

Task

Designing an Eco-Friendly Home

In this activity, you will design an eco-friendly home that reduces greenhouse gas emissions and protects the biodiversity of the surrounding ecosystem.

 Estimated time to complete: 8 to 10 hours

 You will need these materials:

- a ruler
- a pencil
- graph paper or poster board

Part A: Define the Problem

Despite the availability of cleaner energy sources, most of the energy used to power American homes comes from the burning of fossil fuels such as coal and oil. The burning of fossil fuels releases carbon dioxide into the air. Carbon dioxide is a greenhouse gas that contributes to climate change.

Why do you think it's a challenge to reduce fossil fuel usage in homes in the United States? How could the use of fossil fuels affect the biodiversity in neighborhoods and the surrounding ecosystems?

Answer:

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Part B: Conduct Background Research

Research is the first step in engineering an eco-friendly home that saves energy and protects biodiversity. Begin by selecting a location for your house anywhere in the United States. You could choose your own neighborhood or pick a location in a different state.

Find the ZIP code for the location you chose. For large cities, it might be helpful to use a GPS app such as Google Maps to pinpoint the exact ZIP code where you want to set your house.

Next, use the ZIP code to help conduct online research about the energy needs and current biodiversity threats in that location. Here are some questions that your research could answer:

- What type of area is it? Is it a city, a suburb, or a rural area?
- What is the main source of energy used to heat the homes there? (Possibilities include electricity, propane, natural gas, and oil.)
- Does the area currently have cleaner energy alternatives available? (Alternatives include solar power and hydroelectric power.)
- What is the climate of the area? How does the climate relate to the energy needs of the home?
- Does the area have any unique resource challenges? For example, you can conduct research on whether the area is prone to droughts or floods, has a polluted water supply, or has power outages caused by weather.
- How does the city or town dispose of household waste? Is it stored or is it destroyed? Is there a recycling program or a composting program?
- Does the region have any biodiversity challenges? Does the region have any endangered species, habitat loss, pollution, or invasive species?

Write 1-2 paragraphs explaining the findings of your research.

Answer:

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Part C: Specify Your Requirements

Now research the types and sizes of homes that are generally found in your neighborhood. Some ZIP codes have a wide range of homes, while others do not. For example, in a densely populated city, narrow multifamily apartment buildings with narrow lots tend to be more common. In the suburbs, however, you may find homes in a variety of sizes and larger lots.

Based on your answer to part B and your research on the types and sizes of homes in this region, name any three specifications that reduce carbon dioxide expenditure and promote biodiversity in the neighborhood you chose. These specifications should be what you think an eco-friendly home in this ZIP code should have.

Answer:

Characters used: 0 / 15000

Part D: Consider Constraints

What limitations will there be to building an eco-friendly home in this neighborhood? Consider social, financial, and climate constraints while determining these limitations.

Answer:

Characters used: 0 / 15000

Part E: Estimate Greenhouse Gas Emission

You'll design your eco-friendly home to reduce the use of carbon dioxide compared to the average home in the state. Estimate greenhouse gas emissions for your house. Use these three government tools to generate the data you need.

- First, go to the [US Energy Information Administration](#) and click "Average monthly residential electricity consumption, prices, and bills by state." Find your state and the average kilowatt-hours of electricity used per month in your state. Multiply that number by 12 to get the amount of energy used in one year.
- Then visit the [EPA's Greenhouse Gas Equivalencies Calculator](#) and enter the kilowatt-hours of energy for one year into the "If You Have Energy Data" box. Select kilowatt-hours of electricity and click Calculate. The kilowatts converted into emissions equivalents (such as miles driven and average household energy). This information will give you a better perspective on the greenhouse gas emissions for the average home in your state.
- Finally, click the [EPA's Power Profiler](#) and enter the ZIP code. Choose one of the electrical companies listed (any one will work) and press Enter. Scroll down to see how much of the energy in this ZIP code comes from renewable energy and nuclear energy (a nonrenewable, cleaner energy source) compared to fossil fuel sources (oil, coal, and gas). You'll also see bar graphs that compare your ZIP code's energy profile to the national average.

Based on the data you gathered, answer the following questions:

- What conclusion can you draw about the emissions of greenhouse gases for the average home in your state or ZIP code? What factors do you think contribute to this emission rate?
- How do the emissions in your ZIP code compare to greenhouse gas emissions across the nation? Even if it's better than the national average, is there room for improvement?

Answer:

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Part F: Brainstorm Ideas

Brainstorm ideas for your house. Think about devices, appliances, and building materials you want your house to have. In addition, these computer tools might help you brainstorm some ideas.

- This [calculator](#) gives you the average energy use of household appliances, so you can research energy-saving alternatives.
- This [quiz](#) can tell you what your carbon footprint is and how to reduce it in your home. Consider turning some of the questions into energy solutions. For example, one of the questions is, Do you turn off your faucets? If water supply is a concern in your region, perhaps faucets that turn off automatically might be an eco-friendly solution.
- This [database](#) provides information about air emissions rates in a region. Search the ZIP code for the location you chose and select one of the electrical companies listed. Then scroll down to see how much of the energy in this ZIP code comes from renewable and nuclear energy (a non-renewable, cleaner energy source) compared to fossil fuel sources (oil, coal, and gas). Bar graphs compare the ZIP code's energy profile to the national average.

Write down your ideas for the house you'll design. Explain how those ideas can reduce carbon dioxide emissions and preserve natural diversity.

Answer:

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Part G: Design a Scale Model

Using the information you've gathered, design a scale blueprint of the floors in your home. You can use graph paper, poster board, or other paper to make your diagram.

Determine a layout for the home and the area in square feet each room will require. For square- or rectangle-shaped rooms, multiply the room's length by its width. You can also use a measuring tape to measure the length and width of the rooms in your own home to help determine the area. Calculate the total square feet of the home to make sure the entire area of the home is reasonable for the ZIP code.

Next, determine the scale for the dimensions. Figure out how much drawing space you have on the paper, and then determine a proportion. For example, say the total area of the house is 728 square feet. According to the dimensions of the house in the sample diagram below, the home's length will be approximately 30 feet and the width will be 28 feet. If you intend to make your blueprint on an A-4 size paper, you can use the following scale:

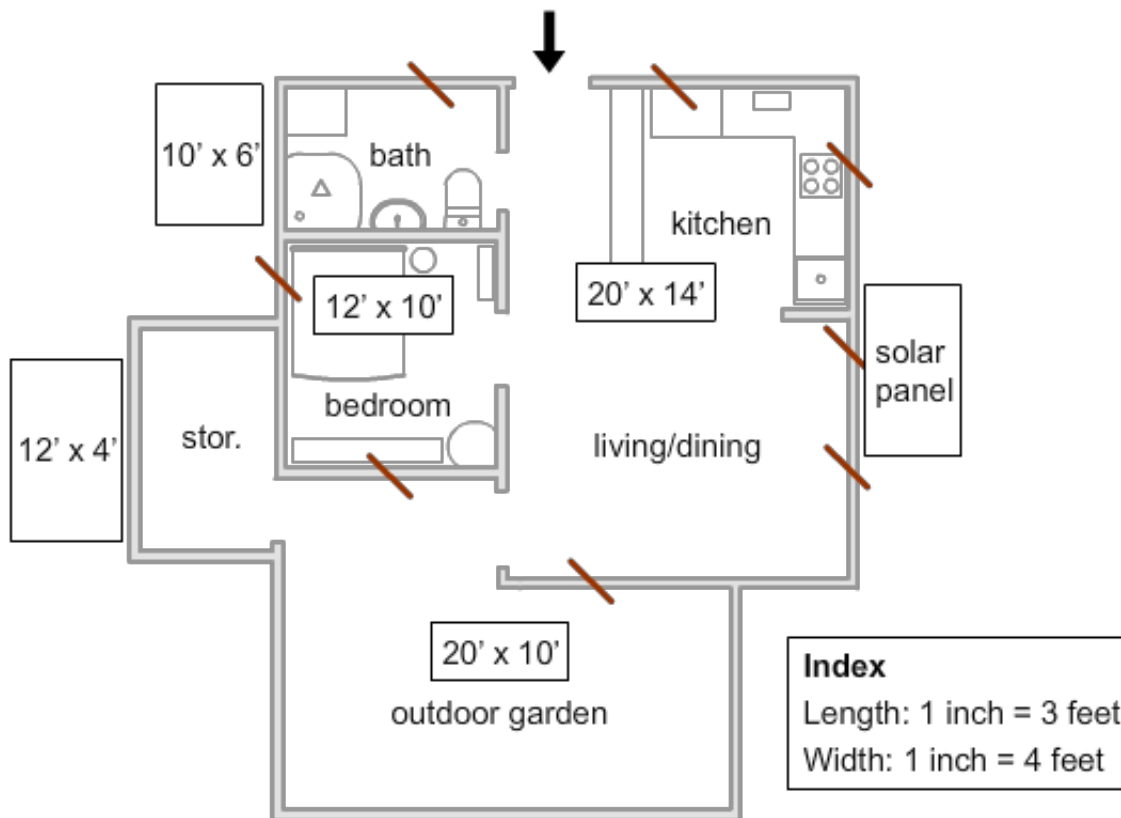
The dimension of an A-4 size paper is approximately 11 inches by 8 inches. Taking the dimensions of the paper into consideration, the blueprint will have to fit within the dimensions of 10 inches by 7 inches. Because the dimensions of the house in the

blueprint need to be 30 feet by 28 feet, the dimensions of the house need to be scaled down to fit on the paper. So, the scale for the length of the blueprint is 1 inch = 3 feet. The scale for the width is 1 inch = 4 feet.

If your house has more than one floor, make a separate layout for each floor. Your drawing should include these features:

- the scale
- the actual length and width of each room
- labels for each room

Your finished floor plan should look similar to this one:



After completing the scale diagram, it's up to you to decide the best way to show the eco-friendly features of your home. You could write descriptions directly in the diagram or number the features and create a key. Most importantly, your diagram should be easy to read and understand.

Take a photo of your final diagram. Use the Insert Image button to insert the photo in the answer space. Or follow your teacher's instructions for submitting your model.

Answer:

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Part H: Simulate the Effectiveness of the Home Over Time

Choose any two features of your eco-friendly home, and simulate quantitatively how these features could save energy or reduce carbon dioxide emissions cumulatively over five years.

Get started by researching energy use data or carbon dioxide emissions savings for your specific home features. Many government agencies such as the Department of Energy and the Environmental Protection Agency have data or estimates of carbon dioxide or energy expenditures for different household devices and appliances. Manufacturers might also offer this information. Some of the online tools you've already used in this activity may provide information to help you make your case. Here are some examples of the type of information to research:

- If you used energy-efficient light bulbs in the house, you could use this calculator to estimate how many pounds of carbon dioxide are saved each year per light bulb compared to traditional light bulbs.
- If your model included a wind turbine near the home, you could research how much electricity a home turbine in your ZIP code generates and compare that amount to the average annual energy requirements for a home of that size.

Show your carbon dioxide or energy savings cumulatively. An example is shown. Be sure to include a reference section for your data. You can use the Insert Table tool to create a table in the answer space. Or you can use a spreadsheet program on your computer that can compute your data cumulatively over time. Your instructor may give you additional instructions.

	Reference for Data	Pounds of CO ₂ saved per year	Pounds of CO ₂ saved by end of Year 1	Pounds of CO ₂ saved by end of Year 2	Pounds of CO ₂ saved by end of Year 3	Pounds of CO ₂ saved by end of Year 4	Pounds of CO ₂ saved by end of Year 5
8 energy-efficient light bulbs	Environmental Protection Agency's Carbon Footprint Calculator	145	145	290	435	580	725

Answer:

Characters used: 0 / 15000

Part I: Explain Ways to Improve Your Design

Imagine that you have unlimited funding and space to build your home. Describe four ways you can modify your design to improve your home's impact on carbon dioxide emissions or biodiversity.

Answer:

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Part J: Relate Human Activity and Biodiversity

Do you think building eco-friendly homes that reduce greenhouse gas emissions could have positive effects on biodiversity? Explain your reasoning.

Answer:

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