

## X. Window into Green Building



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## 10.1 Introduction

“Think Globally – Act Locally” is a popular bumper sticker with a valid and realistic message. Steve Gerus and Dr. Rosemary Blieszner, a married couple in Blacksburg, Virginia, live by the motto. Co-owners of Bell Electric, LLC, Steve and Rosemary built a new office for their business and other retail tenants. Consistent with their vision of sustainable development as Smart Growth that is simultaneously pro-business and pro-environment, the new building reflects some of the latest most and creative thinking in green building design. The building incorporates many of the principles studied in this curriculum and be a showcase example of SOL 6.9 - Resources.



### Objectives

*In this lesson students will:*

- Promoting use of renewable resources via solar power, natural lighting, salvaged flooring lumber, and greenhouse amenities;
- Conserving of non-renewable resources by high efficiency cooling/heating and recycled stone masonry;
- Enhancing land use via access to mass transportation, pedestrian commuters, and natural landscaping to reduce runoff; and,
- Balancing short-term costs with long-term benefits.

### SOLs

Science 6.2, 6.3, 6.5, 6.6, 6.9

### Key Terms/ Concepts

- Green Building Design
- Smart Growth
- Recycling
- Natural Lighting & Cooling
- Greenhouse
- Photovoltaic (PV)

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## 10.2 Student Information

### *Green Building Design*

Green buildings are born through Smart Growth concepts, which are methods of development that conserve and protect natural resources while creating a healthier human habitat. In this Window, we study an actual building recently constructed in Virginia that illustrates modern principles of Green Building design through a combination of several building techniques which may prove cost-effective in the long term:



- ***Landscape Compatibility*** – the building is not sited directly alongside the street, but rather falls back and uses natural grades. This cuts down on erosion and overall land disturbance.
- ***Transportation and Housing*** – the building is sited across the street from a bus stop and several neighborhoods. Employees who work in the building can choose among several different housing opportunities and use public transportation or walk and thus reduce pollution.
- ***Economic Impact*** – the contractors and owners of this building are local citizens, which means money is being re-circulated through the local economy.
- ***Energy Efficiency*** – the building uses natural heating and cooling. Solar panels are arranged on the roof to supplement the electrical supply to the building.
- ***Recycled Materials*** – the building is constructed using some recycled lumber.

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## 10.3 Teacher Content

The market forces that drove the architectural and site-planning decisions for this project were typical for commercial real estate development. The developers understood that if the benefits offered tenants did not exceed the burden of rents, those businesses would locate elsewhere. More interesting

are the ways in which the developers used Smart Growth and “green building” principles to add value, at minimum expense, for both tenants and the larger community.

Smart Growth is development that protects natural resources while creating healthier human habitat. It includes consideration of the environmental impact of building at a specific location. This particular building site falls away from the street, and the temptation might have been to fill it up to street grade, as had been done with an adjacent property.

The developers instead chose to preserve some of the natural topography by nesting the footprint of the building close to the original grade. They gained these advantages: a gradually inclined parking lot and driveway, wrapped around the building, allows on-grade access to both building levels; in addition, the wind loading on the structure is lessened and the building now blends into its site rather than dominating it.

Smart Growth encourages a mixture of land uses. Development at this specific site, on the town’s main street, creates a healthier human habitat for employees by its location across the street from a bus stop and by being surrounded by neighborhoods that provide a variety of affordable housing choices. Walking, biking, or using public transportation offers a cheaper, more pleasant and energy-efficient commute, and benefits the community by minimizing added traffic burden.

Smart Growth also encourages a strong, enduring relationship among owners, builders, and tenants. The owners and contractors involved in this project are local. Tenants and neighbors are not burdened by having an absentee landlord. And contractors who are not “here today and gone tomorrow” take greater pride in their work. When jobs and profits are not exported, money is re-circulated in the local economy, and the community gains.

The building itself has many features that illustrate principles of “green building design.” First among these is the extensive use of **natural lighting and cooling**, both around the perimeter and down the east-west midline that runs the length of the building.



The use of Low-E glass maximizes light gain while minimizing cooling load. Lighting fixtures utilize compact fluorescent, electronic ballast fluorescent and Light-Emitting Diodes (LED) technology, for lowered cooling load and more lumens per watt. Heating is also energy efficient, utilizing dual-fuel heat pumps. These use natural gas when the temperature gets so low that heat pumps become inefficient. Electricity, with its high production cost to the environment, is preserved for non-heating uses.

Another major feature of the building is the presence of 72 **photovoltaic (PV)** solar panels, arranged in nine arrays on the roof. These panels use an inverter to transform 14 volts DC into 120 volts AC and feed this non-polluting, renewable energy source directly back into the power grid, generating a net flow of energy to and from the building. Another feature of the roof is a greenhouse, which functions as a passive solar source, maintenance platform for the PV panels, and plant-filled air cleaner.



The conservation of natural resources that marks green building design also emphasizes the use of recycled building materials. This building has a bridge from the parking lot to the upper level, with flooring made of re-milled 300-year-old timbers 24' 4" long, salvaged from a submerged wharf pier in Savannah Harbor. Surely there are less expensive choices, but if we can teach our children about alternatives to our "throw-away culture," it will be a worthwhile investment. The approach to the upper-floor entrance bridge also features local cut Ordovician limestone, recycled from nearby building projects.

There is no single feature of this project that makes it Smart Growth, and no single feature of the building that qualifies it as earth-friendly. It is rather the case that many lesser decisions have been guided by an awareness of the long-term impact of human presence on the larger built environment, and on both renewable and non-renewable resources. Some trade-offs have involved significant increases in short-term cost, but others have been no more than turning found opportunities in site-planning and architecture to the common good.



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## 10.4 Enrichment

Explore the visionary designs of William McDonough ([www.mcdonoughpartners.com](http://www.mcdonoughpartners.com) and [www.mbdc.com](http://www.mbdc.com)) and GreenBlue ([www.greenblue.org](http://www.greenblue.org)) for creative examples of cradle-to-cradle design and sustainable development initiatives. For some exciting examples of creative advancements in the development of sustainable building materials and design, recognized annually by the governor, read about actual award-winning innovations by manufacturing companies in Virginia by checking out the website of the Virginia Manufacturers Association: (<http://www.vmaoutreach.com/awards/>).

Also, there are many other organizations devoted to green building design. Following are some websites with exciting information for the classroom:

Center for Excellence for Sustainable Development – [www.sustainable.doe.gov](http://www.sustainable.doe.gov)

Energy Efficiency and Renewable Energy Network – [www.eren.doe.gov](http://www.eren.doe.gov)

Energy Environmental Building Association – [www.eeba.org](http://www.eeba.org)

Energy Building News – [www.buildinggreen.com](http://www.buildinggreen.com)

EPA's Energy Star Program – [www.energystar.gov](http://www.energystar.gov)

Oikos Green Building Source – [www.oikos.com](http://www.oikos.com)

Rocky Mountain Institute – [www.rmi.org](http://www.rmi.org)

Renewable Energy Policy Project – [www.crest.org](http://www.crest.org)

Sustainable Buildings Industry Council – [www.sbicouncil.org](http://www.sbicouncil.org)

Virginia Manufacturers' Association – "Governor's Environmental Excellence Awards" – <http://www.vmaoutreach.com/>

United States Green Building Council – [www.usgbc.org](http://www.usgbc.org)

Southface Energy Institute – [www.southface.org](http://www.southface.org)

Education for Sustainable Development – <http://susdev.agecon.vt.edu>

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## 10.5 Materials List

### **10 – 1** *Green Building Design*

- Internet and library access
- Poster board
- Cardboard models

### **10 – 2** *Local Directory*

- Photos from students
- Poster board
- “How Green Is Your Home?” score sheet

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## 10.6 Activities

### 10 – 1 *Green Building Design*

Have a contest to design a hypothetical building that features sustainability concepts and principles related to: ecological sensitivity, human ergonomics, community access, and economic efficiency/effectiveness

### 10 – 2 *Local Directory*

Students are asked to find local examples of building designs that are consistent and inconsistent with sustainable development

## **10 – 1 Green Building Design**

### **Procedure**

Hold a Green Building Design contest to allow students to research and design a hypothetical building (residential, commercial, governmental, or retail) that features sustainability concepts and principles related to: ecological sensitivity, human ergonomics, community access, and economic efficiency/effectiveness.

### **Assessment**

Ask a panel of judges (faculty and students) evaluate the ideas proposed and give feedback to the class.

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## **10 – 2 Local Directory**

### **Procedure**

Have students find local examples of building designs that are consistent and inconsistent with sustainable development. Discuss how such local buildings and land use decisions relate or link to national and global aspects of sustainability. Have students use the “How Green Is Your Home?” score sheet to assess the design of their own homes.

### **Reflection**

Have the class discuss and vote on the most insightful observations and local examples discovered. Have students design a “Green” home. Use the check list on the next page to evaluate the designs.

## **10 – 2 Local Directory – How Green Is Your Home?**

Use the checklist to score how environmentally friendly your dwelling is.

<b>Categories</b>	<b>Criteria</b>	<b>Possible Points</b>	<b>Points Awarded</b>
<b>Building Materials</b>	Is there recycled wood in the building's construction?	5	
	Is there recycled brick, stone, or tile in the building's construction?	5	
	Are other building materials recycled?	5 each	
	Do your windows have Low-E glass?	4	
	Do your windows have double-paned glass or storm windows?	2	
<b>Design</b>	Are there more windows on the south side of the building?	5	
	Are the windows larger on the south side of the building?	5	
	Is the insulation at least six inches thick <i>or</i> have a rating of at least R-19?	5	
	Does your home have good ventilation, so A/C is not necessary even on warm days?	5	
	Does your building have weather stripping around exterior doors?	5	
	Does your building have storm doors and storm windows?	10	
<b>Location</b>	Is the south side of the building shaded by trees?	5	
	Do trees or a hill block the wind on the north side of the building?	5	
	Is there easy access to public transportation?	5	
	Is school or work close enough to walk or bike?	5	
<b>Energy Use</b>	Are there energy efficient bulbs used in your home?	1 point per bulb	
	Are there solar cells in use anywhere on the building?	5	
	Is a heat pump used for heating the building?	10	
<b>Other Features</b>	Do windows have insulating curtains?	5	
<b>Total</b>			