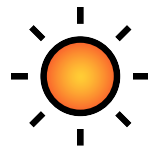


Geography
Secondary 1 and 2

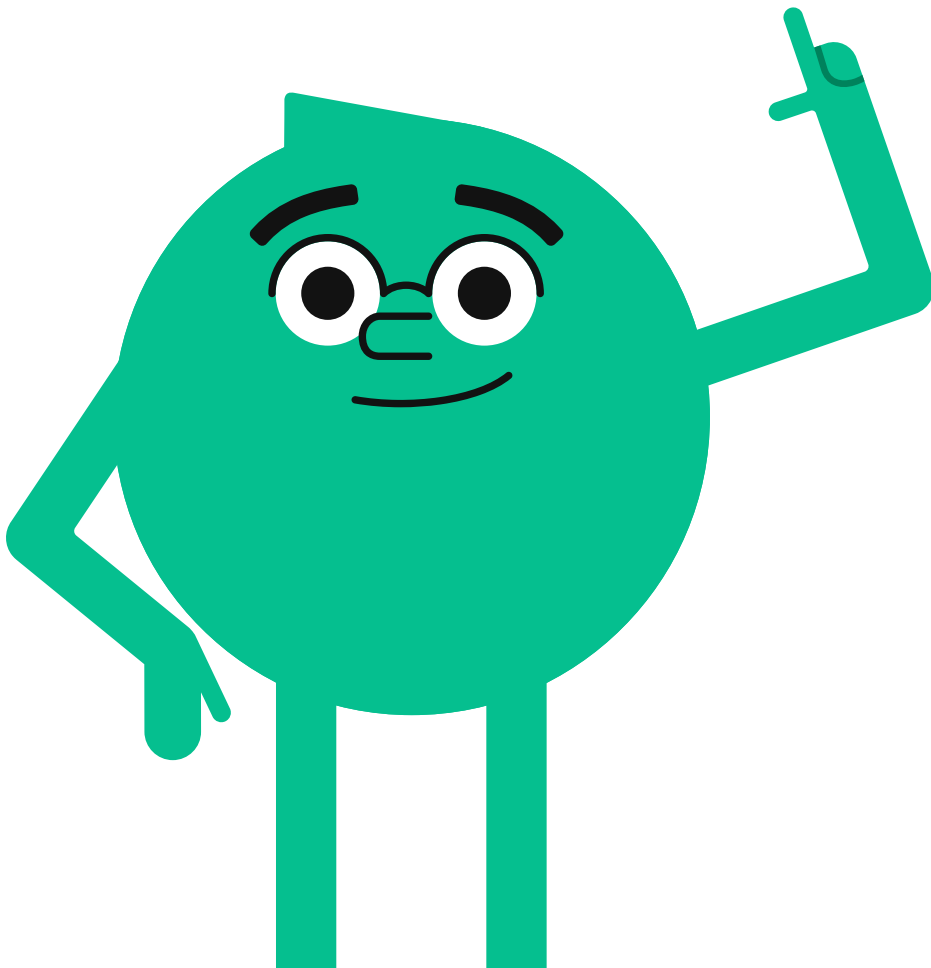
Which Energy Source Would You Choose?

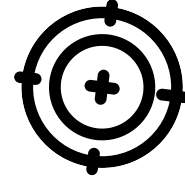


Teacher's Guide

Activity Summary

Which energy source would you choose? is an activity in which students play the role of energy consultants for a city that must choose which energy source is best suited to its needs. Each team must analyze the advantages and disadvantages of two energy sources. Their task is to choose the best option to meet the city's energy needs and explain their choice. This activity can be used as a conclusion to the *Energy-Producing Regions* Geography unit. It allows students to apply their knowledge of concepts related to renewable and non-renewable energy, as well as the infrastructures associated with them and their advantages and disadvantages.





Objectives

- Compare different energy sources
- Identify the advantages and disadvantages of each energy source
- Explain the issues related to the production and consumption of these energy sources



Duration

One 75-minute period

Activity Format

Teams of 3 or 4 students

Materials

- Student Booklet (version A or B)
- Pencil
- Textbook
- Access to these Alloprof concept sheets:
 - [Renewable Energies](#)
 - [Non-renewable Energies](#)
 - [The Characteristics and the Planning and Development of an Energy-Producing Region](#)
 - [The Issues of an Energy-Producing Region](#)



Recommended Steps

Step 1 – Distribute and Read the Scenario (15 Minutes)

- The teacher gives each student one of two version of the student booklet. Version A contains a blank table. Version B contains a partially completed table. The teacher presents the activity instructions.
- The students read the scenario.
- The students form teams of 3 or 4.

If necessary, it may also be helpful to take a few minutes to model how to fill in the table and give an example of an advantage or a disadvantage.

Step 2 – Fill in the Table (20 Minutes)

- Working in teams, students identify the characteristics, advantages, and disadvantages of each energy source presented in the scenario. Then they fill in the table in their student booklet. They may use their textbook, Alloprof's concept sheets, and their class notes.

Step 3: Class Discussion (20 Minutes)

- The students review the table with the teacher as a class. The teacher asks questions to the class and, if needed, adds to the answers provided by students. Each student is responsible for completing their own table.

Step 4: Write the Final Recommendation (20 minutes)

- In teams, students write their recommendation on which energy source they recommend for the city. Their answer should be supported by relevant arguments. They may draw on information from the table and points raised during the class discussion. This writing task can also be completed as homework if necessary.
- The recommendation can be corrected in two ways:
 - The teams' answers are reviewed together as a class
 - The teacher collects the students booklets and checks the answers

The goal is to ensure that each student fully understands the concepts around renewable and non-renewable energy. Answers may differ from one student to another depending on the arguments they choose.

Possible Adaptations

Adaptation for Step 4 – Writing the Recommendation

- Students could also write their recommendations individually instead of as a team.
 - In this case, the students could then return to their original team afterward to discuss and compare their answers.
- Instead of having a discussion with the whole class, each team could discuss their answers with another team.

Additional Scenario

A second scenario is provided in Appendices 3 and 4.

- The teacher could give it to teams that finish more quickly.
- The scenario could be given as homework to complement the in-class activity.



Appendix 1 – Main Scenario

The City of Sivetia

The city of Sivetia is located at the foot of a mountain range crossed by hundreds of streams and rivers. The city's population is growing rapidly, and new schools, hospitals, and industries are being developed. As a result, the existing hydroelectric plants can no longer meet the city's energy needs.

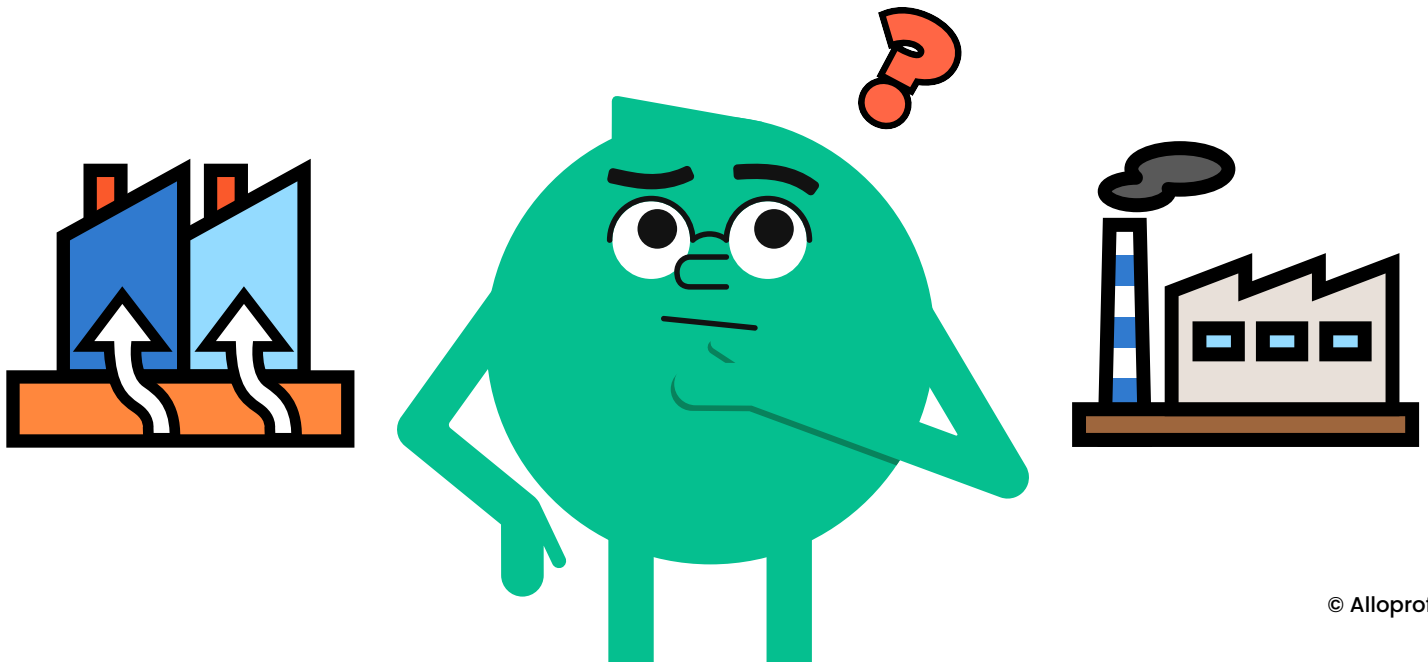
Unfortunately, there are no more rivers with a flow large enough to add additional hydroelectric plants. The city must therefore find a new source of energy.

Sivetia has an important natural resource: less than three kilometres below the surface, there is a very hot groundwater reservoir recently identified by geologists. It releases enough heat to supply a geothermal power plant that could be used to generate electricity. Because the reservoir is relatively close to the surface, construction costs would be lower.

The city is also located near a major oil sands deposit. Many see this as a golden opportunity to meet the region's growing energy demand and to enrich the population. Exploiting these oil sands would provide the fuel needed to operate a thermal power plant. Any surplus production could be sold. However, many questions are raised regarding the environmental impacts of such development.

Both energy sources are located near the city, making them practical for supplying energy to the population.

The city council is debating whether to invest in a geothermal power plant or to focus on developing the oil sands and building a thermal power plant?



Appendix 2 – Corrected Tables

Corrected Table – Version A

City of Sivetia	
Important Information The city's needs: Energy needs are higher than the current production Energy sources: High geothermal potential and substantial oil sands deposits Constraints faced by the city: Hydroelectric potential already fully exploited	
Energy Source 1 Geothermal Energy ☒ Renewable ☐ Non-renewable	Energy Source 2 Oil (Oil Sands) ☐ Renewable ☒ Non-renewable
Required Infrastructure • A thermal power plant (using geothermal energy) • Distribution infrastructure (power lines, etc.)	Required Infrastructure • Oil extraction and processing infrastructure • Transportation infrastructure (train, pipeline, or truck) • A thermal power plant (using oil) • Distribution infrastructure (power lines, etc.)
Advantages • Renewable energy source • Site with strong geothermal potential • Low greenhouse gas emissions • The thermal power plant provides electricity year-round, regardless of weather conditions	Advantages • Job creation • Fuel relatively easy to extract and transport • Possibility of selling petroleum products, contributing to the regional economy • The thermal power plant provides electricity year-round, regardless of weather conditions

Disadvantages	Disadvantages
• High installation costs	• Air, water, and soil pollution • Emits a large amount of greenhouse gases • Environmental degradation and potential health impacts on the population • Non-renewable

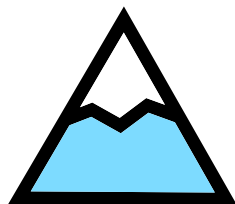
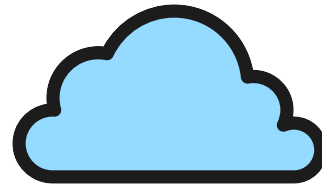
I believe the best source of energy for the city of Sivetia is

geothermal energy

Because:

- Both energy sources would meet the city's energy needs.
- Oil sands require more infrastructure.
- There are more disadvantages to oil sands (pollution, environmental degradation, impacts on public health, etc.).

Therefore, even though the installation costs for the geothermal power plant are higher, this energy source is the most suitable to meet the city of Sivétia's needs.



Corrected Table – Version B

City of Sivetia	
Important Information The city's needs: Energy demand is <u>higher</u> than current production Energy sources: Strong <u>geothermal potential</u> and substantial <u>oil sands</u> reserves Constraints faced by the city: Hydroelectric potential is already <u>fully exploited</u>	
Energy Source 1 <u>Geothermal Energy</u> ☒ Renewable ☐ Non-renewable	Energy Source 2 <u>Oil (Oil Sands)</u> ☐ Renewable ☒ Non-renewable
Required Infrastructure • A <u>thermal</u> power plant (using geothermal energy) • Transportation infrastructure (<u>power lines</u>, etc.)	Required Infrastructure • Oil extraction and <u>processing</u> infrastructure • <u>Transportation</u> infrastructure (train, pipeline, or truck, as well as power lines) • A thermal power plant (using <u>oil</u>)
Advantages • Renewable energy source • Site with strong <u>geothermal potential</u> • Low <u>greenhouse gas emissions</u> • The <u>thermal power plant</u> provides electricity year-round, regardless of weather conditions	Advantages • Job creation • Fuel relatively easy to extract and transport • Possibility of selling petroleum products, contributing to the <u>regional economy</u> • The thermal power plant provides electricity year-round, regardless of weather conditions

Disadvantages	Disadvantages
• High installation costs	• Air, water and soil pollution • Emits a large amount of greenhouse gases • Environmental degradation and possible health impacts on the population • Non-renewable energy source

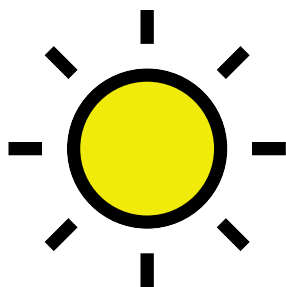
I believe the best source of energy for the city of Sivetia is

geothermal energy,

Because:

- Both energy sources would meet the city's energy needs.
- Oil sands require more infrastructure.
- There are more disadvantages to oil sands (pollution, environmental degradation, impacts on public health, etc.).

Therefore, even though the installation costs for the geothermal power plant are higher, this energy source is the most suitable to meet the city of Sivétia's needs.



Appendix 3 – Additional Scenario

The City of Cendrillon

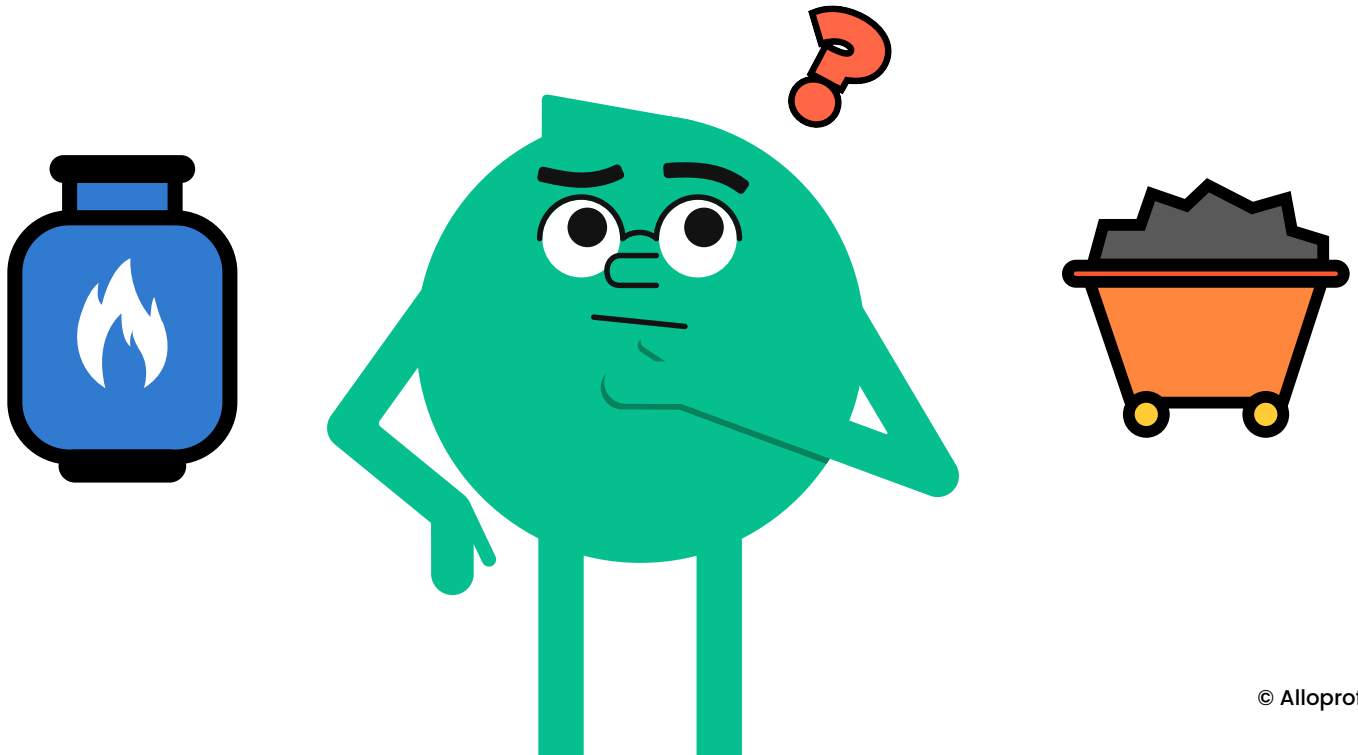
Cendrillon, is a city with a rapidly growing population, and electricity demand is increasing. The city needs to attract new industries to create jobs for its residents. However, to attract these industries, it must guarantee them access to affordable and reliable energy.

A large natural gas deposit has been discovered in the area. Exploiting this deposit would make it possible to build a natural gas power plant to provide a reliable and relatively clean energy source. This option would create local jobs and be cost-effective enough to attract industries.

Another investor is proposing to reopen the region's old coal mine, located just a few kilometres away, and has very large reserves. Coal, a highly polluting energy source, would make it possible to produce electricity at an even lower cost than natural gas. However, residents are concerned about the impact of this decision on air quality and their health.

At the city council, questions arise: Should a natural gas power plant, a cleaner and local energy source, be built, or should the coal mine be reopened to guarantee even lower electricity prices for industries?

Which energy source would you recommend for the city of Cendrillon to meet its electricity and economic development needs? Fill in this table to answer the question.



Appendix 4 – Answer Key for the Additional Table

City of Cendrillon	
Important Information The city's needs: High demand for electricity due to rapid population growth. In addition, the desire to attract new industries requires an additional energy source that is affordable and reliable. Energy sources: Natural gas and coal. Constraints faced by the city: Concern about the effects of pollution on people's health.	
Energy Source 1 Natural gas ☐ Renewable ☒ Non-renewable	Energy Source 2 Coal ☐ Renewable ☒ Non-renewable
Required Infrastructure • Well • Gas pipeline • Thermal power plant • Distribution infrastructure (power lines, etc.)	Required Infrastructure • Mine • Thermal power plant • Distribution infrastructure (power lines, etc.)
Advantages • Relatively low greenhouse gas emissions compared with coal • Less pollution than other types of fossil fuels • Less risk of contaminating water sources • Relatively affordable	Advantages • Reuse of existing infrastructure (mine) • Large coal reserves (energy source) • Relatively affordable
Disadvantages • Difficult to transport (must be compressed or liquefied) • Non-renewable resource	Disadvantages • Produces large amounts of greenhouse gases • Significant air and water pollution • Non-renewable resource

Two possible answers:

I believe the best energy source for the City of Cendrillon is

natural gas,*

Because:

- Both energy sources are able to meet the city's energy needs.
- Natural gas produces less pollution and greenhouse gases than coal.
- It's affordable.

I believe the best energy source for the City of Cendrillon is

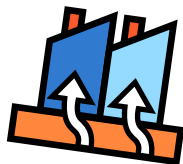
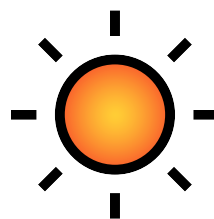
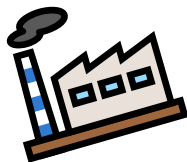
coal,*

Because:

- Both energy sources are able to meet the city's energy needs.
- Both energy sources are non-renewable.
- There are large coal reserves.
- Even though it pollutes more, coal makes it possible to reuse existing infrastructure and avoids having to build more complicated systems to transport natural gas.
- It provides a more affordable source of energy.

Two possible answers are suggested for this scenario. Natural gas is an option based on environmental and health arguments. An argument could also be made for using coal, focusing on economic reasons. This additional scenario could therefore be an opportunity for a class discussion about economic and environmental considerations in relation to choosing an energy source.





Have you tried this activity with your class? Send us your comments and suggestions!

