

The Zero Waste Project

RECYCLING ECONOMICS

Suggested Grade Level: High School

Program Goal: Through design of a zero waste model, students will gain an increased understanding of the process and factors involved in moving a community to zero waste for increased resource recovery and conservation.

Concepts Covered: zero waste; resource recovery; life cycle of materials; waste prevention; linear system; cyclical system

Suggested Time Frame: 3 class periods

Class Period 1

- Engage – Environmental footprint
- Explore – Assign Zero Waste Project

Class Period 2

- Explain – Zero Waste presentations and voting
- Elaborate – Assign community stakeholder research

Class Period 3

- Elaborate – Present arguments at “community meeting”
- Evaluate – Discuss and present ideas to local recycling representative

Lesson Objectives: Students will be able to:

1. Give at least three reasons why cities have waste diversion programs.
2. Understand the difference between linear and cyclical systems.
3. Define the term “zero waste” and understand its role in the economics of waste prevention and recycling.
4. List at least three factors to consider in becoming a zero waste community.

Standards: Missouri Standards: High School Science

- Strand 4: Changes in Ecosystems and Interactions of Organisms with their Environment
1Ca, 1Cb, 2Ba, 2Bc
- Strand 7: Scientific Inquiry
1Ca, 1Da, 1Db, 1Ea, 1Eb, 1Ec
- Strand 8: Impact of Science, Technology and Human Activity
1Ba, 1Ca, 3A, 3Ba, 3Bb, 3Bc, 3Da, 3Db

Materials:

Materials Included:

- Pre and Post Assessment
- “Zero Waste Planning” worksheet
- “Community Feedback” worksheet

Teacher Provided Materials:

- Soda can or other commonly used item

Engage

As a group, talk the students through the “Environmental Footprint” calculator at <http://myfootprint.org/>. This quiz demonstrates the amount of land and ocean required to sustain your consumption patterns and absorb your waste on an annual basis. It ends up telling you “How many ‘earths’ we would need if everyone had the same habits as you.”

- *What do you think of the results?*
- *Are you surprised?*
- *Do you think every place is like this?*
- *What does this say about waste production?*
- *What types of waste do we produce at school? At home? Is it the same everywhere?*
- *What kinds of problems can this lead to?*
Increased cost to manage waste, need for space to put all of the waste, environmental impacts such as pollution and increased

greenhouse gas production.

- *What are some solutions?* Take answers from the students, but be sure to include “reducing resources used, recovering and reusing resources when possible, and recycling” in the answers.
- *How many of you recycle at home? What kinds of things do you recycle? Does everyone in your family recycle?*
- *Does your family compost?*

Ask the students why they think cities have recycling and composting programs. Possible answers include:

- Less discards in landfills
- Less discards incinerated
- Make money on recycled materials
- Demand from the residents
- Environmental benefit to the community
- Economic benefit to the community (recycling creates more jobs than landfilling)

Ask the students why they think states (like Missouri) have bans on yard waste in landfills. Possible answers may include:

- Divert organic waste from landfills. When organic wastes decompose under anaerobic conditions, such as are present in a landfill, the greenhouse gas methane is produced.
- Create a useful product that can be used as soil amendment for horticultures and agriculture.
- Grow the economy and jobs through the composting industry.

Explore

Hold up an aluminum soda can or some other product that is commonly used or consumed every day. Ask the students how many of them have used that product in the last few days. *What did they do with it when they were done? Did they ever stop to think what it took to create that product or what happens to it when they dispose of it?*

Explain that to make the best decisions, it is important to be as aware as possible about the life cycle, or the total process of creating, using and disposing of materials or products made from the Earth’s resources. A good overview of a life cycle of a product can be found at <http://www.extension.umn.edu/distribution/naturalresources/DD5569.html>.

Show the students the soda can or other item again. Ask them to list the steps in the life cycle of

that product. This should include things such as extracting the raw materials, transporting those materials to a factory where they can be processed into the product, transporting the product to a retail location, purchasing of the product by the consumer and then disposal of the product. As these steps are listed, they should be recorded in a horizontal line on the board. Ask the students to describe what the list looks like—a line! And if the process goes in one direction, ending with disposal in a landfill or some other permanent method, it's referred to as a **linear system**.

Ask the students:

- *What's the problem with a linear system?* It assumes an endless supply of resources.
- *Is that really the case in the real world?* No.
- *What are some other alternatives to permanent disposal of the product when the consumer is done?* Reuse or recycle the product.

Draw an arrow from the disposal step around and back into the processing step. This is referred to as a **cyclical system** because resources are incorporated back into the production process.

- *What are the benefits of a cyclical system?* Cyclical systems save energy, resources and money needed for extraction and transportation and keeps waste out of the landfill.

Tell the students the name of this activity is the "Zero Waste Project." Ask the students what they think the term "**zero waste**" means. They might be able to guess from the terms used that it means that no waste is produced, and they are essentially correct. Explain that the only peer-reviewed internationally accepted definition of Zero Waste was developed by the Zero Waste International Alliance (ZWIA) to assist businesses and communities in defining their own goals for Zero Waste:

"Zero Waste is a goal that is both pragmatic and visionary, to guide people to emulate sustainable natural cycles, where all discarded materials are resources for others to use. Zero Waste means designing and managing products and processes to reduce the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that may be a threat to planetary, human, animal or plant health."

In simpler terms, it means that the transition to zero waste, that is, to a "**cradle-to-cradle**" future in which products are designed to be cycled back into products, organics are cycled safely back into soil, toxins that cannot be safely recycled are banned, and discards that cannot be recycled are specially treated and buried in ever-diminishing landfills (<http://www.sierraclub.org/committees/zerowaste/policies/>).

In addition, the waste being referred to is not only at the end of a product's life, but throughout the whole process of extraction, production and consumption of that product. This shift from a linear system to a cyclical system with no waste requires a shift in both the consumer and producers' mindset and decisions.

Divide the students into teams of 3–4 and present the following scenario to the students: “The community wants more/better recycling! Your job is to develop a model zero waste program for this community.” Direct students to use the worksheet to help guide their research, which includes factors such as:

- Benefits to the community
- Possible negative impacts
- Types of materials recycled
- Types of organics composted
- Who will be impacted by these services
- How you will collect those materials
- Frequency of trash, organic, and recycling collection
- How you will get the community to participate?
- What steps need to occur for each of these scenarios to become a reality?
- And if you’re really feeling up to, a budget for the program!

Good places to start researching these questions are:

- Grass Roots Recycling Network Zero Waste Communities page (<http://www.grrn.org/page/zero-waste-community>)
- Zero Waste Alliance (<http://www.zerowaste.org/>)
- EPA’s Wastewise program (<http://www.epa.gov/epawaste/consERVE/smm/wastewise/index.htm>)

Students should also look at other zero waste communities to see how they manage their programs and what sort of results are they getting. Information can often be found on that community’s official website.

Explain

Using PowerPoint or Prezi (or some other format) have students present their plan to the rest of the class, giving strong arguments as to why their plan is the best. Be sure to let the students ask each other questions as the plans are presented.

Once all presentations have been completed, let the students vote to select one option.

Once results are in, let the students discuss why they chose one option over another.

Elaborate

Now that a plan has been selected, divide the class into groups of 2–4 and assign each a role in the community, including:

- A local business
- Waste hauler
- Local politician
- Local resident
- Recycling facility manager
- Compost facility manager
- Landfill manager

Have each group research and come up with rationale either for or against the chosen program. Be sure to have groups discuss the short and long term impacts of each option.

Students may wish to contact local entities such as theirs to discuss how zero waste programs have worked (if at all) for them.

Once the research is completed, tell each group to select a “spokesperson” to explain their position on the selected zero waste program to the rest of the class at the ensuing “community meeting”.

Hold a “community meeting” with the class to, once again, present the final plan. Let representatives from each group present their opinions to the rest of the class. Does anyone object? Are their reasons valid? Can something be done to revise the program to meet these concerns?

Develop a final plan for the community. What do the students think the next step would include?

Evaluate

Explain that there is no national law that mandates waste diversion, so state and local governments often introduce recycling requirements. Bring a local recycling representative to the class to have them discuss any local and state laws or requirements regarding recycling, household hazardous waste, and other solid waste products.

When the representative is in the class, have the students present their final recycling plan to that person and get their feedback.

Extensions

Refer to “Recycling Rules” activity in the Community to Classroom 3R’s Education Lessons found on the St. Louis County Resourceful Schools website at <http://www.resourcefulschools.org/teachers/lesson-plans/grade-5-pick-up-a-new-attitude-waste-watchers-recycling-rules> for more activities about recycling. Even though this lesson is geared to a fifth grade level, there is some great information about how recycled materials are processed at a recycling facility.

Have students view “The Story of Stuff” YouTube video at <http://www.youtube.com/watch?v=gLBE5QAYXp8>. What do they think? Facing the Future has an entire two-week unit of lessons focusing on consumerism, correlated to this video, and is available as a free download at <https://www.facingthefuture.org/Curriculum/PreviewandBuyCurriculum/tabid/550/CategoryID/4/List/1/Level/a/ProductID/1/Default.aspx>.

Pre and Post Assessment

These questions can be used to assess the students understanding of the topics covered in this lesson. Ask the students the same questions before and after the unit using the Student Copy Page. Answers are given on the Teacher Answer Page.

Teacher Answer Page

Pre and Post Assessment Questions for *The Zero Waste Project*

Short Answer Questions

1. List three reasons why a city might have a waste diversion program. (3 points)

- **Less discards going to a landfill, which saves the community money and helps the environment**
- **Make money on recycled and composted items**
- **Demand from community**
- **Environmental benefit for the community**

2. Describe the difference between a linear and cyclical system. (2 points)

In linear systems materials move in one direction through a product's life cycle, ending with permanent disposal. In cyclical systems materials and waste products are recovered and incorporated back into the production process.

3. Define zero waste. (1 point)

Products are designed to be cycled back into products, organics are cycled safely back into soil, toxins that cannot be safely recycled are banned, and discards that cannot be recycled are specially treated and buried in landfills.

4. How can a recycling business earn more money as the amount of recyclable materials collected increases? (2 points)

Fixed costs will remain relatively steady, but the amount available for variable costs will increase.

5. List two factors to be considered in a community zero waste program. (2 points)

- **Types of materials recycled**
- **How will the materials be collected**
- **Frequency of collection**
- **How will you get the community to participate**
- **Budget**

Student Copy Page

Zero Waste Planning

Team Members' Names: _____

1. List at least three different types of zero-waste programs and the communities or organizations that have instituted those programs. Include feedback you found regarding each program such as how well it was received, what worked and what didn't work, what was involved in instituting the program, and any other related information.

Program #1:

Community/Organization:

Notes:

Program #2:

Community/Organization:

Notes:

Program #3:

Community/Organization:

Notes:

Student Copy Page

Zero Waste Planning (continued)

2. Now your group needs to develop their own zero waste program for this community. Describe your program below, which can be similar to one of the programs listed above, a combination of those programs, or one your team develops on their own.

Types of materials recycled?

Types of organics composted?

Who will be impacted by these services?

How you will collect those materials?

Frequency of trash, organic and recycling collection?

How you will get the community to participate?

What steps need to occur for each of these scenarios to become a reality?

What are the fixed costs (*costs that remain the same, no matter how much business is done*) and variable costs (*costs that change depending on what's going on—they can rise and fall as business increases or decreases or unexpected expenses arise*) for this program? How will you generate revenue to cover those costs? How will that revenue increase as the amount of recyclables increases?

Other information:

3. Now that you have designed a program, prepare a presentation to describe your program and explain why you made the choices you did. Be sure to include discussion points on benefits to the community and possible negative impacts.

Student Copy Page

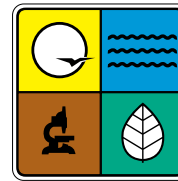
Community Feedback

Team Members' Names: _____

1. Role in the community:
2. Possible short-term impacts of this program to our role in the community:
3. Possible long-term impacts of this program to our role in the community:
4. Therefore, our group likes/dislikes (circle one) the proposed zero waste program because...
(Describe your rationale for the decision below. Be sure to list specific reasons you are for or against the program.)
5. What are some alternatives you might suggest to the program that would benefit your role?

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Missouri Department
of Natural Resources

