

# **SUSTAINABILITY 101**

*An Introduction to the Basics:*

*What is sustainability and why should we care?*

## **BUILDING GREEN**

- The Benefits of Greener Buildings
- Principles of Green Design
- Green Design in Architecture and Construction

## **WHAT IS SUSTAINABILITY?**

### **WHAT YOU CAN DO**

- Applying Sustainability at Work and Home
- Stop Global Warming

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- Our Consumer Society
- Global Warming
- Irreversible Environmental Damage
- Ecosystems Threatened

# ***BUILDING GREEN***

## **The Benefits of Greener Buildings<sup>1</sup>**

Because traditional buildings consume large amounts of energy and other natural resources and can harm the environment (*link here to global warming*) around them, there's a swelling interest in designing, building, and occupying more environmentally sensitive structures. By integrating natural resources, human health, and community concerns into building design and construction, architects and designers can create buildings that are cleaner, healthier for occupants and the environment, and which deplete fewer resources. Moreover, *a well-designed “green” building can be cheaper to build and operate over the building’s lifetime.*

Commercial and residential buildings use one-third of the energy consumed in the United States, and two-thirds of all electricity. Buildings produce roughly a third of carbon dioxide emissions and other emissions that harm air quality and contribute to global warming. Additionally, buildings generate waste during construction and operation; can have poor indoor air quality, affecting worker/resident health; and often don't consider the impact made on the community through increased transportation, sprawl, and cultural and historical impact. Green buildings address a wide range of topics, including:

- water conservation
- waste management
- renewable energy sources
- nontoxic materials
- recycled/reused materials
- energy efficiency
- reduced environmental impact on the building site
- wise use of space/reduced building size
- balance of environmental and economic considerations
- consideration for cultural and historical factors of the site
- proximity to transportation

## **Principles of Green Design<sup>2</sup>**

While the practical application varies among disciplines, some common principles are:

- Low-impact materials: choose non-toxic, sustainably-produced or recycled materials which require little energy to process
- Energy efficiency: use manufacturing processes and produce products which require less energy and transport products in an energy efficient manner

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<sup>1</sup> Reprinted from [www.GreenBiz.com](http://www.GreenBiz.com)

<sup>2</sup> Reprinted from *Wikipedia*, Green Design, [http://en.wikipedia.org/wiki/Green\\_design#column-one](http://en.wikipedia.org/wiki/Green_design#column-one)

- Quality and durability: longer-lasting and better-functioning products will have to be replaced less frequently, reducing the impacts of producing replacements
- Design for reuse and recycling: "Products, processes, and systems should be designed for performance in a commercial 'afterlife'."<sup>[2]</sup>
- Biomimicry: "redesigning industrial systems on biological lines ... enabling the constant reuse of materials in continuous closed cycles..."<sup>[3]</sup>
- Service substitution: shifting the mode of consumption from personal ownership of products to provision of services which provide similar functions, e.g. from a private automobile to a carsharing service. Such a system promotes minimal resource use per unit of consumption (e.g., per trip driven).<sup>[4]</sup>
- Standardization and modularity: standard, modular parts allow products to be repaired rather than replaced and promote interoperability so that systems can be upgraded incrementally rather than wholly scrapped and replaced.

## Green Design in Architecture and Construction<sup>3</sup>

In the application of green design to architecture and construction the focus is for the project to work in harmony with the natural features and resources surrounding the site, and to use materials that are sustainably grown or recycled rather than new materials from non-renewable resources.

Green design employs the following principles:

Building materials are sought within a 500-mile radius of the building site to minimize the use of fuel for transportation. The building itself may be oriented a particular direction to take advantage of naturally occurring features such as wind direction and angle of the sun. When possible, building materials may be gleaned from the site itself; for example, if a new structure is being constructed in a wooded area, wood from the trees which were cut to make room for the building would be re-used as part of the building itself. Taking advantage of available natural light reduces dependence on artificial (energy-using) light sources. Well-insulated windows, doors, and walls help reduce energy loss, thereby reducing energy usage.

Low-impact building materials are used wherever feasible: for example, insulation may be made from low VOC (volatile organic compound)-emitting materials such as recycled denim, rather than the fiberglass insulation which is dangerous to breathe. To discourage insect damage, the insulation may be treated with boric acid. Organic or milk-based paints may be used.

Architectural salvage and reclaimed materials are used when appropriate as well. When older buildings are demolished, frequently any good wood is reclaimed, renewed, and sold as flooring. Many other parts are reused as well, such as doors, windows, mantels,

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<sup>3</sup> Reprinted from *Wikipedia*, Green Design, [http://en.wikipedia.org/wiki/Green\\_design#column-one](http://en.wikipedia.org/wiki/Green_design#column-one)

and hardware, thus reducing the consumption of new goods. When new materials are employed, green designers look for materials that are rapidly replenished, such as bamboo, which can be harvested for commercial use after only 6 years of growth, or cork oak, in which only the outer bark is removed for use, thus preserving the tree.

Good green design also reduces waste, of both energy and material. During construction phase, the goal is to reduce the amount of material going to landfills. Astutely designed buildings also help reduce the amount of waste generated by the occupants as well, by providing onsite solutions such as compost bins to reduce matter going to landfills.

To reduce the impact on wells or water treatments plants, several options exist. "Greywater," wastewater from sources such as dishwashing or washing machines, can be used to flush toilets, water lawns, and wash cars. Rainwater collectors are used for similar purposes, and some homes use specially designed rainwater collectors to gather rainwater for all water use, including drinking water.

## ***WHAT IS SUSTAINABILITY?***<sup>4</sup>

In 1983, the United Nations Commission on Environment and Development defined sustainability as: "A way of living that meets the needs of the present without compromising the ability of future generations to meet their own needs." *Sustainability 101*<sup>5</sup> puts it this way:

It is the commonsense notion that long-term prosperity and ecological health not only go together, they depend on one another. Sustainability means long-term cultural, ecologic and economic health and vitality. Or put another way, sustainability is about actions which are ecologically sound, economically viable, and socially just and humane.

And that's what sustainability is: a concept that says that individuals, companies, governments and other organizations need to think about how the decisions they make and the actions they take every day affect what is called their "triple bottom line."

So what is this "**triple bottom line**?" In the past, when someone asked, "How would this decision affect our bottom line?" they were asking only about the financial impact. But the concept of sustainability says there are actually three bottoms lines to consider.

**Economic** - the financial impact on an individual's income or spending, or on a company's profits and losses.

**Environmental** - the impact on the air, water, land and global climate.

**Social** - the impact on an individual's happiness, health and productivity, or the impact on the community's welfare.

This can be a significant change in thinking. For businesses and other organizations, it is a business approach that creates long term value by embracing opportunities and managing risks deriving from economic, environmental and social developments or changes. That means integrating sustainability into their decision-making processes and paying attention to how their actions affect the environment and society around them, in addition to how they affect the organization financially. Many are finding tremendous benefits from the process - that giving consideration to the environment and society helps their financial bottom line and makes them more attractive to investors and employees.

For example: A company replaces the lighting fixtures in its corporate headquarters building with brighter, more energy-efficient ones. Because the new fixtures use less energy, the company saves money. But the benefits don't stop there. As a result of the company's actions, the local electric utility company generates less electricity and therefore emits less air pollution - that's the environmental impact. And the brighter lighting fixtures create better working conditions for employees - that's the social impact. It's the triple bottom line at work.

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<sup>4</sup> Reprinted from <http://www.greenerfacilities.org/case/sustain101/how/index.cfm>, The Alliance for Sustainable Built Environments

<sup>5</sup> <http://www.greenerfacilities.org/case/sustain101/how/index.cfm>, The Alliance for Sustainable Built Environments

For individuals, adopting sustainability into our personal lives means making decisions that not only make financial sense for us, but also respect the environment and the communities in which we live.

Here's another example: When two co-workers decide to rideshare to work every day, they both save money on gasoline and car expenses. That's their financial reward. Driving one car, instead of two, puts less exhaust into the air - the environmental impact. And it decreases traffic congestion on the freeway - the social impact. That's the triple bottom line for us as individuals.

Finally, a word about what sustainability isn't. When some people hear the word "sustainability," they immediately think it's entirely about the environment - something that only "tree huggers" are interested in. Sustainability is being embraced by businesses, organizations, governments and individuals worldwide who want to succeed financially while helping protect the environment and improve the lives of others at the same time. Sustainability is not rocket science. It's simply using available technologies in smarter ways. In architecture, a sustainable building is sometimes referred to as a "smart building."

## WHAT WE CAN DO

### How You Can Apply Sustainability at Work and Home<sup>6</sup>

Adopting sustainability at work and home means thinking about the economic, social and environmental consequences of the decisions we make every day. Consider these things:

- Am I using energy as efficiently as I could?
- What if I started turning off my computer when I left my office?
- Is the temperature of my refrigerator at home set properly?
- Could I turn off lights at work when they're not in use?
- Should I replace my lights bulbs at home with compact fluorescent lights?
- Am I doing my part to maintain good indoor air quality?
- Would it help if I kept my office window closed?
- Should I have the air ducts in my home cleaned?
- Do I recycle as many products as possible?
- What could I give to charity rather than throw away?
- Do I save water whenever possible?
- Could I install a high-efficiency showerhead at home?
- Could I use environmentally friendly transportation more often?
- Could I ride-share or take the bus to work some of the time?
- Could I ride my bike more when I'm close to home?
- Do I use healthy and safe cleaning products and techniques?
- Could I use green design principles to build/renovate/maintain my home or office?*
- Could I use sustainable principles in deciding where to live and not contribute to sprawl?*

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<sup>6</sup> Reprinted from <http://www.greenerfacilities.org/case/sustain101/how/index.cfm>, The Alliance for Sustainable Built Environments

## **StopGlobalWarming.org<sup>7</sup>**

There is no more important cause than the call to action to save our planet. This is a movement about change, as individuals, as a country, and as a global community. We are all contributors to global warming and we all need to be part of the solution. Join the 520,240 supporters of the Stop Global Warming Virtual March, and become part of the movement to demand solutions to global warming now.

The Stop Global Warming Virtual March is a non-political effort bringing Americans together to declare that global warming is here now and it's time to act.

## **Learn More<sup>8</sup>**

The results are in and the reality of global warming is beyond dispute or debate. It's not just an environmental issue. It affects our public health and national security. It's an urgent matter of survival for everyone on the planet — the most urgent threat facing humanity today. It's going to take action from you and all of us working together.

Global warming isn't opinion. It's a scientific reality. And the science tells us that human activity has made enormous impacts to our planet that affect our well-being and even our survival as a species.

The world's leading science journals report that glaciers are melting ten times faster than previously thought, that atmospheric greenhouse gases have reached levels not seen for millions of years, and that species are vanishing as a result of climate change. They also report of extreme weather events, long-term droughts, and rising sea levels.

Fortunately, the science also tells us how we can begin to make significant repairs to try and reverse those impacts, but only through immediate action. That's why we urge you to join us. The Stop Global Warming Virtual March is virtual but its purpose is real. By spreading the word and sharing this with others, our collective power will force governments, corporations, and politicians everywhere to pay attention.

Join the virtual march at [www.stopglobalwarming.org](http://www.stopglobalwarming.org),

# AND BUILD GREEN!

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<sup>7</sup> Reprinted from <http://www.climatecrisis.net/thescience/>, An Inconvenient Truth

<sup>8</sup> Reprinted from <http://www.climatecrisis.net/thescience/>, An Inconvenient Truth

## ***THE PRICE OF UNSUSTAINABILITY***

### **Our Consumer Society<sup>9</sup>**

Here in North America, we are world-class consumers. Our living standards are among the highest in the world, and to support them we are consuming resources at an impressive clip. Just think about what we devour on a day-to-day basis:

Energy resources. Oil to fuel our cars, trucks, buses, trains and planes. Natural gas and coal to generate electricity to power virtually everything we do at work and play.

Fresh water. For drinking, irrigating farm fields and lawns, cleaning, waste removal and manufacturing.

Other natural resources. Used to make the bottles, cans, paper, cardboard and other packaging and products we discard.

We're also leaving our mark on the environment (*link to global warming*). Air pollution from automobiles and power plants causes health problems and may contribute to changes in our global climate.

Runoff from farm fields and discharges from manufacturing plants foul our rivers and lakes. Mountains of garbage and hazardous wastes are buried in landfills that grow larger every day.

And our consumption can hurt society as a whole. Workers who produce the goods we consume sometimes must work for low pay and labor in poor working conditions.

Freeways are increasingly clogged for longer periods of the day, limiting our mobility and hiking our collective blood pressure. We have fewer opportunities to enjoy outdoor recreation when water pollution closes our beaches, or exhaust from automobiles makes our air unhealthy to breathe.

It's becoming increasingly apparent that as much as we enjoy our comfortable lifestyles, we can't go on in this way forever (*link to global warming*).

The resources we're using are in limited supply. For example: some experts predict that the world's oil supply will last only another forty years. Environmental damage and worsening social conditions create problems for our children and grandchildren to solve - not the kind of legacy we hope to leave them.

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<sup>9</sup> Reprinted from <http://www.greenerfacilities.org/case/sustain101/how/index.cfm>, The Alliance for Sustainable Built Environments

In short, our current lifestyles are "unsustainable." That's not to suggest that we should reduce our living standards. Quite to the contrary, virtually everyone wants to at least maintain - if not continuously improve - their lifestyle. But in order to do so we must find ways to change.

We must use resources more efficiently

We have to minimize our negative impacts on the environment

We must improve peoples' lives

Achieving all three of these objectives is what "sustainability" is all about.

## Global Warming<sup>10</sup>

Carbon dioxide and other gases warm the surface of the planet naturally by trapping solar heat in the atmosphere. This is a good thing because it keeps our planet habitable.

However, by burning fossil fuels such as coal, gas and oil and clearing forests we have dramatically increased the amount of carbon dioxide in the Earth's atmosphere and temperatures are rising.

The vast majority of scientists agree that global warming is real, it's already happening and that it is the result of our activities and not a natural occurrence.<sup>11</sup> The evidence is overwhelming and undeniable.

We're already seeing changes. Glaciers are melting, plants and animals are being forced from their habitat, and the number of severe storms and droughts is increasing.

The number of Category 4 and 5 hurricanes has almost doubled in the last 30 years.<sup>12</sup>

Malaria has spread to higher altitudes in places like the Colombian Andes, 7,000 feet above sea level.<sup>13</sup>

The flow of ice from glaciers in Greenland has more than doubled over the past decade.<sup>14</sup>

At least 279 species of plants and animals are already responding to global warming, moving closer to the poles.<sup>15</sup>

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<sup>10</sup> Reprinted from <http://www.climatecrisis.net/thescience/>. An Inconvenient Truth

<sup>11</sup> According to the Intergovernmental Panel on Climate Change (IPCC), this era of global warming "is unlikely to be entirely natural in origin" and "the balance of evidence suggests a discernible human influence of the global climate."

<sup>12</sup> Emanuel, K. 2005. Increasing destructiveness of tropical cyclones over the past 30 years. *Nature* 436: 686-688.

<sup>13</sup> World Health Organization

<sup>14</sup> Krabill, W., E. Hanna, P. Huybrechts, W. Abdalati, J. Cappelen, B. Csatho, E. Frefick, S. Manizade, C. Martin, J. Sonntag, R. Swift, R. Thomas and J. Yungel. 2004. Greenland Ice Sheet: Increased coastal thinning. *Geophysical Research Letters* 31.

<sup>15</sup> *Nature*.

If the warming continues, we can expect catastrophic consequences.

Deaths from global warming will double in just 25 years -- to 300,000 people a year.<sup>16</sup>

Global sea levels could rise by more than 20 feet with the loss of shelf ice in Greenland and Antarctica, devastating coastal areas worldwide.<sup>17</sup>

Heat waves will be more frequent and more intense.

Droughts and wildfires will occur more often.

The Arctic Ocean could be ice free in summer by 2050.<sup>18</sup>

More than a million species worldwide could be driven to extinction by 2050.<sup>19</sup>

There is no doubt we can solve this problem. In fact, we have a moral obligation to do so. Small changes to your daily routine can add up to big differences in helping to stop global warming. The time to come together to solve this problem is now.

## **Irreversible Environmental Damage**<sup>20</sup>

Exploitation of the natural environment is growing at an unsustainable rate ultimately risking human survival itself. That was the uncomfortable message Professor E. O. Wilson, biologist and entomologist at Harvard University, brought to the opening day of the OECD's Forum 2001 on Sustainable Development and the New Economy.

Economists have long ignored the real cost of environmental degradation, he said, because they do not use the right statistics. The key statistic for measuring sustainability is called the ecological footprint – the average amount of productive land and coastal marine environment appropriated by each person around the world for survival.

In the developing world, which has 5 billion of the earth's 6 billion population, that footprint is about 2.5 acres per person. That compares with a footprint of around 24 acres in the United States.

“For every person in the world to reach US levels of consumption with existing technology would require four more planet earths,” Prof. Wilson told an audience of government officials and representatives from business and civilian groups.

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<sup>16</sup> World Health Organization

<sup>17</sup> Washington Post, "Debate on Climate Shifts to Issue of Irreparable Change," Juliet Eilperin, January 29, 2006, Page A1.

<sup>18</sup> Arctic Climate Impact Assessment. 2004. Impacts of a Warming Arctic. Cambridge, UK: Cambridge University Press. Also quoted in Time Magazine, Vicious Cycles, Missy Adams, March 26, 2006.

<sup>19</sup> Time Magazine, Feeling the Heat, David Bjerklie, March 26, 2006.

<sup>20</sup> Reprinted from

[http://www.oecdobserver.org/news/fullstory.php/aid/1205/Businesses\\_are\\_most\\_avid\\_OECD\\_Observer\\_readers.html](http://www.oecdobserver.org/news/fullstory.php/aid/1205/Businesses_are_most_avid_OECD_Observer_readers.html),  
OECD Forum, 14th May, 2001: Keynote Address "Future of Life"; moderator Donald J. Johnston, OECD Observer;  
Published: May 2001

With so many technological and scientific advances to celebrate, what humanity is neglecting is “much of the rest of life, environmental security and part of what it is to be human.”

Prof. Wilson said that although scientists now know that our biosphere is richer in diversity than ever before realised and it took three billion years to evolve, it is being eroded so fast that the loss will inflict a heavy price on wealth, security and the human spirit.

With world population past 6 billion and on its way to 8 billion by mid century before it is likely to drop, the per capita portion of arable land and fresh water available is dropping to levels that resource experts agree are very risky.

Prof. Wilson is one of the world’s foremost experts on biodiversity and has received numerous environmental awards and two Pulitzer awards.

He warned of the mass extinction of eco-systems and species. “The damage already done cannot be repaired within any meaningful time that has meaning to the human mind,” he said. “The more it’s allowed to grow, future generations will suffer for it in ways that are both well understood now and still ... unimaginable. The radical reduction of the world’s biodiversity is, I believe, the folly our descendants will be least likely to forgive us.”

One of the tragedies underpinning this destruction is that we still have little idea of just how many animal and plant species there are on the planet. There are, he said, around 1.5-1.8 million known species but countless others that have not ever been described by scientists. “We have just begun to explore the planet.”

On this point, he commended the OECD’s “very worthwhile initiative” in creating the Global Biodiversity information facility (GBIF), an international science facility which aims to provide worldwide access, via the Internet, to information about the known 1.8 million species of organisms that inhabit the earth.

The exponential loss of natural habitat and consequent loss of biodiversity is “stunning”, Prof. Wilson said, citing several examples. Nasa has calculated that about 5 % of the earth’s surface is burned every year, much it to the detriment of the world’s tropical forests. He said the Philippines was one of the hardest hit parts of the world but there were other shocking examples including the West Indies, Brazil and Africa.

“A 90 per cent reduction in area ... means extinction of half of the species. (The land) can only sustain half that number of species,” he said. “The rate of destruction of tropical rainforest is equal to about half of all the state of Florida each year.”

But Prof. Wilson sounded a more optimistic note on the resources being poured into environmental protection. He said NGOs were best placed to spearhead the global environmental protection and the largest of the environmental groups can draw on budgets of between \$50-100 million.

“The resources to accomplish this problem (sustainable development) exist. Those who control those resources have many reasons to achieve that goal, not least their own security,” he said in conclusion.

In response to a question by Marsha Johnston of the Sustainable Business Investor Europe magazine, he said that 1.2 million square kilometres of ecologically threatened land could be secured for about \$4 billion.

“At the end of the day, however, it may be essentially an ethical decision. A civilisation able to envision God and an afterlife and to embark on the colonisation of space will surely find a way to save the integrity of the magnificent planet and of the life it harbours,” Prof. Wilson said.

## **Nature Weakened in Ability to Support Life<sup>21</sup>**

Experts have released a report that measures damage to the environment from human activities. The report measures the damage to the services that nature provides for people.

The report was released last month (March 2005). It is part of a project called the Millennium Ecosystem Assessment. United Nations Secretary-General Kofi Annan proposed the project five years ago.

More than one thousand three hundred ecologists and other scientists from ninety-five countries prepared the report. They studied the ability of ecosystems to perform activities like providing food and making water pure. An ecosystem is a group of living things and the environment in which they live.

The report says people have changed ecosystems to meet growing demands for food, fresh water, and energy. These changes have helped improve the lives of thousands of millions of people. But they have weakened the ability of nature to provide important services for people.

The report identified several problems. They include reduced numbers of fish in the world’s oceans and dangers to people living in dry areas. Another problem is a growing threat to ecosystems from climate change and pollution.

The study found that sixty percent of the world’s ecosystems are being harmed by human actions. These include fishing too much and clearing

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<sup>21</sup> Excerpted from <http://www.voanews.com/specialenglish/archive/2005-04/2005-04-19-voa1.cfm> Voice of America, written by Shelley Gollust, Jill Moss and Edward Stautberg, 19 April 2005

land to grow crops.

The study considered many kinds of services that an ecosystem provides. These include things like a forest's ability to store water and cool the air. It also includes cultural services, like providing a place for recreation. And, it includes life-support services like soil formation and the process by which plants make food.

The scientists say many of the areas where the environment is most quickly being damaged are among the world's poorest areas. As a result, they said, damaged environments are likely to harm efforts to help poor people and reduce disease in developing countries.

The report said rich countries also were responsible for some problems. One of them is the increased use of chemical fertilizers. The fertilizers are washed into rivers and coastal waters. Nitrogen in the fertilizers creates areas in the water where nothing can live.

Many earlier studies examined loss of forests and other wild places on land and in the oceans. The new report also deals with losses in dry-land ecosystems.

The scientists say this is where human populations are growing fastest and depend most heavily on natural systems. One example is Africa south of the Sahara Desert. That is where they say dry conditions and growing demands for water have added to social problems.

The statement also said protecting the environment should no longer be seen as something a country considers after more important concerns are dealt with. It said measures to protect natural resources are more likely to be successful if local communities are involved in decisions and share the gains.

The report says action is needed to prevent additional damage to the environment. The scientists who led the project released a statement. It says: "We must learn to recognize the true value of nature – both in an economic sense and in the richness it provides to our lives."