



## **Creating a Sustainable Future:** **Designing and Exploring What Our Learning Looks Like**

**Teacher: Cayley Webber & Christine Avey**

**School: Westmount Charter School**

**Grade: Gr. 4**

**Email: [cwebber@ualberta.ca](mailto:cwebber@ualberta.ca)**

**Inquiry/Project/Activity Title: PEEL: People for Energy and Environmental Literacy**



### **Brief Description of Inquiry/Project/Activity:**

The P.E.E.L project seeks to educate grade 4 students about current energy and environmental trends in Alberta through a collaborative approach and interaction with experts in the field. Overall we worked with over 25 different organizations and individuals on the project through school campus visits, in our outdoor classroom and off campus field trips. This gave students the understanding, knowledge, key concepts and big picture to conduct an energy audit and make practical changes in their school and their own circles of influence. Students considered different forms of energy through the lens of maintaining balance of the triple bottom line: people, the environment and the economy.



## Creating a Sustainable Future: Designing and Exploring What Our Learning Looks Like

### Big Ideas (Key Concepts and Learning Outcomes)

The big ideas (Concepts/Learning Outcomes) in our learning are...

#### **SCIENCE**

**KEY CONCEPT: Humans are part of nature: we depend on ecosystems and on the network of interactions among organisms and within and among ecosystems.**

Learning Outcomes:

- I demonstrate compassion and respect toward all living things.
- I describe how the choices I make impact the environment (air, land and water) and I make choices that have a positive environmental impact locally and globally.
- I understand that healthy ecosystems provide the requirements that are essential to all life, such as fresh air, clean water, and fertile land.
- I evaluate how well nature is protected through land use practices in both nearby areas and protected places such as provincial or national parks.

**KEY CONCEPT: Society has developed a number of systems to produce, transport, store and consume energy using a variety of technologies with varying efficiencies and economic, social and environmental impacts.**

Learning Outcomes:

- I illustrate the things or places in my community or home that produce, transport, or store energy.
- I describe a variety of technologies that are used to create useable energy.
- I can describe examples of energy efficiency and characterize their economic, social and environmental benefits.
- I plan, justify, implement, and evaluate an energy efficiency project in my home, school, or community.
- I demonstrate the energy systems and technologies used for energy consumption in my personal life for electricity, heating/cooling and transportation.



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- I understand the different types of energy sources and the difference between non-renewable and renewable energy sources.
- I understand that a sustainable future requires a blend of energy resources.
- I evaluate the relative merits, financial costs, societal/cultural impacts, efficiencies and environmental costs (i.e. on land, water, wildlife, air, and greenhouse gases) of technologies used to produce renewable and nonrenewable energy for current and emerging technologies.
- I demonstrate the types of energy systems used to produce, transport, store and consume energy.
- I analyze and compare energy sources based on a variety of factors such as efficiency, cost, impacts and amount of energy stored per unit volume or mass and strategize a preferred energy future that considers economic, social and environmental impacts
- I calculate the full cost of a given energy technology, including economic, societal and environmental costs,

**KEY CONCEPT: Our production and consumption of carbon- rich fossil fuels creates a variety of greenhouse gases, which are changing the Earth's atmosphere.**

Learning Outcomes:

- I differentiate between weather and climate and the role each plays in my daily life.
- I understand the role climate plays in healthy ecosystems both locally and globally
- I describe the greenhouse effect and understand the contribution of various gases to planetary greenhouse warming, leading to climate change.
- I describe the factors that create my local climate, how climate change might affect it, and how global climate change is already affecting and will continue to affect my life and the life of others.
- I understand how climate change is influencing human endeavours such as international development and conservation.



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- I articulate and show evidence for my understanding of climate change, and create a personal code of practice that is consistent with this position.

**KEY CONCEPT: Earth's natural systems are constantly changing from both natural and human causes**

Learning Outcomes:

- I understand and give examples in which natural and human events have changed the land where I live.
- I articulate the ways in which a growing human population, combined with our increased consumerism, impacts Earth's natural systems.
- I describe the ways in which human activities (recreational, industrial, etc.) impact the environment – positively or negatively, and describe how these effects can be cumulative.
- I understand that ecosystems have a finite capacity to absorb human impacts before they change

**KEY CONCEPT: Biological diversity varies according to geography and land use, and is essential for healthy ecosystems.**

- I identify diversity in my own schoolyard/community and describe the value it provides for my community.
- I recognize that diversity creates resilient and adaptable natural systems.

### **SOCIAL STUDIES**

**KEY CONCEPT: Creating a sustainable future requires consideration of economic, societal and environmental impacts in decision-making and action at the personal, local, national and global level.**

Learning Outcomes:

- I compare the different roles people play in my community and the interconnections between the roles.
- I plan and implement a project that helps my community.



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- I appreciate how the natural environment supports our economy in a number of ways such as contributing raw materials and absorbing waste.
- I articulate some of the ways in which my personal lifestyle and consumer choices impact the environment.
- I create and implement a personal action plan to reduce my environmental footprint for long-term benefits.
- I collaborate with others in my school or community to implement an action plan to create a positive impact on the environment.
- I understand that the Earth's resources and natural environment provide for all our economic and societal needs; are finite and can become scarce.
- I understand and give examples of how environment, society, and economy are interrelated and interdependent.
- I outline a preferred sustainable future and identify the technology and policy innovations required to achieve this future ( at a grade 4 gifted level).

**KEY CONCEPT: Local, national and global agreements and policies are required to reduce greenhouse gas emissions.**

Learning Outcomes:

- I understand the services governments provide and that voting can be used to make decisions.
- I describe policies that contribute to healthy ecosystems and communities.
- I understand the role and the potential of policy to reduce greenhouse gas emissions.
- I understand the social, economic, political, and environmental dimensions related to climate change.(beginning understanding)
- I determine, recommend, and propose strategies that address climate change in my community, province, country, or internationally ( at a grade 4 gifted level)

**KEY CONCEPT: Exploration, discovery and knowledge of the natural and built environment where we live develops a sense of place and supports locally-based stewardship and citizenship.**



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### Learning Outcomes:

- I discover and document the features of my local natural and built environment that make it special to me.
- I explore and assess how the local environment to which I belong is essential to my life-land for food, resources for energy, clean air and water.
- I develop ideas on how I can provide for my community to demonstrate citizenship and stewardship.
- I design, plan, implement and assess a strategy to improve my local environment – land, air or water.

**KEY CONCEPT: Economic prosperity from energy resource development will change over time and can have positive and negative social and environmental impacts.**

### Learning Outcomes:

- I compare Alberta's energy resource use over time with its economic prosperity, societal/cultural impacts and environmental impacts.

**KEY CONCEPT: The type and amount of energy we use changes over time according to supply, demand, energy security, and available technology.**

### Learning Outcomes:

- I compare the efficiency and sustainability of different energy sources used over time.
- I explain the connection between access to natural resources and prosperity.
- I compare the societal, environmental and economic implications of different energy paths (e.g. current path, blended energy mix, alternative path, off grid).

**KEY CONCEPT: Cultural, biological, social, and economic diversity creates resilience and must be respected and valued.**

- I understand that diversity in all its forms is to be valued and respected.



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### **WELLNESS**

**KEY CONCEPT:** Quality of life is a subjective term that is influenced by many factors including: democratic rights, health, education, environment, social conditions and programs, community, personal well-being, economy and employment.

Learning Outcomes:

- I distinguish between my needs and my wants and identify factors that influence my needs, wants and rights.
- I compare and identify the various factors that influence my quality of life.

**KEY CONCEPT:** Direct experiences with nature develop emotional, mental, psychological, behavioral, physical well-being, a sense of wonder, and appreciation for beauty.

Learning Outcomes:

- I explore a natural environment and illustrate the senses I use.
- I describe what I notice and feel when I am in nature.
- I express my view on the beauty and importance of nature.
- I demonstrate the skills necessary to have a safe and enjoyable experience in nature in various kinds of weather conditions.
- I reflect upon the importance of the natural environment and outdoor living to my personal well-being and a healthy lifestyle.
- I develop interpersonal skills by practicing leadership in an outdoor environment.
- I create and implement a plan to spend time in nature for my personal well being.

**KEY CONCEPT:** Human life is reliant upon the health of our natural environment and this requires an ethic of respect, compassion and stewardship for the natural environment.

Learning Outcomes:

- I demonstrate actions that reflect compassion, respect and stewardship for the environment and others.



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- I understand that human health is reliant upon the health of the environment.
- I identify how the personal choices I make impact the environment, my health and that of others.
- I demonstrate actions that will improve the environment and my personal health.
- I work collaboratively to create and implement a plan to show respect, care or stewardship for the environment.

**KEY CONCEPT: Collaborative and facilitation skills are essential to resolve conflicts, solve complex problems, and create good solutions and decisions.**

Learning Outcomes:

- I contribute to a group or community project.
- I contribute to a group or community project that requires research and agreement on an action.
- I explore and apply various interpersonal and group processes to accomplish group decision-making and group projects.
- I develop and practice the skills of empathy, cooperation, facilitation, and collaboration to accomplish group decision-making and group projects.
- I understand that everyone learns and communicates in different ways and that these need to be considered and valued in group processes.

### Driving Questions

The questions that drive our learning are...

- Where does my energy come from?
- What are the opportunities and challenges of different forms of energy?
- What is the role of conflict in learning about energy and the environment?
- What personal choices can I make now and in the future to balance the triple bottom line- people, the environment, the economy?
- What does it mean to be an informed citizen and entrepreneur in Alberta with respect to sustainability and climate change?



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### Cross-Curricular Competencies (RVS Competencies)

The competencies emphasized in our learning are...

- Know how to learn... to gain knowledge, understanding or skills, through experience, study, and interaction with others
- Think critically...conceptualize, apply, analyze, synthesize and evaluate to construct knowledge
- Identify and solve complex problems...have the capacity to solve a range of problems, from simple to complex
- Manage Information...access, interpret, evaluate and use information effectively, efficiently and ethically
- Apply Multiple literacies...reading, writing, mathematics, technology
- Demonstrate good communication skills and ability to work cooperatively with others
- Demonstrate global and cultural understanding...considering the economy and sustainable development
- Identify and apply career skills and life skills through personal growth and well-being



### Inquiry/ Project/ Activity

Description of the inquiry/project/activity with respect to real life, authentic knowledge building opportunities; experiential learning; integrated learning; working with experts/community; ethical citizenship (stewardship) etc...

Campfire Discussion on Canada's Environmental Stewardship- Paula McGarrigle, Solas Energy Consulting Inc.

Students learned about Canada and Alberta's historical greenhouse gas production. Students discovered that Canada has an international reputation for not meeting



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expectations on its environmental stewardship. This new understanding became a driving force for the PEEL project.

PowerPoint Presentation on Sustainability and the Role of Governments -Dustin Owens, Department of Energy

Students learned that sustainability involves people, profit and planet and that it is a difficult to balance the triple bottom line. Students began to understand that government policy is complex and informed by balancing the triple bottom line which in Alberta is currently unbalanced towards economics and people vs. the environment.

Energy Pathways -Paula McGarrigle

Students were given an overview of various energy pathways -wind, solar, geothermal, natural gas, coal power, and hydropower was presented and discussed the sustainability associated with each pathway. Children were provided a piece of the energy pathway and needed to link with other children in the pathway. Pathways were shown from extraction through to retail consumption.

Solar Energy PowerPoint and hand on materials and demonstrations.-Dave Kelly, *Skyfire Energy*

Students learned about Solar energy and through hands on activities discovered that solar energy production is a viable energy source in Alberta.

Water Exploration - Oksana from Integrated Sustainability

Powerpoint presentation on water a valuable resource. Through hand-on demonstrations, visual diagrams and take home tools for checking toilet leaks and promoting wise use of water usage, students discovered that a





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significant volume of water is used all aspects of life, including food production, and energy production.

#### Rainwater Collection Systems - Dean Jones – SAIT

Through a presentation and hands on activities, students learned how buildings can integrate rainwater collection systems to reduce the environmental impact. Students learned about rain barrels, water harvesting and living walls. Five rainwater collection model homes were provided to teams of students to install collection systems. Students used water to test the system and demonstrate the effectiveness of the rainwater collection system.

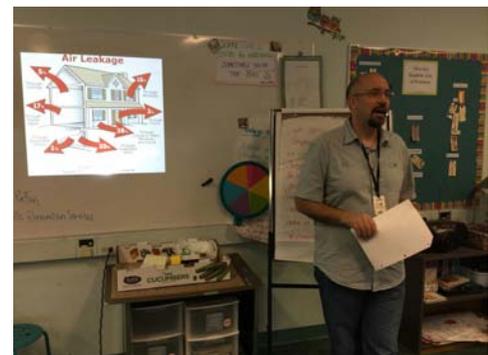


#### Sustainable Design - Jennifer Mehalko (Foundesign)

Students worked through 5 stations that had locally made products, recycled materials, and materials that are made at sustainable factories. products were similar in form and function but differed in their sustainability; Students analyzed which item was more sustainable.

#### Sustainable Construction - Jeff Patton, Foothills Renovations

Through a powerpoint and demonstration learned how planning, construction and maintenance are crucial to building sustainably. Students learned about reusing and repurposing materials, reducing air leaks, making choices in the planning phase to ensure the environment and sustainable materials are prioritized.





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### Building Efficiency - Tyler Hermanson (4-Elements Design)

PowerPoint presentation on heat testing using Thermal-Cameras and how we have the technology that allows us to assess the energy efficiency of our homes through infrared cameras.

### Hydro Power - Lauren Andre, Enbridge

Students explored kinetic energy by holding water in a straw at different heights and measuring the size of the splash on paper. Students learned how energy is harvested from water, including the different types of dams and hydro-systems.

### Wind Power - Tim Weis, Policy Director, *Canadian Wind Energy Association*

Students learned about wind turbines and some of the challenges with building, using and maintaining wind turbines. A wind model was assembled and described. Students went outside to witness wind transforming to power.



to



### Geothermal Power -

Craig Dunn (Borealis GeoPower)

Through presentation, discussion and video students learned about the potential of energy within the earth's crust and the lack of development in this area in Canada.

### Reading your Utility Bill - Leonard Olien (Olien Consulting) and Paula McGarrigle (Solas Energy Consulting Inc.)

Students learned how to read home utility bills and examined their home electricity, natural gas and water usage in histogram form and calculated carbon footprint. The school utilities were also compared on a per square footage basis with the children's energy usage.



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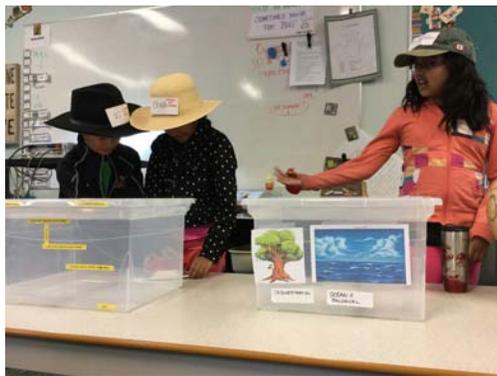
### Transportation Fuel - Paula McGarrigle (Solas Energy Consulting)

Students learned about different types of oil, the oil sands and how crude oil is refined into jet fuel, gasoline, and diesel and that car efficiency varies significantly.

Students aligned toy cars in series from most efficient to least efficient. Students engaged in an energy quiz on transportation fuel.

Format: Presentation, video and activity

### Climate Change Part 1 – Evidence and Causes - Paula McGarrigle (Solas Energy Consulting)



Students learned that climate change is real and evidence indicates that is caused by mankind. Took part in a tub demonstration of various levels of carbon dioxide levels up to 2015 and the levels for each country. Oceans and biological were used to reduce the level of CO<sub>2</sub> in the “atmosphere”. The children demonstrated that it would take

approximately 38 years to reach the levels of CO<sub>2</sub> associated with the 570 ppm (2 degree rise).

### Climate Change Part 2 –Mitigation Options - Paula McGarrigle

Students learned about stabilization wedge options which included a review of Alberta’s historical and projected emission levels. Students also learned about circle of concern, circle of influence, and circle of control. Students learned what they can do within their circle of concern and influence. Completed a handout on “How do I help?” and exercise on identification on personal action.

### Climate Change Part 3 – Stabilization Wedges - Paula McGarrigle, *Solas Energy*



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In teams of four, students - each with a different “expertise” - played a game to determine which technologies and strategies should be used to reduce the growth of emissions from Alberta. The students then completed a review of Alberta’s climate change plan based on the Princeton Carbon Mitigation Institute Greenhouse Gas Stabilization Wedges, which was modified for Alberta (and grade 4 students!) specifically. They summarized their strategies and rated each strategy according to different views of stakeholders. Students presented their strategy to a panel representing government, public, and energy companies and used persuasive language to defend their strategy.

Phase II Kick-off - Paula McGarrigle, Solas Energy



“I can change the world, we can change the world.”

Brainstorm of ideas and concepts and created a word cloud with the results. Listened to the song *One Voice* by the Wallin Jenny’s.

Energy Detectives Part I - Paula McGarrigle

Using the Phantom Load, Energy Usage measurement

students in teams of 4 measured the power requirements of multiple appliances and converted this to a cost per year estimate.

Alberta Energy (former) Minister Oberle Visits PEEL Students

Students asked questions of Alberta’s Energy Minister about government plans and policies around reducing carbon emissions. Students respectfully voiced concerns about





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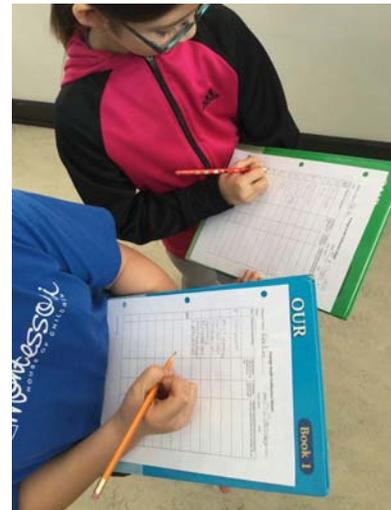
Carbon Capture and Storage and the rate at which Alberta's industry's produce unhelpful emissions.

#### Energy Detectives Part II - Paula McGarrigle

Presentation looking at wasted electricity usage. Visuals included night photos of Calgary from the bow river, North America (at night) from satellite photos, Calgary (at night) from satellite photos, and their school with a light on outside the front entrance (had been on for a few months). Presentation explored the way we think about energy. Introduced character "Wisely the owl" who asks you to use your energy wisely.

Discussed the benefits to using your energy wisely. In teams, students listed things that are used in the school that require electricity. Teams listed things in the school that are sometimes on when they don't need to be. Introduced the concept of an audit. Provided an overview of the next steps: i) Energy Audit (#1); ii) create a culture of change; and iii) second audit. School areas divided into regions.. Reviewed the Rubric for Energywise.

Energy Audit #1 - Students performed the first energy audit by identifying items that use electricity, and evaluated areas on the energy audit rubric for their area of the school. Students reported on the audit.



#### Turn it Off Campaign/Movement

Students developed a campaign for school change and a launch of the audit on Earth Day. Campaign included "High fives" with the saying "High Five for Energy Wise" and peer teaching to kids in younger grades. Campaign ran for 3-4 weeks prior to the second energy audit

#### Energy Detectives Part III- Paula McGarrigle

Conduct a second energy audit (#2) to Identify what improvements were made



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### Carbon Capture and Storage -J.P. Jepp, Shell Canada Limited

Presentation focused on geological storage of carbon dioxide and provided information on the Shell Quest project. In team of 4, students was give three containers of rocks of different sizes. Students poured water into the containers to fill them. Then they measured the amount of water that came out of the containers and reported their findings. The amount of water that each container held represented the porosity of the rock. Students learned that CCS is not a substitute for reducing GHG emissions.

### The Importance of Biodiversity - Biodiversity Institute, AB

Presentation focused on ecosystem health in our school community. Students learned about the importance of biodiversity to healthy and dynamic ecosystems and discussed bioindicators as signs of healthy or unhealthy ecosystems. Students completed a scavenger hunt in our Outdoor Classroom to find varieties of mosses, lichens and fungus.



### Crafting your message - Tom Babbin, Online Editor for the Calgary Herald

Presentation about how to convey your message and the media in which to do this. Students learned the key requirements of a noteworthy story and the importance of sharing their own voice.

Telus Spark Science Centre - Evaluation of the Spark Energy and Environment Exhibit  
Students spent the day at the SPARK centre. Small groups evaluated the quality of information of various aspects of the Energy Exhibit including representation of solar, wind, technology, First Nations, land use, water, conservation. Then, in jigsaw groups of



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approximately 6 - 8 students, Telus Spark staff heard feedback about the exhibit including recommendations for moving forward.

#### Summerview Wind Farms - TransAlta Renewables

Students toured the control station of the TransAlta wind farms in Canada where they learned about the jobs, technology and dynamic skills needed to harvest wind energy in Alberta. After flying kites at the Old Man River Dam, students had the opportunity to visit a wind farm and see inside a turbine.



P.E.E.L. Affair - As a cumulative project, students planned and implemented a community eco-fair and celebration of learning open to the community. The hope for this evening was to celebrate, educate, and promote:

1. Celebrate student learning from this inquiry project;
2. Raise awareness in the school and local community about the importance of being energy literate and being aware of the choices we have as citizens around energy and the environment;
3. Promote the organizations and initiatives that have supported the project through the year or who support Calgarians in living a more environmentally sustainable life (there were approximately a dozen booths set up with information available to the public)

The evening was celebratory in nature as well as promoted sustainable living in all aspects of the evening - local and ethical food truck, compostable cups at the water station, compost/recycling/landfill waste disposal stations. Students displayed their environmental art work from the year,



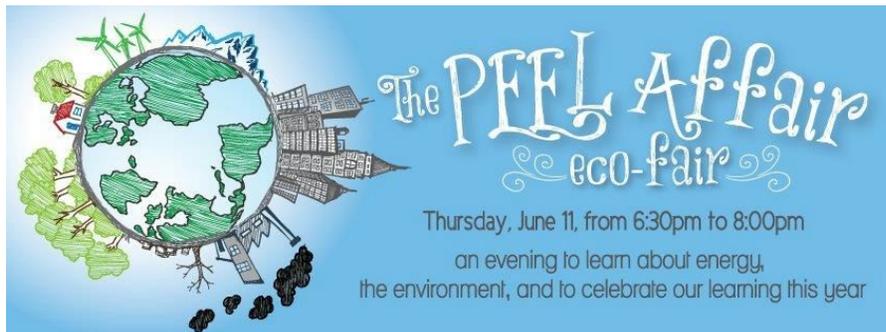


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shared a spoken word poem or song as a class, had an auction for a living wall, and ended by sharing their 3 minute speech with a small audience. The speech was to be written with either a tone of hope or concern about the environmental forecast in Alberta. There was a “Turn It Off” photobooth, energy Kilowatt meters for people to see energy use of various household appliances, a “Make One Change” pledge board. Students were responsible for all aspects of the evening which provided ample

opportunities for diverse learners to participate in various ways.



**Demonstrating our Learning (Assessment)**

**This is how we have**

**demonstrated, documented and reflected upon our learning**

- Student PEEL journals
- Student observations and comments during class discussions
- Hand on demonstrations of learning- ie. Energy pathway
- Water usage diagrams
- Home water usage analysis
- Results of rainwater collection experiment
- Analysis of design of products for sustainability
- Analysis of home utility bills and school electricity usage
- “How do I help” handout
- Alberta Climate Change Plan review
- Summaries of climate change strategies
- Word Cloud of “How we can change”
- Measurements of power requirements and cost of appliances
- School list of energy usage and waste



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- Energy Audit #1 Results
- Student iMovie about the 2008 Alberta Climate Change Action Plan shared with Deputy Minister Steve MacDonald
- Energy Audit #2 Results
- School assembly presentation of audit results and findings
- Participation in PEEL EcoFair
- Letter writing to our presenters
- Artistic representations & environmental identity statements
- Climate Change Speeches

### Success for all Students

This is how we have differentiated, provided supports, etc. to make it for everyone...

- Modifications and accommodations for final projects included one on one or small group support, student choice, varied quantity of written assignments, scribes where required, varied time where required, peer support

### Resources

The resources we utilized to support our learning are...

- Paula McGarrigle, Solas Energy Consulting Inc
- Dustin Owens, Department of Energy
- Dave Kelly, Skyfire Energy
- Oksana from Integrated Sustainability
- Dean Jones – SAIT
- Jennifer Mehalko (Foundesign)
- Jeff Patton, Foothills Renovations
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- Leonard Olien (Olien Consulting)
- J.P. Jepp, Shell Canada Limited
- Tom Babbin, Online Editor for the Calgary Herald
- Field trip to the Wind Farm - Summerview Wind Farm

#### **What Changed for Students**

- Students are now able to identify solar, wind, hydro, geothermal energy, as viable and sustainable options for their energy needs. Students appreciate the abundance of Alberta's solar, hydro, wind potential and jobs involved in these fields.
- Students are now able to identify that energy resources and management is complex and there are always challenges that go along with the opportunities of renewable energy, such as installation, education, negative environmental impacts, and cost.
- Students are now able to identify that biodiversity is important to a healthy ecosystem. They also understand that diversity in energy practices is also critical.
- Students are now able to identify that while water appears to be abundant in Alberta, it truly is a sacred resource and one to be managed and conserved appropriately. Students can identify the unique opportunities citizens have to improve water harvesting practices in their homes.
- Students are now able to identify how government policy impacts regulations in the energy sectors and that citizens must use their voice and their votes to influence government to reflect their environmental values. Students understand that they have personal choice when it comes to influencing other people.
- Students are now able to identify the critical times we are facing in terms of our global climate. Students can identify how conservation and planning in Alberta is critical for local and global health. Students can discuss how carbon emissions relate to climate change and understand that change is needed and is urgent to reduce and mitigate further global impact.



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**Special Acknowledgement:** *The PEEL project emerged out of a concern from a parent regarding the underwhelming resources, knowledge and quality of current information available to teachers working with students around topics of sustainability, climate change, and renewable resources. Paula McGarrigle (Parent Volunteer and Managing Director of Solas Energy Consulting) and Christine Avey (Grade 4 Teacher) put their heads together to generate a 3 - 5 part series on educating grade 4 students on renewable forms of energy and the current energy "climate" in Calgary. This mini-unit soon snowballed into a powerful inquiry and action project. With a robust vision, hundreds of hours of dreaming, doing and adapting content to the minds of gifted 10 year olds, Paula poured her heart, time and resources into this project. Without her knowledge, personal connections, and deep desire to create a healthier future for her two children, Christine and Cayley would have not been able to generate this quality of program. Thank you, Paula, for working so closely with us in your "spare time" to see this project come to be!*

For a full version of this program or to have someone work with you and your students on an inquiry project like this one, contact Paula McGarrigle:  
([pmcgarrigle@solasenergyconsulting.com](mailto:pmcgarrigle@solasenergyconsulting.com)).