Yukon Green Infrastructure Program
2022 annual report

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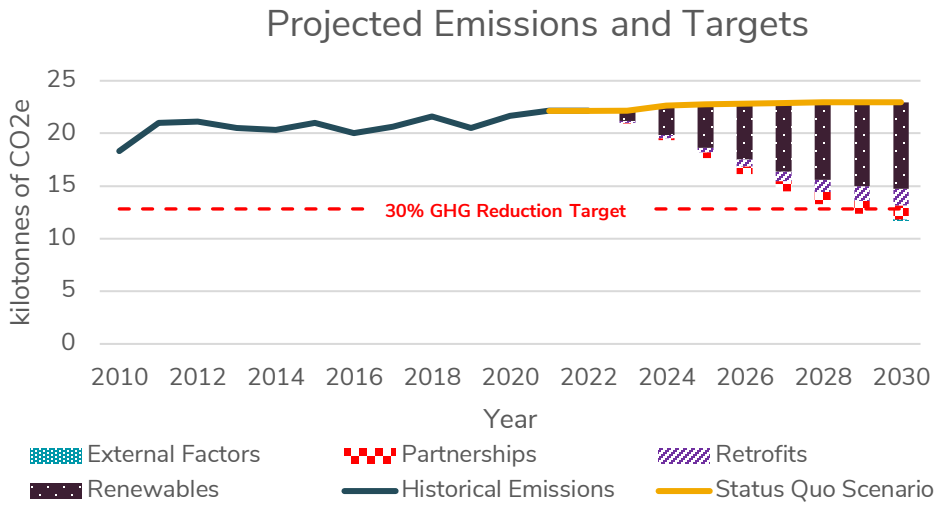
Executive Director's summary

2022 was a transformative for the Yukon Green Infrastructure Program (YGIP). This program is managed by the Sustainable Infrastructure Branch (SIB) within the Department of Highways and Public Works (HPW). Throughout 2022, SIB took on challenging initiatives, built new relationships with partners, and reached early milestones on our long-term priorities. The program team also won the 2022 Yukon Premier's Award of Innovation and Excellence.

We continue to deliver on Our Clean Future targets for Yukon government infrastructure, including reducing greenhouse gas emissions and improving climate resilience of buildings, highways, and fleet vehicles. This year, we have made progress on several energy retrofits and renewable energy projects that were started in the last two years. We also continue to conduct assessments and feasibility studies across the territory so that we have reliable data, sound analysis, and a queue of projects that can be delivered in future years.

Government of Yukon's goal to reduce its building emissions by 30% below 2010 levels by 2030 remains a priority. As seen in the graph, our current trajectory of potential projects is pointing in the right direction, however a lot of work needs to be done to maintain this momentum or enhance it.



As we head into 2023, we will continue looking to find innovative ways to accelerate the government's efforts to address climate change, both from a mitigation and adaptation view. With an incredibly talented team behind this program and excellent support from other areas of government, I am confident that we will continue to deliver results together.

Priyank Thatté,
Executive Director, Sustainable Infrastructure Branch

Renewable energy

Increasing the use of renewable energy is a key part of YGIP's strategy to meet HPW's greenhouse gas (GHG) reduction targets. Renewable energy projects can provide substantial GHG reductions while enhancing a local green economy.

Renewable energy feasibility studies

Feasibility studies are essential to investigate and understand what kind of energy efficiency opportunities exist. We made progress on two key feasibility studies in 2022:

1. Renewable energy heating systems (REHS) feasibility study

This multi-year study evaluates the potential to reduce GHG emissions from 12 locations with Government of Yukon buildings by 4.5 kilotonnes each year. This includes assessing heating systems that connect many buildings and are known as district heating systems.

In each of the site studies, consultants are researching renewable energy options like biomass, geo-thermal, geo-exchange and run-of-river power. These studies provide data and analysis to lay the groundwork for the implementation of potential renewable energy systems in future years.

We analyzed results from studies completed in 2021, and are preparing to move some of these projects to the next step, which is engineering design. We completed feasibility studies at two sites in 2022:

1. Porter Creek Secondary School.
2. Yukon University.

2. Solar power at off-grid camps feasibility study

This feasibility study, completed in 2022, evaluated the potential to install solar systems with battery storage at eight remote highway maintenance camps powered by diesel-generated electricity. Solar power will lessen these camps' reliance on diesel and thus reduce GHG emissions.

Following the study we began the design and construction of two solar systems, at the Klondike and Ogilvie highway maintenance camps. Once completed, we expect the systems to offset more than 100,000 of litres of diesel fuel each year and reduce emissions by 280 tonnes. These projects should be completed in 2023.

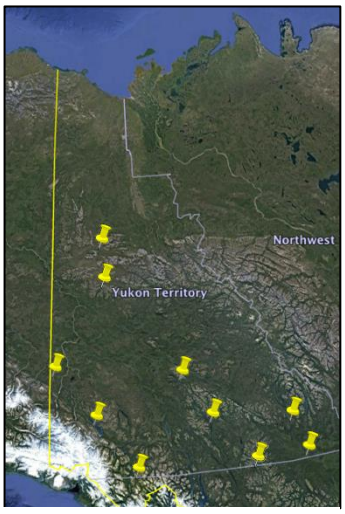
Construction of renewable energy projects

Renewable energies, such as biomass, are a vital part of our strategy to reduce our greenhouse gas emissions and reliance on fossil fuels. Most of the Yukon government's building emissions come from the high demand of heating with oil and propane. Renewable heating opportunities offer the most effective replacement to fossil fuels.

Wood chips are one type of woody biomass fuel that is available in the Yukon.

In 2022, we made progress on the construction of five renewable energy projects:

1. Constructing a biomass system at Elijah Smith Elementary School. This is expected to be complete in early 2023. The awarded contractor will also manage the operations and maintenance of this system.
2. Expanding the district heating system at the Whitehorse Correctional Centre to connect two adjacent buildings, Takhini Haven and the Young Offenders Facility.
3. Designing and constructing solar panel and battery systems at the off-grid Klondike and Ogilvie highway maintenance camps.
4. Designing site preparation requirements to install future "plug-and-play" biomass systems at three highway maintenance camps.
5. Preparing for underground biomass infrastructure in Haines Junction. This infrastructure will set us up for future opportunities to install biomass systems.



We are planning to install solar panels in diesel-dependent highway grader stations across the territory.

These systems have a large impact on our GHG emissions. The first three projects alone will offset an estimated 780 tonnes of GHG emissions each year.

An innovative approach to project delivery

The approach to build the Elijah Smith Elementary School biomass project is very different from most other projects done in the Yukon. We worked with the local biomass industry to build a system that they could then operate and maintain as well. This delivery model marks a foray into alternative procurement for the territory, by combining a construction contract with operational services.

The biomass system is currently being installed in the boiler building at Elijah Smith Elementary School in Whitehorse, Yukon.

Typically, Government of Yukon would hire a business to install equipment that we would maintenance upon project completion. The approach we are taking with this project is different; the local business will also service the system for us after it's built. This partnership is beneficial for both parties as the system will be supported by the experts who built the system, ensuring operational reliability while helping the Yukon reach its unique renewable energy needs.

What's next?

Our work this year has laid the foundation for projects for several years to come. Every feasibility study we complete provides us with invaluable information that guides us in determining what our next steps are to address our GHG reduction targets.

We use these studies to examine renewable energy options that are the most practical for the Yukon; and will bring the most value for Yukoners.

Now that we have the baseline information, we are ready to start the implementation phases of these renewable energy projects. The next steps are releasing tenders for the design and construction of renewable energy systems.

At the same time, we are hard at work determining what buildings are next for energy upgrades. Our goal is to create a steady stream of renewable energy projects that will allow us to achieve our future goals.

This year's construction season will be a busy one and will include more renewable energy projects as a result of our renewable heating and solar feasibility studies.

Energy conservation

Our branch promotes sustainable, resilient and energy efficient practices in Government of Yukon buildings. We work closely with project managers and consultants to providing guidance based on our expertise, current industry standards and government design requirements. This work requires a mix of technical change and culture change.

Energy efficient new construction

In 2022, we provided guidance on several new major projects to ensure designs are compliant with our climate change related requirements in the Design Requirements and Technical Standards manual and following energy modelling guidelines. We worked closely with project teams and consultants to seek out strategies to improve energy efficiency. reduce greenhouse gas emissions, and incorporate renewable energy systems in how we design new buildings. Some key projects include:

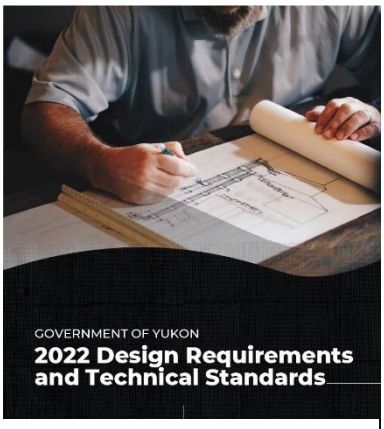
- Whistle Bend Elementary School.
- Old Crow Health and Wellness Centre.
- Coroner's office.
- Gymnastics and Climbing Gym.
- Burwash Landing School.

Our ongoing work on these projects ensures these buildings will meet and exceed the energy performance requirements.

Updated Design Requirements and Technical Standards manual

Speaking of cultural change needed to fundamentally change how projects are designed and planned, this year, we added new enhanced requirements to the government's building design standards. These contributions reflect current industry practices and allows the manual to align better with Our Clean Future goals. These changes ensure that climate mitigation and adaptation are part of the integrated design process. Some notable changes include:

- New buildings connected to diesel-grids shall incorporate renewable electricity generation where practical.
- New buildings shall incorporate at least one supply of supplementary renewable heat where practical, striving to meet 90% of the building's anticipated annual heat load.



Front cover of the 2022 Design Requirements and Technical Standards manual.

- All thermal bridging must be accounted for in effective thermal resistance.
- New and upgraded parking lots must provide rough-in of conduit to every stall to allow for future level II electrical vehicle charging.
- Updated air leakage requirements for new buildings.
- All boiler installations shall include a tie-in for a future connection to an additional renewable heating source.

Energy assessments

This year we completed energy assessments in 30 buildings in the communities, including Carcross, Dawson, Mayo and Teslin. To date, we have assessed 81 buildings, and we are on track to meet our commitment to conduct energy assessments in all our buildings by 2025.

We are always looking to continuously improve our methods. As part of our planning process for this year's energy assessments, we looked back to see how we can make this round better. This year, we added new requirements and deliverables to our energy assessments to maximize energy savings and greenhouse gas reductions. We are also making it easier to implement these retrofits by producing implementation-ready project documentation. These include:

- Incorporating energy models to increase accuracy of savings calculations when completing an assessment.
- Developing carbon reduction packages, which bundle multiple GHG reduction opportunities together to optimize total GHG reductions and capital costs.

Our consultants take thermal images during the energy assessments. This identifies heat loss in the building that we can address through building envelope retrofit projects.

We continue to work within our department to evaluate and prioritize these energy conservation measures.

Building energy retrofits

Completed retrofits

We completed eleven building energy retrofits in 2022, six of which were high efficiency retrofits that reduce more than 5 tonnes of GHG per year. These retrofits are expected to reduce over an estimated 181 tonnes of GHG emissions per year. Delivered by the Property Management Division (PMD), some of these retrofits include:

Upgrading incandescent or fluorescent lights to LEDs can reduce energy use and improve the quality of light in our buildings.

- Atrium skylight replacement and HVAC upgrades at the Andrew A. Philipsen Law Centre.
- Heating plant replacements at the Dawson City and Beaver Creek highway maintenance camps.
- Boiler replacement at the equipment maintenance and storage building in Watson Lake.
- HVAC and paint booth ventilation replacements at the Parks office in Whitehorse.
- Watson Lake Secondary School building envelope upgrade.

Building Optimization Program

In early 2022 we launched the Building Optimization Program. The program's goals include creating an educational campaign, an energy-focused checklist for efficient building operations and a program to improve existing building systems and make them more efficient.

In 2022, our team co-hosted a public seminar with PMD to discuss the energy related requirements in the Design Requirements and Technical Standards.

In 2022, we supported 28 low cost initiatives through YGIP that were implemented by PMD. The building operators were encouraged to identify small energy saving projects that they could implement. This funding program enables building operators to take action towards energy conservation, raising awareness for sustainability and climate change.

The Building Optimization Program will reduce energy use in buildings and educate others on what efficient building operations are. We look forward to doing more on this program in 2023.

What's Next?

We have some exciting initiatives planned for 2023, including:

In 2022, we joined forces with Energy Branch (EMR) and Climate Change Secretariat (ENV) during the Reverse Trade Show to share how Government of Yukon is progressing on Our Clean Future actions

- Continuing to develop the Building Optimization Program, a program that will encourage energy efficient behaviours to reduce GHG emissions.
- Evaluating and prioritizing energy retrofit projects.
- Developing a Renewable Energy Map, a tool that will be used to highlight renewable energy potential throughout the Yukon.
- Continuing to provide information on electric vehicles (EV) and EV infrastructure.
- Continuing to contribute to federal initiatives to broaden awareness and help identify opportunities to improve existing building systems and make them more efficient.
- Work towards a space optimization initiative to identify buildings that are under-utilized seasonally to year-round to find opportunities to reduce GHG emissions.
- Continue to contribute major construction projects like the Yukon University Polaris building by providing guidance and suggestions.

Partnership opportunities

Through its partnerships stream, the YGIP supports collaborative renewable energy projects between the Government of Yukon and external partners including:

- federal, municipal, and First Nation governments; and
- research and academic institutions.

These partnerships support renewable energy projects across the Yukon by providing additional funding for projects, and more opportunities to reduce GHG emissions. We've successfully partnered with organizations and governments this year on a few different projects.

Building resilience initiative

We are partnering with Yukon University to develop a climate hazard map to help Yukoners better understand the risk of floods, wildfires, and permafrost thaw for buildings across Yukon. This project will produce a new resilience assessment tool so building owners can better incorporate climate resilience into their asset management decisions. In addition, it will provide a greater understanding of climate risks and geohazards for the Yukon's building infrastructure so we can mitigate and adapt to the effects climate change.

While the project aims to develop guidance that can be applied to buildings throughout the territory, we are using information from buildings owned and managed by the Yukon government as a test study for the tools.

The initiative will work to improve the capacity to identify and manage the impacts of climate change on our buildings.

Electric Thermal Storage (ETS) at Yukon University

We are partnering with the Yukon Conservation Society and Yukon University to install and evaluate the performance of an ETS unit at Yukon University. ETS units convert electricity into stored heat. The goal of this project is to determine whether commercial ETS units can reduce carbon emissions in a cost-effective way.

This year, we installed monitoring equipment in the building and awarded the contract for the installation of ETS equipment. Based on this data and our technical reviews, we are currently exploring various options that will store electricity as heat effectively.

This brick-based ETS unit is an example of a system that stores electricity as heat.

Watson Lake waste heat district energy system

The Yukon government purchases renewable heat from the town of Watson Lake to heat Watson Lake School. The school is connected to the community's district heating system, which recovers waste heat from the local power generators.

In 2022, we saved almost 120,000 liters of oil and reduced over 300 tonnes of GHG emissions. That's more than 1,700 round trips from Whitehorse to Watson Lake!

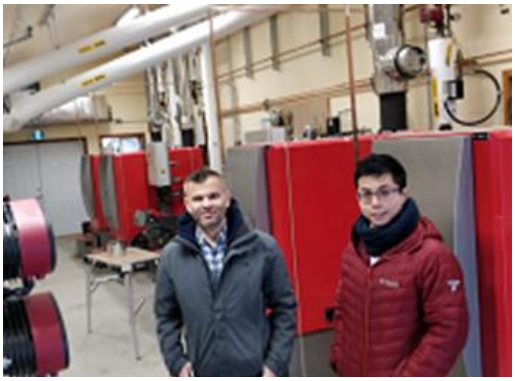
We are working with Watson Lake municipality to explore a potential expansion of this district energy network to connect more buildings.

Watson Lake High School is heated with waste heat from the town's generators.

Teslin biomass district energy system

We are working with Teslin Tlingit Council (TTC) on an energy supply agreement to get establish a heat purchase agreement for Khàtìnas.àxh Community School. This agreement could reduce the school's annual GHG emissions by 0.11 kilotonnes.

This year, in collaboration with TTC, we made necessary modifications to the system so that the building is ready to use biomass heat. In the meantime, we are continuing to negotiate a heat purchase agreement that is attractive to both parties.

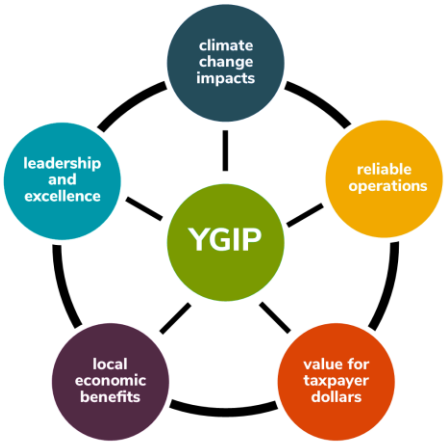


HPW staff visits the Teslin Biomass District System.

Program governance

Climate change is a complex issue that requires comprehensive strategies to address effectively. The YGIP identifies and prioritizes meaningful actions using a five-pillar framework. Decisions are made with a balance of five broad factors using this framework.

The program is taking new steps towards adapting our infrastructure to withstand the impacts of climate change. Improving the resiliency of our infrastructure will be guided by climate change-informed assessments and planning. Climate risk assessments will be essential to determine the risks posed to infrastructure by permafrost, fire, flood and other climate change impacts.



YGIP's 5 pillars are uniquely attuned to Yukon's needs and form the program's decision-making framework.

This year, YGIP also began supporting departmental climate change priorities such as climate resilience in buildings and highways, zero-emission fleet vehicles, public electric vehicle charging stations, and active transportation. Working with the respective experts across the department, we refined eight action items and added five new ones in the 2021 OCF Annual Report.

Alignment with industry standards

This year, we launched a project to align our energy management system with the international standard for energy management, ISO 50001. By aligning with industry standards, we can continuously increase the effectiveness of our energy conservation actions and build the credibility of our energy management system. We plan to gain accreditation by applying for federal recognition in 2023.

Prioritization of energy retrofit projects

While there are many buildings that we could retrofit, it is important to prioritize projects that are the most practical for the Yukon and bring the most value for Yukoners. When creating a priority list, we need to incorporate energy efficiency and GHG emissions of buildings into our decision making. In addition, we use the 5-pillar framework as a decision-making tool to help prioritize retrofits. Creating a prioritization framework was an action item in *Our Clean Future*, and we have implemented ahead of the timeline.

Transparency and Open Data

In August 2022 we launched the Yukon Green Infrastructure Blog. This platform allows us to be more transparent and share what the government is doing to tackle climate change impacts on our infrastructure.

In addition, Government of Yukon building energy data is now publicly available through the Energy Star Portfolio Manager. By sharing this data, we hope to contribute to a more accurate representation of how buildings in the Yukon use energy and inspire new solutions to reduce greenhouse gas emissions.

Premier's Award

Work done by the Yukon Green Infrastructure Program team was recognized at the 2022 Premier's Awards of Excellence and Innovation in June 2022. The team was recognized for their efforts in helping the Government of Yukon reduce emissions, find innovative approaches to implementation, build partnerships, and improve the resiliency of government infrastructure when it comes to climate change mitigation and adaptation.

Click the image for more information about the branch's 2022 Premier's Award.

Outreach

In November 2022, we had a booth at the Reverse Trade Show to engage with the community. It was a trade-show style event where Government of Yukon staff are at booths, and business can pitch their services and network with decision makers. We also participated in a presentation with the Energy Branch and Climate Change Secretariat about climate action opportunities for Yukon businesses.

Program team member presenting at the Reverse Trade Show this past November.

Looking Ahead

It has been two years since the YGIP was created to provide leadership and accelerate achieving Government of Yukon's goals on climate change. In that time, the program has kickstarted numerous projects and initiatives. More importantly, this program and the program team have served as a catalyst in nudging a systemic change across government. We will continue to push this aspect of cultural change forward in a respectful and inclusive manner. We will continue to promote science-based decision making, and support for climate change champions across the government to effect meaningful action.

We're always trying to make smarter and climate-conscious decisions when it comes to government infrastructure. We will improve how we consider climate change impacts when designing, constructing, monitoring, and maintaining Yukon's public infrastructure. This balance of technical and cultural change that is essential so that we look at infrastructure, operations, and service delivery in a different way.

There is keen interest for climate change programs such as the YGIP at all levels of government, as well as the momentum to progress them. In that regard, the program team is grateful for support provided by branches and units across the government. We are excited to continue developing external relationships and working with partners in government, academia, and the private sector as we build toward a resilient and sustainable future for the Yukon.