Grade 5 Learning Experiences: Life Systems / Earth & Space Systems - Conservation of Energy

Experience 5: Spotlight on New & Emerging Technologies

Long Range Plan: Grade 5 Model 1

Students will develop their knowledge in all science strands by investigating how human health is impacted by current methods of energy production, resource use, resource extraction and current ways of life.

Overview of learning experiences	Students will learn about the conservation of energy, as well as the forms, sources, and uses of energy and resources. They will increase their understanding of the effects of energy and resource use on society, human health, and the environment. The learning experiences relate to the Long Range Plan: Grade 5 Model 1
Prior Knowledge / Prior Skill Set(s)	**Background Knowledge and Concepts (Teacher)** - ● Aware of health & safety procedures (i.e. PPE & MDMS) ● Maintain safe facilities & laboratory equipment ● Identify potential workplace hazards & mitigation measures ● Aware of Global Competencies & Transferable Skills; ● Aware of Culturally Relevant & Responsive Pedagogy ● Understand how to implement the UDL framework ● Understand how to engage in an Engineering Design Process ● Understand basic block-based coding concepts, platforms, functions and algorithms for software such as Scratch, Makecode Arcade, and Minecraft EDU. **Background Knowledge and Skills (Students)** ● Aware of safety procedures (e.g., PPE & lab materials) ● Follow safe work or preventative measures as instructed ● Aware of rules for taking community walks ● Familiar with the “Norms of Collaboration” ● Prior knowledge & experience with basic block-based coding concepts, platforms, functions and algorithms for software such

	as Scratch, Makecode Arcade, and Minecraft EDU Students may hold a variety of misconceptions about energy. Here are a few misconceptions that you might hear in your own classroom. **Students may think…** / **Instead of thinking …** Heat is a substance. It is not energy. / Heat is energy. Things "use up" energy. / Energy is neither used up nor lost. . Energy can be changed completely from one form to another. / Energy can only be transferred and transformed. Energy is truly lost in many energy transformations. / Energy doesn't actually disappear. It may transform into unusable forms. If energy is conserved, we can't run out of energy. / Non-renewable energy resources cannot be replaced.
Strand A - STEM Investigation and Communication Skills	**STEM Investigation and Communication Skills:** The learning experiences described below focus on science, technology, engineering, and mathematics (STEM) skills, coding and emerging technologies, practical applications of science and technology, and contributions that people with diverse lived experiences have made to science and technology. **Students will:** **A1.1** use a scientific research process and associated skills to conduct investigations **A1.2** use a scientific experimentation process and associated skills to conduct investigations **A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes

	A2.1 write and execute code in investigations and when modeling concepts, with a focus on using different methods to store and process data for a variety of purposes **A3.2** investigate how science and technology can be used with other subject areas to address real-world problems
Overview / Big Ideas/ Fundamental Concepts	**Overview:** How does energy production and the consumption of energy resources affect humans, their health and the environment? **Big Ideas:** Students will assess the effects of energy consumption and resource use on human health, society, and the environment, and suggest options for conserving energy and resources. **Fundamental Concepts:** ● Energy comes in many forms and can change forms. Energy is required to make things happen (to do work). Work is done when a force causes movement. ● Stewardship involves understanding that we need to use and care for the natural environment in a responsible way and making the effort to pass on to future generations no less than what we have access to ourselves. Values that are central to responsible stewardship are as follows: using non-renewable resources with care; reusing and recycling what we can, and switching to renewable resources where possible. **Guiding Questions:** ● Can you identify some renewable and non-renewable sources of energy? ○ **Suggested Response:** A renewable natural resource is one that can be renewed, or replenished in a reasonable amount of time (in years or a human-life span), once it has been used. Renewable energy is generated from natural sources (sun, wind, rain, tides, and vegetation) and can be generated again and again when needed. A non-renewable resource can take many generations to reproduce. Non-renewable resources are limited in supply and once used cannot be re-generated within a short span of time.

	Non-renewable sources exist in the form of natural gas, oil, and coal. ● How would you explain how the use of energy derived from fossil fuels changes the composition of the atmosphere? How do these changes contribute to climate change? ○ **Suggested Response:** Burning non-renewable resources and commodities such as carbon or fossil fuels releases carbon dioxide into the atmosphere. These are greenhouse gases that are among the primary contributors to climate change. ● What are the long-term impacts of human use of energy and natural resources? (Consider impacts on society and the environment, including climate change.) ○ **Suggested Response:** When non-renewable resources, such as coal and oil are burned, they release particles that can pollute the air, water, and land. Burning fossil fuels also upsets Earth's "carbon budget," which balances the carbon in the ocean, earth, and air. ● How can humans mitigate the negative impacts of their use of energy and natural resources? ○ **Suggested Response:** We need to be good energy stewards. This means that we must use and care for the natural environment in a responsible way. Values that are central to responsible stewardship are as follows: using non-renewable resources with care; reusing and recycling what we can, and switching to renewable resources. Recognize that there is an inherent choice, multiple entry points, and a variety of assessment opportunities inherent within the learning experiences to honour learner variability in classrooms. Below are additional supports and considerations to consider as part of these learning experiences. Listed below are assistive technology tools that can be used to improve a student's functioning and independence and can help give children an increased level of autonomy and independence as they overcome learning challenges; **Instructional Accommodations** - Word Prediction, Speech-to-Text, and Text-to-Speech Software such as Read & Write for Google Chrome helps students to respond orally, help communicate their thinking, and support writing demands.
Differentiated learning opportunities	

	Instructional Accommodations - Presentation Software - Software such Lumio, Peardeck, and Nearpod support visual, audio, and organizational instructional strategies and can assist in accommodating students with special needs. If educators have access to smartboard technology, they can provide additional opportunities for differentiation and student engagement. These student-centered pathways help students to engage with learning, to self-pace, to self-regulate, and to provide opportunities for socio-emotional check-ins. **Assessment Accommodations via Assistive Technology Organizers & Presentation Software** - Apps such as Flip, audio recordings, and graphic organizers as offered by Jamboard, Lumio, Microsoft Whiteboard, and/or Mindomo can be used to provide visual reinforcement and to assist students with the processing of ideas. They can also be used by students to demonstrate their understanding of concepts/skills, and communicate their thinking. **Learning Environment Accommodations** - Students who struggle with social interactions and physical movement can be supported through accommodations within the environment itself. Opportunities for body breaks and calming apps such as Art of Glow and Quiver can help students to self-regulate. Transitions between activities can be less disruptive to students who experience difficulty with time management and self-regulation through the use of visual timers. The use of noise-canceling headphones, microphones, and FM systems as required can help students to remain focused and reduce threats and negative distractions.
Learning Goals / Success Criteria	**Learning Goals:** We are learning about energy consumption and the effects of various technologies on energy consumption. We are exploring how we can use technology in innovative and efficient ways to reduce energy consumption. We are investigating the long-term impacts of human use of energy, how their usage contributes to climate change, and how to mitigate the long-term effects. **Success Criteria:** ● I can explain how we consume energy. ● I can explain how different technologies consume energy.

	● I can demonstrate various ways to conserve energy and resources. ● I can ideate user-friendly solutions to real-world problems related to energy production and consumption. **Ministry of Education Key Points:** The key points listed below will be addressed within these experiences. ● **STEM Skills and Connections**: Students use Microsoft Make Code Arcade to design a game that builds awareness around climate change and encourages students to take action. ● **Research and Experimentation Processes**: Students are introduced to new and emerging technologies through a spotlight on innovations around electricity. ● **Coding:** Students use Microsoft Make Code Arcade to design a game that builds awareness around climate change and encourages students to take action. ● **Emerging Technology**: Students are introduced to new and emerging technologies through a spotlight on innovations around electricity. ● **Contributions to Science and Technology**: Students explore real-world issues such as Indigenous climate justice through an exploration of the Resilience project. ● **Climate Change**: Students discuss the causes of global warming, and how the challenges of global warming impact Indigenous rights. Students investigate how the most vulnerable, disadvantaged, and marginalized communities are most impacted by climate change but contribute the least to these changes. ● **Food Literacy**: Students could address how growing food is affected by climate change and how climate change can disrupt food availability, reduce access to food, and affect food quality. For example, projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may result in reduced agricultural productivity and increased food insecurity. (e.g., as part of the Arcade Game Design Challenge) **Note:** Educators are encouraged to co-create success criteria with students and share “I Can Statements” based on the curricular expectations.

Learning Experience(s) **A.1.1**	**Minds On** (20 mins) **Option 1**: **Notice and Wonder** As our world grows increasingly connected, we require increasing amounts of energy. How do we generate enough energy to meet all of our energy needs? Global Energy Demand from IQ Energy provides an overview of how the world's growing population and increasing energy demand affect the global energy mix and impacts resource extraction. As a class, watch Global Energy Demand. Post viewing, invite students to record their thoughts using a KWL chart, a graphic organizer or a mindmap and/or share their ideas as part of a large group discussion. **Possible Discussion Questions**; ● What do we use energy for? ○ **Suggested Response:** There are three types of ways in which we use energy: residential uses of energy, commercial uses of energy, and transportation-related uses of energy. In our homes, we use energy to watch television, wash clothes, heat and light the home, take a shower, work on a laptop or computer, run appliances, and cook. Residential uses of energy account for almost forty percent of total energy use globally. In a commercial environment, companies use energy to heat, cool, and light commercial buildings and run computers, fax machines, workstations, and/or copiers. The transportation sector is entirely dependent on energy. The transport sector includes all vehicles from personal cars to trucks to buses and motorcycles. It also includes aircraft, trains, ships, and pipelines. ● Why do we need an increasing amount of energy? ○ **Suggested Response:** As populations grow, communities require increasing amounts of energy for their homes, their businesses, and to travel and transport goods. ● Where can we get energy from? ○ **Suggested Response:** In the future, humans will need to get increasing amounts of energy from non-renewable sources, such as biomass, solar, water and wind. Currently, we source our energy from non-renewable and renewable sources, but as the availability of non-renewable resources decreases and the impact of non-renewable resources on the planet becomes increasingly concerning, communities will begin to source alternative forms of

?A.1.1.Scientific Research	renewable energy for their residential, commercial, and transportation needs. Educators can use an organizer like Google Jamboard (see Appendix A for a Google Jamboard example) or Microsoft Whiteboard to share the guiding questions and provocations with students. If you choose to use a digital tool to make student thinking visible, invite students to collectively document their observations and wonderings online before engaging in a large group discussion about their findings. **Option 2**: **Notice and Wonder** Indigenous climate justice frames the challenge of global warming as inevitably tied to, and symptomatic of, the ongoing processes of colonialism, dispossession, and violations of Indigenous rights. Invite students to explore a series of images from the Resilience Project as a means to bring awareness to resource extraction issues and understand that those who are least responsible for climate change – the most vulnerable, disadvantaged and marginalized – tend to suffer its gravest impacts. Begin by inviting students to look at the provocations from the Resilience Project Series closely and ask them to write down 5 things that they see, notice, and/or wonder. As a large group, invite students to list everything that they can collectively remember about the provocation. During this portion of the activity, the educator is encouraged to act as a facilitator and not play the role of "expert". As the discussion continues, paraphrase each student's observations and make connections with the observations of other students.

A.3	Consider using the following guiding questions to prompt conversation. ● What is the first thing you notice about the artwork? ● What else do you observe? ● What interests you most about this artwork? ● What questions do you have about what you see? Educators can use an organizer like Google Jamboard to share the guiding questions and picture provocations with students. If you choose to use a digital tool to make student thinking visible, invite students to collectively document their observations and wonderings online before engaging in a group debrief. **Action** (1.5 hrs) **Experience 5 Spotlight on New & Emerging Technologies** (5 periods) To start a conversation on how technology and innovation can change industries, have students watch Electricity Innovation from Canadian Geographic Education. Discuss with students some of the emerging technologies discussed in the Video (i.e., Artificial Intelligence improving how energy is monitored and metered, energy storage technologies, and renewable energy sources) See “Future Opportunities/Next Steps” for extension and enrichment opportunities.
Consolidation: **A1.1, A.2, A1.5**	**Consolidation:** **Provocation**: Invite students to explore a topic of interest or of immediate personal relevance in connection to energy consumption, resource extraction, and how it relates to climate change. **Research**: Ask students to research the impacts of energy consumption and resource extraction on the planet, paying particular attention to their impacts on climate change. Alternatively, students might choose to explore the many ways in which climate change affects human organ systems and human pathogens. For example, they may choose to research how various diseases and medical disorders are being exacerbated by climate change, and how historically marginalized communities are impacted more severely.

	Build Capacity around SDGs: For further reading on this topic, you may choose to explore the Sustainable Development Goals with your students, focusing on Goal 7 (Affordable and Clean Energy) and Goal 12 (Responsible Consumption and Production). To build your own background knowledge, you may wish to read the article Climate Change is Making Hundreds of Diseases Much Worse. Students may wish to document their findings using a KWL chart or within a graphic organizer. **Prototype/Design**: Invite students to use the Microsoft Make Code Arcade platform to ideate, design, and code an arcade-style game that will help others to understand the impact of resource extraction on the planet and empower them to take bold action around energy production/consumption and climate change. The intent of the digital design challenge is to build awareness about climate change, and more specifically, the ways in which resource usage and extraction exacerbate climate change and impact racialized communities disproportionately. **Learn to Code With Microsoft Make Code Arcade**: Educators can use this slide deck resource to build student capacity with Microsoft Make Code Arcade. Invite students to explore skillmaps to build capacity with block-based coding skills required to engage in this learning experience. **Mind's On**: Educators can use the video provocation entitled "Voices of the Climate Crisis" to spark curiosity about climate change as well as the impact of energy consumption and resource extraction on the environment. **Action**: Educators can also invite students to explore featured climate change submissions - games that were created as part of the Microsoft Make Code Arcade 2021 Game Jam - to generate ideas for their own arcade-inspired games Educators can share either a paper or digital copy of the "Game Jam Organizer" to assist students with planning their game (i.e., narrative, background, sprites, mechanics, feedback and pacing). **Share**: Students can present their games to their peers and describe how their games were intentionally designed to build awareness about climate change and inspire students to take action around climate change. **Note:** An alternative to Microsoft Make Code Arcade is Scratch
Science and	**Strand B: Life Systems**

Technology Expectations	**Topic:** Relating Science and Technology to Our Changing World **B2.4** identify various diseases and medical disorders in humans and the organs and/or body system or systems that they affect **Strand E: Earth and Space Systems** **Topic:** Exploring and Understanding Concepts **E2.1** identify a variety of forms of energy, and describe how each form is used in everyday life **E2.4** demonstrate an understanding that when energy is transformed from one form to another, some energy may dissipate into the environment in the form of heat, light, and/or sound energy
Science and Technology Vocabulary	● Climate Change ● Conservation of energy ● Energy (Heat, Light, Sound, Potential Energy) ● Fossil Fuels ● Renewable and Non-Renewable Energy ● Resource Usage and Resource Extraction ● Sustainability
Equipment and Materials	**Experience 5** Science Spotlight Electricity Innovation **Additional Resources** Resilience Project Scratch Minecraft EDU Microsoft Make Code SDG Goals Website

Timeline and Preparation	The time frames indicated below are suggested and may vary. **Mind's On** - Notice & Wonder #1 — 20 minutes **Mind's On** - Notice & Wonder #2 — 20 minutes **Experience 5 Spotlight** - Emerging Technologies — 40 minutes **Consolidation** - Climate Game Jam — Varies
Safety Considerations	Be sure to review safety guidelines for all experiments and activities and instruct students to follow safety guidelines. Please remember to check the safety notes at the end of the Long Range Plans for additional ideas.
Opportunities For Assessment	According to the Ministry of Education Growing Success Document (2010) assessment is about improving student learning! **Assessment FOR Learning:** Occurs frequently and in an ongoing manner during instruction, while students are still gaining knowledge and practicing skills and is used by teachers to monitor students' progress towards achieving the overall and specific expectations, so that teachers can provide timely and specific descriptive feedback to students, scaffold next steps, and differentiate instruction and assessment in response to student needs. **Assessment AS Learning:** Occurs frequently and in an ongoing manner during instruction, with support, modelling, and guidance from the teacher and is used by students to provide feedback to other students (peer assessment), monitor their own progress towards achieving their learning goals (self-assessment), make adjustments in their learning approaches, reflect on their learning, and set individual goals for learning. **Assessment OF Learning:** Occurs at or near the end of a period of learning, and may be used to inform further instruction and is used by the teacher to summarize learning at a given point in time. This summary is used to make judgements about the quality of student learning on the basis

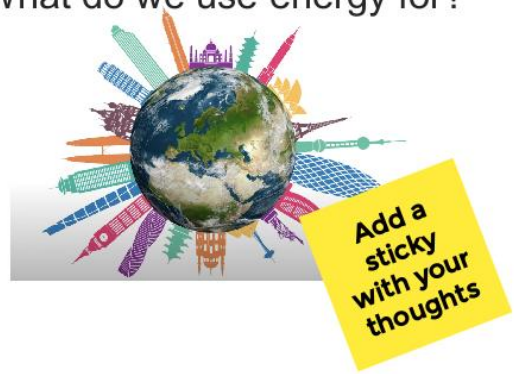
	of established criteria, to assign a value to represent that quality, and to support the communication of information about achievement to students themselves, parents, teachers, and others **NOTE:** The assessment in the learning experiences are intentionally assessment for learning and assessment as learning. The assessment modality is intentionally conversations and observations. This is to help move away from only product based assessment. Throughout the learning experiences students will have many opportunities to demonstrate their understanding through doing, talking and engaging in self-assessment. By collecting assessment for/as learning data teachers can be responsive and provide meaningful feedback. Teachers have been provided with assessment tools to collect evidence of student learning. Assessment opportunities are embedded throughout the learning experiences. Please use the following links for further reference: https://www.dcp.edu.gov.on.ca/en/assessment-evaluation https://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf ● Collaboration and communication are important skills for scientists and that is reflected throughout the learning experiences found in this resource ● Teachers should aim to have a learning environment that is safe, respectful and inclusive (community building should be ongoing). Please see the ETFO Inclusive Classrooms website. ● Students should have an understanding of collaboration norms ● There are a multitude of collaboration strategies that are employed in this resource and teachers are encouraged to review them before starting ● Teachers should adapt the lessons based on the needs of the students in their class (Please refer to the Learning for All document). ● Movement is important to learning. Students should be given opportunities to get up and move through games and active learning strategies ● Teachers should value the lived experiences and stories of their students in the materials they use in the classroom through the use of Culturally Relevant and Responsive Pedagogy (CRRP) Please use the following links below for further reference: https://www.dcp.edu.gov.on.ca/en/program-planning/considerations-for-

	program-planning/human-rights-equity-and-inclusive-education Consult the Achievement Charts for Science & Technology Provide a variety of means of assessment, including conversations, observations and/or products. **Assessment of learning** may include learning maps, graphic organizers, single point rubrics or checklists. See Appendix B: Single Point Rubric as an example. Consider varying assessment pathways using these assessment strategies: Station Rotation Model Flipped Classroom Paper & Pencil Question/Answer Playlists & Hyperdocs for Differentiation Student Portfolios Lab Experiments Observations & Conversations Presentations Student Annotations Competency-Based Approaches Self-Grading Tools
Instructional Strategies and Adaptability	● Create a learning environment in which students feel safe, supported, and valued. ● Embed culturally responsive student-centered instructional practices as well as diverse readings from a variety of voices and perspectives, particularly those voices which may fall outside of traditional canons. ● Ensure that the learning experiences offered to students embody a "Universal Design for Learning" model by offering flexibility in the ways in which students access material, engage with course content, and demonstrate their learning. ● Honour students' background knowledge and invite them to share what they know in ways that are meaningful to them. ● Become a co-learner with students when uncovering content guided by students' wonderings. ● Encourage students to ask good questions and give them the opportunity to find answers and/or solutions. ● Support students as they carry out the scientific and engineering processes.

Additional Supporting Resources	• Science Center: Power-Up: The Science of Energy • Science North: Energy Storage & Innovation for the Classroom • Let's Talk Science: Energy Sources • Indigenous Climate Hub • Is Climate Change Racist? • Climate Change Book Room
Cross-Curricular Opportunities	**Math:** As students look for forms of energy, in the classroom, school, and schoolyard, they should be asked to identify and tally the items they find. As students collect data about energy usage and production, they can then be asked to use appropriate sampling techniques to answer questions of interest, and organize the data in relative-frequency tables.
Future Opportunities / Next Steps	Educators can enrich the consolidation experience by inviting students to download their games to physical computing devices, such as Meowbit. Educators might also consider participating in the global Microsoft Make Code Game Jam. Information about this extension opportunity is available on the Microsoft Make Code website . Educators can invite students to debate the pros/cons of climate-friendly technologies for the energy sector by spotlighting low-carbon grid technologies such as floating solar, floating wind, and green hydrogen technologies. Students can research different emerging technologies that exist and create a presentation, infographic, poster, or website to demonstrate their learning and knowledge of their chosen technology. Students can also use the Engineering Design Process to invent or innovate a technology or apparatus that will help solve an energy-related problem that we face today. For example, how do we reduce carbon emissions in accordance with the Paris Agreement and transition to a greater reliance on renewable resources such as solar power and hydroelectric power in place of fossil fuels and other non-renewable resources.

Appendix A: Energy Consumption Jamboard

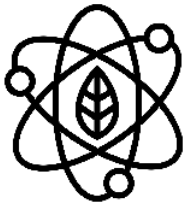
What do we use energy for?



Why do we need an increasing amount of energy?

Add a sticky with your thoughts

Where can we get energy from?



Add a sticky with your thoughts

Appendix B: Single Point Rubric

Single Point Mastery Rubric - Conservation of Energy

Glows Strong aspects of your work	**Outcomes**	**Grows** How you can improve your work
	Criteria: Energy consumption My work demonstrates the various effects of technologies on energy consumption I can create a piece of work that shows how technology can be used to conserve energy	
	Criteria: Benefits Explain the benefits of emerging technologies I can demonstrate how the technology I chose can help benefit the society and the environment	
	Criteria: Compare to other communities Research different communities and how they are using technologies to conserve energy and resources I can make comparisons of how different communities are using emerging energy-saving technology	
	Criteria: Observations How do I and my community use energy and resources and how can we be more efficient I can communicate different types of energy sources and how I use energy in my home and community.	