United Nations Educational, Scientific and Cultural Organization

MOUNT ARROWSMITH BIOSPHERE REGION

BIOSPHERE BOOKLETS

Lesson Plans & Activities

RENEWABLE ENERGY

SUMMARY/OVERVIEW

Grades:	Prep Time:	Learning Environment:	Total Lesson Length:
1-2	20 Minutes*	Indoor	2 hours*

DESCRIPTION:

This booklet explores different types of renewable energy sources and provides local examples on Vancouver Island. By discussing each type of renewable energy source, students can obtain an understanding of how each source works.

*Optional - educators can take students to one or more of the listed locations so students can see and understand the scale of these sources.

CURRICULUM EXPECTATIONS:

Processing and analyzing data and information:

- Experience and interpret the local environment.

Evaluating:

- Consider some environmental consequences of their actions

Questioning and Predicting:

- Demonstrate curiosity about the natural world

BACKGROUND:

Renewable energy sources are a critical form of power in this modern age, as we are faced with the inevitable demise of non-renewable sources such as fossil fuels. British Columbia has abundant renewable energy sources, a natural advantage for new opportunities to meet our growing energy demands with clean, renewable power. The province has also set impressive targets to reduce greenhouse gas emissions by 40% by 2030.

LESSON PLAN

TIME	ACTIVITY	LOCATION	MATERIALS
30 mins	1. Introduction	Indoor	Printed worksheet
1 hour*	2. Renewable Energy "Tour"	Indoor/outdoor*	Printed worksheets
30 mins	3. Conclusion	Indoor	N/A

*Option to take students to a renewable energy source location

TIME	ACTIVITY	LOCATION	MATERIAL
30 mins	1. Introduction	Indoor	Printed worksheet

Introduction to Renewable Energy Sources

GOAL: Introduce students to the concept of renewable energy.
PREPARATION: Print page 3.

LESSON PLAN:

INTRODUCTION: Initial Discussion

1. Ask students if they know what renewable energy is.
    - **Renewable energy** is **energy** that has been derived from earth's natural **resources** that are not finite or limited. Renewable energy is an alternative to the traditional energy that relies on fossil fuels, and it tends to be much less harmful to the environment.

2. Explain that a finite resource, such as fossil fuel, means that there is a limit to the quantity that is available to earth's citizens.

3. Ask students to name some examples of renewable energy sources. Examples may include:
    - Hydropower (water)
    - Solar energy (sunlight)
    - Wind energy (wind)
    - Biomass energy (organic material)
    - Geothermal (heat from earth's core)

4. Explain to students that renewable energy is also clean energy, which means it produces less pollution and greenhouse gas emissions which contribute to climate change. However, these types of energy sources have their challenges, as they can be less reliable. For example, the amount of energy these sources produce can change from day to day (e.g., depending on the amount of sun or wind available that day).

HANDS ON: Word Search

5. Have students complete the word search below (page 3). See answer key on page 4.

Renewable Energy Word Search

Y	P	O	L	L	U	T	I	O	N	N	V
C	D	Z	B	I	O	M	A	S	S	U	Z
L	L	K	P	C	F	I	N	I	T	E	S
E	P	O	W	E	R	T	W	I	N	D	O
A	G	E	O	T	H	E	R	M	A	L	L
N	S	S	W	A	T	E	R	V	G	G	A
F	O	S	S	I	L	F	U	E	L	J	R
W	R	E	N	E	W	A	B	L	E	N	U

Word Bank

Wind Water Geothermal Fossil Fuel Finite Solar

Renewable Energy Biomass Pollution Clean Power

Answer Key

. P O L L U T I O N . .

C . . B I O M A S S . .

L . . . . F I N I T E S

E P O W E R . W I N D O

A G E O T H E R M A L L

N . . W A T E R . . . A

F O S S I L F U E L . R

. R E N E W A B L E . .

TIME	ACTIVITY	LOCATION	MATERIAL
1 hour	2. Renewable Energy "Tour"	Indoor	Printed worksheet

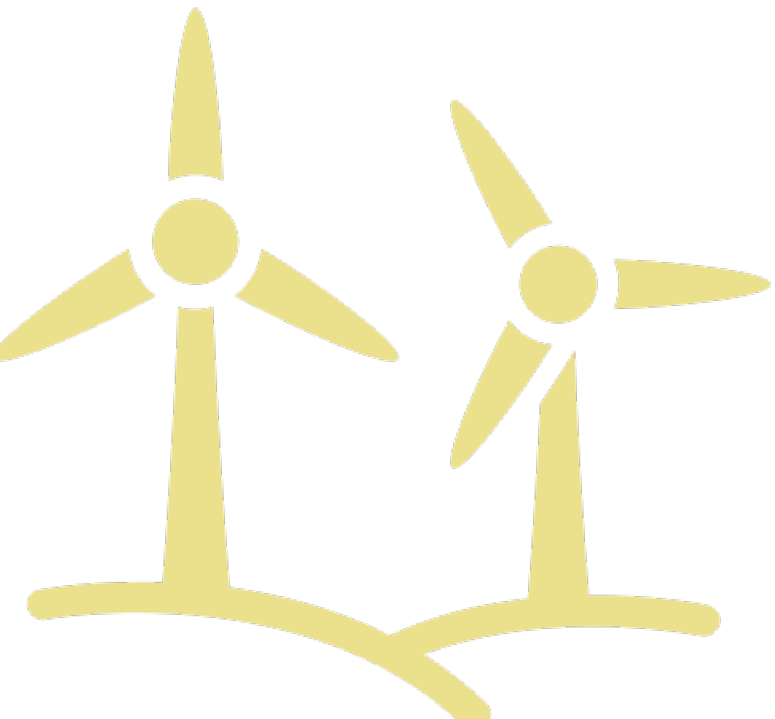
Renewable Energy "Tour"

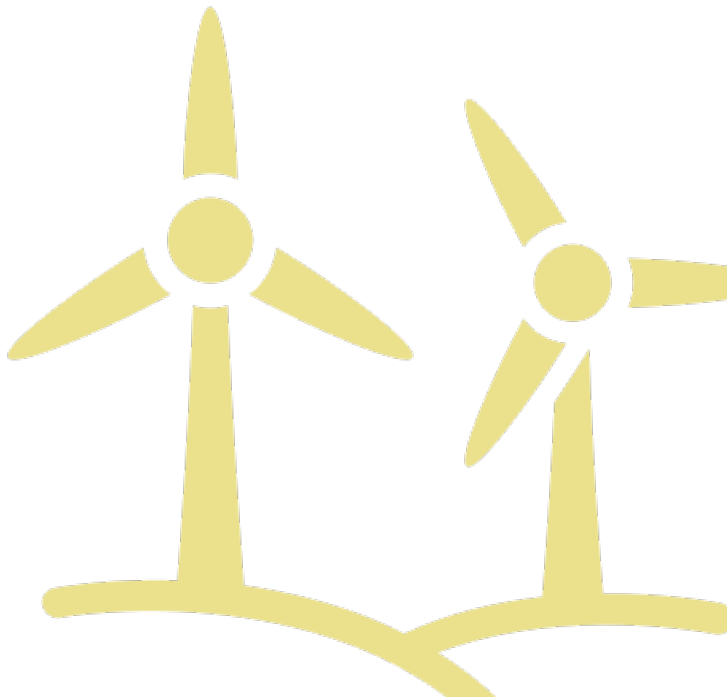
GOAL: Explore different types of renewable energy sources and provide students with local examples on Vancouver Island.

PREPARATION: Print pages 6-9.

LESSON PLAN:

1. The following sections outline places on Vancouver Island where renewable energy is created – along with talking points on each renewable energy source.
2. Hand out the **renewable energy fact sheets** (page 6-9). Review each source with students.
3. Photos or videos of each place can be shown for visual aid through the attached links (though if possible, students could visit one or more of the locations to help visualize).





Wind Energy

Places on Vancouver Island

- Cape Scott Wind Farm
  - 35km to the west of Port Hardy
  - For more information click here (https://bit.ly/3L5lKFH)

Disadvantages

- Days without wind means no power is being generated.
- Due to noise created from turbines, they must be placed away from cities and towns.

Talking Points

- Wind energy harnesses the kinetic energy from the wind and converts it into electrical energy for use in our homes and businesses.
- Winds are caused by the sun's heating of the earth, and the earth's rotation.
- Residents living near wind turbines often oppose them for visual reasons.
- Wind accounted for 5.1% of electricity generation in Canada in 2018.
- Watch this TedEd video that explains how wind turbines work: https://youtu.be/xy9nj94xvKA

Cape Scott Wind Farm on Vancouver Island

Solar Energy

Places on Vancouver Island

- **The T'Sou-ke First Nation Solar Project**
  - Located west of Victoria.
  - Also utilizes greenhouses for sustainable food production.
  - Solar project is part of a unique eco-tourism project.
  - For more information, click here (https://bit.ly/3iq9P95)
- **Calvert Island Field Station**
  - Up until 2010, the site burned up to 500 liters of diesel fuel per day. They then integrated solar energy to power the station with the help of Hakai Energy Solutions.
  - Although visiting may prove difficult, an effective video (https://bit.ly/3wtW4i2) was created to highlight their efforts.

Talking Points

- Solar photovoltaic (PV) power is the conversion of sunlight into electricity via solar cells within a solar panel or module.
- The potential for solar energy varies across Canada. The potential is lower in coastal areas, due to increased cloud coverage.
- The areas in southern Canada, where 90% of the population lives, receive more solar radiation than Germany, which is the world leading nation in the use of PV per capita.
- Solar power generation requires no fuel or moving parts. It makes no noise and produces no emissions with minimal maintenance.
- Watch this video on solar energy to learn more: https://youtu.be/inPtRWtvDaM

Disadvantages

- Batteries are required to store power, and require resources to maintain operation.
- Energy is only generated when the sun is shining. This means at night and on cloudy days the supply of power is interrupted.

T'Sou-ke First Nation Solar Project

Hydro Power

Places on Vancouver Island

- **John Hart Generating Station**
  - Located in Campbell River, beside the Elk Falls Provincial Park.
  - The facilities along the Campbell River system not only generate electricity, but also contribute to the surrounding communities by providing services such as flood control, domestic water supply, and recreation.
  - There is also an interpretive centre at the site.
    - For more information and a video click here (https://bit.ly/3qvfa3q)

Talking Points

- Hydro power uses the power of flowing water, without wasting or depleting it in the production of energy.
- Hydroelectricity is British Columbia's largest source of electric power generation.
- There are a few types of Hydropower that are utilized on Vancouver Island:
  - Tidal Power – Harnessed from ocean currents and tidal height differences.
  - Wave Energy – captures the energy found near the surface of the water and converts it to power.
  - Run-of-River – uses natural stream flows in mountainous regions to generate electricity.
- Utilizing a number of different energy sources aids in energy security, decreasing the reliance on a single energy source, and increasing energy self-sufficiency.
- Use this link to watch a video on how hydro power works: https://youtu.be/q8HmRLCgDAI

Disadvantages

- Has the potential to harm the environment with damaged wildlife habitat, harmed water quality, and obstructed fish migration.
- Amount of power generated from hydropower depends on precipitation (rain) levels, which can change each year.

John Hart Dam in Campbell River, B.C.

Biomass Energy

Places on Vancouver Island

- Although there is nowhere to safely visit, Nextterra has created a community in Victoria using Biomass Energy. See the video by clicking here (https://youtu.be/39blxH9PEi4)

Talking Points

- Biomass energy generation is the creation of heat and/or power from carbonaceous substances such as wood, agricultural crops, animal waste, and aquatic plants.
- Most of Canada's biomass energy is made in BC – particularly from the burning of wood waste from the forestry industry.
- FortisBC also captures gases (methane) generated by landfills and farming operations.
- Watch this video to learn how Biomass energy production works: https://youtu.be/nVl17JLn_uo

Nextterra Biomass Energy at Dockside Green, Victoria, B.C.

TIME	ACTIVITY	LOCATION	MATERIAL
30 mins	3. Conclusion	Indoor	Printed worksheet

Conclusion

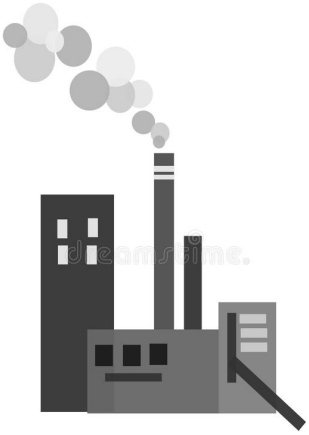
1. Ask students to share what they found interesting in this session.
2. Explain to students that although renewable energy sources are not our only source of power, it plays an important role in our future.
    a. Ask students to recall why renewable energy sources are not our only source of power.
3. To wrap up this topic:
    a. Print off the **"Renewable Energy Colouring Sheets"** from the same website this booklet was retrieved from (**https://www.mabr.ca/teaching-resources**). Have the students colour all or just their favourite colouring sheet.
    b. Print pages 11 and 12 for an activity where students can cut out and sort images into either renewable or non-renewable energy sources.

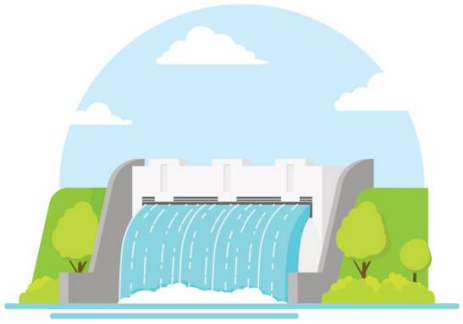
Sorting Energy Sources

Using the table below, cut out and sort the images of different forms of energy production into either the renewable or non-renewable category.

Renewable Energy	Non-Renewable Energy

Natural Gas Energy

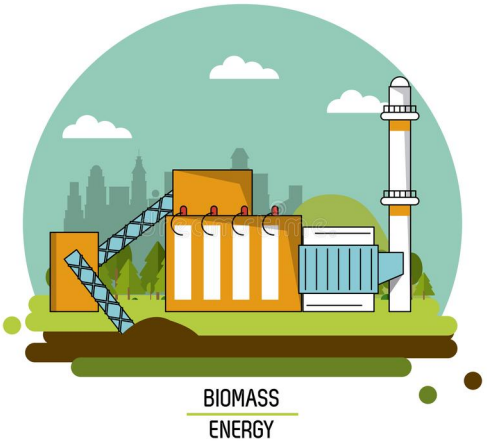




Hydro Power Energy

Wind Energy

Solar Energy



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Show us your results! Snap a picture and share it with us on social media, or email it to the MABR Coordinator at

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