



Climate Change

Saskatchewan Edition

Saskatchewan Greenhouse Gas Emissions



Climate Change and Greenhouse Gases

The 20th century was the warmest the world has seen in 600 years and the last two decades were the warmest on record. Many of the world's top scientists believe that average global temperatures could continue to rise significantly. In Saskatchewan we could see average increases of three to six degrees Celsius by the end of the 21st century.

It is not just increasing temperatures that concern scientists, but what the increases may bring. Climate change may mean severe winds, hail, snow and ice storms, more droughts in some areas, more floods in others, as well as lower lake and river levels. Reduction in the size of glaciers and reduced snow pack in the Rockies mean less water in the rivers of Saskatchewan. There will be more risk for agriculture, wildlife and forestry.

Scientists report that human activities are increasing the concentration of greenhouse gases (GHGs), such as carbon dioxide, in our atmosphere. This increase traps more heat in the atmosphere, upsetting the natural balance. Concentrations are increasing due to activities such as using fossil fuels for energy, deforestation, agriculture, as well as from the production of consumer products and various industrial processes.

In 1997, under the Kyoto Protocol, 160 countries agreed to work on this global challenge to reduce GHG emissions. Canada's target would be to decrease emissions to six percent below 1990 levels during the period 2008-2012 - about a 26 percent reduction from business-as-usual projections.

In Canada, federal, provincial and territorial governments have developed a National Implementation Strategy to address climate change as well as a National Business Plan listing actions proposed or already underway. Saskatchewan has 33 initiatives listed in this plan.

Climate change is a complex subject and the solutions are equally complex. Effective action on climate change will require all of us to consider our contribution. The climate change challenge is to maintain our economic prosperity while reducing GHG emissions globally.

Saskatchewan
greenhouse gas emissions

are
large

Here's
where they
come from...*

29% → Fossil Fuel Industries

24% → Electricity Generation

19% → Transportation

18% → Agriculture & Forestry

6% → Res. & Commercial

3% → Industrial

1% → Other

Here's Why:

Residents and businesses in Saskatchewan use more energy and produce more GHG emissions per capita than most other Canadians. Why?

- Our climate is more extreme than many other parts of Canada, relatively hot in summer (air conditioning) and extremely cold in winter (heating).
- Our province is sparsely populated over a large area of land. We travel further than others to conduct our business and to attend to our daily lives.
- More than three quarters of the electricity in Saskatchewan is generated from fossil fuels (coal or natural gas).
- Farming is energy-intensive and Saskatchewan has more land under crop production than any other province.
- A large part of our economy depends on extracting natural resources such as lumber, oil, potash and natural gas.
- The distances to our markets are great, and in large part, over land.

What Can We Do?

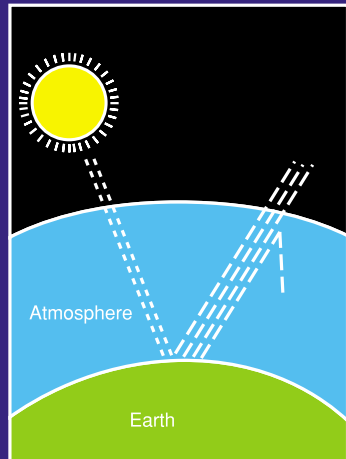
It should be recognized that the problem of accelerated climate change wasn't created in a day and will not be solved quickly; 'balance' is the key to any effective solution.

This publication is a description of some of the issues and current actions that are being taken to reduce greenhouse gas emissions, as well as some further steps we can all take.

*Source: Environment Canada, Emissions Report for 1999.

What is the greenhouse effect?

Greenhouse gases naturally emitted from land and water perform an essential function of keeping the Earth warm by trapping heat from the sun. This is called the greenhouse effect.



Without such gases to stabilize temperatures our climate would be much colder.

However, as these gases increase in our atmosphere, the concern is that human activity is changing the naturally-occurring delicate balance. As a result, the insulating effect of the atmosphere has increased and average temperatures are rising. Manmade emissions, deforestation and past land management practices threaten to overload the atmosphere and cause the climate to change.

Climate Change, AGRICULTURE and FORESTRY

Agriculture and Land Management



Over the past century, settlement and cultivation of the prairies have caused a significant depletion of the amount of soil organic matter.

Saskatchewan has an opportunity to increase the amount of soil organic matter through better land management.

As farmers adopt more efficient production practices by managing their soils, fertilizer use, manure handling, livestock grazing, crop residue practices and energy use, they also reduce emissions of GHGs. These farming practices improve the health of the soil and help to reduce atmospheric concentrations of GHGs. In addition to carbon dioxide (CO₂), agricultural operations may also emit nitrous oxide and methane, two highly potent greenhouse gases that also contribute to atmospheric warming.

Saskatchewan Forest Centre

Saskatchewan's forests already play a role in lowering the GHGs that cause climate change by absorbing CO₂. The opening of the Saskatchewan Forest Centre (SFC) in Prince Albert offers new opportunities to increase that role.

SFC is focused on developing technologies, conducting research and identifying market opportunities that will boost the forest industry. It brings together top-notch technical and professional personnel who are working on new forestry ideas. SFC welcomes farmers, woodlot owners, Aboriginal people, environmental and community groups, and businesses that can put such ideas to use.

Through the agroforestry component of its program, the Centre will contribute to Canada's efforts to meet climate change goals. At the same time, it will open a new door to innovation and growth for Saskatchewan's forest sector and the rural economy.

Rebuilding the Soil



Another method of reducing the warming due to carbon dioxide (CO₂) emissions is to capture and store them. Plants capture CO₂ from the atmosphere through photosynthesis, which releases oxygen, and retains a reservoir of carbon in the organic matter. This natural process is called carbon sequestration, or the creation of carbon sinks. Soil organic matter is high in carbon, making organic matter restoration an approach to GHG emissions reduction.

The Saskatchewan Soil Conservation Association (SSCA) includes farmers, industry and government. In conjunction with the Prairie Farm Rehabilitation Administration (PFRA) and Saskatchewan Agriculture and Food, SSCA is

examining a variety of ways to rebuild prairie soils. Practices such as growing perennial crops, minimum tillage and reduced frequency of fallowing, can improve the farmers' bottom line while reducing GHG emissions.

FACT: Saskatchewan leads the country in tillage and conservation practices that help remove carbon dioxide from the atmosphere.

Trees Play a Part



Forests can be significant carbon sinks. Trees take CO₂ out of the atmosphere and convert it to oxygen and wood fibre. SaskPower and Saskatchewan Environment and Resource Management signed a reforestation agreement whereby SaskPower helps pay for tree seedlings to be planted in the province.

Agriculture and Agri-Food Canada's Shelterbelt Centre at Indian Head, operated by the PFRA, distributes more than five million trees and shrubs to prairie clients each year. These efforts help farmers reduce wind erosion and also help reduce CO₂ levels in the atmosphere.

Millions of seedlings are planted each year in Saskatchewan by the forestry industry. One company, Weyerhaeuser Canada Ltd., plants as many as seven million seedlings each year. These seedlings absorb carbon dioxide as they grow.

Greenhouse Gases and ELECTRICITY

FACT:
Regular incandescent bulbs produce 10% light and 90% heat while fluorescent bulbs use 75% less energy to produce equivalent light and will last seven times longer.

The Winds of Change

In Canada, there is great variety in the regional distribution of electricity resources. These resources have traditionally dictated the means of electricity generation, and range from the large naturally occurring coal deposits in Alberta and Saskatchewan to the large hydro endowments of British Columbia, Manitoba and Quebec. The most common sources of electricity generation in Canada are hydro (60%), nuclear (17%), coal (15%) and natural gas (3%).



Due to its available resource base, Saskatchewan currently generates about 60% of its electricity using coal and 16% with hydro resources. The remainder of electricity in Saskatchewan is mainly supplied from natural gas.

Increasing public concerns regarding pollution, the possibility of human induced climate change and improving technologies are all contributing to a change in the electric utility industry. Saskatchewan has also embraced this change through the introduction of renewable fuel sources.

Although current technology and economics do not permit renewable energy to provide a large part of the province's electricity needs, the introduction of renewables and the shift away from greenhouse gas intensive fuel sources has contributed to reductions in greenhouse gas emissions.

A Conservation Culture



Prior to the awareness that GHG emissions were causing climate change, many people were of the view that conservation of resources and reduction of wastes was important for its own sake. They felt that with finite resources the world would be better served if people only consumed what was essential to their lives and avoided wasting resources.

Conservation practices can also further reduce greenhouse gas emissions. If we can become less wasteful of our resources, we can, in turn, reduce the emissions required to produce them.

Steam and Electricity



Steam is used to produce electricity and it is also used in many industrial processes. It is possible to use high pressure steam first to generate electricity and then to use the same steam, at a lower pressure and temperature, in industrial processes. This is called "cogeneration". Cogeneration reduces emissions because it uses energy for two applications instead of just one.

Cogeneration plants in Saskatchewan have saved large amounts of fuel because of their improved efficiencies, and, because of those efficiencies, have significantly reduced the amount of carbon dioxide emissions discharged into the atmosphere.

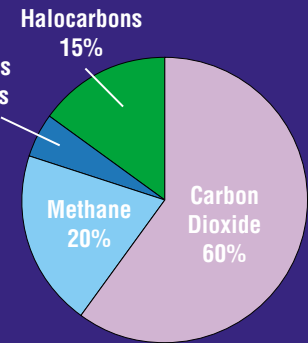
A large cogeneration plant near Lloydminster has a capacity of 215 megawatts. Electricity is sold to SaskPower and the steam is sold to the Husky Oil Lloydminster Upgrader.

Another example is the Cory Cogeneration Station near Saskatoon. This SaskPower International and ATCO Power cogeneration project has the capacity to produce 228 megawatts of electricity and thermal energy for the Cory potash mine. A similar project is in operation at Belle Plaine, where IMC Canada operates a cogeneration plant that produces both electricity and steam for its potash plant.

At Prince Albert, Weyerhaeuser Canada, a forest products company, operates a pulp and paper mill that uses cogeneration to produce electricity and steam.

What are greenhouse gases?

Greenhouse gases produced by human activities worldwide are illustrated in the adjacent chart.* This chart shows how much each gas contributes to the greenhouse effect, taking into account how much of it there is and how much radiation it can absorb.



Manmade carbon dioxide emissions come mainly from burning fossil fuels. Plants convert carbon dioxide to oxygen, thus deforestation reduces the planet's carbon dioxide absorbing capability.

Some nitrous oxide and all CFCs, one of the main halocarbons, are by-products of synthetic production processes. A total worldwide ban has been placed on production of CFC materials but their impacts are very long lasting.

Methane gas (natural gas is predominantly methane) in Saskatchewan comes from natural gas production, coal mining, landfills and livestock production. Nitrous oxide is released by agricultural cultivation and fertilizer use.

*United Nations, IPCC Report

Dealing with climate change

Dealing with climate change involves three main approaches:

- Reducing Emissions
- Capturing Emissions and
- Adapting to Climate Change.

Reducing emissions is the most fundamental action required. Some people feel that unless countries are prepared to actively promote methods of reducing emissions the problem will continue to grow. However, in some cases it may be possible to capture and hold such emissions before they are released into the atmosphere.

Canada and Saskatchewan are of the view that energy efficiency, renewable energy, fuel switching, domestic sinks and emission credits trading offer practical and effective options to reduce greenhouse gases.

Many scientists involved with addressing climate change consider that some of the approaches to reduce greenhouse gases are likely to take considerable time to implement and that strategies that capture existing emissions such as carbon sinks and emission credits trading are important measures.

Saskatchewan is in a unique position to use agricultural land and forestry as carbon sinks.

FACT:
The average car carries 1.3 people to work. Organize a car pool, walk, cycle, take a bus!

Ethanol, Emissions and the Economy



The name George Poitras is well known to First Nations people in Saskatchewan. A former schoolteacher, counselor, band

council member, and eventually Chief of the Peepeeksis First Nation, George Poitras has made his mark on the Saskatchewan environmental, energy and economic development scene. Since the early 1970s, his endless energy and efforts have been directed to promoting ethanol production.

Ethanol could displace portions of other carbon-based fuels, such as gasoline, and thereby potentially reduce the amount of greenhouse gases that escape into the atmosphere. Saskatchewan drivers use about 1.6 billion litres of gasoline per year. If gasoline were produced using 10% ethanol, the reduction of GHG emissions would potentially be significant.

In addition to reducing the amount of greenhouse gas emissions, the production of ethanol in Saskatchewan could create many new jobs in the province. A large ethanol market would exist if provincial gasoline, and possibly diesel fuels, were blended with ethanol. Saskatchewan presently produces just 12 million litres of ethanol annually – all at the Pound-Maker Agriventures' feedlot near Lanigan. Many more facilities the size of the Lanigan project would be needed to meet a largely expanded provincial requirement for ethanol blended fuels. Researchers and economic analysts are determining the actual reductions in GHG emissions that would be achieved using different feedstock processes for ethanol production, as well as the economic viability of blending gasoline for today's markets.

ENERGY and TRANSPORTATION

Technology Is Important



Saskatchewan has 64,000 kilometres of pipeline in its gas distribution system, providing service to more than 317,000 homes, farms and businesses in over 585 communities. Several other pipelines cross Saskatchewan carrying oil and gas to other parts of Canada and the United States.

Gas companies like SaskEnergy and TransCanada Pipelines Limited, through their industry associations, have made large investments in technological improvements in appliances such as domestic furnaces. Efficiencies of domestic furnaces and water heaters have improved so

much that per capita gas consumption has actually decreased by about 25%.

While the largest reductions in GHG emissions are obtained through improved technology, gas transmission companies also keep a sharp eye out for ways to reduce such emissions in their own operations. SaskEnergy received an award from the Canadian Energy Producers Association for automating its pipeline heaters and, in the process, saving energy and further reducing emissions. TransCanada Pipelines Limited was recognized by the Canadian Gas Association for its reduction of emissions by improving compressor turbine efficiencies, and for reducing gas emissions from its valve and control systems.

Energy Transportation



In general, ocean transport is considered to be the lowest GHG emitter per kilometre-tonne of cargo carried. Pipelines, are the next lowest emitter, followed by rail, trucks and automobiles. Saskatchewan export products are mostly bulk commodities like grains, coal, potash, oil and gas. Most of these products are moved with energy-efficient modes of transportation, mainly rail and pipelines.

With the abandonment of many rail lines and the centralization of the country elevator network, much more grain hauling is being done using trucks. This also increases GHG emissions.

Cars and trucks are essential to transportation in Saskatchewan. Although as a group they are large emitters of GHGs, their emissions can be reduced by maintaining vehicles in good working condition, reducing speed, and turning engines off when not in use. Such steps also reduce overall operating costs and extend the life of vehicles.

Can Saskatchewan adapt?

Adapting to weather is no stranger to residents of Saskatchewan. Famine or plenty were often only one season away for First Nations people who struggled to survive in the difficult climate of the western plains. For the farmers who homesteaded in Saskatchewan, adapting to a different climate and resulting economic conditions were also a way of life.

Water availability is expected to be one of the most profound impacts of climate change. It is predicted that precipitation patterns will change and crop and livestock production capabilities in many areas will be altered. Furthermore, northern forests may also be affected by reduced moisture and forest fire hazards will increase. Changes to wildlife habitat and ecology are predicted.

The federal government and prairie provinces established the Prairie Adaptation Research Collaborative (PARC) as the lead agency to link groups studying the issue of what impacts will take place and what adaptation strategies may be most suitable for dealing with climate change.

There are many ways that people can act individually and collectively to change the way that we use and manage renewable resources (soils, water, plants) so that ecosystems and human activities are less vulnerable to climate change. This is the essence of adaptation and the focus of PARC's research programs.

Adapting to Climate Change



Melt water from the Rocky Mountains feeds the groundwater reservoirs and the big river systems that cross the Canadian prairies. With world temperatures rising those sources are shrinking. This means less water for people, agriculture and hydroelectric power.

The Prairie Adaptation Research Collaborative (PARC), located at the University of Regina, along with a team of scientists from Natural Resources Canada, are measuring water amounts emptying into the North Saskatchewan River Basin and the impacts on communities downstream. They're also helping us understand how our changing climate will affect our groundwater supplies, since in some rural areas up to 75 percent of the population relies on groundwater.

NGOs Play an Important Role

Non-Government Organizations (NGOs) play an important role in addressing climate change. Ducks Unlimited has restored and conserved Saskatchewan's wetlands and uplands for over 60 years. The good wildlife habitat Ducks Unlimited creates and the environmentally friendly land-uses it promotes help to improve people's drinking water and reduce emissions that can cause climate change. The Saskatchewan Wildlife Federation is also concerned about the impact of climate change on fish and wildlife and supports habitat improvement. Other NGOs such as the Saskatchewan Environmental Society (SES) focus on public information and environmental advocacy. The SES also provides practical assistance to organizations to reduce energy use through its Destination Conservation program.

What Are Saskatchewan People Doing?

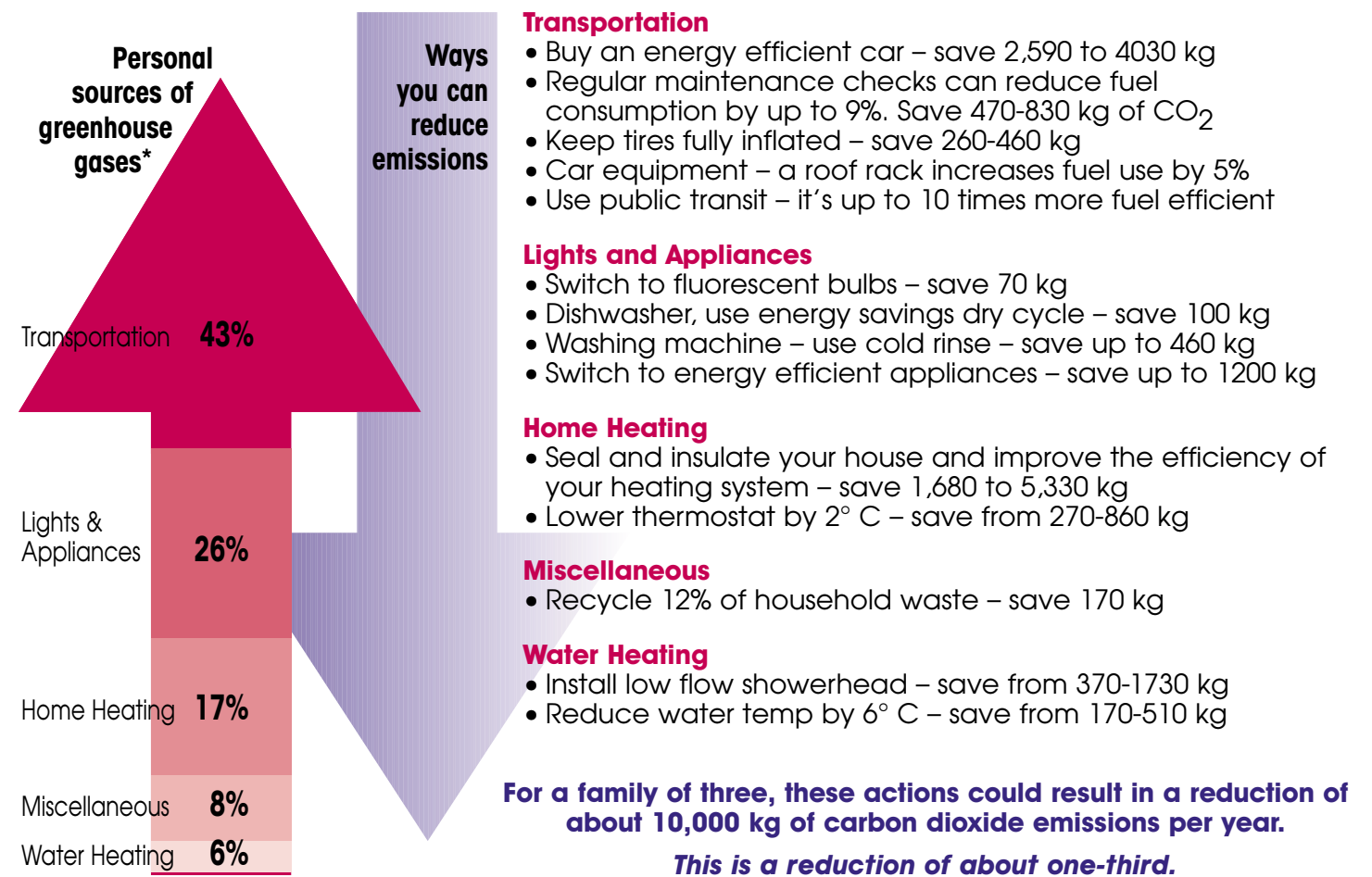
Education and Information

Climate change is a complex topic. It contains scientific, economic, social and political implications. One of the most important first steps in addressing climate change is for the public to become informed. Climate Change Saskatchewan was created to provide the Saskatchewan public with a centralized and integrated information and education service. This service helps individuals and families, educators and students, business and industry, as well as groups and communities. Climate Change Saskatchewan assists those groups in gaining insight into the issues, finding resources and developing suitable responses.



What Can I Do?

There are important steps that individuals can take to help reduce GHG emissions. These steps involve personal adjustments to the way we do things. Conserving energy is one of the more fundamental ways individuals can reduce their personal GHG emissions.



*Source: Environment Canada, You Can Make a Difference, Sask Chart - 2001

Investing in the Wind

Saskatchewan's first major supply of green power comes from a \$20 million wind power project located five kilometres southeast of Gull Lake. The project incorporates 17 wind turbines with a capacity of just over 11 megawatts of electricity. The electricity generated supplies federal government buildings in Saskatchewan as well as other customers.

This project was a major first step towards developing a viable and cost-effective green power industry in Saskatchewan. It also helps to meet the province's growing energy needs in a sustainable manner. Just as important, energy from renewable sources, like wind power does not contribute to climate change and helps Canada reduce its GHG emissions.

Partners in the wind power project include Enbridge Inc., Suncor Energy Inc., the Government of Saskatchewan through SaskPower, and the Government of Canada.

SaskPower is developing the province's second wind power project. This additional six megawatts will help supply provincial government buildings and other customers with green power.



The first of 17 wind turbines at SunBridge installation near Gull Lake, Sask

Weyburn CO₂ Project

Storing carbon dioxide underground, also called geological sequestration, is a key option for helping Saskatchewan, Canada, and the world, meet the climate change challenge to reduce GHGs. The Weyburn-Midale oil field uses an innovative technology called CO₂ enhanced oil recovery that will recover about 130 million barrels of oil that otherwise would have been left in the ground. Over the life of the project, 14-20 million tonnes of CO₂ will be stored, the equivalent of the annual emissions from 3.2 million vehicles.

The Weyburn field, operated by PanCanadian Petroleum, is an excellent reservoir for evaluating the technology of CO₂ storage. Almost 50 years of production history on the field is available to researchers from the University of Regina, University of Saskatchewan, the Saskatchewan Research Council and geologists from Saskatchewan Energy and Mines.

This monitoring project is being coordinated by the Petroleum Technology Research Centre (PTRC) at the University of Regina and is being conducted under the auspices of the International Energy Agency, Greenhouse Gas R&D Program. Funding and support are provided by Saskatchewan Energy and Mines, the Government of Canada, PanCanadian Petroleum, and SaskPower, together with other Canadian, Japanese, US and European interests.



Emissions captured at Weyburn oilfield are projected to be the equivalent of removing 200,000 cars from the road for 15 years.

Making Vehicles More Energy Efficient

The vehicles that we rely on each day account for about 15 percent of Canada's GHG emissions. Converting vehicles to alternative cleaner fuels is a key part of our response to climate change. To maximize the benefits of dual or alternative-fueled vehicles, switching technology is required.

Making vehicles more energy efficient.



Researchers at the Saskatchewan Research Council's (SRC) Saskatoon facilities are perfecting a state-of-the-art computer technology that effectively operates the vital functions of an entire vehicle. It works like the human brain checking information, making the best operational decisions, solving complicated problems and improving the vehicle's effectiveness and efficiency. This research marries smart environmental action with innovative economic progress.

Cleaning Coal

Coal is the predominant fuel for electric power generation in the world. Coal is also an important part of Saskatchewan's overall fuel mix. Through the development and application of new technologies coal is becoming a cleaner energy resource than it used to be. For Luscar Ltd, Canada's largest and Saskatchewan's only coal supplier, its efforts to reduce GHG emissions from its mines have earned it national recognition.

Some interesting research on GHG emissions is being undertaken at the International Test Centre for Carbon Dioxide Capture based at the University of Regina. Funding for the Centre comes from Natural Resources Canada, the Government of Saskatchewan, Pan Canadian Petroleum, SaskPower, Luscar Ltd., and others.

The Centre, one of only three of its kind in the world, consists of two components. The first is a pre-commercial carbon dioxide capture unit that uses an existing facility attached to SaskPower's Boundary Dam Power Station near Estevan. This chemical absorption unit will be used for technology demonstration as well as for conducting tests leading to commercial applications.

The second component is the construction of a pilot plant at the University of Regina to conduct research and development on new carbon dioxide capture technologies. If carbon dioxide can be captured economically, it could be pumped underground for enhanced oil recovery projects.

The development of technologies to capture carbon dioxide and subsequently use and store it presents an opportunity for Saskatchewan. Reducing GHG emissions will enable industry to continue to use Saskatchewan's abundant and economical coal resources for power generation, as well as sustaining its competitive position.



Over \$50 billion invested in North America in clean coal technology.

The Green Atom

Nuclear energy production is free of GHG emissions that contribute to climate change.

The natural resource that fuels this energy production is uranium. Saskatchewan is a leader in uranium mining, accounting for about a third of the world's primary uranium supply. The world's highest grade uranium deposits are located in northern Saskatchewan. The energy potential of Saskatchewan's uranium reserves is greater than all known Canadian conventional oil reserves.

Saskatchewan-based Cameco Corporation owns and operates some of the largest uranium mining, milling and processing facilities in the world and is a shareholder in four CANDU nuclear reactors generating electricity in Ontario. Uranium from Cameco's operations fuels nuclear plants worldwide, and Saskatchewan uranium production is helping avoid, on average, emissions of over 400 million tonnes of carbon dioxide – six times the GHG emissions produced each year by all Saskatchewan sources.



Uranium produced by Cameco in Saskatchewan fuels GHG emission-free electricity worldwide.

A Smart School

We all want the best schools and libraries for our children and we want those facilities to be as environmentally friendly as possible. The Windsor Park Educational/Community Complex in Regina meets both of these goals.

Opened in September 2000, the Complex is one of the most energy-efficient and environmentally responsible educational facilities of its kind in the world. With the help of the Commercial Building Incentives Program, operated by Natural Resources Canada, this 7,000 square metre complex uses 44 percent less energy than similar buildings that meet conventional standards. Features include controls that cut energy required for lighting in half, sensors that adjust heating and ventilation according to the number of people in a room, and a high-efficiency gas boiler. Consequently, its energy costs are considerably lower and GHG emissions per year are cut by 474 tonnes.

Windsor Park shows our young people the power and importance of innovation and creative thinking when it comes to climate change.



Innovative engineering designs cut greenhouse gases by half.

SaskPower is committed to innovation in many areas.



Open to Innovation

Each day more energy radiates to the Earth from the sun's rays than the total amount of energy the planet's 6 billion inhabitants would consume in 27 years. The challenge is to capture and store some of this solar energy. SaskPower's development of alternative energy options and applications reflects the company's commitment to a sustainable environment by addressing climate change. One application of solar power is a demonstration project in Regina with a peak capacity of 2.8 kilowatts generated by a bank of solar panels on the roof of the Saskatchewan Science Centre.

The Regina project is one of many innovative measures being taken by SaskPower to demonstrate and evaluate the merits of solar power. Another is the Quill Lakes Solar Panel Project. SaskPower's installation of solar powered pumps provides water to four rangeland pastures every summer while allowing shoreline habitat of the endangered Piping Plover to be fenced off from cattle. The use of solar power has been critical to the success of the project.

Understanding Climate Change

When it comes to climate change, knowledge is essential. The more we know about its causes and impacts, the better prepared we are to make changes, large and small, that start reducing our GHG emissions.

Two well-known institutions are helping the people of Saskatchewan learn more about climate change and what they can do about it. The Saskatchewan Science Centre's Discovery Junction in Regina uses a small prairie town as a setting for active, hands-on insight into the world of energy and the science of climate change. Thousands of visitors have explored the global challenge of climate change and found out first-hand what they can do to save energy, from building energy-efficient homes to simple things like turning off the TV or computer when it's not being used. It also features a mobile exhibit that takes Discovery Junction to people in all corners of Saskatchewan. Sunshine Heights, a solar energy exhibit, is adjacent to Discovery Junction.

At the Royal Saskatchewan Museum in Regina, visitors to the Eco Regions Exhibit gain a better understanding of climate change impacts and learn what they can do in their own communities and towns. Climate change themes are also built into permanent displays such as Time Tunnel, Global View, the Human Factor and the Home Place Exhibit.

How will climate change affect us?



Making a difference



Climate Change Saskatchewan

Climate Change Saskatchewan is a Public Education and Outreach project hosted by the Saskatchewan Instructional Development and Research Unit (SIDRU) at the University of Regina, Faculty of Education. It is funded by the Province of Saskatchewan and the Government of Canada's Climate Change Action Fund.

For more information:

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