

A Guide to  
**Re-Energy:**  
**Energy Storage Unit Guide**



# Land Acknowledgement

In the spirit of respect, reciprocity and truth, we acknowledge and honour Moh'kinsstis, and the Treaty 7 region of Southern Alberta where this pilot project was conducted. This land is the traditional Treaty 7 territory of the Blackfoot Confederacy; Siksika, Kainai, Piikani, as well as the Tsuut'ina and the Îyâxe Nakoda Nations. This territory is home to the Métis Nation of Alberta, Region 3 within the historical Northwest Métis homeland.

With gratitude, we acknowledge the land and the Indigenous people that have taken care of it since time immemorial, and continue to honour and celebrate this territory.



# Table of Contents

Land Acknowledgement	2
Table of Contents	3
Curriculum Connections	4
Unit Summary	6
• Unit Breakdown	6
• Grade Level	6
• Time Required	6
• Overview	7
Activities Outline	8
• Learning Outcomes	8
• Planning Notes	8
• Teaching Tips	8
• Resources	9

# Curriculum Connections

## Activity: Energy Storage Word Match

### Alberta

- Grade 7 Science: Interactions and Ecosystems
- Grade 8 Science: Mix and Flow of Matter
- Grade 9 Science: Matter and Chemical Change
- Grade 9 Science: Electrical Principles and Technologies
- Science 10: Energy and Matter in Chemical Change
- Science 10: Energy Flow in Technological Systems
- Science 10: Energy Flow in Global Systems
- Science 10: Stewardship
- Science 20: Science Technology and Society
- Science 30: Chemistry and the Environment
- Science 30: Energy and the Environment
- Social Studies 10: To what extent should we embrace globalization? (10-1)
- Social Studies 10: Living in a Globalizing World (10-2)

## Activity: Pumped Hydro Storage

### Alberta

- Grade 9 Science: Matter and Chemical Change
- Science 10: Energy and Matter in Chemical Change
- Science 30: Chemistry and the Environment

## Activity: Electrostatic Effect

### Alberta

- Grade 7 Science: Interactions and Ecosystems
- Grade 8 Science: Mix and Flow of Matter
- Grade 9 Science: Electrical Principles and Technologies
- Science 10: Energy Flow in Technological Systems
- Science 10: Energy Flow in Global Systems
- Science 30: Energy and the Environment

## Activity: Endothermic and Exothermic Reactions

### Alberta

- Grade 9 Science: Matter and Chemical Change
- Science 10: Energy and Matter in Chemical Change
- Science 30: Chemistry and the Environment
- Science 30: Energy and the Environment

## Activity: Heat Transfer Lab

### Alberta

- Grade 9 Science: Matter and Chemical Change
- Science 10: Energy and Matter in Chemical Change
- Science 30: Chemistry and the Environment
- Science 30: Energy and the Environment

### Ontario

- Environmental Science 11: Scientific Solutions to Contemporary Environmental Changes (U/C Preparation)
  - Conservation of Energy (U/C Preparation)
  - Energy Conservation (Workplace Preparation)
- Physics 11: Electricity and Magnetism
- Physics 12: Energy Transformation
- Chemistry 12: Energy Changes and Rates of Reaction

# Unit Summary: Energy Storage

## Unit Breakdown

There are 5 backgrounders on Electric Vehicles:

1. Energy Storage 101
2. Chemical Energy Storage
3. Mechanical Energy Storage
4. Electrical Energy Storage
5. Thermal Energy Storage

There are also 5 activities that tie alongside their above backgrounders on Electric Vehicles:

1. Energy Storage Word Match
2. Pumped Hydro Storage
3. The Electrostatic Effect
4. Endothermic and Exothermic Reactions
5. Heat Transfer Lab

There are 2 take action activities which include:

1. Investigating How to Make a Battery (Spiral Inquiry)
2. Exploring Energy Storage in Your Community (Spiral Inquiry)

There are 2 construction plans:

1. Build a Penny Battery
2. Build a Flywheel Model

There are five PowerPoint presentations available on the topics/backgrounders listed above that should be utilized to present this information to the class. Each of the five activities is intended to follow the backgrounders and contains instructions, a worksheet, and other additional resources if necessary.

## Grade Level

Suitable for Grades 7 to 12

## Time Required

1 hour - 2 hours per lesson



## Overview

Energy storage is a new technology and is undergoing lots of innovation. This technology may become a key player in the energy sector. There are many forms of energy storage including chemical, mechanical, electrical and thermal. Each has a range of applications, capacity, durability and lifetime to meet a range of needs. The main use of energy storage is to shift the time the energy is produced to when it is in demand. This can save money for the customer and increases revenue for the generator. For example, if the wind is blowing during the night when demand is low, the energy produced from a wind turbine can be stored for times of high demand.

The Energy Storage unit is divided into five topics. Some topics are more advanced than others. Recommended grades for each are provided in the presentation and in this lesson plan. There are several supplemental activities available for each topic. These are intended to help the learners solidify their understanding of the concrete topic.

# Activities Outline

## Learning Outcomes

By the end of this unit, learners will:

- Understand energy storage applications with renewable energy including residential, distribution, and utility-scale projects
- Investigate types of energy storage applications used in microgeneration renewable energy
- Analyze the advantages and disadvantages of energy storage applications in reducing GHG emissions

## Planning Notes

### 1. Materials

- a. The Energy Storage Unit contains five presentations. There are hands-on activities and demonstrations found in each.

### 2. Prior Learning

- a. Learners should have an understanding of some of the basic scientific concepts such as current, magnetic field, electrostatic effect, etc. Concepts will be described briefly in the presentations.

## Teaching Tips

This unit can be taught with the slide presentation, or with alternative research and analysis completed on the educator's own time. It is recommended to pause the presentation to show the learners a concept in an application. This will help to solidify their understanding.



## Resources

The following resources are credible websites, publications and videos learners and educators can reference to further their learnings.

- Print Resources:

- See learner worksheets.

- Websites:

- *NSERC - Canadian Energy Storage Activity Database:*

- This is a database that shows commercial, and research and development energy storage projects in Canada. This research is maintained by the University of Waterloo. You can filter the database by actor, initiative, media item, project or R&D project.

 <http://energystorageactivity.ca/>

- *Battery University:*

- This is a free educational resource that provides numerous articles on topics related to batteries. Articles are easy to read and appropriate for learners in grades 7 – 12.

 <https://batteryuniversity.com/>

- *Sandia National Laboratories Global Energy Storage Database:*

- a.This database lists the announced, operational, and decommissioned energy storage projects around the world. The type, size, and location of the projects are also listed. This is a USA Department of Energy (DOE) database.

 <https://www.sandia.gov/ess-ssl/global-energy-storage-database-home/>

- Videos:

- *Energy Storage 101 (1:28 minutes):*

- This video discusses what energy storage is and how it is used.

 <https://www.youtube.com/watch?v=9eAFEU7pMwU>