Recycling & the Circular Economy
Lesson title

Zero Waste and the Circular Economy

Grade level

Grades 6-12

Lesson overview

More and more students are practicing recycling and understand its benefits to the planet. But they might not realize recycling is also a vital component of the “circular economy,” a system designed to phase out pollution and waste and phase in products and solutions that have longer life spans and multiple uses. Schools, businesses, cities, and governments are now actively developing “circular systems” to conserve resources, save money, and reduce waste.

Not only is it important for students to understand the principles of “circularity,” but it is also motivating for them to know what new products can come from their recycling efforts. Rubicon’s “Trick or Trash” campaign uses a specially-designed recycling box for candy wrappers and is donated to schools ahead of Halloween. The accompanying activities are designed for students in grades 6-12 and lay the foundation for understanding a circular economy.
Learning Outcomes

Students will be able to:

• Define the concepts of zero waste, linear and circular economy
• Explain the benefits of a circular vs. linear economy
• Identify key principles of a circular economy
• Identify and define five approaches individuals and business can take to create an effective circular economy and provide examples.
• Provide examples of everyday behavior change that can contribute to reduced or zero waste.
• Analyze an existing business model to determine circular and/or linear characteristics and consider the effectiveness in terms of a zero-waste goal. Identify any existing strategies that could be models for other businesses and/or suggest strategies that may help the business develop a more circular approach.
Enduring Understanding

Students will understand the ecological and economic benefits of a circular economy and how adjusting linear business models and changing everyday behaviors can contribute effectively toward the significant reduction and, ideally, elimination of waste.

Guiding Questions:

- What is the circular economy? Give an example.
- What actions can be taken by individuals and companies to minimize waste?
- What are some examples of cyclical systems in nature? How could a business or individual model this system to decrease waste?
- What are some everyday behaviors in your life that could be changed to reduce waste?
- How can public awareness of actions that support sustainability be increased?
Vocabulary
Linear Economy: The flow has a clear beginning and end: Goods are produced, used and discarded in a “take-make-waste” approach.

Circular Economy: The flow is cyclical and regenerative: Products and services are designed in a way that allows them to be reused, either in the biological or technical cycles. All products are manufactured in a way so they can be disassembled and materials will either be broken down by nature or returned to production.

Zero Waste: Conservation of resources through responsible production, consumption, reuse and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.

Biomimicry: An approach to learn from the patterns and strategies of nature to find solutions to meet our needs and challenges by creating products, processes, and policies modeled after successful natural systems.

Cradle to Cradle: A sustainable strategy that mimics the regenerative cycle of nature in which waste is reused. In nature, when a tree or animal dies or creates waste, that waste breaks down and becomes nutrients for another process; The Cradle to Cradle approach attempts to eliminate waste altogether by focusing on a cyclical process.
Vocabulary

Cradle to Grave: A term used in life-cycle analysis to describe the entire linear life of a material or product up to the point of disposal.

Performance Economy: A “closed-loop” approach to production processes focusing on product-life extension, long-life goods, reconditioning activities (remanufacturing, refurbishing, and repair) and waste prevention.

Industrial Ecology: This approach aims at creating closed-loop processes in which waste from one industry or process serves as an input for another, thus eliminating the notion of a wasteful by-product.

Natural Capitalism: Focuses on increasing the productivity of natural resources and shifting to biologically inspired closed loop systems modeled after nature’s cyclic designs where every output is either returned harmlessly to the ecosystem as a nutrient or becomes an input for the next step in the process/flow.
Materials / Resources

ACTIVITY 1:
- Knowledge Building slides 11-14
- Rubicon blogs
- Drawing/writing utensils
- Design/graphing program or phone/computer for recording (depending on method of illustration chosen)

ACTIVITY 2:
- Rubicon blogs
- Reflection questions

ACTIVITY 3:
- Link to case studies
- Rubicon blogs
Knowledge Building
Understanding a Circular Economy
What is the circular economy?

In a linear economy, the flow has a clear beginning and end: Goods are produced, used and discarded in a “take-make-waste” approach.

In a circular economy, the flow is cyclical and regenerative: Products and services are designed in a way that allows them to be reused, either in the biological or technical cycles. All products are manufactured in a way so they can be disassembled and materials will either be broken down by nature or returned to production.
Principles of Circular Economy?

1. “Designing out” waste or simply rework the systems to not produce waste. This is achieved by design of product or services that are durable, uses recyclable material, and are repairable;

2. Identifying and separating the biological components from technical components of waste. Biological components (residual resources that are non-toxic, often organic like paper and wood) are safely returned to the biosphere; Technical components (unsuitable for biosphere systems, like metals and plastics) are reused indefinitely. Example: Separating waste at home, composting green waste and recycling other waste, such as aluminum, glass, paper, plastics.

3. Using renewable energy to decrease dependence on coal and other fossil fuels and producing locally when possible.
5 Approaches to Create a Circular Economy

1. **Biomimicry**: An approach to learn from the patterns and strategies of nature to find solutions to meet our needs and challenges. The core idea is that nature has already solved many of the problems we face. In the context of sustainability, the goal is to create products, processes, and policies modeled after successful natural systems.

2. **Cradle to Cradle**: A sustainable strategy that mimics the regenerative cycle of nature in which waste is reused. In nature, when a tree or animal dies or creates waste, that waste breaks down and becomes nutrients for another process. While the linear Cradle to Grave approach aims to decrease waste, the Cradle to Cradle approach attempts to eliminate waste altogether by focusing on a cyclical process.

3. **Performance Economy**: A “closed-loop” approach to production processes focusing on product-life extension, long-life goods, reconditioning activities (remanufacturing, refurbishing, and repair) and waste prevention.
5 Approaches to Create a Circular Economy

4. **Industrial Ecology**: This approach aims at creating closed-loop processes in which waste from one industry or process serves as an input for another, thus eliminating the notion of a wasteful by-product. With an emphasis on natural capital restoration, industrial ecology also focuses on social well-being.

5. **Natural Capitalism**: “Natural Capital” refers to the world’s natural assets: soil, air, water (abiotic resources), and all living things (biotic resources or biodiversity). It is a global economy in which business and environmental interests overlap, recognizing the interdependencies that exist between the production and use of human-made capital and flows of natural capital. It focuses on increasing the productivity of natural resources and shifting to biologically inspired closed loop systems modeled after nature’s cyclic designs where every output is either returned harmlessly to the ecosystem as a nutrient or becomes an input for the next step in the process/flow.
Activities
Activity 1

Circular Logic: Picturing a Circular Economy

Review the slides in the “Knowledge Building: Understanding a Circular Economy” section of this presentation and read the blogs below. Illustrate examples of linear and circular economies as a drawing, a narrative, a video, or create it using a design or graphing program. Discuss the similarities and differences and identify examples of behavior change that could work towards transforming a linear economy to a circular economy.

Quick tip:
No cheating! Do not cut and paste examples from the internet, simply create a model based on your current understanding of linear and circular economies. There will be plenty of opportunities for further exploration.

RUBICON BLOGS

- Building the Circular Economy
- The Economic Benefits of a Circular Economy
- A Future Without Waste
Activity 2

What a Waste! Reflecting on the Waste Crisis

Read 2-3 of the short blogs below and choose one blog to examine and comment on using reflection questions. In addition, share what thoughts or questions you have on the subject. With guidance from your teacher the commentary can be written, discussed with a partner or group, or presented to the class.

RUBICON BLOGS

• What is a Materials Recovery Facility?
• Dumpster Diving: How to Perform a Waste Audit
• The Waste Wake Up Call
• Sustainable Packaging: Everything You Need to Know
• Rubicon Reports on New Plastics Economy Progress
• Microplastics: The Little Big Threat Lurking Everywhere
• Plastic Waste: What it is and How to Solve It
Activity 2

Reflection questions

• Why is excessive waste becoming a crisis and what are the negative impacts?
• Recycling is important, but sometimes there is confusion that reduces the effectiveness of recycling efforts. What are some of these challenges and how can they be addressed?
• Why are plastics a major concern in terms of the waste crisis and how can plastic waste (and production) be significantly reduced? What are some “greener” alternatives?
• What are some innovative ideas for reducing waste, increasing public awareness, and encouraging effective behavior change (for companies & individuals)? What can YOU do?
Designing a Greener World

The industrial revolution has helped raise the level of comfort and quality of human life, but in the process we have unfortunately created systems that are heavily dependent on the use of energy and other resources to produce and deliver products and services, as well as contributing significantly to the waste crisis. However, an increasing number of companies are embracing innovative circular economy models to reduce energy use, protect natural resources and reduce or eliminate waste through regenerative practices.
Activity 3

Directions

• Review the slides “Three Principles of a Circular Economy” (slide 12) and “Five Approaches to Creating a Circular Economy (slides 13 and 14)
• Review the short blogs.
• On the next page, explore one or more case studies that are of interest to you, about companies employing inspiring and effective strategies to reduce waste and negative environmental impact.

Rubicon blogs

• Building a Circular Economy is a Corporate Social Responsibility
• How to Make Waste Reduction Pay
Company case studies

- **Fair Phone**: Sustainable smartphones
- **Lucart Professional**: Sustainable beverage cartons
- **Sheep Inc.**: Fashion working with nature
- **Resortecs**: Dissolvable stitches that improve clothing recycling
- **Apeel**: A plant-based coating to reduce food waste
- **Napapijri**: 100% recyclable clothing
- **ThredUp**: Online platform for buying secondhand clothes
- **Groupe Renault**: World’s first circular economy factory for vehicles
- **Biopak**: Compostable food service packaging
- **Niaga**: Recyclable carpets, mattresses & furniture
Design Challenge:
Propose design solutions to model a circular economy by significantly reducing waste in a business or product of your choice (e.g., fashion, automotive, food, packaging, electronics, etc.):

1. Choose a product or service
2. Identify and define the typical problem with this type of product or service in terms of a linear economy model, resource usage and excess waste.
3. Propose a business model or strategy promoting solutions to significantly reduce (or eliminate!) waste and negative impact on natural resources.

Quick tip:
Consider basing your model on one or more of the approaches identified in slides 13 and 14, “Five Approaches to Creating a Circular Economy and/or a company case study that inspires you.”
Activity 3

Reflection 1

• How has your understanding of linear vs. circular economies changed since the first activity?

• Biomimicry is an approach to learn from the patterns and strategies of nature to find solutions to meet our needs and challenges. Can you think of an example of an effective system, behavior or strategy in nature after which a company or individual could model a waste reduction plan?

• Is there a particular company or product that inspires you in terms of striving toward zero waste through circular, regenerative practices? Do you have an idea for one?
Reflection 2

• What are some things consumers can do to effectively encourage businesses to pursue a circular rather than linear economy?

• Can you identify opportunities for behavior change in your daily life that could significantly reduce waste and/or negative impact on natural resources?

• Plastic waste is a major concern. What strategies to reduce plastic production, consumption and waste interest you? Do you have ideas about how to tackle this problem?
The life of your Halloween candy

What happens to the 600 million pounds of candy Americans buy for Halloween each year?
Trick or Trash this Halloween?

- Collect your wrappers
- Bring them to school and place in the “Trick or Trash” recycling bin
- We will fill up the box and send it to the recycling company
Supporting resources

- United States Environmental Protection Agency
- National Geographic – Pollution
- RUBICONMethod
- Rubicon – A guide to what makes something recyclable
- Recycle Across America

- Ellen MacArthur Foundation
- World Economic Forum

- National Geographic – Great Pacific Garbage Patch
- ICUN – Marine Plastics
- National Wildlife Federation Stemming the Tide: Taking Action on Campus Against Plastic Pollution
TRICK or TRASH

Thank you!