

DATE: May 26, 2020

TO: Board of Trustees

FROM: Darrel Robertson, Superintendent of Schools

SUBJECT: Division Carbon Footprint and Student Readiness for Climate Change
(Response to Request for Information #061)

ORIGINATOR: Dr. Lorne Parker, Assistant Superintendent

**RESOURCE
STAFF:** Maegan Lukian, Coreen Moccia, Christopher Wright

ISSUE

The following information was requested by Trustee Dunn:

What knowledge, skills and attitudes will students need in a world impacted by climate change? What is Edmonton Public School's current carbon footprint?

BACKGROUND

Edmonton Public Schools understands the importance of preparing students for climate change through curriculum delivery. Detailed information on how climate change is included in the Alberta curriculum was presented to Board on January 28, 2020 (Attachment I). The Division is committed to environmental stewardship through continual improvement and modeling best practices of sustainability.

A carbon footprint is a way of quantifying the amount of greenhouse gas (GHG) emissions for which an individual, organization, or event is responsible. Appropriate carbon accounting is of growing importance in most sectors of society and increasingly, organizations have recognized the need to monitor and calculate their carbon footprint so they can adopt strategies to manage and reduce it.

Reporting has increased in importance as both local and national governments focus on carbon accounting, transparency and sustainability efficiencies to counter the impacts of climate change. The Division recognizes that monitoring emissions and minimizing environmental impacts will act to enhance operational efficiency.

CURRENT SITUATION

Student Readiness for Climate Change:

There are a range of views as to what specific knowledge, skills and attitudes will be required for students to live in a world impacted by climate change. Some key organizations and Division administration have identified that the development of broad, key competencies in students will best prepare them for the future.

The Organisation for Economic Co-operation and Development (OECD) indicates that competencies such as “critical thinking, problem solving, and the ability to find individual solutions to emerging issues are also important. And increasingly, individuals need skills to effectively manage change and uncertainty in a fast-paced modern world. This includes both cognitive and metacognitive skills as well as socio-emotional skills, such as empathy and the capacity to collaborate with others (OECD ,2017b)” ([Trends Shaping Education 2017 Spotlight OECD, 2017, p.9](#)).

Similarly, the United Nations Educational, Scientific and Cultural Organization (UNESCO), in their document, *Climate change education for sustainable development: the UNESCO climate change initiative*, states that, “Simply introducing new content about climate change science, causes, consequences and solutions will not be an adequate response to climate change. New values, creative thinking and problem solving-skills need to be instilled at all school levels through teaching and learning methodologies that are participatory, experimental, critical and open-ended” ([Climate Change Education for Sustainable Development, 2010, p.14](#)).

It is understood that increasing knowledge of the causes and impacts of climate change can lead to responsible daily decisions on behalf of communities and individuals. In Article 6 of the United Nations Framework Convention on Climate Change, the 197 parties commit to "the development and implementation of educational and public awareness programmes on climate change and its effects", on national and international levels ([United Nations Framework Convention on Climate Change, 1992, p.10](#)).

In Alberta, the competencies identified in the current Ministerial Order on Student Learning (#001/2013) may be key to preparing students in a world impacted by climate change. These competencies are:

- critical thinking
- problem solving
- managing information
- creativity and innovation
- communication
- collaboration
- cultural and global citizenship
- personal growth and well-being

Administration believes that a focus on the development of these competencies in Kindergarten to Grade 12 will further support the development of the knowledge, skills and attitudes students will need in a world impacted by climate change. Additionally, the Division will be examining the new provincial curriculum as it becomes available to identify related key knowledge, skills and attitudes to provide additional supports to teachers as needed in this area.

Division Carbon Footprint:

The Edmonton Public Schools EnviroMatters Office has been working with a sustainability consulting firm to monitor the Division’s carbon footprint in accordance with internationally accepted WRI Greenhouse Gas Protocol and ISO 14064. In 2015, the Division conducted a benchmark sustainability report using data from 2011 to 2014 to help determine the value of Division-wide carbon footprint reporting. Subsequently, in 2017, the Division began annual carbon footprint reporting. The most recent 2018 report is Edmonton Public Schools’ second year undertaking the Instep Carbon and

Sustainability Monitoring Program, with 2017 registered as the base year under the GHG protocols and ISO 14064 Standard.

Scopes being measured include:

- Scope 1 emissions are direct emissions that occur in sources directly under Division control, including natural gas, company vehicles and refrigeration and cooling.
- Scope 2 emissions refer only to those indirect emissions that are produced through the generation of electricity purchased by the Division.
- Scope 3 emissions refer to all other indirect emissions that may be outside the Division footprint boundary, including distributed energy, landfill waste, air travel, land transport, student bus transport and third-party freight.

There are many other environmental impacts that are not included in GHG emission calculations, yet still have environmental impacts that are included in the annual carbon footprint reporting. This includes water use, recycling, composting, paper and publications.

Edmonton Public Schools' 2019 carbon footprint is still being calculated. Based on the 2018 report, the Division's current carbon footprint is approximately 128,132 tonnes of CO₂e produced from identified emission sources and records an increase of seven per cent when compared against the 119,334 tonnes of CO₂e generated in the base year of 2017.

Total CO₂e emissions increased in 2018 mainly due to increases recorded in natural gas and consumed electricity. Consumed electricity (59,754 tonnes of CO₂e) was the most significant source of emissions, contributing 47 per cent of all Division greenhouse gases to the annual profile. This was closely followed by natural gas which contributed 52,579 tonnes of CO₂e or 41 per cent of the total profile. These building-associated energy emissions continue to dominate the profile, and make up 88 per cent of the total tonnes of CO₂e emissions generated for the 2018 period. Other significant contributors were student bus transportation which contributed 10,966 tonnes of CO₂e (or 9 per cent) and emissions from energy distribution losses (2,926 tonnes of CO₂e) which contributed two per cent. All other areas individually contributed less than one per cent of the total emissions profile.

By establishing the base year in 2017, Edmonton Public Schools can now monitor improvements in subsequent years in accordance with internationally accepted parameters. Likely contributors to the increase in emissions from 2017 to 2018 were increased gas consumption due to a colder winter (i.e., more Heating Degree Days) and the addition of 11 new schools to the Division during that period. Once the 2019 report is finalized, this will help the Division better understand this increase and its annual emissions behavior. Transitioning from monitoring the Division carbon footprint to setting achievable emissions reductions targets requires stable and predictable funding for climate resilience initiatives.

With 213 schools and over 104,000 students, the Division generates significant quantities of CO₂e emissions over a 12-month period, especially in consumed electricity, natural gas, student transportation and landfill waste. Fortunately, awareness and understanding of climate impacts are steadily growing, especially among youth. This presents Edmonton Public Schools with an opportunity to create continuing environmental monitoring and reporting programs that encompass environmental education aspects throughout the organization.

KEY POINTS

- Competencies that may be key to preparing students in a world impacted by climate change include critical thinking, problem solving, managing information, creativity and innovation, communication, collaboration, cultural and global citizenship and personal growth and well-being.
- A focus on the development of these competencies in K-12 will further support the development of the knowledge, skills and attitudes students will need in a world impacted by climate change.
- Based on the 2018 report, the Division's current carbon footprint is approximately 128,132 tonnes of CO₂e produced from identified emission sources.
- Building-associated energy emissions make up 88 per cent of the total tonnes of CO₂e emissions generated for the 2018 period.
- Transitioning from monitoring the Division carbon footprint to setting achievable emissions reductions targets requires stable and predictable funding for climate resilience initiatives.

ATTACHMENTS and APPENDICES

ATTACHMENT I Response to Request for Information #055

ML:kk

**Response to
Request for Information Report**

DATE: January 28, 2020

TO: Board of Trustees

FROM: Darrel Robertson, Superintendent of Schools

SUBJECT: District Climate Readiness
(Response to Request for Information #055)

ORIGINATOR: Dr. Lorne Parker, Assistant Superintendent

**RESOURCE
STAFF:** Darryl Kaminski, Maegan Lukian, Coreen Moccia, Christopher Wright

REFERENCE: Curriculum Connections to Climate Change (Attachment I)

ISSUE

The following information was requested by Trustee Stirling: *In light of the City of Edmonton's declaration of a state of climate emergency, I ask that administration prepare a report on the District's climate readiness and carbon emissions reduction efforts, including policy, people, plans and Infrastructure, and what is being done to mitigate risk from climate-related extreme weather events such as wildfire smoke, heat events, storms or other incidents. Additionally, please include information on how climate change is included in the Alberta curriculum.*

BACKGROUND

In June 2019, following on a motion by Prime Minister Trudeau, the House of Commons [voted to declare](#) a national climate emergency. In August 2019, the City of Edmonton [declared](#) a climate emergency, reaffirming the City's commitment to being a climate resilient city as laid out in Edmonton's strategic plan. Edmonton joins other major Canadian cities, including Vancouver, Ottawa, Montreal and Halifax in declaring climate emergencies at the municipal level.

Beginning in 2016, the City of Edmonton and various stakeholders worked together to develop the [Climate Resilient Edmonton: Adaptation Strategy and Action Plan](#), which was presented to the Executive Committee of City Council in November 2018.

CURRENT SITUATIONClimate readiness and carbon emissions reduction efforts:

Regarding policy, Edmonton Public Schools recognizes the importance of sustainable learning environments and is committed to making environmentally

conscious decisions. The EnviroMatters Office, created in the fall of 2008, is an initiative of the Infrastructure department and the centre of the Division's environmental initiative. In 2010, the

Division developed an Environmental Policy ([EO.BP – Environment](#)) to guide and support environmental initiatives across the Division and recognize that the pursuit of teaching and learning impacts the environment. In the spring of 2018, the Division released its first formal [Energy and Environment Strategy](#) which outlines current environmental initiatives and serves as a framework to help monitor and determine next steps in the Division's environmental sustainability efforts.

Edmonton Public Schools has an Environmental Coordinator and Energy Coordinator who works out of the EnviroMatters Office to recommend, organize and manage sustainable initiatives across the Division, and the Project Management Office team oversees solar installations and energy efficient upgrades to existing buildings. Individuals within the Infrastructure team are certified Environmental Professionals and LEED Accredited Professionals and the Division also has partnerships with expert consultants on matters of carbon reporting, utility procurement, energy performance and green building design.

The Division also established an Environmental Advisory Committee and Green Cleaning Committee to allow representatives from various departments to discuss environmental concerns and provide advice on existing and proposed sustainable program development.

In regard to plans and strategic planning, the Division EnviroMatters Office has been working with a sustainable consulting firm since 2015 to monitor the Division's carbon footprint in accordance with internationally accepted WRI Greenhouse Gas Protocol and ISO 14064. The information gathered through monitoring can assist Division staff to make informed decisions regarding retrofitting, renovations and strategic planning for energy, waste, and water reductions. Next steps could include Division climate change vulnerability assessments to accurately determine climate readiness and set targets for improvement.

The Infrastructure department recently conducted a feasibility study and developed a comprehensive solar strategy to expand rooftop solar module installations across the Division, in an effort to reduce costs and emissions tied to electricity use. Upon completion of Phase I, Edmonton Public Schools will be home to three new solar arrays - one visible from the Centre for Education, another the first in Canada to achieve Net Zero (Electrically) and third, the largest K-12 installation in Western Canada. Renewable and alternative energy sources are an important strategy for reducing emissions. By 2022, including both Division and school-led initiatives, Edmonton Public Schools will have solar on 16 schools, eventually generating an approximate 3,000 megawatt-hours per year.

One of the climate resilience goals of the City of Edmonton is to ensure Edmonton communities, businesses and institutions are aware, connected and prepared for climate change. The City of

Edmonton is planning to develop and implement an institution climate change readiness program to help support institutions prepare for climate change. The EnviroMatters Office is investigating how Edmonton Public Schools may work with the City of Edmonton to support this initiative and expand Division climate resilience planning.

Additionally, the Government of Canada has introduced the [Climate Action Incentive Fund](#) (CAIF). CAIF is a new Environment and Climate Change Canada program, funded from the proceeds of the federal carbon pollution pricing system. Programming will be available where provinces have not committed to their own carbon pollution pricing systems, and one of the funding streams will be used to support projects that decrease energy usage, save money and reduce carbon pollution for municipalities, universities, schools and hospitals in these jurisdictions. The federal government implemented the federal price on carbon pollution in Alberta on January 1, 2020, and Edmonton Public Schools Infrastructure department will investigate any funds made available to the Division through CAIF.

In terms of Infrastructure, Edmonton Public Schools follows the Leadership in Energy and Environmental Design (LEED) Silver standard for building new Division schools, and looks to external consultants and best practice models for environmental program development and for upgrades to existing schools.

The Division has eight LEED Silver and seven LEED Gold certified schools and 10 newly opened schools that are currently awaiting certification. Soraya Hafez, Thelma Chalifoux and Dr. Anne Anderson schools, currently under construction, are also being built to achieve a minimum LEED Silver certification.

An energy performance contract with Ameresco Canada was completed for 30 school buildings, resulting in significant and important infrastructure upgrades while reducing energy and water consumption. This project exceeded the forecasted electricity savings of over 4.5 million kWh of electricity per year by 41 per cent. A similar two-phase Infrastructure Optimization Project is also underway for 37 school buildings and is 97 per cent complete. The Infrastructure Optimization Project applies successful strategies, ideas and proven components in the energy performance contract. In addition to this work, there are ongoing infrastructure improvements including upgrades to HVAC, Building Automation, and LED lighting systems that are also optimized for energy efficiency and reduced maintenance costs.

A significant component of Edmonton Public Schools' Infrastructure Strategy must address the Division's rapidly aging facilities and deferred maintenance deficit. Rationalizing space in mature communities where fewer students live, yet where extra utility and operating costs are incurred, is a key consideration. It is critical that energy consumption be reduced to improve operating efficiency and reduce operating costs, while also reducing greenhouse gas emissions and our carbon footprint.



Multiple strategies can be deployed to achieve this, including:

- School consolidation/replacement in mature communities resulting from mature community engagement, to deliver modern and efficient facilities.
- Replacement or modernization of existing single schools where programs or student populations are stable.
- Evergreening of a large inventory of dated and inefficient portables and relocatable classrooms.
- Retrofitting heating and ventilation (HVAC) systems with more modern and efficient systems.
- Retrofitting building exteriors with more effective insulating windows, walls, doors and roofs.

A final strategy is to deliver needed schools and student capacity closest to where students live, predominantly in areas with the highest growth and where new development is focused. The further students reside from the school they attend, the greater student transportation distances contribute to greenhouse gas emissions and our carbon footprint. With a rising school utilization rate across the Division, it is challenging to right-size, modernize, and consolidate and replace older infrastructure effectively without space for students in newer areas of the Division.

Our Division strives to deliver high quality, 21st Century learning environments, ensuring our buildings are environmentally sustainable and efficient. Inherently, there will need to be a concerted and coordinated effort to upgrade and replace existing facilities and deliver new schools and student spaces in developing areas. This cannot be balanced and achieved without stable and predictable funding. An annual funding rate of two to three per cent of the replacement cost of the Division school buildings has been proposed as a method that would achieve the delivery of new space, the modernization and replacement of existing space and the provision of portables and relocatable classrooms within 10 years. Stable, predictable funding is necessary for long-term carbon emissions reduction and climate resilience planning.

Mitigating risk from climate related extreme weather events:

To address the risk of increased heavy rainfall events and urban flooding, Edmonton Public Schools Infrastructure department has been working with EPCOR Drainage Services on compiling information on flooding risks for Division school properties. EPCOR will be developing individual location fact sheets to share with the Division for mitigation planning. These fact sheets will include degree of flood risk and additional information such as planned construction in the area, dry ponds for the locations and potentially water and electrical consumption assessments.

Previous chronic water infiltration during heavy rain events at a number of Division high schools led Infrastructure to conduct a study to identify the reasons for water infiltration. Nearly all corrective measures identified in the study have been addressed and a Division incident response team has been developed to mobilize in the event of an emergency, such as flooding, to contain the situation and eliminate further loss. In the course of regular yearly inspections, Infrastructure

Maintenance also works to remove debris around roof drains and assess schools with inadequate grading during storms and heavy rains to mitigate flood risk.

To further prevent flood damage from heavy rainfall events and aid in water conservation, Infrastructure Maintenance is currently piloting a leak and flood detection system within the maintenance facility and select pilot schools throughout the Division. The system works to provide early detection of major water floods and also minor toilet and tap leaks through wireless devices that sense moisture, gather sensor data, measure water meter flow and report back. Water consumption and alert history are stored for review in an online dashboard which can assist with future flood mitigation planning.

Infrastructure Maintenance has also been installing portable air conditioning units in Division portable and modular structures, to mitigate the risk of overheating for Division staff and students during high-heat events. During wildfire smoke events, if notified by the school that they are having air quality issues, Infrastructure Maintenance will remotely turn off all ventilation units until the event.

has cleared. Indoor environment and air quality is addressed by using improved air exchangers in new mechanical upgrades, efficient heating systems and controls and scheduled filter cleaning.

Additionally, Edmonton Public Schools has Occupational Health and Safety procedures and guidelines in place to help Division staff mitigate risk from climate-related extreme weather events. Resources include:

- Indoor Environmental Quality Guidelines outlining recommended cleanup procedures to minimize damage to infrastructure after sewer backup, floods and water leaks.
- Health and Safety Guidelines outlining important tips and precautions to be taken by staff during high heat and cold weather events.
- Outdoor Air Quality Risk Self-Assessment Guidelines and Air Quality Index reference for staff to use in response to reduced air quality due to forest fire events.

Climate change in the Alberta curriculum:

Detailed information on how climate change is included in the Alberta curriculum is outlined in the attached reference document, Curriculum Connections to Climate Change (Attachment I), prepared by the Division Curriculum and Resource Support department. Curricular connections to climate change are found in Grades 4-12 Science (including Senior High Biology, Chemistry and Physics) and K-12 Social Studies, as well as in Grades 5-9 through the Career and Technology Foundations curriculum.

KEY POINTS

- In 2019, the Federal Government declared a national climate emergency, followed by the City of Edmonton declaration of a municipal climate emergency.
- Edmonton Public Schools understands the importance of risk mitigation and has taken important steps toward climate readiness and understanding the Division's carbon footprint to support work around emissions reductions.
- To further plan and prepare, the Division could consider conducting a climate change vulnerability assessment to accurately determine climate readiness and set targets for improvement.
- Stable, predictable funding is necessary for long-term carbon emissions reduction and climate resilience planning.
- Curricular connections to climate change are found in Grades 4-12 Science and K-12 Social Studies, as well as in Grades 5-9 through the Career and Technology Foundations curriculum.

ATTACHMENTS and APPENDICES

ATTACHMENT I Curriculum Connections to Climate Change

ML:kk

Curriculum Connections to Climate Change

Background:

The following is a summary of curricular connections to the concept of climate change. Each curricular connection describes foundational knowledge that builds towards an understanding of climate change. The connections listed here may not always seem obvious or explicit. For example, learning about chemical changes in Grade 9 is foundational knowledge because understanding how combustion of hydrocarbons leads to the production of carbon dioxide is essential to understand how human actions can lead to increases in carbon dioxide emissions.

Curricular Connections by Subject

Area: Science:

Grade 4 Science

Light and Shadows

- Identify sources of light, describe the interaction of light with different materials, and infer the pathway of a light beam.

Waste in Our World

- Recognize that human actions can affect climate, and identify human actions that have been linked to the greenhouse effect.

Grade 5 Science

Wetlands

- Identify individual and group actions that can be taken to preserve and enhance wetland habitats.

Grade 6 Science

Trees and Forests

- Identify human actions that enhance or threaten the existence of forests.

Grade 7 Science

Stewardship (Attitude outcome)

Students will be encouraged to: Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Interactions and Ecosystems (Social and Environmental Emphasis)

- Identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments)
- Analyze personal and public decisions that involve consideration of environmental impacts, and identify needs for scientific knowledge that can inform those decisions

- Identify intended and unintended consequences of human activities within local and global environments (e.g., changes resulting from habitat loss, pest control or from introduction of new species; changes leading to species extinction)
- Analyze a local environmental issue or problem based on evidence from a variety of sources, and identify possible actions and consequences (e.g., analyze a local issue on the control of the beaver population in a nearby wetland, and identify possible consequences)

Plants for Food and Fibre (Science and Technology Emphasis)

- Investigate and identify intended and unintended consequences of environmental management practices (e.g., identify problems arising from monocultural land use in agricultural and forestry practices, such as susceptibility to insect infestation or loss of diversity)
- Identify the effects of different practices on the sustainability of agriculture and environmental resources (e.g., identify positive and negative effects of using chemical fertilizers and pesticides and of using organic farming practices)

Heat and Temperature (Social and Environmental Emphasis)

- Describe the nature of thermal energy and its effects on different forms of matter, using informal observations, experimental evidence and models.
- Apply an understanding of heat and temperature in interpreting natural phenomena and technological devices.
- Analyze issues related to the selection and use of thermal technologies, and explain decisions in terms of advantages and disadvantages for sustainability.
- Identify positive and negative consequences of energy use, and describe examples of energy conservation in their home or community.

Grade 8 Science

Stewardship (Attitude outcome)

Students will be encouraged to: Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Light and Optical Systems (Nature of Science Emphasis)

- Investigate how light is reflected, transmitted and absorbed by different materials; and describe differences in the optical properties of various materials (e.g., compare light absorption of different materials; identify materials that transmit light; distinguish between clear and translucent materials; identify materials that will reflect a beam of light as a coherent beam)
- Measure and predict angles of reflection

- Investigate, measure and describe the refraction of light through different materials (e.g., measure differences in light refraction through pure water, salt water and different oils)

Fresh and Saltwater Systems (Social and Environmental Emphasis)

- Identify evidence of glacial action, and analyze factors affecting the growth and attrition of glaciers and polar icecaps (e.g., identify factors that affect the size of polar ice sheets and the Columbia Icefield)

Grade 9 Science

Stewardship (Attitude outcome)

Students will be encouraged to: Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Biological Diversity (Social and Environmental Emphasis)

- Describe ongoing changes in biological diversity through extinction and extirpation of native species, and investigate the role of environmental factors in causing these changes

Matter and Chemical Change (Nature of Science Emphasis)

- Observe and describe patterns of chemical change, by: – observing heat generated or absorbed in chemical reactions, and identifying examples of exothermic and endothermic reactions

Environmental Chemistry (Social and Environmental Emphasis)

- Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
- Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality
- Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment

Electrical Principles and Technologies (Science and Technology Emphasis)

- Describe and discuss the societal and environmental implications of the use of electrical energy.
- Identify concerns regarding conservation of energy resources, and evaluate means for improving the sustainability of energy use.

Science 10

Stewardship

-Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Energy Flow in Technological Systems (Science and Technology Emphasis)

- Analyze and illustrate how technologies based on thermodynamic principles were developed before the laws of thermodynamics were formulated.
- Explain and apply concepts used in theoretical and practical measures of energy in mechanical systems.
- Analyze data and apply mathematical and conceptual models to develop and assess possible solutions.

Energy Flow in Global Systems (Social and Environmental Emphasis)

- Describe how the relationships among input solar energy, output terrestrial energy and energy flow within the biosphere affect the lives of humans and other species.
- identify the potential effects of climate change on environmentally sensitive biomes

Science 20

Stewardship

-Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Chemical Changes

- illustrate how technological problems often require multiple solutions that involve different designs, materials and processes and that have both intended and unintended consequences

Changes in Living Systems

- describe the potential impact of habitat destruction on an ecosystem
- explain that society and technology have both intended and unintended consequences for humans and the environment

Science 30

Stewardship

-Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment

Energy and the Environment

- Explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.
- Describe the sun as Earth's main source of energy and explain the functioning of some conventional and alternative technologies that convert solar, nuclear, tidal and other energy sources into usable forms.

- explain that decisions regarding the application of scientific and technological development involve a variety of perspectives, including social, cultural, environmental, ethical and economic considerations

Chemistry and the Environment

- identify organic compounds commonly considered to be environmental pollutants
- list the sources of, and analyze the hazards posed by, halogenated hydrocarbons and benzene derivatives
- identify and explain how human activities and natural events contribute to the production of photochemical smog, the depletion of the ozone layer and increased concentrations of organic compounds in the environment;
- explain how science and technology have both intended and unintended consequences for humans and the environment

Biology 20

Mutual Respect (attitude outcome)

- research carefully and discuss openly ethical dilemmas associated with the applications of science and technology
- explore personal perspectives, attitudes and beliefs toward scientific and technological advancements

Stewardship (attitude outcome) Students will be encouraged to:

demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment; e.g.,

- assume part of the collective responsibility for the impact of humans on the environment
- participate in civic activities related to the preservation and judicious use of the environment and its resources
- encourage their peers or members of their community to participate in a project related to sustainability
- consider all perspectives when addressing issues, weighing scientific, technological and ecological factors
- discuss both the positive and negative effects on human beings and society of environmental changes caused by nature and by humans
- participate in the social and political systems that influence environmental policy in their community
- promote actions that are not injurious to the environment
- make personal decisions based on a feeling of responsibility toward less privileged parts of the global community and toward future generations
- be critical-minded regarding the short- and long-term consequences of sustainability

Unit A: Energy and Matter Exchange in the Biosphere

- explain that the process of scientific investigation includes analyzing evidence and providing explanations based upon scientific theories and concepts
 - evaluate the evidence for the influence of ice and snow on the trapping of solar energy (albedo effect) and hypothesize on the consequences of fluctuations for biological systems
- explain that science and technology have both intended and unintended consequences for humans and the environment
 - discuss the influence of human activities on the biogeochemical cycling of phosphorus, sulfur, iron and nitrogen: – feedlot operations – composting – fertilizer applications – waste and sewage disposal – vehicle and refinery emissions – acid deposition – persistent organic pollutants
 - describe how human activities can have a disrupting influence on the balance in the biosphere of photosynthetic and cellular respiratory activities: – fossil fuel combustion – depletion of stratospheric ozone – forest destruction.
- formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues
 - hypothesize how alterations in the carbon cycle, resulting from the burning of fossil fuels, might affect other cycling phenomena;
- describe the geologic evidence (stromatolites) and scientific explanations for change in atmospheric composition, with respect to oxygen and carbon dioxide, from anoxic conditions to the present, and describe the significance to current biosphere equilibrium.
- work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results
 - work cooperatively as a group to investigate, synthesize and present information on the effects of changes to stratospheric ozone levels on society, agriculture, plants and animals

Biology 30:

Mutual Respect (attitude outcome)

- research carefully and discuss openly ethical dilemmas associated with the applications of science and technology
- explore personal perspectives, attitudes and beliefs toward scientific and technological advancements

Stewardship (attitude outcome) Students will be encouraged to:

demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment; e.g.,

- assume part of the collective responsibility for the impact of humans on the environment
- participate in civic activities related to the preservation and judicious use of the environment and its resources
- encourage their peers or members of their community to participate in a project related to sustainability
- consider all perspectives when addressing issues, weighing scientific, technological and ecological factors
- discuss both the positive and negative effects on human beings and society of environmental changes caused by nature and by humans
- participate in the social and political systems that influence environmental policy in their community
- promote actions that are not injurious to the environment
- make personal decisions based on a feeling of responsibility toward less privileged parts of the global community and toward future generations
- be critical-minded regarding the short- and long-term consequences of sustainability

Chemistry 20

Unit D: Quantitative Relationships in Chemical Changes

-explain how the appropriateness, risks and benefits of technologies need to be assessed for each potential application from a variety of perspectives, including sustainability

- assess the significance of specific by-products from industrial, commercial and household chemical reactions
- analyze the use of technologies, such as smokestacks and catalytic converters, to reduce emissions that are harmful to the environment, such as $\text{SO}_2(\text{g})$ and greenhouse

Chemistry 30

Thermochemical Changes

Students will determine and interpret energy changes in chemical reactions

-explain that the goal of technology is to provide solutions to practical problems

- provide examples of personal reliance on the chemical potential energy of matter, such as the use of fossil fuels
- identify ways to use energy more efficiently
- identify and explain the selection of different fuels used by communities in urban, rural and remote areas, and compare that selection to the fuels used by the early inhabitants of a particular area of Alberta

-explain that technological problems often require multiple solutions that involve different designs, materials and processes and that have both intended and unintended consequences

- explain the applications of fossil fuels, with examples from industries in Alberta
- evaluate the impact of the combustion of various energy sources, including fossil fuels and biomass, on personal health and the environment and describe the technologies used by early peoples to mitigate the harmful effects of combustion.

- explain that the goal of technology is to provide solutions to practical problems
- explain how catalysts, such as catalytic converters on automobiles, reduce air pollution resulting from the burning of fuels
- explain that the products of technology are devices, systems and processes that meet given needs; however, these products cannot solve all problems
- evaluate the economic and environmental impacts of different fuels by relating carbon dioxide emissions and the heat content of a fuel.

Unit C: Chemical Changes of Organic Compounds

Students will explore organic compound as a common form of matter:

- describe, in general terms, the physical, chemical and technological processes (fractional distillation and solvent extraction) used to separate organic compounds from natural mixtures or solutions; e.g., petroleum refining, bitumen recovery.

Students will describe chemical reactions of organic compounds

- relate the reactions described above to major reactions that produce thermal energy and economically important compounds from fossil fuels.
- explain how science and technology have both intended and unintended consequences for humans and the environment

Science 14

Unit B: Understanding Energy Transfer Technologies (Science and Technology Emphasis)

- explain the need to encourage and support the development of machines that are efficient and rely upon renewable energy sources

Unit D: Investigating Matter and Energy in the Environment (Social and Environmental Emphasis)

- trace the development of a technological application that has altered an ecosystem

Science 24

Unit A: Applications of Matter and Chemical Change (Science and Technology Emphasis)

- Define, operationally, endothermic and exothermic reactions
- Investigate and describe simple chemical processes occurring in everyday life
- Investigate and describe greenhouse gases and air pollution resulting from combustion reactions
- Investigate and describe technologies used to reduce emissions that cause acid deposition

Unit B: Understanding Common Energy Conversions Systems (Science and Technology Emphasis)

- Investigate and describe evidence of energy transformations in the home and everyday contexts
- Describe electrical power generation in terms of converting thermal/hydro/wind/solar/nuclear energy into electricity
- Devise a plan for making more efficient use of household energy conversion devices
- Students will investigate and describe the energy conversions associated with change in chemical and biological systems
 - investigate and describe common chemical reactions that produce or absorb energy
 - outline, in general terms, the formation of the following fossil fuels: oil, coal and natural gas
- Analyze and describe the impact of fossil fuel based technologies and their importance in meeting human needs
 - explain the importance of the fossil fuel industry in Alberta in meeting energy requirements
 - compare present fossil fuel consumption by industry, homes and automobiles with projected consumption in the future
 - describe the sources of fossil fuels; and describe, in general terms, the extraction and refining processes used to provide people with fossil fuels
 - assess the impact of fossil fuel based technologies on the environment
 - describe the importance of combustion reactions to a modern industrial society, and describe the implications of depleting fossil fuel reserves

Unit C: Disease Defence and Human Health (Social and Environmental Emphasis)

- trace, from a historical perspective, the connection between diseases and contaminated drinking water, air pollution and personal hygiene
- analyze the impact of public health initiatives and maintaining high standards of personal hygiene in fostering healthier societies and individuals

Physics 30

Electromagnetic Radiation

- Explain the nature and behaviour of EMR, using the wave model.
- Describe, quantitatively, the phenomena of reflection and refraction, including total internal reflection

Career and Technology Foundations (CTF)

- In Grades 5 to 9, the [Career and Technology Foundations \(CTF\)](#) curriculum provides flexible ways for students to pursue areas of interest, including

environmental and sustainable development programming. CTF enables students to plan, explore and create solutions for relevant and meaningful challenges.

Career and Technology Studies (CTS)

COURSE ENS2130: RENEWABLE & NONRENEWABLE ENERGY RESOURCES

- Level: Intermediate
- Prerequisite: ENS1110: Natural Resources
- Description: Students examine current and potential renewable and non-renewable energy production, the contributions of each to sustainable energy development, and the effects of these forms of energy production on the environment.

Social Studies

General values and attitudes K-12 (front matter)

- appreciate and respect how multiple perspectives, including Aboriginal and Francophone, shape Canada's political, socioeconomic, linguistic and cultural realities
- demonstrate a global consciousness with respect to humanity and world issues
- demonstrate a consciousness for the limits of the natural environment, stewardship for the land and an understanding of the principles of sustainability

General Knowledge and Understanding K-12 (front matter)

- understand their rights and responsibilities in order to make informed decisions and participate fully in society
- understand the unique nature of Canada and its land, history, complexities and current issues
- understand how knowledge of the history of Alberta, of Canada and of the world, contributes to a better comprehension of contemporary realities
- understand historic and contemporary issues, including controversial issues, from multiple perspectives
- understand the diversity of Aboriginal traditions, values and attitudes
- understand how political and economic distribution of power affects individuals, communities and nations
- understand the role of social, political, economic and legal institutions as they relate to individual and collective well-being and a sustainable society
- understand how opportunities and responsibilities change in an increasingly interdependent world
- understand that humans exist in a dynamic relationship with the natural environment.

ISSUES-FOCUSED APPROACH TO TEACHING SOCIAL STUDIES (front

matter) The program of studies is designed to promote metacognition through critical reflection, questioning, decision making and consideration of multiple perspectives on issues. Through this process, students will strive to understand and explain the world in the present and to determine what kind of world they want in the future.

- Current Affairs
 - Social studies fosters the development of citizens who are informed and engaged in current affairs.
 - Investigating current affairs from multiple perspectives motivates students to engage in meaningful dialogue on relevant historical and contemporary issues, helping them to make informed and reasoned decisions on local, provincial, national and global issues.
- Controversial Issues
 - Studying controversial issues is important in preparing students to participate responsibly in a democratic and pluralistic society.
 - Such study provides opportunities to develop the ability to think clearly, to reason logically, to open- mindedly and respectfully examine different points of view and to make sound judgments.

Grade 1 Social Studies

My World: Home, School and Community

- Students will determine what makes their communities thrive by exploring and reflecting upon the following questions for inquiry:
 - How does caring for the natural environment contribute to the well-being of our community?

Grade 2 Social Studies

Canada's Dynamic Communities

- Students will appreciate the physical and human geography of the communities studied.
 - demonstrate care and concern for the environment
- Students will investigate the physical geography of an Inuit, an Acadian, and a prairie community in Canada by exploring and reflecting the following questions for inquiry:
 - What are the main differences in climate among these communities?
- Students will investigate the economic characteristics of communities in Canada by exploring and reflecting upon the following questions for inquiry:
 - ○ What kinds of natural resources exist in the communities (e.g., fishing, agriculture, and mining)?
 - What impact does industry have on the communities

A Community in the Past

- Students will examine how the community being studied has changed, by exploring and reflecting upon the following questions for inquiry:
 - In what ways has our community changed over time?
 - How have the people who live in the community contributed to change in the community?

Grade 3 Social Studies

Global Citizenship

- Students will examine the geographic characteristics that shape communities in other parts of the world by exploring and reflecting upon the following questions for inquiry:
 - In what ways do the people in the communities depend on, adapt to and change the environment in which they live and work?
 - In what ways do the communities show concern for their natural environment?
- Students will explore the concept of global citizenship by reflecting upon the following questions for inquiry:
 - What are some environmental concerns that Canada and communities around the world share?

Grade 4 Social Studies

Alberta: A Sense of the Land

- Students will examine, critically, the physical geography of Alberta by exploring and reflecting upon the following questions and issues:
 - What are the factors that determine climate in the diverse regions of Alberta (e.g., latitude, mountains)?
 - What are the significant natural resources in Alberta, and where are they located (e.g., mineral deposits, coal, natural gas and oil, forests)?
- Students will analyze how Albertans interact with their environment by exploring and reflecting upon the following questions and issues:
 - How are natural resources used by Albertans (i.e., agriculture, oil and natural gas, forests, coal)?
 - How do Albertans deal with competing demands on land use (e.g., conservation, solar and wind power, recreation, agriculture, oil exploration, forestry)?

Alberta: Celebrations and Challenges

- Students will appreciate the factors contributing to quality of life in Alberta.
- Students assess, critically, the challenges and opportunities that Alberta has faced in its growth and development by exploring and reflecting upon the following questions and issues:

- In what ways have occupations and commerce been affected by geography, climate and natural resources in Alberta (i.e., forestry, agriculture, aviation, seasonal activities, tourism)?

Grade 5 Social Studies

Physical Geography of Canada

- Students value Canada's physical geography and natural environment.
- Students will examine, critically, the physical geography of Canada by exploring and reflecting upon the following questions and issues:
 - How do landforms, bodies of water and natural resources affect the quality of life in Canada?
 - What are the factors that determine climate in the diverse geographical regions of Canada (e.g., latitude, water, mountains)?
- Students will analyze how people in Canada interact with the environment by exploring and reflecting upon the following questions and issues.:
 - In what ways do natural resources and the physical geography of a region determine the establishment of communities?
 - How are natural resources used, exchanged and conserved in Canada?

Grade 9 Social Studies

Issues for Canadians: Economic Systems in Canada and the United States

- Students will assess, critically, the relationship between consumerism and quality of life in Canada and the United States by exploring and reflecting upon the following questions and issues:
 - How does individual consumer behaviour impact quality of life (e.g., environmental issues)?
- Students will assess, critically, the interrelationship between political decisions and economic systems by exploring and reflecting upon the following questions and issues:
 - How do government decisions on environmental issues impact quality of life (i.e., preservation, exploitation and trade of natural resources)?

Social Studies 10-1

Related Issue 3

- Students will recognize and appreciate multiple perspectives that exist with respect to the relationships among politics, economics, the environment and globalization.
- Students will explore multiple perspectives regarding the relationship among people, the land and globalization (spirituality, stewardship, sustainability, resource development).

- Students will evaluate actions and policies associated with globalization that impact the environment (land and resource use, resource development agreements, environmental legislation).
- Students will analyze multiple perspectives on sustainability and prosperity in a globalizing world.

Related Issue 4

- Students will accept political, social and environmental responsibilities associated with global citizenship.
- Students will analyze how globalization affects individuals and communities (migration, technology, agricultural issues, pandemics, resource issues, contemporary issues).

Social Studies 10-2

Related Issue 3

- Students will recognize and appreciate multiple perspectives that exist with respect to the relationships among economics, politics, the environment and globalization.
- Students will recognize and appreciate impacts of globalization on the interdependent relationships among the economy, people and the environment.
- Students will explore multiple perspectives on relationships among people, the land and globalization (spirituality, stewardship, sustainability, resource development).
- Students will analyze the impact of actions and policies associated with globalization on the environment (land and resource use, resource development agreements, environmental legislation).
- Students will examine multiple perspectives on sustainability and prosperity in a globalizing world.

Related Issue 4

- Students will accept political, social and environmental responsibilities associated with global citizenship.

Social Studies 20-1

Related Issue 3

- Students will analyze impacts of the pursuit of internationalism in addressing contemporary global issues (conflict, poverty, debt, disease, environment, human rights).

Social Studies 20-2

Related Issue 3

- Students will analyze impacts of the pursuit of internationalism in addressing contemporary global issues (conflict, poverty, debt, disease, environment, human rights).

Social Studies 30-1

Related Issue 1

- Students will explore factors that may influence individual and collective beliefs and values (culture, language, media, relationship to land, environment, gender, religion, spirituality, ideology).
- Students will explore themes of ideologies (nation, class, relationship to land, environment, religion, progressivism).

Related Issue 2

- Students will analyze the extent to which modern liberalism is challenged by alternative thought (Aboriginal collective thought, environmentalism, religious perspectives, neo-conservatism, postmodernism, extremism).

Related Issue 3

- Students will evaluate the extent to which the principles of liberalism are viable in the context of contemporary issues (environment concerns, resource use and development, debt and poverty, racism, pandemics, terrorism, censorship, illiberalism).

Social Studies 30-2

Related Issue 1

- Students will explore factors that may influence individual and collective beliefs and values (culture, language, media, relationship to land, environment, gender, religion, spirituality, ideology).
- Students will identify themes of ideologies (nation, class, relationship to land, environment, religion).

Related Issue 2

- Students will examine the extent to which modern liberalism is challenged by alternative thought (Aboriginal collective thought, environmentalism, religious perspectives, extremism).

Related Issue 3

- Students will evaluate the extent to which the values of liberalism are viable in the context of contemporary issues (environment concerns, resource use and development, debt and poverty, racism, pandemics, terrorism, censorship).