



Green Infrastructure Program

2021 annual report

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A MESSAGE FROM THE DEPUTY MINISTER

The climate crisis is one of the defining issues of our era. Climate change is generating a myriad of impacts and affecting infrastructure across our territory. The window for meaningful action is short, and my department is taking steps to address the crisis.

The Yukon Green Infrastructure Program (YGIP) is making government infrastructure more resilient to climate change and reducing its carbon footprint. I am pleased to report progress on multiple streams under this multi-year investment fund, such as:

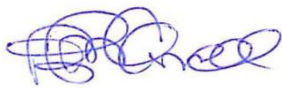
- implementing renewable energy systems;
- retrofitting buildings; and
- spearheading a host of other sustainability initiatives designed to address both climate change adaptation and mitigation.

Through our work on this program, we are blazing a new trail and taking bold, innovative, measurable steps forward in many aspects of climate change in the Yukon.

For a relatively young program our highly motivated team has delivered where it matters. In the last year, we:

- Looked at the potential for renewable energy systems in 81 buildings.
- Completed a procurement process for renewable energy system construction projects.
- Laid the groundwork for future projects via 52 building energy assessments.
- Advanced \$10 million in on-the-ground capital projects and made progress towards 13 Our Clean Future action items through collaboration with other areas of government.

I am very proud of the work that the Sustainable Infrastructure Branch has done to move this program forward. I would also like to acknowledge our many internal and external partners. Without their contribution, this work would not have been possible. I wish to extend my sincere gratitude and wish the team success for 2022.



Paul McConnell
Deputy Minister

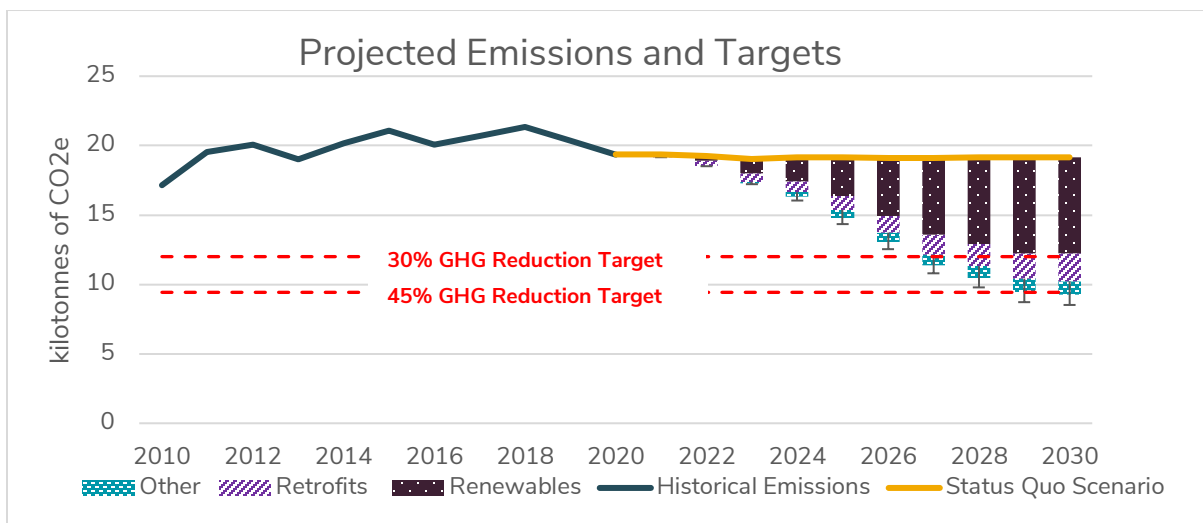
EXECUTIVE SUMMARY

Within the department of Highways and Public Works, the Sustainable Infrastructure Branch (SIB) administers the Yukon Green Infrastructure Program (YGIP). The focus of this multi-year investment program is twofold: reducing carbon emissions from and improving the climate resilience of the Yukon government's buildings and assets.

Our branch leads departmental efforts to incorporate climate change considerations in our work and to provide guidance on:

- energy conservation;
- greenhouse gas (GHG) emission reduction;
- renewable energy;
- climate risk; and
- other climate change-related topics.

One of the primary targets of this program is to support the Yukon government's objective to achieve, by 2030, a 45% reduction of greenhouse gas emissions compared to 2010. The YGIP is delivering on a three-pronged strategy to achieve this target: increase the use of renewable energy, improve energy efficiency of buildings, and develop partnerships. Later sections of this report will discuss these efforts in detail.



Energy retrofit projects and renewable energy projects are the cornerstones of our strategy to meet our 45% greenhouse gas emissions reduction target.

In 2021, SIB initiated two feasibility studies to explore renewable energy options at 81 buildings at 12 locations across the territory. These projects have the potential to identify

new renewable energy projects that could achieve major GHG reductions – up to 6 kilotonnes. We also undertook procurements for two biomass systems.

Our branch also worked with the Property Management Division to complete 52 energy assessments this year. The consultants for this project recommended over 400 energy conservation measures. Together, these measures, once implemented, could result in up to 2.4 kilotonnes in GHG reductions and \$4 million in annual energy savings.

As of fall 2021, the branch transitioned to a new, more central, role within the Capital Planning Division. We will be looking for ways to accelerate the department's efforts to address climate change. We look forward to working with other divisions to support the delivery of their respective actions, and make progress together.



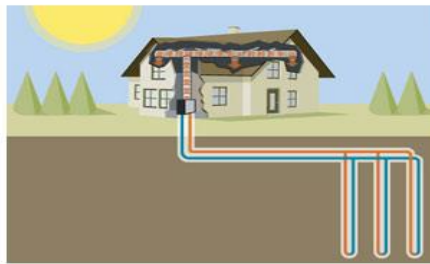
RENEWABLE ENERGY

Increasing the use of renewable energy is a key part of YGIP's strategy to meet HPW's GHG reduction targets. Renewable energy projects can:

- provide substantial GHG reductions; and
- enhance the development of a green economy.

Internal research

This summer, we published a [renewable energy options paper](#). It summarizes our extensive internal research on renewable energy systems in northern climates.



The renewable energy options paper provides research on various energy systems.

Renewable energy feasibility studies

Sustainable Infrastructure Branch progressed two feasibility studies in 2021:

- renewable heating feasibility study at 81 high GHG emission buildings at 12 locations across the territory; and
- solar power feasibility study at 11 highway maintenance camps that are off-grid diesel-powered.

Renewable Energy Heating Systems (REHS) Feasibility study

This multi-year study will look at the potential to reduce GHG emissions from 81 buildings at 12 locations across the territory by 4.5 kilotonnes each year. This includes district systems connecting up to 70 buildings.

Consultants are evaluating renewable energy options like biomass, geo-thermal, geo-exchange, and micro-hydropower at each site. These studies lay the groundwork for potential renewable energy systems that could be implemented in the coming years.



We completed evaluations at three sites in 2021, including:

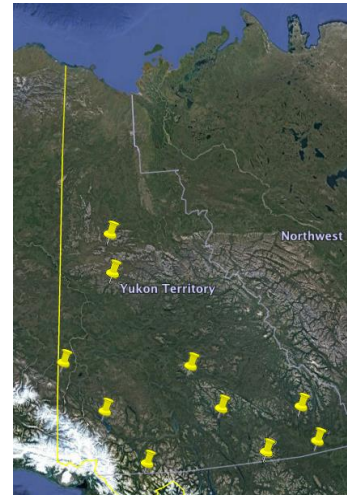
- Haines Junction complex;
- Dawson City biomass system expansion; and
- Whitehorse Highways and Public Works (HPW) services complex.

Solar power at diesel dependent highway maintenance camps

We also completed a solar energy feasibility study for diesel-dependent highway maintenance camps across the territory. This study investigated the viability of installing solar photovoltaic (PV) systems with battery storage to offset diesel generator use.

Solar installations at these sites would achieve substantial reductions in greenhouse gases, an estimated 0.8 kilotonnes annually. These systems can power the sites during summer months and shoulder seasons to reduce the use of diesel generators.

Procurement for the installation of solar panel systems in select sites is scheduled for 2022.



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

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. Due to their northern location, Yukon buildings have high heating loads. Renewable heating options offer the most effective replacement to fossil fuels.



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

In 2021, we started procurement work on two biomass energy systems. These systems, once constructed will reduce annual greenhouse gas emissions by 0.6 kilotonnes:

- Project 1: A build-operate-maintain contract for biomass energy at Elijah Smith Elementary School.
- Project 2: Expansion of the district heating system at the Whitehorse Correctional Centre to connect two adjacent buildings, Takhini Haven and the Young Offenders Facility.



Innovative procurement model

The Elijah Smith Elementary School biomass project used an innovative approach, packaging a construction contract with operational services. We worked with the local biomass industry and the Yukon Wood Products Association to develop a build-operate-maintain approach to ensure long-term success.



The biomass system will be installed in the boiler building at Elijah Smith Elementary School in Whitehorse, Yukon.

This type of contract provides service providers the means to oversee all aspects of the biomass system's operations, including equipment selection and fuel type. It also provides local businesses with an additional source of ongoing revenue.

What's next?

Our work this year has laid the foundation for capital projects for several years to come. The reports coming in through our feasibility studies are invaluable to determining what our next steps are.

Each site's study allows us to closely examine renewable energy options that:

- are the most practical for the Yukon; and
- will bring the most value for Yukoners.

Our team is ready and keen to begin the implementation phases of these renewable energy projects. As studies are completed, tenders for the design and construction of renewable energy systems will be released.

At the same time, we are hard at work looking at the next series of buildings in our portfolio. Our goal is to create a steady stream of renewable energy projects that will allow us to achieve both our 2030 and 2050 targets.

In addition to our project work, we will continue to develop our research and knowledge capacity. SIB is developing a renewable energy map as a tool to identify additional opportunities for renewable energy systems. The tool helps identify buildings that are near viable renewable energy options, such as potential micro-hydropower sites.

We'll also publish reports to share additional findings from our research on renewable energy technology.



ENERGY CONSERVATION

Our branch promotes sustainable, resilient, and energy efficient practices in YG buildings. We work closely with project managers and consultants providing guidance based on our expertise, current industry standards, and requirements laid out in the Government of Yukon's Design Requirements and Technical Standards Manual.

Energy efficient new construction

In 2021, we contributed to three notable, new major construction projects in Whitehorse and Old Crow:

- Whistle Bend Elementary School;
- Whitehorse Airport Maintenance Facility; and
- Old Crow Health and Wellness Centre.

Our ongoing work on these projects ensures these buildings will meet and exceed the energy performance requirements as per the government's Design Requirements and Technical Standards Manual. This includes the energy performance and greenhouse gas reduction targets that are 35% better than the base building (National Energy Code of Canada for Buildings 2017 reference building).



Energy assessments

This year we completed 52 energy assessments. The energy assessments were included as part of building condition assessments by the Property Management Division (PMD).

We worked with a consultant to:

- assess mechanical, electrical, water and building envelope systems; and
- identify opportunities for energy conservation measures.

Moving forward we will work with other PMD branches to evaluate and prioritize these energy conservation measures and set up an energy retrofit pipeline for future years.



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.

Building energy retrofits

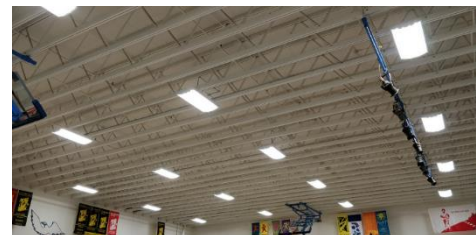
Completed retrofits

We supported Property Management Division to complete nine building energy retrofits in 2021. Seven of these were high-efficiency retrofits anticipated to reduce building GHG emissions by 5 tonnes or more. These retrofits include:

- an air handling unit replacement at École Émile Tremblay;
- a boiler replacement at St. Elias Community School; and
- a mechanical system upgrade at Whitehorse Correctional Centre.

Retrofits in progress

There are 38 energy retrofit projects underway in Yukon government buildings. These buildings are located across 11 communities, including Whitehorse, Watson Lake, Dawson City, Mayo, Ross River and more.



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



What's next?

Our branch will continue to tighten our energy performance requirements, encourage efficient building operations, and improve our project prioritization process.

We have some exciting initiatives planned for 2022:

- Adding new energy efficiency and renewable energy requirements to the Design Requirements and Technical Standards Manual, which applies to new and existing buildings.
- Launching the Building Optimization Program. This program encourages low-cost/no-cost opportunities to streamline building operations and occupant behaviour in ways that deliver efficiency gains and promote building energy performance.
- Evaluating and prioritizing the many energy retrofit projects recommended by the energy assessments completed this year.



Loreena Dobson, our Energy Technical Specialist, inspects equipment at a building.

PROGRAM DEVELOPMENT

Climate change is a complex issue that requires comprehensive strategies to address it effectively. The Green Infrastructure Program identifies and prioritizes meaningful actions using a five-pillar framework model.

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 the Yukon's needs.

Prioritization of energy retrofit projects

It is important to incorporate energy efficiency and GHG reduction calculations for prioritizing projects. We have fully integrated the 5-pillar framework into our work. They're applied to everything we do: from one-off assessments to the comprehensive intake and evaluation process for building retrofit projects. This was an action item in Our Clean Future, and we have implemented it two years ahead of the timeline.

Energy modelling guidelines

Our branch developed new energy modelling guidelines. We did this to ensure consistency for GHG calculations for each project. These models, done at different stages of a project, are used during the evaluation of different design options for new and existing building projects. Having an energy model completed at different stages of project development allows us to understand how a building will perform after construction.



Partnership opportunities

This year, SIB expanded the Yukon Green Infrastructure Program. Through a new partnerships stream, the YGIP can fund collaborative renewable energy projects between the Yukon government and external partners including:

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

These opportunities support renewable energy projects across the Yukon by providing revenue sources through energy purchase agreements. We've realized several successful collaborations this year.

Energy 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.

The goal of this project is to determine whether commercial ETS units can reduce carbon emissions in a cost-effective way. This case study looks to further an emerging technology's technical readiness in the north. If successful, it can be widely adopted across the Yukon's commercial and institutional buildings.



Electric Thermal Storage units convert electricity into stored heat.

Fuel metering in Old Crow

In collaboration with Energy, Mines and Resources' Energy Branch, we're installing fuel meters for 18 heating systems at 10 buildings in Old Crow. This work is part of a larger initiative by the Yukon government to gather energy use information in the First Nation community by:

- metering all of the buildings in Old Crow; and
- understanding their energy use.

Watson Lake Waste Heat District Energy System

The Yukon government purchases renewable heat from the Town of Watson Lake to heat Watson Lake High School. The school is connected to community's district heating system, which recovers waste heat from the local power generators. Last winter, the school reduced emissions by 0.36 kilotonnes and saved \$46,000 in utility costs.

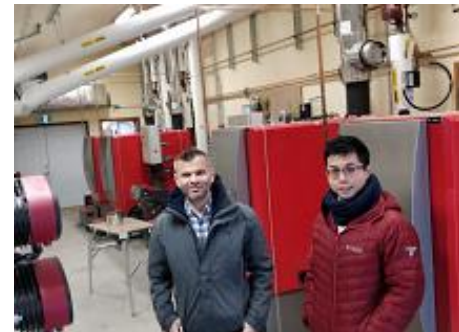
We are working with Watson Lake municipality to explore the expansion of this district energy network to connect more buildings.



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

Teslin Biomass District Energy System

HPW is working with Teslin Tlingit Council to establish a heat purchase agreement for Khàtinas.àxh Community School. This agreement could reduce the school's annual GHG emissions by 0.11 kilotonnes. This year, HPW extended support for this project by designing and performing system modifications required for the connection's technical compliance.



HPW staff visits the Teslin Biomass District System.

Outreach

Highways and Public Works continues our outreach efforts to increase government transparency and support other departments and contribute to a "one government" approach on climate change initiatives.

Timeline

February 2021

We hosted a biomass industry conference to provide information on upcoming projects.

May 2021

We shared information on upcoming biomass projects at the Yukon Wood Products Association's annual general meeting.



July 2021

We engaged with the local biomass industry regarding the Elijah Smith Elementary School biomass project. This was accomplished through a Request for Information process.

November 2021

We led a joint presentation with other departments on growing a local green economy during the Reverse Tradeshow.

Now

The Sustainable Infrastructure Branch continues to lead the coordination of HPW commitments in Our Clean Future. We are also working very closely with Energy, Mines and Resources' Energy Branch and Environment's Climate Change Secretariat on various overlapping initiatives and files by providing insight and learning from others through our work.

What's Next?

The Yukon Green Infrastructure Program will continue to focus and deliver where it matters the most. Next year, we will:

- refine our guidance to reduce our building's GHG emissions;
- develop new requirements to improve our asset's resilience to climate change;
- deliver more renewable energy projects; and
- incorporate climate change considerations in more functions across HPW.

As we wrap up our energy assessments this year, we are looking ahead to develop an energy retrofit implementation strategy that is both practical and replicable. We are exploring ways we can select, bundle and prioritize recommendations more effectively.

Some of our renewable energy feasibility studies are nearing completion. We are excited to learn from these reports and select new renewable energy projects to pursue.

We will also improve our portfolio's climate change resilience by partnering with Yukon University to develop a resiliency knowledge platform for climate adaptation work at Yukon government buildings. The project team will consult with other Government Yukon branches including:

- Water Management Branch (Environment);



- Wildland Fire Management (Community Services); and
- The Yukon Geological Survey (Energy, Mines and Resources).

The goal of this project is to develop a platform that can help HPW incorporate and make implementation decisions to account for risks, such as floods, wildfires and thawing permafrost, into our asset management decisions.

We are also taking a harder look at our operations to identify opportunities to include GHG emissions and climate risk resilience into our decision-making processes.

Next year will be an exciting year for HPW as we further our progress on the Yukon's climate change commitments.



LOOKING AHEAD FOR 2022

In 2019, the Government of Yukon announced *Our Clean Future* (OCF). This strategy is the government's road map to addressing climate change, sustainable energy, and a green economy.

We're off to a good start with YGIP: we have begun implementing a suite of projects that will meet the targets set under the OCF strategy. We will continue to adapt our efforts to the most current climate change science and the Yukon's evolving green economy.

We're always trying to make smart, climate-conscious decisions when it comes to government infrastructure. We do this by looking at what will reduce our emissions the most. We will also improve how we consider climate change impacts when designing, constructing, monitoring, and maintaining the Yukon's public infrastructure.

In 2022, we expect an organic growth of this program in the following areas:

Signature projects

- Continuing planning, design, and implementation of energy projects to get us closer to our 2030 goals.

Energy management

- Developing Yukon-based guidelines and specifications to improve the energy efficiency of our buildings and set out a path to net carbon neutrality.
- Expanding energy management functions across the department. Includes integrating an energy and sustainability lens into various decision-making processes, such as the 5-year capital plan.

Sustainability leadership across the department

- Pursuing more partnerships with governments, businesses and academia to improve our leadership goals and accelerate the action items under *Our Clean Future*.

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. 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.

