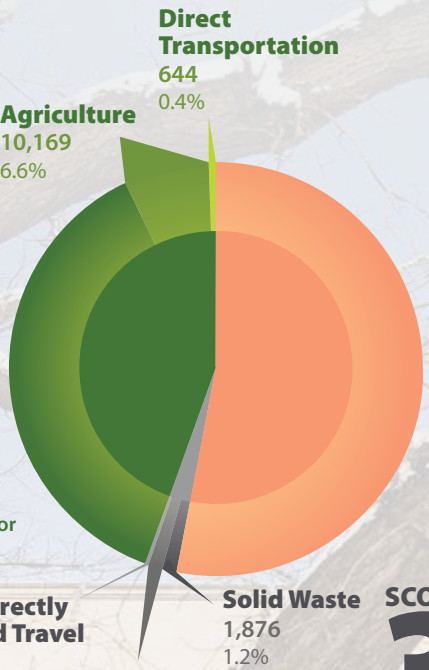
UNIVERSITY OF SASKATCHEWAN | sustainability.usask.ca

Greenhouse Gas (GHG) Emissions

AT A GLANCE

Total 2022 Emissions | 153,329 tonnes CO_2e



SCOPE 1 | **68,131** | 44.4%

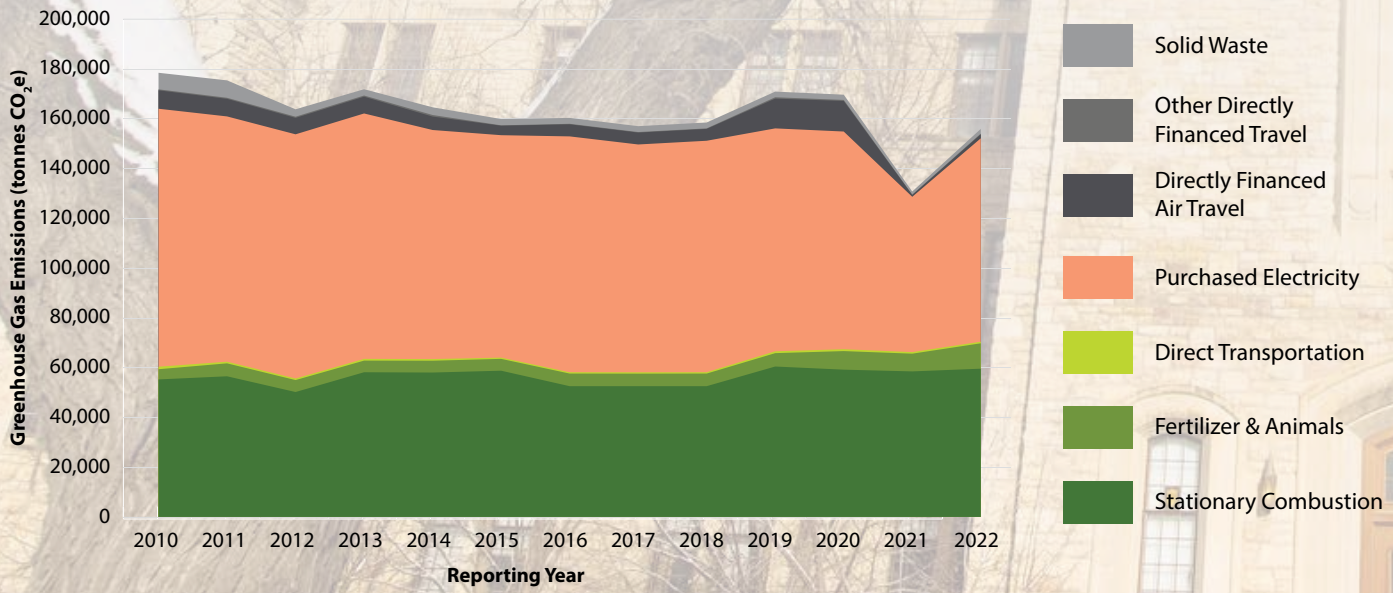
Direct GHG emissions from sources owned or controlled by the university.

SCOPE 2 | **81,440** | 53.1%

Indirect GHG emissions from purchased electricity consumed by the university.

SCOPE 3 | **3,758** | 2.5%

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



USask's emissions in 2022 include:

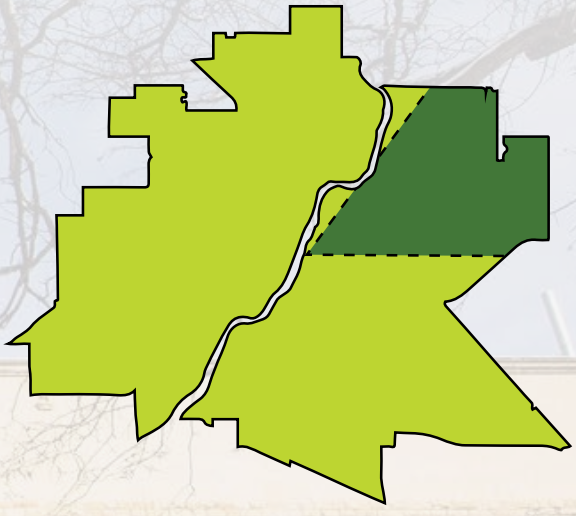
30,575,205 m^3
of natural gas burned

5,897,442 km
of staff/faculty air travel

1,197 metric tonnes
of waste loads

Just how much is 153,329 tonnes CO_2e?

It's enough emissions to provide annual energy needs for 15% of the homes in Saskatoon...



...and would be produced by enough coal to completely fill a 15km train (that's Saskatoon end-to-end).

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SCOPE 1

DIRECTLY PRODUCED EMISSIONS

Direct combustion of natural gas within USask's Central Heating Plant, which generates steam, heats 82% of USask buildings, provides these buildings with domestic hot water and in some cases supplies process steam for things like humidification, sterilization and food preparation. This alone contributes to 37% of the institutional Greenhouse Gas (GHG) emissions. In order to do this, during 2021, USask burned 30,575,205 m3 of natural gas and 7,470 litres of oil, generating 57,318 metric tonnes of carbon dioxide equivalent (CO_2e).

Additional sources of direct combustion include fuels used for USask vehicles (644 tonnes CO_2e), emergency electric generators (included in on-campus stationary emissions) and farm production in the form of emissions from animal waste and fertilizers.

Fertilizers impact the environment in both a positive and negative way. Production, transportation and use of mineral fertilizers contribute directly and indirectly to emissions of greenhouse gases, notably CO_2 and nitrous oxide (N_2O). Fertilizers also enhance agricultural productivity and stimulate CO_2 uptake by the crop. They increase yield and reduce the necessity to cultivate new land, thus avoiding GHG emissions from land use change.

Fertilizers produce greenhouse gases after being applied to fields. Crops on average only take up about half of the nitrogen they get from fertilizers. The remainder gets broken down in the soil, releasing N_2O into the atmosphere. Although N_2O accounts for only a small fraction of USask GHG emissions, kilo for kilo, N_2O warms the planet 300 times as much as CO_2.

While USask percentage of overall emissions due to livestock is relatively small at 6%, a high proportion of emissions are in the form of methane (CH_4). The remaining part is almost equally shared between N_2O (29%) and CO_2 (27%). This means that livestock supply chains do have a sizeable impact on global emissions and are estimated at:

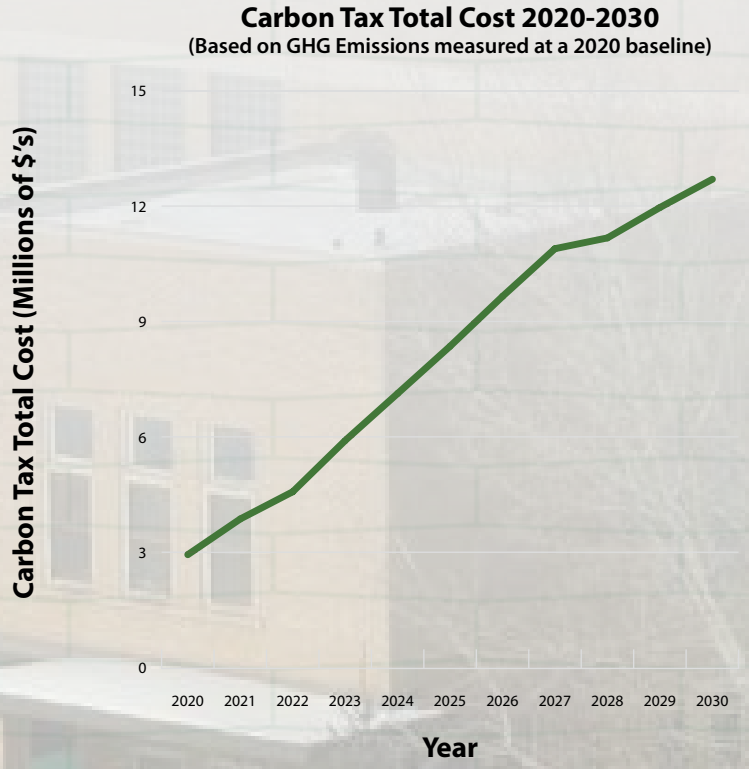
- 1 Gt CO_2e of CO_2 per annum, or 5% of anthropogenic CO_2 emissions[1]
- 3.1 Gt CO_2e of CH_4 per annum, or 44% of anthropogenic CH_4 emissions[1]
- 2 Gt CO_2e of N_2O per annum, or 53% of anthropogenic N_2O emissions[1]

[1]*IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.*

CARBON TAX, EMISSIONS, & IMPACT TO USASK

The Federal Greenhouse Pollution Pricing Act (Federal Carbon Tax), came into effect April 2019. It puts a price on the emission of CO_2e and in 2022 is set at $50/tonne with a planned increase to $170/tonne by 2030. The charge on carbon emissions is intended to impact daily decisions of both consumers and commercial emitters. It is recognized that putting a price on carbon pollution is an efficient means to reduce GHG emissions while also driving innovation.

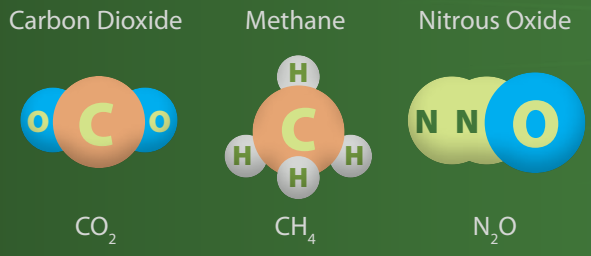
In 2021, USask paid approximately $3.7M in carbon tax directly related to fossil fuel combustion and indirectly through electricity generated and purchased from SaskPower. Assuming steady demand for heating, cooling and electricity to power our campus from now till 2030, carbon tax will increase to approximately $12.1M per year. Offsetting this tax are incentive programs to encourage reduced consumption and lowering of GHG. Through the Federal Low Carbon Economy Challenge, USask received $1.5M to support the reduction of emissions as part of our Optimizing Energy Efficiency project. Further funding is being sought to continue reduction efforts as part of an overall Heat Recovery program (see future initiatives section).



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 CO_2 is the most common of the greenhouse gases, it is not the only one of concern. Others such as CH_4 and 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.

SCOPE 2

INDIRECT EMISSIONS

Purchased electricity accounts for 53% of total GHG emissions. Both emissions related to electricity along with overall consumption have declined since 2019 with consumption dropping by 4%.

PLANS FOR THE DECARBONIZATION OF SASKATCHEWAN'S POWER GRID

SaskPower has set a goal to reduce GHG emissions by at least 50% from 2005 levels by 2030 and work towards net zero GHG emissions by 2050. Initial focus has been on reducing the impact of coal powered generation either by plant closure, carbon capture & storage or by using natural gas generation as a bridge.

A number of projects are in operation or moving forward to reduce emissions and significantly increase the amount of renewables available on the grid:

- Chinook 353MW Natural Gas Fired Generating Station
- Great Plains 360MW Natural Gas Fired Generating Station
- Riverhurst 10MW Wind Facility
- High Field 10MW Solar Facility
- Golden South 200MW Wind Facility
- Blue Hill 175MW Wind Facility
- Regina 20MW Energy Storage Facility
- Hydro Station Refurbishments
- Intertie 750MW with Manitoba
- Small Modular Nuclear Reactors

While the efforts by SaskPower in grid decarbonization directly benefits USask GHG emissions profile, it is anticipated that the cost of decarbonization will result in increased electricity rates across the province. The recently announced 4% rate increase planned for September 2022 will be followed by another 4% increase in April 2023. These rate changes will result in an increase of approximately $1.4M per year to USask cost of electricity. Continued focus by USask on reducing demand for electricity will provide dual benefit of reduced greenhouse gas emissions while lowering overall utility expenses.

SASKPOWER TARGET VS. ACTUAL GRID INTENSITY

Often best laid plans are challenging to implement due to external forces. In 2021, SaskPower forecast was for a grid emissions intensity (kg of CO_2 per kilowatt) of 0.510. Due to a very hot and dry summer, electricity production from hydro was much lower than anticipated, leading to a higher reliance on fossil fuel power generation resulting in a grid emissions intensity of 0.637. This has a direct impact on the amount of CO_2e that USask emits from our operations.

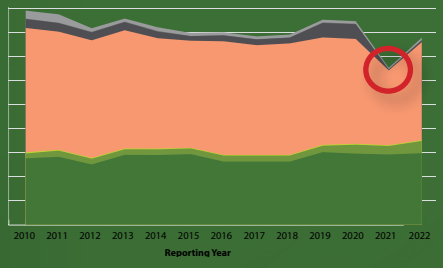
OTHER INDIRECT EMISSIONS TIED TO USASK ACTIVITIES

These emissions are tied to the activities of others that are not owned or controlled by the University such as daily commuting to campus, business travel for faculty and staff and solid waste generated on campus and disposed of in landfills.

Frequently Asked Questions

What about COVID-19?

Did you notice the dip circled in the chart at right earlier? That major dip in reported emissions is largely a result of the impact of the COVID-19 crisis and response throughout 2021. This year will represent an anomaly in our reporting, but there are a few important lessons that were learned.



Though the difference in directly-financed air travel seems small on the chart, it **more than doubled** as COVID-related travel restrictions began to loosen. Going forward, it will be important to revisit our reliance on global air travel and where we can reduce our emissions in this category.

The other more noticeable change is in electricity-related emissions:

	2021	2022	% Change
Electricity Emissions (CO_2e)	62,182	81,439	↑ **30%**
Electricity Consumption (kWh)	117,545,726	127,849,054	↑ **8%**

The 30% jump in emissions outshines the fact that actual consumption only saw a modest 8% increase. This tells us two things:

1. The increase in emissions can be primarily attributed to SaskPower missing their forecasted grid intensity reductions, and
2. Removing a large portion of the campus community from the physical campus has a smaller than expected impact on electrical consumption. This is particularly true in hotter than normal years where electrically-powered air conditioning becomes critical.

SCOPE 3

CURRENT INITIATIVES

REDUCING DEMAND

A prime example of demand reduction is the ongoing Optimizing Energy Efficiency project focused on improving the operational efficiency of the heating and cooling system in 26 buildings across main campus. This $3.5M project received $1.5M in funding from the Federal Government Low Carbon Economy Challenge covering 50% of eligible expenses to improve building operations, reduce utility consumption and utility costs. This project is on track to exceed the GHG reduction target of 4,230 tonnes of CO_2e by close to 50%, a great accomplishment. Additionally, the project is also projected to save USask $1.1M per year in utility expenses providing excellent return on investment.

The USask Sustainability Revolving Fund (SRF), established in 2014, provides funding for projects, initiatives or programs that produce utility savings and advance the sustainability of campus operations. Since it's inception, the SRF has funded 23 separate projects for a total of $1.6M resulting in annual emission reduction of 2,400 tonnes CO_2e while saving $536k in utility expenses. With an overall simple payback of less than 3 years, SRF is a very cost-effective mechanism to drive sustainability. While primarily used to support operational initiatives, for the first time, in 2021, SRF was used to support a Canadian Foundation for Innovation (CFI) grant application as matching funds in order to partially offset the cost to install high efficiency research equipment.

In April of this year, USask received $500k from the Provincial Strategic Preventative Maintenance and Renewal Fund (SPMR) to begin a multi-year process of upgrading the building automation systems within the Agriculture Building. Building automation controls the lighting, heating, ventilation and cooling systems within the building to provide energy efficient thermal comfort and indoor air quality. The current obsolete system will be replaced with USask standard digital controls helping to address the deferred renewal liability. Besides providing an improved level of comfort, the upgrades will allow for occupancy-based control of lights, temperature and ventilation rates, greatly reducing the utility demand and therefore GHG emissions.

The Agriculture Building, built in 1991, is a prime candidate for building systems renewal for emissions reductions.

DECARBONIZE SUPPLY

With $500k from the USask Strategic Initiatives Fund, the Office of Sustainability has engaged external consultants to map out potential technical pathways to decarbonize USask's District Energy Systems and support the overall goal of reaching net-zero emissions by 2050.

There are 2 major elements to the study. Part 1 is an overall assessment of the Central Heating Plant. This covers an operational analysis of the equipment, maintenance, and operating strategies related to steam production. Key deliverables include a road map to ensure that the Central Plant steam systems can reliably and efficiently serve the campus' current and future needs. The assessment will include evaluating existing steam production and distribution system conditions, understanding current and future service needs, evaluate options for meeting these future needs, and articulating an implementation plan that can guide operational and maintenance plans, and capital renewal projects. Information contained within this report will be used to establish short-term (0-2 years), medium-term (3-6 years) and long-term (7+ years) operational strategy and equipment renewal requirements.

The second part of the study will focus on the opportunities and options to decarbonize USask District Energy Systems (DES) and associated facilities. The study is intended to quantify technical, economic, environmental, operational and logistical considerations related to decarbonizing the DES and to aid in financial decision making by providing short-, medium- and long-term recommendations which will be aligned with key assumptions around campus growth, energy supply and costs.

BUILD BETTER

In order to lower USask's overall carbon footprint, new construction and major renovations need to perform better than the existing stock of buildings on campus. As example, a major project is currently underway on the W.P. Thompson Building to provide renewed and more flexible space utilization to support a projected 30% increase in biology course enrollments and decrease the building's deferred maintenance through the selective deconstruction of the east wing and construction of a two-story rebuild, along with selective renovations in the west wing. Once complete, the building energy consumption is expected to decrease by almost 50%.

A second major project underway is the VIDO Animal Care Facility and Renovations to Existing Building Project. This project will see a major increase in the size of the facility, but by applying up-to-date building code standards and implementing energy-saving tactics, overall energy consumption and therefore GHG emissions are projected not to increase in absolute terms.

Frequently Asked Questions

What is so different about reducing emissions at USask?

The University of Saskatchewan is a world-renowned research institution. As such, the campus is home to many energy-intensive buildings, laboratories, and other research facilities.

When working to reduce GHG emissions at USask, it is critical to balance reductions with our ability to continue facilitating world-class research. Many energy-intensive facilities possess unique features that make emissions reductions very difficult without compromising the functions of the facility.

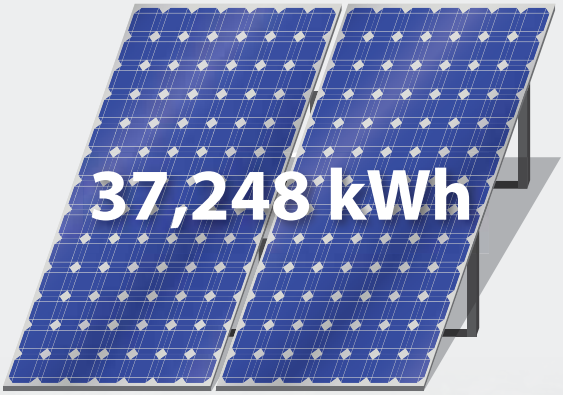
This is one of the reasons why it is so important that the university maintains a **district energy system**, i.e. our ability to distribute thermal energy to multiple buildings in an area or neighbourhood via our campus heating plant. Improving this system is a core priority in overall campus emissions reductions.

INITIATIVES

REDUCING DEMAND

A second proposal—the Low Carbon Economy Challenge – Heat Recovery Project—has been submitted to the Federal Low Carbon Economy Challenge, a grant that supports GHG reduction, for $1M. The grant covers 50% of eligible expenses which include external program management expenses, design, procurement, and construction costs. If successful, this will support up to ten heat recovery projects across main campus. The primary purpose of this project is to install energy recovery devices in multiple buildings across the University of Saskatchewan main campus to capture thermal energy from exhaust streams to pre-heat incoming make-up air in winter or pre-cool incoming make-up air in the summer. Based on duct arrangements and ventilation system design, installed equipment will include energy recovery wheels, energy recovery ventilators, or run around coil arrangements.

Solar Photovoltaic (PV) arrays on campus have generated



of electricity and offset overall campus emissions by 24 tonnes CO_2e.

BUILD BETTER

In June 2021, the City of Saskatoon adopted the High-Performance Civic Buildings policy which mandates that all new civic buildings meet Leadership in Energy and Environmental Design (LEED) certification with specific focus on energy consumption, indoor air quality and water conservation. An administrative procedure is in development to support practical application of the policy. USask intends to align, where applicable, internal sustainability design guidelines with the City of Saskatoon policy.

INCREASE ORGANIC WASTE DIVERSION

USask has a successful organic waste diversion program, in particular managing organics from grounds maintenance and Marquis Hall Food services. In 2024, the City of Saskatoon will implement a mandatory organics diversion plan for Industrial, Commercial, Institutional (ICI) organizations. USask will develop and implement a corresponding internal collection program to comply with this planned legislation and expand overall landfill diversion rates.

CONCLUSION

USask's Sustainability Strategy has committed USask to reducing GHG emissions by 45% from 2010 levels by 2030 and reach net zero carbon emissions by 2050. These challenging goals directly support and are in alignment with the United Nations Sustainability Development Goal 13: Take urgent action to combat climate change and its impacts.

Decarbonizing USask will require substantial investment in capital, both financial and community, in order to achieve these goals.

To limit the need for incremental investment, deliberate decisions must be made around ongoing and necessary building and infrastructure renewal to ensure sustainability is addressed.

Reducing demand for heating, cooling and electricity has the dual benefit of both offsetting ever growing utility expenses while also addressing GHG emissions.

Changes in supply such as a shift from fossil fuels to renewable energy sources will continue to power and heat campus but with a much lower overall GHG footprint and lower carbon tax implications.

Leveraging government funding will also be necessary to reach these goals.

For more information, please contact the Office of Sustainability at:

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To learn more about campus sustainability, please visit:

sustainability.usask.ca