WE Are Innovators

Elementary Resource

Module 2: Circular Economy and Nature

AN INITIATIVE OF

MADE POSSIBLE BY

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!

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

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

Visit **www.WE.org/we-schools/program/campaigns/we-are-innovators** to download the application.

Our Learning Skills Legend

Argument formation | Information literacy | Leadership skills | Organization | Action planning | Research and writing | Critical thinking | Reflection

Word Bank	Materials
Circular Economy—An alternative to a traditional linear economy (make, use, dispose) in which resources are kept in use for as long as possible, maximum value is extracted from them whilst in use, then products and materials are recovered and regenerated at the end of each service life.	• A computer with Internet access • Speakers • Blackline Master 1: Jigsaw Organizer • WE Are Innovators - Educator Planning Form • WE Are Innovators Challenge – Student Planning Form • Appendix 1: Working Toward Sustainable Innovation
Environmental Protection—Policies and procedures aimed at conserving the natural resources, preserving the current state of the natural environment and, where possible, reversing its degradation.	
Innovate—Make changes in something established, especially by introducing new methods, ideas or products. Innovator—A person who introduces new methods, ideas or products.	

Sources:
www.businessdictionary.com
www.en.oxforddictionaries.com
www.wrap.org.uk/about-us/about/wrap-and-circular-economy

Module 2:

Circular Economy and Nature

Overview:

This module is designed to help students understand the impact that patterns of human consumption can have on the environment. For example, how does our garbage disposal behavior impact our water resources? Students will explore consumption patterns and the effects on natural resources as well as land, water and air contamination.

Through this module, students will be introduced to innovative people and organizations that are designing alternative products and services to address local and global problems.

Based on the case studies students will use their creativity and imagination to develop an original innovative idea of their own.

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 around environmental protection 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 environmental issues affecting both local and global communities.

2. Thinking Outside the Box
   Introduce students to people and organizations that are developing new and innovative solutions to help address local and global issues.

3. Become an Innovator
   Challenge students to use their own creativity and innovation skills to develop an idea that will address the environmental issues they care most about.

4. Share and Reflect
   Students will be given opportunities to share their 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
   The best idea from the class can be submitted to the WE Are Innovators Challenge!

The **Educator Planning Form** and recommended module timeline are included as support resources to personalize the module to meet student needs and complement 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.

Exploring the Issue:

Educator's Note: Based on discussions and case studies presented in this module, students will explore how innovators use creativity, observation, critical thinking and problem-solving skills to identify and understand problems or issues, and how they develop unique and effective ways of seeking solutions. They will learn how innovators often see large and complex problems as challenges and focus on possibilities first and the obstacles second. Students will see how resilience and reflection help innovators overcome obstacles and adjust until their idea is the best it can be. Albert Einstein once said, "We cannot solve a problem by using the same kind of thinking we used when we created them."

1. To begin, Show students the video "Ocean Garbage Patch Could Be Bigger Than Mexico," **www.cnn.com/videos/world/2017/08/15/south-pacific-garbage-patch-kinkade-pkg.cnn** (3:40) to introduce the effect human consumption can have on the environment.

2. Based on the video, ask students to discuss the following questions with a partner or in a small group:
   a) Where did the plastic come from?
   b) What impact does the garbage patch have on ocean life?
   c) What have humans done to contribute to the problem?
   d) What did Captain Charles Moore mean by a "throwaway society"?

Educator's Note: The following activity will use an active listening strategy to help students engage with other students' responses and contribute new ideas to the discussion. Before starting the discussion, explain to students that when it is their turn to share, they can agree with the previous student's response, or they can offer an alternative idea. This strategy avoids repetitive answers and can prevent anxiety if another student shared the same response they prepared.

3. Ask one pair or group to share their response to the first question, then ask the other students to agree with the response or add a new idea. Continue by asking different groups to respond to the questions and have other students agree or add new ideas.

Educator's Note: The following activity will use the jigsaw strategy. This is a collaborative strategy that helps students learn from one other. Each student will be assigned to a home group and then will join another group to become an expert on a topic or a specific aspect of the content they are learning about. Students then return to their home group to teach the other members about what they have learned.

4. Divide students into groups of four and number each student in the group from one to four. These will be their home groups. Ask students to then form new groups by joining students who have the same number. These will be their expert groups. Give each group one of the following articles to read and the questions below to guide their reading. Provide each student with a copy of Blackline Master 1: Jigsaw Organizer to help them record their learning to share with their home groups.

Educator's Note: Make sure to preview all articles and audio files prior to the activity to ensure the suitability for the class age group. As an alternative, select one article to read and discuss as a class.

Guiding Questions:

- What problem is effecting the environment in the article?
- Why is it an important issue?
- Where is it occurring?
- Who is being affected by it?
- How are humans contributing to or causing this problem?

Articles:

a) "Runoff, " **www.nationalgeographic.org/encyclopedia/runoff**

b) "Smog Delays Flights in China," **www.tweentribune.com/article/tween56/smog-delays-flights-china**

c) "Severe Pollution Causes India's Bellandur Lake To Spew Toxic White Foam," **www.dogonews.com/2015/11/5/severe-pollution-causes-indias-bellandur-lake-to-spew-toxic-white-foam**

d) "These Killer Whales Exhale Sickening Germs," **www.sciencenewsforstudents.org/article/these-killer-whales-exhale-sickening-germs**

5. Once students have read the article and discussed the questions, they will return to their home groups to share what they have learned.

6. To conclude, have students write a short reflective paragraph or record an oral response describing what they have learned about issues affecting the environment and how they feel about the fact that human behaviors and attitudes are causing or contributing to the problem.

Enrichment

To help students understand more about how these issues are affecting their local community, encourage them to investigate and get involved with groups or initiatives that are working to protect local natural resources. This experience will help students to deepen their learning in preparation for creating their own innovative idea.

Thinking Outside the Box:

1. As a class, brainstorm what students already do in their everyday lives to take care of the environment. For example: recycling, not littering or using a reusable water bottle.

2. Explain that, even though we are taking individual actions to protect the environment, environmental issues still exist with serious impacts on our planet.

> **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 this definition in the class for students to refer to throughout the module.
> Source: www.en.oxforddictionaries.com

3. Use one or more of the following options and guiding questions, to explore how people around the world are working to find new and different ways to address environmental issues.

Option 1 : A New Approach to Environmental Protection

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**.

- Sofia Benedicto is a chemical engineer who is passionate about making sure that every project she develops is not only good for business, but good for nature as well. Her focus on valuing nature is helping to redefine what it means to protect the environment. To learn more about Sofia and her work, check out Appendix 1: Working Toward Sustainable Innovation. To see how a business commits to valuing nature in their work, visit **www.dow.com/en-us/science-and-sustainability/2025-sustainability-goals/valuing-nature**.

- Dr. Han Zhang is a sustainability leader and advocate in Dow's Packaging and Special Plastics area. Dr. Zhang is committed to creating products that are not only produced more efficiently, but also contribute to making our planet more sustainable. To learn more about Dr. Zhang and his work, check out Appendix 1: Working Toward Sustainable Innovation. To see an example of Dr. Zhang's work, check out the Hefty EnergyBag program, which turns non-recycled plastic into usable energy. Visit **www.dow.com/en-us/science-and-sustainability/sustainable-brands-detroit-2017/hefty-energy-bag** to learn more.

Guiding Questions:

a) Why is Dow committed to valuing nature?

b) What skills or knowledge in science and technology do Dow employees like Sofia Benedicto and Dr. Zhang use in their work?

> **Educator's Note:** Appendix 1: Working Toward Sustainable Innovation is available at two different reading levels to meet the needs of all your students.

Option 2: Smog-Capture Technology

Introduce students to "Mexico City's Smog-Capture Building," **www.bbc.com/news/av/world-latin-america-25538944/mexico-city-s-smog-capture-building**, which helps clean and filter the city's air pollution.

Guiding Questions:

a) What environmental problem does this idea try to solve?

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

c) Can this idea be used in other places around the world?

d) What challenges do you think the innovators faced?

e) Why is this an innovative idea? How does this idea change the way you think about how we can protect the environment? (Refer to the definition of innovative idea.)

Extension

For a more challenging case study, use the option below:

> **Educator's Note:** According to the Ellen McArthur Foundation, "A circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times." For more information about this concept, visit www.ellenmacarthurfoundation.org/circular-economy/overview/concept.
>
> To learn more about how Dow is advancing the circular economy, visit www.dow.com/en-us/science-and-sustainability/2025-sustainability-goals/advancing-a-circular-economy.

Present students with an alternative to the strategies and initiatives they are accustomed to by introducing them to the concept of a "circular economy" using the video "Re-thinking Progress: The Circular Economy," **www.youtube.com/watch?v=zCRKvDyyHmI** (3:48).

Guiding Questions:

a) What is a *circular economy*?

b) What environmental problem does this idea aim to solve?

c) Why is this an innovative idea? How can the circular economy model change human behavior?

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

e) How was this innovation inspired by nature?

f) How does a circular economy relate to acting as a responsible consumer?

Become an Innovator:

1. Divide students into small groups and challenge them to choose one environmental issue and 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.

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

> **Educator's Note:** Explain to students that innovators and scientists must also think about their own safety and the safety of those around them. They must always consider hazards or safety risks while they are working or developing their ideas. Discuss each group's ideas 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.

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.

> **Educator's Note:** If this presentation will be used to assess students' knowledge and skills based on curricular expectations, it's important to first establish research and/or presentation criteria with students so they are clear about what is expected.

2. As innovative ideas are completed, create opportunities 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 issues of environmental protection in their local and global communities. 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:

   - What have you learned about the importance of an innovative 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?

4. Encourage students to make a connection to the United Nations Sustainable Development Goals. Introduce students to the United Nations Sustainable Development Goals by showing them **"The World's Largest Lesson 2016," www.vimeo.com/178464378**. Examine the purpose of the goals and what each of the 17 goals are by visiting **www.un.org/sustainabledevelopment/sustainable-development-goals**.

   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, and take photos of any prototypes or models students 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

Dr. Han Zhang—Version 1

What is your role at Dow?

I am the sustainability and advocacy leader for Dow Packaging and Specialty Plastics, Asia Pacific. I am responsible for supporting Dow's 2025 Sustainability Goals.

What is your educational background?

I received my doctorate degree at the School of Natural Resources and the Environment from the University of Michigan. I earned my bachelor's and master's degrees in thermal engineering from Tsinghua University. I also received a certificate in MBA from the University of Michigan.

What brought you to Dow?

At the University of Michigan, I learned how the development of towns and cities can impact the environment and I became more interested in sustainability. After graduating, I began wondering what I could do that was good for both business and the environment, and then I discovered Dow. Dow has a long history of working toward sustainability goals and this was something I was passionate about.

What do you like most about your job?

Being able to do something good for business, people and the environment is the best part of my job. To be able to do that, you need to be creative and innovative because most of the time there is no clear pathway. For example, to address the problem of plastic packaging that could not be recycled, we developed the Hefty EnergyBag program. Dow has now teamed up with local governments and businesses to collect these plastics and convert them into energy. This keeps them from filling up landfills.

What does being an innovator mean to you?

Being an innovator gives me the opportunity to do something new, solve problems, test different ideas and continue to learn new techniques and gain knowledge.

Appendix 1: Working Toward Sustainable Innovation

Dr. Han Zhang—Version 2

What is your role at Dow?

I am the sustainability and advocacy leader for Dow Packaging and Specialty Plastics, Asia Pacific. In my current role, I am responsible for pushing forward Dow's 2025 Sustainability Goals and developing strategies to grow business value by using Dow's sustainability expertise.

What is your educational background?

I received my doctorate degree in the School of Natural Resources and the Environment from the University of Michigan. I earned my bachelor's and master's degrees in thermal engineering from Tsinghua University. I also received a certificate in MBA essentials and entrepreneurship from the University of Michigan's Ross School of Business.

What brought you to Dow?

At the University of Michigan, I learned about the environmental impact economic development was having and became more interested in sustainability. After graduating, I began wondering what I could do that was good for both business and society, and then I discovered Dow. Dow has a long history of implementing multi-generation sustainability goals and this was something I was passionate about, so I joined the company without any hesitation.

What do you like most about your job?

Being able to do something good for business and society is the best part of my job. To be able to do that, you need to be creative and innovative, because most of the time there is no clear pathway. For example, in order to address non-recyclable plastic packaging, we developed and implemented the Hefty EnergyBag program. Dow has now teamed up with municipal and industry partners to collect and convert these materials into energy, and keep them from filling up landfills.

What does being an innovator mean to you?

Being an innovator gives me the opportunity to do something new, solve new challenges, test different ideas and continue learning new techniques and gaining knowledge.

Appendix 1: Working Toward Sustainable Innovation

Sofia Benedicto—Version 1

What is your role at Dow?

I work as an remediation specialist. My job is to protect people and the planet by helping other teams reduce their impact on the environment.

What is your educational background?

I have a bachelor's degree in chemical engineering from Universidade Federal do Ceará, which is in Brazil. I also have a specialization in sustainability management from Universidade de Salvador.

What brought you to Dow?

I joined Dow eight years ago because I wanted to create new solutions to help others, using chemistry, biology and physics. I was motivated to join because I was passionate about sustainability, which is a key element of their mission and values.

What do you like most about your job?

As scientific knowledge is changing every day, I love that I constantly get to learn new things. Every project we do takes us one step closer to a better, cleaner and safer environment.

What does being an innovator mean to you?

To me, being an innovator means making connections that are not obvious, and connecting concepts and ideas to solve problems. An example of this in my role at Dow is that I always consider the impact a new project might have on an ecosystem and what the benefits to the ecosystem might be. This is part of our decision-making process to find the solution that is good for both business and for nature.

Appendix 1: Working Toward Sustainable Innovation

Sofia Benedicto—Version 2

What is your role at Dow?

I work as a remediation specialist. My job is to help protect people and the planet by working with other teams to help minimize the impact industries have on the environment.

What is your educational background?

I have a bachelor's degree in chemical engineering from Universidade Federal do Ceará, which is in Brazil. I also have a specialization in sustainability management from Universidade de Salvador.

What brought you to Dow?

I joined Dow eight years ago because I wanted to innovate new solutions that would help others, using chemistry, biology and physics. I was motivated to join because I was passionate about sustainability, which is a key element of their mission and values.

What do you like most about your job?

As the scientific knowledge in this field is advancing every day, I love that I constantly get to learn new things. Every project we do takes us one step closer to a better, cleaner and safer environment.

What does being an innovator mean to you?

To me, being an innovator means making connections that are not obvious, and connecting concepts and ideas to solve problems. An example of this, we at Dow are considering the impacts and benefits to ecosystem services from a given project, and using this as part of our decision-making process to find the solution that is good for both business and nature.

WE Are Innovators - Educator Planning Form

Lesson	Length (# of days)	Start Date	End Date
Exploring the Issue			
Thinking Outside the Box			
Becoming an Innovator			
Share and Reflect			
WE Are Innovators Challenge			

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: _____

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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?

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WE Are Innovators Challenge - Student Planning Form

What area of innovation will I focus on?

- ☐ Sustainable Innovation
- ☐ Circular Economy and Nature
- ☐ Food Waste
- ☐ Energy and Housing
- ☐ Water Access and Reuse

What are my key dates?

Draft due:

Final version due:

Presentation:

What problem am I trying to solve?

Why is it important to me?

Guiding Questions

- How does this problem effect people, animals or the environment?
- In which region, country or city does this problem occur most?
- What information do I still need to find out?

What do I already know about the problem?

Guiding Questions

- How will these ideas help to solve the problem?
- Which idea do I think will work best?
- How will it have a positive impact on people and the environment?

What ideas could help to solve this problem?
List all your ideas, even those that seem impossible!

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WE Are Innovators Challenge - Student Planning Form

Guiding Questions • What do I need to do first? • What steps will I take? • What will my idea look like? • Where can I access the materials and resources I will need?	**How will my idea work?** Use words and images to make a plan for your idea. **What materials or resources will I need?** Consider what building materials, tools or technology you will need and what type of space you will require to work. For example: glue gun, cardboard/wood, laptop, etc. **What could the hazards or safety risks be?**
Guiding Questions • Who can I ask for help?	**What challenges or problems could I face? How will I resolve them?**

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Blackline Master 1: Jigsaw Organizer

What problem is affecting the environment in the article?

Who is being affected by it?

Why is it an important issue?

Where is it occurring?

How are humans contributing to or causing this problem?

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