

ENVIRONMENTALLY SUSTAINABLE CONSTRUCTION

Teachers Notes & Worksheets

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ENVIRONMENTALLY SUSTAINABLE CONSTRUCTION

This is an entire philosophy for the designing and construction of homes and communities. The DVD provides an overview of techniques used to create a home that is comfortable to live in, with minimal negative impact on the environment. Building a home using good design principals saves energy, water and money. There are five chapters in the DVD: Environmental Sustainability, Passive Design, Material Use, Energy Reduction and Water Consumption.

ENVIRONMENTAL SUSTAINABILITY

There are three key issues that affect the community: Streetscapes, Sustainable Landscapes and Sustainable Transport.

Streetscapes. A street is more than a collection of buildings and trees. Good house design should allow for individuality without detracting from the character of the street or the amenity of neighbours. Well-designed and cared for streets provide a sense of community. It encourages social interaction between residents, and creates a safe environment. Safe footpaths encourage people to walk.

Sustainable Landscapes. It is important to consider the landscape as integral to a home's design. Trees can be used to screen sunlight and act as a windbreak. The inclusion of a wide range of native plants in the garden encourages wildlife. Hardy plants consume little water, other than rainfall. The creation of green space is important to all communities, either in an area of high-rise units or a housing development in the suburban sprawl.

Sustainable Transport. Reducing the reliance on the private car for transport, especially for commuters, is of utmost importance. Of the 14 tonnes of greenhouse gases produced in the average Australian home, one third is from car emissions. Efficient and reliable public transport systems will reduce excessive noise and air pollution, the depletion of finite oil reserves and the high cost of constructing and maintaining roads.

Questions from the DVD:

1. What are the main criteria for creating sympathetic home designs?

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2. What important areas do sustainable landscapes address?

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3. What percentage of all trips is on public transport in: 1 average Australian cities? 2 Paris and London? 3 Curitiba Brazil?

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PASSIVE DESIGN

Passive Design utilises sunlight, shading, air circulation, thermal mass and insulation to maintain thermal comfort, while lowering energy costs and greenhouse gas emissions. Sunlight is used in winter to warm a home. By orientating a new building or renovation so that windows face the winter sun, the house is warmed during the day. The use of skylights makes use of daylight as the only form of illumination during the day. Plants and trees can be used as shade on the hotter eastern and western sides of the house. Insulation cuts down noise but, more importantly, acts as a barrier to heat flow and is essential to keep a home warm in winter and cool in summer. Louvre windows are ideal for passive cooling, where air is circulated around a room and then out. Thermal mass is the ability of a material to absorb heat. Concrete has a high thermal mass and, when used in combination with north facing windows in winter, the heat from the sun is absorbed. At night, this heat is radiated throughout the house. Apartments and Multi-Unit Housing have Passive Design advantages. With shared walls and floors, proportionately less of the building is exposed to heat and cold.

Questions from the DVD:

4. What is the best orientation for windows during winter?

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5. What are the best methods of shading a house in summer?

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6. What percentage can be saved on heating and cooling energy with effective roof and ceiling Insulation?

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7. What is the Thermal Mass of: 1 Concrete? And 2 Brick?

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8. What is the best way to maximise the benefit of Louvre Windows?

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9. How much light does a Skylight admit compared to a vertical window of the same size?

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10. What are the advantages of having shared walls in a multi-unit building?

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MATERIAL USE

The selection of materials used in construction can yield improvements in the comfort, cost effectiveness and energy efficiency of a home. An important factor to consider in choosing building materials is Biodiversity Off-Site. If products used are the result of the destruction of natural ecosystems, it is preferable to consider using those without such a negative impact.

Questions from the DVD:

11. What are the two Construction Systems and give examples of each?

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12. What is the definition of Embodied Energy?

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13. Give two examples of Embodied Energy in both Construction Systems?

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ENERGY REDUCTION

Energy reduction within the home is a major factor in Environmental Sustainability. Households within Australia account for 17% of all greenhouse gas emissions. It is practical to reduce the usage of power from fossil fuel power stations.

Photovoltaic cells installed on a roof converts renewable solar energy to a 240V household supply. Cooking with natural gas produces one third of the greenhouse gas emissions compared to electricity and is 20% cheaper. Use of new technologies in lighting will also reduce energy costs.

Refrigerators have an energy star rating. Those with the most stars are given the best energy-efficiency rating. Water heating consumes 25% of household energy. Choosing the most energy-efficient system can save money and lower greenhouse gas emissions. Heating and cooling uses 38% of household energy. The choice of a heating or cooling system, combined with passive design principles, will have a dramatic effect on the energy efficiency of a home.

Questions from the DVD:

14. List the energy consumption of Standby, Cooking, Lighting, Appliances, Water Heating and Heating and Cooling.

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15. List three types of light globes and describe their characteristics.

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16. What are the Greenhouse Emissions per year of Electric Off-Peak Storage, Natural Gas Storage, and Solar Energy?
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17. What are the four main energy sources used to heat a home?
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WATER CONSUMPTION

Australia is a mostly arid continent, and at times of severe drought the supply of fresh, clean water is a major problem. How water is consumed in the household is a major priority. There are simple ways to reduce water usage. Low impact toilets with a dual flush, water efficient showerheads, and reduced showering times can have an immediate impact. Collection of rainwater into tanks can be used for flushing toilets, washing clothes and watering the garden. Minimising the size of a lawn and replacing it with garden beds and shrubs, prevents evaporation and reduces surface run-off.

Questions from the DVD:

18. How many homes will be supplied by Sydney's desalination plant? And how is it powered?
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19. What does WELS stand for? And what does it rate?
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20. What percentage is Outdoor Water Use for the average household? What percentage of that do lawns consume?
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THE FUTURE

The way we live and the way we create our environment are interconnected. Designing and constructing homes that are environmentally sustainable makes common sense. Of course, any changes made have to be within the household budget.

DESIGN ASSIGNMENT

Research five simple design alterations for your own home, which will make it more energy efficient. Outline what effect these changes will have on the environmental sustainability of the home.

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