

**Financial Literacy Lessons and Activities for The Ontario
Geography Curriculum**

**Energy and Financial Literacy:
Using the Electricity Computer Simulation
to Explore Energy Resources and Financial
Concepts**

An activity package

For:

Grade 7 (Natural Resources Unit)

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Financial Literacy Lessons and Activities for The Ontario

Geography Curriculum

Grade: 7
(Geography)

Energy and Financial Literacy: Using the Electricity Computer Simulation to Explore Energy Resources and Financial Concepts

Brief Description:

This lesson focuses on ten major renewable and non-renewable energy resources, while at the same time addressing some basic financial concepts. The highlight of the lesson is the computer simulation Electricity (www.electrocity.co.nz). ElectroCity is a free, browser-based online game that has been developed specifically for teachers and Gr.7 to 9 students. Students build and manage their own virtual towns and cities, making important decisions and learning about concepts such as energy generation, environmental management, and fiscal responsibility. One of the key rules is that students need to maintain a healthy bank account in order to buy and build things for their cities. If they mismanage their finances and run out of money then the game is over.

Time Circle:

This lesson will take approximately seven or eight 45-minute periods.

If time is short, you can remove the Energy Resource group presentations and have the students fill out their Energy Resource organizers online individually or in pairs (see 'Processing' section below). This will decrease the lesson time down to five or six 45-minute periods.

Learning Expectations:

Connections to Financial Literacy:

The following topics from the MOE document "A Sound Investment: Financial Literacy Education in Ontario Schools" (2010) will be explored in this lesson:

- the concepts of income, money, earning, saving, spending,... budgeting,...risks and rewards,...taxes, and planning ahead;
- the difference between wants and needs;
- future consequences of financial decisions.

Curriculum Expectations (from the Natural Resources strand) Grade 7 Geography Canadian and world Studies revised 2004:

Overall:

- describe how humans acquire, manage, and use natural resources, and identify factors that affect the importance of those resources;
- describe positive and negative ways in which human activity can affect resource sustainability and the health of the environment.

Materials:

- Chalkboard or whiteboard
- data projector or SMART board (if available)
- computers (ideally one per student, but one per two students will also work)



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	<p>Specific:</p> <ul style="list-style-type: none"> • describe a variety of ways in which people use and manage renewable, non-renewable, and flow resources to meet their needs; • explain the concept of sustainable development and its implications for the health of the environment; • present and defend a point of view on how a resource should be used; <p><u>Learning Goals (Unpacked Expectations):</u></p> <p>At the end of this lesson, students will be able to:</p> <ul style="list-style-type: none"> • define ten different sources of renewable and non-renewable energy and outline their pros and cons; • have a basic understanding of financial concepts such as income, money, earning, saving, spending, budgeting, risks and rewards, taxes, and planning ahead; • understand the difficulty and complexity of making large-scale decisions such as those common in urban planning and energy management. 	
<p>Assessment Opportunities:</p>		
<p><u>Before - Activation Minds On!:</u></p>	<p><u>Class discussion (diagnostic assessment)</u></p> <ol style="list-style-type: none"> 1. To get a sense of what students already know about energy, guide a class discussion using the following questions: <ul style="list-style-type: none"> • What is the difference between non-renewable and renewable energy? • What are some examples of non-renewable energy? Renewable energy? 2. Explain to the class that they will be participating in a computer simulation (Electricity) that puts them in the shoes of a mayor of a small city. One of the main rules of the simulation is that if you mismanage the city's finances and run out of money then the game is over. You also need to have a healthy bank account in 	<p><u>For, As or Of Learning:</u></p> <p><u>Diagnostic:</u></p> <p>The class discussion in the "Minds On" section can be used as a diagnostic to gauge the general level of understanding with regards to energy resources and some basic concepts of</p>



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	<p>order to buy and build things for your city. This would be a good time to open a discussion on some key financial terms and concepts. For example:</p> <ul style="list-style-type: none"> • What are your sources of personal income? What are your costs? What are some sources of income and costs for a city? • What is the difference between 'wants' and 'needs'? What are some of your personal wants? (in terms of buying things or services) Needs? What are some examples of 'wants' and 'needs' for a city? • What does bankruptcy mean? • What does long-term financial planning mean? Why is it important? What are some examples of long-term financial planning for an individual? How about for a city? 	<p>financial literacy.</p> <p><u>Formative:</u></p> <p>The Energy Resource Presentations in the "Processing" section can be assessed using the attached rating scale.</p>
<p>During –</p> <p><u>Processing:</u></p> <p>Strategies:</p> <ul style="list-style-type: none"> • Research • Organizer • Presentation • Computer simulation • Direct instruction <p>Groupings:</p> <ul style="list-style-type: none"> • Pairs or small groups • Individual 	<p><u>"Energy Resources" Presentations and Organizer (formative assessment)</u></p> <p>NOTE: If you are short on time, instead of doing the group Presentations, students can simply fill out their organizers by researching the information on computers individually or in pairs using the Electrocity online fact sheets.</p> <ol style="list-style-type: none"> 1. Assign a pair/group to each of the ten main energy resources: <ul style="list-style-type: none"> • co-generation • hydro • nuclear • ocean • solar • wind • thermal: <ul style="list-style-type: none"> - coal, natural gas, biomass, geo-thermal 2. Each group will prepare a 3-5 minute presentation outlining a description of its assigned energy resource, and its pros and cons. You can decide what format you want the students to do the presentation in (e.g. chalkboard, flip chart, PowerPoint, SMARTBoard). Ideally, students will have time in a computer lab to do research using websites such as the following: <ul style="list-style-type: none"> • www.electrocity.co.nz/Resources/: Excellent online energy fact sheets found in the Teacher Resources section of the Electrocity website. It should be pointed out to students that these fact sheets were created in New Zealand, and therefore a small amount of the information is not relevant to the Ontario context. The fact sheets, however, are quite general, and contain good information describing the types of energy and their pros and cons. • www.darvill.clara.net/altenerg/index.htm: A great teacher-created website from Andy Darvill in the UK. Concise descriptions of the energy resources, along with some excellent videos and online formative quizzes. <p>Note: If computers are difficult to book, then the Electrocity fact sheets can be printed out for each group.</p>	<p><u>Summative:</u></p> <p>A quiz can be used at the end of the lesson to evaluate how well the students have integrated the Energy Resource information and some of the financial literacy concepts (a sample Quiz is attached with an Answer Key).</p>



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	<p>3. As each group presents, students can fill out their Energy Resources Organizer. An Answer Key for the Organizer has also been provided.</p> <p>4. You can do a formative assessment of each group's presentation using the attached Energy Presentation rating scale.</p> <p><u>Electricity Computer Simulation (www.electricity.co.nz)</u></p> <p>1. Using a data projector or SMART board, go through the general instructions for the Electricity simulation. An excellent way to do this is to click on the "How To Play" link at the top of the screen and go through the instruction pages with the students (don't spend too much time on this, as a big part of this simulation is trial and error). You can also show students the "Hints" tab on the main game screen – let them explore these on their own if they wish.</p> <p>Note: the term "Local Body Rate" is a term in New Zealand for the income tax rate.</p> <p>2. You can also show students some exemplar cities by clicking on "Finished Cities" and then clicking on "Take A Look" for any of the cities listed.</p> <p>3. Students can then complete the simulation. Depending on how quickly the student plays, each game will take approximately 20-30 minutes. Ideally students should be allowed to complete the simulation more than once (this can also be done at home, as the simulation is browser-based).</p> <p>4. As they complete the simulation, students should fill out the accompanying Simulation Worksheet.</p>	
<p><u>After –</u> <u>Consolidation:</u></p>	<p><u>Class Discussion</u></p> <p>1. Take up the Simulation Worksheet with the class. The Analysis questions should be good jumping-off points for discussion:</p> <ul style="list-style-type: none"> • Out of the ten main energy resources we looked at in the organizer, which one do you think was the most beneficial during the simulation? Explain (include variables such as amount of power produced, costs, environmental effects, popularity, ability to upgrade, etc.). • What were some of the sources of income for you as mayor? Costs? • What purchases in the simulation were 'wants' for you as mayor? 'Needs'? • What were some examples of long-term financial planning from your simulation attempts? 	



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	<p><u>Culminating Task - Quiz (summative assessment)</u></p> <p>1. A simple quiz can be used to evaluate how well the students have integrated the Energy Resource information and some of the financial literacy concepts (a sample Quiz is attached with an Answer Key).</p>	
<p><u>Home Activity or Future Classroom Consolidation:</u></p> <p>There are a number of other computer simulations that teach financial literacy:</p> <p><u>Farm Blitz:</u> http://financialentertainment.org/play/farmblitz.html</p> <p>This game was created by low-income adults with inspiration from the world's two most popular games (Bejeweled and Farmville). Farm Blitz combines elements of both titles to simulate the process of creating good savings habits and avoiding the pitfalls of accumulating too much debt.</p> <p><u>Admongo:</u> http://game.admongo.gov/</p> <p>Created by the U.S. Federal Trade Commission and PR agency Fleishman-Hillard, Admongo explores the fact that children spend billions of dollars a year on products and services, and influence billions more in family purchases. Advertising is ubiquitous, and the distinction between advertising and other content in new media —</p>	<p><u>Provide meaningful and appropriate follow-up by:</u></p> <ul style="list-style-type: none"> • Teachers should mark the quiz and then go through the answers step by step with the class. Many of the questions could also be interesting springboards for further discussion. • It might be interesting to try the Electrocitiy simulation at various points during the year and compare the students' experiences and perspectives to see if they have changed. 	




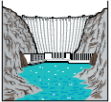
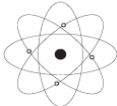


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<p>advergaming, for example — often is blurred. It is likely that many children may not understand when they are being “pitched” a product or service.</p> <p>Debt Ski: http://www.indebted.com/the-game/debtski/</p> <p>The game is intended to spotlight the dangers of excessive debt, challenge young people to avoid destructive financial behavior, and spur fiscally responsible action. It is a part of mtvU's Indebted, a campaign that empowers young people to change the course of the financial crisis they are inheriting.</p> <p>For more financial games go to the 'Games for Change' website: http://www.gamesforchange.org/game_categories/economics/</p>		
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Energy Resources Organizer (Electricity Fact Sheets: <http://www.electricity.co.nz/Resources/>)

Name: _____

Energy Resources	How is electricity generated?	What are the main advantages?	What are the main disadvantages?
Co-generation 			
Hydro Energy 			
Nuclear Energy 			
Ocean Energy 			
Solar Energy 			


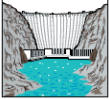
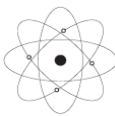

Grade 7 Geography


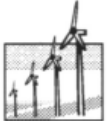



Energy and Financial Literacy

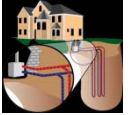
Appendix 1

Energy Resources	How is electricity generated?	What are the main advantages?	What are the main disadvantages?
Wind Energy 			
Thermal Energy – Coal 			
Thermal Energy - Natural Gas 			
Thermal Energy – Biomass 			
Thermal Energy – Geothermal 			

Energy Resources Organizer – Answer Key (Electricity Fact Sheets: to www.electricity.co.nz/Resources/)

Energy Resource	How is electricity generated?	What are the main advantages?	What are the main disadvantages?
Co-generation 	Co-generation is the production of electricity in combination with another industrial process. The heat produced is used twice – once to generate electricity and once for another purpose.	<ul style="list-style-type: none"> - improves efficiency - can save money (businesses generate their own electricity and steam supply at the same time) 	<ul style="list-style-type: none"> - still burns non-renewable sources that produce CO2 emissions
Hydro Energy 	Water turns a turbine which drives the generator of a power station.	<ul style="list-style-type: none"> - renewable form of electricity - produces few or no greenhouse gas emissions 	<ul style="list-style-type: none"> - land must be flooded disrupting wildlife, natural vegetation, agriculture and humans - when rainfall is limited, hydro generation is reduced
Nuclear Energy 	A power station uses the process of nuclear fission, using uranium as the main fuel source. A large amount of energy is released by splitting atoms. The energy is absorbed as heat by a coolant, and then produces steam that drives a turbine and electrical generator.	<ul style="list-style-type: none"> - heat needed to create steam is produced very efficiently without CO2 emissions - creates relatively very large amounts of energy 	<ul style="list-style-type: none"> - radioactive waste created will remain harmful for thousands/millions of years - accidents are very rare, but still possible
Ocean Energy 	<p>Tidal Energy: turbines are installed in harbour entrances or straits where currents flow.</p> <p>Wave Energy (experimental): Kinetic energy of wave moving parts on a float is captured to generate electricity.</p>	<ul style="list-style-type: none"> - oceans contain huge amounts of energy - tides and tidal currents are predictable, renewable sources of energy - does not emit CO2 	<ul style="list-style-type: none"> - still experimental and can be very inefficient - produces energy far away from where it is needed - can affect natural ecosystems - very expensive

<p>Solar Energy</p> 	<p>Solar Thermal Collectors: dark coloured panels absorb heat from sun and transfer this heat to fluids circulating through the panel.</p> <p>Solar Electricity: photovoltaics (PV) transform light energy into electricity.</p>	<ul style="list-style-type: none"> - renewable resource - silent - produce no emissions - no fuel to run them 	<ul style="list-style-type: none"> - PV are relatively expensive - weather dependent
<p>Energy Resources</p>	<p>How is electricity generated?</p>	<p>What are the main advantages?</p>	<p>What are the main disadvantages?</p>
<p>Wind Energy</p> 	<p>Wind turns blades which in turn power a rotor inside a generator producing electricity.</p>	<ul style="list-style-type: none"> - renewable - no CO2 emissions or other pollutants - large wind farms can produce significant energy - can be serviced individually - land underneath can still be used 	<ul style="list-style-type: none"> - some people think they are an eyesore and are noisy - some possible links to health conditions (unclear)
<p>Thermal Energy – Coal</p> 	<p>Coal is burnt to create heat energy which can then create steam. Steam is used to drive a steam turbine connected to a generator which produces electricity.</p>	<ul style="list-style-type: none"> - relatively cheap and available 	<ul style="list-style-type: none"> - non-renewable - emits CO2
<p>Thermal Energy - Natural Gas</p> 	<p>Same as Coal above.</p>	<ul style="list-style-type: none"> - produces a lot more electricity and less pollution than coal 	<ul style="list-style-type: none"> - non-renewable - emits CO2
<p>Thermal Energy – Biomass</p> 	<p>Biomass is fuel from living things, such as wood. Wood waste from pulp and paper mills, for example, can be burned to produce heat energy which can then create electrical energy.</p>	<ul style="list-style-type: none"> - wood waste of a pulp and paper mill, for example, can be used to power the mill - renewable 	<ul style="list-style-type: none"> - emits CO2

<p>Thermal Energy – Geothermal</p> 	<p>Geothermal energy is the heat that flows from the hot interior of the Earth to the cooler surface. Wells are drilled deep into the ground and a mixture of hot water and steam is taken out at high pressure. Steam is separated and used to drive a turbine and generator.</p>	<ul style="list-style-type: none">- renewable- not dependent on the weather or mining	<ul style="list-style-type: none">- geothermal fields must be closely managed- relatively expensive- relatively smaller generating capacities
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Rating Scale for Energy Resource Presentation (Formative Assessment)

Names: _____, _____, _____

	Look Fors	Teacher Comments	Level 1 Needs Improvement	Level 2 Satisfactory	Level 3 Good	Level 4 Excellent
Knowledge and Understanding	<ul style="list-style-type: none"> an excellent understanding of the energy resource and its pros and cons is demonstrated 		Needs Improvement	Satisfactory	Good	Excellent
Communication (Oral)	<ul style="list-style-type: none"> clear speaking voices are used throughout frequent eye contact with all members of the audience (not just the teacher) welcoming body language that helps to engage the audience 		Needs Improvement	Satisfactory	Good	Excellent
Communication (Visual)	<ul style="list-style-type: none"> visuals greatly clarify and enhance the key information (e.g. drawings, photos, videos, notes) 		Needs Improvement	Satisfactory	Good	Excellent
Application	<ul style="list-style-type: none"> presentation is organized and rehearsed so that it flows smoothly audience engagement is encouraged and facilitated 		Needs Improvement	Satisfactory	Good	Excellent

Additional Comments:

Name: _____

Date: _____

Electrocity Online Simulation Worksheet (www.electrocity.co.nz)

ElectroCity is a fun and educational online game that simulates, in a very simplified way, energy management. ElectroCity allows players to create their own city and explore different approaches to energy and the environment.

**Electrocity Instructions:**

1. Go to www.electrocity.co.nz and click "How to Play". Spend some time going over the instructions (this will help you in the long run).
2. Click on "Finished Cities" to see what is possible.
3. Click on "Game" to start your simulation. You can click on the "Hints" tab whenever you want for additional advice.
4. You will have 150 "turns" to complete your simulation (if you don't go bankrupt first!). NOTE: the "Local Body Rate" is how much tax you are charging your citizens (this game was created in New Zealand).
5. After you have finished each "attempt" at the simulation, record your scores below. NOTE: you will not be marked on your scores. When you have completed three attempts, answer the Analysis Questions below.

Scores:

Attempt 1 Final Population Tally: _____, Final Money Tally: _____

Energy Management: ____, Popularity: ____, Population: ____, Environment: ____, Overall: ____

Briefly describe one strategy that worked well for you during this attempt:

Briefly describe one strategy that did not work well:

Attempt 2 Final Population Tally: _____, Final Money Tally: _____

Energy Management: ____, Popularity: ____, Population: ____, Environment: ____, Overall: ____

Briefly describe one strategy that worked well for you during this attempt:

Briefly describe one strategy that did not work well:

Attempt 3 Final Population Tally: _____, Final Money Tally: _____

Energy Management: ____, Popularity: ____, Population: ____, Environment: ____, Overall: ____

Briefly describe one strategy that worked well for you during this attempt:

Briefly describe one strategy that did not work well:

Analysis Questions:

1. Out of the ten main energy resources we looked at in the organizer, which one do you think was the most beneficial during the simulation? Explain (include variables such as amount of power produced, costs, environmental effects, popularity, ability to upgrade, etc.).

2. What were some of the sources of income for you as mayor? 'Costs'?

3. What purchases in the simulation were 'wants' for you as mayor? 'Needs'?

4. What were some examples of long-term financial planning from your simulation attempts?

5. Why is long-term financial planning so important when running a city?

6. What are some examples of long-term financial planning for individuals?

Full Name: _____

Date: _____

Energy Resources and Financial Literacy Quiz

KU: /7

TI: /13

1. Define geothermal energy: (1 mark, KU)

2. Define wave energy (a form of ocean energy): (1 mark, KU)

3. Define biomass energy: (1 mark, KU)

4. In terms of purchases, what is the difference between a “need” and a “want”? (2 marks, KU)

5. Briefly describe 2 reasons why personal long-term financial planning is important. (2 marks, KU)

6. Out of the 10 energy sources studied, which one do you think Canadian governments should put the most focus on in the coming decades? Explain and be sure to include at least two of the energy source’s advantages and at least one of its disadvantages. (5 marks total, TI: 2 marks for the depth of your answer, and 3 marks for accurate descriptions of the pros and cons)

7. If you were the mayor of your city or town, what would you first spend a significant amount of money on? Give a brief description and explain why you think it is important. (5 marks (TI) for the depth and logic of your answer)

8. Briefly describe three possible ways that you could raise the money needed for your idea in Q.7. (3 marks (TI) for the depth and logic of your answer)

Energy Resources and Financial Literacy Quiz – Answer Key

KU: /7

TI: /13

1. Define geothermal energy: (1 mark, KU)

ENERGY IS THE HEAT THAT FLOWS FROM THE HOT INTERIOR OF THE EARTH TO THE COOLER SURFACE. WELLS ARE DRILLED DEEP INTO THE GROUND AND A MIXTURE OF HOT WATER AND STEAM IS TAKEN OUT AT HIGH PRESSURE. STEAM IS SEPARATED AND USED TO DRIVE A TURBINE AND GENERATOR.

2. Define wave energy (a form of ocean energy): (1 mark, KU)

KINETIC ENERGY OF WAVE MOVING PARTS ON A FLOAT IS CAPTURED TO GENERATE ELECTRICITY.

3. Define biomass energy: (1 mark, KU)

BIOMASS IS FUEL FROM LIVING THINGS, SUCH AS WOOD. WOOD WASTE FROM PULP AND PAPER MILLS, FOR EXAMPLE, CAN BE BURNED TO PRODUCE HEAT ENERGY WHICH CAN THEN CREATE ELECTRICAL ENERGY.

4. In terms of purchases, what is the difference between a “need” and a “want”? (2 marks, KU)

- **A NEED IS SOMETHING YOU HAVE TO HAVE, SOMETHING YOU CAN'T DO WITHOUT. A GOOD EXAMPLE IS FOOD. IF YOU DON'T EAT, YOU WON'T SURVIVE FOR LONG.**
- **A WANT IS SOMETHING YOU WOULD LIKE TO HAVE. IT IS NOT ABSOLUTELY NECESSARY, BUT IT WOULD BE A GOOD THING TO HAVE. (socialstudiesforkids.com)**

5. Briefly describe 2 reasons why long-term financial planning is important. (2 marks, KU)

- **TO BE ABLE TO ABSORB UNEXPECTED PITFALLS (E.G. ILLNESS, UNEMPLOYMENT)**
- **TO SAVE UP FOR LARGER PURCHASES (E.G. HOME, TRAVEL)**
- **TO KEEP A HEALTHY ACCOUNT BALANCE AND AVOID BANKRUPTCY**

6. Out of the 10 energy sources studied, which one do you think Canadian governments should put the most focus on in the coming decades? Explain and be sure to include at least two of the energy source's advantages and at least one of its disadvantages. (5 marks total, TI: 2 marks for the depth of your answer, and 3 marks for accurate descriptions of the pros and cons)

REFER TO THE ANSWER KEY FOR THE ENERGY SOURCES ORGANIZER.

7. If you were the mayor of your city or town, what would you first spend a significant amount of money on? Give a brief description and explain why you think it is important. (5 marks (TI) for the depth and logic of your answer)

ANSWERS VARY.

8. Briefly describe three possible ways that you could raise the money needed for your idea in Q.7. (3 marks (TI) for the depth and logic of your answer)

- **RAISE TAXES (E.G. PROPERTY TAX, TOLL ROADS)**
- **RAISE FEES FOR SERVICES (E.G. GARBAGE, COMMUNITY CENTRES)**
- **RAISE FINES (E.G. SPEEDING, PARKING)**
- **SELL GOVERNMENT RESOURCES (E.G. CITY-OWNED BUILDINGS)**
- **CUT BACK ON CURRENT SERVICES (E.G. LESS POLICE OFFICERS)**
- **FUNDRAISING OR SPONSORSHIP**
- **OTHER?**