A Guide to

Re-Energy:

Electric Vehicle Unit Guide

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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.

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Curriculum Connections

Backgrounder: History of Electric Vehicles

Alberta

- Grade 7: Structures and Forces
- Grade 8: Mechanical Systems
- Science 10: Energy Flow in Global Systems
- Science 10: Stewardship
- Social Studies 10: Living in a Globalizing World (10-2)

Backgrounder: Types of Electric Vehicles

Alberta

- Grade 7: Structures and Forces
- Grade 8: Mechanical Systems
- Science 10: Energy Flow in Global Systems
- Science 10: Stewardship
- Social Studies 10: Living in a Globalizing World (10-2)

Backgrounder: Electric Vehicle Batteries

Alberta

- 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 Flow in Global Systems
- Science 10: Energy and Matter in Chemical Change
- Science 10: Energy Flow in Technological Systems
- Chemistry 30: Electrochemical Changes

Backgrounder: Electric Vehicle Emissions

Alberta

- Science 10: Stewardship
- Science 20: Science Technology and Society
- 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)

Backgrounder: How to Buy an Electric Vehicle

Alberta

- Science 10: Stewardship
- Social Studies 10: To what extent should we embrace globalization? (10-1)
- Social Studies 10: Living in a Globalizing World (10-2)

Unit Summary: Electric Vehicle

Unit Breakdown

There are 5 backgrounders on Electric Vehicles:

1. History of Electric Vehicles
2. Types of Electric Vehicles
3. Electric Vehicle Batteries
4. Electric Vehicle Emissions
5. How to Buy an Electric Vehicle

There are also 4 activities that tie alongside their above backgrounders on Electric Vehicles:

1. History of the Electric Vehicle
2. What EV Should You Buy?
3. Planning a Trip in Your EV
4. Build an Electric Vehicle Model

There are 2 take action activities which include:

1. Exploring Electric Vehicle Charging Stations in Your School or Community
2. How is Your Community Adapting for Electric Vehicles? (Spiral Inquiry)

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 four 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

Electric vehicles have increased significantly in popularity in a few short years. Many individuals are making the transition to alternative fuel sources for transportation. The electric vehicle lessons will teach learners about the history of EVs, the types of EVs, the battery technology, the emissions, and how to buy one. By the end of the lessons, learners should have an understanding of the growing trend and the direction the market is headed. Learners should understand where the technology started, and where it is now.

In the circle of concern, these lessons fall under the circle of control and influence. These lessons may provide learners with an idea of how they can contribute and make a difference to the climate change movement as their first car will likely be an electric vehicle.

The Electric Vehicle unit is divided into five topics. Some topics are more advanced than others. Lessons are best suited for junior high and high school learners.

Fuel-Cell Cars were not discussed in this unit. They are often discussed alongside electric cars in other sources because they have no tail-pipe emissions like conventional gasoline engines, and the fuel produces electricity locally rather than storing in a battery. As an extension, learners can research fuel-cell cars and put together a presentation or poster illustrating how they work (i.e., what fuel is used and how this makes energy), the pros and cons, the feasibility in Alberta, etc. Fuel cell cars work very similarly to fuel cell batteries (see energy storage lessons).

Activities Outline

Learning Outcomes

By the end of this unit, learners will:

- Examine the differences in the efficiency of transportation vehicle fuel types
- Identify the types of EVs in Alberta, suppliers, and charging stations, types of charging stations
- Complete a calculation on the operating cost comparison between internal combustion engines (ICE) and electric vehicles
- Determine an optimal charging strategy for a long-range EV (such as a Hyundai Kona, or Tesla) based on weather, EV charging equipment available en route, and driving behaviour
- Calculate the greenhouse gas emissions for a vehicle travelling from Edmonton to Calgary using different transportation vehicle fuel types (diesel, gasoline, electric vehicle, and hybrid vehicle)

Planning Notes

1. Materials
    a. There are five presentations included in the Electric Vehicle unit. These presentations can be taught in any order. The activities are designed to solidify the learners' understanding. Learners will apply their learnings with real-world examples and have the opportunity to showcase their projects.
2. Prior Learning
    a. A basic understanding of energy and electricity will make some concepts easier for learners. All new concepts are explained in the presentations.

Teaching Tips

This unit can be taught with the slide presentation, or with alternative research and analysis competed in 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.

Start with the presentations. Go through each presentation with the learners to provide the foundation for the activities. Refer to the notes section of the presentation for tips on how to use the lesson. Following the presentations, there are a series of lesson activities for the learners to complete.

These activities build on the learnings of the presentations. Each activity has a real-world application for the learners to explore.

First is an activity on the “History of the Electric Vehicle”. The activity contains educator instructions and tips on how to integrate the activities and PowerPoint presentations.

“What EV Should You Buy?” and “Planning a Trip in Your EV” activities teach learners the real-world applications of EVs. Learners will play out a scenario and determine which electric vehicle is best suited for their lifestyle. Learners will also plan a trip with an EV and determine how far they can travel, where they need to stop to recharge, how long the trip will take, etc. These activities are designed to take the learnings in the presentations beyond deskwork. Learners will conduct their own research and make educated decisions relating to the use of EVs.

Following the above lesson activities are two take action activities. These activities are designed to encourage learners to apply their learnings to the public. Lastly, there is the construction plan for the “Build an Electric Vehicle Model” activity, including a template to use.

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:
  - *Natural Resources Canada (NRCAN):*
    - Has a page on their website titled Buying an electric vehicle. The page discusses at a high level the types of EVs (plug-in hybrid electric and battery electric) on the market and how they work. There are two videos on each technology discussed.

      https://www.nrcan.gc.ca/energy/efficiency/energy-efficiency-transportation-and-alternative-fuels/choosing-right-vehicle/buying-electric-vehicle/21034

- Websites Continued:
  - *Consumer Reports:*
    - Has some articles on electric vehicles. The two listed are great resources to answer all your questions regarding electric vehicles. Both articles were published in 2023.
      - Electric Cars 101: The Answers to All Your EV Questions: **https://www.consumerreports.org/hybrids-evs/electric-cars-101-the-answers-to-all-your-ev-questions/**
      - Hybrid/EV Buying Guide: **https://www.consumerreports.org/cro/cars/hybrids-evs/buying-guide/index.htm**
- Videos:
  - *Union of Concerned Scientists:*
    - This video explains the life cycle analysis of EV and ICE vehicle emissions. This video is provided in the EV GHG presentation as well.

      https://www.youtube.com/watchv=K9m9WDxmSN8#action=share
- Publications:
  - *Go Electric BC:*
    - a.Offers this brochure illustrating the battery EV, plug-in hybrid EV, extended-range EV, and fuel cell vehicles available in British Columbia as of July 2024. Most of the vehicles on the list are available in Alberta. Some of the pricing may differ.

      https://goelectricbc.gov.bc.ca/rebates-and-programs/for-individuals/find-a-vehicle-thats-right-for-you/