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Pollution Prevention by Building Green

The natural resources and energy required for the development and maintenance of our country's infrastructure are growing at a staggering pace, yet the availability of natural resources to fill this demand is rapidly declining. From an economic standpoint, this process cannot continue long.

In recognition of this situation, the building industry has begun to address the economic and environmental consequences of its practices. For builders to remain competitive in a changing market, fundamental changes in design, building methods and materials are necessary. The building industry is now delivering products that are much more environmentally and economically sustainable.

The term "green building" describes more than just an actual building. "Green building" is a concept that includes the design of the structure, site selection, building methods, building materials and landscaping practices. Green building may also be referred to as "sustainable design" or "high-performance building."

Green building employs the concepts of pollution prevention to enhance the health of the community, as well as the health of the environment. The principles of green building are equally applicable to residential, commercial, and industrial building projects.

Save Energy — Design and Build Energy-efficient Buildings

One of the greatest environmental impacts of a building is its long-term consumption of energy. Therefore, designing buildings for the lowest possible energy use should be a high priority. Decisions about energy efficiency that are made during the design and construction of a building establish the environmental performance of that building for decades to come. Economic savings that accrue over the useful life of a building represent an important investment opportunity. Well-designed buildings are no different than well-designed machines; they last longer, operate more efficiently and retain higher value throughout their life. A significant tool in evaluating the investment value of green building is "Life Cycle Assessment." This determines the long-term returns of well-designed and constructed buildings. Many tools are available for effectively calculating the value of investing in high-performance building.

The first step is to design the most energy efficient structure for the given location. In buildings with high heating requirements, incorporate high levels of insulation and high-performance windows, and make buildings as airtight as possible. In areas where cooling costs are important factors, minimize cooling loads through careful consideration of the building's orientation, ventilation, glazing selection, lighting design, landscaping and thermal mass.

Buildings should utilize the most energy efficient heating, cooling, lighting and mechanical systems. Whenever possible, consider sources of renewable energy to meet energy demand. By selecting low-flow devices and looking for opportunities for wastewater reuse, water costs can be greatly reduced. When considering building materials, try to utilize products that have the lowest "embodied energy" (energy needed for the extraction, manufacturing and transport of the material).

Reuse and Recycle Buildings and Building Materials

Whenever possible, utilize existing buildings and infrastructure instead of developing open space. Existing buildings often contain a wealth of material and architectural value, and contribute to a sense of place. In some cases the workmanship and quality of existing structural materials is impossible to replicate today, making the restoration all the more valuable. When restoring or renovating buildings,

maximizing energy efficiency should be a priority for designers and builders.

Green Materials

Much of the environmental impact associated with building materials is already realized by the time the materials are installed. Raw materials are extracted from the ground or harvested from forests, and pollutants may be generated during manufacture. Energy is consumed throughout the entire cycle (extraction, manufacturing and transport). Materials may emit additional pollutants during their application, installation or use. Some materials also have significant environmental and cost impacts associated with disposal.

Low environmental impact and resource efficient materials should be utilized throughout the building and maintenance process. Characteristics of "green" materials are:

- materials that are as non-toxic as possible for the producers, builders, occupants and the environment;
- materials that have a long, useful life, requiring less materials or energy over time to replace them; and
- materials that have the lowest embodied energy, lowest non-renewable content and lowest environmental impact (where harvested and where installed).

Smaller is almost always better, relative to the environment. Therefore, using the minimum necessary materials and generating the least waste should be the goal of any project. The single best alternative to green a project or building may be to size the structure to fit its intended use.

Protect and Enhance the Site

Avoid building in fragile ecosystems or ecologically significant environments, such as wetlands, old-growth forests or remnant stands of native prairie. If you can't avoid it, minimal alteration to the land must be a high priority.

Before construction begins, develop a plan to protect trees, native plants and topsoil during construction. This procedure also has economic benefits from a development cost perspective. With on-site wastewater systems, provide responsible retention/treatment to minimize surface and ground water pollution. Many innovative wastewater reuse and treatment systems now exist. These systems can reduce costs and do a better job at removing pollutants than conventional septic systems. On sites that have been ecologically damaged, make an effort to remediate impacts and reintroduce native species.

Save Water

You can achieve water efficiency in a building by installing water-efficient plumbing fixtures and appliances. You also can achieve water efficiency outdoors in many ways. By landscaping with low-water-use plants (xeriscaping), separating and using gray water for landscape irrigation (where codes permit), and providing for ground water recharge through effective storm water infiltration designs, you will need less water to create a beautiful landscape.

Benefits of Green Buildings

Benefits of building green include:

- lower utility and maintenance costs;
- minimization of construction waste;
- protection of occupant health;
- protection of ecosystems;
- more comfortable living space;
- green buildings blend in with the surrounding landscape;
- attractive buildings with greater long-term value; and
- supportive of local and more sustainable economies.

Green Buildings in Ohio

The **Adam Joseph Lewis Center for Environmental Studies** on the campus of Oberlin College is a model for "green" sustainable buildings. The Lewis Center was designed to challenge the way society views its relationship with the environment. It is a demonstration of how we can create and design a building that will make a minimal ecological impact on future generations. From construction to landscaping, the Lewis Center has made use of state-of-the-art technology in areas such as:

Adam Joseph Lewis Center for Environmental Studies.

Materials

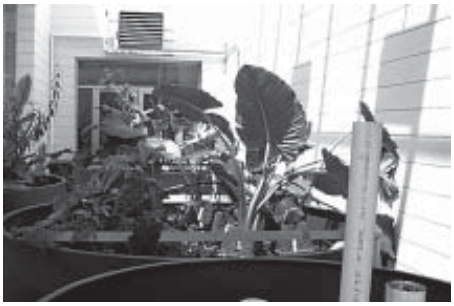
- Constructed from low-toxicity, durable, low-maintenance materials
- Recycled materials were used whenever possible throughout the facility
- All wood is certified by The Forest Stewardship Council to be grown in sustainably-managed forests

Solar Design

- Building is oriented along an east-west axis, to maximize the solar energy potential
- Photovoltaics (PV) located on the rooftop. Energy efficient windows are positioned to allow daylight into every room of the building. Operational data of the PV system is now available online, along with overall building performance measures. www.oberlin.edu/ajlc/systems_energy_1.html

Energy Efficiency

- Energy-efficient lighting installed throughout
- Interior walls constructed of energy-efficient materials



Adam Joseph Lewis Center for Environmental Studies living machine solarium.

- Lighting, heating and ventilation are all on demand; energy is not used when rooms are unoccupied
- Geothermal wells supply additional heating and cooling

Water Use and Treatment

A living machine is utilized to treat and reuse the building's waste water. Operational data for the living machine and building water use is available online at www.oberlin.edu/ajlc/systems_lm_1.html.

Indoor Air Quality

- Low-VOC paints and adhesives used
- Fresh air ventilation is constantly maintained throughout the building

Landscaping

- Plants native to northern Ohio were planted
- A pond and wetland exist to further clean runoff and storm water

The **Cleveland EcoVillage** project aims to demonstrate how urban neighborhoods can be good for people and good for the earth. As old cities are redeveloped, it is vital that this regeneration take into account ecological design and long-term sustainability. The site for the project is centered around a transit station, which will lessen dependence on automobiles. The project will consist of more than 250 units of new housing and mixed-use commercial development, which will put people within walking distance of the goods and services they desire. Buildings are to be built with the "green building" concept. To increase a sense of community, houses will be located close to sidewalks, and there will be a shared garden area. Abundant greenspace is to

Cleveland EcoVillage town homes on W. 58th Street.

Photovoltaic arrays on the roof of detached town home garage.

be incorporated throughout the community as well as a bike path.

McPhail Center for Environmental Studies at Denison University

This project is a renovation of an existing building, Barney Hall, on the Denison campus. Finishes and coating for the building were of the lowest toxicity possible. The old heating system was converted to a high-efficiency natural gas boiler system. Extensive use of recycled content materials were used in the renovation. Future plans include the addition of photovoltaic panels.

Ohio Lung Association's **Dublin Health House**

The American Lung Association seeks to promote improvements in indoor air quality. Located in Dublin, OH, this demonstration home is an effort to design building envelopes and mechanical systems for effective fresh air exchange with minimal impact on energy usage. This project provides an example of how to improve the indoor air quality of housing throughout Ohio.

Cleveland **GreenBuilt Homes Project Houses**

The project is part of the U.S. Department of Energy (DOE) "Building America" program, and will meet the standards of the U.S. DOE Energy Star and American Lung Association Health House programs. The houses were designed by Building Science Corporation in Boston, which leads one of four consortiums of builders that seek to raise the quality of their products. Lessons learned in these consortiums will be shared, refined and expanded to include more green building components in each new house.

For more information, please refer to OPP's fact sheet #104, "Green Building Projects in Ohio."

Web Resources and References

General Resources

U.S. Green Building Council
www.usgbc.org

Sustainable Building Sources
www.greenbuilder.com/general/BuildingSources.html

Energy Star™
www.energystar.gov

Environmental Building News
www.BuildingGreen.com/

Building Environmental Science & Technology (B.E.S.T)
www.nrg-builder.com/

Partnership for Advancing Technology in Housing (PATH)
www.pathnet.org

Sustainable Architecture Building & Culture
www.SustainableABC.Com/index.html

American Institute of Architects, Committee on the Environment
www.aia.org/cote_default

Health House Program
www.healthhouse.org/

National Association of Home Builders
www.nahbrc.org/

Rebuild America Program
www.rebuild.org/index.asp

Oikos Green Building Source
http://oikos.com/

State, City and Regional Green Building Programs

Greater Cleveland Green Building Coalition
www.clevelandgbc.org

EcoCity Cleveland/ Cleveland EcoVillage Project
www.ecocitycleveland.org/ecologicaldesign/ecovillage/intro_ecovillage.html

Austin, TX
Green Building Program
www.ci.austin.tx.us/greenbuilder/

Built Green® Colorado Program
www.builtgreen.org/

California Integrated Waste Mgmt. Green Building Guide
www.ciwmb.ca.gov/GreenBuilding/

Florida Green Building Coalition
http://floridagreenbuilding.org/

King County, WA, Green Home Building
www.metrokc.gov/procure/green/bul55.htm

Maryland Environmental Design Program
www.dnr.state.md.us/ed/index.html

Southface Energy Institute, Atlanta, GA
www.southface.org/

Hawaii BuiltGreen™
http://biahawaii.inets.com/docs/webdocs/buildgreen/HI_BG_Checklist.pdf