



## Sustainable Building Solutions: Eco-Friendly Insulation Investigation

### Learning Objectives

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- Understand key concepts in sustainable building insulation
- Analyze different eco-friendly insulation materials
- Develop practical skills in sustainable construction planning
- Evaluate environmental impact of building materials

### Warm-Up Knowledge Check (15 minutes)

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*Work with a partner to define these essential terms. Use the reference materials provided to ensure accuracy.*

1. Thermal insulation:

2. R-value:

3. Embodied energy:

4. Sustainable construction:

5. Carbon footprint:

### Material Investigation (25 minutes)

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*Examine the provided insulation samples and complete the analysis table below:*

<b>Material</b>	<b>Physical Properties</b>	<b>Texture</b>	<b>Environmental Benefits</b>
Hemp Insulation			
Wood Fiber			
Recycled Cotton			

## Technical Calculations (30 minutes)

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Using the provided R-value chart and calculator, solve the following problems:

**Problem 1:** Calculate the required thickness of hemp insulation to achieve an R-value of 38 in a roof installation.

**Problem 2:** Compare the heat loss through a wall section using:

- a. Traditional fiberglass insulation (thickness: 140mm)
- b. Wood fiber insulation (thickness: 140mm)

**Problem 3:** Calculate the annual energy savings when upgrading from standard insulation (R-19) to high-performance eco-friendly insulation (R-38) in a 200m<sup>2</sup> house.

## Case Study Analysis (20 minutes)

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Read the provided case study about the Green Office Building Project in Bucharest and answer the following questions:

1. What specific eco-friendly insulation materials were chosen for this project and why?

2. Describe two major challenges faced during the installation process and how they were resolved.

3. Calculate the percentage reduction in energy costs after one year of operation.

4. Explain how the chosen materials contributed to the building's LEED certification.

## Technical Drawing Exercise (45 minutes)

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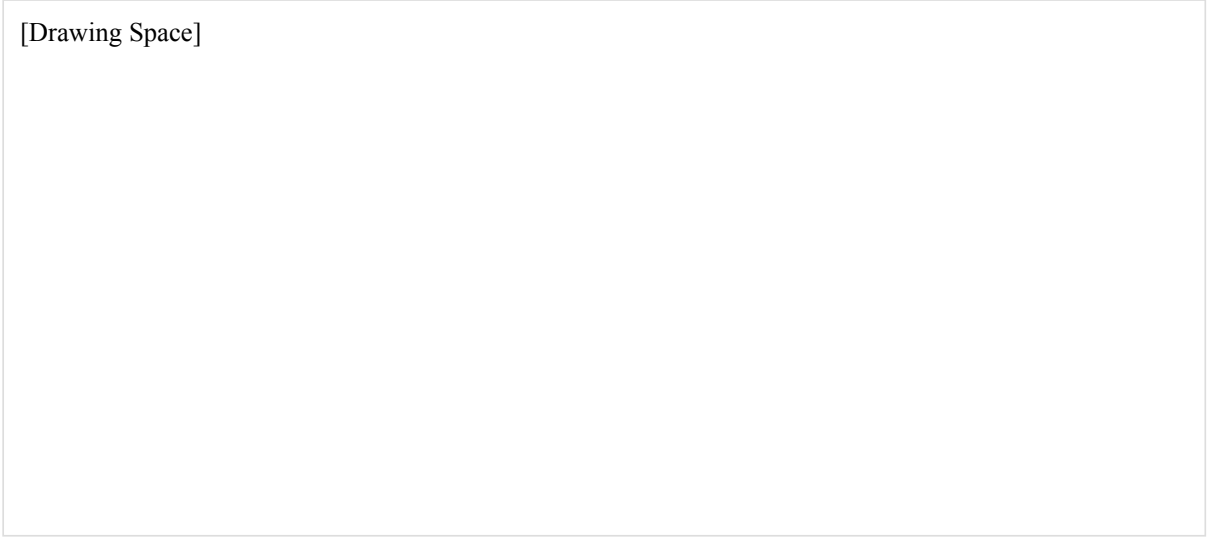
*Create detailed technical drawings showing proper installation methods for eco-friendly insulation:*

### **Drawing 1: Wall Section**

Include and label the following components:

- External cladding
- Vapor barrier
- Insulation layer
- Internal finishing
- Air gaps and ventilation

[Drawing Space]

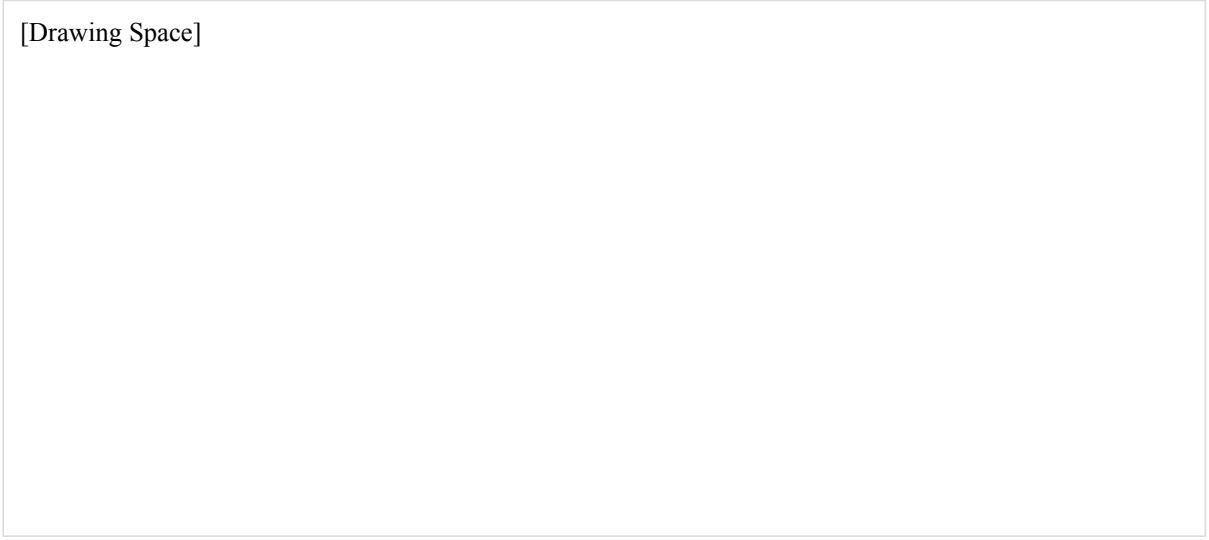


### **Drawing 2: Detail of Insulation Junction**

Show how different insulation sections connect at:

- Wall-roof junction
- Wall-floor junction
- Window reveals

[Drawing Space]



## Environmental Impact Assessment (30 minutes)

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Complete a comparative analysis of different insulation materials' environmental impact:

Impact Category	Hemp	Wood Fiber	Recycled Cotton	Traditional Fiberglass
Carbon Footprint (kg CO <sub>2</sub> /m <sup>2</sup> )				
Embodied Energy (MJ/kg)				
Water Usage (L/kg)				
Biodegradability (Years)				

## Cost-Benefit Analysis (45 minutes)

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Using the provided data, complete a 25-year cost-benefit analysis for each insulation type:

### Initial Costs:

- Material cost per m<sup>2</sup>
- Installation labor
- Additional materials (vapor barriers, fixings)

### Long-term Benefits:

- Annual energy savings
- Carbon credit values
- Maintenance costs
- Replacement frequency

## **Installation Techniques Workshop (60 minutes)**

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*Document the proper installation steps for each material type:*

### **Hemp Insulation Installation**

1. Safety Equipment Required:
2. Wall Preparation Steps:
3. Cutting Techniques:
4. Fitting Methods:
5. Vapor Barrier Installation:

### **Wood Fiber Installation**

1. Safety Equipment Required:
2. Wall Preparation Steps:
3. Cutting Techniques:
4. Fitting Methods:
5. Vapor Barrier Installation:

## Performance Testing Protocol (45 minutes)

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*Design and document a testing protocol for insulation performance:*

### Thermal Performance Testing

Test Parameter	Equipment Required	Method	Expected Results
Heat Flow			
Moisture Resistance			
Air Infiltration			

## Building Regulations Compliance (30 minutes)

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*Review building regulations and complete compliance checklist:*

### Regulatory Requirements

Requirement	Applicable Standard	Compliance Method	Documentation
Fire Safety			
Thermal Performance			
Moisture Control			

## Final Project: Sustainable Building Design (90 minutes)

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*Design a small residential building incorporating sustainable insulation solutions:*

### Design Parameters

- Building footprint: 120m<sup>2</sup>
- Two stories
- Climate zone: Temperate
- Target energy rating: A+
- Budget constraints: Medium

[Design Space - Include floor plans, wall sections, and insulation details]

### Project Deliverables

1. Complete material specifications
2. Installation sequence
3. Cost estimation
4. Energy performance calculations
5. Environmental impact assessment



## Final Assessment

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*Complete this self-assessment checklist to evaluate your understanding:*

- I can explain the key properties of eco-friendly insulation materials
- I can calculate R-values and thermal efficiency
- I understand proper installation techniques
- I can evaluate environmental impact of different materials

## Homework Assignment

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*Research one innovative eco-friendly insulation material not covered in class. Prepare a one-page report including:*

- *Material composition and manufacturing process*
- *Environmental benefits and potential drawbacks*
- *Cost comparison with traditional materials*
- *Real-world application examples*

***Due Date: Next class session***