WE Are Innovators

High School Resource

Module 4: Energy and Housing
**Welcome Educators**

In partnership with Dow, WE is committed to empowering young people to change the world through innovation. When young people are encouraged to use an innovative mindset, they can put their creativity, observation, critical thinking and problem-solving skills to work and design a new solution to issues that challenge our local and global communities.

The WE Are Innovators steps:

- Introduce the module options and select one or more based on student interest and potential links to current classroom program or extracurricular groups
- Use the resources to explore the issue related to the module topic
- Learn about innovative scientific work being done and related career case studies
- Work as innovators to create a new idea for the issue
- Submit one idea per class or group for a chance to win a financial grant for your school and join on a ME to WE Service Trip!

<table>
<thead>
<tr>
<th>Module</th>
<th>Students will explore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sustainable Innovation</strong></td>
<td>• What is an innovative mindset?</td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>• What types of skill sets, problem-solving styles and knowledge support an innovative mindset?</td>
</tr>
<tr>
<td></td>
<td>• What makes a solution sustainable?</td>
</tr>
<tr>
<td></td>
<td>• How do scientists work safely?</td>
</tr>
<tr>
<td></td>
<td>• What does work look like in this area? How do Dow scientists approach problems?</td>
</tr>
<tr>
<td><strong>Circular Economy and Nature</strong></td>
<td></td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>• What is “responsible consumerism?”</td>
</tr>
<tr>
<td></td>
<td>• How can an innovative mindset impact product development or change a related behavior?</td>
</tr>
<tr>
<td></td>
<td>• What does work look like in this career area?</td>
</tr>
</tbody>
</table>

**Guiding Questions**

_Sustainable Innovation_

*How can science combined with critical thinking and creative problem-solving skills work together to solve social issues?*

*How can science be used safely while still meeting the needs of the world’s population?*

_Circular Economy and Nature_

*How do human behavior, attitudes and mindsets about consumption contribute to a sustainable planet?*

*How can science create opportunities beyond the original “reduce, reuse and recycle” approach?*

*How can innovative designers contribute?*

*How can nature lead us to a more sustainable world?*_
<table>
<thead>
<tr>
<th>Module</th>
<th>Students will explore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Waste</strong></td>
<td>- What is meant by food waste and what are the statistics?</td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>- How does innovation in packaging and refrigeration keep food fresh?</td>
</tr>
<tr>
<td>How does food waste impact our ability to eradicate hunger?</td>
<td>- How can technology support human behaviors to prevent food waste?</td>
</tr>
<tr>
<td>How can science create ways to keep food fresher longer?</td>
<td>- What does work look like in this career area?</td>
</tr>
<tr>
<td>How will food preservation ultimately save resources?</td>
<td></td>
</tr>
<tr>
<td><strong>Energy and Housing</strong></td>
<td>- What makes a home energy efficient?</td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>- How exactly do building materials and products save energy?</td>
</tr>
<tr>
<td>How can choices about how we build and maintain homes and buildings create efficiency?</td>
<td>- What opportunities are there in homes and buildings that will create energy efficiency?</td>
</tr>
<tr>
<td>How does energy efficiency affect the environment?</td>
<td>- What does work look like in this career area?</td>
</tr>
<tr>
<td><strong>Transportation Solutions</strong></td>
<td>- What are the physical and economic barriers to transportation in urban and rural areas?</td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>- How do conventional transportation options impact the environment?</td>
</tr>
<tr>
<td>How can transportation options be accessible for all?</td>
<td>- How can science and technology support the development of sustainable transportation?</td>
</tr>
<tr>
<td>How can transportation solutions be safe for both people and the planet?</td>
<td>- What does work look like in this area?</td>
</tr>
</tbody>
</table>

Visit [WE.org/we-schools/program/campaigns/we-are-innovators](WE.org/we-schools/program/campaigns/we-are-innovators) to download the application.
Module 4:

Energy and Housing

Overview:
This module is designed to help students understand that when houses are energy inefficient, they waste money and drain natural resources. Students will explore how traditional housing designs and building materials contribute to heat and cold-air loss and deplete energy sources.

Through this module, students will be introduced to innovative people and organizations that are designing alternative products and services to help people make more responsible choices about how they design their homes and how they think about energy efficiency.

Based on their learning during case study discussions, students will use their creativity and imagination to develop an original, innovative idea related to energy inefficiency.

One idea from each group or class can be submitted to the WE Are Innovators Challenge!

How to Use This Module:
The five parts of this module will develop student understanding of energy and housing issues and how an innovative approach from young people can be used to develop solutions for the future.

1. Exploring the Issue
Engage students in learning about social, economic or environmental issues affecting both local and global communities.

2. Thinking Outside the Box
Introduce students to people and organizations that are developing innovative solutions to help protect the environment.

3. Become an Innovator
Challenge students to use their creativity and innovative mindset to develop an idea that will address the issues related to energy inefficiency.

4. Share and Reflect
Students will be given opportunities to share ideas within the school and potentially their local community. Students will reflect on what they have learned about themselves as innovators and their power to shape the future.

5. WE Are Innovators Challenge
Encourage students to submit their ideas to the WE Are Innovators Challenge.

Use the Educator Planning Form to personalize the module to fit the needs of your students. The recommended module timeline is designed to be flexible enough to adapt to your current unit plans.

The module can be used as part of an existing science unit or as part of an integrated unit that combines Science, Social Studies and English Language Arts.

The culminating activity of creating an innovative solution offers assessment and evaluation opportunities as students apply their science knowledge and skills to a real-world context.

It is important to note that Internet access will be required to access videos and articles used in this module. Make sure to review your school or district’s Internet-use policy before you begin.
Exploring the Issue:

1. Provide each student with a copy of **Blackline Master 1: My Energy Use at Home**. Preview the Blackline Master with students and give them an opportunity to complete it.

2. As a class, discuss and list students’ responses on the board. Make sure students consider energy used for powering devices, lighting, heating and air conditioning, and heating water.


4. Discuss:
   - What are the top energy users in an average home? What uses the least amount of energy?
   - What surprised you most about the statistics on energy use?
   - How does this information help us to understand how we use energy in our homes?

5. Show students the following image that demonstrates heat loss from a house.

Source: [www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/heatrev3.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/energy/heatrev3.shtml)

6. Explain to students that, while the most energy in a home is used for heating and air conditioning, hot and cold air constantly escape from many homes through the:
   - windows
   - gaps around doors
   - roof
   - walls
   - floors

   The red color on the image shows where heat is escaping from the house. When this happens, it means the house is not energy efficient. An energy-efficient home is designed to reduce the amount of energy that is used, which saves money and reduces the strain on our natural resources. Post the definition of energy efficient in the class for students to refer to.

7. Divide students into four groups.

8. Give each group one of the following questions to investigate and provide them with the resources listed below to support their investigation:
   a) How do hot and cold air escape from a house?
   b) How does the loss of heat or cold air from a house create a problem?
   c) In which areas of the country would this problem occur most? Why?
   d) What impact does the loss of heat or cold air have on the environment?

9. Have each group choose one representative to share their findings with the class.

10. To conclude, discuss or have students respond in a short paragraph to the following questions:
    - How can homes that are not energy efficient negatively impact the environment?
    - Why is this an important issue?
Thinking Outside the Box:

1. Show students the pictures from Blackline Master 2: Energy-Efficient Houses.

2. In pairs, ask students to discuss what they think the houses have in common.

3. Ask partners to share their thinking. If students haven’t suggested it, explain that these homes have been designed to be energy efficient. Although they all look different, all of them aim to save money on energy and to reduce their impact on the environment.

   Educator’s Note: An innovative idea is a new or creative idea that changes the way we think about a problem. At first, innovative solutions may seem impossible or unrealistic, but the innovators who create them use their imagination and perseverance to bring these ideas to life. Post the definition of innovative idea on the board for students to refer to throughout the module.

   Source: www.oxforddictionaries.com

4. Using one or more of the following options, and the guiding questions, explore how homes around the world are being designed in new and innovative ways to increase their energy efficiency.

Option 1: Innovative Insulation

Dow is a leader in sustainable innovation. Their 2025 Sustainability Goals are designed to support the United Nations Sustainable Development Goals and to advance the well-being of humanity by helping lead the transition to sustainable planet and society. To learn more about Dow’s 2025 Sustainability goals, check out www.dow.com/en-us/science-and-sustainability/2025-sustainability-goals.

Melissa Rose leads the development of rigid polyurethane foam products for Dow. Rigid polyurethane foam is used to make insulated metal panels, refrigerators, coolers and freezers. She is committed to making sure the appliances we use are as energy efficient as possible. To learn more about Melissa and her work, check out Appendix 1: Working Toward Sustainable Innovation.

Guiding Questions:

a) Why is Dow committed to creating more efficient homes?

b) What skills or knowledge in science and technology do Dow employees like Melissa Rose use in their work?

c) What positive impact does their work have on people and the environment?

d) How does their work represent sustainable innovation?

Option 2: Net-Zero Buildings

Explain to students that architects and home builders around the world are developing net-zero or zero-energy buildings, including houses, office buildings and other structures. These buildings help to save money and reduce the impact on the environment.

A zero-energy building is a building “which produces as much energy as it uses over the course of a year.” Source: www.wbdg.org/resources/net-zero-energy-buildings

Builders of zero-energy homes try to minimize energy loss through the design and materials they choose, and look for ways to produce energy through alternative methods such as solar power.

Watch the following videos to explore what these zero-energy homes look like:

• “Zero House,” www.vimeo.com/79487048 (2:42)


Guiding Questions:

a) How does this house differ from houses you are familiar with?

b) How does the design of this home make it more energy efficient?

c) What positive impact does this idea have on people and the environment?

d) Why did these builders choose to build zero-energy houses?

e) Why is this an innovative idea? How does it change the way we think about energy-efficiency? (Refer to the definition of innovative idea.)

Option 3: Exploring the Geodesic Dome

Around the world, people are choosing to use the geodesic dome shape for their homes. Not only do these houses require fewer building materials, they are also more energy efficient.

Explore the following links to see how using alternative building design can help to reduce a home’s environmental impact.

• “Life Inside a ‘Dome’ Home,” www.youtube.com/watch?v=8aCRg-gXm_8 (2:40)

• “5 Great Reasons to Build a Geodesic Dome Home,” www.inhabitat.com/5-great-reasons-to-build-a-geodesic-dome-home

Guiding Questions:

a) How does this house differ from houses you are familiar with?

b) How does the design of this home make it more energy efficient?

c) What positive impact does this idea have on people and the environment?

d) Why would someone choose a dome or another alternative design when building their house?

e) Why is this an innovative idea? How does it change the way we think about housing design? (Refer to the definition of innovative idea.)

Extension: Invite a local architect, builder or Dow ambassador to the class to discuss how they are creating energy-efficient homes in the local community. Encourage students to ask how they could make their own homes more energy-efficient as well. This experience will help students to deepen their learning in preparation for creating their own innovative idea.

Become an Innovator:

1. Divide students into small groups and challenge them to design their own energy-efficient home. Challenge them to create a new and innovative way to approach it. Remind students that designing an innovative solution may seem difficult at first, but they should use their imagination and challenge themselves to consider ideas that have never been tried before. Refer to the innovative mindset and behaviors discussed earlier.

2. Provide each student or group with a copy of the Student Planning Form to support their work.

Educator’s Note: Explain to students that innovators and scientists must think about their own safety as well. They must always consider hazards or safety risks while they are working or developing their ideas. Discuss each group’s idea and identify any health or safety risks they might present. For example: If students will need tools to develop their ideas, they must consider what safety equipment will be required to use those tools.

3. Inform students that, once they have designed their idea, it will be presented to the class. Advise students on the presentation format options available.

Share and Reflect

1. Ask each group to present their idea. This is a time for students to receive peer and/or teacher feedback. The process of answering questions, clarifying ideas and justifying their thinking will encourage students to continue to develop their skills and mindset as innovators as they return to their idea and make adjustments or revisions.

2. As innovative ideas are completed, create an opportunity for students to present their ideas to other classes in the school, to parents or to other community members. This will not only allow students to celebrate their achievements, but also to take action and raise awareness for the importance of energy-efficient housing. Consider using one of the following options:
   • Host an “Innovation Fair” where students can display and present their ideas at different stations in the school library or a large meeting area and present them to other classes, parents or community members.
   • Ask each group to create a short presentation and record it using video recording software. Share the video on the school website or other social media platforms. Make sure to refer to the school or district Internet-use policy before posting anything online.

3. Collect all Student Planning Forms and presentation materials and conclude the module by asking students to write a reflection in response to one of the following questions:
   • Consider the case studies, what have you learned about the importance of an innovator mindset and approach?
   • How can innovation in science create positive change in local and global communities?
   • To what extent do you see yourself as an innovator? What skills or attitudes do you still need to develop?
   • How has this experienced changed the way you feel about the power of science to solve problems and challenges in the world?
   • How has “innovative thinking” changed your attitudes towards social issues?


Challenge students to justify how their innovation idea supports one or more of the sustainable development goals. Investigate how to contact the United Nations and ask each group to compose a letter to send that outlines what their idea is and how it would contribute to achieving the goal(s) by the UN’s 2030 deadline.
WE Are Innovators Challenge:

1. Challenge students to submit their idea to the WE Are Innovators challenge.

2. Students will need to describe the idea and its potential impact on the issue. Take photos of any prototypes or models created.

3. To submit an idea, download the application form from www.WE.org/we-schools/program/campaigns/we-are-innovators.
Appendix 1: Working Toward Sustainable Innovation

Melissa Rose

What is your role at Dow?
I lead product development for the application side of our business and our technical customer service work for our rigid foam business.

What is your educational background?
I have a Bachelor of Science degree in Chemical Engineering from the South Dakota School of Mines and Technology. I didn’t know anything about engineering in high school, but I had a teacher who suggested that I should consider engineering because of my interest in math and science.

What brought you to Dow?
I started as a co-op student with roles in manufacturing and engineering while attending university. When I graduated, I was hired into manufacturing and then moved to research and development. I have had a great career learning about how chemicals are made and how to make them safer and more environmentally friendly. With my research and development experience, I can better serve our customers and deliver solutions to the market.

What do you like most about your job?
I love to interact with customers to understand their needs to either find an existing solution or to create a new one. In 2014, energy policies in the United States changed and we had to understand the manufacturers’ needs and develop new or improved foams to support them. My team was able to see them go through these major design changes and work alongside them during the transition.

What does being an innovator mean to you?
An innovator brings new products to the market or develops solutions for the market to help society move forward. They focus on how to develop things that improve our lives and how to make things more energy efficient, healthier and sustainable. They are problem solvers who think outside the box, take risks, listen to others and their clients, and think about how to dig deeper to really understand the root of the challenge and find opportunities for solutions.
# WE Are Innovators - Educator Planning Form

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Length (# of days)</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploring the Issue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinking Outside the Box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Becoming an Innovator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share and Reflect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WE Are Innovators Challenge</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Learning Goals
Personalize to fit within your school district context and long-range program goals.

- 
- 
- 

## Curricular Expectations and/or Outcomes to Be Assessed:
How will I connect this to my existing curricular expectations?

- 
- 
- 

## Grouping
- [ ] Small groups
- [ ] Whole class
- [ ] Other: ____________

### Integrated unit:
- [ ] Yes  
- [ ] No

### Subject areas:

**Opportunities for Cross-curricular Planning:**
What connections or links can I make to other subject areas?

- [ ] English Language Arts:
- [ ] Communications/Technology:
- [ ] Social Studies (History/Geography):
- [ ] Science:
- [ ] The Arts (visual or performing arts):
- [ ] Other:

---

Permission is granted by WE Charity to reproduce for classroom use.
Options for Summative Assessment:

- Presentation
- Product: ____________________________
- Reflection
- Other: ______________________________

Planning Considerations:
What resources will I need to help students create and present their ideas? Who will I need to consult?

Options for Extension/Enrichment:
How can the class or individual students go beyond the WE Are Innovators Challenge?
WE Are Innovators Challenge - Student Planning Form

<table>
<thead>
<tr>
<th>What area of innovation will I focus on?</th>
<th>What are my key dates?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Sustainable Innovation</td>
<td>Draft due:</td>
</tr>
<tr>
<td>☐ Circular Economy and Nature</td>
<td>Final version due:</td>
</tr>
<tr>
<td>☐ Food Waste</td>
<td>Presentation:</td>
</tr>
<tr>
<td>☐ Energy and Housing</td>
<td></td>
</tr>
<tr>
<td>☐ Transportation Solutions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What problem am I trying to solve?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Why is it important to me?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Guiding Questions</th>
<th>What do I already know about the problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How does this problem</td>
<td></td>
</tr>
<tr>
<td>effect people, animals</td>
<td></td>
</tr>
<tr>
<td>or the environment?</td>
<td></td>
</tr>
<tr>
<td>• In which region, country</td>
<td></td>
</tr>
<tr>
<td>or city does this problem</td>
<td></td>
</tr>
<tr>
<td>occur most?</td>
<td></td>
</tr>
<tr>
<td>• What information do I</td>
<td></td>
</tr>
<tr>
<td>still need to find out?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guiding Questions</th>
<th>What ideas could help to solve this problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• How will these ideas</td>
<td>List all your ideas, even those that seem</td>
</tr>
<tr>
<td>help to solve the problem?</td>
<td>impossible!</td>
</tr>
<tr>
<td>• Which idea do I think</td>
<td></td>
</tr>
<tr>
<td>will work best?</td>
<td></td>
</tr>
<tr>
<td>• How will it have a</td>
<td></td>
</tr>
<tr>
<td>positive impact on people</td>
<td></td>
</tr>
<tr>
<td>and the environment?</td>
<td></td>
</tr>
<tr>
<td>Guiding Questions</td>
<td>How will my idea work?</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>• What do I need to do first?</td>
<td>Use words and images to make a plan for your idea.</td>
</tr>
<tr>
<td>• What steps will I take?</td>
<td></td>
</tr>
<tr>
<td>• What will my idea look like?</td>
<td></td>
</tr>
<tr>
<td>• Where can I access the materials and resources I will need?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guiding Questions</th>
<th>What materials or resources will I need?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Who can I ask for help?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Guiding Questions</th>
<th>What challenges or problems could I face? How will I resolve them?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Who can I ask for help?</td>
<td></td>
</tr>
</tbody>
</table>

Permission is granted by WE Charity to reproduce for classroom use.
Blackline Master 1: My Energy Use at Home

How do I use energy at home?
Blackline Master 2: Energy-Efficient Houses