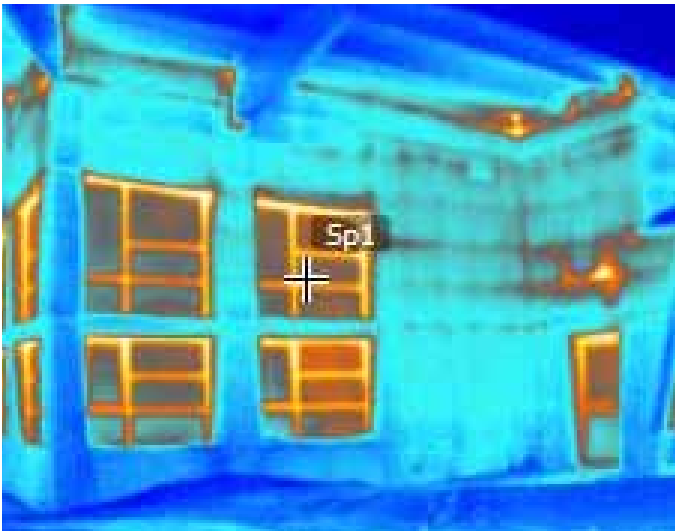


Public Works and Services Energy Conservation Projects

ANNUAL REPORT 2014-2015





If you would like this information in another official language, call us.

English

Si vous voulez ces informations en français, contactez-nous.

French

Kĩspin ki nitawih̄tĩn ē nĩh̄iyawih̄k ōma ācimōwin, tipwāsinān.

Cree

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Tłıchq

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Chipewyan

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South Slavey

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North Slavey

Jii gwandak izhii ginjik vat'atr'ijahch'uu zhit
yinothan ji', diits'at ginohkhi.

Gwich'in

UVANITTUAQ ILITCHURISUKUPKU INUVIALUKTUN, QUQUAQLUTA.

Inuvialuktun

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Inuktitut

Hapkua titiqqat pijumagupkit Inuinnaqtun, uvaptinnut hivajarlutit.

Inuinnaqtun

Official Languages Division: (867) 920-6484
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Minister's Message



Throughout the life of the 17th Legislative Assembly, the Government of the Northwest Territories has maintained a strong focus on energy conservation and renewable energy initiatives in support of our stated goals of reducing dependence on fossil fuels and addressing greenhouse gas (GHG) emissions associated with the operation of our public infrastructure.

The 2014-2015 Public Works and Services Energy Conservation Projects Report is a retrospective look at what the GNWT has achieved through its investments in energy conservation and renewable energy initiatives over the past five years and highlights important changes we have made as a government to support this work going forward.

Some of the GNWT's major achievements highlighted in the 2014-2015 Energy Conservation Projects Report include:

- Establishment of the Capital Asset Retrofit Fund Program and Energy Priorities Investment funding to support ongoing initiatives in energy conservation and alternative renewable energy solutions to reduce our dependence on fossil fuels.
- Creation of energy performance guidelines for all new GNWT public buildings to exceed the requirements of the Canadian National Energy Code for Buildings.
- Achieving real operational savings of \$8 million over the past five years.
- Reduction of our fossil fuel use by 3.5 million litres annually (equivalent to 9,500 tonnes of GHG emissions) through alternative renewable energy sources such as hydroelectric power and biomass.
- Support of renewable energy heating solutions, installing 22 biomass plants and small scale district heating systems for major public buildings.
- Promotion of renewable biomass energy technology throughout much of the North with plans to explore new opportunities in the Beaufort Delta starting in 2015-2016.
- Establishing a focal point for GNWT energy initiatives and programs within the department of Public Works and Services for energy policy and energy solutions.

Our investments in renewable energy and a continued focus on energy conservation and efficiency are substantially contributing to how we manage the impacts of our increasing energy demands, as well as meeting our objectives for reducing our GHG emissions. Without the investments in energy conservation and renewable energy over the past 5 years, the GNWT would have experienced a 28% increase in the amount of heating fuel and a 5% increase in total energy used in 2014-2015.

On behalf of the department of Public Works and Services, I am pleased to present the 2014-2015 Energy Conservation Projects Report and I look forward to our new corporate role in energy policy, planning and solutions in support of the GNWT.

The Honourable
Tom Beaulieu
Minister of Public Works and Services



Table of Contents

Minister’s Message	i
Executive Summary	1
Introduction.....	3
Our Mission.....	3
The Challenges.....	3
Looking Ahead – “The New PWS”	4
Annual Operational Cost and Energy Use Review	5
Energy Conservation Initiatives	9
Capital Asset Retrofit Fund	10
Biomass	11
Energy Efficient Design.....	13
Performance Indicators	16
Greenhouse Gas Emission Reductions.....	16
Energy Reductions	17
Utility Cost Savings.....	18
Conclusion.....	19
Moving Forward with Energy Efficiency	19



Executive Summary

Energy conservation and the management of non-renewable energy use associated with the operation of our public buildings continue to be a priority for the Government of the Northwest Territories (GNWT). As the asset manager for the majority of GNWT's building infrastructure, the department of Public Works and Services (PWS) is uniquely positioned to implement energy initiatives for GNWT facilities in support of government goals and priorities which aim to reduce our reliance on imported fossil fuel and greenhouse gas emissions (GHG).

This fifth edition of the PWS Energy Conservation Projects Report highlights the results of our energy investments over the past five years and provides an update on those energy projects that were initiated in 2014-2015. As such, the 2014-2015 report serves as a five-year retrospective review of the successes and accomplishments the GNWT has achieved in the management of our energy consumption, investment in alternative renewable energy sources and reduction of our GHG emissions.

Highlights from energy-related initiatives in 2014-2015 include:

- Three new biomass systems in the North and South Slave Regions
- Three new biomass boiler systems put into service in Norman Wells
- Multiple high bay LED lighting projects across the NWT
- The installation of a five kilowatt solar photovoltaic system at the Gamèti Health Station
- A number of heating and ventilation optimization projects
- The commissioning of new energy efficient assets such as the office building in Yellowknife and health centre in Fort Providence

Operational savings resulting from energy conservation activities totalled \$2 million in 2014-2015, bringing the overall savings to government since it began tracking and prioritizing energy conservation initiatives to nearly \$8 million. These activities have reduced energy usage in major assets such as schools by up to 15% and overall energy usage in GNWT assets by 5%.

Completed energy conservation projects such as building retrofits, biomass and electric boiler installations, and residual heat recovery systems have all contributed to the annual reduction of 3.5 million litres of heating oil, the equivalent of 9,500 tonnes of GHG emissions.

In 2014-2015, the GNWT's utility budget approached \$30 million while GHG emissions produced from the burning of fossil fuels to provide heat and electricity to GNWT assets totalled 33,000 tonnes.

Tracking this data is essential to documenting the progress that government has made, and continues to make, in reducing its dependence on imported fossil fuels and the production of GHG emissions. In managing our energy consumptions, PWS continuously collects data and monitors the utility consumption for 530 GNWT public buildings across the NWT.

Effective April 1st, 2015, the GNWT has expanded the role PWS plays in energy policy and management. The department is now responsible for the GNWT energy activity including the divisions of Energy Policy and Planning, Energy Solutions and Fuel Services. The new energy activity will help all stakeholders focus on energy policy and projects across the NWT.



The spark that started it all

The first commercial wood pellet boiler system installed in a government facility in the NWT was in 2007 at the North Slave Correctional Centre in Yellowknife. This project was initiated by the private sector on a proposed sale of heat basis over a five year period. The capital investment for the project was provided by the proponents and amortized over the life of the contract for the supply of heat. The GNWT also benefited from operational savings over the cost of heating oil each year.

The two 750 kilowatt wood pellet boilers at the North Slave Correctional Centre displace the need for approximately 560,000 litres of heating oil every year and are responsible for the cumulative displacement of over 13,600 tonnes of GHG emissions since the first year of operation in 2007.

This project provided the proof that this technology is an economic, reliable, and environmentally responsible alternative to heating with fossil fuels in the NWT. Following the success of this project, the GNWT looked to its own assets for potential candidates for wood pellet boiler systems. Since this installation, 21 more wood pellet boilers have been installed and no new GNWT building is constructed without the consideration for biomass heating.

Introduction

Our Mission

With energy efficiency and sustainability as guiding principles, PWS delivers quality services to satisfy the needs of its clients, while achieving the best value for government, communities, businesses and residents. The department has the responsibility to provide safe and reliable facilities that are sustainable and energy efficient, to support the delivery of government programs.

The Challenges

The NWT is heavily dependent on the use of imported fossil fuel for heating and electricity. The remoteness of communities, our limited transportation infrastructure and a lack of economies of scale, together with harsh weather conditions, result in high annual operating and maintenance costs for GNWT assets. The North's dependence on fossil fuels for heating and electricity results in higher GHG emissions when compared to cleaner burning renewable energy sources. This fact has allowed the GNWT to have significant impact on GHG consumption and energy reductions through investing in priority renewable energy and conservation projects over the past several years.

Reliability is an important factor when planning for upgrades or new equipment and system components for assets in remote communities. One of the priorities for PWS Operation and Maintenance staff is to ensure proven equipment and systems are installed in remote communities in order to keep buildings in service, ensure occupants are comfortable, and meet our energy performance expectations over the long term. The conservative approach of implementing simple, proven and robust energy technologies has been a key element of our strategy in generating the return on our energy investments over the past several years.

Our Focus

In response to the challenges we face, the GNWT released the *Northwest Territories Energy Action Plan (Energy Action Plan)* in 2013, which included short term actions and long term planning for energy supply aimed at reducing energy costs, imported oil, and GHG emissions. The main objectives of the *Energy Action Plan* are to:

- ensure reliable energy supply,
- improve affordability,
- reduce environmental impacts,
- maximize economic benefits of the energy system,
- optimize the use of government resources, and
- continue to engage community and Aboriginal governments.

PWS plans to address the energy priorities by:

1. Continuing to focus on retrofitting GNWT assets to reduce energy usage, operating costs and GHG emissions through the Capital Asset Retrofit Fund Program.
2. Using of alternative, renewable energy sources in new and existing assets such as biomass, hydro, solar photovoltaic and residual heat to reduce operating costs, GHG emissions and the dependence on imported fossil fuels.
3. Designing and constructing new facilities with high energy efficiency requirements to achieve better energy performance than the National Energy Code for Buildings (2011).
4. Properly maintaining of assets to ensure optimal performance of building energy systems and the expected useful life of equipment is met or exceeded.

Looking Ahead – “The New PWS”

Effective April 1st, 2015, the responsibility for corporate energy policy and energy-related functions of government of the GNWT were established within PWS.

The new activity is structured to guide, support, and promote the energy activities and initiatives of the GNWT with a focus on:

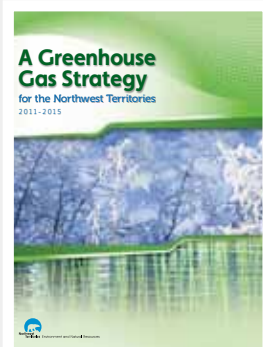
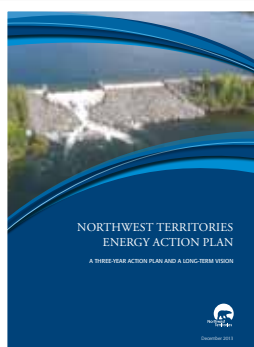
- Energy Policy and Planning,
- Energy Solutions, and
- Fuel Services.

The GNWT’s renewed approach to the development of energy policy and energy solutions will enable PWS to fulfill a corporate role with respect to directing, coordinating and managing the energy functions and initiatives.

In addition, the new consolidated energy function will provide a coordinated approach to managing various energy programs and functions including:

- Energy efficiency and energy conservation initiatives,
- Reliability and affordability of energy supply,
- Development and promotion of renewable and alternative energy solutions including biomass, solar, and wind power.

PWS will continue in its role of managing energy consumption and addressing GHG emissions associated with the operation of GNWT public infrastructure. This includes a continued focus on the development of small scale renewable and district heating projects, the reduction of our dependence on fossil fuels through investment in biomass and hydro based electric space heating, as well as investment in energy-related infrastructure projects not directly related to large scale energy production or distribution.



Annual Operational Cost and Energy Use Review

Utilities tracking is an essential first step in any energy efficiency strategy. In 2010, PWS was given the responsibility of handling all utility payments for GNWT-owned assets. Along with managing the payments of utilities, tracking consumption data also became a primary focus for the department. Since that time, PWS has continued to monitor and report on the utility budget internally for budgeting and accounting purposes, as well as report through the energy reports published annually over the last four years.

Beginning in 2014, the Financial Shared Services (FSS) division of the department of Finance became the invoicing and payment centre for government expenditures. While payments for utilities now flow from FSS, this budget

is still managed by PWS and the department continues to monitor the GNWT's utility and energy expenditures. Benchmarking, analyzing, monitoring, and performance evaluation are only possible through the centralized tracking of utilities which makes this activity pivotal to a successful energy efficiency initiative.

In 2014-2015, the GNWT's utility budget for building assets was approximately \$30 million. As the breakdown in Figure 1 shows, electricity costs made up 54.9% of the total utility budget, similar to past years. This is not surprising when one considers that the cost of electricity on a unit of energy basis is approximately three to four times more expensive when compared to heating fuel costs.

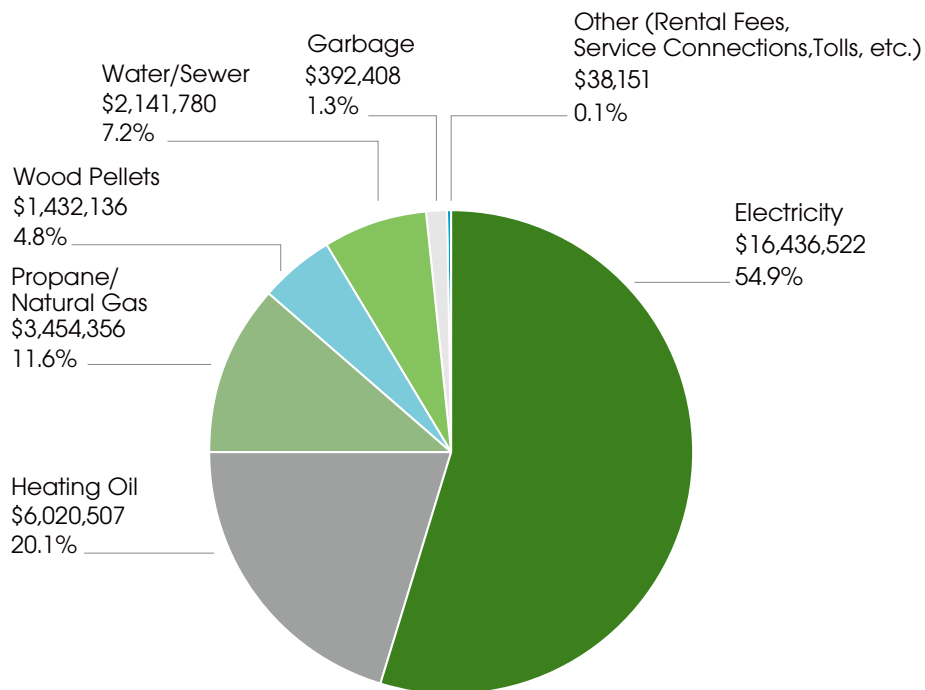


Figure 1
2014-2015 utility cost breakdown

Energy Price Comparison

The price of home heating fuel is something that affects all NWT residents. Each year, heating oil purchases account for 33% of the GNWT's \$30 million utility budget. Fluctuations in the price of heating oil make budgeting for these expenditures challenging

Historical Price Comparison

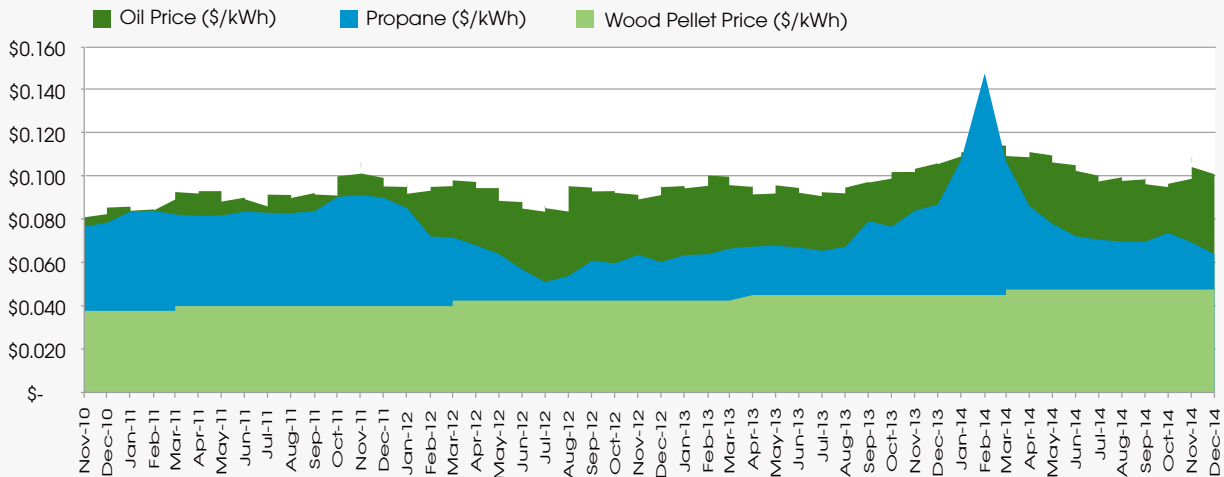


Figure A:
Price comparison of wood pellets, propane and heating oil on a per unit energy basis in Yellowknife

The bulk price of pellets has not significantly changed in the last five years. Wood pellets have been 45% cheaper on average than heating oil, allowing the GNWT to benefit from consistently lower cost heating which does not fluctuate like an oil commodity. One of the major influences that needs to be considered in the price variation of pellets in the NWT is location and the associated transportation costs.

A quick look at the unit price comparison of heating oil, wood pellets, and electricity and it is easy to see why the GNWT's energy budget is heavily driven by the cost of electricity.

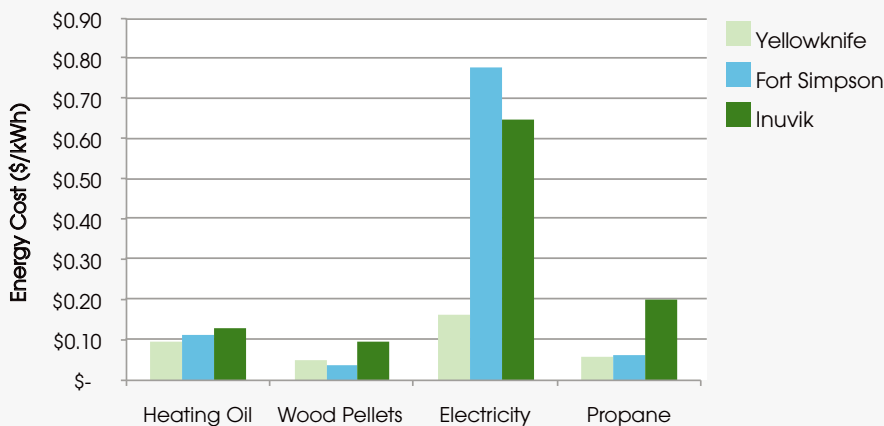


Figure B:
2014-2015 energy price comparison in three NWT communities

While the cost of electricity represents the majority of our energy spending, GHG emissions and energy usage are typically led by the burning of fossil fuels for heating purposes as seen in Figures 2 and 3. In 2014-2015, approximately 33,000 tonnes of GHG emissions were released as a result of burning fossil fuels for heat and electricity generation for GNWT assets. In 2014-2015, the GNWT's production of GHG emissions was impacted by lower than average water levels in the Snare Hydro system which contributed to an increase in the burning of diesel by the Northwest Territories Power Corporation's

Jackfish power plant in Yellowknife. This increase in diesel for power generation was a major contributor to the increase in GHG emissions over the 2013-2014 figure of 32,820 tonnes. As Figure 2 below shows, had the Jackfish diesel power plant not been required to operate to supplement hydro power generation, the total approximate GHG emissions for 2014-2015 resulting from the GNWT's investments in energy conservation and renewable energy sources would have been 29,765 tonnes for a reduction of more than 3,200 tonnes.

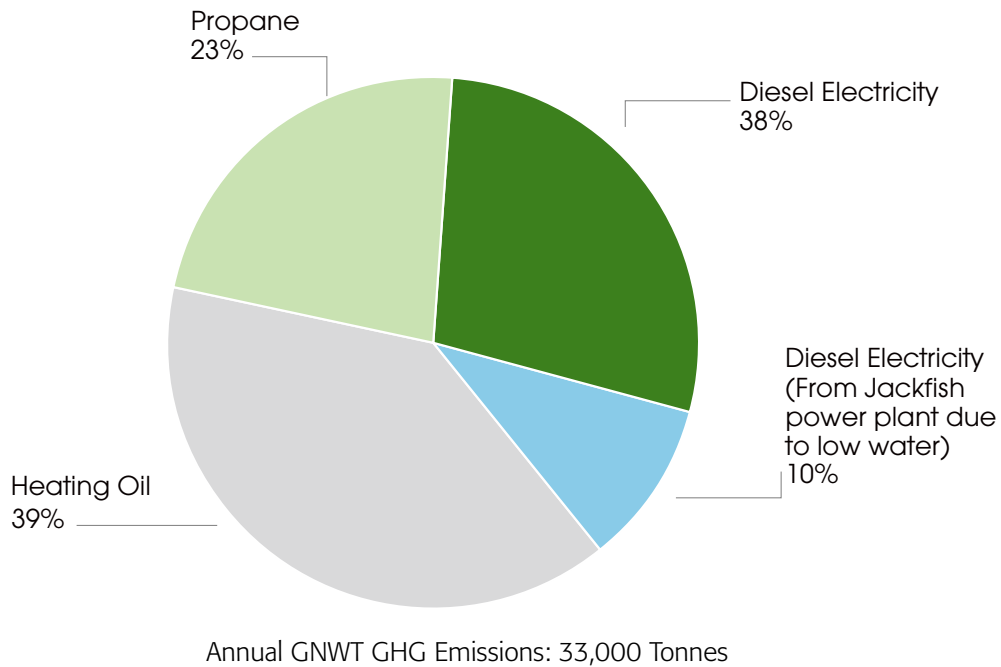


Figure 2:
Sources of Annual Greenhouse Gas Emissions from GNWT facilities in 2014-2015

A number of biomass boilers came online in 2014-2015, which contributed to a significant increase in wood pellet usage during that time. As a result, the GNWT's biomass usage increased 86% over usage from the previous year. Monitoring and optimization of energy performance for existing biomass installations also contributed to the overall increased usage of renewable energy and reduction in GHG emissions for 2014-2015 as compared to the previous year.

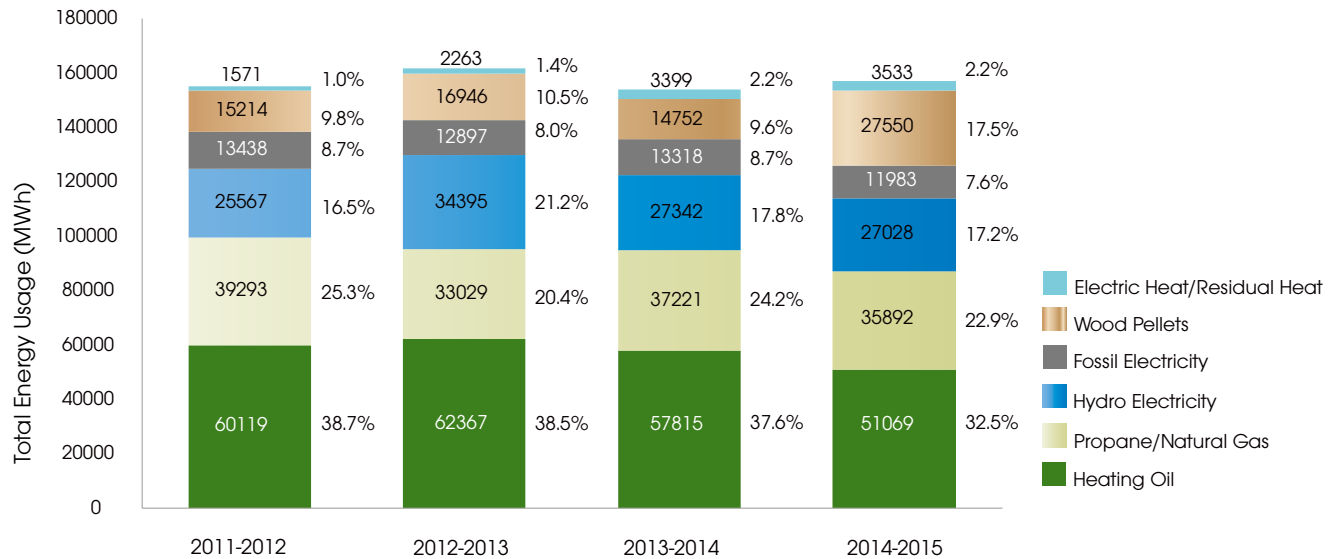


Figure 3
Energy use comparison between fiscal years

The GNWT's asset base has grown over the past four fiscal years by 39,000 m². New assets brought online impact the overall annual energy usage for GNWT facilities. There has been minimal to no growth in energy usage from year to year as the GNWT's energy initiatives and investments have helped offset the growth related to new infrastructure. In addition, as the use of biomass increases, it continues to reduce the consumption of fossil fuels for heating which is a significant reduction over past years.

Utility highlights include:

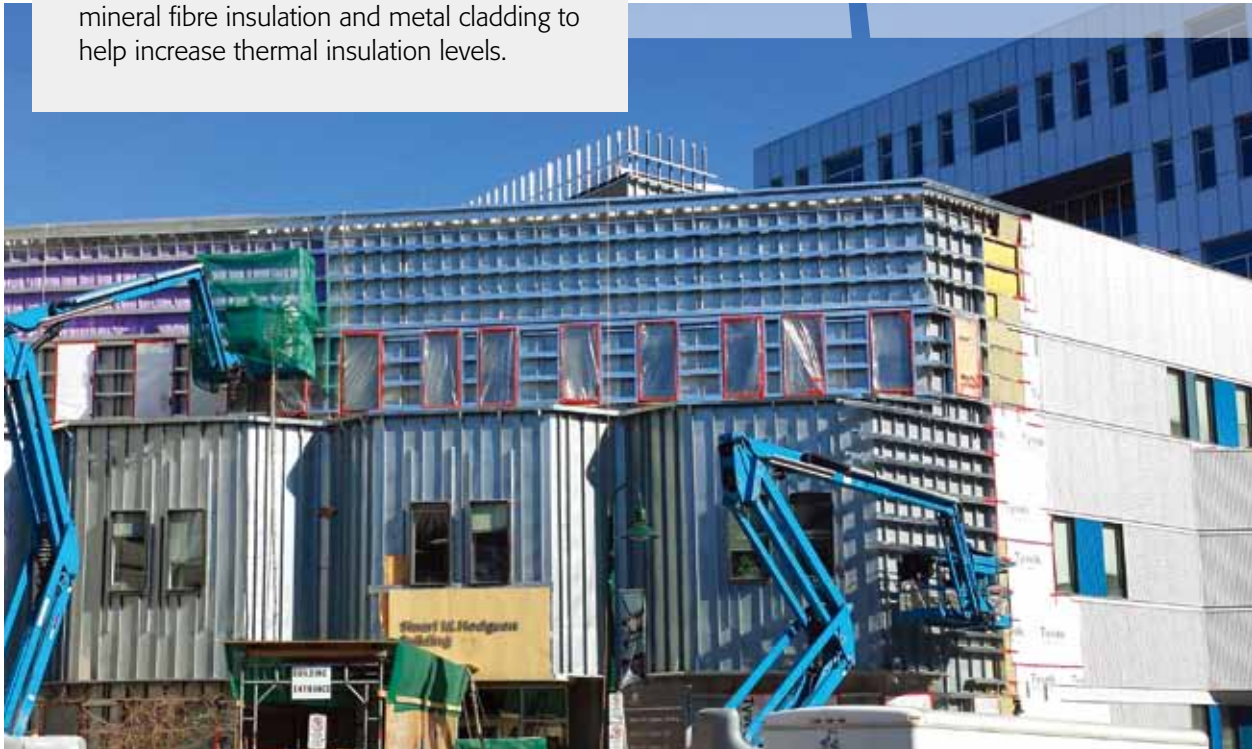
- 11% reduction in fossil fuel for electricity (2011-2012 as compared to 2014-2015)
- 15% reduction in heating oil use (2011-2012 as compared to 2014-2015)
- 37% of total energy now comes from renewable sources (2014-2015)

Energy Conservation Initiatives

The GNWT has made a commitment to energy efficiency and environmental responsibility through the reduction of its own GHG emissions. With guidance from the new *Northwest Territories Energy Action Plan*, the *Greenhouse Gas Strategy* and the *NWT Biomass Energy Strategy*, PWS worked to deliver a number of energy conservation initiatives to help the GNWT meet the objectives set out in these documents. In particular the Capital Asset Retrofit Fund (CARF) Program along with biomass boiler installations, electric boilers in hydro communities, and high energy efficiency standards in new constructions have helped make significant progress towards achieving our GHG goals and reducing operating costs.

Completion of the envelope upgrade at the Stuart Hodgson Building in Yellowknife.

This project involved the application of spray foam insulation followed by an outer layer of mineral fibre insulation and metal cladding to help increase thermal insulation levels.



Capital Asset Retrofit Fund (CARF)

The GNWT has taken a clear position to lead by example when it comes to energy efficiency. To this end, in 2008 it created the CARF Program. Through the continued support of the 17th Legislative Assembly, the program provides funding to PWS to perform energy retrofits on existing assets in an effort to reduce the GNWT's utility budget and GHG emissions. Over 35 energy retrofits, on facilities of various types and sizes, have been completed throughout the NWT since CARF was created.

Energy benchmarking and auditing, thermal scanning and feedback from operation, maintenance and technical staff are all ways that PWS identifies projects and buildings for energy retrofits. In the past, these projects have included:

- Envelope Upgrades
- Lighting upgrades
- Heating control optimizations
- Ventilation optimizations
- Efficient water fixtures
- Re-commissioning of aging systems

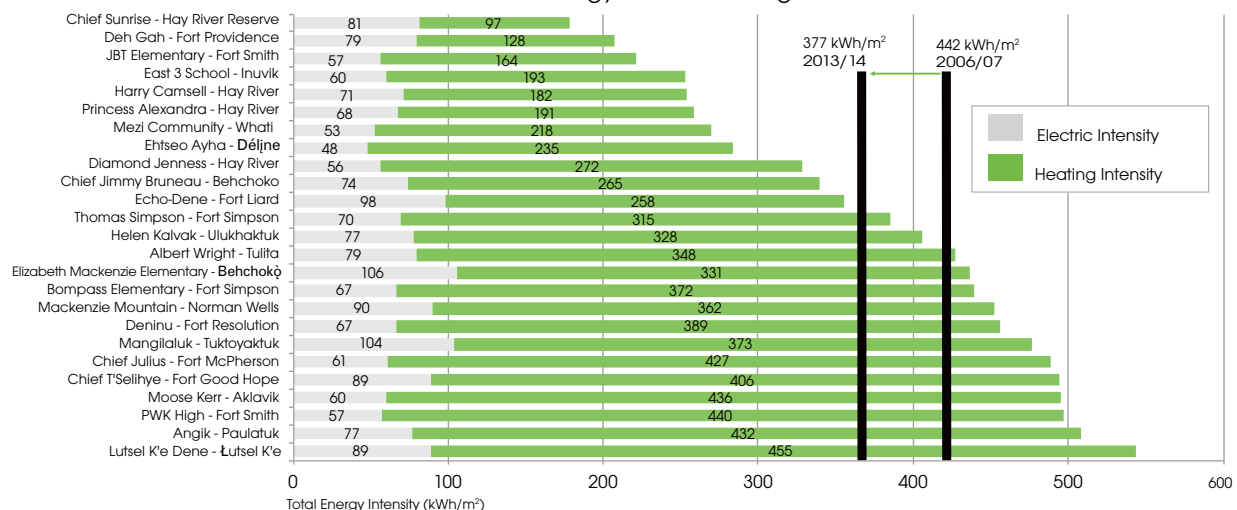
PWS monitors and tracks the success of energy retrofit projects with respect to GHG reductions and utility cost savings. The CARF Program makes it possible for the GNWT to re-profile savings from energy retrofit projects to capital funding. This re-profiling of savings achieved from energy projects makes it possible for the GNWT to

continue with capital energy related investments year over year. Since 2010-2011, the GNWT has re-profiled a total of \$1.48 million from the annual utility budget to capital funding and this is anticipated to increase to \$1.7 million in 2015-2016.

Through the 2014-2015 Capital Asset Retrofit Fund program, a diverse scope of projects were undertaken in thirteen communities across the NWT. Highlights from this year's projects include:

- A 5 kilowatt solar photovoltaic installation at the Gamètì Health Station
- High bay LED lighting at the North Slave Correctional Centre, Inualthuyak School, Mangilaluk School, Chief Julius School, Inuvik Airport Maintenance Garage, and Sir Alexander Mackenzie's Carpentry and Auto Shops
- Two biomass boiler installations at the South Mackenzie Correctional Centre in Hay River and the Deninu School in Fort Resolution
- An upgrade of the existing Northwest Territories Power Corporation residual heat installation at the Chief Julius School in Fort McPherson
- HVAC controls optimizations at the Mezi School, Paul W. Kaiser High School, Legislative Assembly Building and North Slave Correctional Centre

2013-14 NWT Schools Energy Benchmarking



Biomass

The GNWT had its first commercial wood pellet boiler installed at the North Slave Correctional Centre in 2007. Since that initial installation, the GNWT has carried out a number of additional installations to help reduce GHG emissions and operating costs. The use of wood pellet boilers has proven to be a reliable technology in the NWT. Residents, businesses, local and territorial governments have all benefitted from the success of this technology.

As of the end of the 2014-2015 fiscal year, the GNWT has installed 22 biomass boilers to service GNWT assets, 18 of which have been brought

online over the last five years. In the 2014-2015 fiscal year alone, nine biomass boilers were installed which include:

- Three wood pellet boiler systems commissioned in the fall of 2014 in Norman Wells at the Mackenzie Mountain School, Airport Terminal Building and Airport Combined Services Building
- Three small installations (<250 kilowatt) in the South Slave Region at the Deninu School (Fort Resolution), New Health Centre (Fort Providence) and South Mackenzie Correction Centre (Hay River)

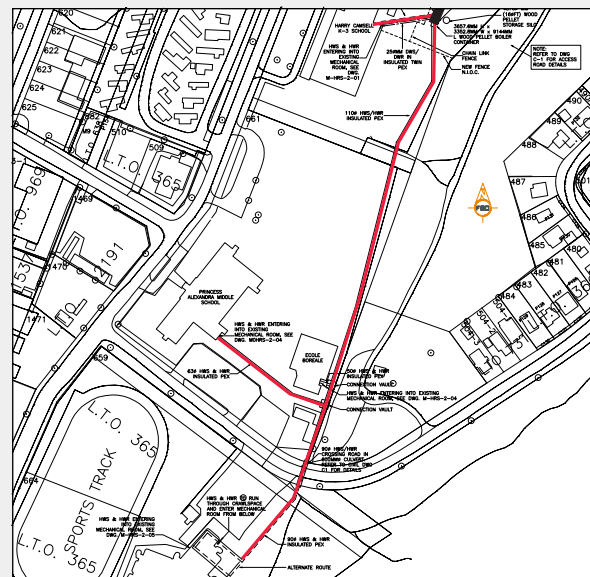
Small Scale District Heating

District heating has been commonly used by the GNWT for a number of years. One of the earliest implementations of district heating systems was to connect heating, loads to NTPC generating stations in diesel-fired communities. Residual heat produced by diesel fired generators could be used to heat nearby buildings. Systems such as this were installed in the communities of Fort McPherson, Whati and Fort Liard. In each case, residual heat is utilized to heat the schools in these communities.

More common now is the use of district heating to connect facilities to a centralized biomass boiler plant. In past years, the GNWT has initiated or connected to a number of district heating systems. Which include:

- Four Hay River schools connected to a single 900 kilowatt wood pellet boiler
- Paul W. Kaiser High School and Recreation Complex in Fort Smith connected to a 750 kilowatt wood pellet boiler
- A 540 kilowatt wood pellet boiler at the Elizabeth Mackenzie School in Behchokò which is connected to the community recreation complex and the Northwest Territories Housing Corporation's new 9-plex

- The New Long Term Care facility in Behchokò connected to the community's district wood pellet boiler heating system
- The new office building in Yellowknife is providing biomass heat to the existing Arthur Laing and Stuart Hodgson Buildings



Hay River Schools small scale district heating system

- A 650 kilowatt wood pellet boiler installed in the new office building in Yellowknife that will service the heating needs of the new office building, Stuart Hodgson and Arthur Laing Buildings
- A 400 kilowatt wood pellet boiler to service the Yellowknife Airport Terminal Building
- The largest single wood pellet boiler installation of 1,250 kilowatt at the new Hay River health centre

When these new wood pellet boilers are fully operational in the winter of 2015, it is expected they will burn approximately 2,000 tonnes of wood pellets annually. This is equivalent to approximately one million litres per year reduction in heating oil consumption and an annual GHG emission reduction of 2,600 tonnes.



The wood pellet boiler system installed in the new office building in Yellowknife has already begun to offset heating fuel usage for the new office building, Stuart Hodgson Building and Arthur Laing Building. This district heating system in downtown Yellowknife will displace approximately 275,000 litres of heating oil annually.



224 kilowatt wood pellet boiler at the Mackenzie Mountain School



224 kilowatt wood pellet boiler system at the Norman Wells Airport Maintenance Building



168 kilowatt wood pellet boiler system at the Norman Wells Air Terminal Building

The three biomass installations in Norman Wells at the Airport Maintenance Building, Airport Terminal Building and Mackenzie Mountain School were able to provide base loading heating in the 2014-2015 fiscal year. These pellet boiler installations have self-contained pellet storage that use a pneumatic feed system to move pellets to the boilers.

Wood pellets are provided by a local supplier in Norman Wells. These projects have also encouraged private sector usage of wood pellets in Norman Wells which has grown significantly over the last two years.

Electric Heat

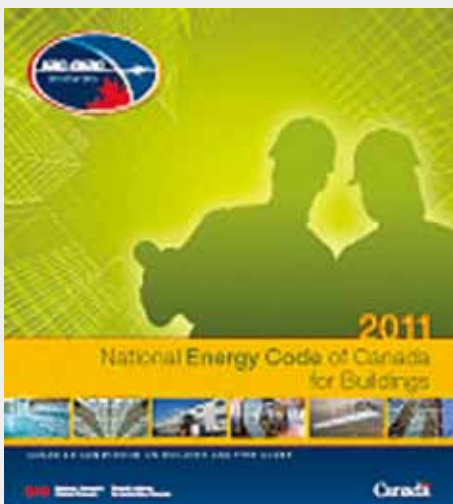
In an effort to maximize the use of hydro power produced from the Taltson Dam, the GNWT and NTPC completed four electric boiler projects in Fort Smith, starting in 2008. These electric boilers use the excess power generated from the Taltson Dam on an interruptible basis.

The first two buildings to be retrofitted were the J.B. Tyrell Elementary School and Breynat Hall in 2008, followed by the department of Transportation's Highways Maintenance Garage in 2009 and finally the Northern Lights Special Care Home in 2012.

Recently, NTPC has identified an additional 1.4 megawatt of power potentially available to supply electrical energy from the Taltson system for additional electric heat conversions. PWS is currently exploring opportunities with the NTPC to develop additional electric boiler projects that will utilize this excess power in Fort Smith and Fort Resolution.



Taltson Dam



Energy Efficient Design

On behalf of the GNWT, PWS has established energy performance standards for the design and construction of all new GNWT public buildings. Working within established project budgets, PWS works to construct and retrofit GNWT buildings to be as energy efficient as possible. New GNWT buildings are currently designed to be 10% better than the current National Energy Code for Buildings (2011). This is verified with energy modelling during the design stage of the project, as well as verification and commissioning of new facilities upon completion to ensure buildings are constructed as designed and perform as intended.

Code Development

PWS technical staff participate in many national energy-related code development committees, including:

- The National Research Council Standing Committee for Energy Efficiency in Buildings which will inform code changes to the 2015 National Energy Code for Buildings.
- The Canadian Standards Association Technical Subcommittee looking at building energy estimation methodology.
- The Public Infrastructure Engineering Vulnerability Committee looking at the impact of climate change on northern engineered infrastructure.
- The Building Technology Transfer Forum.
- Assisting with the development of ASHRAE Cold Climate Design Guide.

Providing a northern voice and technical expertise on these development committees is crucial to the future success of energy conservation projects for the GNWT. Many of the standards, including the upcoming 2015 Canadian National Energy Code for Buildings (NECB) will dictate future projects and performance measures.

Capital Renewal of Health Care Facilities

In 2015-2016, the GNWT will be granting substantial completion on the Health Centre in Hay River. The facility will replace the H.H. Williams Memorial Hospital. Even though this new facility has been modelled to perform 10% better than the NECB, it will still have an energy intensity that is higher than the existing health centre.

Codes such as CSA Z317.2-10 “Special requirements for heating, ventilation, and air-conditioning systems in health care facilities” and increased level of services are the main drivers for increased energy usage in this modern day health care facility. Z317.2 dictates minimum ventilation rates and other requirements for HVAC equipment to maintain adequate indoor air quality. As the level of services increase, as they typically do with a health centre replacement, so do the HVAC requirements, which directly impact the energy use of a facility.

Health Centres are the most energy intense type of facility the GNWT owns and operates. The design and construction of the new Norman Wells Health Centre, Fort Resolution Health Centre and Stanton Territorial Revitalization Project are all required to perform 10% better than the NECB and follow the guidelines in the Good Building Practices for Northern Facilities.



The new Hay River Health Centre

Energy Modeling

In an effort to optimize our capital investments, PWS requires that all large facilities follow a design review process which includes an energy modeling workshop. These workshops bring everyone together, from builders to the end users, to discuss the purpose of the building and how to design it to meet all program requirements as energy efficiently as possible within existing budgets. By bringing all stakeholders together, new energy efficient options can be discussed and incorporated into designs without hindering the facility's ability to meet the needs of its users or extending the project's delivery schedule.

Good Building Practice for Northern Facilities (GBP)

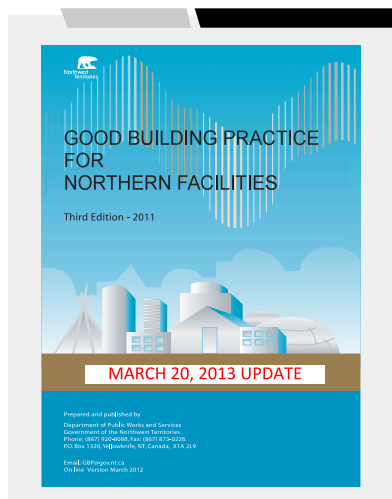
PWS has created and continually updates a GNWT design guideline, the *Good Building Practice for Northern Facilities* (GBP), to ensure that new buildings and additions are more energy efficient than that of a base building built to the current edition of the NECB. The GBP, guidelines require GNWT facilities to exceed this national benchmark by 10%. Collaborative energy modeling workshops with designers and builders along with the application of the GBP helps ensure all new buildings meet high energy efficiency standards while not compromising the design and lifecycle performance.

A new version of the NECB for 2015 is scheduled to come into effect this year and the current edition of the GPB will be updated to reflect the revised energy performance benchmarks

Performance Verification and (Re-) Commissioning

Commissioning of a project requires that PWS staff verify a building is code-compliant, and creates a healthy and comfortable environment for occupants. All building systems are verified through functional performance checks, before the building is turned over to the GNWT, to ensure they are operating as per design and manufacturer's information. Commissioning and performance verification help ensure that new buildings and additions reduce the GNWT's energy consumption, operation costs and GHG emissions.

Re-commissioning involves a renewal of heating, ventilation and air conditioning systems back to their original design set points. Over time, there is a tendency for systems to drift from design which can result in increased energy usage. A re-commissioning will ensure all equipment is functioning as intended, on schedule and at targeted design values.



Inuvik Hospital Re-Commissioning

Inuvik Hospital was originally commissioned in 2003. Only four days of effort on site were required to re-commission the mechanical and ventilation systems at the Inuvik Hospital, which resulted in annual savings of over \$125,000.

Performance Indicators

The monitoring of GNWT utility data enables PWS to verify the efforts of the GNWT over the past five years to reduce GHG emissions, energy reduction and operational savings is in direct support of the objectives set out in the *NWT Energy Action Plan*. This important task of monitoring and verification helps showcase the effectiveness of the GNWT's efforts to make a positive impact on our own environmental footprint.

The following performance indicators are a result of energy efficiency activities that involve the CARF Retrofit Fund activities energy retrofitting activities, biomass boiler installations, electric boiler installations and significant capital renewal projects.

GHG Emission Reductions

One key metric that is monitored to discern the effectiveness of energy efficiency activities is to monitor the reductions in GHG emissions. PWS had set a goal to reduce GNWT GHG emissions by 7,500 tonnes annually. This target was met in the 2013-2014 fiscal year as shown in Figure 4. In the 2014-2015 fiscal year, the GNWT continued to grow this annual figure with a reduction in GHG emissions totalling 9,500 tonnes. PWS will be looking to set a new target for GHG reductions for future years.

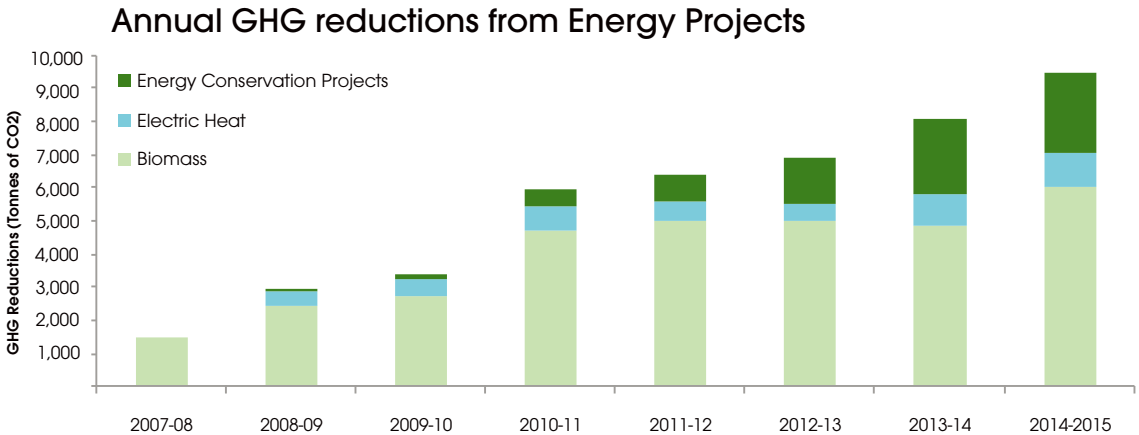


Figure 4:
GHG gas emission reductions from GNWT energy initiatives

Again, biomass boiler installations have proved to be one of the most significant activities the GNWT has undertaken to reduce GHG emissions. Biomass boiler projects account for 64% of the total GHG reductions in 2014-2015. The increase in biomass usage in 2014-2015 is a result of the optimization of existing biomass installations and an increase in the total number of boilers in operation.

For 2014-2015, these initiatives resulted in a further annual GHG reduction of 2,500 tonnes. Of particular note, the energy retrofitting of GNWT assets is having a significant impact and now represents 26% of our total annual GHG reductions.

Energy Reductions

Reducing the GNWT's reliance on imported fossil fuels is a primary objective of the *2013 Energy Action Plan*, and initiatives to help make an impact in this area have been strongly supported by the 17th Legislative Assembly. Without the implementation of past energy initiatives, the GNWT's energy use would look much different than it does today. As shown below in Figure 5, the GNWT's energy sourcing would be dramatically different if energy activities such of biomass, electric heat and building energy retrofits were removed.

Energy initiatives have helped reduce the annual GNWT's energy usage by 9,310 MWh, representing a 5% reduction in total energy usage.

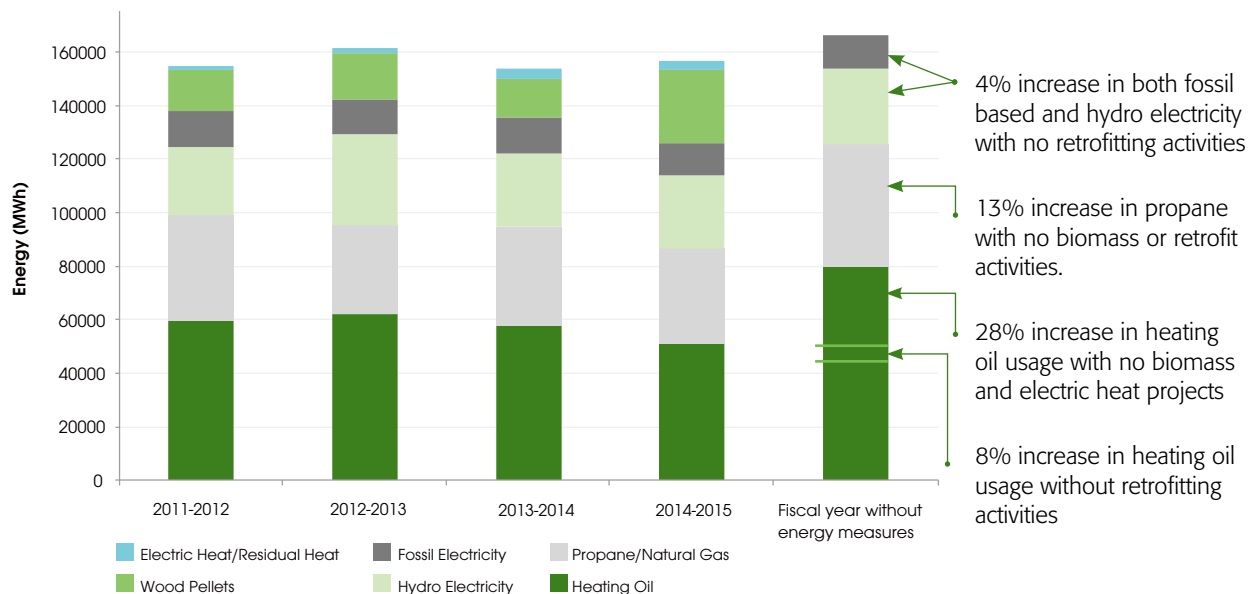


Figure 5:
Representation of the 2014-2015 energy usage of GNWT facilities if no energy initiatives had been completed.

While renewable energy projects such as the installation of biomass and electric boilers produce significant savings in GHG emissions, true reductions in energy consumption are driven primarily by energy conservation and management initiatives.

The efforts made over the past five years to increase energy efficiency and reduce energy usage in GNWT facilities are producing significant results. Over this period, the GNWT has added new assets totaling 39,000 m² while reducing the amount of heating oil used. These effort have also reduced energy usage in major assets such as schools by up to 15% and overall energy usage in all GNWT assets by 5%, totalling 9,310 megawatt hours, which is enough energy to power approximately 1,223 homes for a year in the NWT¹.

1. Based on average household power usage of 7,610 kWh/capita in NWT homes.

Utility Cost Savings

Through our energy conservation and renewable energy initiatives, PWS successfully reprofiled \$1.48 million dollars annually in utilities funding resulting from savings in energy cost and consumption.

In the 2013-2014 energy report, PWS forecasted annual utility cost savings reaching \$1.72 million by the end of 2014-2015. This utility savings target was met, with total savings of \$2 million achieved in the 2014-2015 fiscal year.

Factors for increased utility cost savings

- Improved performance from existing biomass boiler installations
- Four new biomass boiler systems coming online in 2014-2015
- Completion of new HVAC retrofit and optimization projects

The new wood pellet boiler system constructed at the South Mackenzie Correction Centre utilizes pneumatic tubing to bring wood pellets from the storage hoppers to the four wood pellet boilers inside the boiler building.



Conclusion

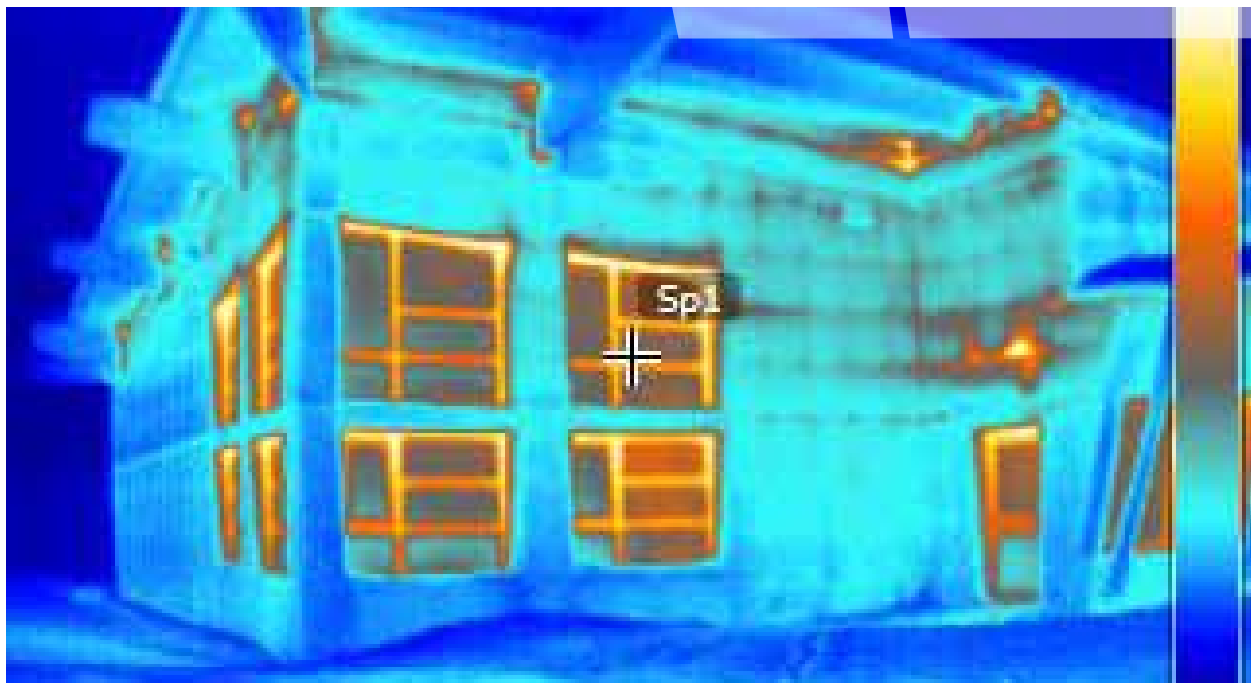
Moving Forward with Energy Efficiency

The success the GNWT has seen in the past five years from energy-related activities has strengthened the focus of environmental responsibility. PWS will continue with building efficiency and GHG reduction activities to support the GNWT's goals.

Highlights in the 2015-2016 fiscal year will include:

- Commissioning biomass boilers at the Prince of Wales Northern Heritage Centre, the Chief Albert Wright School (Tulita) and Chief T'Selehye School (Fort Good Hope)
- Commissioning biomass boiler systems at the New Hay River Health Centre and Fort Providence Health Centre
- Installing a new electric boiler at the PWK School in Fort Smith which will use excess power from the Taltson Dam
- Envelope upgrades at the Echo Dene School in Fort Liard and the Chief Julius School in Fort Resolution
- Continued focus on energy efficiency lighting conversion projects in thermal communities
- Various priority energy retrofits based on energy audits, energy benchmarking and studies from previous fiscal years
- Biomass feasibility studies for assets in the Beaufort-Delta Region

By the end of 2015-2016, PWS is anticipating utility savings totalling \$2.2 million annually and associated GHG reductions of 10,000 tonnes. Verification of these figures will be completed at the end of the 2015-2016 fiscal year.



Thermal Scan Image from a building envelope investigation.



