The Manual can be used as a comprehensive framework for your energy strategy, focusing on the Energy Star Buildings Five Stage Approach - a strategy that can help building owners realize through proven technologies enormous energy savings and pollution prevention. The complete manual can be found at http://www.epa.gov/buildings/manual/index.html. Additionally, a manual geared to energy conservation at federal facilities is available at http://www.eren.doe.gov/femp/greenfed. An overview is provided:

Stage 1: Green Lights

Installing readily available, proven lighting technologies can reduce your building's lighting energy use by 50 to 70 percent. Besides saving on energy bills, these lighting improvements will also decrease glare, reduce maintenance costs, and provide a better working environment.

Stage 2: Building Tune-Up

Conducting these simple, low- or no-cost adjustments to existing building equipment can result in an energy savings of 5 to 15 percent, and have a dramatic effect on the scale and type of upgrades needed in later stages.

Stage 3: Other Load Reductions

Reducing the energy demand of your building by improving the energy efficiency of office equipment (such as computers, copiers, and fax machines) and of the building envelope (including windows, insulation, and exterior surfaces) will not only lower electric bills, but also save on heating and cooling costs.

Stage 4: Fan System Upgrades

Optimizing the fan systems can save 50 to 85 percent in related energy costs, while improving building comfort and reducing unnecessary noise from improperly-sized fan systems.

Stage 5: Heating and Cooling System Upgrades

Implementing the first four stages of this approach eliminates the heat emitted from inefficient equipment and prevents heating and cooling losses. To further capitalize on these improvements, energy-efficient heating and cooling systems should be "right-sized" to meet the exact needs of your building.

ATTACHMENT 14

ENERGY STAR
ENERGY STAR BUILDINGS ALLIES

Energy Star Buildings Allies are companies that manufacture, distribute, specify, finance, install or maintain energy-use products in the commercial and industrial marketplace. Businesses join the Energy Star Buildings Ally Partnership to help EPA promote the five-stage Energy Star Buildings strategy to their customers. They serve as the critical link between end-users (Partners) and the Partnership, providing Partners with the knowledge and resources necessary to implement profitable upgrades, and optimize energy efficient measures.

By working with EPA to promote this whole-building approach to energy efficiency, Allies are helping transform the building systems marketplace. To support these efforts, EPA provides Allies with technical information and outreach tools designed to educate consumers and expand the market of energy-efficient products and services.

Please forward any questions or comments to the ASAP Energy Experts or call the Energy Star Hotline at 1-888-STAR-YES

EPA is pleased to offer this directory as an information source. EPA does not endorse, certify or specifically recommend any particular company, service or product.

For a complete list of Energy Star Buildings Allies, see http://yosemite.epa.gov/appd/asap/home.nsf. Listings are organized by company name, company location, and products manufactured.

ATTACHMENT 15

WATER CONSERVATION

FEDERAL ENERGY MANAGEMENT PROGRAM
ENERGY EFFICIENCY AND RENEWABLE ENERGY

Why Agencies Should Buy Efficient Products

- The Energy Policy Act of 1992 (EPACT) encourages energy- and water-efficient federal procurement. Executive Order 12902 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy and water efficiency, while saving taxpayer dollars.

Water-Saving Faucet

Efficiency Recommendation			
Product Type	Recommended Flow Rate (a)	Best Available Flow Rate	Self-Closing (c)
Faucet (b)	2.0 gallons per minute or less	1.5 gallons per minute	0.25 gallons per cycle

(a) Based on ASME test procedure A112.18.1M-1994, with an inlet water pressure of 60 pounds per square inch (psi).
(b) This Recommendation covers residential kitchen and bathroom sink faucets, as well as commercial bathroom sink faucets.
(c) Self-Closing Faucet means a fitting that has an automatic shutoff after a preset time, or when the user moves away.

Where to Find Water-Saving Faucets

The federal supply source for water-saving faucets is the General Services Administration (GSA), which offers them through its "Special Order" program. Request models that meet this Efficiency Recommendation. When buying from a commercial source (retailer or distributor), select or specify models with a flow rate that meets the recommended level.

Buyer Tips

Self-closing and metered faucets shut off automatically after a specified time, or when the user moves away, resulting in significant water savings. A typical on-cycle is 10 seconds, in compliance with the Americans with Disabilities Act (ADA) regulations.

Adding a faucet aerator is a cost-effective way to save water. Faucet aerators replace the faucet head screen, lowering the flow by adding air to the spray. High-efficiency aerators can reduce the flow from 2-4 gpm to less than 1 gpm at a fraction of the cost of replacing faucets. Refer to the November/December, 1995 Home Energy and February, 1995 Consumer Reports for more information on aerators.

Early Replacement

Early replacement of an older, high flow faucet can lead to even greater water and energy savings than shown in the cost-effectiveness table below.

Faucet Cost-Effectiveness Example

Performance	Base Model (a)	Recommended Level	Best Available	Self-closing
Water Use Only				
Gallons per minute/cycle	2.2 gpm	2.0 gpm	1.5 gpm	0.25 gpc (b)
Annual Water Use	17,160 gallons	15,600 gallons	11,700 gallons	3900 gallons
Annual Water Cost	$69	$62	$47	$16
Lifetime Water Cost (c)	$550	$500	$380	$130
For Electric Water Heating				
Annual Energy Use	970 kWh	890 kWh	700 kWh	310 kWh
Annual Energy Cost	$58	$54	$42	$19
Lifetime Energy Cost	$440	$400	$310	$140
Lifetime Energy and Water Cost Savings (c)	–	**$100**	**$300**	**$700**
For Gas Water Heating				
Annual Energy Use	54 therms	50 therms	42 therms	24 therms
Annual Energy Cost	$21	$20	$17	$10
Lifetime Energy Cost	$165	$155	$130	$75
Lifetime Energy and Water Cost Savings (c)	–	**$60**	**$200**	**$500**

(a) The flow rate of the Base Model just meets the current federal standards for faucets, based on ASME standard test conditions.
(b) The duration of 1 cycle is based on the American with Disabilities Act specification of 10 seconds.
(c) Lifetime Energy or Water Cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed faucet life of 10 years. Future energy price trends and a discount rate of 4.1% are based on federal guidelines (effective from April, 1998 to March, 1999). Future water and waste water treatment costs are conservatively assumed to increase only at the rate of inflation.

Cost-Effectiveness Assumptions

Faucet use is assumed to last for 1 minute, 30 times per day, and 260 days per year. The faucet water temperature is assumed to average 80°F and the inlet water pressure 60 psi. For self-closing faucets, each faucet use is assumed to require 2 on-cycles. The assumed electricity and gas prices are 6¢/kWh and 40¢/therm, the 1996 federal average energy prices in the U.S. The assumed combined water and waste-water price is $4/1,000 gallons.

Metric Conversions

1 gallon = 3.8 liters
1 psi = 6.9 kPa
°F = (1.8 * °C) + 32

1 therm =100,000 Btu
=29.3 kWh
=105.5 MJ

Using the Cost-Effectiveness Table

In the example above, a new faucet which just meets the Recommended flow rate of 2.0 gpm generates $100 in water and energy cost savings when water heating is electric, or $60 in savings if water is heated with gas. Similarly, a Best Available faucet, with a flow rate of 1.5 gpm, saves $300 (with electric water heating) or $200 (with gas water heating). Since first-cost premiums are either small or non-existent for these faucets, their purchase is virtually certain to be cost-effective. Enormous cost savings, of $700 (electric) and $500 (gas), are evidenced with the 0.25 gpc self-closing faucet. However, these faucets generally cost substantially more, and usually require additional maintenance.

What if my Water or Energy Price is different?

Recalculate your Lifetime Energy or Water Costs by using your own water and energy prices, and make the corresponding adjustments in the Lifetime Energy and Water Cost Savings. For example, to adjust for a different electricity price, multiply the Lifetime Energy Cost by this ratio: $\left(\frac{\text{Your price in } ¢/\text{kWh}}{6.0\ ¢/\text{kWh}}\right)$.

Similar adjustments can be made for different gas and water prices.

Water-Saving Showerhead

Efficiency Recommendation		
Product Type	Recommended Flow Rate (a)	Best Available Flow Rate
Showerhead	2.2 gallons per minute or less	1.5 gallons per minute

(a) Based on ASME test procedure A112.18.1M-1994, with an inlet water pressure of 80 pounds per square inch.

Where to Find Water-Saving Showerheads

The federal supply source for water-saving showerheads is the General Services Administration (GSA), which offers them through its "Special Order" program. Request models that meet this Efficiency Recommendation. When buying from a commercial source (retailer or distributor), select or specify models with a flow rate that meets the recommended level.

Buyer Tips

A common complaint is that some "low-flow" showerheads give an unsatisfactory shower. However, there is a substantial difference in the quality of spray for different showerheads, even among models with the same flow rate. For spray pattern ratings and other features, refer to the February, 1995 Consumer Reports discussion on showerheads. Before purchasing a large volume of showerheads, consider sampling a few different models for user satisfaction.

Although showerhead flow rates are reported at an inlet water pressure of 80 psi (in accordance with the Energy Policy Act of 1992), the actual flow rate of the showerhead will depend on the actual inlet water pressure.

Early Replacement

Early replacement of an older, high-flow showerhead can lead to even greater water and energy savings than shown in the Cost-Effectiveness table, below. For example, replacing an older (4.0 gpm) unit with a recommended new showerhead (2.2 gpm) will have a 3-5 month payback and save $500-1000 over a ten year period, assuming average federal utility rates. Some older showerheads become occluded by mineral buildup and dispense significantly less water than their rated flows, however, mitigating savings from replacement units.

Showerhead Cost-Effectiveness Example			
Performance	Base Model (a)	Recommended Level	Best Available
Water Use Only			
Gallons per minute (gpm)	2.5 gpm	2.2 gpm	1.5 gpm
Annual Water Use	18,250 gallons	16,060 gallons	10,950 gallons
Annual Water Cost	$73	$64	$44
Lifetime Water Cost (b)	$590	$520	$350
With Electric Water Heating			
Annual Energy Use	2,370 kWh	2,120 kWh	1,540 kWh
Annual Energy Cost	$142	$127	$92
Lifetime Energy Cost	$1,070	$960	$690
Lifetime Energy and Water	–	**$200**	**$600**
With Gas Water Heating			
Annual Energy Use	131 therms	120 therms	94 therms
Annual Energy Cost	$53	48	38
Lifetime Energy Cost	$400	$370	$290
Lifetime Energy and Water	–	**$100**	**$350**

(a) The flow rate of the Base Model just meets the current federal standards for showerheads.
(b) Lifetime Energy or Water Cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed showerhead life of 10 years. Future energy price trends and a discount rate of 4.1% are based on federal guidelines (effective from April 1998 to 7 March 1999). Future water and waste water treatment costs are conservatively assumed to increase only at the rate of inflation.

Cost-Effectiveness Assumptions

Showerhead use is assumed to be 10 minutes per shower, 2 showers per day, and 365 days per year. The showerhead water temperature is assumed to be 106°F and the inlet water pressure 80 psi. The assumed electricity and gas prices are 6¢/kWh and 40¢/therm, the 1996 federal average energy prices in the U.S. The assumed combined water and waste-water price is $4/1,000 gallons.

Using the Cost-Effectiveness Table

In the example shown above, a new showerhead with a Recommended flow rate of 2.2 gpm will generate $200 in water and energy cost savings when water heating is electric, or $100 in savings if water is heated with gas. Similarly, a Best Available showerhead, with a flow rate of 1.5 gpm, will save $600 (with electric water heating) or $350 (with gas water heating). Since first-cost premiums are either small or non-existent for these showerheads, their purchase is virtually certain to be cost-effective.

Water-Saving Replacement Toilet

Efficiency Recommendation		
Product Type	Recommended Flush Rate (a), (b), (c)	Best Available Flush Rate
Toilet	1.6 gallons per flush or less	1.5 gallons per flush

(a) Based on ASME test procedure A112.19.6-1990
(b) The Recommended Flush Rate applies to "flushometer" (flush valve) as well as "gravity tank" toilets, and is measured in gallons per flush (gpf).
(c) The Recommended Flush Rate is exactly that required by the Energy Policy Act of 1992. This Recommendation is issued for the purpose of promoting early replacement.

Where to Find Water-Saving Replacement Toilets

The federal supply source for toilets is the Defense Logistics Agency (DLA). When buying from a commercial source (retailer or distributor), select or specify models with flush rates that meet the recommended level. All toilets manufactured for use in the U.S. after 1996 are required to meet this level.

Buyer Tips

There is a wide range in flushing performance of new toilets. It is advisable to test various models under actual conditions before purchasing in volume.

Installation and User Tips

For initial installation of a low-flush toilet, "snake" drain lines and replace the entire fixture. After a low-flush gravity tank unit is in operation, only the valve and ballcock need be replaced if the rest of the fixture still functions. With flush-valve toilets, make sure valves are properly adjusted. Leaky valves are a source of enormous water loss in both flush-valve and tank toilets, and are especially common in hard-water areas. These leaks are often invisible and inaudible. Semi-annual dye tablet testing is a simple and inexpensive way to detect leaks.

There are a variety of retrofit devices available to reduce the water flow of existing toilets. Some of these measures are effective and reliable while others can lead to plumbing problems. Consult your local water utility for appropriate water-saving options and rebate programs.

Technology Tips

For specialized situations like prisons or hospitals, non-ceramic, metal toilets are available which have straight drain lines and have a flush rate of 0.5 gallons per flush (gpf). Replacing 3.5 gpf with 0.5 gpf toilets can lead to lifetime water savings even larger than those shown in the Cost-Effectiveness table, below.

Early Replacement

Early replacement of a high flush-rate toilet can produce hundreds of dollars of water savings over the life of the new unit, as shown in the following table.

Toilet Cost-Effectiveness Example			
Performance	Typical Existing Unit	New Unit (a)	Best Available
Gallons per flush (gpf)	3.5 gpf	1.6 gpf	1.5 gpf
Annual Water Use	27,300 gallons	12,500 gallons	11,700 gallons
Annual Water Cost	$110	$50	$45
10-year Water Cost (b)	$880	$400	$380
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	–	**$480**	**$500**

(a) The flush rate of the new unit meets the current federal standards for toilets.
(b) The 10-year Water Cost is the sum of the discounted value of annual water costs, based on average usage and an assumption that early replacement of the toilet occurs at the midpoint of a 20-yr. useful life. A discount rate of 4.1% is based on federal guidelines (effective from April, 1998 to March, 1999). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.

Cost-Effectiveness Assumptions

Savings estimates are based on an existing flush rate of 3.5 gpf. Toilet use is assumed to be 30 flushes per day, and 260 days per year. The water price is assumed to be $4/1,000 gallons.

Using the Cost-Effectiveness Table

In the example shown above, early replacement of the existing toilet with a new unit at the recommended flush rate of 1.6 gpf will save $480 in water costs over a 10-year period (the time before the old fixture would normally be replaced). Likewise, the Best Available model, with a flush rate of 1.5 gpf, will save $500 in water costs over a 10-year period. The example assumes that no water is lost through leakage.

Water-Saving Urinal

Efficiency Recommendation		
Product Type	Recommended Flush Rate (a), (b)	Best Available Flush Rate
Urinal	1.0 gallons or less	0.0 gallons

(a) Based on ASME test procedure A112.19.6-1990
(b) The Recommended Flush Rate is exactly that required by the Energy Policy Act of 1992. This Recommendation is issued for the purpose of promoting early replacement.

Where to Find Water-Saving Replacement Urinals

The federal supply sources for urinals are the Defense Logistics Agency (DLA) and, for waterless models, the General Services Administration (GSA). All urinals for sale through commercial sources should also comply with the recommended level, since any urinal manufactured for use in the U.S. after 1993 must not exceed one gallon per flush, by law.

Buyer Tips

Infrared or ultrasound sensors can help avoid water waste attributable to double flushing. Siphonic jet and blowout urinals, which flush automatically at given intervals, can be configured with timers or sensors that avoid automatic flushing during unoccupied hours.

Retrofitting an existing urinal with a water-conserving valve can save substantially on water use at little cost.

Technology Options

For specialized situations like prisons or hospitals, non-ceramic, metal urinals are available which have straight drain lines and a 0.5 gpf rate. Replacing an existing 3.0 gpf with a 0.5 gpf urinal can produce very large lifetime water savings, especially where water costs are high.

Waterless urinals offer enormous water cost savings. A waterless urinal uses a chemical trap with a low specific gravity chemical. This allows waste to flow down the discharge pipe without permitting sewer gases to escape. Daily maintenance cleaning of these urinals is important for odor control. Costs of chemicals and traps need to be compared with water cost savings.

Early Replacement

Early replacement of high flush rate urinals can produce water cost-savings of several hundred dollars, as shown in the following tables.

Urinal Cost-Effectiveness Example			
Performance	Typical Existing Unit	New Unit (a)	Best Available
Gallons per flush (gpf)	3.0 gpf	1.0 gpf	0.0 gpf
Annual Water Use	23,400 gallons	7,800 gallons	0 gallons
Annual Water Cost	$90	$30	$0
10-year Water Cost (b)	$750	$250	$0
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	–	**$500**	**$750**

(a) The flush rate of the new unit meets the current federal standards for urinals.
(b) The 10-year Water Cost is the sum of the discounted value of annual water costs, based on average usage and an assumption that early replacement of the urinal occurs at the midpoint of a 20-yr. useful life. A discount rate of 4.1% is based on federal guidelines (effective from April, 1998 to March, 1999). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.

Cost-Effectiveness Assumptions

Savings estimates are based on the flush rate for an existing unit of 3.0 gpf. Urinal use is assumed to be 30 flushes per day, and 260 days per year. The water price is assumed to be $4/1,000 gallons (supply + wastewater treatment).

Understanding the Cost-Effectiveness Table

In the example shown above, early replacement of the existing urinal with a new unit at the recommended flush rate of 1.0 gpf will save $500 in water costs over a 10-year period (the time before the old fixture will be replaced). Likewise, the Best Available model, a waterless urinal, will save $750 in water costs over a 10-year period. The example assumes that no water is lost through leakage in either of the water-using models.

For Addition Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
  Phone: (800) 363-3732
  http://www.eren.doe.gov/femp/procurement
- American Water Works Association's "WaterWiser" is a good resource for water conservation and efficiency information.
  Phone: (800) 559-9855
  http://www.waterwiser.org

- New York State Department of Environmental Conservation, Bureau of Water Resources, has a list of certified water saving plumbing fixtures.
  Phone: (518) 457-1626
- California Energy Commission (CEC) has a list of certified plumbing fixtures.
  Phone: (916) 654-5106
- Home Energy magazine provides water conservation tips.
  Phone: (510) 524-5405
  http://www.homeenergy.org
- Consumer Reports rates plumbing fixtures. A February, 1995 article, “Water Savers,” is especially relevant.
  http://www.consumerreports.org
- Contact your local water utility for details about local water conservation programs and incentives.
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
  Phone: (202) 484-0880

Federal Supply Sources:

- Defense Logistics Agency
  Phone: (215) 697-3272
  DSN 442-3272
- General Services Administration (GSA)
  Phone: (817) 978-8483

ATTACHMENT 16

MEMORANDUM ON ENVIRONMENTALLY BENEFICIAL LANDSCAPING

Subject: Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds

The Report of the National Performance Review contains recommendations for a series of environmental actions, including one to increase environmentally and economically beneficial landscaping practices at Federal facilities and federally funded projects. Environmentally beneficial landscaping entails utilizing techniques that complement and enhance the local environment and seek to minimize the adverse effects that the landscaping will have on it. In particular, this means using regionally native plants and employing landscaping practices and technologies that conserve water and prevent pollution.

These landscaping practices should benefit the environment, as well as generate long-term costs savings for the Federal Government. For example, the use of native plants not only protects our natural heritage and provides wildlife habitat, but also can reduce fertilizer, pesticide, and irrigation demands and their associated costs because native plants are suited to the local environment and climate.

Because the Federal Government owns and landscapes large areas of land, our stewardship presents a unique opportunity to provide leadership in this area and to develop practical and cost- effective methods to preserve and protect that which has been entrusted to us. Therefore, for Federal grounds, Federal projects, and federally funded projects, I direct that agencies shall, where cost-effective and to the extent practicable:

(a) use regionally native plants for landscaping;

(b) design, use, or promote construction practices that minimize adverse effects on the natural habitat;

(c) seek to prevent pollution by, among other things, reducing fertilizer and pesticide use, using integrated pest management techniques, recycling green waste, and minimizing runoff. Landscaping practices that reduce the use of toxic chemicals provide one approach for agencies to reach reduction goals established in Executive Order No. 12856 "Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements;"

(d) implement water-efficient practices, such as the use of mulches, efficient irrigation systems, audits to determine exact landscaping water-use needs, and recycled or reclaimed water and the selecting and siting of plants in a manner that conserves water and controls soil erosion. Landscaping practices, such as planting regionally native shade trees around buildings to reduce air conditioning demands, can also provide innovative measures to meet the energy consumption reduction goal established in Executive Order No. 12902, "Energy Efficiency and Water Conservation at Federal Facilities;" and

(e) create outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques, to promote awareness of the environmental an economic benefits of implementing this directive. Agencies are encouraged to develop other methods for sharing information on landscaping advances with interested nonfederal parties.

(Presidential Sig.) William J Clinton
THE WHITE HOUSE
April 26, 1994

ATTACHMENT 17

EPA FACILITIES MANUAL, VOLUME 1
ARCHITECTURE, ENGINEERING, AND PLANNING GUIDELINES

February 1998
Section 2 - Site Work

2.5 Landscaping and Site-Related Requirements

2.5.1 GENERAL

Landscape planning, design, and development must be integrated with building massing, design, and materials. The landscaping design process must coincide with the building design process to create a single design that integrates site and buildings(s). The use of durable exterior materials that enhance both the site landscaping and the building design and help to integrate the two design disciplines is strongly encouraged.

If the facility is to be a part of an existing campus or among other buildings in a master-planned development, the landscape design as well as the building design must be integrated with, and compatible with, the style(s) of the previously constructed permanent facilities on campus. The existing and developed site assets shall be used to full advantage. The existing physical features of the site and surrounding buildings shall be observed and documented.

- The landscaping of the site shall create an environmentally sensitive and aesthetically attractive design. The natural environment should blend with the proposed new construction.
- Landscaped courts and open spaces that are accessible to all staff are encouraged.
- Grass-covered areas away from public view shall be provided and equipped as outside eating and visiting areas (with picnic tables, benches, and landscape furnishings).
- The facility surroundings shall be landscaped with trees, shrubs, flowering plants, and grass in a way that will enhance the aesthetic character of the building(s) and hide or screen exposed equipment and building parts, features, or functions that, by their nature, are not aesthetically pleasant. Vegetation may be used to screen, or form a barrier to, particulate matter and to protect the building(s) from motor vehicle pollutant sources.
- The topography of the site around the building(s) shall slope away from the building(s) and away from neighboring building(s) to direct any water away from the new facility and from any neighboring building(s).
- Xeriscape design practices (use of vegetation requiring minimal watering) shall be used to minimize maintenance of the plantings.
- In general, low-maintenance landscape design and features shall be used.

2.5.3.1 EXISTING CONDITIONS

The landscape architect shall (1) preserve existing trees and undergrowth, where appropriate, for buffers; (2) review buffer requirements of the local community; and (3) use existing trees to the extent possible, since the larger size will provide greater immediate impact on-site.

2.5.3.2 PLANTINGS

Guidelines on plantings are as follows:

- Establish functional design criteria.
- Consider focal or entry area; design main entry area to produce an obvious sense of arrival at facility
- Create views or screen views as needed.
- Develop color and seasonal interest.
- Provide orientation (e.g., with respect to sun and wind) for facility and creation of shade.
- Consider ultimate size and scale relative to specific area or site size.
- Consider formal planting plan or informal, naturalistic plan.
- Avoid major plantings in areas where expansion is planned.
- Provide appropriate location of plantings relative to prevailing wind and sun.
- Break up large areas of pavement with landscape islands.
- Choose plants and design plantings to be tolerant of climate, weather conditions, rainfall, and other environmental conditions.
- Determine irrigation requirements.
- Determine maintenance requirements such as fertilization rates, soil acidity, and, if required, pruning and trimming needs.
- Coordinate plantings with location of signs, light standards, hydrants, underground utilities, and other man-made structures.
- Ensure that lawns slope to provide proper drainage (minimum 1 percent grade).
- Provide ground cover on severe slopes for aesthetic and maintenance considerations.
- Planting must be reviewed and approved by the appropriate EPA personnel.

ATTACHMENT 18

NATURAL LANDSCAPING – SPECIAL SITUATIONS

There are several situations where landscaping design needs special attention:

Preserve existing native vegetation

Preserving existing natural vegetation is a fundamental purpose of natural landscaping. While very little area within the region has been left in its native state by humans, there are rare and valuable natural area remnants (wetlands, prairies, and woodlands) which should be protected and properly managed. With removal of exotic species, native plants will often re-establish themselves rather quickly.

Restore ecological systems

Another primary use of natural landscaping involves restoring entire ecosystems with a full complement of native species. These projects include restoration of previously altered hydrology, such as stream and wetland restoration and removal of drain tiles. Intensive design, monitoring and maintenance programs with long-term professional oversight are critical to the success of the restored landscape.

Create greenways

Linear open spaces called "greenways" provide exceptional opportunities for utilizing natural landscaping to protect and restore the region's ecological identity. Many of the region's forest preserves are in greenway corridors and are being managed to maintain their natural character. Greenways are appropriate on both public and private property. Local and regional greenways are excellent and appropriate locations for natural landscaping. Many greenways contain rivers, streams, or other waterways. In these locations native vegetation in buffer strips adjacent to the stream provides wildlife habitat, bank stabilization, and water quality benefits. These buffer strips protect natural resources from human impacts and filter our pollutants that could flow into streams.

To stabilize streambanks and shorelines

Native willows, grasses and other plants can be used to stabilize eroding streambanks and shorelines. The techniques that employ native plant materials are collectively called bioengineering. They are effective, less costly, and provide better wildlife habitat than traditional engineering approaches.

To manage flood and stormwater

Floodplains are regulated so they will be retained in non-intensive, open space uses in order to reduce hazards from flooding. Planting native vegetation in floodplains helps absorb and slow flood waters. Stormwater detention basins designed to replicate the natural water purification functions of wetlands also improve water quality and wildlife habitat as well as creating aesthetically pleasing landscapes. Careful design and planting of these basins allows them to blend more naturally into the landscape than conventional basins.

ATTACHMENT 19

MILLION SOLAR ROOFS – PHOTOVOLTAICS

Background of Photovoltaics

Photovoltaic-generated power offers advantages over diesel generators, primary (one-time use) batteries, and even conventional utility power. These benefits make photovoltaic the power of choice in more and more cases every day:

High Reliability. Photovoltaic cells were originally developed for use in space, where repair is extremely expensive, if not impossible. Photovoltaic still powers nearly every satellite circling the earth because it operates reliably for long periods of time with virtually no maintenance.

Low Operating Costs. Photovoltaic cells use the energy from sunlight to produce electricity—the fuel is free. With no moving parts, the cells require little upkeep. These low-maintenance, cost-effective photovoltaic systems are ideal for supplying power to communications stations on mountain tops, navigational buoys at sea, or homes far from utility power lines.

Environmental Benefits. Because they burn no fuel and have no moving parts, photovoltaic systems are clean and silent. This is especially important where the main alternatives for obtaining power and light are from diesel generators and kerosene lanterns. As we become more aware of "greenhouse gases" and their detrimental effects on our planet, clean energy alternatives like photovoltaic become more important than ever.

Modularity. A photovoltaic system can be constructed to any size based on energy requirements. Furthermore, the owner of a photovoltaic system can enlarge or move it if his or her energy needs change. For instance, homeowners can add modules every few years as their energy usage and financial resources grow. Ranchers can use mobile trailer-mounted pumping systems to water cattle as the cattle are rotated to different fields.

Low Construction Costs. Photovoltaic systems are usually placed close to where the electricity is used, requiring much shorter power lines than if power is brought in from the utility grid. In addition, using photovoltaic eliminates the need for a step-down transformer from the utility line. Less wiring means lower costs, shorter construction time, and reduced permitting paperwork, particularly in urban areas.

How Photovoltaics Work

The "photovoltaic effect" is the basic physical process through which a PV cell converts sunlight into electricity. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum (see "Light and the Sun" for more about that). When photons strike a PV cell, they may be reflected or absorbed, or they may pass right through. Only the absorbed photons generate electricity. When this happens, the energy of the photon is transferred to an electron in an atom of the cell (which is actually a semiconductor). With its newfound energy, the electron is able to escape from its normal position associated with that atom to

become part of the current in an electrical circuit. By leaving this position, the electron causes a "hole" to form. Special electrical properties of the PV cell—a built-in electric field—provide the voltage needed to drive the current through an external load (such as a light bulb).

Photovoltaic Cells

Photovoltaic cells work by converting sunlight to electricity. Sunlight is composed of particles of energy known as photons. The photovoltaic cells absorb these photons and converts it into electricity. To maximize the amount of electricity produced, photovoltaic cells are given an antireflection coating.

Photovoltaic cells today come in a variety of forms out of which the most common structure is that of a semiconductor material into which a large-area diode or p-n junction has been formed. A p-n junction is formed by joining a uniform p-type sample and a uniform n-type sample. A p-type semiconductor is silicon that has been doped with boron, aluminum, gallium or indium. An n-type semiconductor is one in which the silicon is doped with phosphorous, arsenic or antimony. As a result, an internal electric field builds up.

The energy of the photon that is absorbed by the photovoltaic cell is transferred to an electron in the p-n junction. This causes the electron to be dislodged from its location, creating a current as it travels across the junction. The generated current is gathered using a grid of physical connections while the built-in electric field of the photovoltaic cell provides the voltage required to drive the current through an external load such as a light bulb.

Photovoltaic Systems

The basic unit for a photovoltaic system is a photovoltaic cell. A photovoltaic cell typically produces roughly about 1 to 2 Watts. To increase the power generated for more practical applications, the photovoltaic cells are connected together to form larger units called modules. Larger units can be constructed by connecting modules together to produce arrays.

A complete photovoltaic system however, consists of the arrays as well as a number of other components. These components are known as the balance of system or BOS. BOS basically adjusts and converts the direct-current electricity harnessed by the photovoltaic modules or arrays such that it can be used by an alternating-current load. BOS may also include storage devices, such as batteries. After all, when no light is available, photovoltaic modules cannot generate electricity. In addition to this, structures to point the photovoltaic modules toward the sun to get maximum power are often required.

The two types of systems currently used are the Flat-Plate Systems and the Concentrator Systems.

Flat-plate collectors are, as the name implies, a collection of a large area of photovoltaic cells that are mounted on a rigid, flat surface. As such, flat-plate collectors are able to use direct sunlight as well as diffuse sunlight (sunlight that is reflected, e.g. from the ground).

Concentrator Systems on the other hand, use concentration optics. Sunlight is gathered using lenses, thus the intensity of the sunlight striking the cell is increased. The concept here is similar to using a magnifying glass. Concentrator systems are also equipped with tracking devices for tracking the position of the sun year round.

Depending on the location of the place, either a flat-plate or a concentrator system is chosen for the installation. For instance, in a place such as Houghton, MI where there is not much sunlight for the better part of the year, a flat-plate system would be a better choice as opposed to a concentrator system. This is because the flat-plate is able to use all of the sunlight that strikes it including diffuse sunlight. Flat-plate cells are also relatively simple and easy to construct.

Concentrator systems require expensive elaborate tracking devices and can only utilize direct sunlight. In a place like sunny Arizona, concentrator systems would be a better choice. Since concentrator lenses are used, a smaller number of cells would be used in its construction thereby lowering the costs (photovoltaic cells are the most expensive components of a photovoltaic system). In addition, concentrator cells in these conditions are more efficient as opposed to the flat-system as the intensity of the light rays striking it is increased.

Photovolataics and the Utility

The owner of a grid-connected photovoltaic system can not only buy, but can also sell, electricity each month. This is because electricity generated by the photovoltaic system can be used on site or fed through a meter into the utility grid. When a business requires more electricity than the photovoltaic array is generating (for example, in winter), the need is automatically met by power from the utility grid. When the business requires less electricity than the photovoltaic array is generating, the excess is fed (or sold) back to the utility. Used this way, the utility backs up the photovoltaic like batteries do in stand-alone systems. At the end of the month, a credit for electricity sold gets deducted from charges for electricity purchased.

Photovoltaic Directory

A directory available at http://www.eren.doe.gov/millionroofs/yellow.html includes manufacturers of photovoltaic modules and those who support the manufacturing industry, designers and installers of photovoltaic systems, companies who manufacture components that make up the balance of photovoltaic systems (including batteries), companies that manufacture related products like pumping and lighting systems, and consultants for photovoltaic systems. It also includes organizations that set standards or test photovoltaic equipment, and organizations that provide information and training in Photovoltaic technology.

ATTACHMENT 20

MILLION SOLAR ROOFS – SOLAR WATER HEATING

Solar water heating is a renewable energy technology that is well proven and readily available and has considerable potential for application at federal facilities. Solar water-heating systems can be used effectively throughout the country and most facilities will have an appropriate near-south-facing roof or nearby unshaded grounds for installation of a collector. A variety of types of systems are available and suitable for many applications. For example, low-temperature unglazed systems can heat swimming pools and associated hot tubs or spas, saving money on conventional heating or extending the swimming season. In mild climates, passive systems without pumps or electronic controllers can provide low-maintenance hot water for facilities with limited or expensive utility service. High-temperature parabolic-trough systems can economically provide hot water to jails, hospitals, and other facilities in areas with good solar resources that consistently use large volumes of hot water. And active flat-plate systems can service any facility in any area with electric or otherwise expensive conventional water heating.

About the Technology

An estimated one million residential and 200,000 commercial solar water-heating systems have been installed in the United States. Although there are a large number of different types of solar water-heating systems, the basic technology is very simple. Sunlight strikes and heats an "absorber" surface within a "solar collector" or an actual storage tank. Either a heat-transfer fluid or the actual potable water to be used flows through tubes attached to the absorber and picks up the heat from it. (Systems with a separate heat-transfer-fluid loop include a heat exchanger that then heats the potable water.) The heated water is stored in a separate preheat tank or a conventional water heater tank until needed. If additional heat is needed, it is provided by electricity or fossil-fuel energy by the conventional water-heating system. By reducing the amount of heat that must be provided by conventional water-heating, solar water-heating systems directly substitute renewable energy for conventional energy, reducing the use of electricity or fossil fuels by as much as 80%.

Today's solar water-heating systems are well proven and reliable when correctly matched to climate and load. The current market consists of a relatively small number of manufacturers and installers that provide reliable equipment and quality system design. A quality assurance and performance rating program for solar water-heating systems, instituted by a voluntary association of the solar industry and various consumer groups, makes it easier to select reliable equipment with confidence. After taking advantage of possible use-reduction measures, federal facility managers should investigate installing solar water-heating systems.

Application

Water heating accounts for a substantial portion of energy use at many federal facilities. Nationwide, approximately 18% of energy use in residential buildings and 4% in commercial buildings is for water heating. Federal facilities with large laundries, kitchens, showers, or swimming pools will likely devote even more energy to water heating. Solar water heating systems can efficiently provide up to 80% of the

hot-water needs of many federal buildings—without fuel cost or pollution and with minimal operation and maintenance expense.

Solar water-heating systems are most likely to be cost effective for facilities with water-heating systems that are expensive to operate or with operations such as laundries or kitchens that require large quantities of hot water. A need for hot water that is relatively constant throughout the week and throughout the year, or that is higher in the summer, is also helpful for solar water-heating economics. On the other hand, hard water is a negative factor, particularly for certain types of solar water-heating systems, because it can increase maintenance costs and cause those systems to wear out prematurely.

Environmental Benefits

By tapping available renewable energy, solar water heating reduces consumption of conventional energy that would otherwise be used. Each unit of energy delivered to heat water with a solar heating system yields an even greater reduction in use of fossil fuels. Water heating by natural gas, propane, or fuel oil is only about 60% efficient and although electric water heating is about 90% efficient, the production of electricity from fossil fuels is generally only 30% or 40% efficient. Reducing fossil fuel use for water heating not only saves stocks of the fossil fuels, but eliminates the air pollution and climate change gas emission associated with burning those fuels.

Types of Solar Water-Heating Systems:

Although solar water-heating systems all use the same basic method for capturing and transferring solar energy, they do so with such a wide variety of specific technologies that one almost needs to learn a whole language of terms for distinguishing different collectors and systems. The distinctions are important though, because various water-heating needs in various locations are best served by certain types of collectors and systems. Systems can be either active or passive, direct or indirect, pressurized or nonpressurized. For more information on types of systems, visit DOE's website at http://www.eren.doe.gov/femp/prodtech/sw_water.html.

System Design

System design for solar water-heating systems seeks to effectively combine solar water-heating with conventional water-heating. Rather than trying to store enough hot water to last through a long period of cloudy weather, solar water-heating systems generally have conventional water-heating systems as backup. Exceptions, such as the Chickasaw National Recreation Area systems cited later as a case study, are situations in which a lack of hot water for a few days is acceptable and the expense of conventional backup is not justified. Typically, a conventional hot-water heater draws preheated water from the solar water-heating system storage tank. If that preheated water is not hot enough, the conventional water heater operates as it would if it were starting with cold water and further heats the water until it reaches its set delivery temperature. Occasionally, the solar-heated water (up to 180°F [82°C]) is too hot for safe use, so it is mixed with cold water in a tempering valve.

Size of System

The most cost-effective size for a solar water-heating system will often be one that is just sufficient to meet the full summer demand and that meets approximately two-thirds of the year-round demand. Including enough capacity to meet more of the winter demand reduces cost-effectiveness both because excess capacity is wasted in the summer and because it is increasingly difficult to serve each additional portion of the winter demand with the reduced solar resource. The most cost-effective size can vary widely with specific circumstances, however, and for commercial building systems especially, it is sometimes best to plan to supply considerably less than two-thirds of hot-water use. The key factors in determining the most cost-effective size for a system are the type and cost of conventional fuel and the cost of the solar water-heating system to be installed.

Installation

Solar collectors can be mounted on the roof of a building or on nearby grounds. For year-round uses, the most efficient orientation for the collector is facing south, tilted at an angle about equal to the latitude of the site. Collectors can be tilted to the proper orientation with mounting racks. For cost savings and aesthetic reasons, however, they are increasingly being laid flat against pitched roofs. If the orientation is at all close to optimal, the sacrifice in available energy is usually quite modest.

Incorporating solar water-heating systems in new construction has the advantages of ensuring that there is an appropriate roof for collector placement, allowing for aesthetic design, and reducing installation costs. If the builder, architect, or engineer is used to working with solar water-heating, it can also save on design cost. But, almost any building can incorporate a solar collector retrofit. It is relatively easy to add a solar water-heating system to an existing facility and the economics will be nearly as good.

Federal-Sector

The Office of Technology Assessment reported in 1991 that the U.S. Government owns or leases approximately 500,000 buildings, owns an additional 422,000 housing units for military families, and subsidizes utility bills for nine million private households. If the objective were to reduce fossil fuel energy use and associated pollution, regardless of cost-effectiveness, the potential application of solar water heating would clearly be immense. Even limiting application to cost-effective situations, opportunities for solar water heating may still be quite substantial. Combining the large number of military and other housing units with the fact that 18% of residential energy use is for water heating and an Energy Information Administration statement that 38% of U.S. residential water heating is electric, points to a very large potential application for small systems where economics are likely to be attractive. Federal prisons, hospitals, and barracks are ideal situations for large, high-temperature systems to prove cost effective. An estimate of the number of swimming pools at federal facilities is not available, but there are certainly a significant number and the likelihood of solar pool heating being cost effective is quite good.

A general rule of thumb for federal facilities is that a renewable energy installation should pay for itself within about 10 to 15 years. Because the lifetime of a system can be as much as 30 years, that means you can look forward to as much as 20 years of "free energy."

Economic Criteria

The policy for evaluating whether solar water-heating or other renewable energy projects are cost effective and therefore appropriate for federal facilities is contained in 10 CFR Part 436A of the Code of Federal Regulations. The principal criterion of these regulations is that the life-cycle cost (value in base-year dollars of all costs for the full analysis period) for the project must be less than any alternatives, including projected utility payments with the existing water-heating system. (Three similar criteria may be used instead for retrofit projects, and projects with "insignificant" cost are presumed cost effective.)

Executive Order 12902 goes beyond the cost-effectiveness regulations to stipulate that if a project will pay for itself (simple payback period time for savings to return the cost of the investment) in less than 10 years, it shall be built (Sections 103 and 303). For most situations the 10-year payback criterion will be more rigorous than the life-cycle-cost criterion. Many projects will meet the life-cycle-cost criterion even though their simple payback is somewhat longer than 10 years. Agencies must build projects with a simple payback of less than 10 years, but may also build any project that meets the life-cycle-cost criterion. Life-cycle-cost analysis calculates the sum during the life of the project of the present value of investment costs, operation and maintenance, replacement costs, and energy costs, minus salvage value of replaced parts.

Although standard life-cycle-cost analysis does not include a way to take credit for environmental externalities such as benefits of reducing fossil fuel consumption, these may be an important consideration if the economic efficiency calculation is close. The National Park Service has developed guidelines for calculating and including avoided air emissions resulting from reduced electrical power production in their internal economic evaluation of large energy efficiency and renewable energy projects. These figures can be utilized to justify renewable project costs and may be included in life cycle costing:

- CO_2 $14.00 per Ton
- SO_2 $0.85 per Pound
- NO_x $3.75 per Pound

Contact the National Park Service's Denver Service Center (Doug DeNio, 303-969-2162) for more information or visit their website at http://www.nps.gov/dsc. Some agencies have chosen to relax the economic evaluation criteria somewhat for showcase buildings in new facilities or demonstration projects at existing facilities. Projects must be basically cost effective, however, or else they do not make good demonstrations.

Sources

For more information, visit http://www.eren.doe.gov/femp/prodtech/sw_water.html.

Software available from FEMP's Federal Renewables Program at the National Renewable Energy Laboratory (303-384-7509) gives a preliminary analysis of whether solar water heating would be cost effective for your situation on the basis of a minimal number of data.

ATTACHMENT 21

MILLION SOLAR ROOFS – SOLAR SPACE HEATING

Solar space heating offsets building heating loads by either heating recirculated building air or preheating outside or ventilation air. For heating recirculated air, solar panels receive direct sunlight and heat the air that is circulated through them and back to the building. The transpired collector, which uses a dark collection surface with perforated metal plates to heat the air just behind the plate surface, is very effective in preheating outside or ventilation air. One additional benefit of the transpired collector is that it can also serve as a component of the building shell.

Transpired solar collectors are ideal for industrial and commercial buildings with large ventilation requirements and have proven to be highly successful for manufacturing facilities. But they are applicable wherever outside air must be heated. Installations have included schools, warehouses, shipping facilities, and even corridor ventilation for high-rise apartments.

The transpired solar collector is a simple concept. Take a sheet of metal; perforate it with numerous tiny holes; paint it black or some other dark color that fits the building design, mount it on a sunny, south-facing wall, leaving space between the main building wall and the metal; and use fans to suck air through the tiny holes. The dark metal absorbs the solar heat. The fans pull the fresh air into the plenum, heating it and drawing it into the building's ventilation system. On a sunny day, this kind of system can raise the ventilation air temperature by as much as 30°C.

Installation is simple, whether you retrofit a system into a building or include the collector in the original building design. Such a system is also structurally sound and inexpensive. Payback periods for the initial investment typically run from three to six years, depending upon whether the system is retrofitted or in the original building design.

For more information on solar space heating, see the Department of Energy’s website at http://www.eren.doe.gov/millionroofs/spaceheat.html.

ATTACHMENT 22

MILLION SOLAR ROOFS – FREQUENTLY ASKED QUESTIONS

1. What is the Million Solar Roofs Initiative?

Million Solar Roofs is an initiative to install solar energy systems on one million U.S. buildings by 2010. It was announced by President Clinton on June 26, 1997, in his speech before the United Nations Session on Environment and Development. The initiative includes two types of solar technology: photovoltaics that produce electricity from sunlight and solar thermal panels that produce heat for domestic hot water, space heating, or heating swimming pools.

The U.S. Department of Energy will work with partners in the building industry, other federal agencies, local and state governments, utilities, the solar energy industry, financial institutions, and non-governmental organizations to remove market barriers to solar energy use and develop and strengthen local demand for solar energy products and applications. The Initiative will not direct and control the activities at the state and community level, nor will it typically pay for the installation of solar energy systems. Instead, the Million Solar Roofs Initiative will bring together the capabilities of the Federal government with key national businesses and organizations and focus them on building a strong market for solar energy applications on buildings.

The Million Solar Roofs Initiative will:

- Reduce greenhouse gas and other emissions. In 2010, with one million solar energy roofs in place, the Initiative could reduce carbon emissions in an amount equivalent to the annual emissions from 850,000 cars.
- Create high-tech jobs. By 2010, approximately 70,000 new jobs could be created as a result of the increased demand for photovoltaic, solar hot water, and related solar energy systems.
- Keep the U.S. solar energy industry competitive. By increasing the domestic market for solar energy, increasing domestic production and reducing the unit cost for solar energy systems, the Initiative could enable U.S. companies to retain their competitive edge in the worldwide market. By 2005, the photovoltaic market alone is expected to exceed $1.5 billion worldwide.

2. Why are we undertaking this Initiative and at this time?

Greenhouse gas emissions are caused mostly by the inefficient burning of fossil fuels. By increasing the efficiency of how we use fossil fuels, reducing our use of these fuels and switching to alternative, non-polluting fuels, we can significantly reduce the amount of greenhouse gases we put into the atmosphere and reduce the threat of global climate change. One of the most promising non-fossil sources is solar energy. As President Bill Clinton said in a June 1997 speech to the United Nations, "Capturing the sun's warmth can help us turn down the Earth's temperature."

Photovoltaics were invented approximately 40 years ago at AT&T's Bell Laboratories and were later developed as a means to power satellites and space vehicles. As the U.S. investment in the technology improved their performance and reduced their costs, other countries saw their potential and started their

own development efforts. In the past two decades, research and development have improved the efficiency and reliability of photovoltaics and reduced the costs of photovoltaic electricity by a factor of 5.

The Million Solar Roofs Initiative will help increase the market for solar energy and encourage increased development and production of solar energy systems. At the same time, the Initiative will give consumers an affordable, clean-energy option, create new U.S. high-technology jobs, and play an important role in reducing greenhouse gas emissions.

3. What are the qualifications for a building to be a part of this Initiative?

To be included in the Million Solar Roofs Initiative, a building's solar energy system must comply with all relevant parts of the National Electrical Code (NEC), Underwriters Laboratories (UL) standards, and the Solar Rating and Certification Corporation (SRCC) standards. The system must also be located on or immediately adjacent to the building and meet the following minimum standards.

Photovoltaic Systems:

- Residential systems must be a minimum of 0.5 kW.
- School and church systems must be a minimum of 1.0 kW.
- Commercial systems must be a minimum of 2.0 kW.

Solar Thermal Water Heating Systems:

- Residential domestic systems must be a minimum of 1.0 kW equivalent or 20 square feet of collector area.
- Residential swimming pool heating systems must be a minimum of 100 square feet of collector area.
- Commercial domestic systems must be a minimum of 2.0 kW or 40 square feet of collector area.
- Commercial swimming pool heating systems must be a minimum of 400 square feet of collector area.

Solar Thermal Space Heating Systems:

- Collector area must be a minimum of 100 square feet or 4.0 kW.

4. Who is a Million Solar Roofs Partner?

The Million Solar Roofs Initiative requires the participation of all interested individuals, businesses, industries, governments, federal agencies, utilities, and non-governmental organizations. The Initiative will work "bottom up," attracting partners building by building, community by community, state by state, and business by business. It will also work "top down" by developing financing leveraging resources, coordinating Federal agency support, and sharing information. There are three types of partnerships:

Individual Partnerships: Any person or organization who installs the minimum-size photovoltaic or solar thermal energy system on a residential, commercial, institutional, or government building will be able to register with the Million Solar Roofs Registry. There is no requirement for participation in any other activities for these parties to be a partner in the Initiative.

State and Community Partnerships: Million Solar Roofs state and community partnerships bring together business, government, and community organizations at the regional level with a commitment to install solar energy systems. Learn more about our current partnerships.

Examples of state and community partners include the following:

- Builders
- Energy service providers
- Utilities
- Non-governmental organizations
- Local governments
- State governments
- Federal government agencies.

National Partnerships: At the national level, partners will make a commitment to install a significant number of solar energy systems and provide national support for the Initiative. Examples of potential national partners include the following:

- Any entity that commits to installing more than 5,000 solar roofs by 2010
- Solar energy equipment manufacturers and distributors
- National utility companies and energy service providers
- National financial institutions
- National government associations such as the National Association of Counties, the National League of Cities, the National Association of State Energy Officials, the U.S. Conference of Mayors, and the International City/County Management Association National business associations
- National non-governmental organizations.

5. What activities will partnerships undertake?

Examples of activities that Million Solar Roofs partners may undertake include the following:

- Developing a plan for solar energy installations under the Million Solar Roofs Initiative
- Committing to a specific number of solar energy systems to be installed on buildings in the period between 1998 and 2010
- Committing government actions to overcome barriers to solar energy and energy efficiency applications in buildings
- Identifying financial incentives for solar energy installations
- Establishing net metering for photovoltaics
- Developing and/or modifying codes and standards that affect solar energy installations
- Implementing training programs for building officials, the construction industry, solar energy system installers, and utility personnel
- Providing outreach support for solar energy and energy efficiency
- Taking part in national information sharing, peer-to-peer exchanges, and cooperative research and training projects.
- Connecting the Million Solar Roofs Initiative with other sustainable community initiatives.

6. What assistance is available?

The Million Solar Roofs Initiative, coordinated by the U.S. Department of Energy (DOE) and supported by its partners, provide the following:

- Assistance in accessing low-cost loans, buy-down grants, and other financial assistance
- Training, technical assistance, and information from DOE's Regional Support Offices; the program staffs of DOE's Offices of Power Technologies and Building Technology, State and Community Programs; the DOE Federal Energy Management Program; and the DOE national laboratories
- Recognition and support on a national, regional, and local basis
- Linkage with solar energy businesses, associations, and related industries that can provide assistance to local teams and others interested in solar energy applications.

7. What is the Federal commitment with its own buildings?

The Federal sector represents approximately 0.5% of the U.S. building inventory with its 500,000 buildings. These half-million buildings require the Federal government to spend over $3 billion each year for heating, cooling, lighting and powering the operations. During the past twenty years, actions have been taken to reduce that energy bill through energy efficiency investments and the application of renewable energy (including solar) systems on new and existing Federal buildings.

President Clinton has committed the Federal government to install solar electric and solar thermal energy systems on 20,000 Federal buildings by 2010. The U.S. Department of Energy's Federal Energy Management Program will assist Federal agencies to meet that commitment.

The Federal Energy Management Program recently established umbrella contracts with energy service companies to purchase energy efficiency services for Federal buildings. These "Super Energy Savings Performance Contracts" enable all Federal agencies to improve the efficiency of their buildings through cost effective partnerships with the private sector. The next round of procurements will put in place almost $200 million in contracts, which will use private financing to install solar energy systems at Federal facilities and enable Federal agencies to support the Million Solar Roofs Initiative. In addition, the General Services Administration has developed and implemented streamlined procurement procedures for Federal agencies to obtain solar energy systems. The Department of Defense has already installed many solar energy systems on its buildings, including solar hot water systems on Navy housing and a solar space heating system on an Army aviation maintenance facility.

8. What are Photovoltaics?

Photovoltaic devices, or solar cells, convert sunlight directly to electricity. It is an attractive alternative to conventional sources of electricity for many reasons: it is silent, non-polluting, and renewable; it requires no special training to operate; it is modular and versatile; it is extremely reliable and virtually maintenance free (with no moving parts); and it can be installed almost anywhere. The customer pays only for the system; the fuel is free.

Photovoltaic cells are made of a semiconductor material, usually silicon, and produce an electric current in the presence of light. Individual cells are combined to create modules that produce a specific amount of peak power. The modules, in turn, can be combined to create arrays that produce larger amounts of power. These arrays can be sized to meet the power requirements of the particular application.

9. What is solar thermal heating?

Solar energy can be used to heat both water and air. Solar water heaters use the sun to heat either water or a heat-transfer fluid, such as an antifreeze mixture, in collectors usually mounted on the roof. The hot water, produced directly in the collector or via heat from the transfer fluid, is then stored in a standard

insulated water tank. Some systems use an electric pump to circulate the fluid through the collectors. These environmentally friendly systems are increasingly cost competitive for providing domestic hot water and for heating swimming pools.

Solar space heating offsets building heating loads by either heating recirculated building air or preheating outside or ventilation air. For heating recirculated air, solar energy panels are normally required to receive direct sunlight and provide air temperatures higher than the interior temperature to be effective. The transpired collector, which uses a dark collection surface with perforated metal plates to heat the air just behind the plate surface, is very effective in preheating outside or ventilation air. One additional benefit of the transpired collector is that it can also serve as a component of the building shell.

10. How much will solar energy systems cost?

A residential solar hot water system may cost anywhere from $1,800 to $3,500 and compete effectively with water heated by electricity that costs 8 cents per kWh or more. Solar thermal space heating is very effective in most areas of the country. For example, the cost of a 100-square-foot transpired collector installation can range from $1,000 for retrofits on existing buildings and $500-$700 for new systems, but can produce energy savings to offset the entire cost of the system in five years or less.

Photovoltaic costs are more complicated because system size, features, and net cost to the users depend on the financing terms and interest rates, available incentives, and access to low-cost hardware and installation through bulk purchasing programs. For example, residential photovoltaic systems recently installed in Sacramento, California, cost just under $7,000 per kilowatt and provide energy at approximately 24 cents per kilowatt-hour. Customers voluntarily contribute $4 per month for these systems that are owned by the local utility and provide power directly to the utility grid. Participation is based on the customer's interest in supporting photovoltaics and non-polluting energy production.

Solar technologies are cost-effective in many niche applications today, for example, the use of photovoltaics at remote installations not on the power grid. A solar energy system's cost can also be reduced by Federal, state, and local tax incentives and other financial support. Additional cost reductions are possible through the use of state-implemented net metering options. Financing assistance can, in some cases, reduce the cost of solar energy systems to the point where monthly payments for the system are less than the savings on the monthly energy bill.

The preceding information is available on the Web at http://www.eren.doe.gov/millionroofs/faq.html.

ATTACHMENT 23

MILLION SOLAR ROOFS – EPA REGION 10 SOLAR PROJECT

The EPA Region 10 Million Solar Roofs project is a 2.1 kW installation at the environmental assessment laboratory in Manchester, WA. The system will be used as a source of alternate power for a laboratory that has as its mainstay system a Scintag Diffractometer. This system requires both 208 VAC single phase @ 30 amps and 120 VAC @ 20 amps.

The system will be configured as a grid connected system with battery storage to provide UPS in case of grid power interrupt. We anticipate normal laboratory operation to be approximately two working days per week (8 hours per day). So, there is potential for generating substantial electricity credits into the power grid.

The system configuration will use 28 BP275F, 75 watts each, solar modules from BP Solar Inc. These modules use high efficiency monocrystalline silicon cells. Two Trace Engineering SW5548 Inverters will be used for DC to AC conversion. To maximize the incidence of sun light, the panels will be installed on Zomeworks Universal (passive) Trackers. The total cost of the project is $22,000.

ATTACHMENT 24

FACTORS AFFECTING INDOOR AIR QUALITY

The indoor environment in any building is a result of the interaction between the site, climate, building system (original design and later modifications in the structure and mechanical systems), construction techniques, contaminant sources (building materials and furnishings, moisture, processes and activities within the building, and outdoor sources), and building occupants.

The following four elements are involved in the development of indoor air quality problems:

Source: there is a source of contamination or discomfort indoors, outdoors, or within the mechanical systems of the building.
HVAC: the HVAC system is not able to control existing air contaminants and ensure thermal comfort (temperature and humidity conditions that are comfortable for most occupants).

Pathways: one or more pollutant pathways connect the pollutant source to the occupants and a driving force exists to move pollutants along the pathway(s).
Occupants: building occupants are present.
It is important to understand the role that each of these factors may play in order to prevent, investigate, and resolve indoor air quality problems.

Sources of Indoor Air Contaminants

Indoor air contaminants can originate within the building or be drawn in from outdoors. If contaminant sources are not controlled, indoor air quality problems can arise, even if the HVAC system is properly designed and well-maintained. It may be helpful to think of air pollutant sources as fitting into one of the categories that follow. The examples given for each category are not intended to be a complete list.

Sources Outside Building

Contaminated outdoor air
- pollen, dust, fungal spores
- industrial pollutants
- general vehicle exhaust

Emissions from nearby sources
- exhaust from vehicles on nearby roads or in parking lots, or garages
- loading docks
- odors from dumpsters
- re-entrained (drawn back into the building) exhaust from the building itself or from neighboring buildings
- unsanitary debris near the outdoor air intake

Soil gas
- radon
- leakage from underground fuel tanks
- contaminants from previous uses of the site (e.g., landfills)
- pesticides

Moisture or standing water promoting excess microbial growth
- rooftops after rainfall
- crawlspace

Equipment

HVAC system
- dust or dirt in ductwork or other components
- microbiological growth in drip pans, humidifiers, ductwork, coils
- improper use of biocides, sealants, and/ or cleaning compounds
- improper venting of combustion products
- refrigerant leakage

Non-HVAC equipment
- emissions from office equipment (volatile organic compounds, ozone)
- supplies (solvents, toners, ammonia)
- emissions from shops, labs, cleaning processes
- elevator motors and other mechanical systems

Human Activities

Personal activities
- smoking
- cooking
- body odor
- cosmetic odors

Housekeeping activities
- cleaning materials and procedures
- emissions from stored supplies or trash
- use of deodorizers and fragrances
- airborne dust or dirt (e.g., circulated by sweeping and vacuuming)

Maintenance activities
- microorganisms in mist from improperly maintained cooling towers
- airborne dust or dirt
- volatile organic compounds from use of paint, caulk, adhesives, and other products
- pesticides from pest control activities
- emissions from stored supplies

Building Components and Furnishings

Locations that produce or collect dust or fibers
- textured surfaces such as carpeting, curtains, and other textiles
- open shelving
- old or deteriorated furnishings
- materials containing damaged asbestos

Chemicals released from building components or furnishings
- volatile organic compounds or
- inorganic compounds

Unsanitary conditions and water damage
- microbiological growth on or in soiled or water-damaged furnishings
- microbiological growth in areas of surface condensation
- standing water from clogged or poorly designed drains
- dry traps that allow the passage of sewer gas

Other Sources

Accidental events
- spills of water or other liquids
- microbiological growth due to flooding or to leaks from roofs, piping
- fire damage (soot, PCBs from electrical equipment, odors)

Special use areas and mixed use buildings
- smoking lounges
- laboratories
- print shops, art rooms
- exercise rooms
- beauty salons
- food preparation areas

Redecorating/remodeling/repair activities
- emissions from new furnishings
- dust and fibers from demolition
- odors and volatile organic and inorganic compounds from paint, caulk, adhesives
- microbiologicals released from demolition or remodeling activities

Indoor air often contains a variety of contaminants at concentrations that are far below any standards or guidelines for occupational exposure. Given our present knowledge, it is difficult to relate complaints of specific health effects to exposures to specific pollutant concentrations, especially since the significant exposures may be to low levels of pollutant mixtures.

Indoor Air Pollutants

Frequently, no single pollutant is present in unhealthy amounts, yet because there are so many pollutants present, the total effect may be unhealthy. Pollutants most likely to cause problems in the office are:

1. Carbon Monoxide

This odorless gas is a regulated outdoor air pollutant. It can be an even greater hazard indoors. In some office buildings, afternoon levels of carbon monoxide can be 10 to 20 times greater than the EPA's daily standard for outdoor air quality.

Major sources: Garages and loading docks in buildings are a major source of carbon monoxide. If improperly vented, or if there is a leak in the duct work, the gas can seep into a building's offices in unhealthy amounts.

2. Formaldehyde

Formaldehyde is a commonly used chemical compound found in as many as 3,000 different building products.

Major sources: In office buildings, the major sources of formaldehyde are likely to be particle board, fiberboard and plywood in furniture and paneling; glues; and upholstery and drapery fabrics.

3. Volatile Organic Compounds

Volatile organic compounds (VOCs) are released from certain solids or liquids as gases at room temperature. They include a variety of chemicals (benzene, carbon tetrachloride, styrene) which may have both short-term and long-term health effects.

Major sources: Volatile organic compounds can be found in some furniture, paint, adhesives, solvents, upholstery, draperies, carpet, spray cans, clothing, construction materials, cleaning compounds, deodorizers, copy machine toners, felt-tip markers and pens, and correction fluids.

4. Biological Agents

Biological agents are present in the air almost everywhere, and are a common factor in office air pollution. They include bacteria, viruses, fungi, pollen, dust mites and other insects, animal dander (tiny scales from hair, feathers, or skin) and molds.

Biological agents can travel through the air and are often invisible. They are usually inhaled, either alone or by attaching themselves to particles of dust and then entering the respiratory system.

Major sources: Offices can be especially vulnerable to microorganisms, because fungi and bacteria find nourishment in inadequately maintained air-circulation systems and in dirty washrooms.

5. Secondhand Tobacco Smoke

Secondhand smoke, the smoke from someone else's cigarette, cigar or pipe, contains more than 4,000 chemicals including nicotine, formaldehyde, carbon monoxide, and other known cancer-causing agents.

While smokers themselves face serious health risks from tobacco, it is now clear that even people who don't smoke may be threatened. Exposure to secondhand smoke, also called environmental tobacco smoke, may have certain harmful, possibly even fatal, health effects such as lung cancer and heart disease.

ATTACHMENT 25

INDOOR AIR QUALITY
EPA'S RESEARCH TRIANGLE PARK LABORATORY FACILITY

The interplay between function, environment, and cost extends beyond building materials to entire building systems. One of the most critical of these systems attempts to optimize indoor air quality (IAQ) and energy efficiency. These two objectives, however, typically conflict—as one increases, the other decreases.

The easiest way to improve IAQ is to *increase* the volume of clean outside air circulating through a building. This drastically increases heating and cooling costs in most climates. Similarly, one of the largest energy drains on a building is the heating and air conditioning system. The easiest way to reduce the energy required to heat and cool a building is to *minimize* the volume of outside air entering the building. This reduction in outside air circulation usually lowers IAQ.

To address these competing demands, EPA worked closely with HOK (the architecture and engineering firm) to develop a 150-page *Indoor Air Quality Facilities Operation Manual* that documents the necessary IAQ procedures during building construction and maintenance. The manual outlines procedures to maximize both IAQ and energy efficiency by:

- Eliminating as many IAQ contaminants as possible.
- Increasing energy efficiency throughout the building to offset any reductions in energy efficiency due to the need to increase air circulation.

Eliminating IAQ Contaminants

EPA and the A/E firm worked to eliminate as many IAQ contaminants as possible. They accomplished this by specifying materials with minimal contaminants of concern that also met functional and cost requirements, establishing appropriate installation sequences to prevent IAQ contaminants from being absorbed into the building, requiring extensive IAQ testing before building occupancy, and incorporating design features to eliminate specific IAQ hazards following building occupancy.

Material Selection

The largest sources of potential IAQ contaminants are interior building materials, office furniture, and equipment. Interior building materials, including carpets, carpet padding, paints, sealants and caulking, glues, floor and ceiling tiles, cabinets, molding, composite wood products, and other wood work, can contain contaminants that are gradually emitted (off-gassed) throughout the life of the material. The contaminants include formaldehyde, 4-PC, other VOCs, and small particulate substances that act as eye or throat irritants. Additional IAQ contaminants can originate with office furniture, room dividers, and photocopiers (*Indoor Air Quality Facilities Operations Manual*, EPA Research and Administration Facility, July 1996).

Before any material was specified for use in the building, it was examined for possible adverse affects on IAQ, in addition to its general environmental impact. If possible, products containing materials known to

adversely affect IAQ were not specified. To further protect IAQ, the construction contract requires the contractor to test indoor paint, carpet, ceiling tiles, and fireproofing materials in an environmental chamber on an appropriate substrate, which is designed to simulate the actual application and materials interaction as much as possible. This testing will help ensure that the materials meet the design established for the facility by the EPA design team. Materials with contaminants of concern below the EPA-designated levels can be used throughout the facility. If a product exceeds EPA's designated levels, an alternative product will have to be selected.

Definition of Low VOC Content Levels
As Defined in the RTP Construction Contract

Materials or Product	VOC Content Level
Form Release Agents	350 g/L
Plastic Laminate Adhesive	20 g/L
Casework and Millwork Adhesives	20 g/L
Transparent Wood Finish Systems	350 g/L
Cast Resin Countertop Silicone Sealant	20 g/L
Garage Deck Sealer	600 g/L
Water Based Joint Sealants	50 g/L
Non-water Based Joint Sealants	350 g/L
Portland Cement Plaster	20 g/L
Gypsum Drywall Joint Compound	20 g/L
Terrazzo Sealer	250 g/L
Acoustic Panel Ceiling Finish	50 g/L
Resilient Tile Flooring Adhesive	100 g/L
Vinyl Flooring Adhesives	100 g/L
Carpet Adhesive	50 g/L
Carpet Seam Sealer	50 g/L
Water-based Paint & Polychromatic Finish Coatings	150 g/L
Solvent-based Paint	380 g/L
High Performance Water-based Acrylic Coatings	250 g/L
Pigmented Acrylic Sealers	250 g/L
Catalyzed Epoxy Coatings	250 g/L
High Performance Silicone	250 g/L
Casework Sealant	50 g/L
Liquid Membrane-forming Curing and Sealing Compound	350 g/L

Several EPA employees explained that, although it is not required, it might be in the contractor's best interest to test additional materials because the building must pass strict EPA-defined IAQ tests before occupancy. (See the section on testing below.)

Sequencing

IAQ is affected not only by the materials that are used but also by the order in which they are installed. Certain materials and finishes (Type One materials), off-gas potential indoor contaminants for a short duration after they are manufactured or installed. The contaminants off-gassed by Type One materials can be adsorbed by "fuzzy" materials and finishes (Type Two), which are woven, fibrous, or porous in nature. Type Two materials can become repositories for substances that can be released much later or that promote subsequent bacterial growth.

Type One Materials:

- Composite wood products, specifically including particle board from which wood paneling, doors, or furniture may be fabricated.
- Adhesives, sealants, and glazing compounds.
- Wood preservatives, finishes, and paint.
- Control and/or expansion joint fillers.
- All hard finishes requiring adhesive installation.
- Gypsum board and associated finish processes.

Type Two "Fuzzy" Materials:

- Carpet and padding.
- Fabric wall covering.
- Exposed insulation.
- Acoustic ceiling materials.
- Fabric covered acoustic wall panels.
- Upholstered furnishings.

Note: Materials that may be categorized as both Type One and Type Two are considered Type One materials.

The construction contract specifies air exchange rates and proper air filtration procedures to ensure that whenever possible any necessary off-gassing from Type One materials is dissipated before Type Two materials are installed. These procedures prevent Type Two materials from adsorbing substances that might later reduce IAQ.

The contractor is also required to properly clean all duct work and replace all air filters before building occupancy.

Testing

After building construction is complete, but before EPA occupancy, the construction contractor is required to hire an independent IAQ consultant to test levels of indoor air contaminants to ensure that they are within EPA-specified requirements. The contractor will test 16 locations over three consecutive days throughout the building as directed by EPA with the building operating at normal ventilation rates.

The average results will be used to determine compliance with contract IAQ requirements as defined in the table below.

Maximum Indoor Air Concentration Standards

Indoor Contaminants	Allowable Air Concentration Levels *
Carbon Monoxide (CO)	<9 ppm
Carbon Dioxide ($_{CO2}$)	<800 ppm
Airborne Mold and Mildew	Simultaneous indoor and outdoor readings
Formaldehyde	<20 $\mu g/m^3$ **
Total Volatile Organic Compounds (TVOC)	<200 $\mu g/m^3$ **
4 Phenyl Cyclohexene (4-PC)***	<3 $\mu g/m^3$
Total Particulates (PM)	<20 $\mu g/m^3$
Regulated Pollutants	<National Ambient Air Quality Standards (NAAQS)
Other Pollutants	<5% of Threshold Limit Value - Time Weighted Average (TLV-TWA)

* All levels must be achieved prior to acceptance of the building. The levels do not account for contributions from office furniture, occupants, and occupant activities.
** Above outside air concentrations.
*** 4-PC is an odorous contaminant constituent in carpets with styrene-butadiene-latex rubber (SBR).

If the building fails any EPA standards, the construction contractor must rectify the problem and retest the building at no additional expense to the government.

Exhaust Stacks

EPA was also concerned about potential IAQ concerns following building occupancy. One of the primary areas of concern was the exhaust gas from the EPA labs. The EPA laboratory complex includes 13 exhaust stacks—three on each of the four laboratory buildings and one on the high bay engineering research wing. Together, they vent exhausts from nearly 300 fume hoods. The exhaust stacks were originally designed to be 20 feet high and, although the primary fresh air intakes for the buildings will be located well away from the exhaust stacks, EPA officials questioned whether the stacks would be high enough to prevent potentially hazardous materials from recirculating into the building.

In order to determine if the stacks were tall enough, EPA had a 1:192 scale model of the buildings and site terrain constructed. EPA scientists placed the model in the EPA Meteorological Wind Tunnel where ethane gas was emitted from the model's exhaust stacks and its concentration measured at the model's fresh air intakes. Wind direction and speed were systematically varied in order to identify worst case scenarios.

The results indicated that there was some risk of exhaust reentry during certain wind conditions that occur with some frequency at the building site. The scientists increased the height of the exhaust stacks on the

model and repeated the experiment to determine if it would reduce exhaust reentry. After completing the experiment, they concluded that increasing the stack height by 10 feet would improve IAQ by significantly reducing the potential for exhaust reentry at the fresh air intakes. Although the potential risk of exhaust reentry was minimal at the original 20-foot stack height, it was virtually eliminated at the 30-foot stack height.

As a result of the modeling, EPA decided to increase the height of the buildings' exhaust stacks from 20 to 30 feet. While the increase will require more material to construct the stacks, increasing the stack height will improve overall indoor air quality and should reduce required maintenance of filters at the air intakes.

ATTACHMENT 26

U.S. GREEN BUILDING COUNCIL
LEED™ "LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN"

GREEN BUILDING RATING SYSTEM

The U.S. Green Building Council

The U.S. Green Building Council is the only balanced nonprofit consensus coalition of the building industry, promoting the understanding, development, and accelerated implementation of "Green Building" policies, programs, technologies, standards and design practices. Since its formation in 1993, the U.S. Green building Council has filled a vital need in the U.S. building industry, becoming the center for debate and action on environmental issues facing the industry's multiple interests. The Council's membership is open and balanced; it is comprised of leading and visionary representation from all segments of the building industry including product manufactures, environmental groups, building owners, building professionals, utilities, city government, research institutes, professional societies and universities.

This type of representation provides a unique integrated platform of carrying out important programs and activities. Through our committee-based organization, we are endeavoring to move the green building industry forward with market-based solutions, such as a green building rating system.

A Green Building Rating System: Leadership in Energy and Environmental Design

The LEED Green Building™ Rating System is a priority program of the US Green Building Council. It is a voluntary, consensus-based, market-driven building rating system based on existing proven technology that evaluates environmental performance from a "whole building" perspective over a building's life cycle. LEED™ is intended to be a definitive standard for what constitutes a "green building".

The US. Green Building Council's LEED Green Building™ Rating System is based on accepted energy and environmental principles and strikes a reasonable balance between known effective practices and emerging concepts. Unlike other rating systems currently in existence, the development of the LEED Green Building™ Rating System has been open to public scrutiny and has involved the participation of virtually all segments of the building industry including product manufacturers, environmental groups, building owners, utilities, state and local governments, research institutions, professional societies and colleges and universities.

LEED™ is a self-certifying system designed for rating new and existing commercial, institutional, and high-rise residential buildings. It is a feature-oriented system where credits are awarded for satisfying each criteria. Different levels of green building certification will be awarded to applicants that earn two thirds of the available credits and meet all prerequisites. The system is designed to be comprehensive in scope, yet simple in operation.

The Rating Body

Responsibilities
The U.S. Green Building Council (Council) will establish and manage a Rating Body whose primary responsibilities are establishing and reviewing the Leadership in Energy and Environmental Design (LEED™) Building rating system criteria, settling disputes and developing policies for its operation and management.

Composition and Term of Service
The Rating Body is responsible for reviewing and updating program criteria every three years or as technology and regulations warrant program changes. A Rating Body subcommittee will also settle disputes regarding certification. Proposed operational guidelines, systems and program changes will be subject to Council approval through the Council's consensus-based voting procedures.

The Rating Body will be comprised of volunteer Council members, and will attempt to reflect the balance and diversity of the Council itself. The Rating Body will be comprised of up to 15 voting members and will strive to include at least one representative from each of the following membership categories:

- Product Manufacturers
- Building Control and Service Contractors
- Utility Companies
- Real Estate (Managers, Owners, Users, Others) Professionals
- Professional Societies
- Environmental Organizations
- Local, State and Federal Governments
- Professional Firms
- Contractors, Builders
- Financial (Lenders, Insurers, Others)
- Universities and Research Institutes

Council members, officers and liaisons will have the opportunity to volunteer or nominate candidates to serve on the Rating Body. The Rating Body Chairman will be appointed and approved by the U.S. Green Building Council's Board of Directors. Each Rating Body member will serve up to a three-year term, so long as the representative organization is a member of the Council. Voting members to the Rating Body will be accepted according to the balance of the current voting membership. Any interested party may participate in Rating Body meetings, or comment on Rating Body work products, but only members can vote.

The Rating Body may also consult non-USGBC member experts with technical and administrative expertise in various disciplines such as energy, indoor air quality, building management, operations and maintenance, sustainable design, and materials as circumstances warrant.

Program Administration
The administrative operations of the program will be vested with the U.S. Green Building Council staff. A designated Rating System Program Coordinator and staff, will oversee day-to-day activities. The Coordinator is responsible for issuing and reviewing applications, verifying compliance, maintaining records, responding to information requests, responding to complaints, issuing news releases and other promotional materials and serving as the program liaison to the Rating Body.

Certification
Responsibility for certifying compliance with Rating System criteria will be vested with registered professional engineers and/or architects who will be required to sign and seal applications, and submit a statement that in their professional opinion the building applying for certification as a LEED™ Building meets the program criteria contained herein. See the LEED™ Green Building Design Assistance Manual for a sample certification form.

All buildings certified are subject to review and verification by the Rating System Program Coordinator. Upon receipt of an application, the Program Coordinator will verify within 30 days of receipt of all necessary information, that the application is complete and appears to satisfy program criteria. If there is some question about the application, it may be forwarded to the Rating Body for clarification.

Certification will permit the complying building to use the term LEED™ Building in advertising and other representations of the building for the period of five years from the date of certification. Before the end of five years the building must reapply under the appropriate USGBC certification program, which will evaluate the Operations and Maintenance of the facility.

Documentation
All certification documents will be available for public review at the U.S. Green Building Council offices and at the building site. Documentation requirements include a completed application/certification form (See the LEED™ Building Design Assistance Manual), as well as a complete set of approved construction documents (drawings and specifications). As-built drawing also will be required before final certification.

Denial of Certification
Periodically, the Rating System Program Coordinator may conduct random, more detailed reviews of certification applications, including buildings that are already certified. If there is a question or exception raised by the Coordinator's review of the application, the application may be forwarded to the Rating Body for clarification. The notice of rejection to the building owner or applicant will contain a written reason and basis for its decision to deny the application, and the necessary actions to reverse the rejection. The building owner or applicant shall have six months from the date of rejection to satisfy the corrective actions cited in the rejection letter to the sole and final discretion of the Rating Body by a two-thirds majority vote. Denial of certification also can be appealed using the process described below.

Termination of Certification
Any building can terminate its LEED™ Green Building certification at any time without penalty or liability, subject to the following conditions:

1. The certified LEED™ Green Building owner agrees to provide the USGBC with written notice of its intent to terminate its status as a LEED™ Building.
2. The certified LEED™ Green Building agrees to relinquish all rights and privileges of its prior certification within 30 days of providing such written notice.
3. The USGBC or its Rating Body reserves the right to terminate a building's green design building certification for good cause without penalty or liability. Good cause includes, but is not limited to, the certified building's or applicant's failure upon closer review to meet the criteria specified in the rating system.

The USGBC or its Rating Body agrees to provide written notice of its decision and supporting reasons to terminate a building's green design certification. Upon receiving such notice of termination, a certified building retains all rights and privileges of certification pending final resolution of its status.

A certified building owner may respond in writing to demonstrate compliance or appeal the decision to withdraw certification within 30 days of receiving the termination of certification notice. The building owner or applicant agrees that failure to provide such written response shall be construed as acceptance of the decision.

Dispute Process
All building owners or applicants whose certification is denied or withdrawn will be given an opportunity to appeal the decision of the Rating Body. The decision of the Rating Body may be appealed within 30 days of its decision and either reversed or upheld by a majority vote of the USGBC Board of Directors. The applicant, building owner subject to termination, and the Council agree that the decision of the Board of Directors is final, not appealable to the Council membership, not subject to judicial review and not subject to arbitration or mediation.

Display of LEED™ Green Building Plaque
Approved applicants will receive a LEED™ Building plaque that must be displayed on the outside wall by the main entrance or in the building lobby. Successful applicants will be provided certification guidelines regarding the appropriate use of their designation as a LEED™ Building and its use in any associated promotional materials.

Application and Certification Fees
The Council will impose an application fee and a certification fee that will cover operating costs and program expenses. Fees will be based on a fixed charge ascribed to the floorspace of buildings applying for recognition as a certified green building. The application fee is non-refundable and the applicant agrees to waive its rights to refund, whether or not the application is rejected or the certification is terminated. The certification fee must be received and processed before the applicant will be permitted to license the LEED™ Green Building name and receive the promotional materials associated with LEED™ Green Building certification. The U.S. Green Building Council or its Rating Body reserves the right to modify these fees as warranted by changes in program administration costs.

LEED™ GREEN BUILDING RATING SYSTEM CRITERIA

Eligibility
All commercial buildings as defined by standard building codes are eligible for consideration as a LEED™ Building. Commercial occupancies include, but are not limited to: offices, retail and service establishments, institutional buildings (libraries, schools, museums, churches, etc.), hotels and residential buildings of four or more habitable stories. Residential buildings, three habitable stories or less and occupied buildings more than 3 years old as of January 1, 1998, will be covered under separate USGBC rating systems.

Compliance Criteria

For classification as a LEED™ Building, applicant buildings must satisfy all of the prerequisites and a certain number of credits to attain different LEED™ Building classifications. Having satisfied the basic prerequisites of the program, applicant buildings are then rated according to its degree of compliance (on a percentage basis) with the credit system listed below.

A total of 44 Credits, plus 4 Bonus Credits are available under the LEED™ Building Rating System with four categories of certification:

- LEED™ Green Building Platinum™: for buildings that earn 81% (36) or more of the available credits
- LEED™ Green Building Gold™: for buildings that earn 71-80% (31-35) of the available credits
- LEED™ Green Building Silver™: for buildings that earn 61-70% (27-30) of the available credits
- LEED™ Green Building Bronze™: for buildings that earn 50-60% (22-26) of the available credits [1]

In addition, the USGBC will present an award for the "Green Building of the Year" for the LEED™ Building with the highest score for the year. In addition, the USGBC or its Rating Body will present "LEED™ Pioneer" designation for existing buildings that wish to apply. Applications for a LEED™ Pioneer designation will be considered on an individual basis within existing Rating System criteria and must achieve at least 40% of the total points available. Normal application fees apply for this designation.

The award level for a LEED™ Green Building Bronze™ will begin at 50% for the first three-year cycle to recognize relatively new buildings that did not have the benefit of designing to LEED, but are generally considered to be 'green'. Beginning with the next revision cycle of LEED, the lower rung of the Bronze rating will begin at 60%.

For example, a rammed-earth building that uses material taken from excavating the basement to build the walls may qualify for a point under the Construction Waste Management section since waste is being prevented by building with on-site materials.

Note: EPA and DOE are currently revising the Energy Star building program to accommodate new as well as existing buildings. This new program will be based on new performance requirements. When revised Energy Star program criteria have been established, a corresponding LEED™ credit level will be determined.

Credit Equivalence

Under certain circumstances an action will be taken that will comply with the spirit, though not necessarily the letter, of the compliance criteria. [2] Under these circumstances, the applicant must demonstrate that the actions taken are substantially similar in impact to the relevant criteria and request credit for those actions. Areas where substantial equivalence is being claimed must be clearly indicated on the application and the appropriate documentation provided to support the claim. Credit equivalence may only be claimed on specific points and will be limited to a maximum of 3 credits per application.

Applicability of Referenced Standards

Beginning January 1, 1998, LEED™ rating system criteria will be revised no later than every 3 years, unless compliance with a particular standard is required by local building regulations. Under extraordinary

circumstances, the Council may use its consensus process to modify criteria before the end of the three-year period.

Compliance Support
Details about the application and compliance process, key summaries of all of the standards referenced in the Rating System Criteria, as well as a list of design assistance resources can be found in the LEED™ Building Design Assistance Manual, or are available in their entirety from the U.S. Green Building Council.

LEED™ GREEN BUILDING RATING SYSTEM PREREQUISITES

All buildings must comply with the following prerequisites:

ASBESTOS

For all buildings, the building owner's prime design professional of record (architect or engineer) must submit a signed and sealed statement certifying in their professional opinion that the building is either (1) free of asbestos containing material pursuant to OSHA asbestos regulations governing building owners, 29 CFR Part 1926 including §1926 (communication of hazards and testing), or (2) complies with the OSHA Part 1926 asbestos rule for protection from human exposure, training, hazard communication, and other applicable OSHA Part 1926 requirements for building owners. Any building renovation must demonstrate compliance with EPA regulations requiring management of asbestos under NESHAP.

BUILDING COMMISSIONING

For buildings larger than 50,000 habitable square feet, commission the building according to the 'GSA Model Commissioning Plan and Guide Specifications'.

For buildings less than 50,000 habitable square feet, commission the building according to the Bonneville Power Administration's Building Commissioning Guidelines-Second Edition.

ENERGY EFFICIENCY

Comply with state and local energy codes or ASHRAE 90.1-1989 and subsequent revisions whichever is stricter.

Comply with the Department Of Energy's International Performance Measurement and Verification Protocol (IPMVP) for energy consumption.

INDOOR AIR QUALITY

Comply with ASHRAE Standard 62-1989 with the proviso that the ambient air quality standard requirements shall be site specific and not region specific (i.e. ambient air quality at the proposed point of fresh air intake).

Building fresh air intake shall be located away from loading areas, building exhaust fans, cooling towers and other point sources of contamination.

OZONE DEPLETION/CFCs

For new buildings, CFC refrigerants and halon fire suppression systems are not permitted. Existing buildings being rehabilitated must have a CFC and halon management and 5-year phase-out plan.

SMOKING BAN

Prohibit smoking in all areas of the building.

STORAGE AND COLLECTION OF RECYCLABLES

Provide a centralized ground-floor location for collection and storage of materials separated from each other for recycling, including: newspaper, glass, metals, plastics organic waste (food and soiled paper) and dry waste.

THERMAL COMFORT

Comply with ASHRAE Standard 55-1992 .

WATER CONSERVATION

Comply with Plumbing Fixture Requirements of the Energy Policy Act of 1992 .

Comply with the Department Of Energy's International Performance Measurement and Verification Protocol (IPMVP) for water consumption.

WATER QUALITY (LEAD)

Meet the requirements of EPA Publication # 812-B-94-002: "Lead in Drinking Water in Schools and Non-Residential Buildings," April 1994

LEED™ GREEN BUILDING RATING SYSTEM CREDITS

A total of 44 Credits, plus 4 Bonus Credits is available. Bonus credits may be counted toward certification.

BUILDING MATERIALS

There is a total of 7 CREDITS available for building materials measures.

1 OR 2 CREDITS FOR LOW VOC MATERIALS

--1 credit for complying with 1 or 2 measures;
--2 credits for doing all three

(a) Limit VOC content in adhesives. At a minimum all adhesives must meet the VOC limits of South Coast Rule #1168 by the South Coast Air Quality Management District.

(b) Limit the VOC content in architectural sealants (material with "adhesive" characteristics used as a filler; not material used as a "coating"). At a minimum, all sealants must meet the limits of Regulation 8, Rule 51 of the Bay Area Air Resources Board.

(c) Limit the VOC content in paints and coatings. At a minimum all paints and coatings must meet the requirements of New Jersey State Department of Environmental Protection, Title 7, Chapter 27, Subchapter 23.

1 CREDIT FOR USE OF LOCAL MATERIALS:

One credit is available for using a minimum of 20% of building materials as calculated by total materials cost (exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead fees etc.) manufactured within 300-miles of the building site.

1 CREDIT FOR RESOURCE REUSE:

One credit is available for using salvaged or refurbished materials for 5% of total building materials as calculated by total materials cost (exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead fees etc.).

1 CREDIT FOR ADVANCED RESOURCE REUSE

One additional credit is available for specifying salvaged or refurbished materials for 10% of total building materials as calculated by total materials cost (exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead fees etc.).

1 CREDIT FOR RECYCLED CONTENT:

One credit is available for buildings using a minimum of 20% of the materials as calculated by total materials cost (exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead fees etc.) that contain at least 20% post-consumer recycled content OR a minimum of 40% post-industrial recycled content.

1 CREDIT FOR ADVANCED RECYCLED CONTENT:

One additional credit for buildings using a minimum of 50% of the materials as measured by total materials cost (exclusive of costs for mechanical, electrical, plumbing systems and labor) that contain at least 20% post-consumer recycled content OR a minimum of 40% post-industrial recycled content.

CONSTRUCTION WASTE MANAGEMENT

There is a total of 2 CREDITS available for construction waste management measures.

1 CREDIT FOR MANAGEMENT PLAN

One credit is available for developing a construction and demolition waste management plan that identifies licensed haulers of recyclables and documents costs for recycling and frequency of pick-ups. At a minimum, the plan shall mandate recycling of cardboard, metals, concrete, brick, asphalt, land clearing debris (if applicable) and beverage containers.

1 CREDIT FOR ADVANCED MANAGEMENT PLAN

One additional credit is available for meeting the requirements above and also recycling clean dimensional wood, plastic, glass, gypsum board, and carpet, and for evaluating the cost-effectiveness of recycling rigid foam insulation, engineered wood products and other materials.

ENERGY

There is a total of 10 CREDITS available for energy measures.

Energy Efficiency (Up to 7 credits available.)

Five different levels of energy efficiency earn from 1 to 5 credits, plus two additional credits for waste heat recovery and natural space conditioning. Each level is described below.

1 CREDIT LEVEL

One credit is available for completing EPA's Green Lights Program requirements.

or

One credit is available for meeting California's Title 24 lighting requirements .

2 CREDIT LEVEL

Two credits are available for completing the EPA/DOE Energy Star Building Program requirements.[3]

or

Two credits are available for exceeding the requirements of ASHRAE/IES Standard 90.1-1989 and subsequent revisions "Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings" by 20% or more.

3 CREDIT LEVEL

Three credits are available for exceeding ASHRAE/IES Standard 90.1-1989 and subsequent revisions by 30% or more.

4 CREDIT LEVEL

Four credits are available for exceeding ASHRAE/IES Standard 90.1-1989 and subsequent revisions by 40% or more.

5 CREDIT LEVEL

Five credits are available for exceeding ASHRAE/IES Standard 90.1-1989 and subsequent revisions by 50% or more.

1 CREDIT FOR NATURAL VENTILATION, HEATING AND COOLING

One additional credit is available for a building that uses natural ventilation and passive energy design to accomplish all heating and cooling requirements for a minimum of 8 months of the year.

1 CREDIT FOR WASTE-HEAT RECOVERY SYSTEM

One additional credit is available for installing a waste heat recovery system, that recaptures at least 20% of total waste heat, is used to pre-heat water or incoming air. To receive credit for this measure, the energy benefits from heat recovery must be in addition to whatever energy measures have been used to obtain other credits.

Renewable/Alternative Energy (Up to 3 credits available.)

Three different levels of Renewable Energy use earn from one to three credits. Each level is described below.

1 CREDIT LEVEL

One credit is available for use of building-integrated or directly-connected renewable energy systems to supply 10 percent of the building's total energy load.

2 CREDIT LEVEL

Two credits are available for the use of building-integrated or directly-connected renewable energy systems to supply 20 percent of the building's total energy load.

3 CREDIT LEVEL

Three credits are available for the use of building-integrated or directly-connected renewable energy systems to supply 30 percent of the building's total energy load.

EXISTING BUILDING REHABILITATION

There is a total of 2 CREDITS available for rehabilitation of an existing structure, depending upon what fraction of the building's structural shell is maintained:

1 CREDIT LEVEL

One credit is available for maintaining a minimum of 75% of the building's structural shell while undertaking extensive rehabilitation of an existing structure.

2 CREDIT LEVEL

Two credits are available for maintaining 100% of the building's structural shell while undertaking extensive rehabilitation of an existing structure.

INDOOR AIR QUALITY

There is a total of 3 CREDITS available for indoor air quality (IAQ) measures.

1 CREDIT FOR CONSTRUCTION IAQ MANAGEMENT PLAN

One credit is available for the development and implementation of an IAQ management plan for the construction process, which is consistent with Sheet Metal and Air Conditioning Contractors National Association's (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction." The management plan shall provide for:

* Protection of the ventilation system components (equipment & pathways) from contamination,

or

* after completion of construction and prior to occupancy: provision of cleaning requirements for ventilation system components and pathways exposed to contamination during construction.

1 CREDIT FOR ADVANCED CONSTRUCTION IAQ MANAGEMENT PLAN

One additional credit is available for undertaking the management plan requirements above and implementing the following additional measures:

* reduction of construction contaminants in the building prior to occupancy (e.g. dust, particulates, water infiltration-related contamination, VOCs),

and

* if the return air side of a system is used during construction, provide a minimum of 85% filtration, as determined by ASHRAE Standard 52.1-1992 , on return-side system components during construction and replacement of all filtration media prior to occupancy.

1 CREDIT FOR PERMANENT AIR MONITORING SYSTEM

One credit is available for the installation of a permanent air monitoring system.

* System should have the capability to monitor supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO2), total volatile organic compounds (TVOCs) and particulates (including PM10).

LANDSCAPING/EXTERIOR DESIGN
There is a total of 3 CREDITS available for landscaping measures:

1 CREDIT FOR EROSION CONTROL

One credit is available for the certification of compliance with Sections 4.2 e. & f. of the Maryland Model Erosion and Sediment Control Ordinance and Section 6 (Group 2) of the Maryland Model Stormwater Management Ordinance.

1 OR 2 CREDITS FOR REDUCING HEAT ISLANDS
--1 Credit for implementing one or two measures;
--2 Credits for implementing all three measures;

(a) Planting at least one (1) tree on the site for every 1,000 square feet of impermeable surface on the building lot, including parking, walkways and plazas, etc. Providing natural or artificial cover (e.g. trees or covered walks) to shade at least 60% of impermeable surfaces of the property;

(b) Providing light-color (high-albedo, or reflectance) for 80% of the roofing materials of a building. Materials should have an albedo reflectance of at least 0.5;

(c) Providing high-albedo materials on 80% of the property's non-parking impervious surfaces (e.g. sidewalks, plazas, parking lots). Materials should have an albedo reflectance of at least 0.5. Outdoor parking lots Impervious surfaces should use light-colored aggregate and not be finished with a final coat of blacktop.

LEED-CERTIFIED DESIGNER
There is a total of 1 BONUS CREDIT available for using a LEED-Certified Designer

1 BONUS CREDIT FOR USING A LEED-CERTIFIED DESIGNER

One credit is available for buildings designed by teams with at least one principal designer who has satisfactorily completed a LEED™ Design training course at the Bronze level.

OCCUPANT RECYCLING
There is a total of 1 CREDIT available for occupant recycling measures.

1 CREDIT FOR OCCUPANT RECYCLING EQUIPMENT

One credit is available for multistory buildings of four or more stories which install a mechanical system allowing for the floor to floor transportation and sorting of newspaper, glass, metals, plastics, organic waste (food and soiled paper) and dry waste for recycling (or disposal) in separate containers on the ground floor of the buildings, other than by labor. OR for buildings three stories or less, installing a compactor(s) and/or baler(s) as required to accommodate a recycling diversion rate of at least 75% of the building waste stream.

OPERATIONS AND MAINTENANCE FACILITIES
There is a total of 2 CREDITS available for Operation and Maintenance facility and design measures.

1 CREDIT FOR CHEMICAL STORAGE AREAS

One credit is available for designing all chemical storage and mixing areas for housekeeping products (central storage facilities AND janitors closets, where appropriate) to allow for adequate and secure product storage with water in the space for mixing concentrated chemicals, drains plumbed for the

appropriate disposal of liquid waste products, equipped with separate outside venting, and operated under negative pressure.

1 CREDIT FOR ARCHITECTURAL ENTRYWAYS

One credit is available for permanent architectural entryway system(s) (e.g. grills, grates, etc.) designed to catch and hold particles to keep them from contaminating the building interior.

OZONE DEPLETION/CFCs

There is a total of 2 CREDITS available for CFC, HCFC and Halon elimination measures.

1 CREDIT FOR ELIMINATING CFC, HCFC AND HALON USE IN MECHANICAL EQUIPMENT

One credit is available for building-level HVAC and refrigeration equipment that does not contain CFCs or HCFCs and a non-halon/CFC/HCFC fire suppression system.

1 CREDIT FOR ELIMINATING CFC AND HCFC USE IN BUILDING MATERIALS

One credit is available for using building materials (e.g. insulation, carpet pad) that do not use CFCs or HCFCs as foaming agents or in other parts of the manufacturing process.

SITING

There is a total of 3 CREDITS and 1 BONUS CREDIT available for siting measures:

1 CREDIT FOR INFILL DEVELOPMENT

One credit is available for new construction on vacant land located in areas with an existing development density of 100,000 square feet per acre or more.

OR

Rehabilitate an existing building.

1 CREDIT FOR REDUCED HABITAT DISTURBANCE

One credit is available for having a development footprint (including building, utilities, access and parking) which exceeds the open space requirement for the site per local zoning by 25%.

OR

Rehabilitation of an existing building (if rehabilitation includes an addition that exceeds 50% the footprint of the existing building, then the above requirement for reduced habitat disturbance must also be met).

1 CREDIT FOR SITE PRESERVATION / RESTORATION

One credit is available for implementing a preservation plan for topsoil and existing trees;

AND

Limiting the construction disturbance to 50 feet beyond the building perimeter for earthwork, site utility lines (except minor trenching for main branches), and surface parking (on grade surface parking constructed of pervious paving is acceptable beyond 50 feet);

AND

Restoring a minimum of 50% of degraded habitat areas on the site.

1 BONUS CREDIT FOR BROWNFIELD DEVELOPMENT

One bonus credit is available for development in a site classified as' brownfield' using EPA guidelines, including EPA OSWER Dir. 9610.17 and ASTM Standard Practice E1739 for site remediation where required.

TRANSPORTATION

There is a total of 3 CREDITS, plus 1 BONUS CREDIT available for transportation measures.

1 OR 2 CREDITS FOR ALTERNATIVE TRANSPORTATION FACILITIES

--1 credit for implementing 1 or 2 measures;
--2 credits for implementing 3 measures

(a) providing suitable means for securing bicycles for at least 5% of the building occupants

(b) providing shower and changing facilities for cyclists.

(c) providing transit and pedestrian-friendly physical linkages to mass transit infrastructure, such as covered or internal access to subway, bus or trolley stops or stations OR providing preferred parking for carpool participants.

1 CREDIT FOR EFFICIENT BUILDING LOCATION

One credit is available for a building location within ½ mile of a fixed rail station (either commuter rail, light rail or subway) or within 1/4 mile of 2 or more bus lines.

1 BONUS CREDIT FOR ALTERNATIVE FUELING FACILITIES

One bonus credit is available for installing refueling facilities for alternative-fuel vehicles using, for example, electricity, natural gas or methanol/ethanol. Liquid or gaseous fueling facilities must be separately ventilated or located outdoors.

WATER CONSERVATION

There is a total of 4 CREDITS available for water conservation measures.

1 CREDIT FOR WATER-CONSERVING FIXTURES

One credit is available for installing fixtures that use 20% less water than the water usage requirements in the Energy Policy Act of 1992 .

1 CREDIT FOR WATER RECOVERY SYSTEM

One credit is available for installing a gray water system that recovers non-sewage waste water or uses roof or ground storm water collection systems, or recovers ground water from sump pumps.

1 CREDIT FOR WATER-CONSERVING COOLING TOWERS

One credit is available for installing cooling tower systems designed with delimiters to reduce drift and evaporation.

1 CREDIT FOR WATER-EFFICIENT LANDSCAPING

One credit is available for 100 percent of exterior plantings that use plants tolerant of climate, soils, and natural water availability, and that do not receive watering from municipal potable water after a period of establishment is complete.

WATER QUALITY
There is a total of 2 CREDITS, PLUS 1 BONUS CREDIT available for water quality measures.

1 CREDIT FOR SURFACE RUNOFF FILTRATION
One credit is available for the installation of oil grit separators or water quality ponds for pre-treatment of runoff from surface parking areas.

1 CREDIT FOR SURFACE RUNOFF REDUCTION
One credit is available for using pervious paving materials for a minimum of 50% of non-landscaped areas, exclusive of the building footprint (roadways, surface parking, plazas, pathways) on the site.

1 BONUS CREDIT FOR BIOLOGICAL WASTE TREATMENT
One credit is available for the installation of an on-site biological waste water treatment system. This system shall be capable of treating both gray water and black water to local prevailing health standards.

Tally Sheet

Applicants must meet all of the Prerequisites as well as score the requisite number of points in the desired LEED Building™ category.

A total of **44 credits**, plus **4 bonus credits** is available. Bonus credits may be counted toward certification.

1. LEED Building Platinum™: for buildings that earn 81% (35) or more of the available credits.
2. LEED Building Gold™: for buildings that earn 71-80% (31-34) of the available credits.
3. LEED Building Silver™: for buildings that earn 61-70% (27-30) of the available credits.
4. LEED Building Bronze™: for buildings that earn 50-60% (22-26) of the available credits.

In addition, the USGBC will present an award for the "Green Building of the Year" for the LEED Building™ with the highest score of the year.

Prerequisites (11)
Asbestos Avoidance or Management
Building Commissioning
Elimination of CFC's
Energy Efficiency
Erosion Control
Indoor Air Quality
Smoking Ban
Storage & Collection of Occupant Recyclables
Thermal Comfort
Water Conservation
Water Quality--Lead

Building Materials (7 Credits)

1 or 2 Credits for low VOC materials
1 credit for 1 or 2 measures; 2 credits for 3
(a) Limit VOC content in adhesives

(b) Limit the VOC content in architectural sealants
(c) Limit the VOC content in paints and coatings
1 Credit for use of local materials
1 Credit for resource use
1 Credit for advanced resource reuse
1 Credit for recycled content
1 Credit for advanced recycled content

Construction Waste Management (2 Credits)

1 Credit for management plan
1 Credit for advanced management plan

Energy (10 Credits)

Energy Efficiency (7 Credits) (Note: points are NOT additive, except for Heat Recovery, Natural Ventilation and Bonus Credit)

1 Credit for:
EPA Green Lights Partnership
or
California Title 24 Lighting

2 Credits for:
EPA Energy Star Building Certification
or
Exceeding ASHRAE 90.1 by 20%

3 Credits for exceeding ASHRAE 90.1 by 30%
4 Credits for exceeding ASHRAE 90.1 by 40%
5 Credits for exceeding ASHRAE 90.1 by 50%
1 additional Credit for Natural Ventilation, Heating and Cooling
1 additional Credit for Waste-Heat Recovery System

Renewable Energy (3 Credits)

1 Credit for 10% of building energy from on-site renewable sources
2 Credits for 20% of building energy from on-site renewable sources
3 Credits for 30% of building energy from on-site renewable sources

Existing Building Rehabilitation (2 Credits)

1 Credit for maintaining 75% of the structural shell when renovating and existing building
2 Credits for maintaining 100% of the structural shell when renovating an existing building

Indoor Air Quality (3 Credits)

1 Credit for construction IAQ management plan
1 Credit for advanced construction IAQ management plan

1 Credit for permanent air monitoring system

Landscaping (3 Credits)

1 Credit for erosion control
1 or 2 Credit for reducing heat islands
-- 1 Credit for 1 or 2 measures; 2 Credits for 3
(a) shade cover
(b) reflective roofing materials
(c) reflective surface

Occupant Recycling Equipment (1 Credit)

1 Credit for occupant recycling systems and equipment

Ozone Depletion/CFCs (2 Credits)

1 Credit for eliminating CFC, HCFC and Halon use in mechanical and fire suppression
1 Credit for eliminating CFCs and HCFCs in building materials

Siting (3 Credits, plus 1 Bonus Credit)

1 Credit for reduced habitat disturbance or building rehabilitation
1 Credit for site restoration
1 Credit for infill development or building rehabilitation
1 Bonus Credit for brownfield development

Transportation (3 Credits, plus 1 Bonus Credit)

1 or 2 Credits for alternative transportation facilities
(1 Credit for 1 or 2 measures, 2 Credits for 3 measures)
(a) bicycle racks
(b) shower and changing facilities
(c) transit and pedestrian-facility physical linkages or carpool parking

1 Credit for efficient building location
1 Credit for alternative fueling facilities

Water Conservation (4 Credits)

1 Credit for water-conserving fixtures
1 Credit for gray water recovery system
1 Credit for water-conserving cooling towers
1 Credit for water efficient landscaping

Water Quality (2 Credits. Plus 1 Bonus Credit)

1 Credit for surface runoff filtration
1 Credit for surface runoff reduction
1 Bonus Credit for biological waste treatment

Standards or Regulations Referenced in LEED

Asbestos
OSHA Asbestos Regulations in 29 CFR Part 1926 Safety and Health Regulations for Construction

Building Materials
South Coast Rule #1168-South Coast Air Quality Management District

Regulation 8, Rule 51, Bay Area Air Quality Management District BAAQMD: (415) 771-6000

Title 7, Chapter 27, Subchapter 23 -- New Jersey State Department of Environmental Protection NJDEP - Arthur Diem, Rule Development: (609) 984-0490

Brownfield Development
EPA OSWER Dir. 9610.17 ASTM Standard Practice E1739: Site Remediation

Building Commissioning
GSA 'Model Commissioning Plan and Guide Specification'

Bonneville Power Administration Building Commissioning Guidelines-2nd edition PECI (503) 248-4636

Energy Efficiency
ASHRAE/IES 90.1-1989 'Energy Efficient Design of New Buildings Except New Low-Rise Residential Buildings' (800) 527-4723 (U.S. and Canada) or 404-636-8400 (worldwide)

DOE's International Performance Measurement and Verification Protocol (IPMVP)

California Title 24 Lighting
California Energy Commission Publications Unit, 1516 Ninth Street, Sacramento, CA 95814 (916) 654-5200

EPA Green Lights Requirements
Manager EPA Green Lights Program US EPA (6202J) Washington DC 20460;
fax (202) 233-9569; voice (202) 775-6650

EPA Energy Star Buildings Requirements

Erosion Control
Maryland Model Erosion and Sediment Control Ordinance - Sections 4.2 e & f
Maryland Model Stormwater Management Ordinance-Section 6 (Group 2)
Maryland Department of the Environment, Water Management Administration-Nonpoint Source Program: (410) 631-3543

Indoor Air Quality
ASHRAE 62-1989'Ventilation for Acceptable Indoor Air Quality' (ANSI approved)
(800) 527-4723 (U.S. and Canada) or 404-636-8400 (worldwide)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)'IAQ Guidelines for Occupied Buildings Under Construction' SMACNA: 4201 Lafayette Center Dr. Chantilly, VA 22021 (703) 803-2980 voice; (703) 803-3732 fax

Filters providing 85% filtration as tested according to ASHRAE Standard 52.1-1992 :'Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter' (ANSI approved) (800) 527-4723 (U.S. and Canada) or 404-636-8400 (worldwide)

Thermal Comfort
ASHRAE 55-1992 'Thermal Environmental Conditions for Human Occupancy' (ANSI approved) (800) 527-4723 (U.S. and Canada) or 404-636-8400 (worldwide)

Water Conservation
Energy Policy Act of 1992-Plumbing Fixture requirements (42 USC Section 6295 (j))

Water Quality

EPA Publication # 812-B-94-002: "Lead in Drinking Water in Schools and Non-Residential Buildings," April 1994 EPA Safe Drinking Water Hotline: (800) 426-4791

Notes

1. The award level for a LEED Building Bronze™ will begin at 50% for the first three-year cycle to recognize relatively new buildings that did not have the benefit of designing to LEED, but are generally considered to be 'green'. Beginning with the next revision cycle of LEED™ , the lower rung of the Bronze rating will begin at 60%.
2. For example, a rammed-earth building that uses material taken from excavating the basement to build the walls may qualify for a point under the Construction Waste Management section since waste is being prevented by building with on-site materials.
3. EPA and DOE are currently revising the Energy Star building program to accommodate new as well as existing buildings. This new program will be based on new performance requirements. When revised Energy Star program criteria have been established, a corresponding LEED credit level will be determined.

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