ENERGY EDUCATION

TOOL KIT

BY INSIDE EDUCATION

TEACHER'S GUIDE

WELCOME TO YOUR ENERGY EDUCATION TOOL KIT!

Learning about energy is a valuable way for students to understand Alberta's natural resource landscape and how it impacts our economy, society and environment.

The **Energy Education Tool Kit** includes tools, activities and lessons adapted from Inside Education's programs that will help you create an immersive energy education experience for your students. This kit is divided into 8 topics, each exploring a different aspect of energy in Alberta. Each topic has an introductory sheet, tools, guiding questions, activities, and opportunities to "consider, connect and learn more". These activities connect directly to the Alberta Program of Studies, with Curriculum Connections listed below. The tools required for each activity are in your Energy Education Tool Kit, and instructions on how to use them are included on the introductory worksheet.

These activities are generally designed for a grade 4-12 audience and the materials are intended to last for a long time, so the kit can be used in multiple classrooms for years to come. We hope you enjoy exploring energy in Alberta through this unique educational resource!

CURRICULUM CONNECTIONS

Grade 4 Social Studies Unit A: Alberta, A Sense of the Land
Grade 4 Science Unit C: Building Devices and Vehicles that Move
Grade 5 Science Unit A: Electricity and Magnetism
Grade 5 Science Unit B: Mechanisms Using Electricity
Grade 6 Science Unit D: Evidence and Investigation
Grade 8 Science Unit D: Mechanical Systems
Grade 9 Science Unit C: Environmental Chemistry
Grade 9 Science Unit D: Electrical Principles and Technologies
Career & Technology Studies Cluster D: Natural Resources (NAT)

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REFERENCES

Cenovus. "Cenovus Caribou Habitat Restoration Project" Published June 2016.
Retrieved from: https://www.cenovus.com/news/docs/Cenovus-caribou-project-factsheet.pdf

City of Vancouver. 2010. "Do-It-Yourself Home Energy Audit: green home renovation healthy homes for a healthy environment"
Retrieved from: https://vancouver.ca/files/cov/green-energy-audit-guide.pdf

City of Edmonton. Home Energy Toolkit.
Retrieved from: https://www.edmonton.ca/programs_services/environmental/energy-toolkit.aspx

Enbridge - Enbridge Blog. "Piping Up For Technology Part 8 Smart Ball" Published January 11, 2016.Retrieved from: https://www.enbridge.com/Stories/Piping-Up-For-Technology-Part-8-SmartBall.aspx

Government of Canada. "Energy Maps" Published June 10, 2019
Retrieved from: https://www.nrcan.gc.ca/maps-tools-publications/tools/geodetic-reference-systems/energy-maps/16872

Capital Power. "Halkirk Wind Fact Sheet" Published October 8, 2019
Retrieved from: https://www.capitalpower.com/wp-content/uploads/2019/10/Halkirk-Wind-Factsheet.pdf

Jacobs Consultancy, Prepared for Alberta Department of Energy. "Energy Potential and Metrics Study" Published March 2014
Retrieved from:https://open.alberta.ca/dataset/e52bef4d-0fff-436d-bd00-07fedaba0122/resource/2c5bc6b3-3205-4021-8742-7a7ad773d5f1/download/2014-energy-potential-metrics-study-epms-alberta-context-march-2014.pdf

Power Technology. Cascade Combined-Cycle Gas Turbine (CCGT) Power Plant, Alberta
Retrieved from: https://www.power-technology.com/projects/cascade-combined-cycle-gas-turbine-ccgt-power-plant-alberta/

ScanTherm: Infrared Thermal Imaging. Thermal imaging inspections for assessing heat loss caused by poor continuity of insulation, thermal bridging, low U-value and air leaks.
Retrieved from: https://www.scantherm.co.uk/thermal-imaging-surveys/commercial-building-heat-loss/

TransAlta. WindCharger Battery Storage
Retrieved from: https://www.transalta.com/facilities/plants-operation/windcharger/

University of Alberta - Future Energy Systems. "Canadian Renewable Energy Projects Map" Published 2021.
Retrieved from: https://www.futureenergysystems.ca/resources/renewable-energy-projects-canada

A quick reference guide to the topics and materials in your Energy Education Tool Kit.

1 TOPIC #1
NATURAL RESOURCES FOR ENERGY

Explore the natural resources used for energy in Alberta. Students will learn where natural resources are found in the province, as well as the opportunities and challenges of using each natural resource for energy.

Materials included: *Natural resource samples (coal, oil, natural gas, nuclear, biomass, wind, solar, hydro, geothermal), "Natural Resource Riddles" (Elementary & Junior/Senior High versions), "Alberta's Natural Resources" Map, "Considerations for Using Natural Resources for Energy in Alberta" Chart*

2 TOPIC #2
CANADA'S ENERGY LANDSCAPE

Through playing the Energy Moves board game, students will learn about the steps involved in producing, transporting and using Alberta's oil and gas resources. Along the way students will be challenged to think critically about their role in the energy landscape.

Materials included: *Energy Moves board game*

3 TOPIC #3
ELECTRICITY GENERATION

Discover how electricity is generated from natural resources as well as which natural resources are used the most for electricity generation in Alberta. Students will also use tools to understand electromagnetism and explore how kinetic energy is transformed into electrical energy.

Materials included*: "Fill in the Blank - Turn on a light using natural gas", "Fill in the Blank - Turn on a toaster using wind power" (Elementary), "Alberta's Electricity Mix - Discussion Questions" (Junior/Senior High), "Build an Electromagnet" activity, hand generator, multimeter, Electricity Poster*

4 TOPIC #4
RENEWABLE & ALTERNATIVE ENERGY

Learn about different types of renewable and alternative energy and the opportunities and challenges associated with each. Students will build a wind turbine model, conduct a solar generation experiment, and create hydrogen through an electrolysis experiment.

Materials included: *Wind turbine model, 12V solar panel, Electrolysis experiment (plastic cup, 9V battery, baking soda, thumb tacks)*

5 TOPIC #5
EXPERIENCE FOSSIL FUELS

Discover how fossil fuels connect to our economy and daily lives. Students will learn about Alberta's abundant coal, oil and natural gas reserves, and explore how energy is produced. Students will complete a matching activity to explore how innovations in the fossil fuel industries are working to address issues surrounding air, wildlife and water.

Materials included: *Issues & Innovations matching cards*

6 TOPIC #6
ENERGY EFFICIENCY & CONSERVATION

Students will learn how they can reduce their energy consumption through energy efficiency and conservation. Students will use tools to measure and track the electrical output of different types of light bulbs and classroom devices.

Materials included: *LED light bulb, incandescent light bulb, energy meter, infrared thermometer, lux meter*

7 TOPIC #7
ENERGY STORAGE

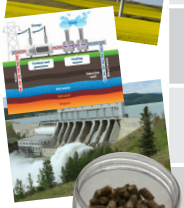
As renewable sources for electricity generation increase, the need for energy storage becomes more important due to the variable nature of these resources. Students will compare how energy can be stored using battery and flywheel technology by experimenting with two different car models.

Materials included: *Zecar (flywheel storage model), electric car (battery storage model)*

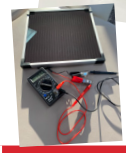
8 TOPIC #8
STEWARDSHIP

Discover ways to lessen your impact on the environment by conducting a school energy audit. Students will use tools to measure heat loss, electricity usage, and water usage at your school, and discuss ways to reduce overall energy usage at school and at home.

Materials included: *Infrared thermometer, energy meter*

Photo	Tool Name	Brief Description
1 | Natural Resources for Energy		
	**Coal sample**	Sample of coal as an energy resource.
	**Oil sands sample**	Sample of oil sands as an energy resource.
	**Natural gas pipe**	Model of a natural gas pipe demonstrating natural gas as an energy resource.
	Nuclear sample *(plastic replica)*	Sample of uranium *(nuclear energy)* as an energy resource.
	Solar sample	Example of a solar panel demonstrating the sun as an energy resource.
	**Wind sample**	Photo of a wind turbine demonstrating wind as an energy resource.
	**Geothermal sample**	Diagram demonstrating geothermal as an energy resource.
	Hydro sample	Photo of a hydroelectric dam demonstrating water as an energy resource.
	**Biomass sample**	Sample of biomass *(wood pellets)* as an energy resource.
	**Alberta Natural Resources Map**	Map of Alberta's natural regions and the natural resources found within each.
	Natural Resource Riddles *(cards)*	A series of 9 clues that correspond to each of the natural resource samples.
2 | Canada's Energy Landscape		
	**Energy Moves Board Game & Cards**	Board game with 6 sets of cards - consultation, environmental assessment, resource extraction, transportation, reclamation & monitoring, and processing.
3 | Electricity Generation		
	**Hand Generator**	Converts mechanical energy to electrical energy to light a light bulb. Leads can also be attached to a multimeter, LED bulb, etc.
	**Multimeter**	An instrument that measures electric current, voltage and resistance.
	**D-Cell battery**	A large battery used in the electromagnet building experiment.
	**Bolt (zinc, 3in)**	A zinc bolt used in the electromagnet building experiment.

All of the items on this list are available for purchase from various vendors. If you need a hand sourcing tools for your classroom, do not hesitate to reach out — we are happy to help! **info@insideeducation.ca**

Photo	Tool Name	Brief Description
	**Paperclips**	Small and large paper clips used to test the strength of an electromagnet.
	Electrical tape	Electrical tape used to connect copper wire to the battery in the electromagnet building experiment.
	**Insulated copper wire** *(20AWG)*	Insulated copper wire used in the electromagnet building experiment.
	**Electricity poster**	The Electricity poster includes a number of activities on topics including electricity safety, natural resources for electricity, and generating electricity across Canada.
4 | Renewable & Alternative Energy		
	**Wind turbine models (5)**	These DIY wind turbine models demonstrate how wind energy is captured and generated. Complete as a design challenge between groups and measure output using the light indicator and multimeter.
	**Electrolysis Experiment**	To use Hydrogen as an energy source, the Hydrogen needs to be extracted somehow. One way is through electrolysis - i.e. splitting water into Hydrogen and Oxygen. This simple experiment shows how the process of electrolysis works to produce Hydrogen.
	**Solar panel**	This 12V solar panel contains photovoltaic cells that capture solar energy and convert it to electrical energy.
5 | Experience Fossil Fuels		
	**Issues & Innovations Cards**	Match the issue to the innovation to learn more about what's being done to lessen the impact of the fossil fuels industries on water, wildlife and air.
6 | Energy Efficiency & Conservation		
	**Energy Meter**	Measures the amount of electrical energy consumed by an electrical device.
	**LED light bulb**	A source of electrical light that uses one or more Light Emitting Diodes *(LEDs)* to produce light.
	Incandescent light bulb	A source of electric light that works by incandescence, which is the emission of light caused by heating a filament.
	**Lux Meter**	A device that measures the brightness of illumination *(light)* of a surface.
7 | Energy Storage		
	**Zecar**	This model car uses the stored kinetic energy of its flywheel to scoot across the floor.
	Electric car model	This model car uses the stored energy of its battery to scoot across the floor.
8 | Stewardship		
	**Infrared thermometer**	An instrument that detects the infrared radiation emitted by an object to determine its temperature.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