UNIVERSITY OF SASKATCHEWAN

2021

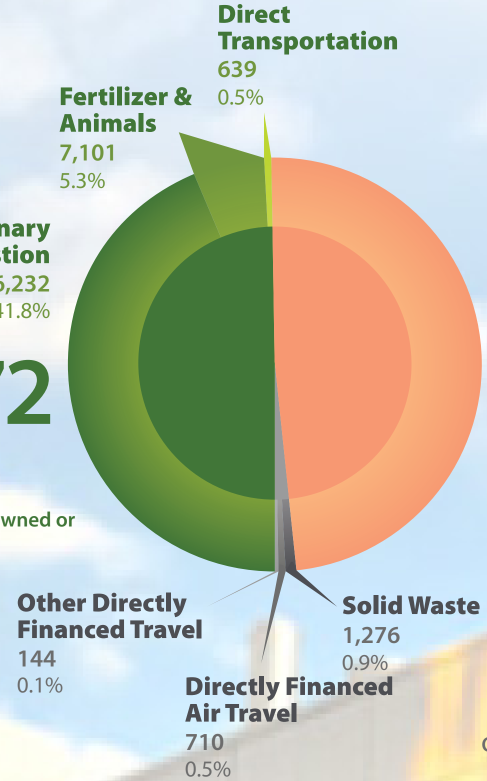
GREENHOUSE GAS EMISSIONS INVENTORY

SUSTAINABILITY • YOUR UNIVERSITY, YOUR WORLD •

Greenhouse Gas (GHG) Emissions

AT A GLANCE

Total 2021 Emissions | **128,285 tonnes CO_2e**



SCOPE 1 | **63,972** 50%

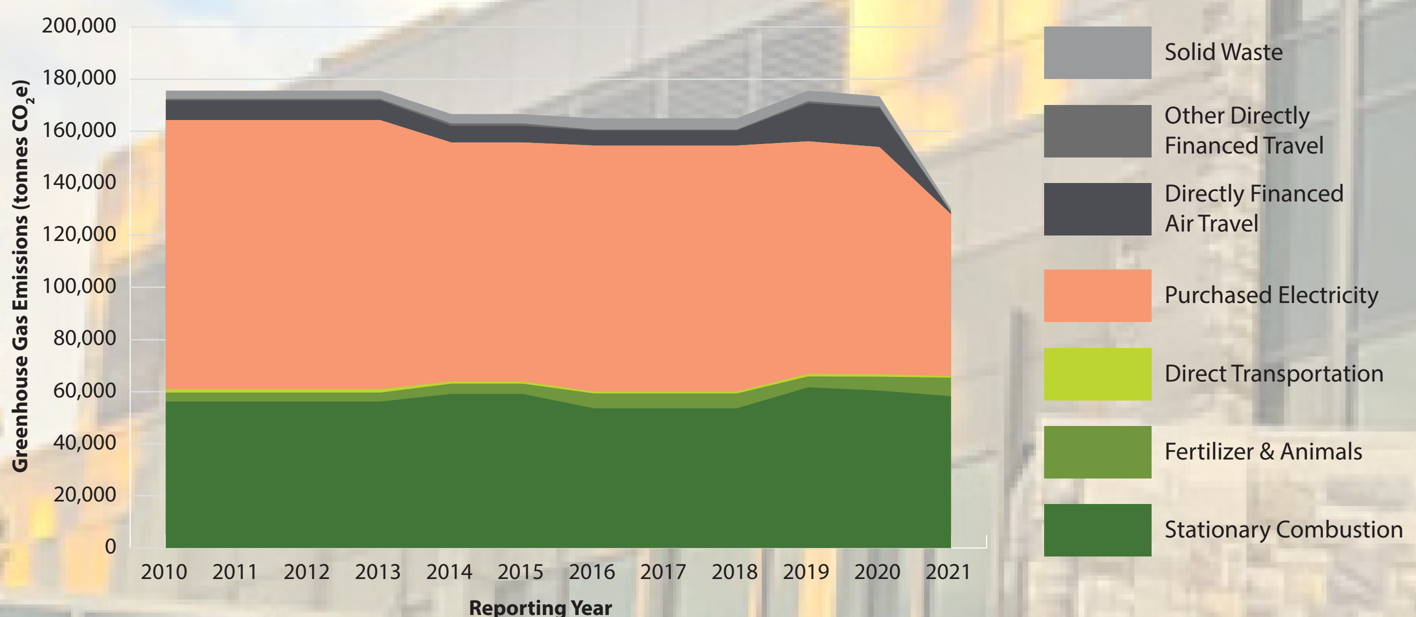
Direct GHG emissions from sources owned or controlled by the university.

SCOPE 2 | **62,182** 48.5%

Indirect GHG emissions from purchased electricity consumed by the university.

SCOPE 3 | **2,135** 1.5%

Other indirect GHG emissions from sources not owned or controlled by the university.



The COVID-19 pandemic continued to impact all aspects of life through 2021, but its impact on the university's emissions was dramatic.

Emissions from directly financed flights dropped an astounding **95%**

While solid waste emissions dropped by **67%**

The major source of USask's emissions are still the buildings on campus, representing **88%** of our total emissions.

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INTRODUCTION

According to the latest Climate Report from the United Nations' Intergovernmental Panel on Climate Change (IPCC), climate change is proceeding at a faster pace and producing widespread effects that are, more than ever, definitively tied to human influences.

These impacts can be felt all around the globe. July 2021 left North America feeling scorched and dry as the US National Ocean and Atmospheric Association (NOAA) confirmed it to be Earth's hottest month on record going back 142 years. In the same month, unexpected heavy rainfalls throughout Western Europe resulted in hundreds of fatalities and the massive destruction of infrastructure across Germany and Belgium. At home in Canada, rising sea levels due to polar ice melt and the thawing of permafrost—which also accelerates the further release of carbon into our atmosphere—have us scrambling to mitigate the significant changes occurring within our societies, economies, and, most importantly, our shared environment.

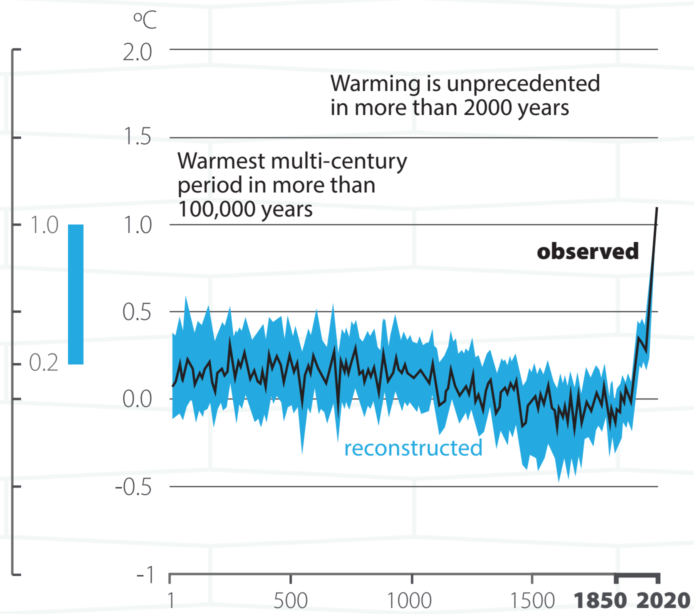
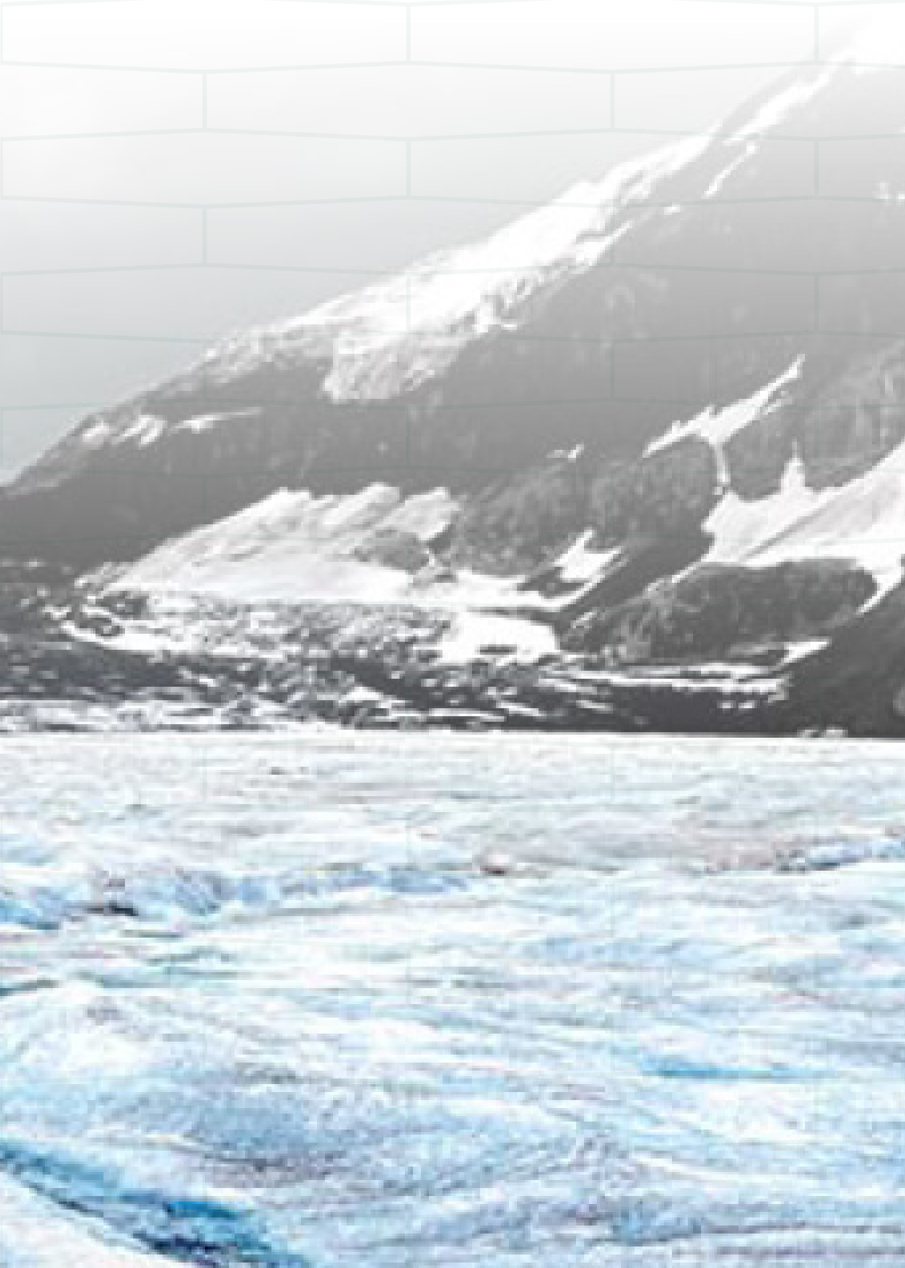


Figure 1. Change in global surface temperature (decadal average as reconstructed (1-2000) and **observed** (1850-2020) (IPCC, 2021).

> *It is unequivocal that human influence has warmed the atmosphere, ocean and land.*
>
> *~IPCC, Climate Change 2021: The Physical Science Basis*

The IPCC report finds that the global average temperature is now 1.1°C warmer than it was in 1850 -1900 with the World Meteorological Organization (WMO) suggesting a 40% likelihood that the 1.5°C threshold is exceeded by 2026. These changes will not just be short-term hardships. These are fundamental shifts in the very nature of our planet that will be irreversible for centuries to come. Universities around the world are taking on the mantle of responsible action and setting the standard.



Frequently Asked Questions

Why is 1.5°C warming used as a threshold?

Let's be clear: any degree of warming will cause long-term impacts to global environments and societies. The use of 1.5°C has been used by the IPCC as a general indicator of when many of the impacts of climate change can be seen as transitioning from "destructive" towards "catastrophic".

For example, the IPCC projects that a world above the 1.5 threshold could mean:

- 1.7 billion more people experience severe heatwaves at least once every five years.
- Seas rise – on average – another 10 centimeters (almost 4 inches).
- Up to several hundred million more people become exposed to climate-related risks.
- The coral reefs that support marine environments around the world could decline as much as 99 percent.
- Global fishery catches could decline by another 1.5 million tonnes.

CONTEXT

Canada, along with other higher latitude countries around the world, are seeing a greater overall temperature increase than the rest of the globe. In fact, according to Canada's Changing Climate Report (2019), Canada is warming at twice the rate as the rest of the world. Our large and varied geography will result in differing impacts across each region of the country, but thanks to predictions based on climate modeling there are insights into what USask can expect the future to bring. The City of Saskatoon (2019) has developed a helpful method of splitting these impacts into three categories: Warmer, Wetter, and Wilder.

WARMER

Since 1948, the average annual temperature in Canada rose by 1.7^{0}C, more than double that of the total warming experienced globally since 1880 (Government of Canada, 2018). If the rate of current emissions stays constant, Canada's average annual temperature is projected to increase by 4^{0}C or more by 2100 (ICLEI Canada, 2015).

Warming temperatures across the country will have a sundry collection of impacts on all areas of life. Warmer oceans mean saltier and more acidic oceans, which will have profoundly negative effects on already critical fish stocks across Canadian fisheries. Earlier and hotter summers also means the expansion of territory for dangerous disease vectors such as Lyme disease-carrying ticks, which have already seen increased sightings in Southern Saskatchewan (Olson, 2021).

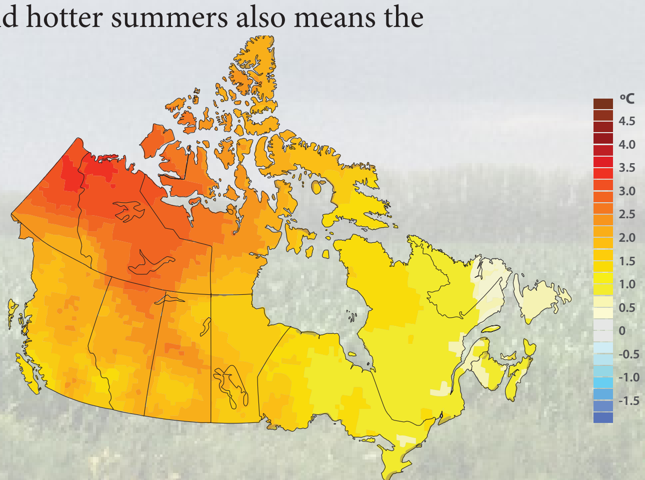


Figure 2. Increase in Canada's average annual temperature from 1948-2016 as taken from the Government of Canada's Changing Climate Report (2019).

Northern Canada in particular will face existential changes as temperatures increase. The loss of permafrost foretells massive infrastructural damages across the region, while diminishing permanent sea ice is already threatening commercial and research channels through the Northwest Passage. These impacts will ripple across the entire globe, as reduced ice levels lessen the arctic region's total reflected solar energy, setting off a cycle of warming and melting that will accelerate the already escalated rate of change.

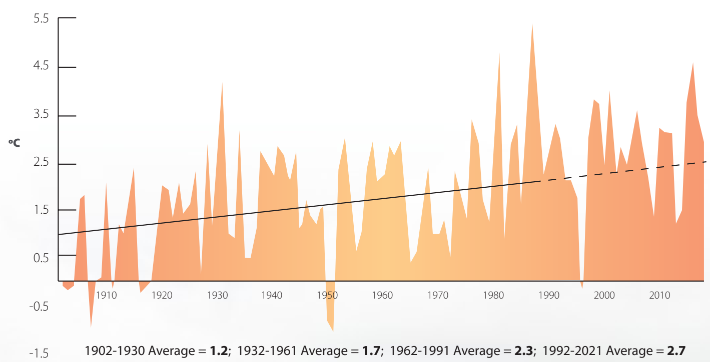


Figure 3. Saskatoon's historical average temperature (City of Saskatoon, 2019).

Back home in the West, Saskatchewan and the rest of the prairies are seeing the country's greatest rate of increase in average mean temperature. The average annual temperature rise in the university's home of Saskatoon is projected to increase by almost 7^{0}C by 2100 (City of Saskatoon, 2019).

WETTER

There are two major sides of "wetter" conditions to consider: sea level rise and changes to precipitation.

Sea level rise may not seem overly relevant to Western Canadians, but it will have profound effects on our country as a whole. Rising sea levels will mean more intense wave seasons and greater risk of catastrophic

Figure 4. A selection of climate change-related impacts as they may be distributed across Canada. (Adapted from Connolly, 2019).

flooding in coastal areas. Atlantic Canada in particular will face some of the country's most dramatic rises in sea level; NASA's sea level projection tool suggests that Halifax will see a rise of 20cm between 2030 and 2040, which translates into 4 times the current annual flooding events experienced by the city (NASA, 2021; Connolly, 2019).

Looking to precipitation, Saskatoon can prepare to see changes in the amount, frequency, and timing in all its forms. Saskatoon is used to receiving its highest levels of precipitation during the late spring and summer months (May to August) enabling a green and vibrant city. Under projected future scenarios, this is expected to shift earlier with a majority of this precipitation (March to June), leaving the summer months to deal with frequent dry spells or drought conditions.

The risk of drought will be especially felt by the agricultural communities of the Canadian Prairies. The peak flows of snow melt-fed river basin flow patterns—like those in the Saskatchewan River Basin—are expected to come earlier in the spring. Warmer winter temperatures, smaller snowpack, and the loss of glacier ice can expect to reduce summer flows and further exacerbate demand stress on the water supply.

WILDER

"Warmer" and "wetter" don't occur without bringing about the "wild", as the more frequent conditions that generate large and intense storms increase the likelihood and severity of extreme weather events. Heavy, intense rainstorms will produce incredible strain on storm run-off systems while high winds will damage infrastructure and drive-up insurance costs.

With sweltering and dry summer heat also comes one of our most primal adversaries: fire. Devastating wildfires like that which swept through Fort McMurray in 2016 and Lytton BC just this summer, are projected to become much more common and greater in scope under future scenarios. The heat also creates a paradoxical effect come winter, as increased air moisture may bring blizzard conditions. These fierce winter storms threaten civic infrastructure, energy grids, and many aspects of human health and safety.

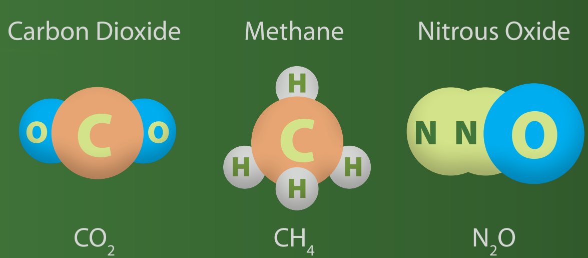
To help achieve the ambitious greenhouse gas reduction goals set out in our Sustainability Strategy 2021-2030, USask will have to bring to life our commitments to courageous curiosity, boundless collaboration, and inspired communities.

METHODOLOGY

Frequently Asked Questions

What is CO_2e and why do we use it?

Carbon-dioxide equivalent (CO_2e) is a standard measurement when discussing GHG emissions. While carbon-dioxide is the most common of the greenhouse gases, it is not the only one of concern. Others such as methane (CH_4) and nitrous-oxide (N_2O) contribute to the same warming effects in the earth's atmosphere.



Trying to account for all of these other compounds in reporting would be unnecessarily difficult and complicated. Instead, CO_2e is used to describe the concentration of CO_2 that would cause the same effects as the other compound in question. This allows for uniform and simplified reporting of GHG emissions while still accounting for the diversity of compounds of concern in the atmosphere.

In order to accurately understand how USask is contributing to climate change, an annual greenhouse gas inventory is taken to measure and better understand these contributions. For 2021, this inventory was determined by using the Sustainability Indicator Management and Analysis Program (SIMAP), a carbon-accounting platform designed by the University of New Hampshire's Sustainability Institute to track, analyze, and improve campus-wide sustainability. SIMAP is an on-line version of the Clean Air-Cool Planet Campus Carbon Calculator used to conduct previous USask GHG inventories.

Emissions are reported in metric tonnes carbon-dioxide equivalent (MT CO2e). GHG emissions are categorized into three broad scopes: Scope 1 are direct GHG emissions that occur from sources owned or controlled by USask, and includes natural gas and liquid fuel consumption for buildings and fleet operations, and agricultural emissions from animals and fertilizer; Scope 2 are indirect GHG emissions from purchased electricity consumed by USask, and; Scope 3 emissions are a result of the activities of USask but occur from sources that are not owned or controlled by the university, and include business travel for faculty and staff, as well as solid waste disposal from the university in local landfills.

USask produces steam for building heating and sells a portion to external customers (about one-third). Emissions from steam generated on-site are Scope 1 and are included in the inventory whether used by the campus or sold. USask also purchases generated electricity from SaskPower not only for internal consumption, but also for resale to external customers. Indirect emissions from the generation of purchased electricity consumed by the university are Scope 2. Accordingly, the emissions from the sold electricity do not form part of our inventory.

For all projection models referred to in this report, 2021 results have been omitted due to the university not operating business-as-usual during the COVID pandemic

WHERE WE ARE

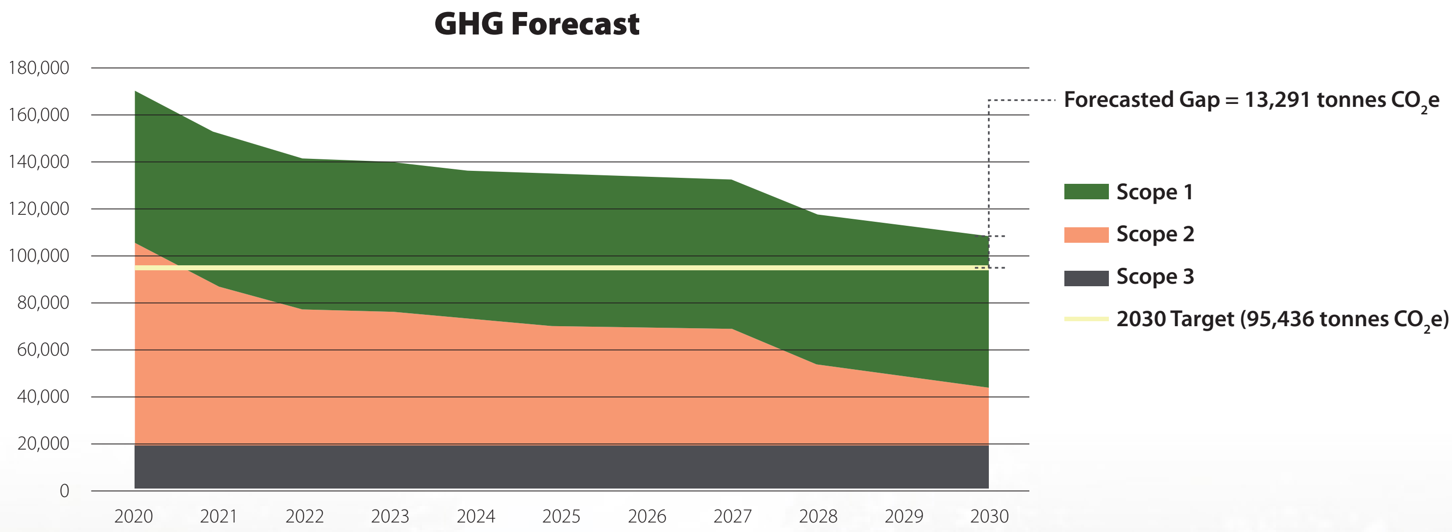


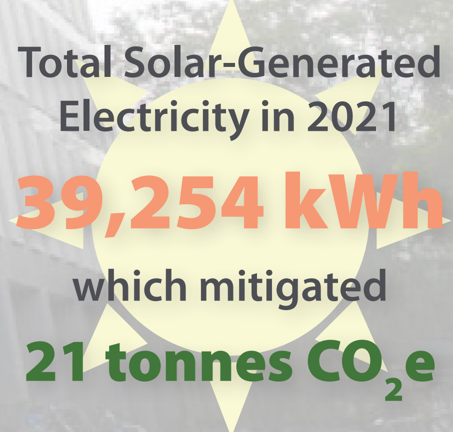
Figure 5. A forecast of USask's emissions from 2020-2030 assuming consumption of natural gas and electricity levels is maintained at 2020 levels. This applies SaskPower's forecast for grid carbon intensity reductions. The university's 2030 target, a 45% reduction in CO2e from 2010 levels, has been superimposed.

The University of Saskatchewan 2021 – 2030 Sustainability Strategy has established aggressive targets for the reduction of greenhouse gases emitted as part of our ongoing operations. Our 2030 greenhouse gas emissions target is a 45% reduction from 2010 levels and achievement of net-zero emissions by 2050. This strategy has been tied to the United Nations' Sustainable Development Goals (SDGs) and aims for greater reductions than those outlined in the UN COP 21 Paris Agreement which form the basis for Canada's own federal GHG reduction targets.

Figure 5 represents a forecast of greenhouse gas emissions over the coming 9 years based on utility consumption maintained at 2020 levels and benefits derived from SaskPower's focus on decarbonizing Saskatchewan power generation. In order to decarbonize, SaskPower is scheduled to shut down coal power generation on or before the year 2030. This generation will be replaced by lower emission natural gas fired plants, local renewables in the form of solar and wind installations, and transmission line interconnectivity with Manitoba to take advantage of their abundant hydro power generation.

With approximately 50% of USask's current emissions tied to electrical consumption, the efforts of SaskPower will translate into a considerable drop in overall greenhouse gases. This still leaves USask, however, with a gap of over 13,000 tonnes CO_2e to address through our own efforts. This gap alone is equal to around one quarter of the total emissions from heating of our buildings.

Looking further towards the year 2050 and USask's goal of net-zero emissions, mitigation of an additional 109,000 tonnes CO_2e will be necessary. While the campus footprint has grown by 21% over the last 10 years with only a slight increase in average Scope 1 emissions—it is critical that not only growth in emissions cease but there also begin substantial and immediate focus on campus energy and building infrastructure to reduce the reliance on natural gas.



SOLUTIONS

BUILD NEW BETTER – CLIMATE SENSITIVE POLICIES

Operating USask buildings is the primary source of greenhouse gas emissions producing, on average, 85% of all of GHG emissions. Considerable progress has been made over the last 10 years in reducing the energy intensity of new buildings. Health Sciences E-Wing, a Leadership in Energy and Environmental Design (LEED) Gold certified building, consumes 58% less energy per square meter than the average main campus building. Other LEED certified buildings such as Gordon Oakes Red Bear Student Centre, College of Law Addition and Health Sciences D-Wing all contribute to lowering overall carbon footprint.

To continue driving down utility consumption and emissions, USask is actively reviewing the implications of adopting as policy, green building standards such as LEED and the Canadian Green Building Council's (CaGBC) Zero Carbon Building Standard for all new construction and renovation. These amendments to current policy would, even as the institution grows, prevent adding incremental emissions to the current inventory and support the long-term goal of net zero by 2050. It has been shown that if addressed early in project planning, the incremental cost to meet these green building standards results in costs only marginally higher than traditional builds.

PRICING LONG-TERM SUSTAINABILITY IN PROJECTS

Many capital projects still contribute to increased GHG emissions despite not involving new builds or major renovations. An Impact to Sustainability section has recently been incorporated into USask's Capital Investment Framework templates to increase visibility around the magnitude and potential costs of mitigation. Recent projects have shown, net of utility savings, mitigation costs between $700 to $1,000 for each tonne of CO_2e. By incorporating these costs into project estimates, this will help inform decisions around viability and ensure emissions mitigation costs are clearly identified early in the planning of potential projects.

IMPROVING WHAT WE HAVE

It is predicted that most of the buildings currently on campus will still be in operation in 2050. The beautiful and historic architecture of the University of Saskatchewan is part of the wonder of our institution. Work is ongoing to maintain the existing characteristics of campus while reducing the overall environmental impact. This is accomplished through continuous building system improvements and maintenance activities that support overall climate goals.

Beginning in 2015 with the SaskPower sponsored Energy Action Plan, efforts are currently underway on hundreds of individual initiatives to make USask existing buildings operate more efficiently. These initiatives are aided by the Optimizing Energy Efficiency (OEE) project, which takes advantage of a $1.5M grant from the Government of Canada's Federal Low Carbon Economy Fund. The primary result will be reduced GHG emissions through lower electricity and natural gas consumption, while occupants will see greatly improved comfort through better heating, ventilation, and cooling systems.

The best source of renewable energy is reducing energy consumption.

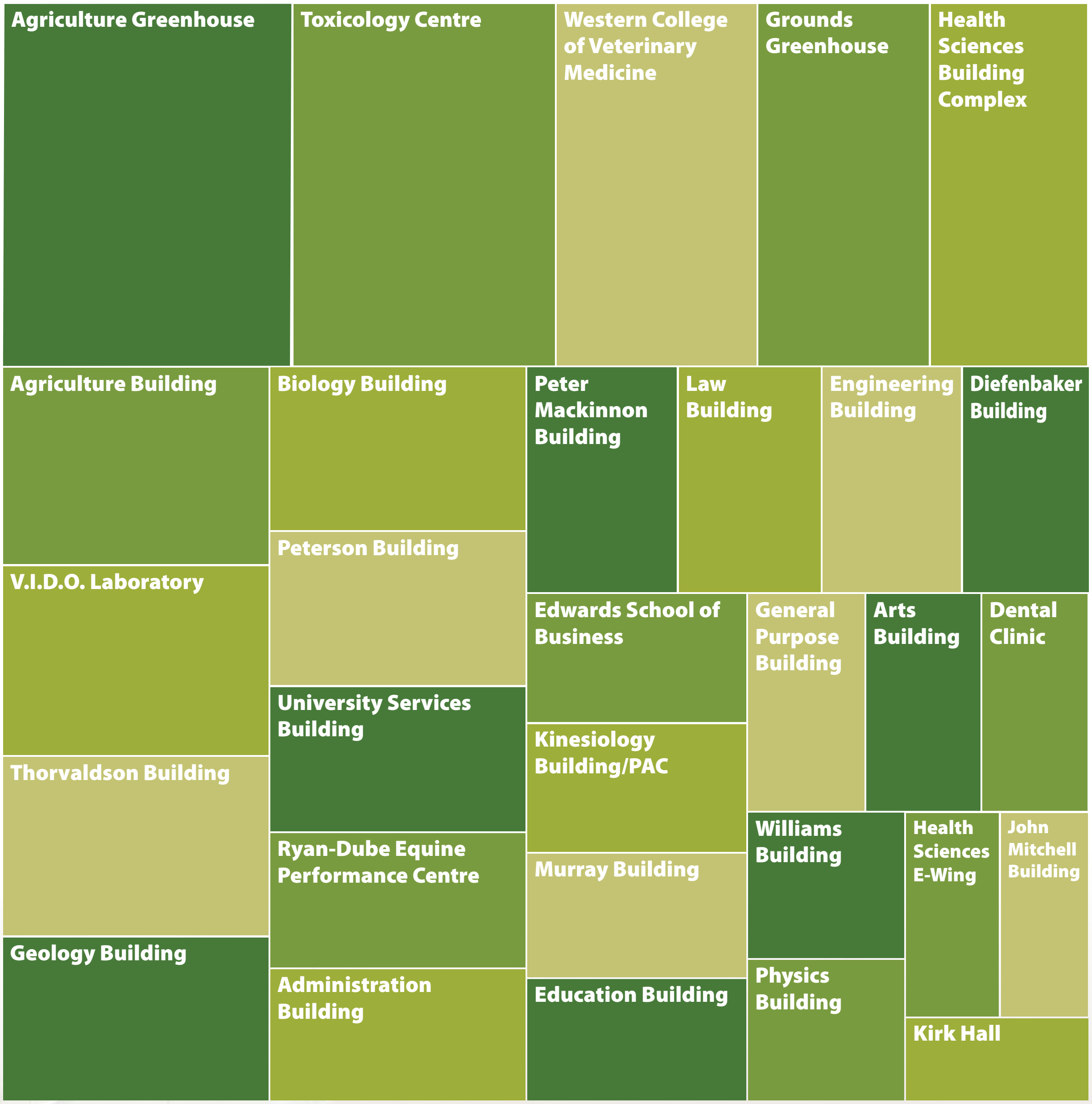


Figure 6. Tree Map of University Buildings sorted by average 2030 emissions intensity (CO_2e/m^2) which accounts for building floor space to allow for fairer comparison between large and small buildings.

Currently focused on 26 buildings across campus, the project is using a proven, systematic process of energy management, retro-commissioning, and controls upgrades. When completed, the university is projected to realize an annual emissions reduction of over 4,230 tonnes CO_2e, saving over 70,000 gigajoules of energy each year and $600,000 in utility costs.

Building recommissioning is fundamental in ensuring that our existing buildings continue to operate as intended. USask's recommissioning team is currently working on implementing measures to improve energy saving, efficiency, and indoor environment quality through demand-controlled ventilation, variable speed drives, operating schedules, and setpoint adjustments.

Growth of the USask community is expected to continue its current trend, so it is important that the initiatives tied to utility reduction similarly grow in scope. USask is considering expanding the focus of Utility Management by bringing together stakeholders across campus to focus on specific methods of driving down consumption in their areas. Work will be required to establish sponsorship, team structure and reporting mechanisms so that the unique needs of different groups across campus will receive proper support for technical and behavioural changes that lead to compounding overall reductions.

DECARBONIZE DISTRICT HEATING

In 2020, District Heating & Cooling accounted for ~45% of our greenhouse gas emissions. Steam, generated by burning nearly 30 million cubic meters of natural gas, generates more than 57,000 tonnes CO_2e each year. In order to substantially reduce USask carbon footprint and move towards the 2050 goal of carbon net-zero emissions, USask is in the early stages of developing a long-term plan to decarbonize our district heating.

In order to identify the pathways towards decarbonizing heating USask plans to engage external services to lead a detailed process of consultation and technical reviews. The result will be a comprehensive feasibility assessment which would include the logistical, financial, and policy implications of potential alternatives to meet immediate, medium, and long-term GHG objectives. This will allow USask to align recommendations with institutional priorities and potential academic research within the context of the energy landscape of Saskatchewan.

It is anticipated that the solutions proposed will include behaviour change for our campus community, retrofits, infrastructure renewal, new construction, and alternative energy solutions. It is expected that resulting savings in utilities will offset some of the capital costs to achieve net-zero emissions; more analysis is needed to further understand these financial implications. Ongoing infrastructure renewal efforts should incorporate sustainability as a key aspect, particularly when making major capital decisions. Our best potential lies in leveraging those investments to drive ongoing capital renewal coupled to our sustainability goals.

PARTNERING FOR TOMORROW

USask and the City of Saskatoon are working in partnership on sustainability initiatives. This was made official in 2018 with the signing of a Memorandum of Understanding to explore collaboration opportunities on issues related to urban planning, land development, reconciliation, transit, research, and many other areas. Much of this potential for collaboration intersects with the goals outlined in our sustainability strategy and close collaboration with our partners at the City will be an important part of our path to net-zero emissions.

This has just been recently reinforced though the joint USask and City of Saskatoon, Climate Commitment and Call to Action, which acknowledges the need to enhance sustainable and resilient practices to reduce greenhouse gas emissions and adapt infrastructure, services, and programs for the future impacts of a changing climate.

Research Junction, a major initiative under this MOU, helps combine the expertise of City staff with the aspirations of USask's students and researchers by supporting partnership development, navigating administrative processes, providing grant funding, and promoting opportunities. Success stories out of the Junction include:

- A project looking at forming microgrids that connect renewable energy sources with Saskatoon Light & Power's distribution system;
- An exploration of the potential to reclaim and repurpose food waste to save up to 13,000 tonnes of food and $138,000 in landfill disposal fees; and
- A feasibility study comparing the use of heat pumps for heating and cooling buildings in Saskatoon to conventional natural gas systems.

RESOURCES

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SUSTAINABILITY

YOUR UNIVERSITY, YOUR WORLD

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