

TEACHER'S GUIDE

5th
EDITION

EXPLORING CANADA'S ENERGY FUTURE

PATHWAYS TO NET ZERO

A lesson plan for Canadian geography and science classes, grades 9 through 11



Contents

3	Overview
3	What is the Canada Energy Regulator?
4	Pedagogical approach
4	Tips for using the visualizations
6	Recommended resources
7	ACTIVITY 1A: Canadian Energy Stories
12	ACTIVITY 1B: Our Actions Matter – Do All Actions Have the Same Impact?
15	ACTIVITY 2: Energy Fact Sleuths
22	ACTIVITY 3: Energy Entrepreneurs: Invest in This!
49	ACTIVITY 4: Careers at the Canada Energy Regulator: Employee Profiles
60	Appendix 1: Canada Energy Regulator Visualization Descriptions
61	Appendix 2: Portals to Geographical Thinking
62	Appendix 3: Data Sources
64	Appendix 4: Curriculum Matches
65	Appendix 5: Glossary



Additional resources for students and teachers from the Canada Energy Regulator: www.cer-rec.gc.ca/energystudents
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Overview

ABOUT THIS RESOURCE

This guide has been created to support teachers in using the **Exploring Canada's Energy Future Interactive Tool** with their students available at www.cer-rec.gc.ca/energyfuturesdata.

This interactive tool allows users to explore how possible energy futures might unfold for Canadians over the long term. This analysis is not a prediction of what will take place, nor does it aim to achieve certain goals like Canada's climate targets. Rather, Exploring Canada's Energy Future employs economic and energy models to make projections — based on a certain set of assumptions — given past and recent trends related to technology, energy and climate policies, human behaviour, and the structure of the economy. The activities in the 1st Edition were developed by Beyond the Blackboard Educational Consulting (<http://beyondblackboard.ca/services.html>) for Ingenium and the Canada Energy Regulator. In the 2nd Edition some content was developed by Deanna Burgart. Deanna is a Cree/Dene woman from the Fond du Lac First Nation and award winning 'Indigeneer'. New activities in the 4th and 5th Editions were developed by Ingenium.

The 5th Edition of Exploring Canada's Energy Future Lesson Plan contains updated content and images to reflect the new Energy Futures 2023 (EF2023) report and to align with recent updates to the interactive tool. EF2023, linked with the interactive tool, offers the latest long-term energy outlook from the Canada Energy Regulator. To model net-zero, they began with the end goal in mind — net-zero greenhouse gas (GHG) emissions in 2050 — and used their models to identify pathways to that point. EF2023 contains two new scenarios exploring pathways where Canada can achieve net-zero emissions by 2050 under different levels of global climate action, as well as a reference scenario where Canadian and global climate ambition remain at current levels.

TEACHER TIP

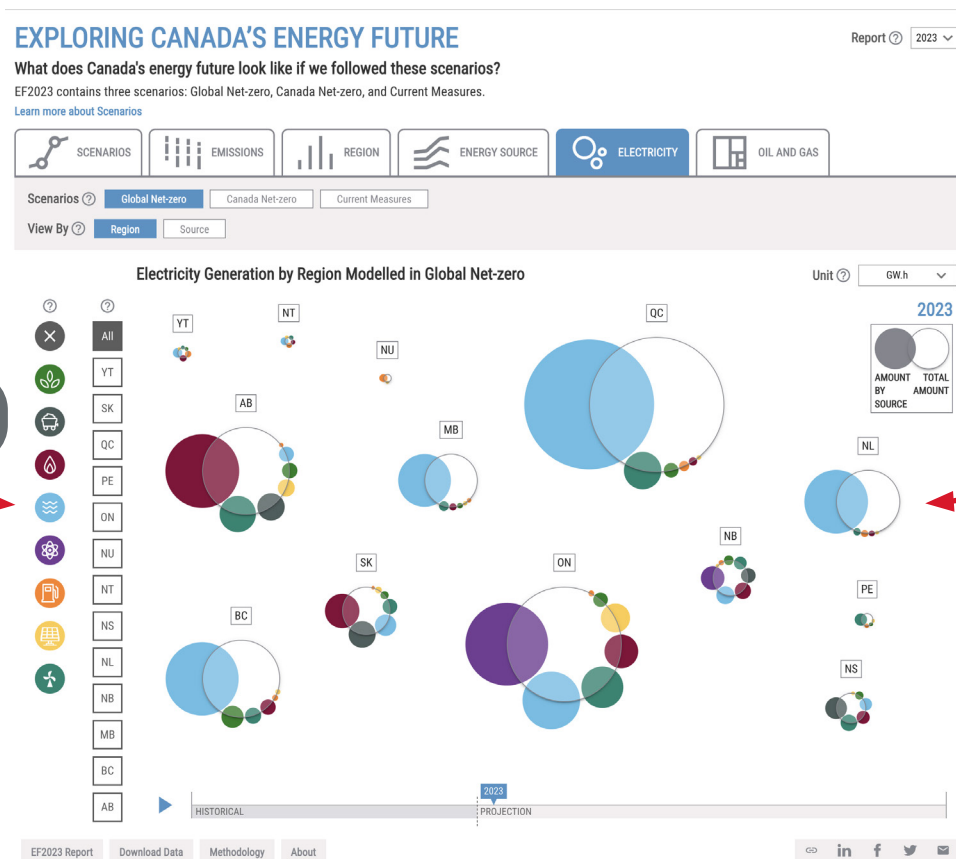
"Net-zero" GHG emissions refers to the balance of human-caused GHG emissions and removals from the atmosphere. Reaching net-zero emissions does not necessarily require eliminating all emissions everywhere. Instead, residual emissions can be balanced by enhancing biological sinks and negative emission technologies.

What is the Canada Energy Regulator (CER)?

The [Canada Energy Regulator](http://www.cer-rec.gc.ca) (CER) is an independent national energy regulator. Its role is to regulate, among other things, the construction, operation, and abandonment of pipelines that cross provincial or international borders, international power lines and designated interprovincial power lines. The CER also regulates the imports of natural gas and exports of crude oil, natural gas liquids, natural gas, refined petroleum products, and electricity, as well as oil and gas exploration and production activities in certain areas. In addition, the CER is charged with providing timely, accurate, and objective information and advice on energy matters.

PEDAGOGICAL APPROACH

The activities in this guide have been designed to promote small group and whole class discussion on factors that affect energy consumption and production trends, anchored in evidence provided by the online tool. The development of media literacy skills has also been targeted by demonstrating how different stakeholders can use the information to support their own energy “stories.” As such, the guide seeks to highlight the nature of geographical thinking, which is more than memorizing facts and figures. Rather, students are asked to analyze elements of time, place, and energy through various economic, political, technological, cultural, and environmental lenses.



TIPS FOR USING THE VISUALIZATIONS

Take a few moments to show the students the salient features of the visualization, such as:

NAVIGATION: individual aspects can be selected (e.g. provinces/territories, sectors, energy sources, etc.) and, in some cases, the timeline can be manipulated to see how the story changes over time.

VARIED UNITS: when students are comparing one visualization to the next, they should ensure that the units are comparable (e.g. both should be in Petajoules or both in GW.h).

SCENARIOS: discuss the importance of providing a reference scenario and scenarios that account for different levels of global action on climate change, technological innovation, and Canadian policies such as carbon pricing. While a reference case is always included, scenarios differ for each report. For instance, the scenarios from EF2023 include:

The **Global Net-zero scenario** assumes Canada achieves net-zero GHG emissions by 2050. It also assumes the rest of the world reduces GHG emissions enough to limit global warming to 1.5 Celsius (°C).

The **Canada Net-zero scenario** assumes Canada achieves net-zero GHG emissions by 2050, but the rest of the world moves more slowly to reduce GHG emissions.

The **Current measures scenario** assumes limited action to reduce GHG emissions beyond current measures. In this scenario, modeling results are not required to achieve net-zero GHG emissions in Canada by 2050. Limited future global climate action was also assumed. This is the reference scenario for EF2023.

Click on these icons to explore all the Energy Future Visualizations.

EXPLORING CANADA'S ENERGY FUTURE

Report ⓘ 2023 ▼

What does Canada's energy future look like if we followed these scenarios?

EF2023 contains three scenarios: Global Net-zero, Canada Net-zero, and Current Measures.

[Learn more about Scenarios](#)

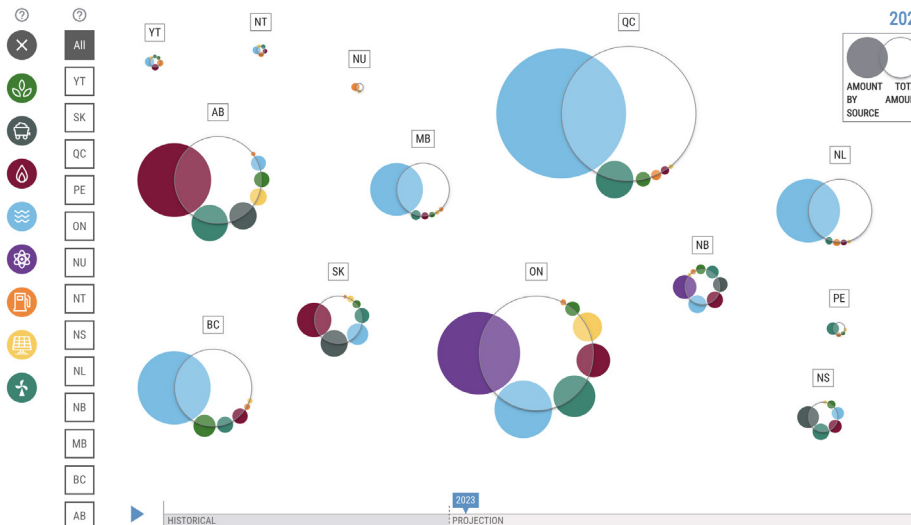


Select the ⓘ icon to learn more about the possible choices.

Electricity Generation by Region Modelled in Global Net-zero

Unit ⓘ GW.h ▼

2023



Click on these links to go to the EF Report, download the data for the graph shown, or learn more about this tool in the methodology.

Click to copy URL, share on social media or email.

EF2023 Report Download Data Methodology About

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TIPS FOR USING THE VISUALIZATIONS

If a scenario is not specified in an activity, students should use the Global Net-zero Scenario.

EXPANDABLE GLOSSARIES: use the question marks next to titles to display definitions and concepts.

DOWNLOADABLE DATA: data can be downloaded to manipulate in Excel or to paste into a document.

SHAREABLE LINKS: persistent links can be copied and pasted to display information combinations created by the students. Selecting the copy URL icon provides a short bit.ly link.

Recommended Resources

Canada's Energy Future: This visualization is based on the CER's flagship publication that outlines the key assumptions made in developing the models, as well as five key findings with respect to possible future trends.

Domestic Climate Policy Assumptions: This resource describes many recent climate policy developments — at both the provincial and federal levels — used in the analysis of Canada's Energy Future 2023.

Provincial and Territorial Energy Profiles: This resource explores Canada's diverse and evolving energy systems by providing facts on energy production, use, transformation, transportation, and trade. These profiles illustrate the diversity of our energy systems and provide information to engage in discussions about energy in Canada.

ACTIVITY 1A: CANADIAN ENERGY STORIES

OVERVIEW	<p>Students look at the Electricity Generation visualization (bubbles) for a specific province/territory and attempt to make sense of the information they are seeing. Note that the data can be manipulated and viewed in a number of ways using the online tool. Note as well that ‘electricity generation’ refers to the electricity being produced in the province and is different from the electricity being consumed (see the province of PEI for example). Students should also examine the scenarios tab to investigate how the different scenarios affect predictions for electricity generation and total energy demand. Extension activities propose sample questions for exploring the Energy Source and Region visualizations where you can look at energy demand by sector and energy demand by region.</p>
LEARNING OUTCOMES	<ul style="list-style-type: none"> • Recognize that provinces and territories have different energy stories • Ability to manipulate CER visualization tools to have the energy stories emerge • Recognize the effect of the various scenarios on the predictions for production and demand for energy • Recognize that different sectors also have different energy stories — the energy you use at home will look very different from the energy you use to move around
MATERIALS	<ul style="list-style-type: none"> • Student handout: Activity 1A: Canadian Energy Stories • Computer access (One computer per two to three students)
CER VISUALIZATION(S)	<ul style="list-style-type: none"> • Explore Electricity Generation (bubbles) https://bit.ly/3NVTvfA • Energy Demand by Region (extension) https://bit.ly/44zSfWn • Explore Energy Demand by Energy Source and Sector (extension) https://bit.ly/3Yld0mA • Compare Scenarios for Electricity Generation https://bit.ly/3K0jKAt • Compare Scenarios for Total End-Use Demand https://bit.ly/44N8fnN

ACTIVITY 1A: CANADIAN ENERGY STORIES

WHAT TO DO

TEACHER TIP

When all energy sources are shown at once, smaller energy productions such as renewables are not highlighted. By focusing on one energy source in particular, we are better able to see its trend. Example: Wind for Electricity Generation
<https://bit.ly/44Srj3W>

TEACHER TIP

Read the CER's [Domestic Climate Policy Assumptions](#) and the [Provincial & Territorial Energy Profiles](#)

1. Assign one province/territory per group of two or three students.
2. Ask students to explore the Electricity Generation visualization for their province/territory and answer the questions on the handout. (5–10 min)
 - What is happening? In a few lines, summarize your province or territory's electricity story.
 - Click on the Scenarios tab at the top of the visualization. What do you notice when comparing the electricity generation in the three scenarios? What surprises you?
 - What surprised you? What caught your attention?
 - Does changing the scenario (Global Net-zero, Canada Net-zero, Current Measures) change the trajectory? How?
 - Does focusing on one energy source in particular change the story? How?
3. Pair students from another province to further their analysis. Point out that provinces can be compared by selecting one or many provinces (5–10 min)
4. What are some similarities? Brainstorm some hypotheses to explain the similarities.
5. What are some differences? Brainstorm some hypotheses to explain the differences.
6. Are these trajectories etched in stone? Why or why not?
 Students share their findings with the class. (2–3 min per province/territory).

HOMEWORK

- Ask students to research a question that arose during the activity (e.g. In Alberta, why do Solar and Wind grow more quickly into the future in the Global Net-zero scenario compared to the Current Measures?). Provide a resource list to help them along.
- Ask students to provide one fun fact about the energy demand or production in their province or territory for a bonus mark ([Provincial & Territorial Energy Profiles](#)).

ACTIVITY 1A: CANADIAN ENERGY STORIES

EXTENSION ACTIVITIES

TEACHER TIP

Teacher Tip: Availability of resources, climate policies, industrial activities, and economic growth may all influence trajectories.

The reason for this change: you do not “adopt” technological innovation, and technology adoption is the trajectory itself and thus is influenced by the other factors.

TEACHER TIP

When all energy sources are shown at once, smaller energy productions such as renewables are not highlighted. By focusing on one energy source in particular, we are better able to see its trend. Example: Biofuels & Emerging Energy in the Northwest Territories: <https://bit.ly/3XFQpRn>

- Find another province/territory that has a similar trajectory to yours. Can you brainstorm reasons why this might be?

ENERGY SOURCE VISUALIZATION

- Take a look at the Energy Source visualization - Total End-Use Demand for All Sectors. Does focusing on one sector in particular (residential, commercial, industrial, transportation) change the story?
- Does focusing on one energy source in particular change the story?
- Which sector uses the most oil products? In Canada, transportation is the most heavily reliant on oil. In fact, Canada is the fourth-largest consumer of oil per person among the world’s most economically-advanced countries.
- Why would Canada consume more oil than most other countries? One of the reasons is that the transportation sector accounts for 55% of Canadian oil demand. The relatively sparse population, number of vehicles on the road, and the long distances across which people and goods must be transported may explain Canada’s relatively high transportation fuel consumption per capita.

REGION VISUALIZATION

- Think about energy demand in your province or territory. Would you expect energy demand to increase, decrease, or stay the same over time? *Students may suggest that it will increase with an increase in population.*
- Take a look at the Region visualization - Total End-Use Demand by Region. Does the trend correspond with what you were thinking? Is a province’s energy demand always proportional to its population?
TIP: Find the province/territory populations on the Statistics Canada website.
- Can you provide hypotheses for why energy demands may decrease or stabilize, even though the population is increasing? *End-use energy demand may peak and decline sooner than we realize even with economic and population growth. The overall decrease in end-use demand will be driven by climate policies that lead to the adoption of key energy efficient technologies. Policies like the carbon price and the zero-emissions vehicle mandate will incentivize Canadians to change the energy they use. For instance, natural gas furnaces used to heat homes may be replaced by heat pumps, which are 2 to 5 times more efficient. Another example is the adoption of electric vehicles — while conventional gasoline vehicles use 12-30% of their energy to move (the rest is lost as heat), electric vehicles use close to 70% of the energy to move while only 30% is lost as heat.*

REFERENCE MATERIALS FOR STUDENTS

- [Provincial & Territorial Energy Profiles](#)

PORTALS TO GEOGRAPHICAL THINKING

- spatial significance
- patterns and trends
- interrelationships
- geographical perspective
- evidence and interpretation

Team members: _____

Assigned province/territory: _____ Date: _____

WHAT TO DO?

1. Open the Exploring Canada's Energy Future Electricity Generation visualization (<https://bit.ly/3NVTvfA>).
2. Select only your province or territory.
3. Scroll along the timeline to see your province or territory's electricity story emerge. Then discuss the following questions:

What is happening? In a few lines, summarize your province or territory's electricity story.

Click on the Scenarios tab along the top of the visualization. What do you notice when comparing the electricity generation in the three scenarios? What surprises you?

Does focusing on one energy source in particular change the story? How?

What surprised you? What caught your attention?

4. Pair up with students from another province or territory and compare your analyses.

What are some similarities? Brainstorm some hypotheses to explain the similarities.

Possible reasons: _____

What are some differences? Brainstorm some hypotheses to explain the differences.

Province/Territory: _____ Province/Territory: _____

Possible reasons: _____

Are these trajectories guaranteed? Why or why not?

ACTIVITY 1B: OUR ACTIONS MATTER – DO ALL ACTIONS HAVE THE SAME IMPACT?

OVERVIEW	The CER works for Canada to keep energy moving safely and efficiently through our country's pipelines and powerlines. Energy plays a fundamental role in the lives of all Canadians. From transportation to healthcare, to the clothes we wear; every product and service in our country requires energy. As individuals, we can affect energy demand. Each student will complete Mission Zero to help them understand that our actions matter and that not all actions have the same impact.
LEARNING OUTCOMES	<ul style="list-style-type: none"> • Recognize that we can affect the energy demand in our province — all actions matter • Recognize that not all actions have the same impact
MATERIALS	<ul style="list-style-type: none"> • Computer (or tablet) access (each student should have the opportunity to complete Mission Zero) • Student handout: Activity 1B: All Actions Matter
CER VISUALIZATION(S)	<ul style="list-style-type: none"> • Mission Zero https://mission-zero.ingeniumcanada.org • Explore Energy Demand by Energy Source and Sector https://bit.ly/3qSckZK • Explore Electricity Generation https://bit.ly/3NVTvfA
WHAT TO DO	<ol style="list-style-type: none"> 1. Each student should complete Mission Zero https://mission-zero.ingeniumcanada.org 2. Explain to students that carbon dioxide equivalent (CO₂e) considers the total climate change impact of ALL the greenhouse gases (GHGs) emitted due to an item or activity. To determine CO₂e all the GHGs are converted into an equivalent amount of CO₂ that would create the same amount of warming. CO₂e can be expressed in kilograms or grams. The process of determining the CO₂e of anything is extremely complex as all steps along the supply chain must be considered. This would include things from raw materials to manufacturing to delivery and use. Ask students to discuss the reasons why different actions have different impacts — discuss some of the GHG emissions due to the actions in Mission Zero. 3. Have students open Exploring Canada's Energy Future Total End-Use by Energy Source for all Sectors (https://bit.ly/3qSckZK) and select their province. Does focusing on one energy source change the story? Why? Is the trend affected by the scenario chosen? Why? 4. Have students open Exploring Canada's Energy Future Electricity Generation (https://bit.ly/3NVTvfA) and view by region. Have students also examine the Emissions visualization with the electricity sector selected (https://bit.ly/3DJSQJK). Students should observe the trend in energy demand. While it is clear that the use of oil products and natural gas will produce greenhouse gases (GHGs), even electricity generation impacts the climate. The size of the impact depends largely on the source used to generate the electricity. How do you think the GHGs emitted due to electricity generation in your province compare to other provinces/territories in Canada? Why?

🇨🇦 Activity 1B: Our Actions Matter – Do all Actions Have the Same Impact?

page 1 / 2

Team members: _____

Assigned province/territory: _____ Date: _____

WHAT TO DO?

1. Each student must complete Mission Zero <https://mission-zero.ingeniumcanada.org>

2. Carbon dioxide equivalent (CO₂e) considers the total climate change impact of ALL the greenhouse gases (GHGs) emitted due to an item or activity. To determine CO₂e all the GHGs are converted into an equivalent amount of CO₂ that would create the same amount of warming. CO₂e can be expressed in kilograms or grams. The process of determining the CO₂e of anything is extremely complex as all steps along the supply chain must be considered. This would include things from raw materials to manufacturing to delivery and use.

Some actions in Mission Zero come with a 40,000 g footprint and others 0 g. Brainstorm some hypotheses to explain why the manufacture of a pair of jeans would have a relatively large climate footprint.

3. Open the Exploring Canada's Energy Future Total End-Use Demand by Energy Source for all Sectors (<https://bit.ly/3qSckZK>)

4. Select your province.

5. Observe the trend in energy demand.

Activity 1B: Our Actions Matter – Do all Actions Have the Same Impact?

page 2 / 2

6. Does focusing on one energy source change the story? Why? Is the trend affected by the scenario chosen? Why?

7. Open the Exploring Canada's Energy Future Electricity Generation visualization (<https://bit.ly/3NVTvfA>) and view by region
8. Open the Emissions visualization with the electricity sector selected (<https://bit.ly/3DJSQJK>)
9. Discuss the following questions:

10. While it is clear that the use of oil products and natural gas will produce greenhouse gases (GHGs), even electricity generation impacts the climate. The size of the impact depends largely on the source used to generate the electricity.

How do you think the GHGs emitted due to electricity generation in your province compare to other provinces/territories in Canada? Why?

ACTIVITY 2: ENERGY FACT SLEUTHS

OVERVIEW	Students use the CER visualizations to support or refute the statements made about energy demand and production in Canadian provinces and territories.
LEARNING OUTCOMES	<ul style="list-style-type: none"> Identify the information available through the CER visualization tool Manipulate the visualization tool to find evidence that supports their claim Employ media literacy skills to determine fact from fiction
MATERIALS	<ul style="list-style-type: none"> Slides template (access to the same document for all of the teams) with provincial/territory statements Computer access (easier to manipulate on computers/laptops than on tablets) Projector
CER VISUALIZATION(S)	<ul style="list-style-type: none"> All may be used
WHAT TO DO	<ol style="list-style-type: none"> Download the slides template and upload to a file-sharing platform, such as Google Slides or Microsoft Office 365 (this will make it easier for students to present their findings). Demo the activity with the example slide. Point out the copy URL button to shorten the link when embedding it in the presentation. Teach the students how to take a screenshot with a screenshot program so they can include a static image of the visualization. Remind them that they can use any visualization, or a combination of visualizations to make their argument. (5 min) Assign one province or territory per group of two or three students (total: 14 groups). Each slide contains true and false statements regarding energy in a specific province or territory. Students read through short market snapshots for their assigned province/territory, then use the CER data visualizations (2023 Report year and selecting the Global Net-zero scenario) to prove or refute the statement. (20 min) Students copy the URL link for their evidence (from the copy URL button) and paste it under the relevant statement. The students should all be working simultaneously on the same document. Students present their work to the class using a single Google Slides document. (20 min)
PORTALS FOR GEOGRAPHICAL THINKING	<ul style="list-style-type: none"> Spatial significance Patterns and trends Interrelationships Geographical perspective Evidence and interpretation

TEACHER TIP

Snapshots have been rated on a scale of one (easiest) to three (challenging) to enable task differentiation.

TEACHER TIP

Although sample visualizations have been provided in the key to support or refute the statement, students may manipulate the tool differently to come up with similar conclusions.

TEACHER TIP

The links provided in the table below are for your information. Many of the links would provide students with the answer without having to manipulate data.

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
3	AB	The higher the global price of oil and natural gas in 2050, the higher their production levels.	T	Compare Scenarios for Oil Production (AB) https://bit.ly/44DCcqr and Compare Scenarios for Gas Production (AB) https://bit.ly/46RtmYe
1	AB	Oil production in Alberta in 2050, in both Global Net-zero and Canada Net-zero scenarios, is roughly the same.	F	Compare Scenarios for Oil production (AB) https://bit.ly/44DCcqr 2050 Global Net zero (1024.71 Mb/d) 2050 Canada Net-zero (3517.65 Mb/d) See Provincial and Territorial Energy Profiles - AB https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-alberta.html
1	BC	By 2050, in Global Net-zero, in BC, wind will make up the second largest source of electricity generation behind hydro.	T	Electricity Generation by Region (BC, 2050) https://bit.ly/3OgfBLn
2	BC	By 2050, BC is expected to have a higher demand for electricity within the transportation sector than any other province.	F	Energy Demand by Sector (Transportation, Electricity, 2050) https://bit.ly/3D1MEMI BC 108.47 PJ QC 143.83 PJ ON 277.02 PJ See Provincial and Territorial Energy Profiles – BC https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-british-columbia.html
1	MB	Manitoba is among Canada's top natural gas producers in all scenarios.	F	Gas Production by Region (MB) https://bit.ly/3pERLPN Correct answer: False – Manitoba does not produce natural gas.

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
3	MB	Oil products continue to provide the largest share of total energy demand in Manitoba through the projected period in all scenarios.	F	Total End-use Demand for All Sectors (2050, MB) https://bit.ly/3JXzdB7 Electricity generation takes over in 2035 in Global Net-zero and in 2034 in Canada Net-zero. This statement is true for current measures. See Provincial and Territorial Energy Profiles - MB https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-manitoba.html
1	NB	The total demand for energy in New Brunswick will be the same in 2050 in all three scenarios.	F	Compare Scenarios for Total End-use Demand (NB, 2050) https://bit.ly/44v0qDB
2	NB	In New Brunswick, in the Global Net-zero scenario, electricity will make up over 90% of energy demand in the residential sector by 2050.	T	End-Use Demand for the Residential Sector (NB, 2050) https://bit.ly/3XKRuaK See Provincial and Territorial Energy Profiles - NB https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-new-brunswick.html
1	NL	In the Current Measures scenario, Newfoundland and Labrador's conventional oil production will grow between 2021 and 2050.	F	Oil Production by Region, Current Measures (NL 2021, 2050) https://bit.ly/3pIAk0Q
2	NL	In 2050, Newfoundland's electricity demand will be 75% of the total energy demand in the Global Net-zero scenario.	F	Total end-use demand for all sectors (NL, 2050) https://bit.ly/3DuJbGL See Provincial and Territorial Energy Profiles – NL https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-newfoundland-labrador.html
2	NS	Historically in Nova Scotia, coal was the main source of electricity generation, but it will stop being used by 2030 in all scenarios.	T	Electricity Generation by Region (NS) https://bit.ly/3DtBFvM

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
3	NS	In Global Net-zero, electricity generation in Nova Scotia is higher than in Current Measures; therefore, total energy demand is also higher in Global Net-zero.	F	NS Total demand - Scenarios https://bit.ly/3O9nO2L NS Electricity generation https://bit.ly/3D8l0O4 See Provincial and Territorial Energy Profiles – NS https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-nova-scotia.html
3	NU	In 2021, almost all of Nunavut's electricity came from burning imported oil.	T	Total Electricity Generation (NU, 2021) https://bit.ly/3NKiimR and Oil Production by Region (NU, 2021) https://bit.ly/3XF5iU0 Note: “Total electricity generation” is the total electricity generated within the province, regardless of where the fuel comes from. In this case, it is interesting that importing diesel is its main fuel source. Shorter ice road access caused by climate change has major implications for diesel transportation. See, The ice roads of Northern Canada are disappearing (CBC) https://www.cbc.ca/radio/day6/episode-335-100-days-of-sean-spicer-disappearing-ice-roads-beatles-live-retro-futurism-at-expo-67-and-more-1.4084549/the-ice-roads-of-northern-canada-are-disappearing-1.4084560
2	NU	In 2020, the transportation sector was the largest consumer of Nunavut's electricity. This is expected to continue through 2050.	F	Energy Demand by Sector (NU, Transportation, Electricity, 2020 and 2050) https://bit.ly/3Kcu9sc Correct answer: the commercial sector is the largest consuming sector for electricity in Nunavut during the projection period. See Provincial and Territorial Energy Profiles - NU https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-nunavut.html

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
2	NT	In 2021, natural gas production in the Northwest Territories accounted for more than 10% of total natural gas production in Canada.	F	Gas Production by Region (NT, 2021) https://bit.ly/3pERLPN Correct answer: It accounts for less than 0.1% of Canadian natural gas production. See Provincial and Territorial Energy Profiles - NT https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-northwest-territories.html
2	NT	The NWTs use the least amount of energy in Canada.	F	Total End-use Demand by Region https://bit.ly/44zSfWn Answer: Nunavut uses the least amount, followed by the Yukon in all scenarios. See Provincial and Territorial Energy Profiles - NT https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-northwest-territories.html
2	ON	In all three scenarios, Ontario will emerge as the leading electricity generator in Canada by 2050.	F	Electricity Generation by Region (2050) https://bit.ly/44yajiY Answer: In current measures, Quebec will generate more electricity than Ontario in 2050
1	ON	In the Global Net-zero scenario, hydrogen will make up just under 8% of Ontario's industrial demand by 2050.	T	End-Use Demand for the Industrial Sector (ON, 2050) https://bit.ly/3rp86bW See Provincial and Territorial Energy Profiles – ON https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-ontario.html
2	PE	In 2021, PEI generated enough electricity to fulfill all of the island's electricity demands.	F	Electricity Generation by Region (PEI, 2021) https://bit.ly/45xdtVP 2.18 PJ Total End-use Demand for All Sectors (PEI, 2021) https://bit.ly/3pzZHly 6.10 PJ Note: pay attention to the units

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
1	PE	In the Global Net-zero scenario, hydrogen makes up nearly 30% of transportation demand in 2050.	T	End-use Demand for the Transportation Sector (PEI, 2050) https://bit.ly/3D6XqB8 See Provincial and Territorial Energy Profiles – PE https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-prince-edward-island.html
2	QC	In the Global Net-zero scenario, Quebec's electricity demand will make up 62% of its total energy demand by 2050. This is the highest share of electricity demand in the country.	T	Total End-use Demand for All Sectors (electricity, Quebec) https://bit.ly/3Dse9iR
1	QC	In the Global Net-zero scenario, Quebec will significantly increase its nuclear energy generation by 2050 (compared to 2021).	T	Electricity Generation by Region (QC) https://bit.ly/46KOCP5 See Provincial and Territorial Energy Profiles – QC https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-quebec.html
2	SK	In all scenarios, bio-mass-based electricity generation in Saskatchewan is projected to become the dominant generation source by 2050.	F	Electricity Generation by Region (SK, 2050) https://bit.ly/3qEJ1ty In Canada Net-zero and Current Measures wind is projected to be the primary source for electricity generation.
1	SK	In 2021, Saskatchewan was Canada's second-largest producer of oil. Alberta was the first.	T	Oil Production by Region (SK, 2021) https://bit.ly/3XF5iU0 See Provincial and Territorial Energy Profiles - SK https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-saskatchewan.html

ACTIVITY 2: ENERGY FACT SLEUTHS – TEACHER KEY

LEVEL	PROV	STATEMENT	TRUE/ FALSE	VISUALIZATION
1	YT	The Yukon will use more energy in the Net-zero scenarios than in Current Measures throughout the projection period.	F	Compare Scenarios for Total End-use Demand (YT, 2050) https://bit.ly/3Oa9esH
1	YT	In the Yukon, in the Global Net-zero scenario, the largest source of energy in Transportation by 2050 will be electricity.	F	Total End-use Demand for All Sectors (YT, transportation, 2050) https://bit.ly/3XK6jub See Provincial and Territorial Energy Profiles – YT https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-yukon.html
1	ALL	Current Measures has higher oil and gas emissions than the Net-zero scenarios from 2023 throughout the projection period.	T	Emissions Modelled in Current Measures https://bit.ly/3PUx3pR
1	ALL	Direct air capture is responsible for more negative emissions in Canada Net-zero than in Global Net-zero. There is no direct air capture in the Current Measures Scenario.	T	Emissions – Direct Air Capture https://bit.ly/3O7r2nj
1	ALL	Electricity generation and hydrogen production start with positive emissions but become negative-emitting sectors throughout the projection period in all scenarios.	F	Emissions (electricity, hydrogen) https://bit.ly/3pJFjhK The statement is true for electricity and hydrogen production for the Global and Canada Net-zero scenarios; however, they are both positive-emitting in the Current Measures scenario.
2	ALL	In 2050, using the Global Net-zero scenario, emissions from the oil & gas and transportation sectors will be less than 10% of 2021 levels.	T	Emissions Modelled in Global Net-zero (Oil and gas, transportation, 2021, 2050) https://bit.ly/3JSyMrW See Provincial and Territorial Energy Profiles - Canada https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html

ACTIVITY 3: ENERGY ENTREPRENEURS: INVEST IN THIS!

OVERVIEW	<p>Students represent various stakeholders and must convince the investors to invest in their idea rooted in CER visualizations. The proposal can either be based on the current trend or arguing that their idea could significantly change the trajectory. The lack of clean, affordable, and reliable energy infrastructure in Indigenous and remote communities in Canada is a pressing issue that demands attention. Including these stakeholders in the conversation and decision-making processes is crucial to ensure they receive the necessary support for sustainable infrastructure development.</p> <p>As the teams present their ideas, they should highlight the relevance and usefulness of their proposal to Canada's journey towards achieving a net-zero greenhouse gas emissions target. They should emphasize how their vision aligns (or does not) with the country's climate goals and contributes to a cleaner and more sustainable energy future. Students should also be prepared to address any potential threats or challenges their idea may pose to Canada reaching its goal of net zero. This could involve acknowledging potential risks or limitations and providing strategies to mitigate them.</p>
LEARNING OUTCOMES	<ul style="list-style-type: none"> • Recognize that a visualization tool may be manipulated to support arguments from various stakeholders • Provide scientific evidence to support a decision to pursue an idea and to persuade an audience
MATERIALS	<ul style="list-style-type: none"> • Activity description and stakeholder profiles, including judging rubric (double sided), and map of CER Total End-Use Energy Demand (2021).
WHAT TO DO	<ol style="list-style-type: none"> 1. In groups of 2 or 3, provide students with a stakeholder profile as well as a copy of the CER map of Total end-Use Energy Demand (2021). There are 16 stakeholder profiles. 2. Explain that each group will have to make a "pitch" to the investors (one or several teachers) to invest in an idea that is supported by one or more CER visualizations. The idea can either be based on the current trend or by arguing that their idea could significantly change the trajectory. 3. The Entrepreneurs use the evaluation sheet to rate the ideas.
EXTENSION ACTIVITIES	<ul style="list-style-type: none"> • Assign students in the class to be investors for their classmates, in order to stimulate participation. Each investor receives an evaluation sheet and is encouraged to ask questions. • The audience (other students) may choose to support (if alliance is possible to their service or product) or argue against the idea. • Have students record their pitch in a two-minute video. • Pair up with another group and record a mini Energy Entrepreneurs episode: each group pitches their idea to the other team's investors. Although they may include comedic relief, the investors must provide at least 2–3 reasons why they choose to support or not to support an idea. Share the episodes in class with popcorn!
CER VISUALIZATION(S)	<ul style="list-style-type: none"> • All may be used

TEACHER TIP

Students will be more motivated if they get to choose their own profile. Although more than one group may choose a profile, their interpretation of it will be different.

REFERENCE MATERIALS FOR STUDENTS	<ul style="list-style-type: none"> • Exploring Canada's Energy Future • CER Energy Market Snapshots • Provincial and Territorial Energy Profiles • Fuel End-Use Prices by Scenario
PORTALS TO GEOGRAPHICAL THINKING	<ul style="list-style-type: none"> • spatial significance • patterns and trends • interrelationships • geographical perspective • evidence and interpretation • ethical judgement

Below are the profile descriptions along with some suggested questions and ideas, to inspire students in their brainstorming session (should they require inspiration!). **Note that 'Indigenous' and 'Nation' are inclusive of First Nations, Métis and Inuit.**

1. RECRUITING INDUSTRY: You are a staff recruitment company seeking an investment to develop a database that will connect Indigenous businesses, professionals, and students with potential employers and clients in the energy industry.	Think about the needs of energy companies. What kinds of jobs are there? What kinds of Indigenous businesses, entrepreneurs, and individuals could meet these needs? What important things should be considered to support Indigenous individuals and businesses in a culturally safe and relevant way as they engage in energy sector business? How will you make money on this investment?
2. EXTRACTION EQUIPMENT MANUFACTURER: You are currently an oil rig manufacturer seeking to expand your business to develop equipment for a new industrial sector.	Which areas have high energy consumption by the industrial sector? Which industries might these be?
3. LEED ARCHITECT: You are a young architect who has been working on LEED projects (Leadership in Energy and Environmental Design) for the past five years. You are seeking an investment from the investors to build a model commercial building that encourages sustainable practices design.	Which areas have high electricity and natural gas prices? Which areas have tight energy production vs. demand? These are areas where an incentive to introduce energy efficiencies is the highest.
4. PIPELINE SERVICES: You are an Indigenous entrepreneur seeking an investment to purchase equipment to supply the oil and gas pipeline companies working on major projects near your community. You currently have construction equipment to participate in building the pipeline(s). You want to purchase pipeline maintenance equipment to support the pipeline operator companies (different from the construction companies) throughout the life of the pipeline.	What will you need to learn about to make good on your new business plans? How will you identify who to talk to in the pipeline operations companies? (The pipeline construction companies that you have existing relationships with are not the same ones that will operate the pipelines). How will you learn what you need to do to qualify to work with these companies?
5. CRYPTOCURRENCY START-UP: You are an entrepreneur looking to start a cryptocurrency mining datacentre. You are asking the investors to invest in your start-up.	Where are there cheap electricity prices and abundant sources with low demand? That means that you have room to demand a lot more without putting pressure on the system to increase prices (cryptocurrency requires large amounts of electricity).

<p>6. ELECTRIC VEHICLE MANUFACTURER: You are an electric vehicle manufacturer who has had a lot of success in California. You are asking the investors to invest in a charging station pilot project in a specific area of Canada.</p>	<p>Which provinces provide the most/best incentives to buy EVs? Which seem most aggressive with regards to lowering the carbon footprint? Add prices of gasoline and electricity to create an appealing story where demand would switch from hydrocarbons to electricity in transportation by virtue of price differential.</p>
<p>7. RENEWABLE ENERGY PROJECTS: You are an Indigenous company seeking an investment to develop and launch a solar farm project in your community, currently powered by diesel.</p>	<p>What benefits and barriers are there to a project like this? What kinds of things would you need to think about to get support from your community leadership and citizens? What kind of skills will you need to build for people in your community to operate a solar farm?</p>
<p>8. ENVIRONMENTAL ENTERPRISE: You seek an investment to develop a product or offer a service that benefits the environment. Your idea could have national potential or could target a specific province or territory.</p>	<p>Are there places that could benefit from lowering their carbon footprint?</p>
<p>9. INDIGENOUS ENGAGEMENT AND CONSULTATION SERVICES: The government of Canada requires energy companies to consult with Indigenous communities about development projects. You are a small Indigenous consulting group in a remote northern community seeking to expand your services and online presence. To better connect with the energy companies' supply chain departments, you're seeking investment to hire and train staff in Calgary, Alberta, where your target clients' head offices are.</p>	<p>What elements go into the online presence you are trying to fund? (Website, social media, marketing?) How will you ensure a return on the investment? (Where is the income growth potential in this?) How will you decide which companies to promote your services to?</p>
<p>10. OIL AND GAS PRODUCER: You have had much success in Western Canada and are looking to expand your business in another Canadian territory or province.</p>	<p>Where are current resources (oil and gas) located? Are there some provinces that don't produce oil and gas whereas their neighbours do? Perhaps this is a good place to discuss the emergence of fracturing technology to develop unconventional resources.</p>
<p>11. INDIGENOUS ENGINEERING AND INFRASTRUCTURE: You are an Indigenous-owned engineering firm committed to incorporating your worldviews and perspectives into your design and construction. You work in many Indigenous communities that are not your own. When going into a new community, it is important to you that your work reflects the perspectives and values of that community. You are pitching to develop a 'best practices' guide to inform Indigenous and non-Indigenous engineering firms about how to do this work.</p>	<p>What kinds of questions will you ask the leaders, Elders and knowledge-keepers of the Nation before proceeding with your design? Who will you meet with to gather this information? How will you communicate with the Nation as you progress with your project?</p> <p>How will you convince investors who may or may not be Indigenous themselves that this is a critical step to take?</p>

<p>12. TRANSPORTATION COMPANY: Your company is looking to expand its business and provide transportation of energy products from areas of supply to potential areas of demand. For example, you can build pipelines to move natural gas, crude oil, bioenergy, and hydrogen, and power lines to move electricity.</p>	<p>Finding matches between high-production areas with high demand areas. Or combining ideas that will create higher demand growth (policymaker groups suggesting policies that will create economic growth) and this group would ensure that energy was delivered to or from to complete the circle. Could they even expand into the transportation of people?</p>
<p>13. RENEWABLE ENERGY DEVELOPER: Your company has had much success in developing solar, wind, algal, geothermal, and tidal energy projects in Norway and India. You are looking for an investment from the Entrepreneurs to develop a new renewable energy project in a specific province in Canada.</p>	<p>Look at demand growth combined with solar radiation and wind maps. Combine renewable energy projects with Smart Grids technology for inserting renewable energy into existing grids. Are there articles that relate to technologies not yet being used, such as algal-based energy?</p>
<p>14. INDIGENOUS ENTERPRISE: You are an entrepreneur based in an Indigenous community. Use the visualization tool to justify creating a product or service with a positive impact on Indigenous communities.</p>	<p>There are numerous examples in Canada where Indigenous communities have entered into relationships with energy producers/providers to achieve best results for their communities. You can look for examples and use them for this exercise.</p>
<p>15. ENVIRONMENTAL NGO: You are a non-governmental organization that seeks to promote environmental conservation with respect to energy production and consumption. You are seeking funding from the Entrepreneurs' not-for-profit fund, to further your cause in either a specific province or territory (or nationally).</p>	<p>The visualizations would help choose areas of interest where improvements can be made. For instance, examine Northern Canada where the use of hydrocarbons is prevalent. Focus on how technology and adaptation of new energy technologies to northern conditions will advance sustainability in the North.</p>
<p>16. INDIGENOUS COMMUNITY ENVIRONMENTAL MONITORING: You are an Indigenous-owned environmental monitoring company committed to incorporating Traditional Indigenous Knowledge into community-led environmental monitoring programs to support the energy industry and protect the environment. When going into a new community, it is important to you that the program is community-led and that you can build a sustainable process that continues once you leave. You need new cash resources to create the templates for this kind of programming.</p>	<p>How will you approach the Elders and Knowledge Keepers? What kinds of questions will you ask them in order to develop this kind of monitoring program? What traditional practices might you consider that are specific to that Indigenous community? What role will knowing about these play in your planning?</p>
<p>17. DATA VISUALIZATION DESIGNER: You are looking for an investment in your new business creating data visualizations, to help companies share and analyze their information.</p>	<p>Looking at the regions that have either high production and/or high demand, you would identify where and if there is a concentration of headquarters and capital cities for provincial governments. These are likely to be the best markets for data visualization services.</p>

<p>18. INDIGENOUS ENERGY POLICY SPECIALIST: You are an energy policy specialist with a background in Indigenous rights and law. You want to build your organization and train others to work in this area, advising government and industry on how to implement the Truth and Reconciliation Calls to Action into their business and day-to-day work. You are looking for a growth investment.</p>	<p>Read Action #92, dealing with business and reconciliation, in the Truth and Reconciliation Calls to Action. What kinds of services could you provide that can help businesses in the energy sector answer these Calls to Action?</p>
<p>19. POLICYMAKER: You are a policymaker looking to design policies in a specific sector to stimulate economic growth, speed up clean energy demand, or slow down fossil fuel demand.</p>	<p>There is much that can be done if you can combine different sources demand data with supply data and energy prices. For instance, a region with abundant electricity generation from clean energy sources and low electricity prices might need fewer electric vehicles subsidies than a region without.</p>
<p>20. INDIGENOUS BRANDING AND MARKETING SPECIALIST: You are an Indigenous-owned business that specializes in marketing and promotional materials for the energy industry. You are pitching to grow your company and promote yourself to a wider audience.</p>	<p>How could you increase your reach to the energy industry throughout Canada? You are currently doing a lot of work with oil and gas companies but would like to diversify to other energy companies. What other kinds of energy companies could you market to?</p>

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: RECRUITING INDUSTRY

You are a staff recruitment company seeking an investment to develop a database that will connect Indigenous businesses, professionals, and students with potential employers and clients in the energy industry.

** Note that 'Indigenous' and 'Nation' are inclusive of First Nations, Métis and Inuit.*

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3. Brainstorm ideas with your team. Consider the usefulness of your proposal to Canada's journey towards achieving a net-zero greenhouse gas emissions target or address any potential threats or challenges your proposal may cause and possible strategies to mitigate them.
4. Create a two to five-minute presentation, including images from the visualization tool and other sources, to convince the investors to invest in your idea. **TIPS:** You may want to see if you can build alliances with other stakeholders to increase your desirability factor. If possible, highlight the usefulness of your proposal to Canada's journey toward achieving net-zero greenhouse gas emissions.

HELPFUL HINTS FOR INSPIRATION

- Think about what you want to see in the future. Do you want to change the trajectories? How can you do that?
- Do the Net-zero scenarios help or hurt your proposal?
- How can your idea help Canada reach its goal of net zero? If your idea poses a challenge or threat, what strategies could be used to mitigate these?
- Do you see anything in the current trajectories that you can use to make plans for the future?
- What are the current resources available in your province of choice?
- What might there be in other provinces that could be in your province of choice?
- Do you know of things that are working in other countries that might work in Canada?
- What types of businesses already operate in your province of choice?
- Why is your chosen province the most profitable for this business?
- Is Canada a good place to start this business? Why or why not?
- Who will be your clients/customers?
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STAKEHOLDER PROFILE: EXTRACTION EQUIPMENT MANUFACTURER

You are an oil rig manufacturer seeking to expand your business to develop equipment for a new industrial sector.

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STAKEHOLDER PROFILE: LEED ARCHITECT

You are a young architect who has been working on LEED projects (Leadership in Energy and Environmental Design) for the past five years. You are seeking an investment from the investors to build a model commercial building that encourages sustainable practices design.

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You are an Indigenous entrepreneur seeking an investment to purchase equipment to supply the oil and gas pipeline companies working on major projects near your community. You currently have construction equipment to participate in building the pipeline(s). You want to purchase pipeline maintenance equipment to support the pipeline operator companies (different from the construction companies) throughout the life of the pipeline.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: ENVIRONMENTAL ENTERPRISE

You seek an investment to develop a product or offer a service that benefits the environment. Your idea could have national potential or could target a specific province or territory.

2. Find out more about the energy profiles of various Canadian provinces and territories by using the following resources:
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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS ENGAGEMENT AND CONSULTATION SERVICES

The government of Canada requires energy companies to consult with Indigenous communities about development projects. You are a small Indigenous consulting group in a remote northern community seeking to expand your services and online presence. To better connect with the energy companies' supply chain departments, you're seeking investment to hire and train staff in Calgary, Alberta, where your target clients' head offices are.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: OIL AND GAS PRODUCER

You have had much success in Western Canada and are looking to expand your business in another Canadian territory or province.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS ENGINEERING AND INFRASTRUCTURE

You are an Indigenous-owned engineering firm committed to incorporating your worldviews and perspectives into your design and construction. You work in many In-digenous communities that are not your own. When going into a new community, it is important to you that your work reflects the perspectives and values of that community. You are pitching to develop a 'best practices' guide to inform Indigenous and non-Indigenous engineering firms about how to do this work.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: TRANSPORTATION COMPANY

Your company is looking to expand its business and provide transportation of energy products from areas of supply to potential areas of demand. For example, you could build pipelines to move natural gas and crude oil, and power lines to move electricity.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: RENEWABLE ENERGY DEVELOPER

Your company has had much success in developing solar, wind, algal, geothermal and tidal energy projects in Norway and India. You are looking for an investment from the investors to develop a new renewable energy project in a specific province in Canada.

2. Find out more about the energy profiles of various Canadian provinces and territories by using the following resources:
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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS ENTERPRISE

You are an entrepreneur based in an Indigenous community. Use the visualization tool to justify creating a product or service with a positive impact on Indigenous communities.

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WHAT TO DO?

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STAKEHOLDER PROFILE: ENVIRONMENTAL NGO

You are a non-governmental organization that seeks to promote environmental conservation with respect to energy production and consumption. You are seeking funding from the investors' not-for profit fund to further your cause, either nationally or in a specific province or territory.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS COMMUNITY ENVIRONMENTAL MONITORING

You are an Indigenous-owned environmental monitoring company committed to incorporating Traditional Indigenous Knowledge into community-led environmental monitoring programs to support the energy industry and protect the environment. When going into a new community, it is important to you that the program is community-led and that you can build a sustainable process that continues once you leave. You need new cash resources to create the templates for this kind of programming.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: DATA VISUALIZATION DESIGNER

You are looking for an investment in your new business creating data visualizations, to help companies share and analyze their information.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS ENERGY POLICY SPECIALIST

You are an energy policy specialist with a background in Indigenous rights and law. You want to build your organization and train others to work in this area, advising government and industry on how to implement the Truth and Reconciliation Calls to Action into their business and day-to-day work. You are looking for a growth investment.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: POLICYMAKER

You are a policymaker looking for an investment in a specific sector to stimulate economic growth, or to speed up/slow down predicted trends in your province or territory.

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WHAT TO DO?

1. Read your stakeholder profile.

STAKEHOLDER PROFILE: INDIGENOUS BRANDING AND MARKETING SPECIALIST

You are an Indigenous-owned business that specializes in marketing and promotional materials for the energy industry. You are pitching to grow your company and promote yourself to a wider audience.

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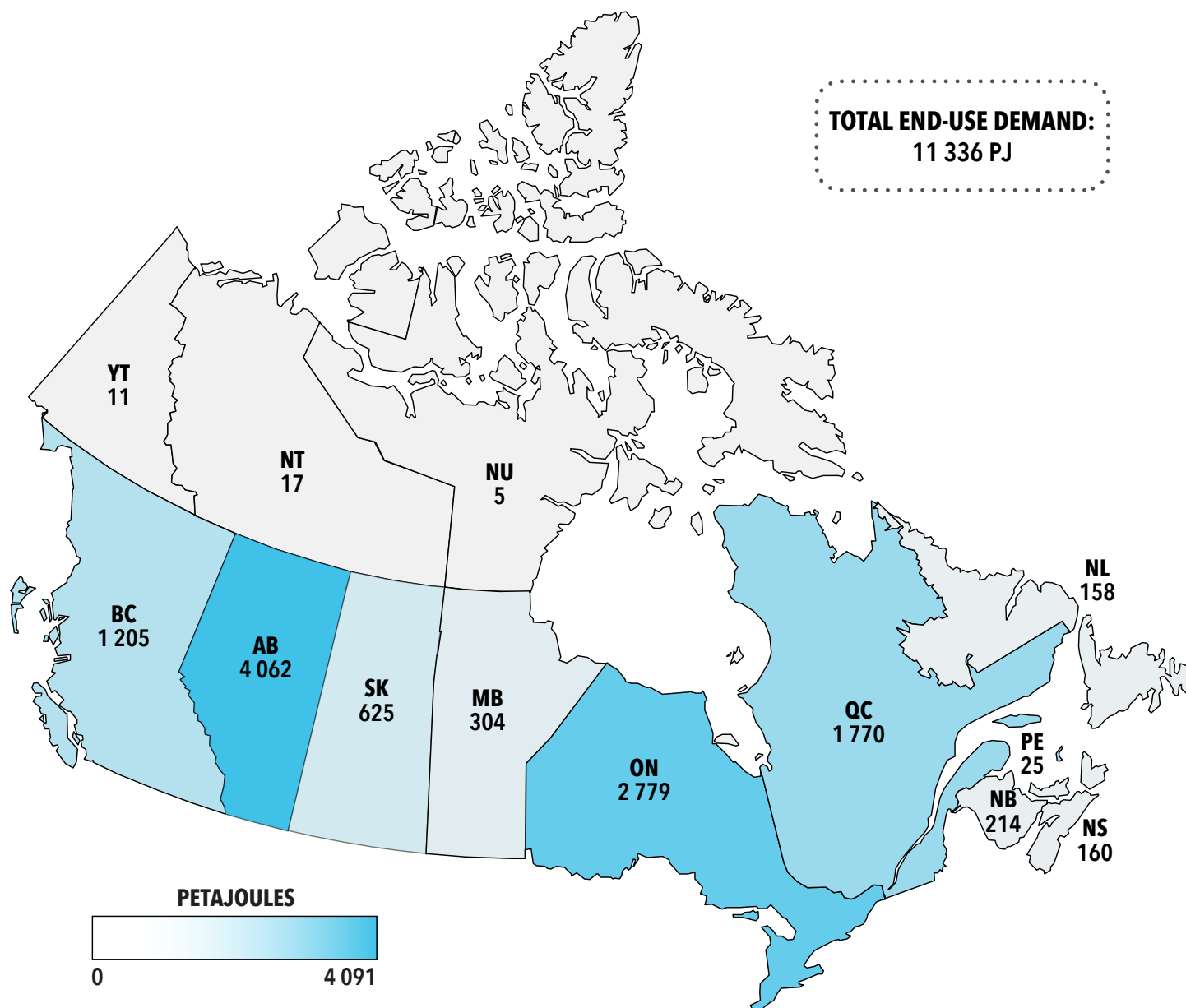
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- Do the Net-zero scenarios help or hurt your proposal?
- How can your idea help Canada reach its goal of net zero? If your idea poses a challenge or threat, what strategies could be used to mitigate these?
- Do you see anything in the current trajectories that you can use to make plans for the future?
- What are the current resources available in your province of choice?
- What might there be in other provinces that could be in your province of choice?
- Do you know of things that are working in other countries that might work in Canada?
- What types of businesses already operate in your province of choice?
- Why is your chosen province the most profitable for this business?
- Is Canada a good place to start this business? Why or why not?
- Who will be your clients/customers?
- Who will benefit from your business?
- Will anyone be against this business or suffer hardship because of it?

🇨🇦 Activity 3: Energy Entrepreneurs: Invest in This!

CANADIAN END-USE ENERGY DEMAND (2021)



Data from: <https://bit.ly/44uolNo>

Team members: _____

Stakeholder Profile: _____ Due by: _____

Remit this rubric to the investors on pitch day

CRITERIA	LEVEL 1 Does not meet expectations	LEVEL 2 Minimally meets expectations	LEVEL 3 Fully meets expectations	LEVEL 4 Exceeds expectations
VIABILITY OF PRODUCT, SERVICE OR INVENTION (30%)				
Identifies a specific need to be addressed, a gap to be filled or a problem to be solved.				
Describes strategies that produce a positive, lasting impact on their target market.				
Clearly identifies and describes their target market.				
CREATIVITY AND INNOVATION (30%)				
Demonstrates a clear action plan.				
Demonstrates creativity and innovation in identifying strategies to meet the need, to fill the gap or to solve the problem.				
COMMUNICATION AND PURSUASIVENESS (40%)				
Effectively uses evidence from the CER's visualization tool to support the idea.				
Effectively uses existing information relating to province or territory of choice to justify the idea.				
Presents a clear, concise, creative and informative sales pitch targeted to the Entrepreneurs.				
Effectively uses branding (company name, logo, taglines) to present a professional image.				
Creates a memorable and effective closing (call to action).				
NOTES:				

ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

OVERVIEW	This activity is designed to illustrate non-conventional jobs at the Canada Energy Regulator that represent a variety of educational trajectories. Students may be surprised by the many different types of people hired by the CER, including artists, communication specialists, writers and engineers.
LEARNING OUTCOMES	<ul style="list-style-type: none"> • Recognize that scientific institutions require contributions from people with a variety of backgrounds and interests. • Discover various entry points into employment in the science and technology field, contributing to their job search skills development.
MATERIALS	<ul style="list-style-type: none"> • Sticky notes (3-4 per student) • Sharpie markers • One set of CER Employee Profiles to post around the room (large print) • One set of CER Employee Profiles per group (small print)
CER VISUALIZATION(S)	None
WHAT TO DO?	<ol style="list-style-type: none"> 1. With the class, brainstorm what kinds of jobs might be available at the Canada Energy Regulator. Write these on individual sticky notes and post on the board. Sort them into general categories. 2. Split students into groups representing the general categories above. What education or experience would be required for that type of job? Write these on individual sticky notes and post on the board. 3. Do the profiles created represent the abilities and interests of everyone in the room? Which kinds of jobs are represented? Which are absent? 4. Post the large print profiles around the room and ask students to roam and read. Did anything surprise them? 5. Hand out one set of Canada Energy Regulator Employee Profiles per group. After looking at the profiles, do they see some of the "absent" categories from Step 3? Did anything surprise them?
HOMEWORK/ EXTENSION	<ol style="list-style-type: none"> 1. Find the Careers page of the Canada Energy Regulator (Home > About Us > Careers). 2. Are you eligible for the Federal Student Work Experience Program? Optional: give students some time to create an account with the FSWEPP or negotiate with your school's career counseling program. 3. Which social media platforms might CER jobs appear on? Twitter, LinkedIn (specified in the Careers page). 4. What does the CER expect to see in your cover letter? Name of position, position ID number, and to list how you meet the essential qualifications listed on the Statement of Merit Criteria. 5. What does the CER expect to see in your CV? Profile (language, skill and attitude highlights), Formal Education, Work Experience (Career Summary), Volunteer Experience, Professional Development, Awards (and recognition), Other Requested Information (e.g. citizenship). 6. What is the difference between formal education and professional development? Formal education represents a degree-granting program such as high school and college diplomas and university degrees. Professional development represents workshops, individual courses and institutes you have attended to develop skills and abilities related to the position. PD includes personal development workshops such as teambuilding and communication skills.

ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Alison**

TITLE: Human Resources Advisor

EDUCATION: Bachelor of Elementary Education with a minor in French.

EXPERIENTIAL/ON THE JOB EDUCATION: Most of my learning in my career since university has been on-the-job learning.

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL?

A construction class in high school.

WHAT WAS YOUR VERY FIRST JOB EVER? I worked at Sobeys in the bakery and cake department.

WHERE WERE YOU BORN? Rocky Mountain House, AB.

WHAT'S YOUR FAVOURITE ANIMAL:

Dogs — We just adopted a dog from Alberta Animal Rescue Crew Society and named her Spirit.

WHAT'S YOUR FAMILY LIKE?

I have a small but mighty family.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB:

I love having a career with the Federal Public Service because opportunities are plentiful — you can have 25 different jobs over your career with one employer!

I am a member of the CER's Indigenous Employee Circle, and I appreciate the friendships I've made within the Circle.

FIRST JOB AFTER GRADUATING?

After high school, I did a youth volunteer program called Katimavik, where I travelled and worked in three provinces with 10 other youth from all over Canada. Afterwards, I joined Katimavik's head office in Montreal, working in participant recruitment.

WHAT DO YOU STILL WANT TO LEARN ABOUT? I want to improve my French and continue to reconnect with my Métis history and culture.

HOW DID YOU COME TO WORK FOR THE CER?

I have worked with the Government of Canada since 2012. I started with Parks Canada as a Heritage Presenter during the summer. After graduating from university, I stayed on with the Federal Government. The CER is my fourth governmental department, and I have been working at the CER since 2017. I love it!



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: Amadou

TITLE: Technical Specialist,
Pipeline Integrity

EDUCATION: B.Sc. in
Integrity Management
Mechanical Engineering,
M.Sc. in Industrial
Engineering.

**WHAT WAS YOUR FAVOUR-
ITE SUBJECT IN GRADE
SCHOOL?** Physics.

**TRAINING AND
EXPERIENCE:** Pipeline
integrity management
(e.g., project application
assessment, compliance
verification activities, and
incident investigation),
maintenance and
reliability engineering,
and machinery
manufacturing.

**WHAT DO YOU WANT
TO LEARN?** I'd like to
continuously improve my
skills, stay on top of current
technical trends and do more
leadership development
training.



**WHERE WERE YOU
BORN?** Mali, Africa.

**WHAT'S YOUR FAVOURITE
ANIMAL:** Doves.

**HOW DID YOU COME TO WORK
AT THE CER?** Through the
Government of Canada's online
job posting and application
portal.

**WHAT IS THE MOST INTERESTING
THING ABOUT YOUR JOB?** Working
within an interesting, dynamic,
knowledgeable engineering team
to continuously find solutions to
challenging pipeline integrity issues
across Canada.

FIRST JOB AFTER GRADUATING:
I was the service workshop
technical lead for a Caterpillar
dealer in Mali, Africa.

**WHAT WAS YOUR VERY FIRST
JOB EVER?** I was a machine tool
operator helper (lathe machine
and milling machine).

ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Amanda**

TITLE: Communications Officer

EDUCATION: BA in Public Relations from Mount Royal University.

WHERE WERE YOU BORN? Valencia, Carabobo, Venezuela.

WHAT'S YOUR FAVOURITE ANIMAL: Pandas! They're very cute and seem so huggable (although I heard they aren't).

WHAT'S YOUR FAMILY LIKE? My family is great. We are all close, and I have no idea where or who I'd be in this world without them. My parents are two genuine, kind and hard-working people. They brought us from Venezuela to Canada so my two siblings and I could live great lives! Both my brother and sister are my best friends. We are all so different and I really love that about us. My partner and I have now been together for almost six years, and we've created a nice life together! We've got two dogs named Presley and Igor. We always joke that it's their world and we are just living in it!

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB: People don't give communications much credit, but how would people understand our world without it? I am happy to work in a field that brings knowledge and understanding to people. The most interesting part about my job is making complicated topics simple. And to be able to do that, I need to understand that topic myself! There is nothing better than having an "aha!" moment when the subject you've been trying to understand finally clicks! And then being able to share that "aha!" moment with others.

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL? If I had to pick one, it would be social studies. I'm passionate about history.

WHAT WAS YOUR VERY FIRST JOB EVER? My first job was at Rexall Pharmacy as a front store clerk when I was 16.

FIRST JOB AFTER GRADUATING? CER! After graduating in November 2018, I was hired as a term at the CER a few weeks later. I have now been at the CER for five years, and I still love it! I feel extremely fortunate.

WHAT DO YOU STILL WANT TO LEARN ABOUT? This is a hard question because I am always learning new things. I honestly learn something new about the CER every day — and I've been around for five years! There are so many people who work alongside me that help the CER live up to its mandate. I hope to meet them all and learn all of their stories.

HOW DID YOU COME TO WORK FOR THE CER? I started as a student in January 2018. I worked really hard during my student term and made relationships throughout the office, which was key to getting my position later.



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Andria**

EDUCATION: Bachelor of Science (Honours) in Marine Biology and Oceanography (Dalhousie University, 2006), Masters of Marine Management (Dalhousie, 2016).

TITLE: Environmental Specialist, Inspection Officer; Environmental Protection team, Field Operations

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL? Math.

EXPERIENTIAL/ON THE JOB EDUCATION: The Inspection Officer path involves a lot of on-the-job learning from more experienced IOs including learning about pipeline construction and mitigation measures to protect the environment.

WHAT WAS YOUR VERY FIRST JOB EVER? Lifeguard.

WHERE WERE YOU BORN? Toronto, Ontario.

WHAT'S YOUR FAVOURITE ANIMAL? I love all animals, with some exceptions (like spiders) but I think as a group the octopus is one of my favourites (can't narrow down to be species level though); I'm impressed with their intelligence and camouflage abilities.

WHAT DO YOU STILL WANT TO LEARN ABOUT? No specific subject matter comes to mind, but when there's an opportunity to learn anything I jump at it.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB? I learn something new almost daily and I love traveling to parts of the country that I might not otherwise see.

FIRST JOB AFTER GRADUATING? Outreach Specialist at Discovery Centre (Halifax NS; science centre). I traveled to elementary schools around the city and did curriculum-based hands-on science activities with students.

HOW DID YOU COME TO WORK FOR THE CER? I moved to Calgary from Halifax in 2011 and saw the CER job posting in 2012. I applied and qualified and was in a pool for about a year before I was hired. I was attracted by the work/life balance, benefits and a chance to serve Canadians and see the country.



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

EDUCATION: BA in Law & Society and a History minor from the University of Calgary.

EXPERIENTIAL/ON THE JOB

EDUCATION: Meeting with Indigenous communities all the time, which involves a lot of travel, driving and being ready to discuss as much Project specific tidbits as possible.

MEET: Angelina

TITLE: Sr. Crown Consultation Coordinator

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL?

I have always loved Social Studies, learning about history and politics and understanding how connected they have always been.

WHAT WAS YOUR VERY FIRST JOB EVER? Working at my school library.

FIRST JOB AFTER GRADUATING? Receptionist/document control person in a law office downtown.

WHAT DO YOU STILL WANT TO LEARN ABOUT? Reconciliation within all areas of the work we do here at the CER.

HOW DID YOU COME TO WORK FOR THE CER? Before applying to the CER, I worked with and supported Indigenous communities in conducting Environmental Assessments for about eight years. I took the position with CER because the role entailed working with Indigenous peoples across Canada.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB: Working and meeting with Indigenous communities is by far my favourite thing about my job. Followed by internal discussions surrounding the honour of the Crown and Section 35 Rights.

WHERE WERE YOU BORN? I was born in Treaty 7 Territory (Calgary). My dad is from Kainai Nation (also known as the Blood Tribe) and my mom is from Tsuut'ina Nation.

WHAT'S YOUR FAVOURITE ANIMAL: Cat cuddles are the best.

WHAT'S YOUR FAMILY LIKE?

My family is full of love — we didn't always have all the material stuff in the world, but we always felt love and a family bond that is unbreakable! I have a very big family, two brothers and two sisters. With five of us growing up and being close in age, there was the odd sibling disagreements but the older and older you get the more and more you appreciate and love all your family time. My mom and dad live near to me in Treaty 7 territory (Calgary), so I visit them as much as possible. I have a daughter who is 7 years old, whom I love with my whole heart. It is very important to me that my daughter Stella knows her roots and where she comes from. Appreciating and acknowledging our ancestors is a beautiful lesson that I learned as a child — one that I will make sure my "girly" learns too!



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Eranda**

TITLE: Market Analyst (Energy Outlook Modelling).

EDUCATION: PhD in Environmental Engineering.

EXPERIENTIAL/ON THE JOB EDUCATION: Coding.

WHERE WERE YOU BORN? Sri Lanka.

WHAT'S YOUR FAVOURITE ANIMAL: Elephant.

WHAT'S YOUR FAMILY LIKE?

My wife and I live in Calgary, and we have 2 daughters, 12 and 4. We like to go camping and visit new places.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB?

Getting to learn about new technologies and working with smart people.

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL?

Mathematics, because I love working with numbers.

WHAT WAS YOUR VERY FIRST JOB EVER? Banking Associate.

FIRST JOB AFTER GRADUATING? Mechanical Engineer.

WHAT DO YOU STILL WANT TO LEARN ABOUT? Everything. Animals and plants and how the ecosystems work.

HOW DID YOU COME TO WORK FOR THE CER? Application through an advertised position.



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: Jason

TITLE: Graphic Designer

EDUCATION: International Academy of Design. Toronto, ON.

WHERE WERE YOU BORN? Blind River, ON.

WHAT'S YOUR FAVOURITE ANIMAL? I don't really have a favourite animal.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB? I get to work with some awesome people!

HOW DID YOU COME TO WORK FOR THE CER? I was working in a print shop in Edmonton and a friend of mine who lived in Calgary stumbled across a job application for the CER and said I should apply. I had a job interview a few weeks later with some awesome people who have long since retired. I've been here since 2005 and I'll probably be here until at least 2031 (according to when I can retire).

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL?

I didn't really like high school that much. I just barely graduated. I would have to say band or art.

FIRST JOB AFTER GRADUATING?

Hockey News Magazine. Literally, after 5 minutes of my final exam I was headhunted to start work the same afternoon color correcting the faces of goalies for their year-end magazine. I went from making \$8 an hour in a hardware store to making \$25 an hour. When I received my first paycheck I almost wept.

WHAT WAS YOUR VERY FIRST JOB EVER? Flipping burgers at Peggy Sue's Diner in Brandon, Manitoba.



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

EDUCATION: 1) Certificate of Arts and Science; (2) Fish and Wildlife Technician Diploma from the College of the North Atlantic. (3) Bachelor of Science in Restoration Ecology from the British Columbia Institute of Technology.

EXPERIENTIAL/ON THE JOB EDUCATION: Heavy Equipment Operator Certificate obtained at Detoncho Training Academy in Yellowknife, NT. Camp Manager/ Conservation Officer at the Tundra Ecosystem Research Station for Government of the Northwest Territories – Environment and Natural Resources Division.

MEET: Lucas

TITLE: Environmental Analyst – Environmental Protection

ROLE: Inspection Officer/ Conservation Officer



WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL? Social Studies.

WHAT WAS YOUR VERY FIRST JOB EVER? In high school, I worked as a part-time grocery store clerk, stocking shelves and unloading freight.

FIRST JOB AFTER GRADUATING? After graduating high school, my first full-time job was an administrative assistant for the Public Service Alliance of Canada (PSAC).

WHAT'S YOUR FAVOURITE ANIMAL: Raven.

WHERE WERE YOU BORN? Fort McMurray, AB, Canada.

WHAT'S YOUR FAMILY LIKE? My mother is Denesuline (Chipewyan) from the Northwest Territories, and my father is from Newfoundland (Irish descent). I'm close with my family and have inherited many valuable traits and characteristics from both sides.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB? I get to travel all over Western Canada and visit communities that I would probably never visit if I didn't work as an Inspection Officer at the CER.

WHAT DO YOU STILL WANT TO LEARN ABOUT? Changing energy futures, and how modern technology will affect the Oil and Gas industry.

HOW DID YOU COME TO WORK FOR THE CER? I saw a job posting on the Government of Canada Job website and applied. After passing the screening exam, I rented a board room from the local employment office and interviewed for the job via teleconference. What happened next is fairly obvious – I was selected for the position.

ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Negar**

TITLE: Group Leader – Pipeline Integrity

EDUCATION: MSc Oil and Gas Engineering, BSc Chemical Engineering.

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL? Persian Literature and Creative Writing.

WHAT WAS YOUR VERY FIRST JOB EVER? I worked as a co-op student (process engineer) for one summer in a food factory outside Tehran, Iran.

FIRST JOB AFTER GRADUATING? Process Engineer.

WHERE WERE YOU BORN? Tehran, Iran.

WHAT'S YOUR FAVOURITE ANIMAL? Owl.

WHAT'S YOUR FAMILY LIKE? I would describe my family as multi-cultural. My husband is from South Africa and our two children were born in Canada.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB? The people I work with across the organization and the diverse nature and scope of my work.

WHAT DO YOU STILL WANT TO LEARN ABOUT? Too many things! But on top of my list is to learn how to remain intrinsically purposeful.

HOW DID YOU COME TO WORK FOR THE CER? Before I joined the CER, I was a drilling engineer working on onshore and offshore projects. I travelled and worked globally for 15 years after my graduation in 2000. I completed my Master's Degree in 2014 and applied for an engineering position that had just opened up at the CER. I joined the organization in 2015 as an Engineer in the Pipeline Integrity team.



ACTIVITY 4: CAREERS AT THE CANADA ENERGY REGULATOR: WHAT'S THEIR BACKGROUND?

MEET: **Raymond**

TITLE: GIS Analyst

EDUCATION: B Sc. Geomatics Engineering from the University of Calgary.

EXPERIENTIAL/ON THE JOB EDUCATION: Mostly the software used day to day at the office or learning process and systems at the CER. Also learning how to use equipment in the field.

WHAT WAS YOUR FAVOURITE SUBJECT IN GRADE SCHOOL? Mathematics.

WHAT WAS YOUR VERY FIRST JOB EVER? Office Assistant.

FIRST JOB AFTER GRADUATING? Land Surveyor.

WHERE WERE YOU BORN? Calgary, born and raised.

WHAT'S YOUR FAVOURITE ANIMAL: My dog. In general? Capybara or a hippo?

WHAT'S YOUR FAMILY LIKE? Mildly sarcastic and quick with a roast but we have each other's backs.

WHAT IS THE MOST INTERESTING THING ABOUT YOUR JOB: Talking to different Business Units and people around the organization and helping solve some of their issues or showing people what we regulate (sometimes it's not so clear).

WHAT DO YOU STILL WANT TO LEARN ABOUT? Programming and paleontology.

HOW DID YOU COME TO WORK FOR THE CER? Some friends from university worked at the CER and needed a backfill.



Appendix 1: Canada Energy Regulator Visualizations

1. SCENARIOS: COMPARE SCENARIOS

- Directly compare the scenarios. Explore the impact of key uncertainties on future energy trends, including technological development, climate policy initiatives such as carbon pricing, or higher or lower energy prices.

VARIABLES: total demand, supply (electricity generation, oil production and global oil prices, gas production and global gas prices [includes both energy used in the province and energy for export]); province, scenario (Global Net-zero, Canada Net-zero, Current measures); emissions by sector static year (2005–2050)

2. EXPLORE EMISSIONS: GREENHOUSE GAS EMISSIONS BY SECTOR

- Compare historical and projected greenhouse gas emissions data from across Canada's economic sectors.

VARIABLES: greenhouse gas emissions; economic sectors; scenario (Global Net-zero, Canada Net-zero, Current measures); static year (2005–2050)

3. EXPLORE BY REGION: ENERGY DEMAND AND GENERATION BY REGION

- Compare historical and projected energy supply and demand data from across Canada's provinces and territories.

VARIABLES: total demand (used by all four sectors); supply (electricity generation, oil production, gas production [includes both energy used in the province and energy for export]), province; scenario (Global Net-zero, Canada Net-zero, Current measures); static year (2005–2050)

4. EXPLORE BY SECTOR: ENERGY DEMAND BY SECTOR

- Explore how energy demand and how energy source mixes from different sectors have evolved in recent history, and how they are projected to evolve in the Energy Futures scenarios.

VARIABLES: sector (total demand, residential, commercial, industrial, transportation), province, source (bio-fuels and emerging energy [includes biomass, hydrogen, ethanol and biodiesel], coal, electricity [includes nuclear, hydro, wind and solar, thermal generation from natural gas, coal and oil], natural gas, oil products), scenario (Global Net-zero, Canada Net-zero, Current measures), static year (2005–2050)

5. EXPLORE ELECTRICITY: ELECTRICITY GENERATION

- Compare the relative amount of electricity generated by various energy sources throughout the provinces and territories for a given year.
- Switch between two views: one that compares the amount of electricity generated by each source for each region, and one that compares the amount of electricity generated by each region for each source.

VARIABLES: province, source (biomass and geothermal, coal, natural gas, hydro, nuclear, oil, solar and wind), scenario (Global Net-zero, Canada Net-zero, Current measures) year (2005–2050)

6. EXPLORE OIL AND GAS: OIL AND GAS PRODUCTION

- Explore oil and gas production across the provinces and territories for a given year.
- Switch between two views: one that compares the amount of oil or gas production by type for each region, and one that compares the production of oil or gas by region for each type.
- Use the timeline to compare actual vs. projected years and see how production changes and is projected to change over time.

VARIABLES: supply (oil production, gas production); types of for oil production (c5+ (pentanes plus), condensate, conventional heavy, conventional light, in situ bitumen, mined bitumen); types of for gas production (coalbed methane, conventional, shale, solution gas, tight); province, scenario (Global Net-zero, Canada Net-zero, Current measures); static year (2005-2050)

Appendix 2: Portals to Geographical Thinking

The following excerpt from Sharpe, Bahbahani and Huynh's *Teaching Geographical Thinking* (p. 4–6, 2016) has been used to guide the activity development for this resource.

A major step in embedding geographical thinking is to make the curriculum problematic, so that the study of geography poses challenges to think through problems rather than supplying lists of information to be remembered. Based on Peter Seixas' Teaching historical Thinking approach, the Critical Thinking Consortium approach proposes six concepts that serve as portals to turn the factual content of geography into a subject for analysis. These six concepts are not “content” — although they have to be taught to students — they are sources of questions that invite and support students to think critically about what they are learning.

SPATIAL SIGNIFICANCE. At the heart of any geographical analysis or representation lies the question of importance. It is a core question in geographer Charles Gritzner's definition of geography, “What is Where, Why There, and Why Care?” Answering the question of “why care?” requires consideration of the other core questions, “what is where?” and “why there?”

PATTERNS AND TRENDS. This portal raises the question: *What can we conclude about the variation and distribution of geographical characteristics over time and space?*

INTERRELATIONSHIPS. This portal raises the question: *How do human and natural factors and events connect with and influence each other?*

GEOGRAPHICAL PERSPECTIVE. The key question in understanding the geography of a place is: *What are the human and physical features and identities, as understood through various lenses, that characterize a place?*

EVIDENCE AND INTERPRETATION. This portal raises the questions: *What information can be used as evidence to support ideas about geography, and how adequately does the geographical evidence justify the interpretations offered?*

Students often approach data from a naïve perspective, assuming that they are accurate, relevant, and free of distortions. To encourage a more critical analysis of data — the source of all subsequent interpretations — we must invite students to examine their accuracy, precision and reliability. This includes analyzing three kinds of sources:

- Primary sources, which provide the raw data for geographical information and knowledge;
- Secondary sources, which are geographical reports not drawn directly from the object of study; and
- Tertiary sources, which provide overviews of information based largely on secondary sources.

ETHICAL JUDGMENT. The central question invoked by ethical judgment is: *How desirable and responsible are the practices and outcomes associated with particular geographical actions and events?* Ethical judgments encompass various lenses — including economic, environmental, cultural, political and historical — and various group and regional perspectives.

REFERENCE:

Sharpe, B., Bahbahani, K., Huynh, N.T. (2016) *Teaching Geographical Thinking*. The Critical Thinking Consortium (TC²) and The Royal Canadian Geographical Society.

Appendix 3: Data Sources

DATA SOURCES FOR ENERGY DEMAND

The primary source for historical energy demand data is Statistics Canada's Report on Energy Supply and Demand and associated data tables. These values are disaggregated at an end-use level using NRCan's National End-use Database. The dataset is also supplemented with data from Environment and Climate Change Canada, and various provincial and territorial sources such as the Alberta Energy Regulator, BC Hydro, Alberta Electric System Operator, and Ontario's Independent Electric System Operator.

DATA SOURCES FOR GREENHOUSE GAS EMISSIONS

Data for greenhouse gas emissions comes from Canada's official greenhouse gas inventory prepared by Environment and Climate Change Canada. The inventory is prepared and submitted annually as a report to the United Nations Framework Convention on Climate Change. The report covers anthropogenic (human-caused) emissions by source as well as emissions removals by sinks (eg. afforestation, wetland restoration, land reclamation, etc.)

DATA SOURCES FOR ELECTRIC GENERATION

The primary source for electric generation data comes from Statistics Canada. It is supplemented by additional data from provincial governments, utilities, and system operators, as well as industry associations (such as CanWEA and CanSIA).

DATA SOURCES FOR CRUDE OIL AND NATURAL GAS PRODUCTION

Data for crude oil and natural gas production comes from a variety of sources. These include CER analysis of Divestco well data, provincial and territorial governments, the Alberta Energy Regulator, and Canadian Association of Petroleum Producers.

Appendix 4: Curriculum Matches

PROVINCE	GRADE LEVEL	SUBJECT	RELEVANT CURRICULUM UNITS
Alberta	9	Science	Electrical Principles and Technologies
			Knowledge and Employability Science: Electrical Principles and Technologies (Science and Technology Emphasis)
	11	Science	Science 20-4 (Knowledge and Employability Science): Understanding Common Energy Conversion Systems
			Science 24: Understanding Common Energy Conversion Systems
Manitoba	9	Science	Senior 1 Science: Nature of Electricity
New Brunswick	9	Science	Physical Science: Characteristics of Electricity
		Social Studies	Canadian Identity: Challenges and Opportunities
Newfoundland & Labrador	9	Science	Electricity
		Social Studies	Canadian Identity: Canada's Changing Identity : Creating a Preferred Future
Northwest Territories	9	Science	Electrical Principles and Technologies
	11	Science	Science 24: Understanding Common Energy Conversion Systems
Nova Scotia	9	Science	Science 9: Characteristics of Electricity
Nunavut	9	Science	Electrical Principles and Technologies
			Knowledge and Employability Science: Electrical Principles and Technologies (Science and Technology Emphasis)
	11	Science	Science 24: Understanding Common Energy Conversion Systems
Ontario	9	Geography	Issues in Canadian Geography (Academic): Geographic Inquiry and Skill Development
			Issues in Canadian Geography (Academic and Applied): Managing Canada's Resources and Industries
		Science	Science (Academic): Physics: The Characteristics of Electricity
	11	Environmental Science	Environmental Science (Univ/College Prep.) Conservation of Energy
			Environmental Science (Workplace Prep.) Energy Conservation
Prince Edward Island	9	Science	Physical Science: Characteristics of Electricity
Saskatchewan	9	Science	Physical Science: Characteristics of Electricity

Appendix 5: Glossary

See also the [Energy Information Program Glossary](#) for detailed definitions

ENERGY SOURCES

CRUDE OIL: contains conventional light and heavy crude oil, condensate, oil sands bitumen (mined and in situ).

OIL PRODUCTS: Includes refined petroleum products and natural gas liquids. Specifically this includes: motor gasoline, diesel, aviation fuel, light fuel oil, kerosene, heavy fuel oil, propane, butane, ethane, petroleum coke, still gas, and non-energy products such as lubricants, asphalt, and petrochemical feedstocks.

NATURAL GAS: Production refers to dry marketable gas production. Total consumption of gas includes some non-marketed producer consumption. In Canada, it is produced from conventional, tight, shale, and coal bed methane resources, as well is produced along with crude oil production (also known as solution or associated gas).

COAL: Includes coal, coke, and coke oven gas.

ELECTRICITY: End-use electric energy that is generated from a variety of sources and technologies. Includes generation primary electricity sources such as nuclear, hydro, wind and solar, and thermal generation from other fuels such as natural gas, coal, and oil.

HYDRO: Amount of electricity generated by hydro power plants.

NUCLEAR: Amount of electricity generated by nuclear power plants.

BIOMASS/GEOTHERMAL: Includes solid biomass fuels such as wood pellets, as well as geothermal sources.

BIOFUELS & EMERGING ENERGY: Includes biomass, hydrogen, ethanol and biodiesel.

SOLAR/WIND: Includes electricity generated using photovoltaic systems or concentrated solar thermal systems generated by wind turbines.

HYDROGEN: End-use hydrogen that is generated by a variety of sources and technologies.

ENERGY UNITS

PETAJoule: A measure of energy that is a quadrillion (10^{15}) joules. According to Statistics Canada, a petajoule is the approximate amount of energy it takes to run the Montreal Metro for one year.

BARREL OF LIGHT OIL EQUIVALENT (BOE): A measure of energy normalized to the equivalent energy content of a barrel of light crude oil. One barrel of light oil equivalent is equal to 6.123 gigajoules.

GW.H: A measure of electric energy that is a billion (10^9) watt hours of electric energy per year. One GW.h is equal to 0.0036 petajoules and 0.0016 MBOE/d.

EMISSIONS UNITS

MEGATONNES OF CARBON DIOXIDE EQUIVALENT (MTCO_{2e}): A measure of emissions for megatonnes of carbon dioxide equivalent (CO_{2e}). CO_{2e} is a measure of how much GHGs contribute to global warming relative to carbon dioxide.

VOLUMETRIC UNITS

THOUSAND BARRELS PER DAY (MB/D): Number of barrels of crude oil produced per day.

THOUSAND CUBIC METRES PER DAY (10³M³/D): Number of cubic metres of crude oil produced per day. One barrel of oil is equal to 0.159 cubic metres.

BILLION CUBIC FEET PER DAY (BCF/D): Number of cubic feet of natural gas produced per day.

MILLION CUBIC METRES PER DAY (10⁶M³/D): Number of cubic metres of natural gas produced per day. One cubic foot of natural gas is equal to 0.0283 cubic metres.

SECTORS

RESIDENTIAL: This is the energy consumed by Canadian households. It includes energy used for space and water heating, air conditioning, lighting, large appliances, and other energy-using devices like televisions and computers.

COMMERCIAL: A broad category including offices, stores, warehouses, government and institutional buildings, utilities, communications, and other service industries. It also includes energy consumed by street lighting and pipelines. Buildings use energy for space and water heating, air conditioning, lighting, appliances and other devices. Pipelines use energy to power pumps or compressors that move oil and natural gas through pipelines.

INDUSTRIAL: This sector includes heavy industry, oil and gas, light manufacturing, forestry, fisheries, agriculture, construction, mining, waste, and others.

TRANSPORTATION: Includes passenger and freight on-road transportation, as well as air, rail, marine, and non-industrial off-road travel, such as recreational all-terrain vehicles and snowmobiles. Demand in the transportation sector includes foreign energy used on Canadian soil, airspace, and waters.

SUPPLY AND DEMAND CATEGORIES

TOTAL DEMAND: The total energy used in the four sectors of Canada's economy: residential, commercial, industrial, and transportation. Includes the use of electricity, natural gas, and petroleum products such as gasoline, coal, and renewable fuels. Also referred to as end-use or secondary demand, it does not include the energy used to generate electricity.

ELECTRICITY GENERATION: The amount of electric energy produced by transforming other forms of energy. In Canada, electricity is generated from hydro, other renewables like wind and solar, and thermal sources like natural gas and coal, and nuclear power.

OIL PRODUCTION: The amount of crude oil produced in Canada. Crude oil is produced from various areas using different technologies. This includes mined and in situ bitumen from the oil sands, conventional light and heavy oil produced in the Western Canadian Sedimentary Basin, condensate, and oil produced from off-shore platforms on the east coast.

NATURAL GAS PRODUCTION: The amount of marketable natural gas produced in Canada. Natural gas is produced from various areas using different technologies. This includes tight, shale, coal bed methane, conventional, and natural gas produced along with oil from oil wells (also called associated or solution gas).

SCENARIOS

Each edition of the various CER Energy Futures reports uses several scenarios to explore how possible energy futures might unfold for Canadians over the long term. EF2023 uses three core scenarios that explore potential outcomes for the Canadian energy system over the next 30 years.

GLOBAL NET-ZERO

This scenario assumes Canada achieves net-zero emissions by 2050. It also assumes the rest of the world reduces GHG emissions enough to limit global warming to 1.5 Celsius (°C).

CANADA NET-ZERO

In this scenario, Canada achieves net-zero GHG emissions by 2050, but the rest of the world moves more slowly to reduce GHG emissions.

CURRENT MEASURES

This scenario assumes limited action to reduce GHG emissions beyond measures in place today. In this scenario, modeling results are not required to achieve net-zero GHG emissions in Canada by 2050. Limited future global climate action was also assumed. This is the reference scenario for EF2023.