Tenant Guidelines

for Energy-Efficient Renovation of Buildings

dio of San Francisco

l the U.S. Department of Energy, Federal Energy Management Program

PUB-798

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Tenant Guidelines

for Energy-Efficient Renovation of Buildings
at the Presidio of San Francisco

National Park Service and the U.S. Department of Energy, Federal Energy Management Program

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For additional copies of the *Guidelines*, contact Jim Christensen, National Park Service, Ft. Mason Building 201, San Francisco, CA 94123, Tel. (415) 561-4332, Fax (415) 561-4350. Download this document from the World Wide Web: http://www.eren.doe.gov/femp/greening.html

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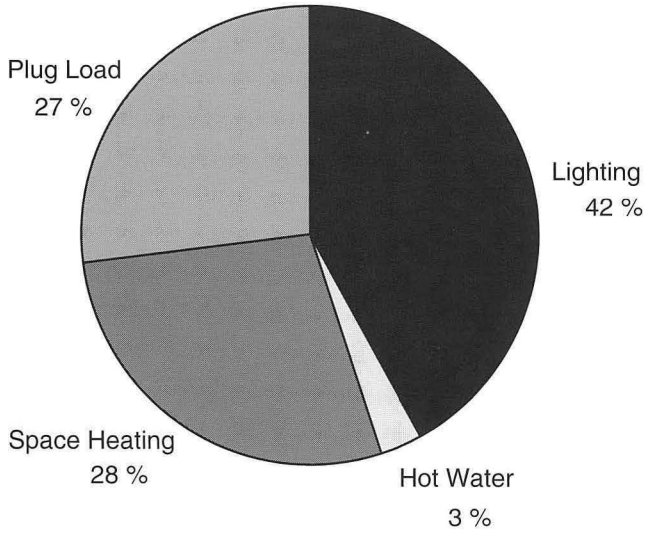


Lighting constitutes the greatest energy end use in a typical Presidio building, followed by space heating and plug loads. Air conditioning is generally not required in these buildings.

Photo: Richard Barnes

The Thoreau Center for Sustainability is one of the historical Presidio buildings rehabilitated and retrofitted for energy efficiency.

Introduction

These *Guidelines* are intended to help current and future tenants of the Presidio work with designers and contractors to incorporate energy efficiency and sustainable practices into the renovations of the buildings. This guide is designed to complement the detailed *Guidelines for Rehabilitating Buildings at the Presidio of San Francisco* (Architectural Resources Group, 1995), available from the National Park Service (see page 14).

Energy efficiency yields benefits far beyond energy savings. Daylighting and efficient electric lighting, natural ventilation and cooling, and other conservation strategies improve tenant health, comfort, and productivity, while preserving the historical heritage of Presidio buildings.

This guide examines the use of energy and resources and opportunities for efficiency in Presidio buildings on the basis of individual components and systems. We begin with recommended and discouraged practices for roofs, walls, and foundations, then move to windows and other openings. Next we address efficiency issues in building interiors—lighting, office equipment, and space planning. We follow with recommendations for mechanical and plumbing systems and conclude with insights on miscellaneous outdoor energy and resource concerns. A concise listing of sources of more detailed information is provided at the end of the document.

We expect this guide to help tenants begin the process of using energy-efficient and sustainable practices throughout the Presidio of San Francisco.

Roofs and Attics

Solar radiation on uninsulated roofs may impose a cooling load during the summer and early fall. Attics serve as buffer zones between roofs and conditioned spaces, allowing excess heat to be vented while providing greater insulating capacity. Rehabilitation efforts should increase the thermal integrity of roofs and attics.

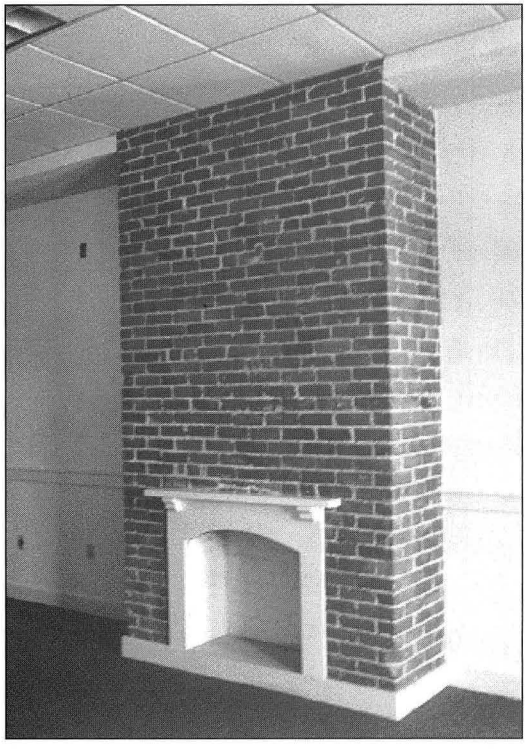
Recommended Practices

- Install reflective or light-colored roofing materials that are compatible with historical roof features.
- Restore damaged or obstructed attic vents and roof ventilators.
- Install or increase attic or roof insulation, provided that it does not alter historical roof features or obstruct attic and roof ventilation.
- Cap unused chimneys with removable devices to reduce heat losses.

Discouraged Practices

- Applying highly reflective paints or other coatings to visible roofs that historically have been uncoated.
- Removing or altering self-ventilating barrel tile roofs.

Air flows under the barrel tiles on this roof, removing the sun's heat before it enters the occupied areas of the building.



The chimneys of unused fireplaces like this one should be capped to reduce heat losses from buildings.

Walls and Foundations

The masonry walls and foundations of many Presidio buildings provide thermal mass that helps regulate interior temperatures. Energy-efficient upgrades to these building components should serve to restore or enhance these properties.

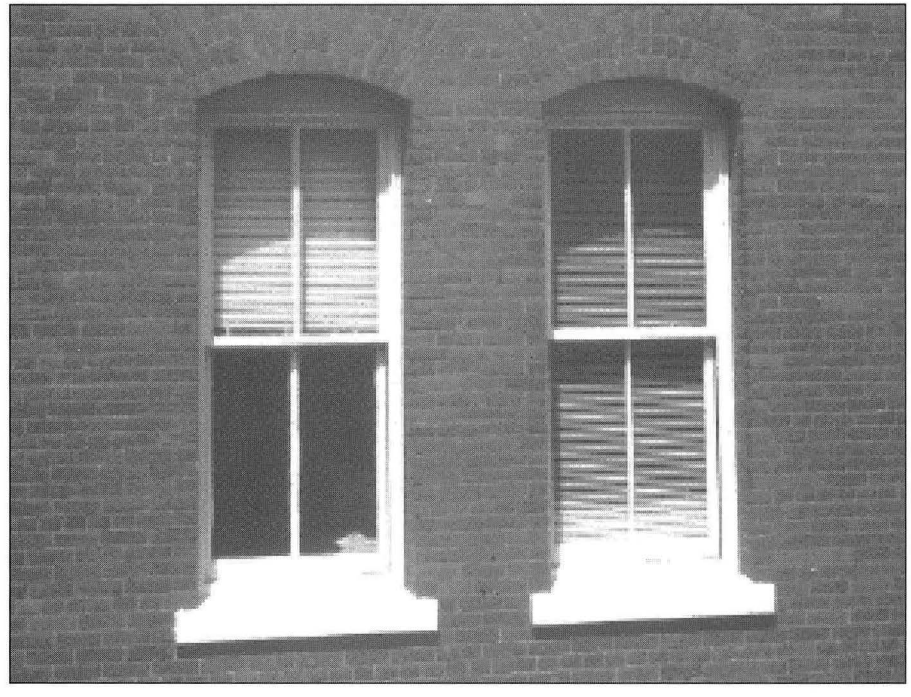
Recommended Practices

- Consider the existing thermal mass of a building before adding permanent insulation. This mass can absorb internally generated heat during the day and release it at night.
- Add or repair interior plaster to increase thermal mass.
- Install removable, light-colored interior wall tapestries or fabric panels to provide seasonal insulation.

The inherent thermal mass of masonry structures mitigates interior temperature swings and, combined with natural ventilation, eliminates the need for air conditioning in many Presidio buildings.

Windows, Skylights, and Doors

Windows, skylights, and doors serve a variety of purposes in buildings: view, transmission of daylight, control of solar heat gain, ventilation, and filtering of undesirable pollutants and noise. All these functions must be considered in restoring windows at the Presidio.



Adjustable interior blinds shade windows and reduce glare without detracting from the historical architecture.

Recommended Practices

- Restore damaged or obstructed windows, skylights, roof monitors, clerestories, and transoms to full operability to take advantage of daylight and natural ventilation.
- Replace badly damaged windows, skylights, and doors with energy-efficient products of similar styles.
- Replace damaged window and skylight glazing with selective low-emittance (low-E) glazing to reduce solar heat gains while transmitting substantial daylight.
- Apply selective low-E films to window and skylight glazing to reduce solar heat gains while transmitting substantial daylight.

Historical architectural features, such as overhangs and porches, provide structural shading and windbreaks.

- Install unobtrusive, removable interior shades, blinds, or curtains to reduce solar heat gains through windows. Adjustable blinds are a good option for glare control.
- Reconstruct removed or damaged historical shutters, overhangs, and porches. Enclose open porches to save energy only by inserting the new glazing in a plane behind the original structural members.
- Caulk and weatherstrip windows, skylights, and doors to reduce infiltration.

Discouraged Practices

- Painting over or otherwise obstructing windows, skylights, roof monitors, clerestories, and transoms so that they transmit less daylight or cannot be opened to permit natural ventilation.
- Installing windows and skylights with reflective glazing or applying reflective films to windows, skylights, roof monitors, clerestories, and transoms.
- Removing, closing off, or altering historical overhangs and porches that provide shading and windbreaks.

Interior Lighting

Interior lighting presents the greatest opportunity for energy efficiency at the Presidio. Many Presidio buildings were built long before today's efficient and relatively inexpensive lighting products became available, and were designed to use daylight. Daylighting can be used to offset electric lighting needs in many buildings. Tenants should always take full advantage of the historical strategies for using daylight, such as high windows, clerestories, and transoms.

The remaining lighting needs in Presidio buildings should be met by judicious selection and installation of energy-efficient lighting equipment and controls. These strategies will improve lighting quality and save considerable lighting energy—often 50% or more. They will also save cooling energy and improve comfort as a result of reductions in heat generated by lights.

Photo: Richard Barnes

High windows in many Presidio buildings transmit substantial daylight that can reduce electrical lighting needs.

Recommended Practices

- Use daylighting to minimize lighting energy requirements. Finish walls and ceilings with light colors to diffuse daylight entering through windows, skylights, clerestories, and transoms.
- Use high-efficiency task lighting to reduce the required level of ambient lighting by as much as two-thirds. Target an ambient lighting power density of no more than 1.25 W/ft^2, and under 1.0 W/ft^2 if best practice is followed.
- Install electronic ballasts, which reduce hum and flickering, and are compatible with efficient fluorescent lamps with high color rendition.

Photo: Richard Barnes

Transoms allow daylight to reach interior office spaces.

- Increase switching to at least the minimum established in California's Title 24 building energy-efficiency standard. Install occupant sensors or other automated lighting system controls, including photocells, which can reduce lighting energy consumption when sufficient daylight is available.
- Use T-8 fluorescent lamps for ambient lighting; compact fluorescent lamps (CFLs) for task, hallway, and accent lighting; halogen infrared lamps for spot lighting; and light-emitting diodes (LEDs) for exit signs. Refer to the *Advanced Lighting Guidelines: 1993* (see page 14) for more detailed information on selecting such fixtures.

Discouraged Practices

- Using high partitions to divide historical building spaces, thus reducing the function of windows in daylighting and ventilation.
- Installing dropped acoustical ceilings, thus eliminating the functions of skylights, roof monitors, clerestories, and transoms as daylighting apertures and historical high ceilings as light diffusers.

Office Equipment and Appliances

Energy-efficient office equipment and appliances expend less energy directly and yield lower associated cooling loads.

Recommended Practices

- Select office equipment with high energy-efficiency ratings, as indicated by the ENERGY STAR® labels provided by the U.S. Environmental Protection Agency and U.S. Department of Energy.

The ENERGY STAR® label can be used to select energy-efficient office equipment and appliances.

- Select office equipment that powers down to a standby mode when not in use. Refer to the *Guide to Energy-Efficient Office Equipment* (see page 14) for more detailed information on procuring such equipment.
- Select ink jet, rather than laser, printers.
- Select printers and copiers that can produce double-sided pages.
- Select kitchen and laundry appliances with high energy-efficiency ratings.

Discouraged Practices

- Leaving unused equipment and appliances on for extended periods.
- Using screen savers, which save no energy, rather than turning off computer monitors.

Space Planning

Energy-efficiency strategies should be integrated into the space planning process to ensure that interrelated historical preservation and sustainability goals are met.

The process of making buildings energy-efficient should be coordinated with other rehabilitation objectives, including historical preservation, seismic upgrades, and space planning. Architects, engineers, and mechanical and electrical contractors should cooperate in this process more than they typically do.

Recommended Practices

- Locate offices near windows and skylights to take advantage of daylight and natural ventilation.
- Remove or lower partitions in interior offices to extend the benefits of daylight and natural ventilation to these spaces.
- Group heat- and pollution-producing office equipment and appliances in dedicated areas with efficient, localized ventilation.

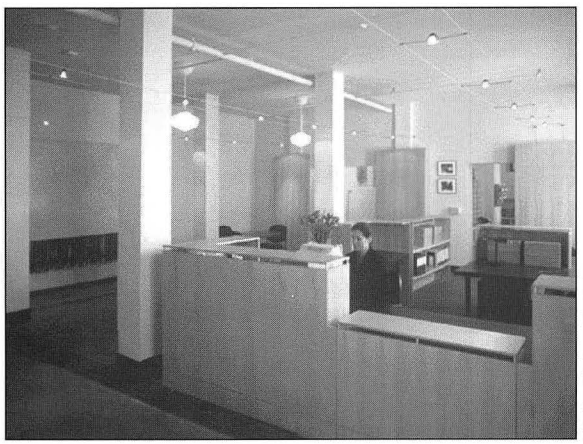


Photo: Richard Barnes

Open office plans permit optimal use of energy-efficient lighting equipment, enhance natural ventilation, and can preserve historically important interior features of Presidio buildings.

Heating, Cooling, and Ventilating Systems

Energy-efficient rehabilitation efforts in Presidio buildings should target the reduction of heating, cooling, and ventilating loads. Secondarily, mechanical systems should be use- and zone-specific. If these approaches are adopted, heating equipment can be downsized dramatically, and cooling equipment can be eliminated entirely in most cases.

The open window in the center provides free ventilation and cooling. Ironically, the unnecessary air conditioner on the left prevents similar use of that window and damages the building's historical integrity.

Recommended Practices

- Maintain operable windows for natural ventilation and cooling. Use ceiling fans or portable fans to provide additional air circulation. These methods often provide the level of ventilation required by building and health codes, making mechanical ventilating and cooling systems unnecessary for health and comfort.
- Consider the existing thermal mass, such as masonry, of a building in sizing and configuring new mechanical systems.
- Improve distribution system efficiency and control. Install zoning and programmable heating system controls where appropriate.
- Insulate pipes and ducts in accordance with California's Title 24 building energy-efficiency standard. Seal leaky ducts. Maintain steam traps.
- Replace old boilers with smaller, modular, energy-efficient models. Consider part-load efficiency in sizing and configuring new mechanical equipment. Use the Title 24 standard for minimum efficiency.
- Commission mechanical systems to ensure optimum performance. Refer to page 160 of the *Guidelines for Rehabilitating Buildings at the Presidio of San Francisco* for the appropriate decision-making process for rehabilitating mechanical and electrical systems.
- Document mechanical system design and operation in a users' manual.

Discouraged Practices

- Installing mechanical cooling systems.
- Installing electrical resistance space heating, including auxiliary heating for heat pumps.

Plumbing

The optimal functioning of plumbing fixtures and systems minimizes water consumption and saves energy.

Recommended Practices

- Consider point-of-use water heaters, rather than central water heaters with circulating pumps, particularly in situations with long distribution runs and low demand for hot water.
- Insulate hot water pipes, especially those of circulating systems.
- Repair or replace leaky plumbing fixtures to minimize water consumption.
- Install faucet aerators, low-flow shower heads, and low-flush toilets and urinals to minimize water consumption.

Materials Use and Recycling

The selection and use of all types of materials inherently influence sustainability. Materials that can be used only once are more costly in the long term. Higher volumes of waste necessitate greater disposal efforts and associated costs.

Recommended Practices

- Select materials, products, and systems on the basis of their life-cycle, rather than first, costs.
- Select materials and supplies made from sustainable resources, such as certified domestic and tropical woods. Select materials and supplies that were produced using minimal energy.
- Enact a comprehensive materials reuse program that reclaims the widest variety and maximum amount of materials possible.
- Reuse and recycle building materials in rehabilitation work.
- Select recycled and recyclable materials and supplies. Reuse materials and supplies whenever possible. Place recycling bins near printers and copiers.
- Select non-hazardous materials and supplies whenever possible. Recycle or properly dispose of hazardous wastes, such as printer and copier toner cartridges.

Exterior Lighting

Like interior lighting, exterior lighting for buildings, sidewalks, streets, and parking lots should be task-specific and energy-efficient. Excess light contributes to "light pollution" and is inappropriate for the Presidio environment.

Recommended Practices

- Whenever possible, illuminate the important elements, rather than flood lighting the entire site.
- Install lighting fixtures that direct light downward to illuminate doors and steps efficiently.
- Install automated lighting system controls and photocells.
- Install fixtures with metal halide lamps. Refer to the *Advanced Lighting Guidelines: 1993* (see page 14) for more detailed information on selecting these fixtures.

Planting and Vegetation

Trees, shrubs, and other plants have several implications for energy efficiency and sustainability. They can act as sun shades and windbreaks. Different types of plants require varying degrees of watering and maintenance and produce varying amounts of waste.

Recommended Practices

- Plant trees to shade adjacent buildings and parking lots during the cooling season.
- Plant trees and shrubs for wind breaks, especially on the north and west sides of buildings.
- Plant native species that require minimal watering and maintenance.
- Compost, rather than discarding, plant wastes.

Large trees provide shading for many Presidio buildings.

Transportation

Energy-efficient transportation saves energy, reduces costs, and improves air quality. Carpooling and public transportation can be encouraged through cash incentive programs.

Recommended Practices

- Designate parking spaces for carpools.
- Provide parking spaces for energy-efficient vehicles, such as bicycles.
- Provide showering and locker facilities for bicycle riders and joggers.

Energy-efficient means of transportation are encouraged at the Presidio.

Operations and Maintenance

Maintenance and record-keeping are vital factors in the success of an energy conservation program. Tenants should monitor energy consumption to identify equipment malfunctions and to evaluate the effectiveness of conservation measures. In addition, routine maintenance practices can help maximize energy efficiency.

Recommended Practices

- Track energy and water bills and investigate changes in usage patterns. Record-keeping is the key to identifying equipment malfunctions and evaluating the performance of conservation measures.
- Clean windows, skylights, roof monitors, clerestories, and transoms regularly to maximize their daylight transmission.
- Inspect and clean lighting fixtures regularly to maximize their efficacy.
- Inspect, clean, and repair mechanical and plumbing systems regularly to maximize their efficiency. Inspect filters at least quarterly and replace them when necessary.
- Confirm that lighting and mechanical system controls are properly functioning to turn off equipment at night and on weekends.
- Educate all employees about energy efficiency, especially the control of mechanical systems.

Native plants require less maintenance than introduced species.

Further Information and Design Resources

Publications

- American Council for an Energy-Efficient Economy. 1996. *Guide to Energy-Efficient Office Equipment.* Rev. 1. Palo Alto, California: Electric Power Research Institute.

  The energy consumption characteristics of personal computers, computer monitors, computer printers, copiers, facsimile machines, combination equipment, and retrofit power management devices manufactured through 1995 are provided in this document.

- Architectural Resources Group. 1995. *Guidelines for Rehabilitating Buildings at the Presidio of San Francisco.* Denver, Colorado: National Park Service, U.S. Department of the Interior.

  This comprehensive set of guidelines is the original and most authoritative treatment of rehabilitation topics, including energy and environmental concerns, for the Presidio.

- Brown, K., D. Sartor, D. Kinsey, T. Voong, D. Chamberlain, T. Riley, S. Wentworth, B. Hines, S. Greenberg, D. Lockhart, J. Waltz, and F. Mayhew. 1997. *Guidelines for Sustainable Building Design: Recommendations from the Presidio of San Francisco Energy Efficiency Design Charrette.* LBL-38868. Berkeley, California: Lawrence Berkeley National Laboratory.

  Local experts on energy efficiency in buildings examined the Presidio and compiled their findings and recommendations in this comprehensive report.

- Eley, C., T.M. Tolen, J.R. Benya, F. Rubinstein, and R. Verderber. 1993. *Advanced Lighting Guidelines: 1993.* DOE/EE-0008. Washington, D.C.: Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy.

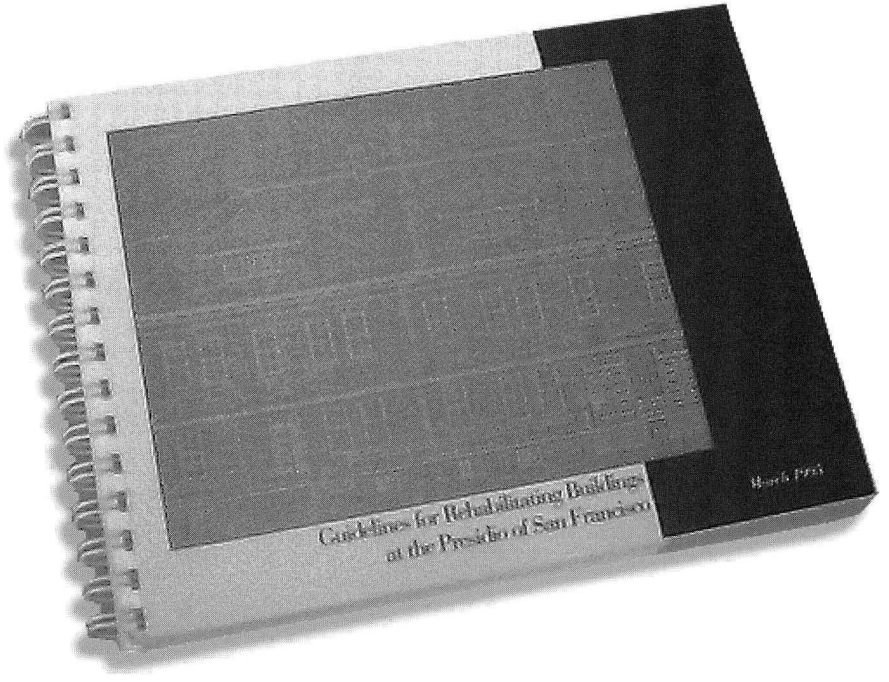
  Architects and engineers will find these guidelines invaluable in the specification of all types of interior and exterior lighting fixtures and system controls for energy efficiency.

- National Park Service. 1993. *Guiding Principles of Sustainable Design.* Denver, Colorado: National Park Service, U.S. Department of the Interior.

  This publication is a detailed compilation of recommended practices for all aspects of sustainable development: site design, building design, energy management, water usage, waste prevention, and environmental impacts.

- U.S. Environmental Protection Agency and U.S. Department of Energy. *ENERGY STAR® Program.* Telephone hotline: (888) 782-7937.

  Under this program, government agencies label office equipment and appliances that meet or exceed specific energy-efficiency standards, allowing consumers of these products to shop wisely.



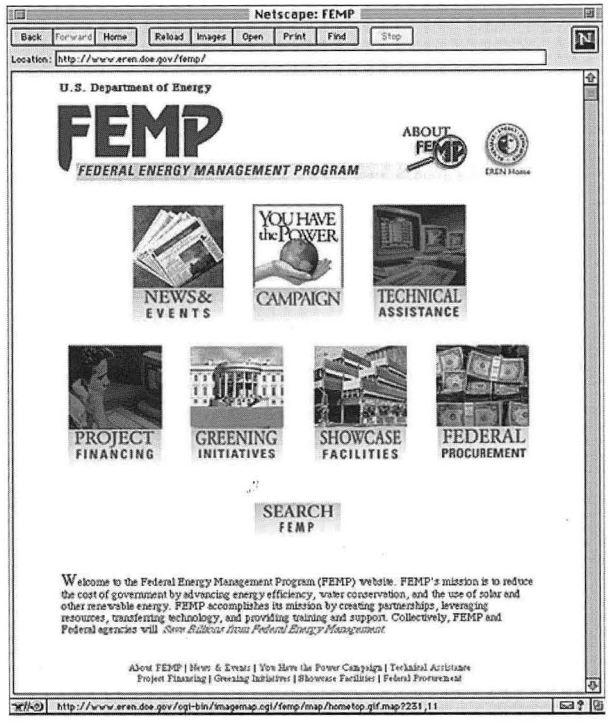
Web Sites

Numerous World Wide Web sites provide information on energy efficiency and sustainable design. Browse our list of favorite sites at our Energy Crossroads:

- Lawrence Berkeley National Laboratory, Center for Building Science: *http://eande.lbl.gov/CBS/eXroads/EnergyXroads.html*

or visit the sites listed below:

- U.S. Department of Energy, Energy Efficiency and Renewable Energy Clearinghouse (EREC): *http://www.eren.doe.gov/erec/factsheets/erec.html*
- U.S. Department of Energy, Federal Energy Management Program (FEMP): *http://www.eren.doe.gov/femp*
- National Park Service: *http://www.nps.gov*
- U.S. Department of Energy, Center of Excellence for Sustainable Development: *http://www.sustainable.doe.gov*
- U.S. Environmental Protection Agency and U.S. Department of Energy, ENERGY STAR® Program: *http://www.epa.gov/energystar.html*
- GreenClips Environmental Journal: *http://solstice.crest.org/environment/greenclips*
- The Presidio Alliance: *http://www.presidio.org*



Notes

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