

Yukon Biomass Energy Strategy

Draft for Public Consultation



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IMPLEMENTING THE ENERGY STRATEGY FOR YUKON

Executive Summary

Supplying and consuming energy for heating has significant social, economic and environmental implications.

Nearly \$60 million per year is spent in Yukon on fuel and electricity to generate heat. More than 80% (approximately \$50 million) of this is spent on imported fossil fuels. Burning fossil fuels is expensive, drains money from Yukon's economy and has both local and global environment impacts.

The intent of this strategy is to reduce Yukon's dependence on imported fossil fuels by optimizing the use of Yukon-harvested wood to meet the territory's heating needs using modern biomass energy systems.

There are many advantages to adopting biomass energy systems in Yukon. A transition to a biomass economy has the potential to reduce heating costs for Yukoners, create new jobs in the local forest and heating industries, reduce greenhouse gas (GHG) emissions, and move the territory towards sustainable renewable energy and greater energy self-sufficiency.

Other northern jurisdictions have already made significant advances in using modern biomass energy systems, including Alaska, Northwest Territories and many northern European nations.

There are many challenges involved in developing a healthy biomass energy industry in Yukon. Old inefficient woodstoves will need to be replaced with modern, efficient and clean burning appliances. The local heating industry will require new expertise and infrastructure to adapt to modern wood heat systems. Harvesting local fuelwood will need to be managed to ensure that it is done on a sustainable basis and in a socially and environmentally acceptable manner. New biomass energy systems will need to be subject to standards that ensure air emissions do not pose a risk to human health or the environment.

This strategy identifies six key action areas that are essential for the successful development of biomass energy in Yukon:

1. Commit to using biomass energy in government infrastructure:

A commitment to biomass energy projects in government infrastructure is essential to build a secure Yukon-based market demand for biomass energy systems and biomass fuels. Through this strategy, Yukon government (YG) will identify and select candidate pilot projects that have potential for biomass heating.

2. Develop regulations, policies and programs for biomass energy industry:

Government will develop or amend policies, standards and regulations to promote the development of an advanced biomass energy industry, including the management and use of high-quality biomass appliances and fuels. Through this strategy, YG commits to expand on programs and incentives to encourage residential biomass heating systems.



3. Manage air quality to protect public/environmental health and safety:

Biomass energy systems will require appropriate controls and reliable monitoring to ensure that air emissions do not pose health or environmental concerns. This will require government to:

- develop new air quality standards and best practices for biomass energy; and
- develop, implement and enforce expanded air quality monitoring programs.

4. Facilitate private sector development in biomass energy:

YG will need to work with other governments, industry, and the local business community to increase local expertise and capacity in biomass energy. This will include developing collaborative approaches on projects that facilitate the growth of a healthy, stable and competitive biomass energy sector.

5. Ensure sustainable timber supply based on completed forest resources management plans:

In partnership with Yukon First Nations, YG will continue to complete regional forest resource management plans and ensure that fuelwood harvest levels are sustainable and consistent with these plans. The plans will be done in consultation with the public. They will respect timber and non-timber values. YG will use these plans to guide its work with industry in making timber tenures available to support biomass projects.

6. Ensure biomass fuel security and quality:

YG will work to promote the development of a secure supply chain of good quality fuel to support biomass energy in the territory. Maintaining a high level of quality control in biomass fuels is critical to operating safe, efficient, reliable and clean biomass energy systems.



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1 Introduction

Supplying and consuming energy for heating has significant social, economic and environmental implications.

In Yukon, approximately \$60 million per year is spent on fuel and electricity to generate heat. More than 80% (\$50 million) of this is spent on imported fossil fuels. This high dependence on imported fossil fuels for heat is costly. It drains money from the territory's local economy. It also contributes significantly to our greenhouse gas (GHG) emissions.

Many countries and communities in the north are making changes to reduce dependence on fossil fuels for energy. They are turning to a fuel source which is cheaper, more locally available, sustainable, and emits less GHGs. That fuel source is biomass, or wood and wood products.

To meet this shift, modern advanced biomass energy systems are developing rapidly world-wide. These systems are clean, automated and economical. They use fuels that are manufactured to strict quality standards to ensure efficient and optimal operation.

Many other northern jurisdictions have already made significant investments in these systems. By the end of 2013, the Government of the Northwest Territories installed 14 modern biomass heating systems in public buildings. By doing this, the government was able to reduce its consumption of heating oil by six million litres, reduce its GHG emissions by approximately 15,000 tonnes¹, and significantly reduce its heating costs. Many Alaskan public and private buildings are converting to biomass heating with a growing biomass industry being created in that state, including the development of an advanced pellet manufacturing sector. Some northern European countries are meeting over 20% of their heat and power needs with biomass.

Advanced biomass energy systems are very viable for Yukon. There are already many proven modern biomass systems for heat available on the market. By increasing the use of these systems in the territory, Yukoners could save money on heating costs, support local economic opportunities for the forest and heating industries, reduce GHG emissions, and become more energy self-sufficient.

This strategy outlines an approach for the expansion of biomass energy use in Yukon. It discusses the challenges and benefits of using biomass energy, identifies goals and principles for the use of biomass energy, and proposes actions for developing and promoting this form of heat in the territory.

The focus of this strategy is to optimize the use of wood for heat, using modern systems that are clean, efficient and economical.

¹ Government of Northwest Territories, April 2012. Annual Report 2011: Public Works and Services Energy Conservation Projects.



1.1 Linkage to Yukon's Energy Strategy and Climate Change Action Plan

This draft Biomass Energy Strategy is a commitment of the 2009 Energy Strategy for Yukon which supports replacing fossil fuels with cleaner renewable energy sources wherever possible. In particular, the energy strategy commits to:

- Increasing renewable energy supply in Yukon by 20% by 2020;
- Investing in research and development of renewable energy technology;
- Demonstrating leadership in developing renewable energy infrastructure;
- Developing a wood-based bioenergy industry in Yukon; and
- Encouraging cost-effective, small-scale renewable energy production to foster innovation and diversity in Yukon's electrical supply.

The Biomass Energy Strategy is also consistent with YG's 2009 Climate Change Action Plan which recognizes that burning wood efficiently for heat produces less GHG emissions than burning oil. If done cleanly and sustainably, burning wood is considered to be carbon neutral. Specifically, the plan commits to: "reducing our GHG emissions through reducing our use of fossil fuels" and "supporting the use of wood energy for residential and institutional heating".

1.2 What is biomass energy?

Biomass energy is energy derived from organic matter, including matter such as wood, agricultural products, organic wastes, municipal solid waste and other living cell materials. Globally, many different organic materials are being used as feedstock for biomass energy.

In Yukon, the primary biomass resource available is wood, and wood-based biomass is the primary focus of this strategy.

1.3 Yukon's wood resources

Yukon has a long history of using wood as a source of energy. The steamboats that plied Yukon's rivers 50-100 years ago were all powered with wood. Many Yukon people heat their homes with woodstoves, especially in communities where timber is accessible.

Approximately 24,000 cords (55,000 m³) of wood are harvested in Yukon to heat homes and buildings. This accounts for approximately 17% of Yukon's total consumption of energy for heat. This volume of wood is equivalent to what can be sustainably harvested from approximately 550 hectares of average Yukon forest in Whitehorse, Teslin and Haines Junction regions. To put this in perspective, the forested land base in these regions is approximately 1.3 million hectares. The total forested land base of Yukon is approximately 28 million hectares, though not all of it has a high productive capacity for forestry. An average of 112,000 hectares burns every year in the territory due to forest fires, which represents nearly 200 times more wood than is currently harvested for energy use in the territory.



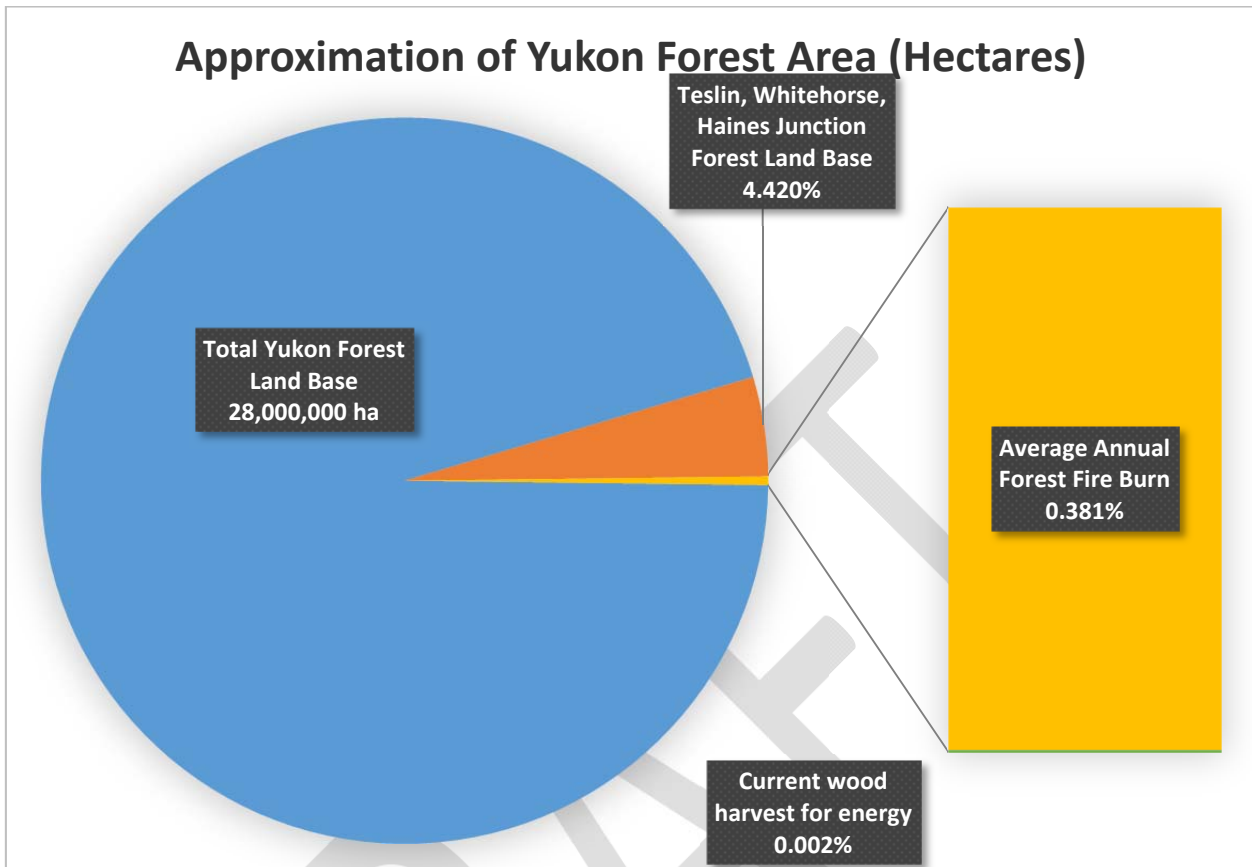


Figure 1: Forest Area vs. Harvested and Forest Fire Burn Area

Most cordwood in the territory is currently harvested in the Haines Junction area from beetle-killed trees and trucked to Whitehorse. The Whitehorse area accounts for approximately 75% of the territory's total heat demand.

There are many opportunities for sustainably harvested wood in the territory for a biomass energy industry. Wood can be salvaged from burned areas, areas which have been subject to insect infestations, sawmill wastes and areas which are cleared or thinned due to new developments or Fire Smart activities. Each forest region in the territory also has its own identified allowable harvest level as defined in the *Forest Resource Act*. The act, along with Chapter 17 of Yukon First Nation Final Agreements, sets out the process to complete forest resources management plans², which provide direction to set sustainable timber harvest levels that reflect regional social, economic and environmental goals.

Currently, the actual timber levels harvested in the territory are well below the identified sustainable allowable harvest levels set for each region. Therefore, there is significant capacity to increase the use of local wood for sustainable and renewable energy in Yukon.

² Forest resources management plans have been completed for Teslin, Haines Junction and Dawson forest regions. The Whitehorse planning process has commenced.



1.4 Modern biomass energy systems

The use of wood for heat and power is increasing world-wide. Wood pellets and chips are being used in both small-scale and large-scale systems, including district heat and combined heat and power systems.

Biomass energy systems available today are significantly improved over the systems available only 10 or 15 years ago. Many of the newer, large-scale systems are automated with bulk fuel delivery, automated fuel feeds, controlled combustion, and advanced air emission controls. Many can also be controlled from remote locations through computer programs and system monitoring.

The recently completed (2012) Whitehorse Correctional Centre has a modern biomass boiler that burns wood pellets. The pellets are supplied in volume by tractor trailer from BC, approximately 40 tonnes per B-train load. The pellets are stored on-site in a silo and fed automatically to the boiler. The boiler installation is compatible with web-based monitoring and control capacity.

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2 Purpose and principles

2.1 Purpose

The purpose of this strategy is to promote and optimize the use of Yukon wood resources for the production of heat and power in Yukon, using modern, efficient, safe and clean technologies. The immediate focus is on using wood products for heat.

2.2 Principles

There are a number of principles that must be considered in the development of a biomass industry in Yukon. These principles are reflected in the proposed actions presented in section 4.

- **Leadership:** YG needs to lead in biomass energy research, implementing biomass energy projects and building a strong policy and technical foundation.
- **Working in partnerships:** YG must work in partnership with other governments, energy providers, public utilities, research institutions and the private sector to develop a strong biomass energy sector.
- **Reliable and advanced technology:** Biomass energy development must be based on technologies that have proven track records of being reliable, safe, clean, and user friendly.
- **Public/environmental health and safety:** Air emissions from biomass energy systems and ambient air quality must be monitored to meet environmental and public health standards.
- **Secure and high-quality fuel supply:** Successful biomass energy development requires a secure supply of high-quality fuels.
- **Cost effectiveness:** Yukon biomass energy systems must help Yukon people reduce heating costs.
- **Energy self-sufficiency:** Yukon biomass energy systems should use Yukon's biomass resources to reduce Yukoners' vulnerability to imported fossil fuel prices and supply.
- **Sustainable forest resource use:** The wood needed to support biomass energy must be managed and harvested on an environmentally sustainable and socially acceptable basis.
- **Support for Yukon jobs:** Using Yukon's wood fuel products for biomass should enhance job opportunities in Yukon's forest and heating industries.
- **Reduction of GHG emissions:** Yukon biomass energy systems must be designed and maintained to emit less GHGs than comparable fossil fuel energy systems.

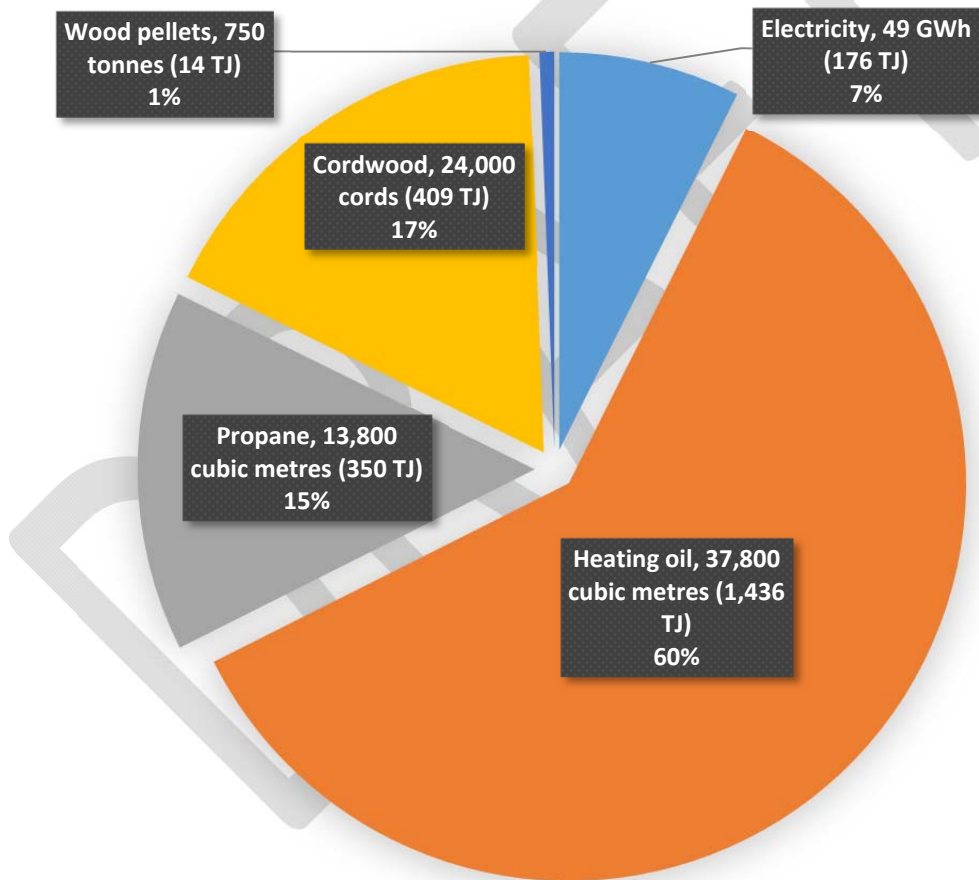


3 Background

3.1 Energy consumption for heat in Yukon

Space heating is a significant sector of Yukon’s economy. Figure 1 illustrates the relative proportions of the different types of energy used for heat in Yukon. Figure 2 identifies the amounts and costs associated with each type of energy.

Figure 2: Estimated Total Breakdown of Energy Use for Heat (Terajoules) in Yukon



Source: Energy Solutions Centre, 2012

As noted in Figure 2, heating oil and propane supply approximately 75% of the heat used in Yukon and account for about 82% of the territorial cost of fuel for heat. All fossil fuels consumed in Yukon are imported.



In Yukon's climate, demand for heat peaks in winter when hydro facilities are already operating at full capacity. When demand exceeds the hydro capacity, diesel generators are used to meet the increased demand. This additional diesel consumption contributes to the costs and GHG emissions associated with using electricity for heat.

3.2 Advantages of biomass energy

There are many benefits to using biomass for energy. These include reducing energy costs, minimizing GHG emissions, improving energy self-sufficiency, and developing new economic opportunities for the forestry sector. Biomass is also a renewable resource and safe to transport.

3.2.1 Energy costs

Heating with wood has the potential to be the most cost effective heating fuel. Figure 3 identifies the estimated costs of different heating fuels in Yukon in dollars per gigajoule of heat.

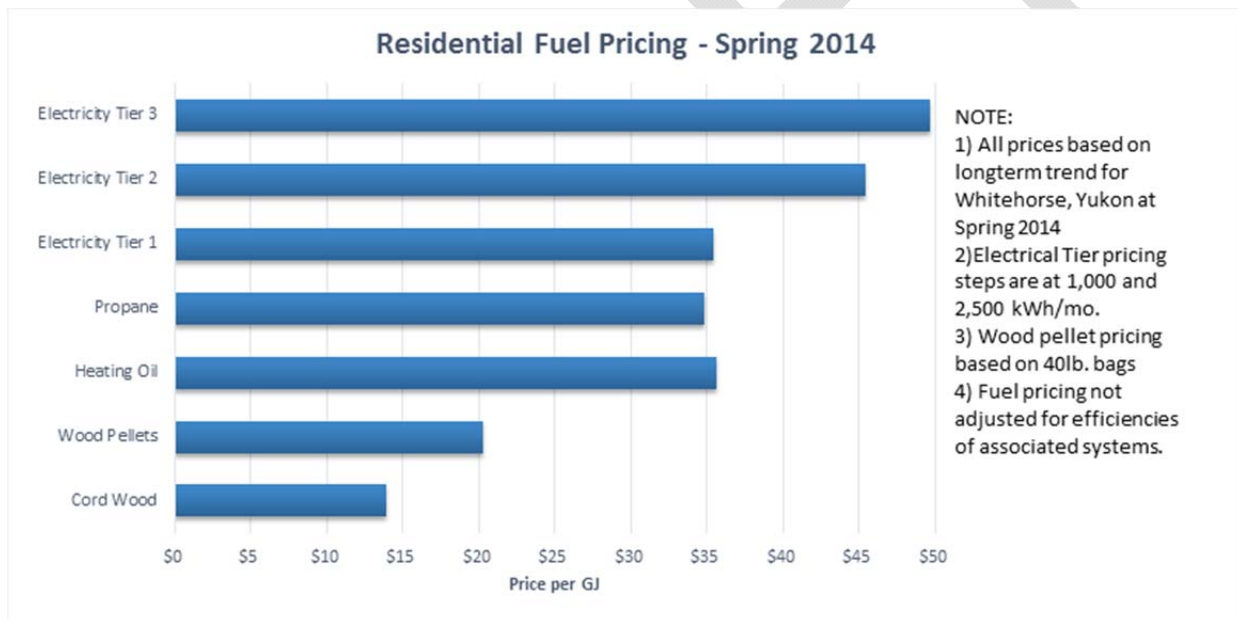


Figure 3: Relative Net Cost of Heat Options 2010 (includes O & M) in \$/GJ

Source: Energy Solutions Centre, 2014

As noted in Figure 3, heating with cordwood, bulk pellets or chips can be as much as half the cost of heating with fossil fuels or electricity. Although the cost of installing a biomass system is normally higher than the cost of installing an oil system, within a relatively short payback period, the lower cost of wood fuel makes up for the higher installation cost and results in significantly lower heating costs in the long-term.



The favourable economics of using wood heat will likely continue. Prices for fossil fuels have been shown to be unstable and can increase quickly. Most long-term industry projections anticipate that prices for wood fuels will be more stable and less expensive than fossil fuels.

3.2.2 Greenhouse gas emissions

Replacing oil heat with wood heat reduces GHG emissions. Burning one litre of heating oil or propane emits approximately 2.8 kilograms of CO₂ equivalent into the atmosphere. In 2009, approximately 40 million litres of heating oil and 8.75 million litres of propane were burned for heat in Yukon. This resulted in 136,500 metric tonnes of GHG emissions (YG Climate Change Secretariat, 2012).

In contrast, wood heating is considered to be nearly carbon neutral. When wood is harvested sustainably, the carbon released into the atmosphere by burning the wood is equal to the carbon absorbed from the atmosphere in growing the wood. Harvesting, transporting and processing the wood results in GHG emissions, but the total amount emitted through activities associated with biomass heat is far less than the equivalent activities related to fossil fuels heat.

3.2.3 Energy self-sufficiency

Harvesting wood for heat will help increase energy self-sufficiency in Yukon. Currently, approximately 75% of the heat generated in Yukon depends on imported fossil fuels. This leaves Yukon consumers highly vulnerable to disruptions in fuel supplies or price increases. In contrast, wood is a local energy resource that is managed and controlled in Yukon. Most Yukon settlements have available fuel wood sources or waste wood within easy transportation distance.

3.2.4 Local forest industry development

Heating with wood will help develop and diversify the economy. On average, for every dollar spent on imported fossil fuels, approximately 60% of it leaves the territory to purchase the fuel wholesale from southern distributors. Still more leaves the territory to pay for the equipment and fuel needed to transport the fuel to Yukon customers. Only a small portion of the total cost of fossil fuels stays in the territory to support wages for local fuel retailers and distributors.

In contrast, for every dollar spent on wood fuel in Yukon, most of it stays in the territory to support local wages and wood fuel contractors. Only a small portion leaves the territory for equipment purchase and fuel.

A recent study³ concluded that there is significant potential to replace oil for heat with modern wood burning appliances. Given our high annual expenditures for oil heat in the north, even a modest switch from fossil fuels to biomass would result in significant new opportunities for Yukon's forest industry.

³ ICF Marbek, Yukon Electricity Conservation and Demand Management Potential Review: Customer-Side Renewable and Alternative Energy, January 2012).



3.2.5 Renewable energy

Wood is a locally available renewable energy resource. When harvested sustainably, trees that are used for fuel are replaced by new growth that over time become large enough to be harvested again for fuel. As long as forest health, habitat, and soil nutrients are maintained, wood harvested on this basis is a reliable, renewable and sustainable long-term source of energy.

The *Forest Resources Act* ensures that forests are managed sustainably through the preparation of forest management plans. The act requires that First Nations and public have opportunities to provide input into the development of the plans. In areas with completed plans, all timber harvesting, including harvesting for biomass energy, must be done within the context of these plans. The plans consider multiple timber and non-timber forest values and identify acceptable harvest levels to ensure maintenance of important forest values and long-term sustainability. In addition, most timber harvest plans go through an assessment under the *Yukon Environmental and Socioeconomic Assessment Act*, which further ensures that harvesting is done on a sustainable basis and subject to public review and input.

Teslin, Haines Junction and Dawson forest regions already have completed forest resources management plans. A forest resources management plan for the Whitehorse and Southern Lakes region is currently in progress.

In designing biomass energy projects that rely on local timber harvest, it will be critical to scale the projects so that they can operate successfully within the acceptable timber harvest levels identified in forest management plans. In cases where there is insufficient local supply to meet the local demand for wood fuel, options for importing wood fuel from outside the region can be considered.

3.2.6 Fuel safety

Wood fuels are safe to handle, transport and store. Wood is solid and non-toxic. If it spills, it is easy to clean up. Wood fuels do not seep into the ground, present a health hazard or damage the environment. This is a significant advantage over fossil fuels, which can be dangerous to handle and can create significant hazards to people and the environment if it is spilled or subject to an accident in storage or transportation.

3.3 Challenges of biomass energy

There are also challenges to using biomass for heat or energy, including air quality management, fuel security and quality, and heating industry transition.

3.3.1 Air emissions

Modern biomass heating appliances are designed to control air emissions so that they do not pose a risk to human health or the environment. Even with these controls, however, the potential for harmful emissions can increase if there are poor operating and maintenance practices, or when lower quality or higher moisture fuels are used.



When wood burns, the main products are carbon dioxide, water vapour and mineral ash. Wood burning can also produce smoke consisting of a mix of pollutants, including fine and coarse particulate matter, carbon monoxide, nitrogen oxides, volatile organic compounds and small amounts of toxins.

Wood smoke is usually a sign of inefficient or poor combustion. Smoke is most frequently associated with poor quality appliances, poor burning practices and/or poor quality fuel. Some Yukon communities have had air quality problems in the past due to these issues. In some communities, wood smoke still remains a real health concern for local residents.

In using wood for energy, strict measures must be taken to ensure that air emissions do not pose a risk to public or environmental health. Only modern appliances that have strict emission controls should be used. Periodic source emission tests should also be conducted to verify performance. Wood fuels must be high-quality so they burn cleanly. All systems must be installed, operated and maintained properly to ensure safe and efficient operation.

Project locations must also be considered. Some valleys in Yukon have a history of wood smoke problems due to air temperature inversions. These areas may require specific measures when considering biomass energy projects. The number and density of multiple biomass projects within an area also needs to be considered. Increasing the number of wood-burning appliances in an area will increase the potential for air quality concerns, even with high-quality fuels, appliances and operations and maintenance practices.

To address these concerns, the development, implementation and enforcement of related air emissions standards, best management practices, as well as source emissions and ambient air quality monitoring are required. This will help to ensure air quality and health standards are maintained for both individual and multiple projects.

3.3.2 Heating industry transition

Currently, Yukon's heating industry is focused on fossil fuels. Only around 17% of the territory's heat is provided through wood. Most of this is with cordwood burned in traditional woodstoves. Only a very small amount of our wood heat is provided through modern pellet or chip systems. At the present time, there is only limited local expertise or infrastructure in place to support modern biomass energy development in the territory.

To facilitate a shift to biomass energy systems, businesses that install and service heating installations will need to develop new expertise, contacts, supply chains and equipment. Businesses that supply heating fuels will need to develop new supply sources, infrastructure and distribution networks.



4 Framework for action

This strategy proposes six key action areas. Each action area has a number of considerations and implementation objectives. The proposed actions are:

4.1 Commit to Using Biomass Energy in Government Infrastructure:

A secure long-term demand for biomass energy and biomass fuels will be needed before local businesses will be able to invest and participate in a biomass energy industry.

Government will:

- a. Conduct biomass energy feasibility assessments for appropriate government projects that require new or upgraded heating systems. YG will identify and select candidate projects that have potential for biomass heating and complete two pilot projects. This includes examining district heat options as well as individual building heat options. This also includes examining different business and financing models for project implementation, partnerships with the private sector.

4.2 Develop Regulations, Policies and Programs for Biomass Energy Industry:

Where appropriate, YG will develop policies, standards, guidelines and programs to promote and manage the use of efficient, clean and safe biomass appliances and fuels.

Government will:

- a. Enhance YG's residential biomass heating incentive program;
- b. Develop regulations as needed for technical specifications and project requirements to ensure that biomass energy development is advanced, safe and efficient, and does not pose a risk to human health or the environment; and
- c. Develop programs to provide information, training, and technical assistance to support biomass energy development in the territory.

4.3 Manage Air Quality to Protect Public and Environmental Health and Safety:

Biomass energy development in the territory must take into account YG's commitment to protect public and environmental health.

Government will:

- a. Develop policies that will require all YG biomass energy systems to be designed, installed, operated, maintained and monitored to ensure that they are safe, secure, and do not pose a risk to human health. This includes both inside and outside the building they are located in. Regular emission tests will be conducted to ensure emission controls are performing.
- b. Ensure that the cumulative effects of emissions to air zones are monitored, and appropriate management actions are taken so that ambient air quality meets all applicable standards.



4.4 Facilitate Private Sector Development in Biomass Energy:

Private sector expertise, involvement and infrastructure will be essential to developing, supplying and servicing biomass energy projects in the territory.

Government will:

- a. Work with other governments, public sector members and private sector groups to share information and coordinate efforts on promoting biomass energy projects. This may include support for feasibility studies, biomass energy programs, incentives, policy development and educational campaigns.
- b. Work with energy providers and public utilities to coordinate biomass energy projects, including possible combined heat and power projects and district heating systems.
- c. Work with the private sector and industry organizations to develop consistent technical standards for the industry, achieve an integrated supply chain, identify training needs, develop technical expertise and identify needs for business assistance.
- d. Work with training and research institutions to develop expertise, share information and deliver training programs.

4.5 Ensure a Sustainable Timber Supply:

To enable the use of local biomass fuels, Yukon's forest industry must have access to sustainable timber tenures. YG is committed to ensuring that timber harvesting for wood fuels will be sustainable and respect non-timber forest values.

Government will:

- a. Continue working with First Nations, communities, interest groups and the public to complete forest resources management plans throughout the territory;
- b. Ensure that biomass that could potentially be used for energy purposes is considered in timber supply assessments and annual allowable cut determinations;
- c. Continue to ensure that social, environmental, and economic goals are considered in making annual allowable cut determinations, as per the requirements of the *Forest Resources Act*;
- d. Work with industry to allow for secure timber tenures that can access wood for energy projects;
- e. Continue to encourage the harvest of fire-killed wood and insect-killed wood for use in biomass operations;
- f. Continue to encourage the use of waste wood for biomass operations, including cut timber from land and road right-of-way clearing or forest thinning projects, and sawmill wastes, etc.;
- g. Work with biomass energy proponents to ensure that projects that rely on local timber harvests are scaled so that they can operate successfully within locally acceptable harvest levels; and
- h. Support pilot studies and demonstration projects to encourage the use of locally processed wood fuel products.



4.6 Ensure Biomass Fuel Security and Quality:

Ensuring a secure supply of high-quality fuel is essential to developing a biomass energy industry. The fuel supply chain will need to be developed in partnership with wood fuel producers, suppliers and distributors.

Government will:

- a. Establish, promote and implement fuel quality standards in the wood fuel supply chain;
- b. Establish industry-wide standards if/and as necessary for the transportation, storage and distribution of wood fuels;
- c. Assist in business planning for infrastructure to transport, store and distribute wood fuels; and
- d. Assist in establishing and promoting wood fuel systems that are automated, reliable and easy to use, so they can compete with fossil fuels in terms of convenience.

5 Conclusion

Biomass energy for heat is a cost-effective and environmentally sustainable solution for heating in the territory. Expanding biomass energy use helps to support numerous YG commitments and objectives, including expanding renewable energy development, reducing GHG emissions, promoting local economic opportunities in the forest and heating industries, and enhancing local energy security and self-sufficiency.

The benefits of using biomass for heat demonstrated a clear economic case for switching from fossil fuels to wood for heat. They also demonstrate a commitment to reducing GHG emissions in the territory.

By meeting the challenges of switching from fossil fuels to wood for heat, the actions in this strategy identify a clear path forward to achieving a strong, economically viable, safe and clean biomass energy industry for Yukon.

