

ENERGY

INITIATIVES REPORT

2018 – 19

Le présent document contient la traduction française du résumé



MINISTER'S MESSAGE



Since the release of the 2030 Energy Strategy (Strategy) in 2018, the Government of the Northwest Territories (GNWT) has taken important steps toward meeting its mandate commitment to reduce the NWT's reliance on fossil fuels and lower the cost of living by advancing renewable and alternative energy projects. The Energy Initiatives Report highlights work and investments undertaken during the first year of our three-year Action Plan to implement the Strategy.

This past year the GNWT and its partners invested the most money ever—over \$21 million—in energy actions and initiatives to stabilize energy costs for NWT residents and move toward a low-carbon future.

We also nearly doubled the budget for the Arctic Energy Alliance (AEA) to roll out new and enhanced programs and services to better help the public to become more energy-efficient, and we launched the GNWT's GHG Grant Program to support larger-scale energy projects—initiated by governments, building owners or industry—that reduce GHG emissions in the NWT.

We know that to achieve our energy objectives, we need engaged and informed residents. This is why we developed a biomass training program this year to help build capacity in communities that use or want to use wood for heating, and produced resource materials that high school educators can use to teach our children about our energy systems and the effects of climate change.

The GNWT also continues to invest in energy conservation and efficiency. Now in its second decade, the Capital Asset Retrofit Fund (CARF) provided \$3.8 million in 2018 – 19 to optimize GNWT assets (e.g. biomass heating, LED lighting, building envelopes). We have also begun energy retrofits on one of our Marine Transportation Services vessels and studied the possibility of electrifying one of our ferries. The Northwest Territories Housing Corporation (NWT HC) began planning to convert a Yellowknife housing complex from oil-fired heating to a central propane/biomass heating system.

Reducing our reliance on fossil fuels will require more renewables to be incorporated into our energy mix. We continue to work with communities to find local solutions such as hydro, wind, solar, or biomass, and we continue to advance large projects like Inuvik Wind and the Taltson Hydroelectricity Expansion that will provide green energy to high-emitting regions and industry.

Finally, we have successfully secured federal funding for future energy initiatives, including \$31.2 million over four years under the Low Carbon Economy Leadership Fund (LCEL), \$55.7 million under the Investing in Canada Infrastructure Program (ICIP), and a commitment of \$1.6 million from the Government of Canada—with an additional commitment of \$18 million as part of the 2019 Federal Budget—to advance the Taltson Project.

This funding sets the stage to build upon this year's successes. The GNWT will continue efforts to complete project milestones identified in our action plan and in turn, meet our goal to transition the NWT to a lower carbon economy, build a sustainable energy system and strengthen our understanding of the short-term and long-term effects of climate change.

Mahsi,

The Honourable Wally Schumann

Minister of Infrastructure

TABLE OF CONTENTS

MINISTER'S MESSAGE	i
EXECUTIVE SUMMARY	6
RÉSUMÉ	8
INTRODUCTION	11
NWT ENERGY SNAPSHOT	12
2030 ENERGY STRATEGY	14
2018 – 19 ENERGY ACTION PLAN REPORTING	16
ENERGY PROGRAMS AND PUBLIC OUTREACH	20
ENERGY CONSERVATION AND EFFICIENCY	24
TRACKING GNWT ENERGY USE AND UTILITY COSTS	36
RENEWABLE ENERGY	40
A LOOK AHEAD	50
APPENDIX A – ARCTIC ENERGY ALLIANCE PROGRAM RESULTS	52
APPENDIX B – ENERGY EFFICIENCY PROJECTS	54
APPENDIX C – COMPLETED BIOMASS PROJECTS.....	55

EXECUTIVE SUMMARY

The NWT's *2030 Energy Strategy (Strategy)* sets out the GNWT's long-term approach to supporting secure, affordable and sustainable energy in the NWT. The Strategy has six (6) Strategic Objectives to guide decision-makers in reaching its our vision by 2030, and defines the organizational roles played by the GNWT and its partners. In 2018 – 19, the GNWT had a successful first year of implementing the Strategy through its three-year rolling Energy Action Plan. The Energy Action Plan sets out the ongoing and annual new Actions and Initiatives that the GNWT and its partners are undertaking to achieve the Strategic Objectives in the Strategy. This report contains summaries of the actions and initiatives undertaken to support the Strategy in 2018 – 19.



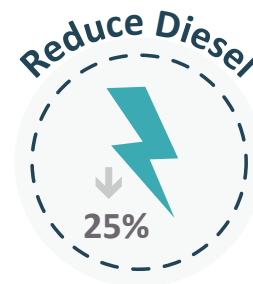
Funding through the Government of Canada's Low Carbon Economy Leadership Fund (LCELFF) facilitated the development and launch of the GNWT's GHG Grant Program for Governments, as well as the enhancement and expansion of programs delivered by the Arctic Energy Alliance (AEA). The GHG Grant Program is designed to fill a gap in funding for larger GHG reduction initiatives, while the GNWT provides smaller grants through the AEA.

For public outreach, the Energy Division developed a suite of lesson plans that teachers can use to achieve outcomes in the High School Experiential Science Curriculum. They also developed a biomass training program to help build capacity in communities that use or are interested in incorporating biomass into their energy mix.

The GNWT continues to lead by example in energy conservation and efficiency. The Capital Asset Retrofit Fund (CARF) provided 3.8 million dollars in 2018 – 19 to optimize GNWT building systems through envelope and lighting upgrades, heating control optimizations, efficient water fixtures and retrofits for aging buildings.

In 2018 – 19, the AEA partnered with the Hamlet of Sachs Harbour as part of a pilot project— funded by the GNWT Department of Infrastructure and Natural Resources Canada—to implement energy efficiency retrofits to residents' homes in NWT communities. The NWT Housing Corporation—under the LCELFF—plans to remove several existing oil-fired heating systems in a Yellowknife Housing complex and to supply the heat to these units from a central propane/biomass heating system.

A major overhaul to the GNWT Marine Transportation Service's (MTS) tug Jock McNiven to make it more energy-efficient began in the fall of 2018, and the GNWT also studied the merits of converting the Peel River Ferry to a diesel-electric hybrid. A hybrid design would allow the ferry to operate from diesel or battery power, removing most of the hydraulics and mitigating the risk of an oil spill.



Renewable energy investments are a major part of the Strategy. In 2018 – 19, the GNWT and the Government of Canada announced approximately \$2.1 million in funding for the Taltson Hydroelectricity Expansion Project, and as part of Budget 2019, the federal government allocated \$18 million over three years to advance the project. This year, the GNWT implemented technical feasibility work, including a study that examined the potential of connecting our hydroelectric systems through a transmission cable crossing Great Slave Lake, and is supporting our Indigenous partners to participate in defining the project structure and business case. The Government of Canada and the GNWT also announced up to \$24.6 million in funding for the refurbishment of the Snare Forks Hydroelectric Facility, the first major overhaul since it was installed in 1976.

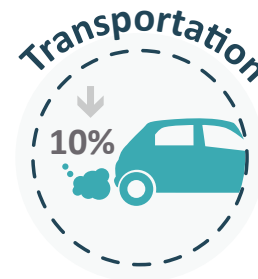
On November 13, 2018, the GNWT and Infrastructure Canada announced up to \$40 million in funding for the Inuvik Wind Project. The Northwest Territories Energy Corporation (NTEC) has been tasked with delivering the project. Construction will be a phased installation process with key elements coming first to allow time for the turbine and blades to be ordered, built and shipped to site.

In the spring of 2019, the GNWT—working with the Aurora Research Institute (ARI)—installed a 60-metre wind-monitoring tower alongside the Mackenzie River in Norman Wells. The tower will gather wind speed data at the site for the next two years to determine the feasibility of a wind turbine project in the community.

The GNWT continues to monitor the wind resource in Sachs Harbour with a wind/solar/battery/diesel hybrid system designed to operate in remote conditions. The third-party power source experienced considerable challenges in the high Arctic environment.

In 2018 – 19, the AEA took part in two community wood stove projects. The first project arranged for 54 stoves to be delivered in four communities, while the second arranged for 55 stoves to be installed in five communities. The GNWT engaged in work on several regional biomass projects through the CARF program, and completed the biomass heating system in the Stanton Hospital.

In February 2018, NTPC began a one-year pilot project in the community of Aklavik, using a variable-speed generator (VSG) and 55 kilowatt solar array. NTPC conducted the first phase of the project, which was to test the performance of the VSG. Information from ongoing analysis of the VSG performance in Aklavik will contribute to better understanding of VSG performance.



In the next three years (2019 to 2022), the GNWT and its partners will spend up to \$227 million towards actions and initiatives that support the *2030 Energy Strategy's* six Strategic Objectives. Up to \$64 million will be invested in 2019 – 20 to support a wide array of energy actions and initiatives.

RÉSUMÉ

La *Stratégie énergétique 2030* des Territoires du Nord-Ouest (la Stratégie) expose l'approche à long terme du gouvernement des TNO : soutenir l'approvisionnement en énergie fiable et durable à prix abordable. La Stratégie compte six objectifs stratégiques pour guider les décideurs dans la réalisation de notre ambition d'ici 2030 et définit les rôles organisationnels joués par le GTNO et ses partenaires. En 2018-2019, le GTNO a connu une première année fructueuse en mettant la stratégie en œuvre par l'entremise de son plan d'action énergétique triennal. Le plan d'action énergétique définit les mesures et les initiatives permanentes ainsi que les mesures et initiatives annuelles nouvelles que le GTNO et ses partenaires entreprennent pour atteindre les objectifs stratégiques établis dans la Stratégie. Le présent rapport contient des résumés des mesures et des initiatives mises de l'avant pour soutenir la Stratégie en 2018-2019.

Le financement obtenu au titre du Fonds du leadership pour une économie à faibles émissions de carbone (FLEFEC) du gouvernement du Canada a facilité l'élaboration et le lancement du Programme de subventions publiques pour la réduction des GES destiné aux administrations ainsi que l'amélioration et la création de programmes mis en œuvre par l'Alliance énergétique de l'Arctique (AEA). Le Programme de subventions publiques pour la réduction des GES vient combler une lacune dans le financement des grandes initiatives de réduction des émissions de gaz à effet de serre, tandis que le GTNO fournit un soutien financier aux projets plus modestes par l'entremise de l'AEA.

Pour sensibiliser le public, la Division de l'énergie a élaboré une série de plans de cours que les enseignants peuvent utiliser dans les cours de sciences expérimentales destinés aux élèves du secondaire.

La Division a également mis au point un programme de formation sur la biomasse pour renforcer les capacités des collectivités qui utilisent ou souhaitent intégrer la biomasse dans leur éventail de sources d'énergie.

Le GTNO continue de donner l'exemple de la conservation de l'énergie et de l'efficacité énergétique. Le Fonds de modernisation des immobilisations (FRI) a fourni 3,8 millions de dollars en 2018-2019 pour optimiser les bâtiments du GTNO, notamment par l'amélioration de l'enveloppe et de l'éclairage, l'optimisation de la régulation du chauffage, l'installation de dispositifs de robinetterie efficaces et la modernisation de bâtiments vieillissants.



En 2018-2019, l'AEA s'est associée au hameau de Sachs Harbour dans le cadre d'un projet pilote financé par le ministère de l'Infrastructure du GTNO et de Ressources naturelles Canada pour installer des améliorations écoénergétiques dans les résidences des Ténos. La Société d'habitation des TNO – dans le cadre du FLEFEC – prévoit de retirer plusieurs installations de chauffage au mazout dans un complexe d'habitations de Yellowknife et de relier ces unités à une installation de chauffage centrale alimentée au propane et à la biomasse.

Une révision majeure du remorqueur Jock McNiven du Service de transport maritime (STM) du GTNO pour le rendre moins énergivore a débuté à l'automne 2018; le GTNO a également étudié les avantages de doter le traversier de la rivière Peel d'un moteur hybride diesel-électrique. Le traversier pourrait ainsi fonctionner au diesel ou à l'électricité (batteries); cette transformation entraînerait le retrait de la plupart des systèmes hydrauliques et l'atténuation des risques de déversement d'hydrocarbures.

Les investissements dans les énergies renouvelables constituent un volet majeur de la Stratégie. En 2018-

2019, le GTNO et le gouvernement du Canada ont annoncé l'octroi d'environ 2,1 millions de dollars pour le Projet d'agrandissement de la centrale hydroélectrique de la rivière Taltson. Par ailleurs, dans son budget de 2019, le gouvernement fédéral a alloué 18 millions de dollars sur trois ans pour faire avancer ce projet. Cette année, le GTNO a lancé des études de faisabilité technique, notamment une étude sur le potentiel de raccordement de nos réseaux hydroélectriques par un câble de transmission traversant le Grand lac des Esclaves, et aide nos partenaires autochtones à participer à la définition de la structure du projet et à l'analyse de rentabilisation. Le gouvernement du Canada et le GTNO ont également annoncé une aide pouvant atteindre 24,6 millions de dollars pour la rénovation de la centrale hydroélectrique de Snare Forks, la première refonte majeure depuis sa mise en service en 1976.

Le 13 novembre 2018, le GTNO et Infrastructure Canada ont annoncé une aide financière pouvant atteindre 40 millions de dollars pour le projet éolien d'Inuvik. La Société d'énergie des Territoires du Nord-Ouest (SETNO) a été chargée de l'exécution du projet. Les travaux de construction consisteront en un processus d'installation progressive, les éléments clés étant exécutés en premier pour laisser du temps afin que l'on puisse commander, construire et livrer la turbine et les aubes.

Au printemps 2019, le GTNO, en collaboration avec l'Institut de recherche Aurora (IRA), a installé une tour de mesure du vent de 60 mètres à Norman Wells, le long du fleuve Mackenzie. La tour permettra de recueillir des données sur la vitesse du vent au cours des deux années à venir afin que l'on puisse déterminer la faisabilité d'un projet éolien dans la collectivité.

Le GTNO continue d'évaluer le potentiel éolien du secteur de Sachs Harbour à l'aide d'un système hybride (énergie éolienne et solaire, batteries et moteur diesel) capable de fonctionner dans les régions éloignées. Le dispositif d'alimentation

électrique à trois sources a connu des ratés considérables dans l'environnement de l'extrême Arctique.

En 2018-2019, l'AEA a participé à deux projets de chauffage au bois communautaires. Le premier projet prévoyait la livraison de 54 poêles dans quatre collectivités, tandis que le second prévoyait l'installation de 55 poêles dans cinq collectivités. Le GTNO a participé à plusieurs projets régionaux d'utilisation de la biomasse dans le cadre du programme du FRI et a achevé le système de chauffage à la biomasse de l'hôpital Stanton. En février 2018, la SETNO a lancé un projet pilote d'un an dans la communauté d'Aklavik afin d'évaluer une génératrice à vitesse variable (GVV) et une installation photovoltaïque de 55 kilowatts. La SETNO a mené la première phase du projet, laquelle consistait à tester le rendement de la GVV. Les informations issues de l'analyse du rendement de la GVV en cours à Aklavik amélioreront notre compréhension du rendement de ces génératrices.



Au cours des trois prochaines années (2019 à 2022), le GTNO et ses partenaires consacreront jusqu'à 227 millions de dollars à des mesures et initiatives orientées vers les six objectifs de la *Stratégie énergétique 2030*. Jusqu'à 64 millions de dollars seront investis en 2019-2020 pour soutenir un vaste éventail de mesures et d'initiatives liées à l'énergie.

COMMUNITY ENERGY USE

How does yours compare?

FORT GOOD HOPE

Thermal Community (Diesel)

Population: 516

Not connected by roads

Not connected by power lines



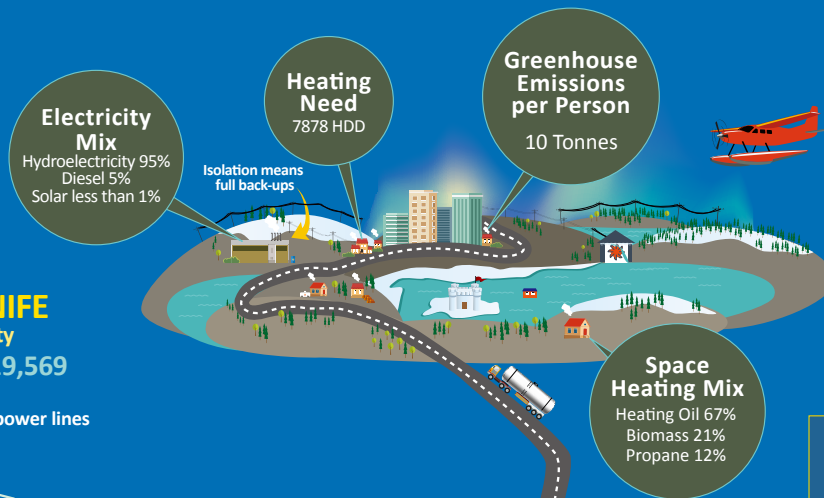
YELLOWKNIFE

Hydro Community

Population: 19,569

Connected by road

Not connected by power lines



60th Parallel

Power lines end

Electricity Mix
Sources of energy used to power buildings

Space Heating Mix
Sources of energy used to heat buildings

Heating Need
Heating Degree Days (HDD) measure how cold a region is. An average house would use about half a litre of oil per HDD

Greenhouse Emissions per Person
The amount of greenhouse gas emitted by a community, divided by its population

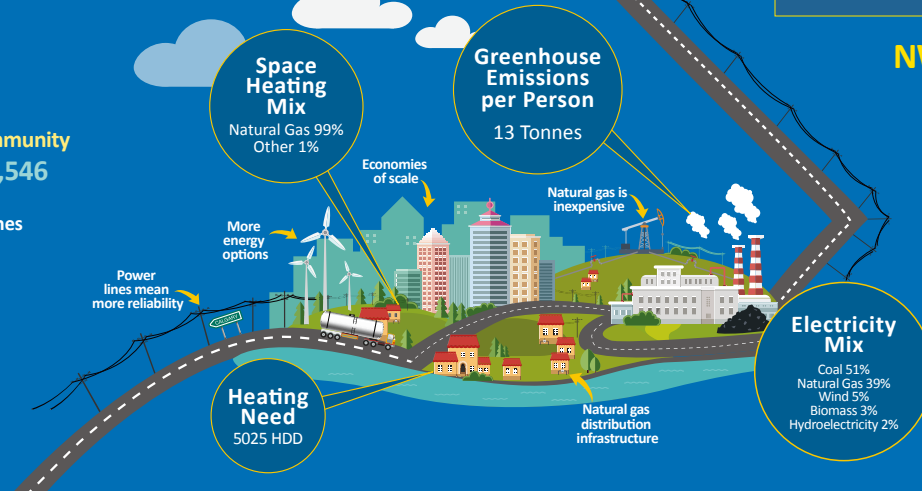
EDMONTON

Grid-Connected Community

Population: 932,546

Connected by roads

Connected by power lines



NWTenergy.ca

INTRODUCTION

The 2018 – 2019 *Energy Initiatives Report (Report)* is a high-level review of the Northwest Territories' current energy situation, and details key energy actions and initiatives that have been undertaken by the GNWT and its partners over the past year. All of these actions and initiatives fall under the *2030 Energy Strategy (Strategy)*, which sets out the GNWT's long-term vision for transitioning to a lower-carbon economy, and the three-year *Energy Action Plan (Plan)*, which details the actions and initiatives to be undertaken to implement the *Strategy*.

To help link energy initiatives with the the strategic objectives in the *Strategy*, this year's *Report* includes graphic icons that identify each strategic objective. Along with providing summaries of all actions and initiatives taken to support the *Strategy*, highlighted initiatives are tagged with the graphic icon(s) that match the strategic objective(s) to which they contribute.

This year's *Report* reflects unprecedented investments made in energy programs, public outreach, energy conservation and efficiency, and renewable energy initiatives that were made available to residents, communities and Governments over the last year. The LOOK AHEAD section outlines how investments in energy are set to increase dramatically in the coming years, strengthening our commitment to reduce our reliance on fossil fuels, to empower Indigenous and community governments to enact local energy solutions, and to build large energy projects that will connect our residents, businesses and industry to clean, reliable energy.



NWT ENERGY SNAPSHOT

ENERGY USE

Energy use in the NWT is different than it is in the rest of Canada. A few large mines and petroleum production comprise the territories' main energy consumers, whereas communities use about 30% of energy produced. Providing reliable and affordable energy to the NWT's many small, isolated communities remains

a constant challenge. Northerners are now turning to alternative energy sources to supplement petroleum products, such as wood for heating and solar panels for electricity. This helps reduce energy costs for individuals and environmental impacts.

Figure 1: 2017 Energy Use by Sector

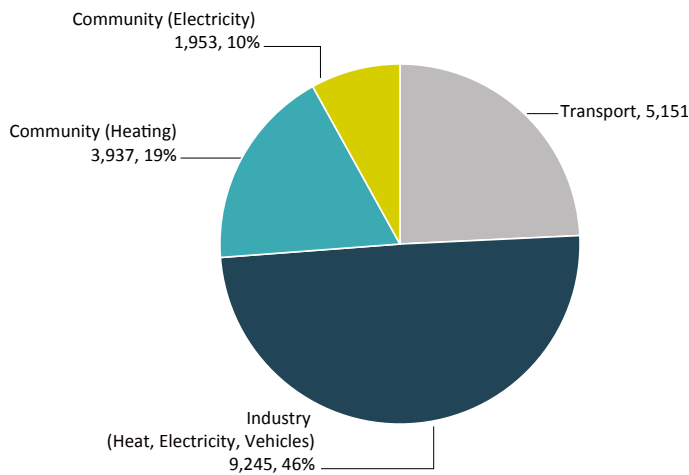


Figure 2: 2017 Energy Use by Sector, Excluding Industry

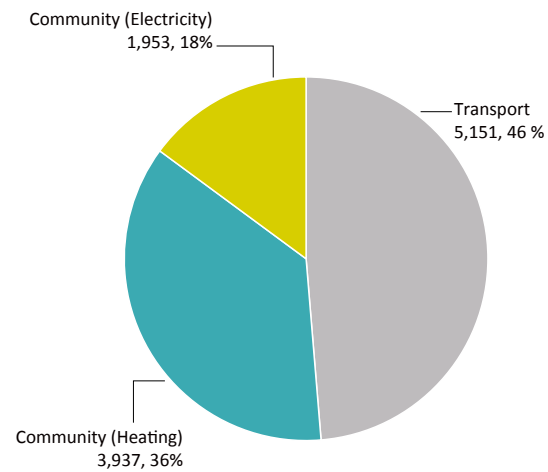
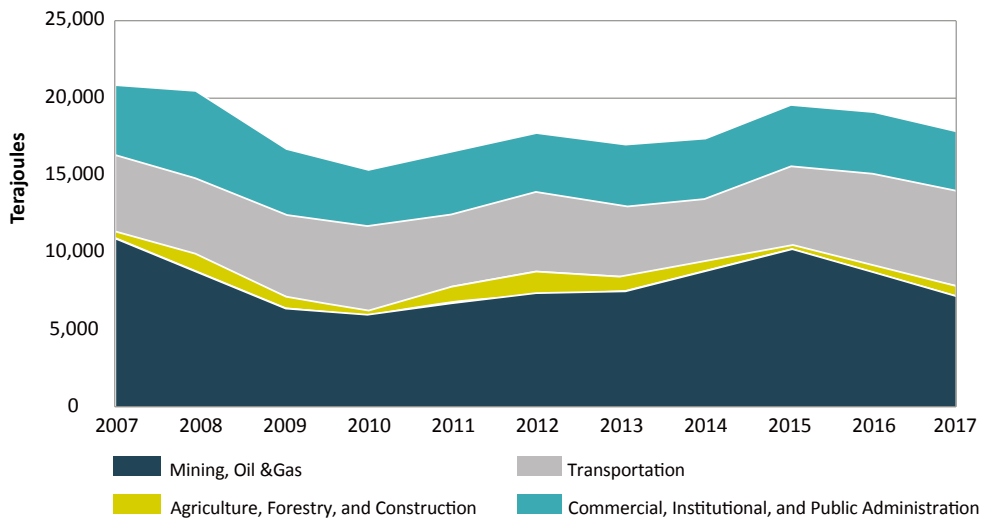


Figure 3: Total Energy Use in the NWT



POWER GENERATION

Most of the power generated for NWT communities comes from hydroelectric facilities, where the energy of flowing rivers is transformed into electricity. Communities not connected to our hydroelectric grid use diesel generators or natural gas to produce electricity. The territories' mines also use diesel generators to produce most of their electricity, with the exception of

one diamond mine that incorporates an on-site wind farm to supplement diesel power generation. Unlike most of Canada, the NWT is not connected to the North American electrical grid. Without access to electricity from the North American grid, each hydro community must have its own source of full scale backup power, adding costs that can affect electricity rates.

Figure 4:

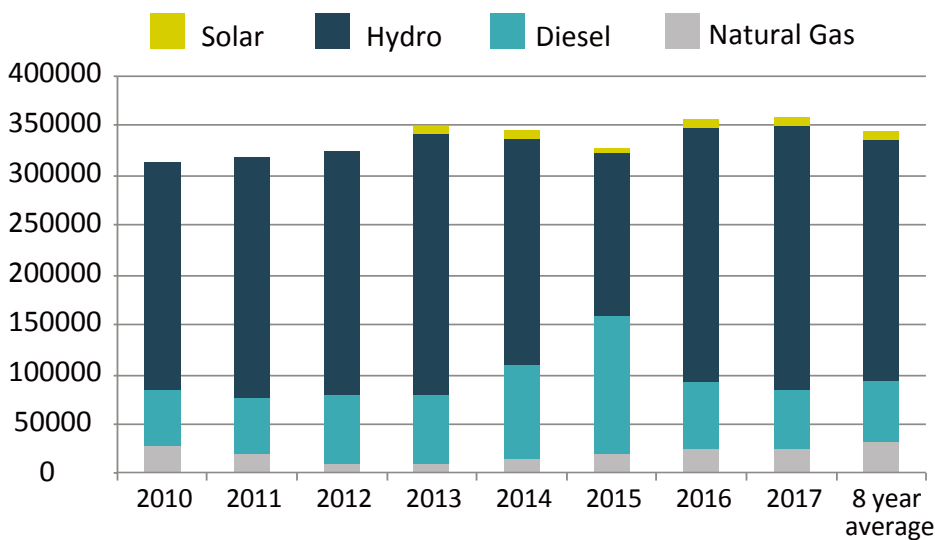
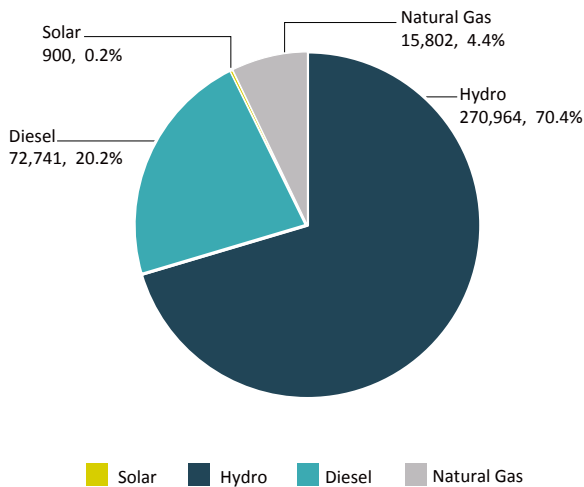


Figure 5: 2017



Did you know?

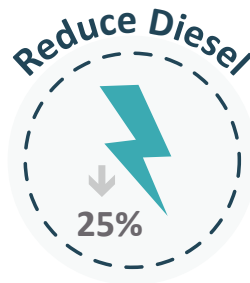
2015 received lower than normal rainfall and hydroelectric production was reduced compared to other years. Back-up diesel increased from a typical 2-5% of annual demand up to 40% of demand in 2014 and 2015 to make up the energy shortfall from low water. However, 2016 and 2017 water levels rose and hydro production returned to normal levels in 2018.

2030 ENERGY STRATEGY

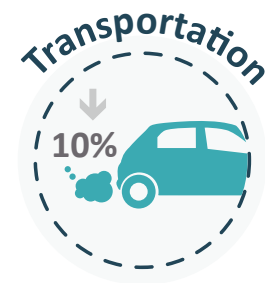
The NWT's *2030 Energy Strategy* (Strategy) sets out the GNWT's long-term approach to supporting secure, affordable and sustainable energy in the NWT. The Strategy has six (6) **Strategic Objectives** to guide decision-makers in reaching its overarching vision by 2030.



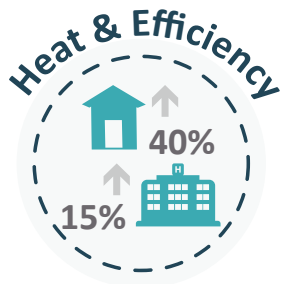
1. Work together to find solutions: community engagement, participation and empowerment.



2. Reduce GHG emissions from electricity generation in diesel powered communities by an average of 25%.



3. Reduce GHG emissions from transportation by 10% per capita.



- 4./5 Increase the share of renewable energy used for space heating to 40%. Increase residential, commercial, and government building energy efficiency by 15%.



6. A longer term vision: develop the NWT's energy potential, address industry emissions, and do our part to meet national climate change objectives.

Addressing climate change is critical, and the strategy promotes energy efficiency and using renewable and alternative energy sources to reduce dependence on fossil fuels. The strategy, along with the Climate Change Strategic Framework, will guide the NWT as

we do our part to help meet national greenhouse gas reduction commitments under the Paris Agreement and the Pan-Canadian Framework on Clean Growth and Climate Change.



ORGANIZATIONAL ROLES IN IMPLEMENTING THE 2030 ENERGY STRATEGY

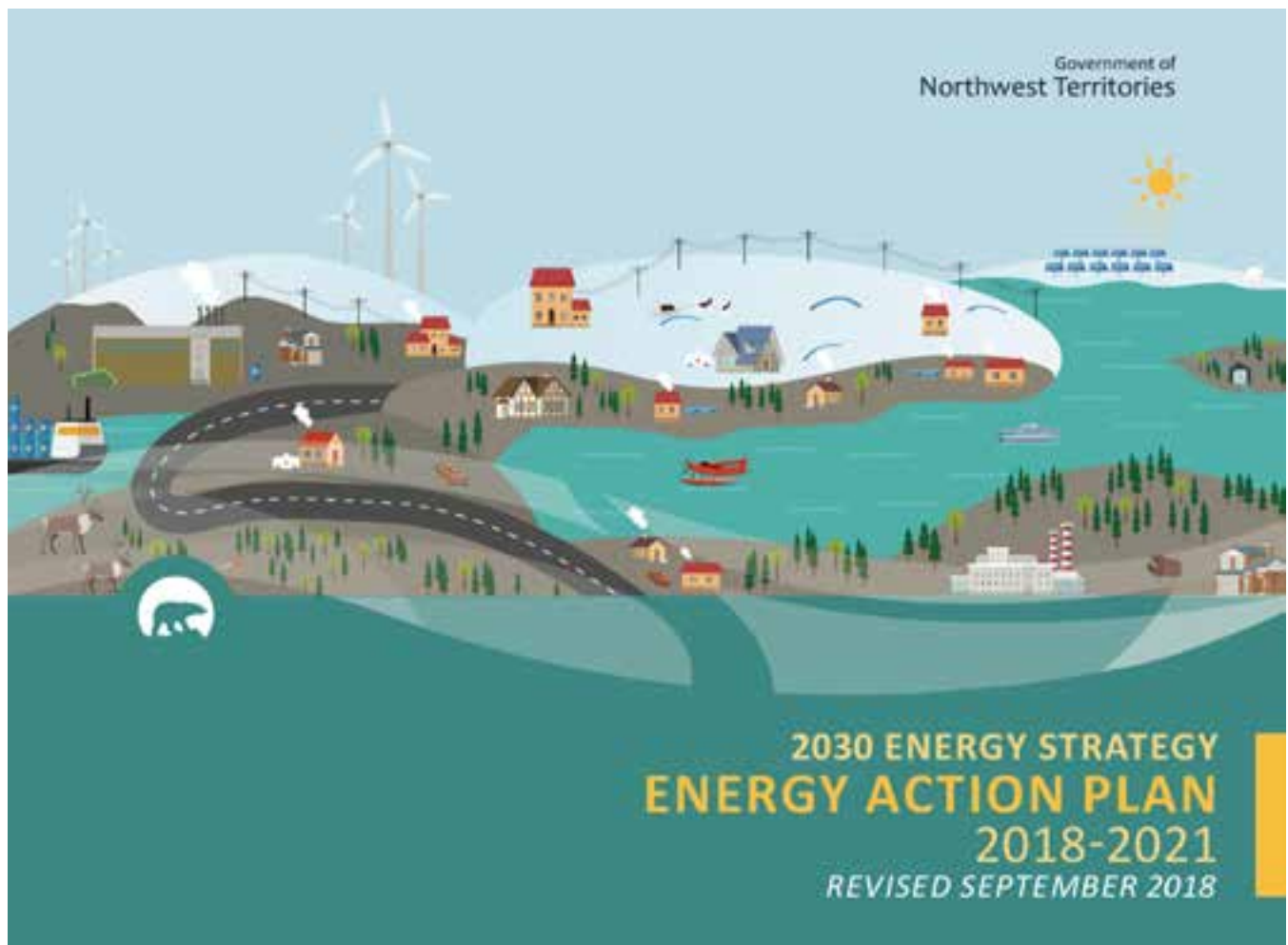
- **NORTHWEST TERRITORIES POWER CORPORATION (NTPC)** is a GNWT crown corporation that owns and operates the NWT's hydroelectric facilities and most of the territory's diesel electricity facilities. Through its capital plan and in partnership with the GNWT, communities and other utilities, NTPC leads the development of renewable and alternative electricity solutions to reduce GHGs from diesel-generated electricity.
- **ARCTIC ENERGY ALLIANCE (AEA)** provides energy efficiency, conservation, alternative and renewable energy programs and services to residents, businesses and communities on behalf of the GNWT. The AEA is one of the primary implementation partners to help the GNWT increase renewables for heating, reduce transportation emissions, and increase energy efficiency.
- **GOVERNMENT OF THE NORTHWEST TERRITORIES (GNWT)—including the DEPARTMENT OF INFRASTRUCTURE (INF) and the NWT HOUSING CORPORATION (NWTHC)**—focuses on reducing energy use and emissions in its operations, including for transportation. The GNWT develops and administers application-based funding programs to support communities, commercial enterprises and industry to reduce energy and GHG emissions. The GNWT also partners with communities and other stakeholders to achieve the strategic objectives of the 2030 Energy Strategy.

2018 – 19 ENERGY ACTION PLAN REPORTING

The GNWT's Energy Action Plan is a three-year plan that sets out the ongoing and annual new **Actions and Initiatives** that the GNWT and its partners are undertaking to achieve the **Strategic Objectives** in the *Strategy*.

SUMMARY OF 2018 – 19 ACTIONS AND INITIATIVES

In 2018 – 19, the GNWT had a successful first year of implementing the Strategy through its three-year rolling Energy Action Plan. Summaries of the actions and initiatives undertaken to support the Strategy's six strategic objectives are listed below.



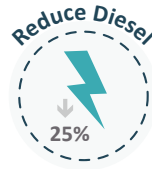


Strategic Objective 1

The GNWT and NTPC engaged with the communities of Fort Simpson, Gameti, Inuvik, Norman Wells and Tulita on a range of energy projects, including community solar in Tulita, the Inuvik Wind Project, and a proposed biodigester project in Gameti. A significant outcome of this engagement was a partnership created between the Tulita Land Corporation and NTPC in the establishment of a Power Purchase Agreement under the GNWT 2030 Energy Strategy's Renewable Electricity Participation Model for Diesel Communities. The GNWT also provided an additional \$70,000 to the Arctic Energy Alliance to support community energy planning, so that communities can better understand the energy options available to them.

To support energy education, literacy and outreach, the GNWT developed eight energy-specific lesson plans for teachers in the NWT that support outcomes in the High School Experiential Science. The lessons examine energy sources used in the NWT and the relationship between fossil fuels and climate change.

The GNWT also secured \$7.2 million under the federal Low Carbon Economy Leadership Fund for application-based GHG reduction projects under the GNWT's GHG Grant Program for Governments. This program was officially launched in October 2018, and provides up to 75% grants to empower community and Indigenous governments to develop their own solutions.



Strategic Objective 2

The GNWT focused on setting the stage to achieve a reduction in GHG emissions from electricity by 25% below historical levels by 2030. This focus paid dividends when the GNWT secured up to \$30 million in funding from the federal government for Inuvik Wind Project, a significant milestone for this key electricity project in the NWT's largest fossil fuel-based community. The GNWT also developed the Inuvik Wind Project's business case, completed technical feasibility work, continued with community engagement and started the procurement and regulatory processes.

To assess the feasibility of installing wind turbines in other communities, the GNWT erected a wind monitoring station in Norman Wells and is continuing to collect wind speed data in Sachs Harbour and at Snare Hydro north of Yellowknife. The GNWT is also currently monitoring a water gauging station installed near Gameti in 2017 – 18, to assess the viability of a mini-hydro project for the community.

Additional federal funding was secured by the GNWT to support the affordability, reliability and sustainability of electricity in the NWT. The GNWT secured \$15 million for a new and more efficient diesel generator in Sachs Harbour that will use less diesel and allow for the integration of wind power should it be feasible, as well as \$10.7 million to fund required upgrades to the Snare Forks hydropower facility, which will reduce pressure on electricity rates.



Strategic Objective 3

Preliminary work to reduce transportation emissions in the NWT included the GNWT and the Arctic Energy Alliance designing an electric vehicle and charging station rebate program to be launched in 2019 – 20. The GNWT secured \$3.8 million in federal funding under the Low Carbon Economy Leadership Fund for the energy retrofit of a GNWT Marine Transportation Services (MTS) tug and two ferries over the next three years. The GNWT will also now support community-based transportation initiatives and energy retrofits for industrial vehicles through both streams (Governments, Buildings & Industry) of the GHG Grant Program.

The GNWT was actively involved in the federal-provincial-territorial Clean Fuel Standards Working Group, provided input into the federal clean fuel standards regulations, and ensured that the NWT's northern and remote energy context was considered by the federal-provincial-territorial Zero Emissions Vehicle (ZEV) Working Group—tasked with developing a strategy to promote the uptake of ZEV in Canada.

The GNWT also examined the technical and economic feasibility of reducing diesel consumption of the Peel River Cable Ferry, by integrating existing diesel generation with onshore solar PV paired with lithium ion batteries and stored on board the ferry. The hybrid system was designed to improve diesel engine efficiency and drive the cable wheel, which pulls the vessel across the river. (Note: Page 25 has further details on this study.)



Strategic Objectives 4/5

Building on our commitment to increase energy efficiency and the share of heating provided through renewable sources, the GNWT secured approximately \$7.1 million under the federal Low Carbon Economy Leadership Fund and contributed an additional \$2 million in GNWT funds to provide the Arctic Energy Alliance with over \$9.1 million in new funding over three years—more than doubling the organization's budget. This funding is being used for a variety of new programs and services, including new support for low income home owners, a deep energy retrofit program, new support to implement community energy plans, an electric heat rebate to take advantage of the reduced rate for electric heating available in the South Slave hydropower system, as well as top-ups to existing rebate programs for energy efficiency and renewable energy for communities, residents and businesses.

The GNWT also secured \$4 million over the next three years to undertake renewable efficiency and energy efficiency upgrades in public housing. The Northwest Territories Housing Corporation set the stage to begin installing a biomass district heating system for 45 public housing units at Sissons Court in Yellowknife, and in future years will undertake efficiency upgrades in other units across the NWT.



Strategic Objective 6

To advance its longer term vision to develop the NWT energy potential and reduce industrial emissions, the GNWT secured almost \$8 million over the next three years to fund the GHG Grant Program for Buildings and Industry. This application-based program can provide 25% grants to larger building owners and industry to undertake GHG emission reduction projects.

For the Taltson Hydroelectricity Expansion Project, the GNWT undertook a conceptual review of the potential for using a high-voltage direct-current power line under Great Slave Lake to connect the North Slave and South Slave hydropower systems. The GNWT secured just under \$2 million to support the Taltson Project last year, which included \$225,000 provided to Indigenous governments to develop capacity to participate in the process.

Most notably, the NWT also secured an \$18 million commitment from the federal government to advance the Taltson Project and fund the engineering and environmental assessment work required before advancing the project.

The GNWT has also supported its partners and undertook work to investigate emerging technologies, including support to the Aurora Research Institute (ARI) for wind monitoring initiatives in Inuvik, Sachs Harbour and Norman Wells. Partnerships were also established with the NWT Association of Communities (NWTAC) to host its Climate Change Forum and Charrette, as well as with the Town of Inuvik to support the Arctic Emerging Energy Technology Conference.

INVESTMENT IN ENERGY

2018 – 19 was a banner year for the GNWT in securing funding for energy initiatives. Under the Low Carbon Economy Leadership Fund (LCEL), the GNWT secured \$31.2 million over four years, including \$8 million over three years for the GHG Grant Program for Buildings and Industry, \$7.2 million for the GHG Grant Program for Governments, and an additional \$9.2 million in combined LCEL and GNWT support for the AEA.

Under the Government of Canada Investing in Canada Infrastructure Program (ICIP), the GNWT secured \$30 million for the Inuvik Wind Project, \$15 million for a new diesel-electric generator in Sachs Harbour, and \$10.7 million for upgrades to the Snare Forks hydropower generator. Late in the year, the GNWT secured a commitment from the Government of Canada for \$18 million to advance the Taltson Hydroelectricity Expansion Project. These projects will help stabilize the cost of energy in the NWT and position the territory for clean economic growth in the future.

ENERGY PROGRAMS AND PUBLIC OUTREACH

GHG GRANT PROGRAM FOR GOVERNMENTS

The GNWT's Government GHG Grant Program is an application based non-repayable grant program designed to support greenhouse gas (GHG) emission reduction projects and initiatives for NWT community governments, municipalities, GNWT departments, and Indigenous governments (including band or tribal councils, land-claim organizations, development corporations and self-governments).

Examples of potential projects include:

- Building energy retrofits
- Biomass boilers and district heating
- Renewable energy for space or water heating
- Non-infrastructure transportation initiatives
- Fuel switching to lower GHG emissions
- Waste-to-energy initiatives
- Methane capture and use
- Energy retrofits to mobile equipment

The GHG Grant Program is funded by Environment and Climate Change Canada's Low Carbon Economy Leadership Fund (LCELFF) and the GNWT. Almost two million dollars in grant money was available for projects in 2018 – 19, with \$7.4 million total available over four years. This fills a gap in funding for larger GHG reduction initiatives. The GNWT provides smaller grants through the Arctic Energy Alliance (next page).



BUILD YOUR GHG SOLUTION

**Have an idea?
Let's talk.**

**GHGgrant@gov.nt.ca
(867) 767-9021**



ARCTIC ENERGY ALLIANCE PROGRAMS

The AEA is a not-for-profit society that works with communities, regulators and policymakers to reduce the costs and environmental impacts of energy and utility services in the NWT. The AEA is funded by the GNWT and provides services through six regional offices across the Territory.

In 2018 – 19, the AEA provided 689 total rebates worth more than \$600,000. Energy evaluations were conducted on 185 homes (23% more than 2017 – 18) to help homeowners find ways to save on energy bills. The AEA partnered with the Hamlet of Sachs Harbour to help residents implement low-cost home retrofits (see page 28), and worked with five other communities to install 55 efficient wood stoves in residential homes. Fifty-four (54) additional stoves were delivered, and will be installed in 2019/20 (see page 47).

Along with \$2.74 million in core funding slated for 2019 – 20, the GNWT is providing an additional \$9.2 million to the AEA over the next four years from the Low Carbon Economy Leadership Fund (LCELF). The AEA developed new and redesigned programs in



Fossil fuel displaced **7,100 GJ**

Annual savings **\$530,000**

GHG reductions **630 tonnes**

Electricity savings **1,500 MW**

See Appendix A for 2018-19 AEA program results.

Go to aea.nt.ca to learn more.

response to this increased funding. Essentially doubling their budget, the AEA will be able to enhance current rebate levels, and launch these new and redesigned programs to enable deep home energy retrofits, provide support for low-income homeowners, promote an electric heat incentive, and install more community wood stoves.



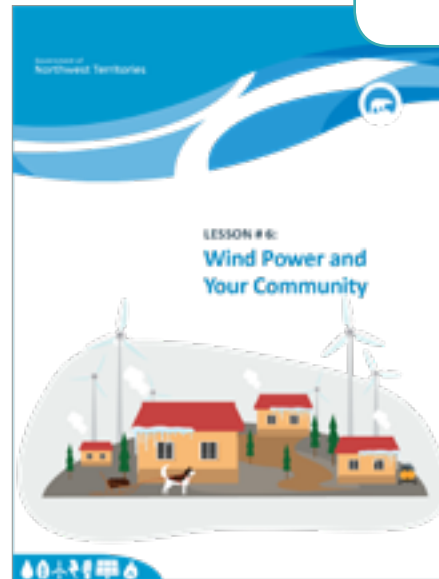
AEA Yellowknife Office



Tlcho Territory Energy Project Coordinator Sonny Zoe (right) and SAO trainee Priscilla Bekale reviewing Gameti's 2018 building energy audit.

NORTHERN ENERGY LESSON PLANS

In support of the 2030 Energy Strategy, supplemental teaching materials were developed for the Northwest Territories Experiential Science Curriculum at the 10, 20 and 30 levels (high school). Eight lesson plans were produced, each one designed to help students and teachers become more familiar with energy issues in the North. Themes addressed in the lesson plans include the effects of energy use on the Earth’s climate system, how electricity and heat are currently produced in the NWT, how renewable energy technologies can reduce our greenhouse gas (GHG) emissions, and how students can calculate their travel emissions and compare them to other types of transportation in the NWT. The supplemental teaching materials will be available to NWT teachers in the fall of 2019, and will also be hosted on the INF and Arctic Energy Alliance websites.



BIOMASS TRAINING



Biomass training session in Yellowknife (Spring 2019).



Biomass heating in the NWT continues to grow, and as federal and territorial programs supporting biomass expand, a need for training was identified. Feedback from owners and operators indicate that the maintenance and general operation of biomass heating systems are more labour intensive and technically challenging than fossil fuel based heating systems. In some cases these challenges have resulted in operators turning off the biomass systems and reverting to the back-up petroleum fuel based system. In response, INF developed and piloted a Biomass Training Course aimed at optimizing the use of biomass boiler systems in the NWT. The course was funded by the federal REACHE program and will be offered through MACA's School of Community Government.

By the end of this training, participants will be able to:

- Identify the benefits of using biomass-fired boilers either exclusively or in conjunction with oil- or propane-fired boilers;
- Recognize the core safety considerations while operating or maintaining a biomass boiler;
- Implement the essential steps to successfully operate a biomass boiler plant;
- Identify the steps to appropriately inspect a biomass boiler plant to ensure safe operation;
- Apply best practice cleaning methods;
- Recognize the required inspection and maintenance procedures; and
- Apply basic troubleshooting methods to common biomass boiler problems.

ENERGY CONSERVATION AND EFFICIENCY

Energy conservation and efficiency is the easiest way to make energy systems and supply more reliable, affordable and sustainable. Energy conservation is any behavior that results in using less energy, such as turning the lights off when you leave a room. Energy efficiency is using technology that requires less energy to perform the same function, such as replacing incandescent light bulbs with LED light bulbs that produce the same light. The following section highlights GNWT initiatives that address energy conservation and efficiency.

STANTON TERRITORIAL HOSPITAL

The new Stanton Territorial Hospital is the largest capital investment in the history of the GNWT. The state-of-the-art building is designed with many energy-efficient features, such as two 1,250 KW biomass boilers that provide 80% of required heat and hot water.

COMMUNITY HOME ENERGY EVALUATIONS AND RETROFITS

Through funding provided by the GNWT, our partners help community homeowners become more energy efficient by conducting information workshops, home energy evaluations, and retrofits.

ENERGY EFFICIENCY ON MARINE VESSELS AND FERRIES

The GNWT's fleet of tugboats and ferries provide opportunities to save fuel and money through conventional retrofits, and to study the feasibility of transitioning marine systems to clean energy alternatives.

CAPITAL ASSET RETROFIT FUND (CARF)

Now entering its second decade, the CARF Program was developed to mitigate rising utility prices and reduce GHG emissions. In 2018 – 19, CARF provided \$3.8 million to optimize GNWT building systems with biomass heating, LED lighting and other energy-efficiency retrofits.





Controlled LED lighting at Stanton Territorial Hospital.

STANTON HOSPITAL

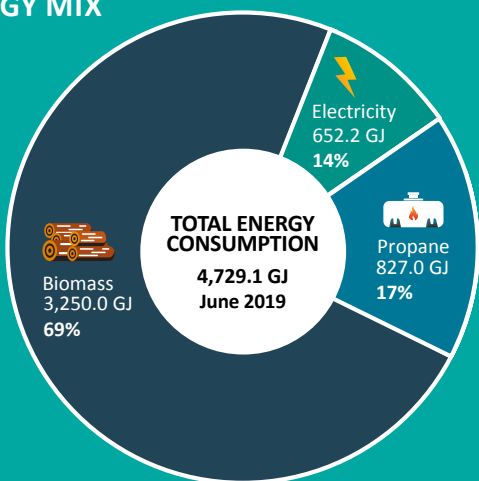
The new Stanton Territorial Hospital has an Energy Use Intensity (EUI) of 586 MWh/M2/year—a 39% reduction improvement compared to the old building. Annual energy consumption is 37% less than required in the 2011 National Energy Code for Buildings, and it will also

be one of the only healthcare facilities in Canada capable of handling the peak heating load with biomass energy. This modern, energy-efficient and patient-centred space is scheduled to open in the summer of 2019, and serve residents of the NWT for the next 30 years.

HIGH-EFFICIENCY BUILDING ENVELOPE

- Roof assembly constructed to minimize heat loss in winter and maintain comfortable temperature year-round
- Nominal R26.8 wall assemblies and R45.6 roof assemblies
- Triple pane, low E argon filled windows

ENERGY MIX



OTHER ENERGY EFFICIENCY MEASURES

- Ventilation Heat Recovery – Incoming air pre-heated by heat from exhausted air
- Variable-speed Drives – Motors on fans and pumps change speed depending on load
- Intelligent Parking Lot Controller – Sense ambient conditions and provide power to connected vehicles as required by the exterior conditions

LED LIGHTING AND LIGHTING CONTROLS

- Provide same illumination
- Longer bulb life
- Easily operated
- Occupancy sensors reduce energy
- Daylight sensors turn lights off



ENERGY MONITORING AND IMPROVEMENT PROGRAM

- Monitors energy use in real-time
- Identifies inefficient processes
- Aids in troubleshooting and maintenance
- Identifies opportunities for improvement
- Displays energy consumption in real-time

HEAT RECLAIM CHILLER

- Takes heat from heat pumps used to cool electrical rooms, freezers and refrigerators, and uses it to pre-heat the low temperature water system

TWO 1,250 KW BIOMASS BOILERS

- Provide 80% of heating and hot water
- Produce 7,000 MWh of annual heating energy
- Reduce GHGs by 1,500 tonnes annually
- Displace 1,000,000 litres of propane annually
- Save \$600,000 annually

SACHS HARBOUR HOME ENERGY RETROFIT PROJECT (AEA)



In 2018 – 19, as part of a two-year pilot project, the AEA partnered with the Hamlet of Sachs Harbour to implement home retrofits designed to reduce energy use, costs and GHGs. The AEA conducted information workshops and home energy evaluations, obtained quotes from contractors, confirmed completed work and conducted post-retrofit evaluations to assess improvement. An evaluation meeting was held with to solicit feedback from community homeowners.

All 10 homeowners participated, and the AEA conducted post-retrofit evaluations on four homes. These retrofits are expected to save 36 gigajoules of energy, 6.5 tonnes of GHGs, and \$2,600 each year. These savings are even higher when factoring in the other six homes, substantial savings for homeowners in such a small, remote community.

SISSONS COURT PUBLIC HOUSING BIOMASS PROJECT (NWT HC)

Using funding from the Low Carbon Economy Leadership Fund (LCELF), the NWT Housing Corporation is moving to remove several existing oil-fired heating systems in a Yellowknife Housing complex and to supply the heat to these units from a central Propane/Biomass heating system.

There are 45 existing units (in 9 buildings) and each unit has an oil-fired furnace, chimney, and exterior fuel storage tank. A new 8 unit building, currently in the design phase will also be heated by this new heating plant.

A Request for Proposals for the design of the propane/ biomass system is being developed. Once the design is complete, tender documents will be issued. The goal is to have the new heating plant fully operating in the fall of 2020.

ENERGY EFFICIENCY ON MARINE VESSELS AND FERRIES



JOCK MCNIVEN ENERGY REFIT

A major overhaul to the GNWT Marine Transportation Service's tug Jock McNiven began in the fall of 2018. The Government of Canada contributed \$2.8 million for the overhaul through ECCC's Low Carbon Economy Leadership Fund. Employing close to 30 people, the midlife refit of the vessel will give it more horsepower and make it more energy efficient, using less fuel and emitting fewer greenhouse gas emissions.

Oil Saved **288,400 Litres**

GHG reductions **808 tonnes**

Annual savings **\$245,140**



FERRY ELECTRIFICATION STUDY

The Abraham Francis Cable Ferry crosses the Peel River about 10 km southwest of Fort McPherson, and operates on diesel engines for 16 hours every day—frequently idling while vehicles are loaded and unloaded. The GNWT studied the merits of converting the ferry to a diesel-electric hybrid, running on batteries for most of the day, and operating the diesel engines at a higher efficiency to charge the batteries for shorter periods. A hybrid design would allow the ferry to operate from diesel or battery power, removing most of the hydraulics and mitigating the risk of an oil spill.

CAPITAL ASSET RETROFIT FUND (CARF)

CARF PERFORMANCE INDICATORS

The Capital Asset Retrofit Fund has steadily increased annual GHG reductions from GNWT assets since its inception. The infographic below shows the past year's GHG reductions (almost 13,000 tonnes) and cost savings resulting from CARF initiatives.

See Appendix B for a list of 2018 – 19 CARF Projects.

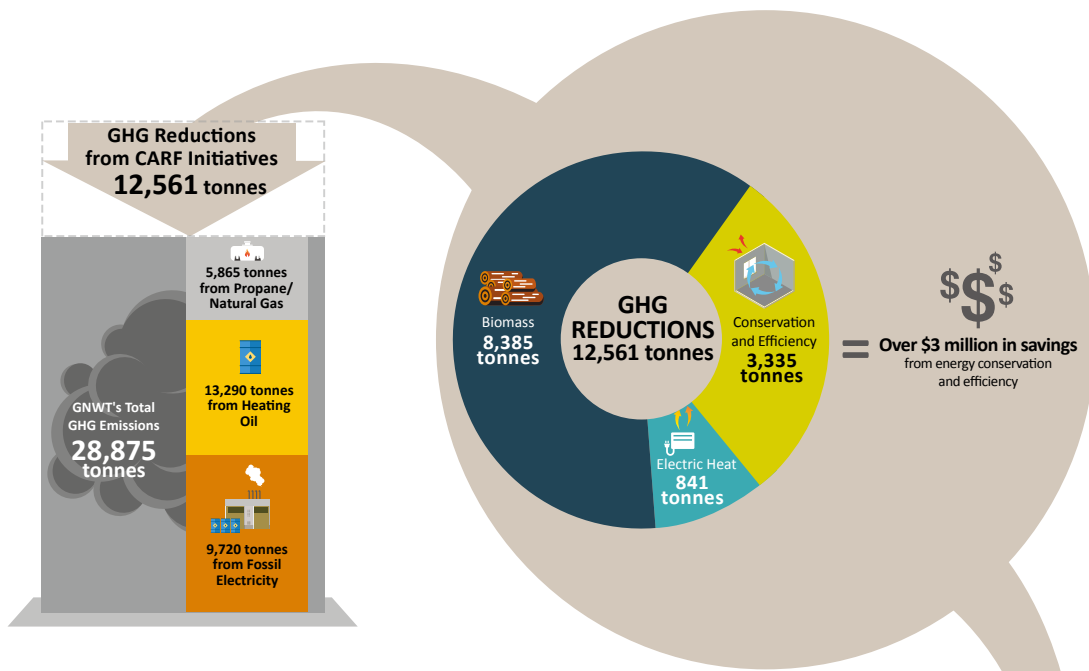
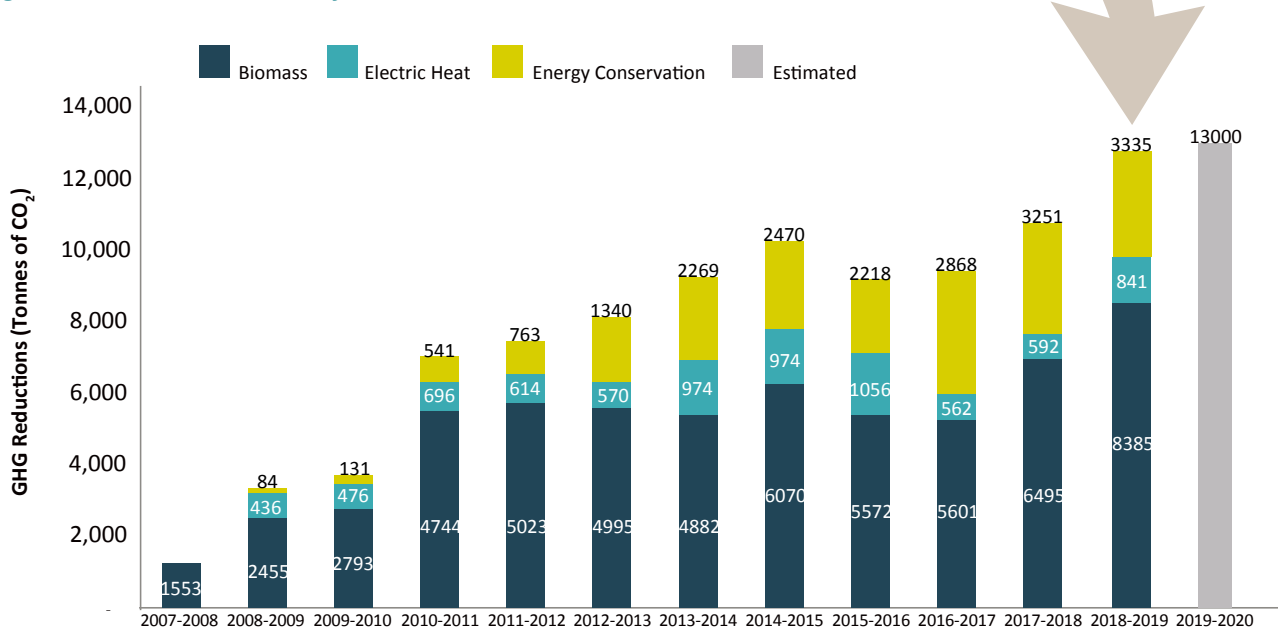


Figure 6: GHG reductions trends from CARF initiatives



INUVIK HOSPITAL BIOMASS (CARF)



Inuvik Regional Hospital

A 1,250kW KOB Viessman wood pellet boiler was installed in the Inuvik Regional Hospital in March 2019. The boiler will burn approximately 1,100 tonnes of wood pellets annually, handling 80% of the heating and domestic hot water load. Biomass will displace 22,000 GJ of natural gas, and offset 1,020 tonnes of GHGs annually.

The installation of the boiler cost \$1.5M. With annual savings of \$90K, the project has an 11.1 year payback. Design of the pad for the silo and pellet offloading area required careful consideration to factor in the unique geotechnical conditions associated with a permafrost environment.



Wood pellet silo at Inuvik Hospital.

Natural gas displaced **20,209 GJ**

GHG reductions **1,017 Tonnes**

Annual savings **\$90,000**

HAY RIVER DISTRICT HEAT PLANT OPTIMIZATION/WOODLAND MANOR TIE-IN (CARF)



Hay River Schools District Heating Plant

A project is underway at the Hay River Schools District Heating Plant to be completed Summer 2019 to optimize the wood pellet boiler. The 900kW Pellet Boiler was installed in 2010 and connected to Diamond Jenness Secondary, Princess Alexandra, Ecole Boreale and Harry Camsell Schools.

The project includes the installation of a thermal storage (buffer) tank, reconfiguring the heat supply piping and tying in the new addition at Woodland Manor. These modifications to the system will increase the load on the boiler and optimize performance through heat storage.

Propane displaced **129,500 Litres**

GHG reductions **197 Tonnes**

Annual savings **\$43,418**

SACHS HARBOUR SCHOOL LIGHTING UPGRADE (CARF)



Inualthuyak School in Sachs Harbour

A lighting retrofit and direct digital controls (DDC) upgrade was completed at the Inualthuyak School in Sachs Harbour. All of the lighting fixtures were replaced with efficient LED lights. The building controls system was upgraded to increase efficiencies of mechanical systems by implementing scheduling for ventilation systems and optimize control of the heating s system. The savings are realized in electricity consumption reductions and ultimately reduced GHG through decreased generator load.



LED Lighting

Generator fuel displaced **20,209 GJ**

GHG reductions **16 Tonnes**

Annual savings **\$36,740**



ECOLIS WILLIAM MCDONALD AND ALLAIN ST-CYR BOILER SYSTEM TIE-IN (CARF)



*Wood pellet boiler
being installed at
Ecole Alain St. Cyr.*

The 540kW Viessman Pyrot Wood pellet boiler installed at Ecole Alain St. Cyr in Yellowknife was recently connected to the William McDonald School heating system located adjacent to EASC on the same site.

In order to increase the load on the pellet boiler during shoulder seasons, and increase the number of days where it would run at 100% load, the William McDonald School heating system has been connected to the biomass system through a heat exchanger. The GNWT will sell heat to YK1 School District when it is available in excess from the pellet boiler. This will increase the boiler output by approximately 1,160 MWh each year which will offset the equivalent of 107,715 litres of fuel oil or 289 tonnes GHG annually.

The boiler should run at full capacity (540kW output) 28% of the year compared to just 1% without William McDonald's heating load. It will also allow the boiler to run an additional 70 days of the year where the load would otherwise be below the lower modulating limit of the pellet boiler. The overall savings would be approximately \$75,000/year.

Fuel oil displaced **107,715 Litres**

GHG reductions **289 Tonnes**

Annual savings **\$75,000**

GNWT BUILDING PRACTICES AND CODES



Rendering of the New Government Building (NGB) in Yellowknife.

BUILDING DESIGN

Part of INF's mission is to provide government departments with safe and reliable facilities that are sustainable and energy efficient. INF incorporates the latest design tools and technology to optimize the useful life of GNWT buildings, including lifecycle costs and comfort level for users.

GOOD BUILDING PRACTICE FOR NORTHERN FACILITIES (GBP)

In 2018 – 2019, the Good Building Practice for Northern Facilities (GBP) Guidelines was updated by INF's Design and Technical Services division to reflect new technologies and environmental changes. Created using the expertise of northern designers and builders from the public and private sector, the GBP is followed for all new builds and retrofits of GNWT facilities, ensuring that government infrastructure is reliable, maintainable and energy efficient.

NATIONAL CODE DEVELOPMENT

To enhance uptake of the GBP's energy efficient design standards and techniques, INF contributes a northern perspective to national code development through the following committees:

- The Canadian Standards Association Technical Subcommittee (studying building energy estimation methodology)
- The Public Infrastructure Engineering Vulnerability Committee (studying the impact of climate change on northern-engineered infrastructure)
- The Building Technology Transfer Forum
- CSA – B365 Code Development
- CSA – Geotechnical Site Investigations for Building Foundations in Permafrost Zones
- Standards Council of Canada – Northern Infrastructure Standardization Initiative

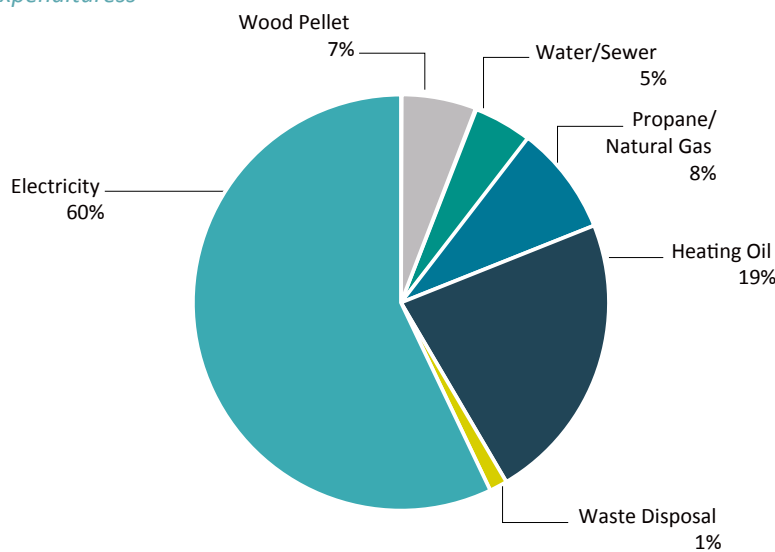
TRACKING GNWT ENERGY USE AND UTILITY COSTS

GNWT ENERGY EXPENDITURES

In 2018/19 the cost of heat and power for GNWT facilities totaled \$30.1 million. Figure 7 below shows that electricity is the largest energy cost for the GNWT,

followed by heating. It should be noted that wood pellet expenditures increased from 5 to 7% in 2018-19 versus the previous year, due to increased biomass heating.

Figure 7: GNWT Utility Expenditures

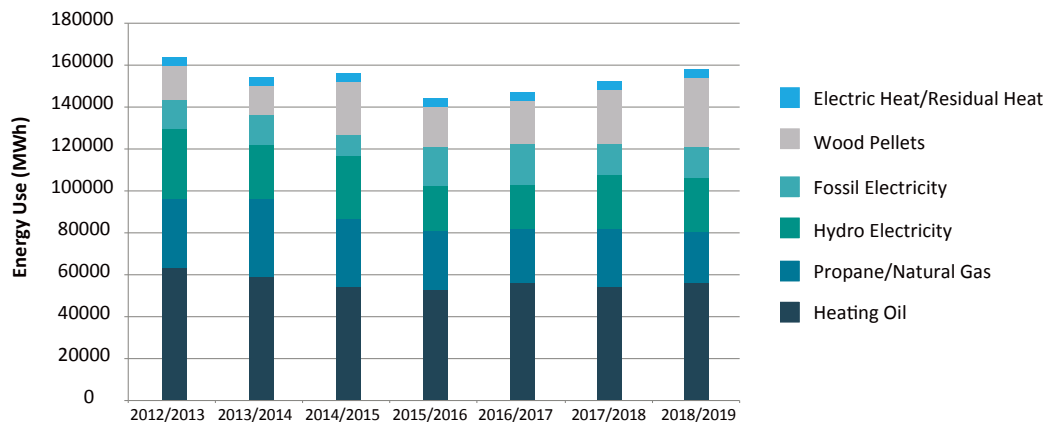


GNWT ENERGY USE

Figure 8 outlines the trend in the GNWT’s total annual energy use by type. Although total energy use has slightly increased from 2017-18, it is important to note that a number of large additions have been made to

GNWT assets in recent years. A return to normal water levels in the NWT’s hydroelectric systems should result in a reduction in fossil fuel-generated electricity in coming years.

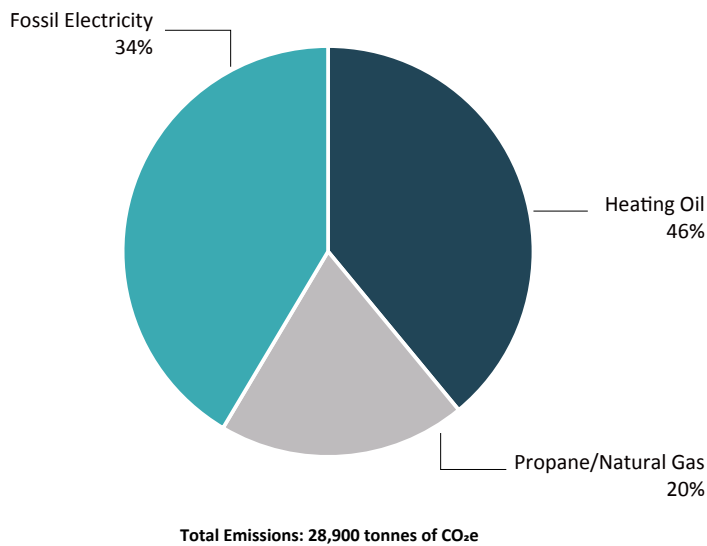
Figure 8: Energy Use by Comparison



GNWT GHG EMISSIONS AND REDUCTIONS

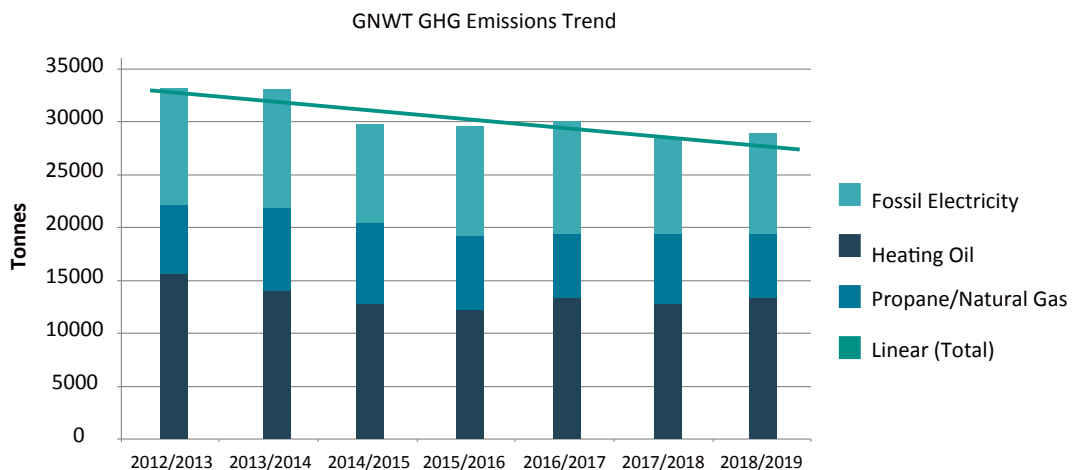
In 2018/19, GNWT buildings were responsible for approximately 28,900 tonnes of greenhouse gas (GHG) emissions from burning fossil fuels for heating and by using electricity generated from fossil fuels (see Figure 9). As a result of GNWT initiatives over the past six years, the GNWT has been able to reduce emissions by almost 12% since 2012/13, or on average about 2% per year or 675 tonnes of GHG (See Figure 10). Please note that data in Figure 10 has been corrected to account for Yellowknife drought conditions.

Figure 9: GNWT Greenhouse Gas Emissions by Energy Type



GNWT GHG EMISSIONS TRENDS

Figure 10: Linear (Total) to GHG Reduction Trend



GNWT SPACE HEATING BY FUEL TYPE

In 2018-19, space heating for GNWT facilities totaled 117,600 MWh. As shown in Figure 11, 32% of this total was provided by renewable electric heat and biomass energy.

This is a 4% improvement from the previous year and the trend towards renewable space heating will continue to increase as existing biomass heating plants are optimized and new ones are installed (See Figure 12).

Figure 11: 2018-19 GNWT Space Heating Energy Sources

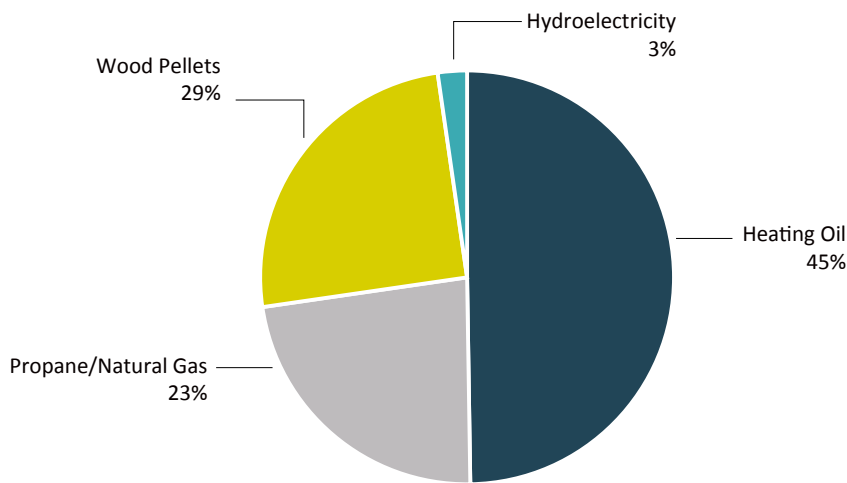
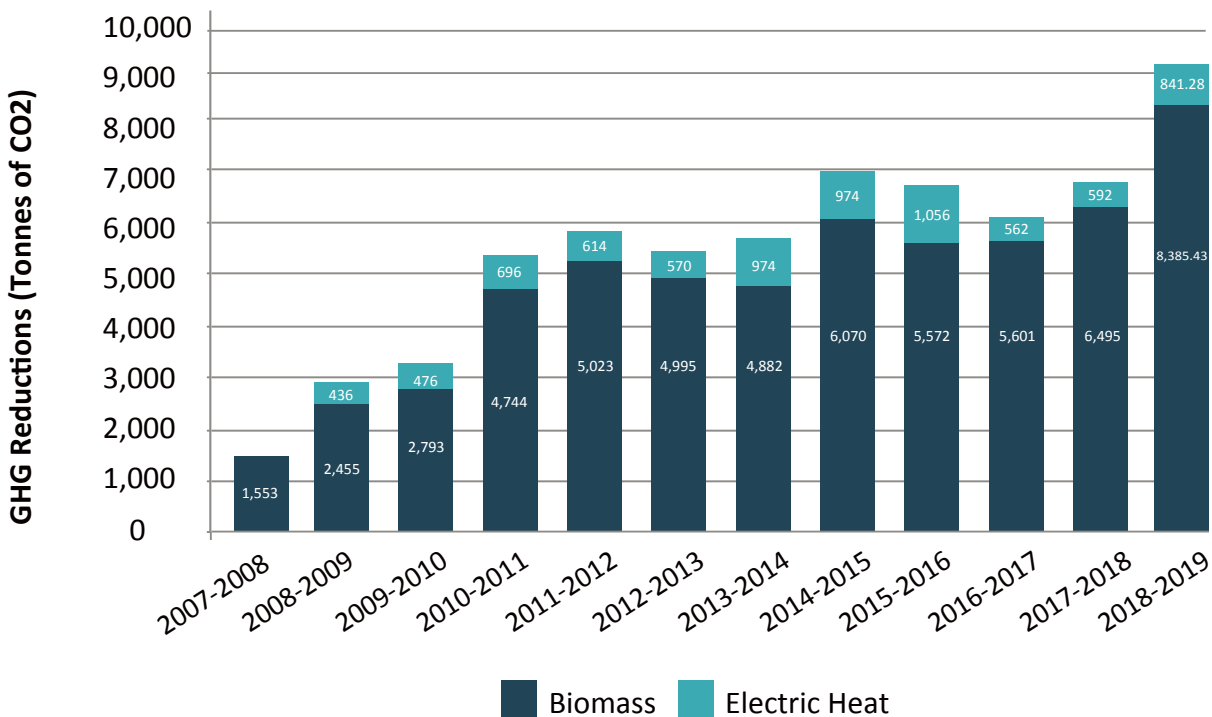


Figure 12: GNWT GHG Emissions Reductions From Renewable Heating



Two 1,250 kW KOB Viessman wood pellet boilers give the Stanton Territorial Hospital a total plant capacity of 2.5 MW, enough to handle 80% of the building's heating and domestic hot water load.



RENEWABLE ENERGY

Renewable energy comes from sources that are naturally replenishing but flow-limited. For example, although inexhaustible, the sun doesn't always shine and the wind doesn't always blow. The NWT currently uses and is developing multiple renewable resources for energy and to reduce GHG emissions.



HYDRO

Most of the NWT's power is generated by hydro energy. The Snare and Bluefish Systems supply the North Slave Region and the Taltson System supplies the South Slave Region. Current hydroelectric development promises to one day provide clean and affordable energy to the resource industry.



BIOMASS

The GNWT installs wood pellet boilers as the primary heat source in its new buildings, while over 20% of the heat produced in NWT communities comes from wood products used in appliances such as wood stoves.



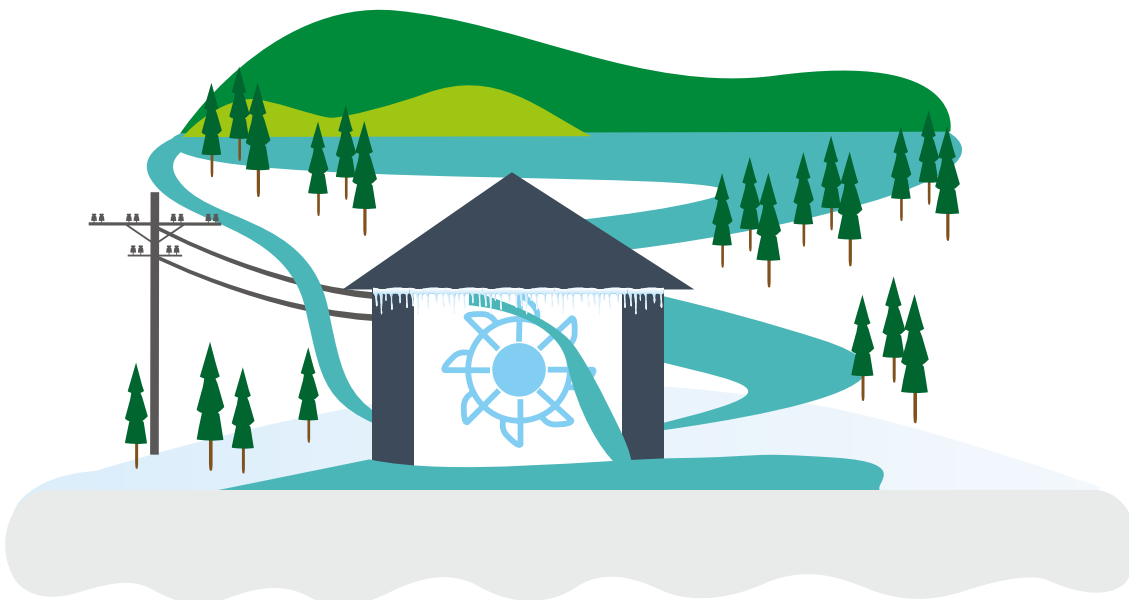
WIND

The GNWT monitors wind potential throughout the Territory that could help remote communities reduce their reliance on fossil fuels to produce power. The Inuvik Wind Project is the first wind turbine project to be developed.



SOLAR

Currently, there are approximately 100 grid-connected solar photovoltaic (PV) systems in the NWT, totaling 900 kilowatts. The GNWT focuses on installing solar power in remote communities, to help reduce reliance on fossil fuels and reduce GHG emissions.





SNARE FORKS REFURBISHMENT



In November 2018, the Government of Canada and the GNWT announced up to \$24.6 million in funding (up to \$14.1 million from the federal government and up to \$10.5 million from the GNWT) for the refurbishment of the Snare Forks Hydroelectric Facility. The first major overhaul since being installed in 1976, this project involves several upgrades at the Snare Forks Powerhouse, including correcting alignment issues with the generation systems of Unit 1 and Unit 2, and addressing issues with the gate mechanism and other components of the generators and turbines.

The Snare Forks Powerhouse is a strategic asset, and this project will improve the reliability of both Snare Forks and the entire Snare Hydro System. In addition to providing electricity to the communities of Yellowknife, Ndilo, Behchoko and Detah, the facility

is also used to handle load swings due to it being “last in line” in the water system, as well as having some storage for either rapid increases or decreases in load which can be met without impacting other generation upstream.

WATER GAUGING STATION IN GAMETI

A water gauging station serving the Rae and Taka Lakes in Gameti was installed in the fall of 2018. The gauging station will measure water flows to determine the potential for a future hydro project.

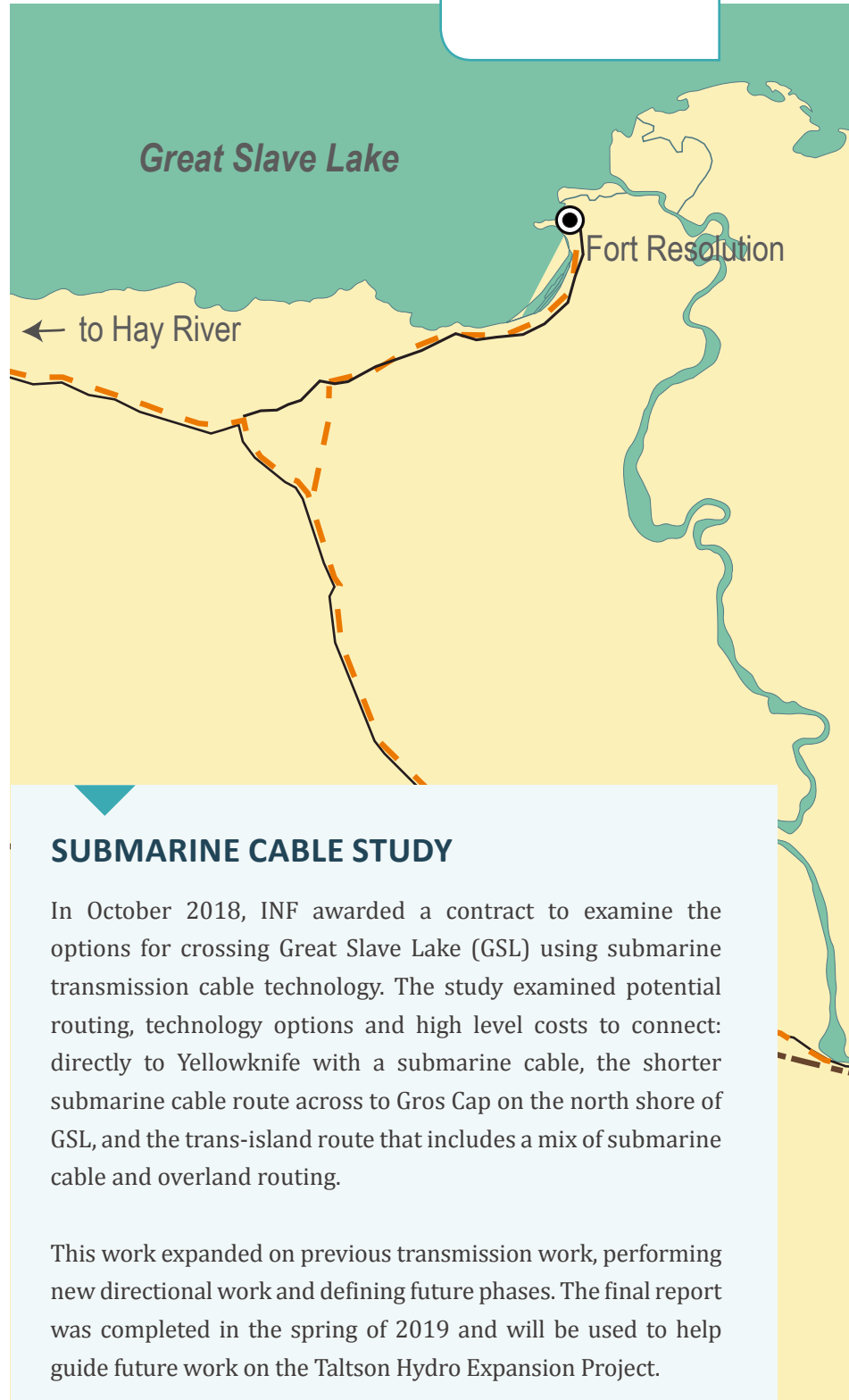


TALTSON HYDROELECTRICITY EXPANSION PROJECT

In January 2019, the Canadian Northern Economic Development Agency (CANNOR) announced \$480,000 in funding for the Taltson Expansion Project, with a corresponding GNWT contribution of \$120,000, as well as \$619,950 from Crown Indigenous Relations and Northern Affairs Canada (CIRNAC). A further \$880,000 was provided by CIRNAC at the end of March 2019 to support work in 2019 – 20.

As part of Budget 2019, announced on March 19, 2019, the federal government allocated \$18 million over three years to the NWT to advance the Taltson Expansion Project. Funding is expected to flow in the form of a grant from CIRNAC.

INF is implementing feasibility work that includes a technical work plan on transmission routing options and supporting our Indigenous partners (Northwest Territory Métis Nation, Salt River First Nation, and the Akaitcho Territory Government) to participate in defining the project structure and business case and guiding upcoming field work.



SUBMARINE CABLE STUDY

In October 2018, INF awarded a contract to examine the options for crossing Great Slave Lake (GSL) using submarine transmission cable technology. The study examined potential routing, technology options and high level costs to connect: directly to Yellowknife with a submarine cable, the shorter submarine cable route across to Gros Cap on the north shore of GSL, and the trans-island route that includes a mix of submarine cable and overland routing.

This work expanded on previous transmission work, performing new directional work and defining future phases. The final report was completed in the spring of 2019 and will be used to help guide future work on the Taltson Hydro Expansion Project.





INUVIK WIND PROJECT



On November 13, 2018, Infrastructure Canada and the GNWT announced \$40 million in funding for the Inuvik Wind Project, with \$30 million in federal funding and \$10 million in GNWT funding.

The GNWT has tasked the NWT Energy Corporation (03) Ltd (NTEC) with delivering the project while providing ongoing community and engagement support and project management of the access road being delivered by the GNWT. Construction will be a phased installation process with key elements (such as the road, battery system and transmission line) coming first to allow time for the turbine and blades to be ordered, built and shipped to site. NTEC will focus on the delivery of the road and the wind turbine.

NOTE: A filing was made with the Gwich'in Land and Water Board (GLWB) on October 30, 2018. The GLWB extended the deadline for comments to February 28, 2019 to allow parties more time to review the submission. Extension of the review period meant no road construction could take place prior to the summer 2019 construction season. Other work with NTEC—including regulatory applications and advanced design and procurement—commenced in 2018.

GNWT is now focused on addressing specific engagement requirements identified by the GLWB. Once NTEC submits the additional engagement information, the GLWB will determine if the Land Use Permit/Water License should be approved or if the project should be referred to an environmental assessment.



NORMAN WELLS WIND STUDY



In the spring of 2019, the GNWT—working with the Aurora Research Institute (ARI)—installed a 60-metre wind-monitoring tower alongside the Mackenzie River in Norman Wells. The tower was purchased last year with funds from the federal government’s Northern Responsible Energy Approach for Community Heat and Electricity (REACHE) program, and uses heated and unheated sensors to measure wind speed and direction at different heights.

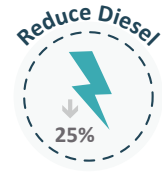
The wind speed monitoring tower was installed close to the Imperial Oil (IOL) site. IOL supported the project by providing power to supply the heated sensors and the tower beacon light. The tower will gather wind speed data at the site for the next two years to determine the feasibility of a wind turbine project in the community.

60-metre wind-monitoring tower being raised in Norman Wells.





SACHS HARBOUR WIND STUDY



Remote renewable hybrid system, aka the Green Cube, monitoring wind in Sach's Harbour.

The GNWT is monitoring the wind resource in Sach's Harbour in hopes of integrating it into the community's diesel plant. The wind-monitoring tower that was erected requires a continuous source of power, a challenge in the High Arctic. Tugliq Energy provided a third-party power source called the Green Cube, a wind/solar/battery/diesel hybrid system designed to operate in remote conditions. In the first winter of operation, one of the wind turbines was destroyed in high winds, and cold temperatures caused the batteries to fail.

Adding to this year's challenges was the inability to change the oil in the diesel generator, due a lack of local maintenance staff. This caused Tugliq staff to travel from Montreal to Sach's Harbour twice to deal with maintenance issues.



COMMUNITY WOOD STOVE PROJECT (AEA)



*Mary Flunki from Whati
with her new wood stove.*



Under its community wood stove projects, the AEA typically forms a two-year partnership with each participating community, where each partner has designated roles and responsibilities and provides 50 percent of the funding for new stoves. In the first year, the stoves and related materials are purchased and delivered to a community. The second year involves the code-compliant installation of the stoves and related materials in the homes of local residents.

The goals of the project are to:

- increase wood burning safety by supporting code-compliant installations
- reduce particulate emissions in smoke from wood stoves
- increase local capacity around wood harvesting and seasonal local employment
- increase wood burning efficiency by installing EPA-certified wood stoves

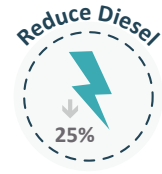
In 2018/19, the AEA took part in two community wood stove projects. The first, funded by the GNWT Department of Infrastructure and the Government of Canada, began this fiscal year. The AEA partnered with the Tlicho Government and each of the Tlicho community governments in Behchoko, Gameti, Wekweeti and Whati. The AEA then had home assessments completed and arranged for a total of 54 stoves to be delivered to the four communities. The stoves will be installed in the 2019/20 fiscal year.

The second project was funded by Crown Indigenous Relations and Northern Affairs Canada, under its Northern REACHE program, and started in the 2017/18 fiscal year. In 2018/19, the AEA completed the project, arranging for 55 stoves to be installed in five communities (Behchokò, Deline, Gamètì, Wekweèti and Whati).

(see Conservation and Efficiency section for more biomass projects)



WHATÌ SOLAR PV SYSTEM



9-plex Senior's Centre in Whatì.

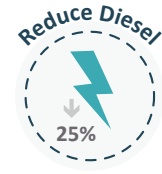
The Northwest Territories Housing Corporation (NWT HC) installed a roof mounted 20kW solar photovoltaic system at a 9-plex senior's centre in Whatì. In total there are 42 solar panels on the roof of the complex. The system will reduce 17.8 tonnes of GHGs per year.



Solar panels (42 in all) on the roof of Whatì Senior's Centre.



AKLAVIK VARIABLE-SPEED GENERATOR WITH SOLAR PV



Variable-speed generator in SeaCan housing, bound for Aklavik.

The Northwest Territories Power Corporation—in cooperation with the GNWT—is committed to exploring new technologies that will reduce diesel consumption and GHG emissions. In February 2018, NTPC began a one-year pilot project in the community of Aklavik, using a variable-speed generator (VSG) that will integrate intermittent energy from the 55 kilowatt solar array built by the GNWT in 2017.

The use of renewables in the NWT is currently limited to 20% of a community's average electrical load. In electricity systems powered by a fixed-speed generator, renewables (intermittent power) can cause wide swings in generation capacity, decreasing the system's stability and increasing the chance of outages. Variable-speed systems absorb input fluctuations by changing their speed, creating a smoother power output and using less fuel when electricity load demand drops.

The first phase of the Aklavik project was to test the performance of the VSG. Based on the analysis of the benefits, the second phase would then determine if there is merit in testing VSG with high penetration solar. Results were inconclusive in terms of fuel efficiency based on preliminary analysis. Lessons learned from both the Aklavik VSG and Colville Lake high penetration hybrid solar diesel plant paired with Lithium ion batteries will be applied to future project opportunities.

Information from ongoing analysis of the VSG performance in Aklavik will be very useful to NTPC. For example, the Northern Energy Innovation (NEI) of Yukon College has started a grid stability study in Aklavik that will, in part, develop a model for theoretical analysis of VSG performance in high penetration renewable scenarios.

A LOOK AHEAD

In the next three years (2019 to 2022), the GNWT and its partners will spend up to \$227 million on actions and initiatives that support the *2030 Energy Strategy's* six Strategic Objectives. Up to \$64 million will be invested in 2019 – 20 to support energy investments, some of which are highlighted below. For a comprehensive list and more detailed descriptions, please refer to the *2019 – 22 Energy Action Plan*.

TALTSOON HYDROELECTRICITY EXPANSION NEXT STEPS

The GNWT will continue feasibility work in 2019 – 20 that will include a technical work plan on transmission routing options, submarine cable options, as well as supporting capacity-building with our Indigenous partners (Northwest Territory Metis Nation, Salt River First Nation and the Akaitcho Territory Government) to establish the business structure of the project. We will also be mapping the regulatory framework, and planning engagement sessions, including traditional knowledge and land-use workshops.

ENHANCED PROGRAMS FOR THE ARCTIC ENERGY ALLIANCE

For 2019 – 20, the GNWT will provide \$2.274 million in funding to the AEA to provide energy and efficiency and conservation programs and services to residents, businesses and community governments. Along with enhanced ongoing programs, the following new programs will be offered:

- Deep Home Energy Retrofit Program – for upgrading insulation, air sealing, windows and heating systems;
- Non-profit Energy Efficiency and Conservation Program – for improving institutional, commercial and industrial buildings to save on

heating fuel, electricity and water;

- Low-income Home Energy Efficiency Project – for energy education and energy-saving kits for low-income homeowners in partnering communities; and
- South Slave Electric Heat Incentive Program – to increase electric heating systems in the communities of Enterprise, Fort Smith, Fort Resolution, Hay River and Kátł'odeeche

GHG GRANT PROGRAM FOR BUILDINGS AND INDUSTRY

In 2019 – 20, the GNWT will continue to work with Environment and Climate Change Canada to launch the final stream of the GHG Grant Program, making businesses, industry and large building owners eligible for grant funding for emission reductions projects in the NWT.

The GHG Grant Program for Buildings and Industry will secure up to an additional \$32 million in emission reduction projects and will potentially yield up to 10,000 tonnes of reduced emissions by the end of program. It is expected that this program will be available in the Spring of 2019.

TRANSMISSION LINE PROJECTS

The GNWT will assess and update the cost estimates to advance new transmission line projects (Whatì, Fort Providence/Kakisa) in 2019 – 20. Regional engagement and consultation with our Indigenous partners will be initiated, and field work—including ground-truthing and environmental baseline studies—will be undertaken for transmission line routing and to prepare for regulatory filings.



APPENDIX A – ARCTIC ENERGY ALLIANCE REPORTING

Alternative Energy Technologies Program			
Metric	Commercial	Residential	Community-based
Number of Rebates and Technology Type	1 biomass boiler 10 solar PV	20 solar PV	1 solar PV
Communities Receiving Rebates	Deline – 1 Fort Simpson – 1 Paulatuk – 1 Yellowknife and area – 5 Remote – 3	Yellowknife and area – 19 Remote – 1	Yellowknife and area – 1
Total Rebate Amount	\$97,000	\$56,000	\$13,000

Energy Efficiency Incentive Program			
Region	Number of Rebates	Rebate Amount	Estimated Annual Greenhouse Gases Avoided (Tonnes)
Beaufort–Delta	85	\$8,000	34
Dehcho	60	\$17,000	53
North Slave	345	\$143,000	260
Sahtu	39	\$1,500	5.4
South Slave	81	\$39,000	110
Tlicho	10	\$4,700	4.6
Total	620	\$213,000	465

Commercial Energy Conservation and Efficiency Program Results

Metric	Totals
Number of Rebates	31
Rebate Amount	\$160,000
Estimated Annual Savings	\$210,000
Estimated simple payback	2.9 years
Estimated annual electricity consumption avoided	810,000 kWh
Estimated annual greenhouse gas increase*	29 tonnes
“Yardstick” building energy audits	8
“Targeted” building energy audits	7
Potential annual savings identified from targeted audits	\$43,000

*Most rebates under this program were for LED lighting retrofits. Converting to LEDs uses less electricity, but requires the use of slightly more heating fuel, since LEDs produce less heat than incandescent or fluorescent lighting. In communities that use hydroelectricity, this creates a small increase in greenhouse gas emissions.

Community Government Building Energy Retrofit Program Results

Metric	Totals
Number of rebates	6
Rebate amount	\$87,000
Estimated annual savings	\$61,000
Estimated simple payback	2 years
Estimated annual electricity consumption avoided	63,000 kWh
Estimated annual greenhouse gases avoided	90 tonnes
“Yardstick” building energy audits	19
“Targeted” building energy audits	19
Potential annual savings identified from targeted audits	\$280,000

APPENDIX B – CAPITAL ASSET RETROFIT FUND (CARF) PROJECTS

FACILITY	LOCATION	DETAILS
North Slave Region		
William McDonald School	Yellowknife	EASC Biomass boiler system tie-in to William McDonald School Boiler Plant. Project to be complete May 2019
Combined Services Building	Yellowknife	Biomass Plant optimization – thermal storage installation and controls tie-in. Project to be complete April 2019
Combined Services Building	Yellowknife	LED Lighting upgrades of building exterior and parking lot lighting. Project complete.
Various lighting retrofits	North Slave	LED lighting upgrades for GNWT buildings in Whati, Lutsel'ke and Wekweeti. Project complete
Ecole Alain St. Cyr	Yellowknife	540 kW biomass boiler installed. Project complete October 2018.
South Slave Region		
School Biomass District Heating Plant - Woodland Manor	Hay River	Biomass Plant optimization – thermal storage installation and tie-in to Woodland Manor Long Term Care Facility. Project to be complete summer 2019
Ft. Simpson Health Centre	Ft. Simpson	Building LED Lighting retrofit. Project to be complete summer 2019
Wrigley Health Centre	Wrigley	Building LED Lighting retrofit. Project to be complete summer 2019
Beaufort Delta		
Moose Kerr School	Aklavik	Design of a Biomass Boiler Plant at the school. Construction to begin fall 2019.
Inuvik Hospital Biomass	Inuvik	Design and Installation of a 1250kW biomass boiler at the Inuvik Hospital. Project to be completed May 2019.
Sahtu		
Chief Ts'elehye School	Ft. Good Hope	Building LED Lighting retrofit. Project to be complete summer 2019.

APPENDIX C – COMPLETED BIOMASS BOILERS

FACILITY	LOCATION	DATE COMPLETED	SIZE (KW)
Inuvik Hospital	Inuvik	May 2019	1250
ENR Lab/Warehouse	Fort Simpson	March 2019	40
Ecole Alain St. Cyr	Yellowknife	October 2018	540
School	Tulita	March 2017	150
School	Fort Good Hope	March 2017	200
Prince of Wales Northern Heritage Centre	Yellowknife	March 2016	300
Airport Terminal Building	Yellowknife	November 2015	400
Health Centre	Hay River	November 2015	1200
Deninu School	Fort Resolution	October 2015	212
Health Centre	Fort Providence	July 2015	75
GNWT Office Building	Yellowknife	December 2014	650
Combined Services Building	Norman Wells	October 2014	212
Mackenzie Mountain School	Norman Wells	October 2014	212
Airport Terminal Building	Norman Wells	October 2014	159
*Health Centre	Fort McPherson	September 2014	
*Behchokò Longterm Care Facility	Behchokò	March 2013	540
Deh Gah School	Fort Providence	March 2013	300
Combined Services Building	Yellowknife	October 2012	540
Central Heating Plant	Fort Simpson	October 2012	823
Elizabeth Mackenzie School	Behchokò	October 2012	540
St. Josephs Secondary School	Yellowknife	November 2011	540
Health Centre	Fort Smith	November 2011	750
Central Heating Plant	Hay River	November 2010	900
Thebacha College	Fort Smith	November 2010	750
Legislative Assembly Building	Yellowknife	October 2010	300
Highways Maintenance Garage	Hay River	October 2010	300
Paul William Kaeser School & Recreation Complex	Fort Smith	October 2010	750
Chief Jimmy Bruneau	Behchokò	October 2009	750
Kalemi Dene School	N'Dilo	September 2009	69
*North Slave Correctional Facility	Yellowknife	November 2006	1,500
*Sir John Franklin	Yellowknife	June 2005	750

 Projects completed in 2018 – 19.

(*) purchased biomass heat for these facilities from a third party.

