Government of
Northwest Territories

LESSON # 5:

Renewable Energy and You

INTRODUCTION

Although most students today are aware of the issues with using fossil fuels and the impact on climate change, many students feel helpless to do anything about this global issue. This project encourages students to see that they as individuals, a community and as a society can, through their own contributions, cause a positive change in peoples behaviours toward the uses of fossil fuels and embrace renewable energy and their applications to daily living.

Students are aware the non-renewable fossil fuels are in a finite supply and we as a society must look at other ways of creating energy that are renewable, sustainable, and ethical produced with a low impact on the environment. By creating technology that allows us to generate clean energy, individuals can reduce their greenhouse gas emissions through the energy choices they make. This will help reduce our reliance on global oil and make people, their community and the country more self-reliant when it come to producing clean ethical energy that has minimal impact on the environment.

Having students research different methods of energy generation can inspire them to think of applications they can use in their daily lives, at home, school, business or on the land to supplant the use of non-renewable fossil fuels. This activity is based on the successful implementation of a renewable resource energy project at Ecole Sir John Franklin High School in Yellowknife.

Although Experiential Science 10-20-30 provides a venue for understanding the impact and mitigation of climate change it is recommended that a club or focus group be formed around the project or projects. This encourages like-minded individuals to come together and use STEM to process and solve problems. The backgrounders can provide the basic understanding of climate change impact and reasoning to help students justify in their proposals the benefits of using a renewable energy source. This will also assist them in designing and implementing a renewable energy project of their own design and purpose. Internet research is critical to better understand renewable energy as new application, products and technology are continuously being developed.

Over the past decade sources of renewable energy have become more cost effective and have gained greater public interest as society considers their actions and impact on climate change. As a class or school club explore renewable resource options and applications to research, develop and install renewable energy projects that can be used in homes, schools, businesses and on the land. This project creates an authentic experience for students to write proposals, work as a team, foster community networking (business, elders, special interest groups), pursue funding, work with government and non-government agencies to seek opportunities to develop and implement a renewable energy project for use in their community to reduce GHG emissions.

LESSON PLAN #5: RENEWABLE ENERGY AND YOU

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GOAL

This activity provides a venue for student to research, determine an application, develop and implement a project that uses renewable energy to reduce GHGs.

BACKGROUND

Experiential Science 10-20-30 provides a venue for student to explore, create awareness and develop real-world projects that address Science, Technology, Society and the Environment (STSE). As climate change impacts the north, students need to see that their actions and the actions of society, on the energy choices, could mitigate the impacts of climate change. This is a good opportunity for students to exercise their social conscience and see how science, technology, society and environmental activities, and the action of a few, can have a positive impact on reducing GHGs.

This activity can be open-ended as an ongoing project or series of Science, Technology, Engineering and Mathematics (STEM) projects that create awareness of renewable resource, their applications, new technologies and well as possible future sources of employment.

KEY WORDS

Renewable resources, renewable energy, energy alternatives, sustainability,
Renewable Energy, Solar Power, Wind Power, Hydro Power, Geothermal Power, thermo-electric generator, generating renewable energy, jobs careers renewable energy, renewable energy home cottage, lining off grid.

TIME

The amount of time project will take will be dependent on the scope of the project.

CURRICULUM CONNECTION

Experiential Science 10, Unit 4 Resource Management and Population Dynamics
General Learning Outcome:

- Students will gain an understanding of the basic processes to ensure sustainable resources.

Specific learning Outcome:

- Students will gain an understanding of the foundations of a sustainable future, economics and ethics by: Investigating the uses of renewable resources in the sub-Arctic and Arctic to reduce the ecological footprint with regard to: Renewable sources of energy, and cost effectiveness
- Researching and developing a media promotion campaign that would encourage people to gain an appreciation of the “Beauty of the Land” and the need to preserve it for future generations.

Experiential Science 20, Unit 4, Petrology and the Ocean Environment

General Learning Outcome:

- Students will gain a general understanding of the petroleum industry including the processes involved in manufacturing petroleum products, the environmental impact of this industry and the careers available related to the petroleum resource industry.

Specific Learning Outcome:

- Students will gain an understanding of the environmental issues surrounding the petroleum resource industry by: Evaluating alternative renewable forms of energy (e.g. wind, geothermal, solar, biomass, heat pumps) by considering: i. Availability ii. Cost and efficiency iii. Environmental impact iv. Other relevant "cultural" considerations

Experiential Science 30, Unit 4, Freshwater Resource Management (STSE)

General Learning Outcome

- Students will investigate governance and ethics related to freshwater resources.

Specific Learning Outcomes:

- Students will understand the foundations of a sustainable future, economics and ethics by: Investigating the renewable resources that can be managed by humans including: Describing and illustrating how the freshwater resources of the region (local watershed) are used and managed by people.
- Developing a management program that would ensure that freshwater is available for future generations.
- Describing and plotting the location of dam sites and the affected watershed.
- Researching and presenting findings, to a mock board of inquiry, on the impact of dam construction and their effect on the environment and on traditional lifestyles / subsistence living.
- Investigating and evaluating the economic, ethical and long-term implications of various water management boards' decisions.

Associated Curricular Connections:

- Language Arts: public speaking, presentation skills, literature research, technical writing, interpreting information from a variety of genre.
- Social Studies & Northern Studies: Citizenship, Traditional Knowledge, self-efficacy, networking and teamwork.

Materials And Methods

The materials necessary again will be dependent on the scope of the project, however students will need access to the internet. *Please see the end of the lesson plan for funding opportunities*

Using the curricular outcomes for Experiential Science 10-20-30 regarding renewable and non-renewable resources initiate a class discussion on types and sources of renewable and non-renewable energy. This provides students with an opportunity to share their previous experiences, knowledge and understanding renewable forms of energy.

1. Divide the class or focus group into teams and provide them with the High School Backgrounder #13: renewable Energy Opportunities. Assign each group a section of the backgrounder: A. Hydro Projects, B. Wind Turbines, C. Solar Power, D. Geothermal heat pumps, E. Bio-mass fuel and F. Hydrogen.

2. Each group will have 30 minutes to read and summarize their findings for presentation to the rest of the group. Note: if class sizes are small summarize one area at a time as a class. After the short presentations, students can have a general discussion on what forms of renewable energy would work best for different circumstances, conditions and applications in their local community. This could include home, school, community and on the land applications for renewable energy.

3. Step 2, is the warm up exercise for the class project. The class project should be a collective exercise where everyone has an opportunity to contribute and decide the scope and application of the renewable energy project. This is a perfect opportunity to envision the application of the project whether it is at home, in the school, the community or at a bush camp. The primary objective is to reduce the use of non-renewable sources of energy for renewable sources of energy that are sustainable, ethical and reduce GHG emissions.

4. Create a list of renewable energy technologies such as: Biofuel, Biomass, Geothermal, Thermoelectric, Hydropower, Solar Power, Tidal Power, Wave Power, Wind Power and describe each briefly. As a group determine which forms of renewable energy are most viable for their community or school, which would reduce or illuminate the use of fossil fuel consumption for that particular application.

5. Once the group has decided which form of renewable energy could potentially be accessed by their community student teams can then research the applications and capacity of these forms of technology for their specific project. Their research should focus on:
    a. The scientific principles that make the technology work;
    b. The efficiency of the technology and its limitations;
    c. How and where is the technology currently being used;
    d. Availability of the technology;
    e. Cost of technology and options;
    f. How is the energy accessed (direct, stored or in combination with other sources; and
    g. Is the technology proven to work in a northern environment.

6. Upon completion of the reports, the class can now start building a case to support and justify the application and uses of the renewable energy for their project. At this point do not let cost impede on the decision, simply choose and option that is possible. The scale of the project may have to be adjusted after to accommodate the real cost of the project.

7. The next step is to conduct a feasibility study, which is particularly important for larger scale projects that might include government and non-government agencies. Students can download the free

software “Renewable Energy Projects Analysis Software” RETScreen ™ which can be downloaded from the Natural Resources Canada website, http://www.nrcan.gc.ca/energy/software-tools/7465. This software is easy to use and students can simply put in their data and the software does the more complex mathematical calculation. The software provides students with an opportunity to manipulate the variables and adjust the scale of the project(s) to justify the cost and payback to potential funders. In some cases the project may be a working ‘proof of concept’ model vs. a full-scale operational model. This is fine as it provides students with the skills, knowledge and attitudes to accept and see the potential applications of renewable resources.

8. The approval process, depending on the scale of the proposal, may have to include school administration and external organizations such as utility companies, public works, energy conservation organizations etc. This process can be complex; however, it is an excellent learning opportunity for students to interact with various people and see how renewable energy projects get started and go to completion.

9. Whether it is a small or large-scale project, stand-a-lone or integrated into a larger system or grid, the end product should demonstrate the viability of renewable as a sustainable source of energy.

As this technology will have to be purchased, proposal writing and fundraising the venture capital is an integral part of the learning process. As Canada, moves towards sustainable forms of renewable energy, municipal, territorial / provincial and federal governments are providing support to businesses, industry and individuals to develop, adapt and employ new forms renewable energy. In the NWT the GNWT’s Public Works and Services and NGO’s such as the Arctic Energy Alliance (aea.nt.ca/) can provide information, direction and potential support for your project.

Inquiry Questions

- How can we make better use of alternative energy sources in the NWT to reduce GHG emissions?
- How can local GHG mitigation strategies help reduce global GHG emissions?

Enrichment Activities/Fast Finishers

If a large-scale project is not feasible in your community, smaller individual “proof” of concept applications can be developed by individual or small groups of students. For example, solar powered charging stations for smart devices or other handheld equipment use in the home, school or on the land provides students with opportunities to expand the applications of the proof of concept. Explore on the land opportunities to use and repurpose renewable forms of energy and technology to supplant the use of fossil fuels.

Sharing The Message

Students can post their ideas and projects on social media to illicit feedback and share their findings.

Student Information

Refer to the student handout: Case Study: Sir John Franklin Solar Initiative, which has sample letters, fundraising ideas and other support documents.

- High School Backgrounder #2: The Greenhouse Effect,
- High School Backgrounder #3: Greenhouse Gases
- High School Backgrounder #13: Renewable Energy Opportunities

Teachers may also wish to review the following backgrounders that provide information on the impacts of climate change.

- High School Backgrounder #6: A Changing Land
- High School Backgrounder #7: The Changing World of Water and Ice
- High School Backgrounder #8: Impacts on Northern Wildlife
- High School Backgrounder #9: Impacts on Fish and Fowl
- High School Backgrounder # 10: Impacts on Northern Marine Life
- High School Backgrounder #11: Northern Communities Impacts and Adaptations
- High School Backgrounder #12: Global Impacts of Climate Change
- Letter to NWT Power Corporation
- Letter Peter Watt

Funding Sources for Alternative Energy Programs

Today, more than ever, there are many funding sources for alternative energy project:

- Federal, Government of Canada: http://www.nrcan.gc.ca/
- Territorial, Government of the NWT: www.pws.gov.nt.ca/en/services/energy-programs
- Non-Government Organization NWT: Arctic Energy Alliance, http://aea.nt.ca/programs/alternative-energy-technologies-program

Evaluation

The scope of the evaluation can be determined as a group using a scoring rubric that is cross-curricular in nature. This activity lends itself to the evaluation of such things as: team work skills, effective speaking and writing, community and global issues, renewable energy, climate change, creativity and sustainability to name a few. As this is not just about science, other subjects / topics within Language Arts, Social Sciences and life skills, such as budgeting can be integrated into the evaluation strategy.

Name _____

Renewable Energy and You: Class-wide Renewable Energy Project

Inquiry Questions

- How can we make better use of alternative energy sources in the NWT to reduce GHG emissions?
- How can local GHG mitigation strategies help reduce global GHG emissions?

This class project is a collective exercise where everyone will have an opportunity to contribute. It is up to the class to discuss and decide the scope and application of the renewable energy project. This is a perfect opportunity to envision the application of the renewable energy retro-fit whether it is at home, in the school, the community or at a bush camp. The primary objective is to reduce the use of non-renewable sources of energy for renewable sources of energy that are sustainable, ethical and reduce GHG emissions.

Briefly Describe the following types of renewable energy:

Biofuel_____

_____

Biomass_____

_____

Geothermal_____

_____

Thermoelectric_____

_____

Name _____

Hydropower _____

_____

Solar Power _____

_____

Tidal Power _____

_____

Wave Power _____

_____

Wind Power _____

_____

OUT OF THE LIST OF RENEWABLE ENERGY SOURCES THAT YOU MADE, WHICH WOULD BE THE MOST EFFECTIVE OR FEASIBLE FOR YOUR APPLICATION?

_____

_____

Name _____

Once the group has decided which form of renewable energy could potentially be accessed by their community student teams can then research the applications and capacity of these forms of technology for their specific project. Your research should focus on:

a) The scientific principles that make the technology work;
b) The efficiency of the technology and its limitations;
c) How and where the technology is currently being used;
d) Availability of the technology;
e) Cost of technology and options;
f) How is the energy accessed (direct, stored or in combination with other sources); and
g) If the technology is proven to work in a northern environment.

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Name _____

Questions to answer as we create our own project evaluation

- What would constitute a mission accomplished/project completed?
- What steps need to be taken in order to reach our end goal?
- What does the timeline look like?
- What Ongoing involvement will this project need?

Project Reflection

- What part of this project did you find the most challenging? At any point did the plan need re evaluation?
- Create a diagram/word web that illustrates all of the parties that where involved in this project
- Now that the project is completed, What advise do you have for someone undertaking a project like this?