

GREEN HOME DESIGN CHALLENGE

INTRODUCTION: Energy – we can't live without it. We use tremendous amounts of energy in our daily lives. Technological advancements have not only lead to our consuming more and more energy than in the past, but have also allowed development of technologies that help us to use energy more efficiently while relying less on non-renewable resources such as coal, natural gas and petroleum.

OBJECTIVE: *To design an energy efficient home that relies as little as possible on non-renewable sources of energy and instead uses energy from as many renewable resources as possible.*

The US Department of Energy sponsors the SOLAR DECATHLON for colleges and universities where they are challenged to design, build, and operate the most attractive and energy-efficient solar-powered house. Each year, competing teams bring their life-size designs to our nation's capitol in an effort to bring attention to the ways in which we use energy in our daily lives. You can learn more about this interesting and motivating program by visiting their web site at <http://www.solardecathlon.org>.

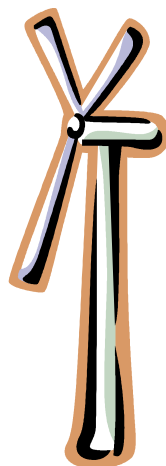
We would like to challenge you to design and construct a scale-model energy efficient home that takes advantage of not only renewable sources such as solar energy, but also such renewable sources of energy as wind and geothermal energy. Specifically, you will need to complete the following:

1. SCALE MODEL OF YOUR HOME (no larger than 24 in. by 24 in. by 24 in.)

Your scale model should include each of your design features with a way to clearly observe each design feature – ie., cut-away design or removable roof, etc. **Students are not required to buy materials for this project. They are encouraged to recycle materials from in and around their home in constructing their models.**

2. DESIGN FEATURE WORKSHEET(S)

These worksheets will require you explain the benefits and disadvantages for your design features.



DESIGN FEATURE WORKSHEET

Design Feature Title _____

Design Feature Purpose _____

Source of Energy _____

Benefits of Using this Energy Source

Disadvantages of Using this Energy Source

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Design Feature Title _____

Design Feature Purpose _____

Source of Energy _____

Benefits of Using this Energy Source

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GENERAL HOME ENERGY SAVING TIPS

<http://www1.eere.energy.gov/consumer/tips/index.html>

(download as PDF - http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf)

1. HEATING AND COOLING YOUR HOME:

Heating and cooling account for about 56% of the energy use in a typical U.S. home, making it the largest energy expense for most homes. A wide variety of technologies are available for heating and cooling your home, and they achieve a wide range of efficiencies in converting their energy sources into useful heat or cool air for your home.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12300

Energy Star Guide to Efficient Heating & Cooling (PDF download)

http://www.energystar.gov/ia/products/heat_cool/GUIDE_2COLOR.pdf

Space Heating your home with Active Solar Heating

http://www.ncsc.ncsu.edu/information_resources/factsheets/20acspht.pdf

Cooling your home with Passive Cooling (PDF download)

http://www.ncsc.ncsu.edu/information_resources/factsheets/13coolng.pdf

Home Cooling (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Home_Cooling_110802040511_Cooling.pdf

2. INSULATING YOUR HOME

Properly insulating your home will not only help reduce your heating and cooling costs but also make your home more comfortable.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/insulation_airsealing/index.cfm/mytopic=11320

Energy Star Guide to Home Insulation and Sealing (PDF download)

http://www.energystar.gov/ia/home_improvement/home_sealing/DIY_COLOR_100_dpi.pdf

Home Insulation tips (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Home_Insulation_110802040945_Insulation.pdf

3. LANDSCAPING

A well-designed landscape not only can add beauty to your home but it also can reduce your heating and cooling costs. On average, landscaping for energy efficiency provides enough energy savings to return an initial investment in less than 8 years.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/landscaping/index.cfm/mytopic=11910

Landscaping for Energy Efficiency (PDF download)

<http://www.nrel.gov/docs/legosti/old/16632.pdf>

Saving Energy with Trees (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Energy_Saving_Landscapes_110802040030_Landscaping.pdf

Energy Saving Landscaping for your Passive Solar Home

http://www.ncsc.ncsu.edu/information_resources/factsheets/Energy_Landscape.pdf

Cooling your home with Passive Cooling

http://www.ncsc.ncsu.edu/information_resources/factsheets/13coolng.pdf

4. **HEATING WATER IN YOUR HOME:**

Water heating can account for 14%–25% of the energy consumed in your home. You can reduce your monthly water heating bills by selecting the appropriate water heater for your home or pool and by using some energy-efficient water heating strategies.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12760

Solar Water Heating (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Solar_Water_Heating_121702033404_solarhotwater.pdf

Passive & Active Solar Hot Water Heating (PDF download)

http://www.ncsc.ncsu.edu/information_resources/factsheets/SolarDHW.pdf

5. **LIGHTING YOUR HOME**

The quantity and quality of light around us determine how well we see, work, and play. Light affects our health, safety, morale, comfort, and productivity. In your home, you can save energy while still maintaining good light quantity and quality.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/lighting_daylighting/index.cfm/mytopic=11970

Energy efficient lighting tips (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Home_Lighting_110802041218_Lighting.pdf

6. **RENEWABLE SOURCES OF ELECTRICITY FOR YOUR HOME**

RESIDENTIAL WIND ELECTRIC SYSTEMS

Small wind electric systems are one of the most cost-effective, home-based renewable energy systems. These systems are also nonpolluting.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/electricity/index.cfm/mytopic=10880

Small wind electric systems (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Small_Wind_Energy_Systems_110702042021_SmallWindGuide.pdf

RESIDENTIAL SOLAR ELECTRIC SYSTEMS

A small solar electric or photovoltaic (PV) system can be a reliable and pollution-free producer of electricity for your home or office. And they're becoming more affordable all the time. Small PV systems also provide a cost-effective power supply in locations where it is expensive or impossible to send electricity through conventional power lines.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/electricity/index.cfm/mytopic=10710

Small solar electric systems (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Small_Solar_Electric_Systems_A_MN_Guide_032103025940_GuidetoSolarElectric.pdf

Photovoltaics – Electricity from the Sun (PDF download)

http://www.ncsc.ncsu.edu/information_resources/factsheets/PVElecSun.pdf

7. RENEWABLE SOURCES OF HEAT ENERGY FOR YOUR HOME

PASSIVE SOLAR HEATING

Your home's windows, walls, and floors can be designed to collect, store, and distribute solar energy in the form of heat in the winter and reject solar heat in the summer. This is called passive solar design or climatic design.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/designing_remodeling/index.cfm/mytopic=10250

Passive Solar Design (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Passive_Solar_Design_121702032826_passivesolar.pdf

Passive Solar Hot Water Heating (PDF download)

http://www.ncsc.ncsu.edu/information_resources/factsheets/SolarDHW.pdf

ACTIVE SOLAR HEATING

Active solar heating systems collect and absorb solar radiation, then transfer the solar heat directly to the interior space (hot air) or to a storage system (hot water), from which the heat is distributed.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12490

Active Solar Hot Air Heating

http://www.warmair.com/html/solar_air_heating.htm

Active Solar Hot Water Heating (PDF download)

http://www.ncsc.ncsu.edu/information_resources/factsheets/SolarDHW.pdf

Solar Water Heating (PDF download)

http://www.state.mn.us/mn/externalDocs/Commerce/Solar_Water_Heating_121702033404_solarhotwater.pdf

GEOHERMAL HEATING

The Earth's heat, which constantly flows outward from its core, provides an enormous source of energy called *geothermal energy*. You can use geothermal energy—no matter where you live in the United States—to heat and cool your home using a geothermal or ground-source heat pump.

Department of Energy's Consumer's Guide

http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12640

Geothermal Heat Pumps (PDF download)

[http://www.state.mn.us/mn/externalDocs/Commerce/Groundsource_Heat_Pumps_121702032457_groundsour
ceheatpump.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/Groundsource_Heat_Pumps_121702032457_groundsourceheatpump.pdf)