Canadian Geographic EDUCATION

ENERGY IQ
QI ÉNERGÉTIQUE

LEARNING INQUIRIES

RESPONSIBLE ENERGY PRODUCTION

TIME: 60-90 MINUTES (CAN BE DIVIDED OVER NUMEROUS BLOCKS)

DEVELOPED BY: CANADIAN GEOGRAPHIC EDUCATION

OVERVIEW/FOCUS QUESTION

What are the impacts of different energy sources on the environment? What energy policies, provincial or federal regulations, and practices are Canadian companies following to meet the nation's energy needs while reducing their impact on the environment?

SUBJECT/TOPIC

GEOGRAPHY, SCIENCE AND TECHNOLOGY

GRADE LEVEL

GRADES 7 - 10

LEARNING GOALS

- Students will be able to describe the environmental impacts of different energy sources.
- Students will be able to define the term "responsible energy development."
- Students will better understand innovations in Canada's energy mix that contribute to reducing impacts on the environment.

MATERIALS NEEDED

- Electronic devices with access to internet

CONNECTION TO THE CANADIAN GEOGRAPHY FRAMEWORK

CONCEPTS OF GEOGRAPHIC THINKING

- Interrelationships
- Geographic perspective

INQUIRY PROCESS

- Formulate questions
- Gather and organize
- Interpret and analyze
- Evaluate and draw conclusions
- Communicate

GEOSPATIAL SKILLS

- Technology

LESSON DESCRIPTION

MINDS ON

Students will discuss what they know about energy production in Canada.

ACTION

Students will learn about the different energy sources available in Canada and the effects of each energy source on the environment, taking into account both industry-level production and consumer-level usage. They will research how energy is produced, and what factors need to be taken into account to produce energy responsibly and efficiently. They will also research which consumer habits have the most significant environmental impacts. Students will research innovations in company practices and technologies that are aimed at reducing their impact on the environment as well as ways in which consumer-level habits could be altered to reflect more sustainable practices.

CONCLUSION

To demonstrate their findings, students will write a newspaper article, record a podcast episode, or film a video examining what steps or innovations energy companies are taking, and what steps consumers could be taking, to be more sustainable. Students will reflect on their research and think critically about ways to improve their own energy efficiency in their daily lives.

LESSON IMPLEMENTATION

MINDS ON

Initiate a discussion to highlight what students already know about energy production and transmission. How and where is energy produced in Canada and what are the different types of energy?

Have students make deductions about which types of energy are produced in their province or territory by asking them to make connections to the different natural resources and geography of their province or territory.

Work with students to define the following terms:

1. Energy
2. Fossil fuel
3. Renewable energy sources
4. Non-renewable energy sources
5. GHG emissions
6. Land use

Have a class discussion about the roles that energy plays in students' daily lives (e.g., lighting, heating, transportation, electronic devices, manufactured goods). Discuss with students how the energy they use is transported from where it is produced to where it needs to go (e.g., pipelines,

electrical grid, trucks, trains, etc.). Ask students to think about how their everyday actions use energy (e.g., driving a car, buying food wrapped in plastic packaging, leaving the lights on, turning up the heat/air conditioner).

ACTION

Begin a class discussion about the environmental impacts of end-use energy (energy that is consumed by the user, such as electricity and gasoline, plastics). Have students brainstorm the ways in which their energy use might have an effect on the environment and make a list on the class whiteboard/smartboard. Have students consider which energy sources are used to produce electricity in their province/territory.

Transition to a discussion on the environmental impacts of energy production. Break students into small groups and assign one of the following energy sources to each group (crude oil, natural gas, hydroelectricity, nuclear, coal, wind, solar, and biomass. Have students pretend they are a company looking to set up a new energy facility (e.g., an in situ oil extraction site, a hydroelectric dam, a nuclear power plant, a surface coal mine, a wind or solar farm) and they must do research about what factors need to be kept in mind for their specific energy source. See the Additional Resources section for some websites to begin with.

Use the following questions as a guide to get students thinking about the different environmental impacts of their energy source, both for production and end use. Students should also think about the impact on wildlife and people's health. These questions are only to spark critical and creative thinking, encourage students to dig deeper and to think about local and global impacts as well.

Energy sources:

Crude oil: Where in Canada is crude oil extracted and how? What are the different environmental impacts (e.g., land use, water use, emissions) of the different production methods? What can be done to mitigate these impacts, and what are some examples of this based on your research of Canadian companies? What are the environmental impacts of the different transportation methods for crude oil? Crude oil is refined into many different petroleum products (RPPs)—what are some examples of RPPs and how are they used? What are the environmental impacts of various RPPs and petroleum-based products (consider things like diesel for power generation

and plastics)? What are the environmental impacts of burning fossil fuels while driving your car or taking public transportation? What role does innovation play in reducing the impact of development on the environment?

Natural gas: Where in Canada is natural gas used and how? What are the environmental impacts of natural gas production (e.g., land use, water use, emissions)? What can be done to mitigate these impacts, and what are some examples of this based on your research of Canadian companies? What are the environmental effects of transporting natural gas to locations where it is used? How does natural gas compare to electricity for efficiency when it comes to heating? What are the environmental impacts of using older appliances (e.g., gas stoves) that are not ENERGY STAR rated?

Hydroelectricity: What are some environmental impacts of the large reservoirs created by hydroelectric dams (e.g., land use, effects on ecology and habitats, emissions)? Are there other ways to produce hydroelectricity? What Canadian innovations are being applied to the hydroelectric sector? Is this energy source an option for all parts of Canada? What are the environmental impacts of electricity consumption at the consumer level and how can they be reduced?

Nuclear: How is nuclear energy created and what is it used for? How does nuclear energy impact the environment (e.g., water use, radioactive waste, construction of the power plant)? How does nuclear energy compare to other energy sources in terms of efficiency and environmental impacts? What Canadian innovations are being applied to the nuclear energy sector? What are some of the other concerns with nuclear energy (e.g., safety concerns)? What are the environmental impacts of electricity consumption at the consumer level and how can they be reduced?

Coal: How is coal mined and what role does it play in energy production? What else is coal used for? What are the environmental impacts of mining coal (e.g., land use)? What about the transportation of coal? How does the burning of coal affect the environment? What are some options for transitioning away from coal as an energy source? How can consumers reduce their environmental footprint when it comes to dependency on coal as an energy source?

Wind: Although there are no emissions from wind energy production, how does the manufacturing, transportation and installation of wind turbines impact the environment? What dangers might

wind farms pose for wildlife? How can this be mitigated (consider what factors are important for siting a wind farm or how the technology might be used)? How is wind energy integrated into the energy mix in Canada and what might be some of the challenges? What strategies can Canadians use to grow the share of renewable energy in the energy mix and reduce their environmental impacts?

Solar: Although there are no emissions from solar energy production, how does the manufacturing, transportation and installation of solar panels impact the environment? How do solar farms affect land use? What are some of the concerns around solar panels at the end of their lifecycle (e.g., recycling and disposal)? How is solar energy integrated into the energy mix in Canada and what might be some of the challenges? How can Canadians transition to using more renewable energy and reduce their environmental impacts?

Biomass: What is biomass and is it considered a renewable or non-renewable energy? What are some of the environmental impacts of growing plants for biomass energy (e.g., land use)? Is biomass from the lumber industry sustainable? What are some of the environmental impacts of electricity produced from biomass? In what part of our lives do we use biofuels and do the benefits outweigh the negatives?

Have students use their research to do a comparison between the environmental impacts of energy production at the industry level and energy consumption at the user level. What are the similarities and differences? Have students create a summary for each energy source that includes all environmental impacts, from production and end-use, so that they have a full picture of each energy source and its potential for environmental impacts.

Now that students have a better understanding of how energy is produced, transported and transmitted in Canada, have them research and discuss what steps energy companies are taking, or could be taking, to mitigate their environmental impact. Have students consider steps taken before energy production (e.g., researching an appropriate site for an energy facility), during energy production (e.g., reducing impact on wildlife at energy production sites) and after energy production (e.g., reclamation practices to return a site to its previous state before energy production occurred).

CONCLUSION AND CONSOLIDATION

Students can submit their findings as a written report or present their research to the class. The goal of their research is to help students learn about the steps that companies in Canada's energy industry are taking to develop energy in a more environmentally responsible and efficient way. Students should be able to show their understanding of environmental impacts at both the industry and consumer levels and suggest realistic ways to transition away from (or to better mitigate) energy development that heavily affects Earth's natural systems, while keeping in mind the growing energy demand in Canada and around the world.

Students can write a news article, record a podcast episode or film a video demonstrating and explaining how energy companies are creating infrastructure and developing their production process to be more efficient, sustainable and environmentally responsible. Students can do research about what companies are doing in the real world and include quotes from their websites or media releases. They should balance this with the earlier research they've done about their energy source and provide facts to support or counter the information they find on energy company websites.

At the end, have students reflect on their research and provide recommendations to improve their own energy efficiency in their daily lives.

EXTEND YOUR GEOGRAPHICAL THINKING

Have students research energy production around the world and make comparisons between countries. They can also look for new and innovative ways that energy is being produced more efficiently abroad, and compare that to the programs and policies currently in place in Canada.

Have students watch the Oil & Gas Innovation or the Electricity Innovation Energy IQ Explainer videos for a more in-depth look at cutting-edge energy production and transmission methods in Canada.

Have students research geothermal and tidal energy production in Canada.

MODIFICATIONS

Students can do independent or group research on individual types of energy and present to the class.

Students can work in groups and research one energy source. Students can present to the class in a think, pair, share format.

Students may want to challenge themselves and research a company associated with a different energy source than the one they mastered previously, or continue to expand their knowledge on their previous research.

ASSESSMENT OPPORTUNITIES

Teachers can observe and assess students' participation in class discussions.

If teachers decide to have students do independent or group projects, then they can assess students' written work or oral presentations.

Teachers can use this lesson cross curricularly for science, language and art, and assess accordingly.

SOURCES AND ADDITIONAL RESOURCES

Explore the Energy IQ website to find videos, infographics, and factbooks to gain a deeper understanding of Canada's energy mix landscape.

Natural Resources Canada - Energy Facts provide information about Canada's various energy sources.

Canada Energy Regulator - Provincial and Territorial Energy Profiles

Learn about Canada's oil and natural gas, as well as the world's energy needs, with the Canadian Association of Petroleum Producers.

Natural Resources Canada - Energy Sources and Distribution

Canadian Wind Energy Association

Canadian Nuclear Safety Commission