

# Sustainable Building Design

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*Sustainable building design requires multidisciplinary consideration of environmental factors throughout the building design process. Areas of major concern include energy efficiency, indoor air quality, and resource efficiency.*

## Summary

### SUSTAINABLE DESIGN AND ANALYSIS SERVICES

#### **Why a Client May Need These Services**

- ▶ To create healthful and more productive habitats
- ▶ To promote or show commitment to an environmental ethic
- ▶ To meet legislated environmental requirements

#### **Knowledge and Skills Required**

- ▶ Knowledge of environmental performance of building materials, components, and systems
- ▶ Understanding of ecological and biological processes
- ▶ Familiarity with life cycle assessment methodologies
- ▶ Familiarity with environmental regulations

#### **Representative Process Tasks**

- ▶ Define sustainability goals
- ▶ Establish targets for environmental performance
- ▶ Gather relevant data for environmental considerations
- ▶ Identify appropriate technologies
- ▶ Participate in design team effort throughout the design process
- ▶ Participate in commissioning to verify environmental performance
- ▶ Educate facility staff about operational issues to maintain environmental performance

In its broadest context, sustainability refers to the ability of a society, ecosystem, or other system to continue functioning into the indefinite future without being forced into decline through exhaustion or overloading of the resources on which the system depends. Sustainable building design, then, defines a process that strives to preserve, protect, and improve the quality of the environment; protect human health; and achieve a prudent and rational use of natural resources.

Among the issues considered in sustainable building design—sometimes called “green design”—are site selection and site design, energy efficiency, resource efficiency, indoor air quality, water conservation, solid waste management and recycling, and building operations and maintenance. Sustainable design professionals emphasize the importance of an integrated design process that considers multiple environmental and resource issues simultaneously with other aspects of design.

Sustainable design emerged in the late 1980s as an extension and integration of the environmental and energy-efficiency movements. Environmentally conscious designers wanted to more fully integrate their approaches with a wide range of environmental issues, including energy efficiency, indoor air quality, and resource efficiency.

According to the U.S. Green Buildings Council, a coalition of organizations and professionals with an interest in green building practices, the market outlook for these services is quite positive because public interest in environmental issues and corporate responsibility is on the rise. The 1997 Cone Roper Cause-Related Marketing report ranks the environment as one of the top societal problems that businesses should work to solve. Indoor air quality

design services for both new and retrofit projects are a particularly rapidly expanding area of opportunity for architects with the required expertise.

## CLIENT NEEDS

Clients look for sustainable design services for many of the same reasons they seek energy analysis and design. Common goals include reducing operating costs, improving design quality, enhancing public image, fulfilling and demonstrating an organizational commitment to the environment, or responding to a remote site where resource availability is unreliable or there are stringent environmental restrictions on development. Large government, institutional, and corporate clients that own and occupy buildings throughout their life cycle are most likely to take a long-term view and be willing to invest extra time, effort, and money up front to

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achieve sustainability goals. Green buildings have good resale value and attributes that may encourage buyers, and banks should be encouraged to make loans to green building projects because of their long-term value and quality and their reduced life cycle operating costs.

Some clients use a “green” facilities label as a marketing or recruitment tool.

Companies competing for scarce computer programming personnel, for example, promote their healthy, energy-efficient work facilities as an incentive to potential employees. As with energy analysis, government agencies at the local, state, and federal level may require analysis of sustainability issues as part of the design process for government facilities. Federal agencies are required to reduce energy consumption by executive order and are encouraged to invest in other cost-effective measures that will reduce environmental impacts and increase the productivity, comfort, and health of building occupants. Many state and city agencies are required to reduce landfill and thus actively promote the use of recycled and recyclable materials.

More environmentally conscious landscaping, materials selection, indoor air quality, recycling, and water conservation are among the issues federal facility managers are encouraged to consider in addition to energy conservation. Some Department of Defense agencies, such as the U.S. Navy, have been particularly proactive in responding to these policies, requiring any firms seeking design work to demonstrate experience in sustainable design.

Some clients seek the services of designers with expertise in sustainable design because of specific concerns. The potential for reducing operating costs through enhanced energy efficiency continues to be a dominant market driver. Clients who have facilities with recognized air quality problems seek expert help in achieving a healthier building environment. Storm water control and water conservation are rapidly emerging as areas of interest, not just in the historically water-scarce western states but elsewhere as well. Erosion and discharge are growing concerns in agricultural, industrial, and urbanized areas alike. Some consultants specialize in designing for chemically sensitive and allergic individuals, many of whom cannot tolerate the chemical compounds from dyes, adhesives, sealers, sealants, finishes, and molds that are emitted into the air from many building products, including carpets, insulation, paint, fabrics, and built-in and movable furniture.

Opinions vary as to whether sustainable design takes more time or costs more money. Some practitioners say sustainable buildings don't have to cost more or take longer to design and build. Others say that any specialized design involving use of specialty products will affect design and construction costs and project schedule. As with any emerging or new design consideration, there is a learning curve. As designers, builders, and clients gain experience with sustainable design, efficiency increases. Costs and benefits for sustainable design are difficult to quantify. Costs include design fees, construction costs, and life cycle operations and maintenance costs. Benefits include operations and maintenance savings as well as environmental, economic, and social benefits.

Sustainable design is a design approach that encompasses many specialized services or areas of expertise such as energy-efficient design and consulting, indoor air quality, lighting design, landscaping, storm water management, and facility management, to name a few. This breadth in relevant subject matter suggests a pragmatic approach for architects or firms interested in offering sustainable design services. Acquire expertise in the constituent areas a few at a time and gradually take on more complex projects.

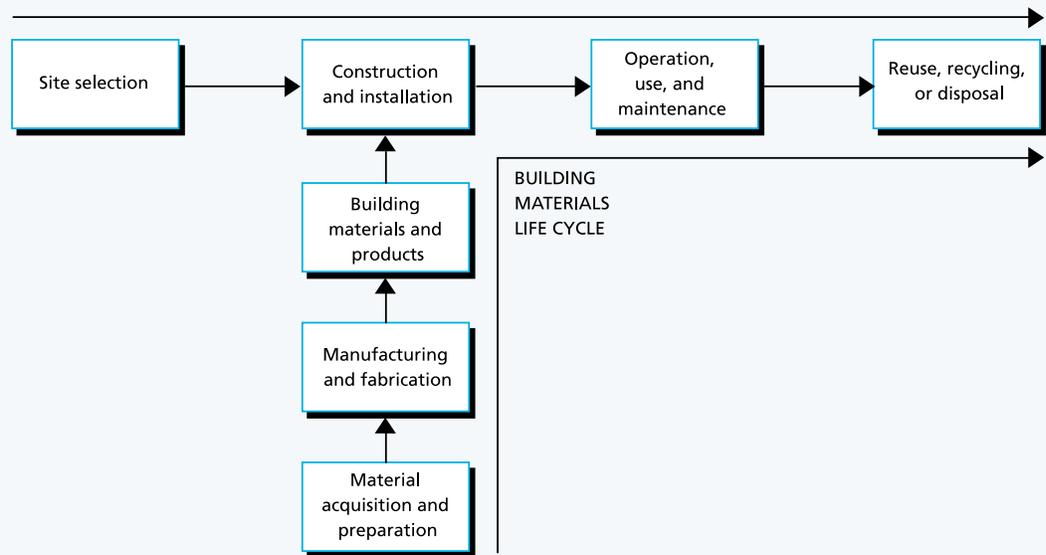
## SKILLS

Because sustainable design requires varied expertise, the project manager ideally will have a broad knowledge base and an understanding of basic environmental concepts, supplemented as necessary by other team members. Special expertise essential to sustainable design includes the capacity to perform various levels of energy analysis, evaluate energy technologies (including passive solar and daylighting concepts), and assess the environmental attributes, cost, and availability of building materials. Some projects may require more rigorous environmental life cycle assessments to develop comparisons between material choices.

Depending on the project, expertise may also be required in the areas of site and landscape design, storm water management and water conservation, recycling, indoor air quality, and economic analysis. On some projects biologists, botanists, industrial hygienists, or experts offering more specialized services such as design for the chemically sensitive may be needed.

 **The AIA Committee on the Environment (COTE) offers workshops and conferences on the subject of sustainable design. Information about upcoming events and reports of past ones, including technical papers, can be found by accessing the COTE page on the AIA Web site ([www.aia.org](http://www.aia.org)).**

## Facility and Material Life Cycles



Environmental impacts occur in the life cycle of building construction materials and products during their acquisition, manufacture, and installation in the building. After installation, further impacts may occur during the operation and use of the building.

AIA, *Environmental Resource Guide* (1996)

## PROCESS

**AIA Continuing Education System (AIA/CES) programs are periodically offered on sustainable design. Check the AIA Web site at [www.aia.org](http://www.aia.org) for current information.**

The sustainable design process requires that sustainable parameters be considered, analyzed, and synthesized with other parameters throughout the building planning and design process. To do this, several important items must be incorporated into the process. First, there is often a special preplanning step to determine sustainability goals. Second, the design team effort is “front loaded,” which means it occurs earlier in the building design process. Finally, the design process must be fully integrated. The architect serves as the team leader to ensure an integrated design.

In order to determine the project scope and fee, it is best to develop a task list of services to be provided and allocate resources to them. Sustainable or green building projects often have three major components:

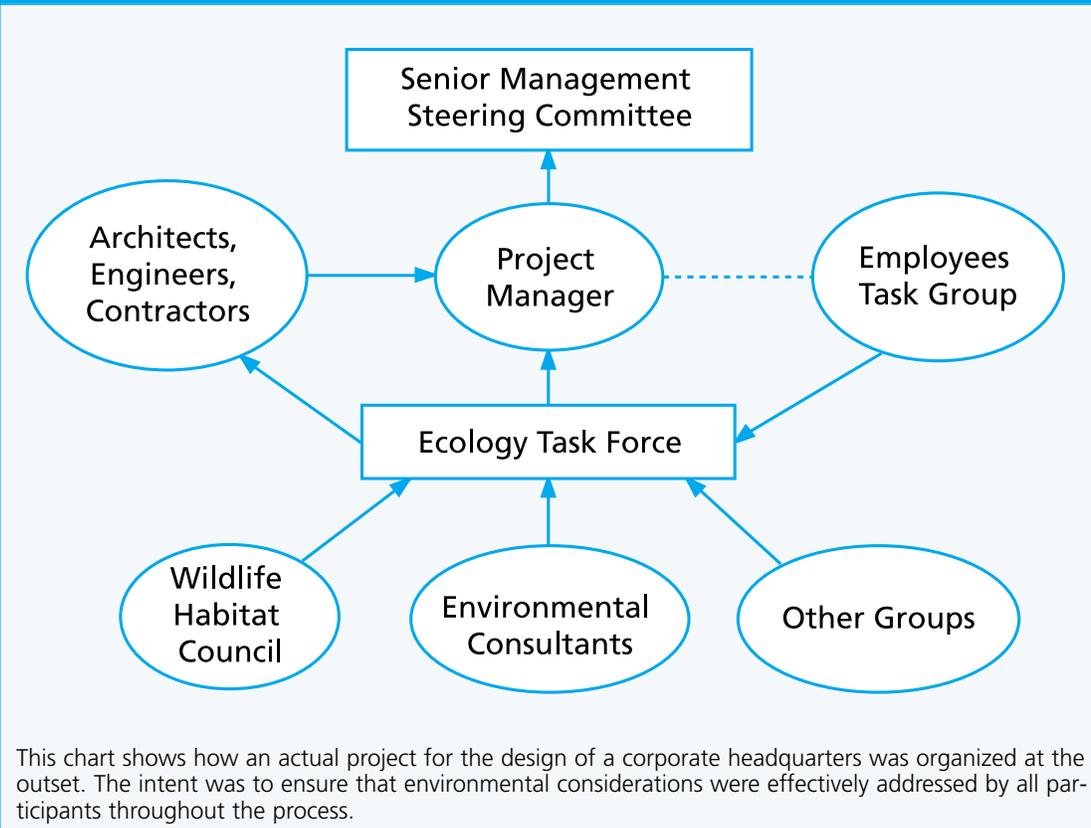
1. Energy efficiency criteria are applied to: building envelope design, lighting and equipment design and selection, HVAC system design, and landscape design.
2. Indoor air quality criteria are applied to ventilation system source control, materials selection, building commissioning, and building maintenance.
3. Resource efficiency criteria are applied to building materials, site and landscape maintenance efficiency, and water issues.

A determination of the task list of services will be an outcome of the preplanning step.

*Preplanning.* This stage of the sustainable building design process is a group brainstorming activity (or charrette) with client representatives intended to define the objectives of the sustainable design effort. The results of the session serve as input to the overall programming process. Each preplanning activity is different, depending on the type of project addressed. When programming is provided as a discrete or separate service, sustainable issues must be integrated into the programming process.

To begin the brainstorming session, the designers usually ask the clients to discuss any relevant organizational mission statements. Next, general project objectives (for example, cost savings; energy savings; health, comfort and productivity; resource preservation and management;

## Environmental Project Team Organization



Adapted from AIA, *Environmental Resource Guide* (Wiley, 1997)

pollution prevention) are explored and prioritized. Important project parameters can be defined. For example, parameters could include practicality, conventional appearance, ease of implementation, need for uninterrupted operations, or minimal risk.

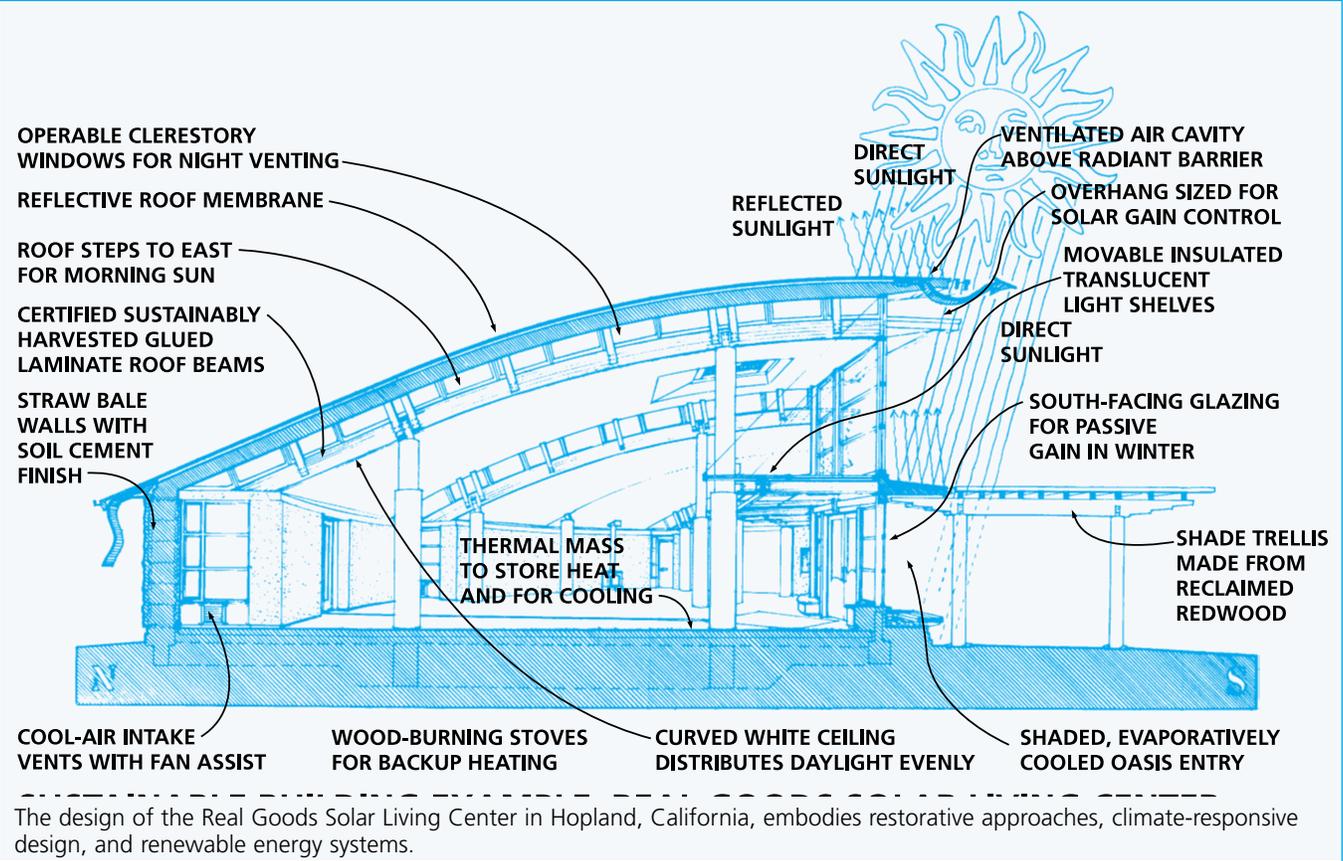
The next step is to gather baseline information. For example, for a retrofit project with a goal of decreasing energy and water consumption, the designers would look at existing energy and water consumption and costs. For new buildings, average consumption and costs for comparable new (but conventional) facilities would be considered. A number of building assessment tools are being developed (such as the LEED rating system, under development by the U.S. Green Building Council) that can help in comparing environmental performance. The rating system provides credits for including various green features in a project.

Finally, targets for environmental performance can be established by referencing the performance of other projects with similar goals. For example, a comprehensive sustainable design program might include quantitative performance targets for energy use, water use, indoor air quality, building and transportation emissions, solid waste, recycling, and the water, botanical, and/or wildlife quality on the site. Other building performance improvement targets are more difficult to quantify, such as quality of light, productivity, and user satisfaction. Worker absentee, illness, and productivity rates are sometimes used as measures because these rates have been shown to improve when the building environment improves.

Life cycle cost analysis of potential savings should be a factor in setting the performance goals and in determining project budget. While the preplanning effort requires extra design time, the client should be able to quickly recover the cost of the extra design effort in operations cost savings and other benefits.

**Front-loading.** Well-executed sustainable design requires consultants to be brought in as early as possible in the process in the interest of optimizing design integration. Overall

▶ **To achieve higher levels of environmental performance in building design, environmental issues should be considered throughout building planning, design, documentation, and construction. Related services in which environmental issues may come into play include Programming (17.1), Building Design (18.3), Construction Documentation—Drawings (18.5), Construction Documentation—Specifications (18.6), Contract Administration (18.9), Energy Analysis and Design (18.11), and Lighting Design (18.15).**



AIA, *Architectural Graphic Standards* (2000)

design fees for a sustainable design team may increase somewhat, due to the preplanning process and the earlier participation of engineering consultants. However, added up-front costs should be balanced by improved coordination of the design documents and, particularly, lower life cycle costs and other benefits to the owner and society.

**Design integration.** All of the members of a design team need to work interactively and often simultaneously in a sustainable design project to ensure that the effects of individual design decisions on the entire building environment are adequately assessed. Designers, consultants, and clients must be involved and stay involved. Energy simulation and other green building design software packages can be tremendous tools for quantifying life cycle costs and environmental impacts and optimizing a design. It is important to draw a distinction between green building products that are recycled and recyclable and those that provide indoor air quality. For example, a 100 percent postconsumer recycled product may emit volatile organic compounds that cause health problems.

**Commissioning and operations.** Commissioning is an especially important component of a sustainable design project, vital to ensuring that installed systems are operating properly. Just as important, user education can be an important determinant of the long-term performance of some resource-conserving design features. User controls and consumption monitoring programs can help ensure long-term performance.

▶ Various related postconstruction services may verify specific aspects of building environmental performance. See Commissioning, Energy Monitoring, and Indoor Air Quality Monitoring.

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The AIA provides a contract document designed especially for alternative architectural services.

**B102–2007, Standard Form of Agreement Between Owner and Architect without a Predefined Scope of Architect’s Services.**

AIA Document B102–2007 is a standard form of agreement between owner and architect that contains terms and conditions and compensation details. B102–2007 does not include a scope of architect’s services, which must be inserted in Article 1 or attached as an exhibit. Special terms and conditions that modify the agreement may be included in Article 8.

The separation of the scope of services from the owner/architect agreement allows users the freedom to append alternative scopes of services.

AIA Document B102–2007 replaces and serves the same purpose as AIA Document B141–1997 Part 1.

For more information about AIA Contract Documents, visit [www.aia.org/contractdocs/about](http://www.aia.org/contractdocs/about)

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