



# Lesson Plan: Energy from Waste, Grade 9 Science (SNC1D and SNC1P)

## Introduction

Energy from Waste (EFW) is a process that takes garbage and combusts (burns) it at extremely high temperatures (greater than 1,000°C). The resulting thermal energy (heat) produces steam, which turns a turbine generator to produce electricity.

In this lesson, students will take a closer look at this process and explore how the Region of Durham uses garbage to create enough electricity to power approximately 10,000 homes per year. Students will watch the process overview of a typical Covanta facility and learn how we generate energy from residual garbage. Students are encouraged to the social, economic, and environmental costs and benefits of EFW in Durham Region.

## Learning Objectives

1. Demonstrate an understanding of Energy from Waste and how garbage is processed to recover energy
2. Create a personal plan of action to reduce electricity consumption at home
3. Assess the major social, economic, and environmental costs and benefits of using Energy from Waste

## Resources Provided

- [Durham York Energy Centre Website](#)
- [Energy from Waste Process Overview](#)
- [Durham York Energy Centre Virtual Tour](#)

## Activity

1. Students will watch the EFW process overview video provided in the course materials and resources.
2. After watching the video, students will answer the following questions:
  - a. What is EFW?
  - b. Is the electrical energy produced at the DYEC a renewable or non-renewable source? Explain your response.
  - c. How does the DYEC produce steam?
  - d. How is the steam used at the DYEC to make electricity?
  - e. Approximately how much electricity is generated from the combustion of 1 tonne of garbage?
3. As a class, explore how a turbine generator works.
4. As a class, discuss and assess the major social, economic, and environmental costs and benefits of using energy from waste to produce electricity in your community.

## The Regional Municipality of Durham - Waste Management Services

If this document is required in an accessible format, please contact [schoolprograms@durham.ca](mailto:schoolprograms@durham.ca)

5. Each student will then create and submit an action plan to reduce the amount of electricity used in their homes. In this action plan, students will consider what daily activities and habits use electricity, where they may be using electricity unnecessarily, and what changes they could make to reduce their electricity consumption. Students will include the roles and responsibilities of various groups (e.g., government, business, family members) required to support their action plan.

## Summary

The DYEC recovers energy from the garbage that remains after maximizing the Region's waste diversion programs. Overall, the facility generates up to 17.5 megawatts of energy. A portion (approximately 2 megawatts) of the electricity is used to power the operation of the Durham York Energy Centre. The remaining electrical energy is sold to the provincial grid. The energy is then delivered to the community which is enough to power approximately 10,000 homes per year.

## Curriculum Connections Expanded

The Ontario Curriculum, Grades 9 and 10: Science, 2008 (revised)

### Science, Grade 9, Academic (SNC1D)

#### A. Scientific Investigation Skills and Career Exploration

- A1. Science Investigation Skills: demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating)

#### E. Physics: The Characteristics of Electricity

- E1. Relating Science to Technology, Society, and the Environment: assess some of the costs and benefits associated with the production of electrical energy from renewable and non-renewable sources, and analyse how electrical efficiencies and savings can be achieved, through both the design of technological devices and practices in the home
- E2. Developing Skills of Investigation and Communication: investigate, through inquiry, various aspects of electricity, including the properties of static and current electricity, and the quantitative relationships between potential difference, current, and resistance in electrical circuits
- E3. Understanding Basic Concepts: demonstrate an understanding of the principles of static and current electricity

### Science, Grade 9, Applied (SNC1P)

#### A. Scientific Investigation Skills and Career Exploration

- A1. Science Investigation Skills: demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communication)

#### E. Physics: The Characteristics of Electricity

- E1. Relating Science to Technology, Society, and the Environment: assess the major social, economic, and environmental costs and benefits of using electrical energy, distinguishing

## The Regional Municipality of Durham - Waste Management Services

If this document is required in an accessible format, please contact [schoolprograms@durham.ca](mailto:schoolprograms@durham.ca)

between renewable and non-renewable sources, and propose a plan of action to reduce energy costs

- E2. Developing Skills of Investigation and Communication: investigate, through inquiry, the properties of static and current electricity and the cost of the consumption of electrical energy
- E3. Understanding Basic Concepts: demonstrate an understanding of the principles of static and current electricity