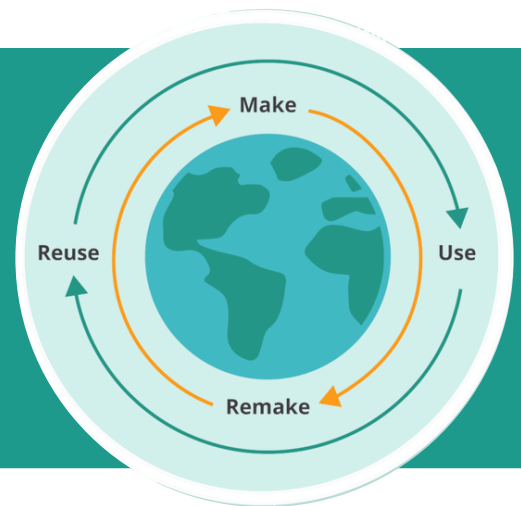


Plastic Waste to Energy

#Eco360

Activity

Grade Level: 9-12



Main Objective

Learners will learn about chemical conversion of plastic waste into energy. Learners will research the benefits and challenges of converting waste into energy through Edmonton's Waste Management Centre and their local waste management centre.

Learning Outcomes

By the end of this activity, learners will:

- Describe how plastic waste can be converted into energy through chemical conversion
- Describe the benefits and challenges of converting waste to energy
- Describe the role of municipalities in managing waste effectively

Length of Activity: 90 minutes

Step 1+2+3: Intro to using plastic as an energy source

Step 4: Case study on Edmonton's waste-to-energy plants

Step 5: Research local waste management facility

Step 6: Answer activity questions

Materials Required

- Internet-enabled device
- Topic backgrounder
- Eco 360 notebook (we recommend asking learners to maintain a notebook for this program to write down reflections as they go through the program)

Curriculum Connections

Alberta

Social 10-1

- 3.7 - Explore multiple regarding the relationship among people, the land and globalization (spirituality, stewardship, sustainability, resource development)

Science 30 Unit D: Waste and the Environment

- 30-D1.3k - Apply the concept of sustainable development to increasing the efficient use of energy

Biology 30 Unit D: Population & Community Dynamics

- 30-D2.1sts - Explain why Canadian society supports scientific research and technological development to facilitate a sustainable society, economy and environment

Ontario

Grade 9 Geography

- E1. The Sustainability of Human Systems: analyse issues relating to the sustainability of human systems in Canada
- E2. Impacts of Urban Growth: analyse impacts of urban growth in Canada (FOCUS ON: Spatial Significance; Geographic Perspective)

Grade 9 Biology (B1.2)


Grade 10 Biology (B1.3)

Activity

Step 1: Introduction to Plastic Waste Energy

Watch this video with your learners to learn about how plastics can be used to create energy:

- Beyond Recycling: Recovering the Energy in Non-Recycled Plastics:

 https://www.youtube.com/watch?v=b5eX-J23_oE&feature=emb_title (5 minutes)

Step 2: Introduction to Pyrolysis

In the previous video, a brief overview of how plastic can be used to create energy is explored. In this next step, introduce the process of Pyrolysis which entails a chemical conversion of plastic waste into fuel.

- How Waste Plastic is Converted into Fuel | Plastic Pyrolysis:

 <https://www.youtube.com/watch?v=1STaZYZ-P1w> (4:39 minutes)

Step 3: Efficiency of Plastic Waste Energy

Converting plastic waste to fuel is an innovative way of dealing with non-recyclable plastic waste that ends in our landfills. However, there are cons to this process. Continue exploring whether it is efficient to convert plastic waste to fuel. Have learners read the following article to explore co-benefits and challenges associated with converting plastic waste to fuel:

- 'Is burning plastic waste a good idea?' article 5-minute read:

 <https://www.nationalgeographic.com/environment/article/should-we-burn-plastic-waste>

Step 4: Case Study - Edmonton's Biofuel Plant


Find out how waste is converted into biofuel in Edmonton by watching the following video with your learners:

 https://www.youtube.com/watch?v=X5SjcPBLFDU&feature=emb_logo (2 minutes)

At the end of January 2024, Enerkem, Edmonton's contracted biofuel plant, closed down earlier than expected. The plant was the first large-scale waste-to-energy facility funded by the Alberta government. Several factors contributed to the closure. Have learners read the news article below to understand why it shut down:

 <https://www.cbc.ca/news/canada/edmonton/waste-to-ethanol-biofuels-plant-in-edmonton-closes-11-years-ahead-of-schedule-1.7102472>

Learners can then conduct research on the future of green energy in Edmonton. Have them explore alternative options and solutions that the city is implementing to address its waste problem. Learners can use these resources as a starting point:

 https://www.edmonton.ca/programs_services/garbage_waste/refuse-derived-fuels

 <https://www.cbc.ca/news/canada/edmonton/edmonton-varme-energy-carbon-capture-facility-1.7094171>

After, discuss the following questions as a class or in small groups:

Note: Have learners support their answers with points from the news article and their research.

1. Why did the plant close down? What were the negatives and positives?
2. Thinking about your answers to question 1, how might failures like the biofuel plant affects government funding for future large-scale waste-to-energy plants?
 - a. List a couple possible reasons why the government might continue or discontinue such funding.
3. Does producing a smaller amount of energy mean that the waste-to-energy technology is unrealistic in sustaining large cities and populations? If so, what could be some possible solutions?
4. Why do you think Edmonton has contracted a Norwegian company to convert its waste to energy? What makes the Norwegian company different from the previous biofuel plant?

Step 5: Research Local Waste Management Facility

In groups of 3 - 5, ask learners to research the waste management program in their local municipality. Have the learners compare their local management program with Edmonton's. Learners will record their findings in their Eco 360 notebooks. After completing the research, have each group present their findings in class.

Step 6: Conclusion

Ask learners to answer the following questions individually or in groups:


1. Is waste to energy a sensible solution to combating plastic waste? Why or why not?
2. What role do you think municipalities play in reducing plastic waste problems in their jurisdiction?

Extension Activity

Educators may also connect with the facility directly to interview them having a set of questions prepared beforehand. Educators may also ask the facility if a virtual tour of the facility can be organized for their class.

Educators can take learners on a virtual field trip from the comfort of their own classroom or homes using the free app called 'Google Expeditions'. Educators can become guides on different locations where learners can feel immersed in VR while using a VR headset that you insert a smartphone into (cardboard viewers work just as well!). There are also options for AR, where headsets are not required, and they can just simply view the guide via their smartphone or tablet device.

- Please watch the video 'How to Use Google Expeditions' as an educator to learn the basic mechanics:

 <https://www.youtube.com/watch?v=pCyCnoSfQvo> (3:57 minutes)

- Once downloaded, search for the Expedition titled 'What Happens to Your Trash and Recyclables?'. This Expedition takes learners to the Sims Municipal Recycling Facility located in New York City, New York where they learn how trash and recyclables end up at important way stations before they make their way to landfills or for reuse in someone else's hands.