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**Energy and Society**

**Investigation of different electrical power generation methods**

Energy efficiency is very important as the cost of electricity rises and the resources to produce electricity decreases. There is also the continual concern with the amount of pollution that is produced during production.

During this investigation you will gather as much information as you can about the method and perspective assigned to you and post your information in Moodle. Once all the information is collected, you will review the information obtained by other students and post your opinion about power generation in the discussion forum.

Electricity can be generated many ways by using: hydroelectric (water dams), tidal, burning oil or natural gas, nuclear fission, biomass, geothermal, wind or solar. (**Note: these are not your rooftop or backyard power unit. We are interested in power plants for a city.**)

Create a cost/benefit analysis for your method of generating power. You must include enough information for students to make an informed decision about the best method to produce electricity in Ontario.

To make the comparisons fair, consider the number of plants, which would be required to produce 500 MW of power. (Find the average power produced by one Ontario power plant, and then estimate how many plants are needed to produce 500 MW.) This makes it easy for people to compare between different energy resources. Note that the average power consumption in a big city like Toronto is roughly 5 GW.

Criteria that you should investigate include, but are not limited to:

* **Social Perspective:**  Impacts to society due to: location (living near a nuclear plant, having a wind turbine on your property), emissions, lights, noise, odour, effects on recreation and aesthetics, effect of construction on local community, etc.
* **Economic Perspective:** Impacts to economic due to: operating costs (cost of fuel, maintenance, staff, waste disposal, disposal of used equipment, carbon tax), capital costs (cost to construct), life expectancy of power plant, percent efficiency, location (electricity needs transportation?), availability of raw materials/fuel (in Ontario), price per kWh of electricity, etc. Please support your criteria with **average dollar values**, **scaled to the number of power plants required to produce 500 MW of electricity**.
* **Environmental Perspective:** Impacts to environment due to: air quality, habitat impact, possibility of failure, management of waste, impact of failure, procurement of raw materials, transportation of raw materials, environmental impact during construction, etc.

You should relate these criteria to the perspective you are researching. For example: how is the location of plants impact on the social concern? How is the procurement of raw materials impact the environment? How is the availability of raw materials/fuel impact economic, etc. **Note:** Not all criteria will suit the energy resource you research (e.g., if you are researching solar – economic, then availability of fuel does not apply since no fuel is used).

**Your tasks:**

1. Use the "resources" wiki on Moodle to find helpful links and post your own resources that you found useful (make sure it is considered reliable resources before posting)
2. Post your cost/benefit analysis in the “cost/benefit analysis forum” for your method of power generation (see 1st deadline)
3. Read the cost/benefit analysis posted by other groups to be informed about the other methods of power generation.  Ask questions in the forum if information is not clear
4. What do you think is the best method to produce electricity in Ontario? Post your opinion in "your opinion forum".  You should take into consideration the costs and benefits to society, the economy and the environment.  Support your opinion! (see 2nd deadline)
5. Read the opinions posted by your classmates and respond to at least one of them. You may respond to opinions of any energy resource **OTHER** than the one you felt is the best.

**HOW IT WORKS**

**ELECTRICITY GENERATION**

INTERNET RESOURCES

We offer you these suggested links to use as resources or as web-accessed components for your students. These are suggestions only and OPG is not responsible for the content of these web sites or maintaining the links.

**ELECTRICITY GENERATION IN ONTARIO**

Ontario Power Generation: [www.opg.com](http://www.opg.com) and [www.opg.com/learningzone](http://www.opg.com/learningzone)

Canadian Association of Petroleum Producers: <http://membernet.capp.ca/>

Canadian Gas Association (natural gas): <http://www.cga.ca/>

Canadian Geographic <http://www.canadiangeographic.ca/magazine/jun12/energy_use_canada_map.asp>

Canadian Hydropower Association – Hydropower in Canada: Past, Present and Future:

<http://www.canhydropower.org/hydro_e/pdf/hydropower_past_present_future_en.pdf>

Canadian Nuclear Association – Education Resources: <http://cna.ca/curriculum/default.asp>

Canadian Nuclear Association – 2009 Nuclear Handbook:

<http://www.cna.ca/english/pdf/NuclearFacts/2009/CNA_Nuclear_Energy_Booklet09.pdf>

Canadian Solar Industries Association: <http://www.cansia.ca/>

Canadian Wind Energy Association: <http://www.canwea.ca/index_e.php>

Environment Canada – Greenhouse Gases: [http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=64](http://www4.hrsdc.gc.ca/.3ndic.1t.4r%40-eng.jsp?iid=64)

Independent Electricity System Operator: <http://www.ieso.ca>

Natural Resources Canada - The Canadian Renewable Energy Network: Clean Fossil Fuels:

<http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/clean_fossils_fuels.html>

Natural Resources Canada - The Canadian Renewable Energy Network: Wind, Solar, Biofuels:

<http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/canren.html>

Ontario Green Energy Act: <http://www.greenenergyact.ca/>

Ontario Power Authority: <http://www.powerauthority.on.ca>

Ontario Sustainable Energy Association: <http://www.ontario-sea.org/>

**BASELOAD VS. PEAK DEMAND**

The Weather Network - Ontario Power Consumption:

<http://www.theweathernetwork.com/power/index>

How it works – CANDU reactor: <http://www.opg.com/power/nuclear/howitworks.asp>

**Other Online Resources:**

Many online resources are unreliable enough for the purpose of research. Please read the document entitled “What are Considered Reliable Resources” on the course Moodle (under Course Information) for more information. Unreliable resources will not be accepted in your research project.

**1st Due Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Post your cost/benefit analysis for your method of generating power. You must include enough information for students in other groups to make an informed decision about the best method to produce electricity in Ontario. Include an explanation of why you chose the ratings that you did. [**Note: delete this paragraph before you cut-and-paste onto the forum and submit to turnitin.]**

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Energy Resource: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Perspective: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Description of Energy Resource: *(Describe what it is, whether it is renewable or not, and if not, how long can it last, how electricity is derived from it, and currently how many percent of Ontario’s electricity is produced by this type of energy resource. About 150 words.)*

Number of plants or units required to produce 500 MW of power: \_\_\_\_\_\_\_\_\_\_\_

Pros and Cons: Use Table below:

|  |  |  |
| --- | --- | --- |
| **Description of criteria**  | **Rating****(+10 to -10)** | **Justification (in full sentences and with embedded references)** |
| e.g., Location (if you are researching the social aspect) |  | As a general guideline, each justification should be less than 150 words (use Tools → Word count). |
| At least 5 different relevant criteria must be given (for level 3). Better if you can think of more (7 or more for level 4). |  | Point form (written in complete sentences) is easier to read than one long paragraph. |
|  |  | You must explicitly justify the rating you gave based on the research (i.e., why a rating of -5 instead of -10, or why you give it a rating of 0.) |
|  |  | You should make every effort to find information specifically from Ontario power plants; however, information from other parts of Canada and around the world could be used as supplementary resources if you can’t find enough Ontario sources. |
|  |  |
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|  |  |
|  |  |  |

Reference List: (note: references must be given by citationmachine.net, and web addresses MUST be included.)

[1] …

[2] …

**NOTE:** This same word document that **includes only the description and the table** must also be submitted to Turnitin via moodle for plagiarism check. Failure to do so will result in the assignment not being marked.

**2nd Due Date: Opinion Due \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Post your opinion:

* What do you think is the best method to produce electricity in Ontario?
* Why is it the best method for Ontario?
* Take into consideration all perspectives (the costs and benefits to society, the economy and the environment).  Be sure to take the scaling into account (e.g., compare cost of building nuclear power plant to the equivalent cost of building wind farm that produces the same amount of power.)
* Support your opinion with concrete reasoning (e.g., if you say it is cheaper, give values).
* Give the sources of info (e.g., Billy MacKenzie’s research showed that …). If you need to do your own extra research to justify your opinion because others’ research are not complete, then make sure you give embedded references and reference list of reliable sources.
* Compare cost, efficiencies, environmental, and social aspects, with other energy resources to show why this energy resource is better.
* Give justification of why the disadvantages are acceptable.
* Write clearly and concisely (no more than ½ page or about 400 words).

**3rd Due Date: Response to a classmates post Due \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* Everyone is expected to make at least one comment to the opinion posted by another student.
* You may respond to opinions of any energy resource **OTHER** than the one you felt is the best.
* Say what you agree and disagree with and always remember to support your comments.
* Justify why your opinion of the best energy resource is better.
* Write clearly and concisely (no more than half a page or less than 300 words).

**Energy and Society Rubric (Please Submit)**

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Energy Source: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Perspective: \_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Criteria:** | **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **Communication – Research of your Power Generation Method** |
| Explanation of Energy Resource**/2** | Explanation not given or incorrect  | Explanation is unclear  | Explanation is incomplete | Explanation is complete and correct |
| Explain pros and cons of method in relevant details**/4** | Explains pros and cons of method with no details | Explains pros and cons of method with some details | Explains pros and cons of method with relevant amount of details | Explains pros and cons of method thoroughly with exceptional level of details |
| Explain pros and cons of method in an organized manner **/2** | Explanation of pros and cons of method demonstrates limited organization | Explanation of pros and cons of method demonstrates some organization | Explanation of pros and cons of method demonstrates good organization | Explanation of pros and cons of method demonstrates thorough organization |
| Communicates information in full sentences without grammatical and spelling errors**/1** |  | Communicates some information in full sentences with some spelling and grammatical errors |  | Communicates information clearly in full sentences with no grammatical and spelling errors |
| Resources used are reliable **/2** | No reliable sources used or references not embedded | Two unacceptable sources used and/or reference format is incorrect | One unacceptable source used and/or reference format is incorrect | all resources used were reliable  |
| **Application – Your Opinion Post and Response to a Peer’s Post** |
| Explain opinion providing details**/2** | Explanation of opinion provided limited details | Explanation of opinion provided some details | Explanation of opinion provided considerable details | Explanation of opinion provided thorough details |
| Opinion employed sound judgement**/3** | Little or no judgement was used when forming opinion | Limited judgement was used when forming opinion | Good amount of judgement was used when forming opinion | Excellent judgement was used when forming opinion |
| Opinion is clear, and concise**/2** | Opinion is not very clear and concise | Opinion is somewhat clear and concise | Opinion is very clear and concise | Opinion is extremely clear and concise |
| Response is thorough and sound judgement was used**/4** | Response is limited with no judgment used | Response is limited with little use of judgment | Response is limited though sound judgment was used | Response is thorough and sound judgment was used in support |

**Mark Summary: Communication: /11 Application: /11**

**Comments:**