



ENERGY EXPLORERS

This activity helps students explore how electricity powers our daily lives, where it comes from in Ontario and Canada, and how we can make it cleaner. Through hands-on learning, students will learn how to make smart, balanced energy choices for the future.

GRADES 4-6

LEARNING OBJECTIVES

- Explain the reliance of our society on electricity
- Identify sources of electricity in Ontario (and in Canada)
- Explain the benefits of transitioning to a cleaner energy grid, identify cleaner energy sources

DURING THIS ACTIVITY, STUDENTS WILL

- Learn about why we need electricity and the main sources of electricity in Canada
- Be introduced to the concept of transitioning to cleaner energy sources
- Learn about the benefits of a cleaner energy, such as protection of air, water, climate and wildlife
- Work in teams to design and power their own community by choosing different energy sources and solving real-world challenges that affect how electricity is produced and used

MATERIALS

- [Energy Source Cards](#) (one set per group of 2-5 students)
- [Energy Constraint Cards](#) (one set)
- One large surface, such as a white board or a large piece of paper per group
- Markers or pencils



INSTRUCTIONS



1 Activate students' prior knowledge about electricity and clean energy.

- "What things in our classroom use electricity?"
- "What would happen if the power went out for a whole day?"

The following points can help support the discussion:

- What is electricity? *Electricity is a type of energy that flows and powers things like lights, heating and cooling, appliances, equipment, communication technology, and emergency systems.*
- How is electricity made? *Heating liquids or gases makes them expand and take up more room. This causes movement that can be used to turn turbines. Movement can also be produced from moving air and water. In power stations, turbines are connected to generators. When the generator turns, magnets wrapped inside spin round and electricity starts to flow through the wires.*

- Some ways of making electricity release greenhouse gases, which are gases that trap heat in the air and contribute to climate change.
- Cleaner electricity helps keep air clean, protect water, reduce climate change, and protect animals and ecosystems.

2 Remind students that not all energy is useful in the same way, and different sources have different strengths and limits, for example in a **process called active electrolocation**, some fish use electricity to "see" their environment. This energy source is self-sufficient and produces no pollution, but it's very weak energy and it only works for the fish, not for powering homes.

3 As a class, review the [Energy Source Cards](#) and discuss the advantages and disadvantages of each source.

TALKING ABOUT ENERGY SOURCES

RELIABILITY Does it work all the time?

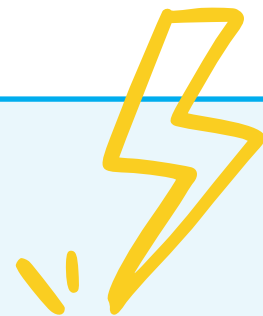
RENEWABLE OR NON-RENEWABLE Will it run out?

ENVIRONMENTAL IMPACT Does it affect air (emissions), water and animals?

LAND USE How much space does it use?

WASTE How much waste does it create? Does it use waste?

AFFORDABILITY How much does it cost? We often measure how much electricity we use in kilowatts (kW), and cents per kW is how much we pay for the electricity (cents/kW).



INSTRUCTIONS

4 Tell the students that they are going to be energy planners, making decisions about how to power a community. But there's a twist – each group must solve a real-world challenge that affects their energy choices!

- Divide students into small groups (3–5 students).
- Give each group:
 - ☐ A large surface, such as a whiteboard or large piece of paper, where they can draw a simple town map (ie. hospital, school, river, power plant, etc.)
 - ☐ A set of energy source cards
 - ☐ ONE constraint card

5 Explain that each groups' job is to power their community using 3–4 energy sources, and they must follow the rule on their constraint card. They must decide:

- a. Which energy sources to use
- b. Which are cleaner vs less clean
- c. How to meet their community's needs

EXTENSION ACTIVITY

Make a 3D replica of your town and energy sources using scrap paper, blocks, or other reusable materials. Add in measurement and area calculations for an additional challenge. You could even bring real power into your town by adding simple electrical circuits (you might need alligator clips, mini motors, mini lightbulbs, batteries, and battery holders)!

RESULTS & DISCUSSION

After they have designed their town, each group presents:

- Their energy choices
- How they solved their challenge
- What trade-offs they had to make

Continue the conservation with a discussion about transitioning to cleaner energy, using the following questions as a guide:

- Do you think every place in Canada should use the same energy sources? Why or why not? *No, different places in Canada use different energy sources because their environments are not the same. For example, places with lots of rivers, like British Columbia and Quebec, use more hydro power.*
- Why do you think we can't switch to 100% clean energy right away? *Transitioning to clean energy across Canada, while staying reliable, affordable, and protecting natural spaces, takes a lot of time and planning.*

POWERING AHEAD

Ontario is a leader in low-carbon electricity. In 2023, about 86% of Ontario's electricity came from emission-free sources! That means most electricity is already being produced in cleaner ways, but there is still more work to do!



INSTRUCTIONS

- How can cleaner energy help protect ecosystems? *Cleaner energy helps protect ecosystems by reducing pollution in the air and water. When there is less pollution, animals have healthier habitats and cleaner places to live.*
- Now that we understand how electricity is made and the choices involved, what actions can we take to use energy wisely and support cleaner energy? *We can be careful about how we use energy (like turning things off when not needed), talk with others about where electricity comes from, and think about cleaner ways to power our homes, schools, and communities.*



NEXT STEP

As a class, reflect on what you've learned about electricity, energy sources, and trade-offs and discuss what you can do to apply this knowledge to make smart, balanced energy choices in your school and community. This could be by sharing information about energy sources with the other classes in your school, and becoming a [Power Detective](#). Explore how schools use energy, identify ways to become energy-saving heroes together, or by taking on the [Earth Rangers Mega Watt mission](#).



RESOURCES

EARTH RANGERS

[Power Detectives](#)

[Mega Watt Mission](#)

WEBSITES

[WattNext Teacher Resources](#)

[Energy Source Characteristics](#)

[The Main Electricity Sources in Canada By Province](#)

[The Great Canadian Electricity Map](#)

with the support of

WATTNEXT

POWERED BY   ONTARIO SCIENCE CENTRE |  OntarioTech UNIVERSITY

ENERGY SOURCE CARDS

Print and cut

NATURAL GAS



Burning natural gas boils water creating steam that turns turbines, generating electricity

Flexible and Reliable **YES**

Renewable **NO**

Greenhouse Gas Emissions **HIGH**

Land-Use **LOW**

Waste Profile **HIGH**

(creates invisible carbon dioxide and can leak methane, which contributes to climate change)

Typical cost per kilowatt **11.3 CENTS/KW**

BIOMASS ENERGY



Burning waste boils water creating steam that turns turbines, generating electricity

Flexible and Reliable **YES**

Renewable **YES**

Greenhouse Gas Emissions **LOW**

Land-Use **LOW-MEDIUM**

Waste Profile **LOW**

(uses waste product from agriculture, forestry, paper industry, etc. to make electricity)

Typical cost per kilowatt **25.8 CENTS/KW**

COAL



Burning coal boils water creating steam that turns turbines, generating electricity.

Flexible and Reliable **YES**

Renewable **NO**

Greenhouse Gas Emissions **HIGH**

Land-Use **MEDIUM**

Waste Profile **HIGH**

(produces air pollution and solid waste like ash)

Typical cost per kilowatt **12.5 CENTS/KW**

CREATE YOUR OWN ENERGY CARD

Create a brand-new energy source that could help power our world. A real idea that exists but is still growing OR a completely creative, futuristic idea!

CIRCLE ONE

Flexible and Reliable **YES NO**

Renewable **YES NO**

Greenhouse Gas Emissions **LOW MEDIUM HIGH**

Land-Use **LOW MEDIUM HIGH**

Waste Profile **LOW MEDIUM HIGH**

Typical cost per kilowatt **CENTS/KW**



ENERGY SOURCE CARDS

Print and cut



HYDRO POWER



Flowing water turns turbines, generating electricity

Flexible and Reliable **YES**

Renewable **YES**

Greenhouse Gas Emissions **VERY LOW**

Land-Use **LOW-MEDIUM**

Waste Profile **LOW**

(produces no emissions, but dams can flood land and disrupt wildlife)

Typical cost per kilowatt **6.1 CENTS/KW**

NUCLEAR ENERGY



Nuclear fission (when the center of a heavy atom, the nucleus, is split) boils water creating steam that turns turbines, generating electricity

Flexible and Reliable **NO / YES**

Renewable **NO**

Greenhouse Gas Emissions **VERY LOW**

Land-Use **LOW**

Waste Profile **HIGH**

(while not much waste is produced, radioactive waste requires special handling and storage)

Typical cost per kilowatt **10.1 CENTS/KW**

WIND ENERGY



Wind turns turbines, generating electricity

Flexible and Reliable **NO**
weather dependent

Renewable **YES**

Greenhouse Gas Emissions **VERY LOW**

Land-Use **MEDIUM-HIGH**

Waste Profile **MEDIUM**

(composite materials, like fiberglass blades, go to landfill)

Typical cost per kilowatt **15.4 CENTS/KW**

SOLAR ENERGY



Photovoltaic (PV) solar cells turn light energy from the sun into electricity

Flexible and Reliable **NO**
weather dependent

Renewable **YES**

Greenhouse Gas Emissions **LOW**

Land-Use **MEDIUM**

Waste Profile **MEDIUM**

(small amounts of hazardous materials in the panels requires special handling and recycling)

Typical cost per kilowatt **50.2 CENTS/KW**



ENERGY CONSTRAINT CARDS

Print and cut



PROTECT NATURE



Your town wants to protect animals and ecosystems

Avoid energy sources that harm habitats.

GROWING COMMUNITY



Your town is growing quickly and needs MORE electricity

Choose energy sources that can produce a lot of power, are reliable, and affordable.

BUDGET CHALLENGE



Your town has a limited budget

Think about cost (cents/kW).

CREATE YOUR OWN CONSTRAINT CARD

Design your own challenge for powering a community

Think about real-world situations that might affect how electricity is created and used.

ENERGY CONSTRAINT CARDS

Print and cut



CLEAN ENERGY PRIORITY



Your town wants very clean, low-emission energy

Try to choose mostly cleaner energy sources.

ALWAYS ON POWER



Your town has a hospital that needs power 24/7

Your energy must be very reliable.

WINDY REGION



Your town is very windy but not very sunny

Think about which energy works best here.

SUNNY REGION



Your town gets lots of sunshine year-round

Use that to your advantage!

