2020 Community Energy Plan

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by Sonya Belisle, Economic & Business Development Officer

&

Kirstine Baccar, Office/Business Development Manager

Superior STRATEGIES

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Acknowledgements

This Community Energy Plan Update was prepared by Superior Strategies for the Red Rock Indian Band in order for the community to pursue energy conservation initiatives, energy efficiency upgrades and alternative energy developments. We are grateful for the support and input from the following individuals that assisted in the completion of this project:

Chief & Council
Melissa McDonald – Community Energy Champion
Nick Wawia – Asset Manager
Priscilla Atkinson – Band Administrator
Tiffany Wawia – Band Administrative Assistant
Ivy Wawia- Receptionist

We would also like to thank the community members of the Red Rock Indian Band for their participation in the completing the survey, as their input was vital to updating this plan.

1.0 EXECUTIVE SUMMARY

The Red Rock Indian Band is a First Nation located approximately 120 km's east of the city of Thunder Bay and 2 km's east of the Township of Nipigon. The First Nation consists of two sections, Parmacheene Reserve 53 and Lake Helen Reserve 53A. The total area covered by these two reserves is 950 acres and is within the 1850 Robinson Superior Treaty area. Red Rock Indian Band is accessible year-round by road.

The purpose of the Red Rock Indian Band Energy Plan update was to:

Review and analyze the existing Energy Plan completed in 2016, perform a community baseline study which will outline the annual energy usage on the Red Rock Indian Band, which includes residential, commercial and industrial applications based on historical data.

Provide energy consumption including electricity, propane, wood, fuel oil, and transportation.

Examine building occupancy data including vacancy rate, use of space and operating schedules. Provide building asset data including conditioned square footage and system specifications.

Provide a summary of results of the baseline study which will include descriptions of data collection processes, methodologies used and energy mapping.

Actively engage community members to determine individual needs and demand for energy types, and to determine the ongoing demand for development and expansion of the Band.

Examine the current and future demand for energy and the types and sources of energy.

Provide information regarding priorities and opportunities related to energy use and possible generation, including opportunities related to conservation, energy efficiency, demand management, impacts to local ecology, and explore renewable energy and small-scale electrical generation.

Implement a plan outline actionable ways to meet energy demands. Identify priorities and opportunities with an evaluation of human and financial resources available in the community. Identify programs which should be included in the energy plan.

There were 28 people in total who participated in the survey's and out of that 28, 17 participated in the Energy Electricity Audit.

The recommendations will be focused on the residential sector as this is the sector that consumes and emits the most energy and CO2. Recommendations will also focus on a feasibility study that will help the RRIB to the next steps of energy conservation.

1.1 Vision, Mission & Goals

Vision: To become a community that sustains its energy needs off of renewable energy sources which are owned and operated by the Red Rock Indian Band.

Mission: To educate our membership on ways to:

1. Conserve energy;
2. Utilize energy in an efficient manner;
3. Adopt alternative energy source.

In order to minimize our environmental footprint and reduce our CO_2 emissions.

Goal: To provide a roadmap that will lead us in meeting our current and future energy needs in an economical, socially acceptable, and environmentally sustainable fashion.

1.2 Summary of Community Energy Consumption, Demand & CO2 Emissions

The total Energy consumption for the community for the year 2019 is 3,348,773.6 kWh; as shown in Figure 1. This was calculated through Energy Surveys, Hydro information, fuel bills, and vehicle information collected. The total Energy CO2 emissions for the community for the year 2019 is 957.12t CO2; as shown in figure 2 below.

Table 1 below summarizes the Energy Consumption and the CO2 emission in both the Residential Sector and Non- Residential Sector through individual Energy Demand.

Figure 1:

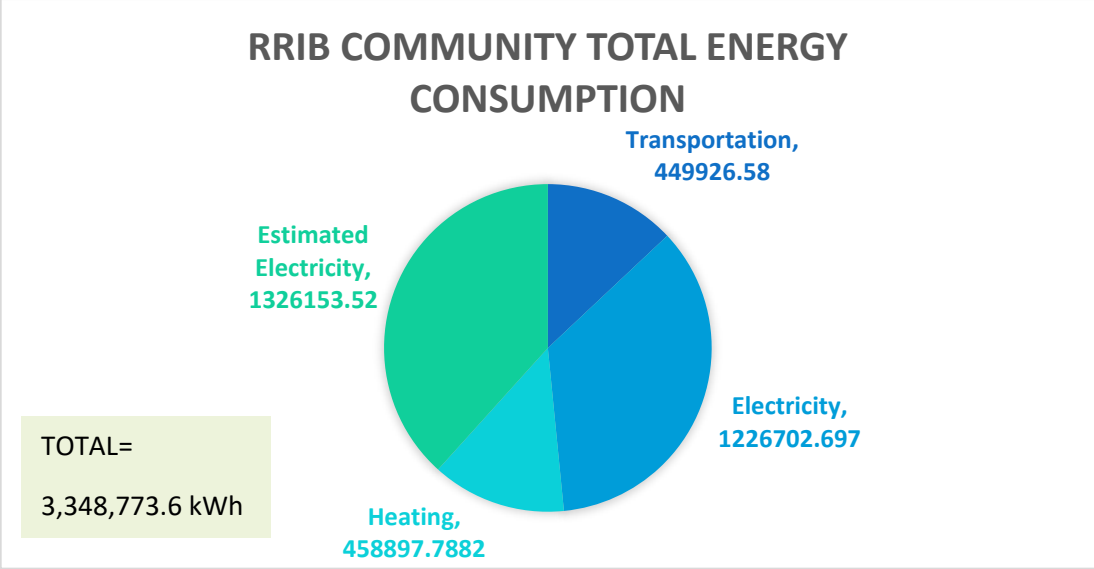

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Figure 2:

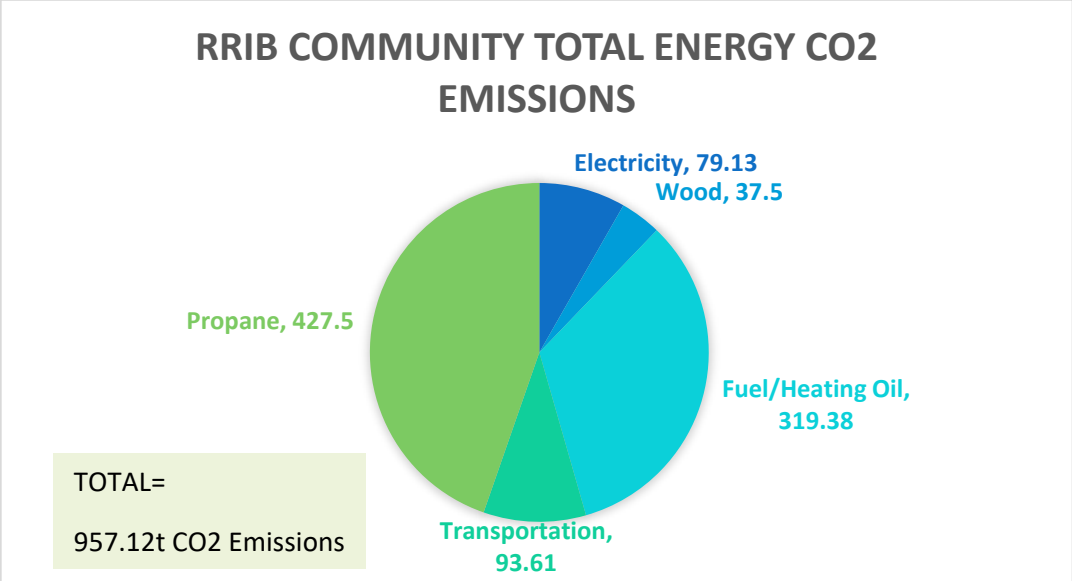


Table 1:

Residential Energy	kWh (equivalent)	tCO2 emissions
Electricity + Estimated 92	1571203.627	48.7 t CO2
Wood	87.921	37.5 t CO2
Fuel/Heating Oil	151695.377	58.1t CO2
Transportation	340308.7	91.4t CO2
Propane	151695.377	172.8t CO2
Non-Residential Energy		
Electricity	981652.585	30.43t CO2
Fuel/Heating Oil	17183.1132	261.28t CO2
Transportation	109617.88	2.21 t CO2
Propane	138236	254.7t CO2
TOTAL=	3,461,680.6 kWh	957.12 t CO2

1.3 Energy Demand & Future Projection

The energy for the year 2016 and 2019 is mapped in Table 2. The Average annual growth rate between 2016 and 2019 has decreased by 17%. The projection of energy demand in 2022 is 915575.74 kWh, using the Linear Forecast in Excel.

The future energy demand will vary dependent on the amount of completed surveys in the future. As well as temperatures that will affect the heating and cooling of each home.

Technology is always progressing and energy efficiency will also progress. Which will also determine the outcome of the RRIB future energy demand.

Once the Energy is recorded in the future RRIB will begin to see a more accurate image of the energy and CO2 emissions trends.

Using the 2016 and 2019 collected data and the equation r=(V2/V1) ^1/n – 1 we were able to calculate the Average Periodic Growth (r). Where as V1= total value in year 2016. Where as V2= total value in year 2019. Where as n = number of years between 2016 & 2019.

Through this equation the Average Annual Growth rate is -0.0167 which is around 17% decrease.

Through the same equation. We can then project the future CO2 emissions through the same trends from 2016-2019 (assuming same measures are being taken).

New equation for estimating the energy demand in 3 years (2022) is V2=V1 x (1 – r) ^n.
Where as V1= total value in year 2019. Where as r = -0.0167(annual growth rate). Where as n = 3 (number of years). This equation can be used to project future energy needs going forward.

The following numbers in the table below are the Annual Energy Demand from the Red Rock Indian Band. They were converted from their original forms in order to calculated a more accurate demand of energy; in this case they were converted to Kilo-watts per hour.

Table 2:

	Annual Energy Demand (kWh)		Predicted (linear forecast)
	2016	2019	2022
Electricity	2028241.66	2552856.212	3077470.764
Fuel/gas	1274383.43	168878.4902	-936626.4496
Propane	78881.38	232004.07	385126.76
Vehicles	2510248.49	449926.58	-1610395.33
TOTAL	5891754.96	3403665.352	915575.7444

Average Annual Growth Rate

r= -0.167148845 (17% decrease)

1.4 Priorities & Opportunities

From the Survey results the community's priorities are:

- Energy conservation to reduce carbon foot print & cost savings
- More education on solar energy and wind energy to eventually begin exploring options and opportunities for the Red Rock Indian Band
- Feasibility study for renewable sources of energy

Energy Opportunities for Renewable are:

- Wind Turbine
- Solar Energy
- Bioenergy

Renewable Opportunities are a high priority but just not feasible at the time considering there is no funding to support this project. The Community Energy Champion will continuously search for opportunities to fund and support these priorities. Below is a table listing the benefits and challenges of each renewable source.

	Benefits	Challenges
Wind Turbine	- Eco-friendly energy alternative (Completely clean) - Free to generate - %100 renewable - Financial availability – financing	- Weather dependant (unpredictable/inconsistent) - Noise level – can emit from 50-60 decibels – very noisy Zoning regulations
Solar Energy	- Renewable energy source - Reduces electricity bills - Diverse applications (produce electricity in areas off grid, distill water in regions with limited clean water, power satellites in space) - Low maintenance costs - Tech development (tech is always improving)	- Cost – initial cost is fairly high - Weather dependant (although tech is always improving) - Solar storage is expensive - Uses lots of space – more energy needed = more solar panels - Associated with pollution (far less compared to other sources: transportation/installation, toxic materials and hazardous products during manufacturing)
Bio Energy	- Supplying domestic clean energy sources - Reducing dependence on oil - Generating jobs - Revitalizing communities - Renewable energy resource (derived from plant-algae based, crop wastes, forest residue, woody energy crops, microalgae, urban wood waste and food waste)	- Biomass has a smaller energy content for its bulk than fossil fuels (cost of labour, transportation and storage is higher) - Needs water and nutrients. Which are in short supply in many areas, must be used to grow biomass crops.

1. **Wind Turbines:**

Two types are Horizontal Axis and Vertical Axis. Working by converting the kinetic energy created by wind into mechanical power.

The interest of Wind Turbine is on the rise. Homeowners are looking to reduce their carbon footprint and save money.

2. **Solar Energy**

You can generate electricity (photovoltaics) or heat (solar thermal). Electricity can be used right away or can be stored for later use in large batteries.

Solar energy is also on the rise, mainly because it is becoming more affordable and accessible. Many people and homeowners are continuously looking for other sources of energy to lower costs but as well as reduce carbon footprint.

3. **Bioenergy**

This is one of the many diverse resources available to help meet our demand for energy. It is a form of renewable energy that is derived from recently living organic materials known as biomass. This can then be used to produce transportation fuels, heat, electricity and products.

Bio fuel: can be converted into liquid fuels for transportation. Cellulosic ethanol and bio diesel can be created. Bio fuels can be used in aeroplanes and most vehicles.

Biopower: biomass can be converted into heat and electricity through burning, bacterial decay and conversion to gas or liquid fuel.

Bioproducts: renewable alternative to fossil fuels in the manufacturing of bioproducts – plastics, lubricants, industrial chemicals and many other products currently derived from petroleum or natural gas.

Anaerobic digestion: is the process through which bacteria's break down organic matter (manure) without oxygen. As bacteria work, they generate bio gas. This generates mostly methane which is primary component in natural gas. Which can then power electricity/heat and transportation.

Thermal Treatment: any waste treatment tech that involves high temps in processing of the waste.

Included in this energy update is a checklist of Location and Site considerations for the Red Rock Indian Band to consider when doing the feasibility study. (Appendices A)

2.0 Environmental Scans

2.1 Residential Energy

There are 105 residential homes on Lake Helen Reserve 51A and camp homes located on Parmachene both are included in the Energy Audit. The approximate size of a home on the Lake Helen Reserve 51A is between 900 to 1200 square foot. There were 28 homes that participated in the survey including one camp-home that is lived in year-round. The RRIB has made significant progress in reducing the energy use from 2016 to 2019. The Energy Programs have been a catalyst for accelerating RRIB towards more affordable energy use year-round.

There are 78 homes who participated in the 2015 Aboriginal Conservation Program, to which have received High Energy Efficient shower heads as well as light bulbs and power cords.

Residential homes have also participated in the energy conservation project that led to insulations, fridge/freezer exchange, light bulbs and energy bars.

2.2 Residential Energy Audits

Due to COVID-19, the current world pandemic, walking through homes was not recommended by the Red Rock Indian Band's current COVID-19 policies and procedures. Seeing as how inspections were completed only four years ago for Residential and Non-Residential buildings, it was not an immediate need in order to complete the energy update.

Residential Energy audits were completed by 28 Residents, 17 residents agreed to Hydro releasing Energy consumed in 2019. Total Residential Energy Consumed in kWh and kWh equivalents is 2,170.413.7 kWh. As shown in Figure 4. The total Residential CO2 Emissions is 408.5t CO2, as shown in Figure 5.

Figure 4:

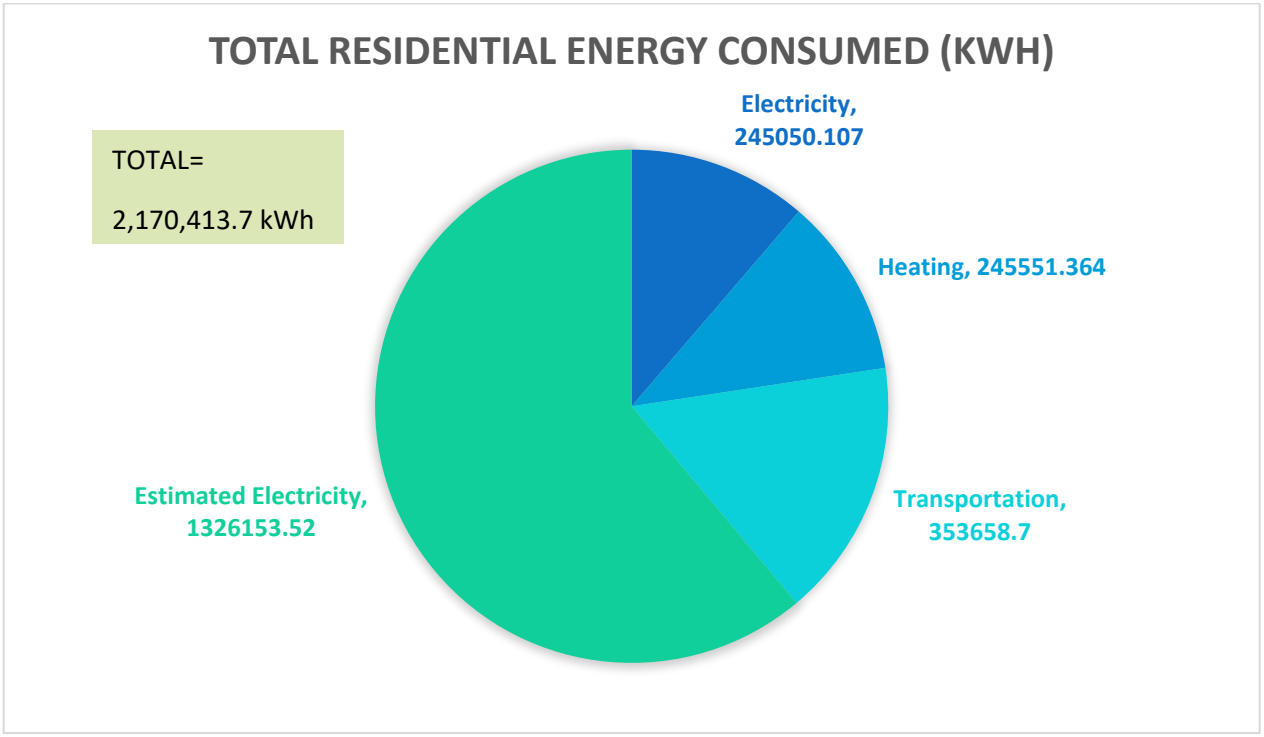
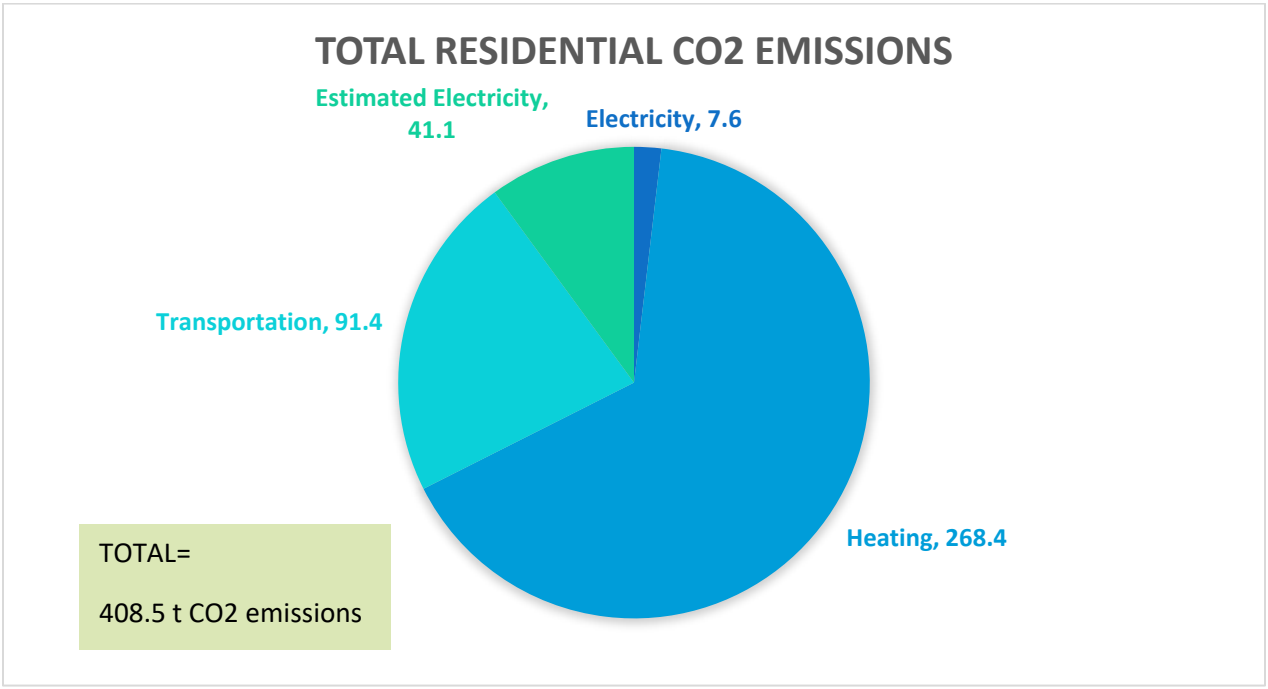


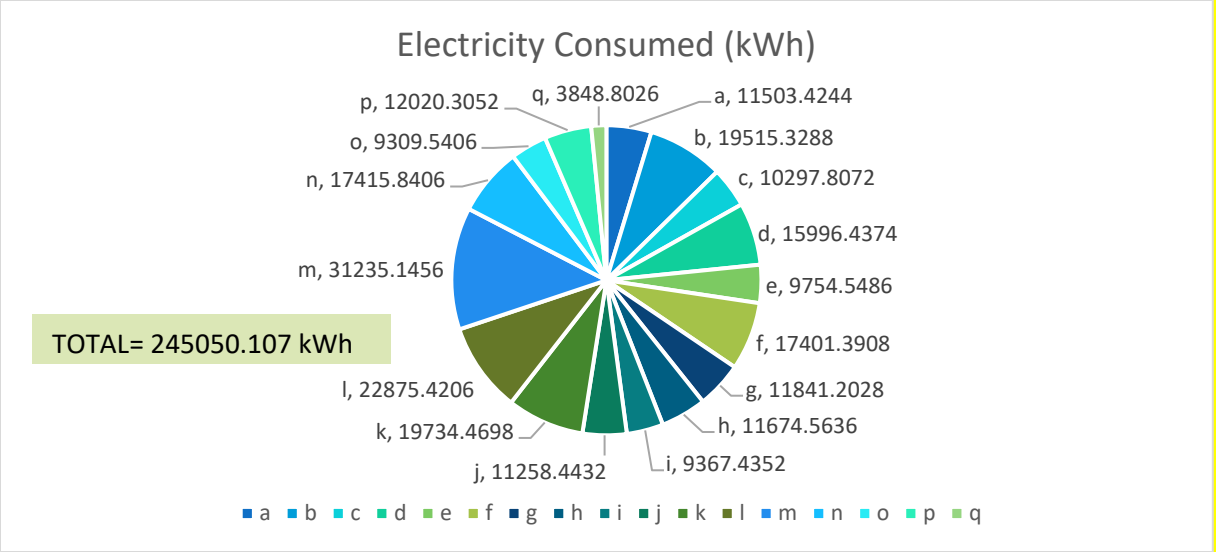
Figure 5:



Residential electricity consumed came to a total of 245,050.107kWh, as shown in figure 6 below. The collected electricity data average is 14,414.71 kWh, which was then multiplied by the 92 homes to which did not complete surveys to get a more complete understanding of the whole community;

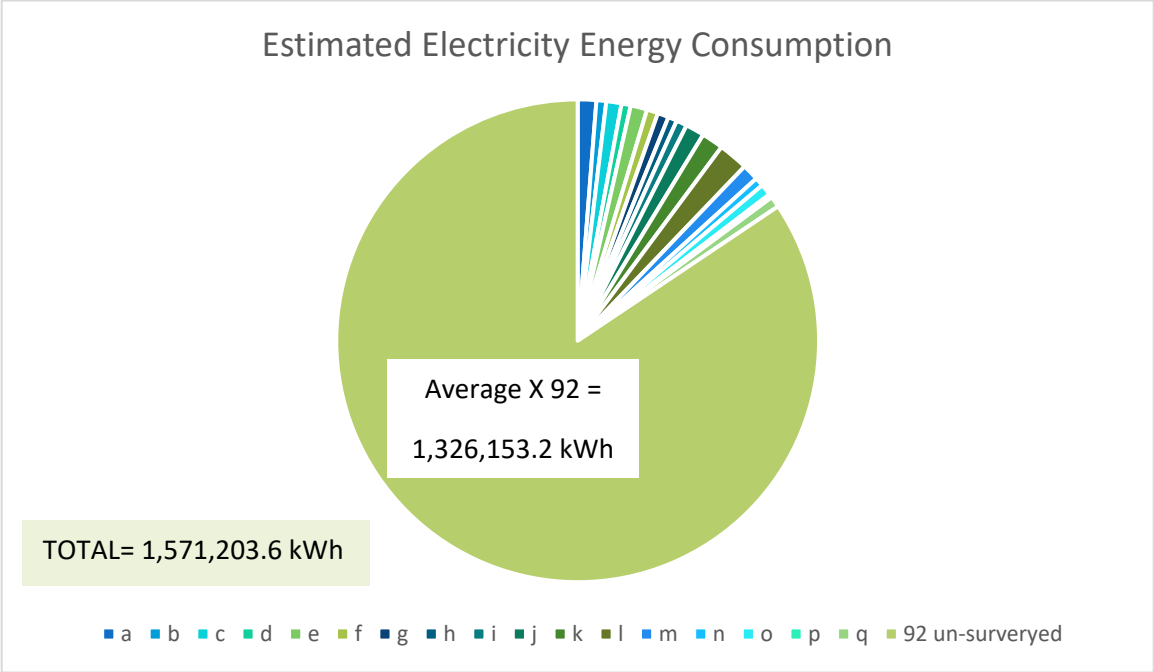
shown in figure 7 below. Which brought the total estimated electricity consumption up to 1,571,203.6kWh.

Figure 6:



Note: Houses were listed as letters denoting the order of which the surveys were completed. This ensured confidentiality for the residents.

Figure 7:



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Residential Heating consists of energy emitted from energy source. Summary of total kWh's are shown in figure 8. Calculations and Survey collection can be found in Appendices D & E.

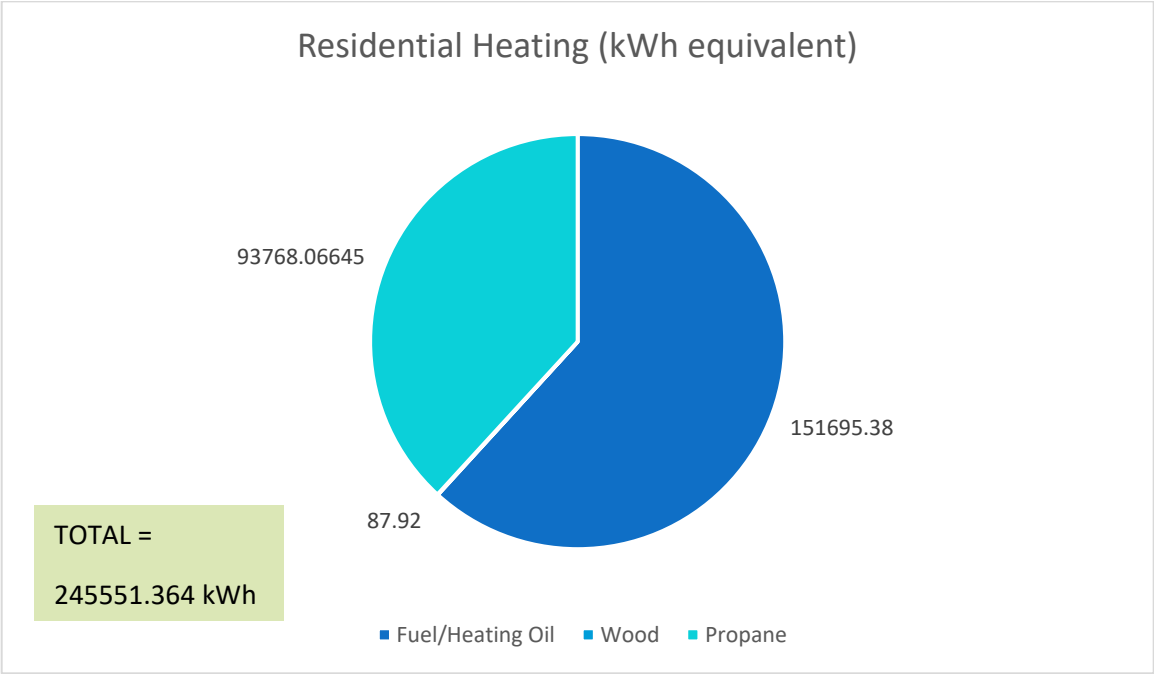
The three heating sources for residents surveyed were Wood, Propane, and fuel/Heating oil. These are estimations as the amount of CO2 released per wood cord and energy consumed all depends on the combustion process. This will vary with the type of wood and the burning rate; how fast does it burn? Is the wood drywood?

The wood used for calculations is white Birch as it has a high burning rate, and Northern Ontario has many. (Appendices C)

Propane was calculated by the amount of L that can fit into the average size tanks and how many BTU were equal to one L burned. (Appendices D)

Fuel and Heating Oil was calculated with Ontario's average fuel/heating oil cost for the year 2019 as well as fuel tank sizes. (Appendices E)

Figure 8:

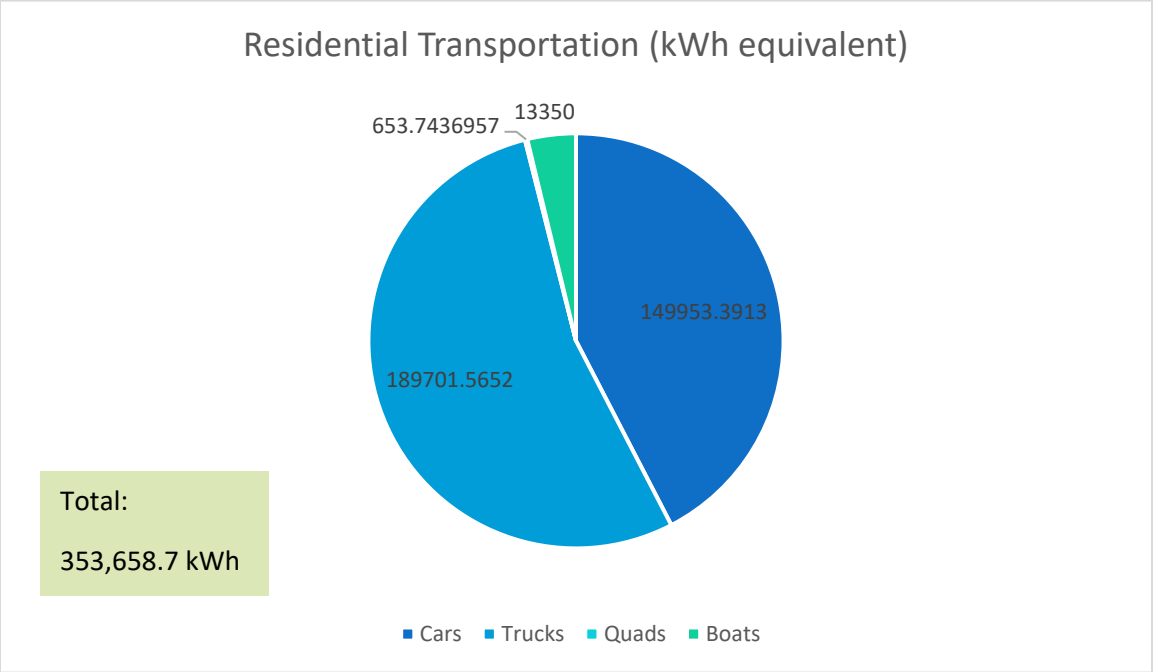


Residential transportation was completed through the Surveys and the Canadian chart produced for vehicles for 2019 and CO2 produced per km. Used the highest CO2 release for each car and truck as it

would give us a more accurate result. Calculations also involved the average km driven per year in 2019 for Ontario Residents. (Appendices E)

It is noted that the Residential Transportation is not an accurate amount as all of the residents did not participate in the survey.

Figure 9:



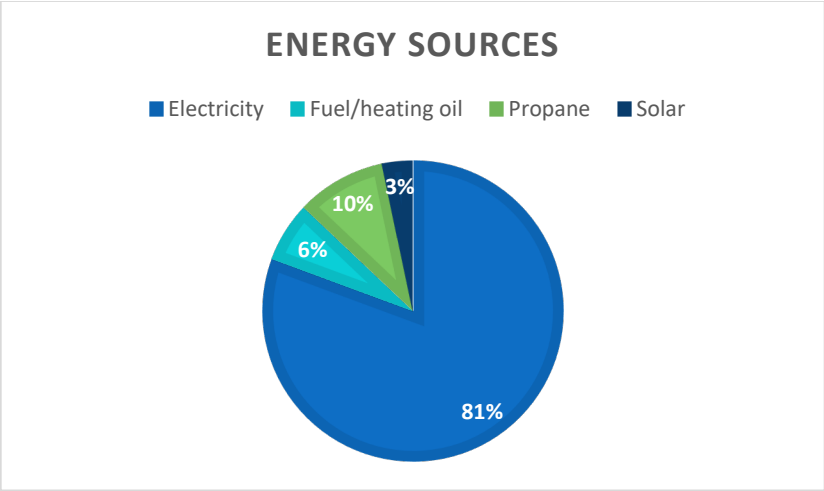
Collected Energy Data

There are 105 residential homes on Lake Helen Reserve 51A and camp homes located on Parmachene both are included in the Energy Audit. There were 28 homes that participated in the survey including one camp-home that is lived in year-round. Of the people who participated, there were no major concerns with Hydro, most reported that cost concerns alleviated once delivery charges were exempt from members. The following figures below are visual summary of that data collected. Original data collected are in Appendices B.

Electricity is the Primary Energy source among the homes that participated in the survey. Secondary Energy sources include Fuel/Heating Oil, Wood, Propane and one home utilizing Solar.

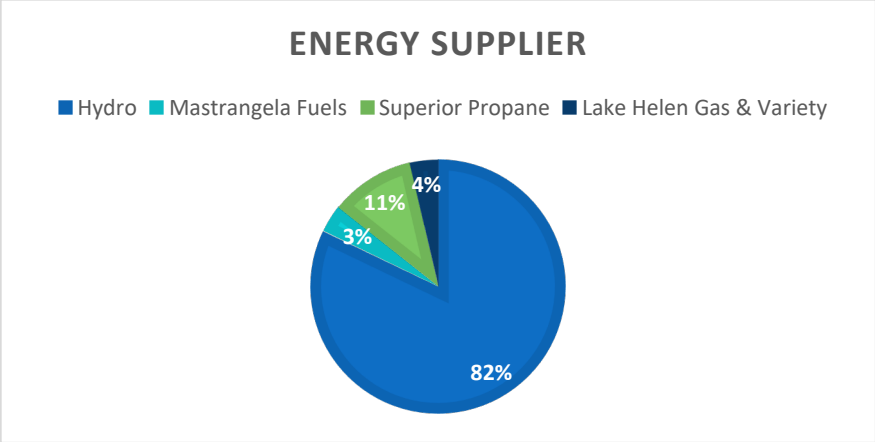
(Figure 10).

Figure 10



82% of the survey's data collected determined that Hydro One is the Primary Energy Supplier among the community. (see Figure 11)

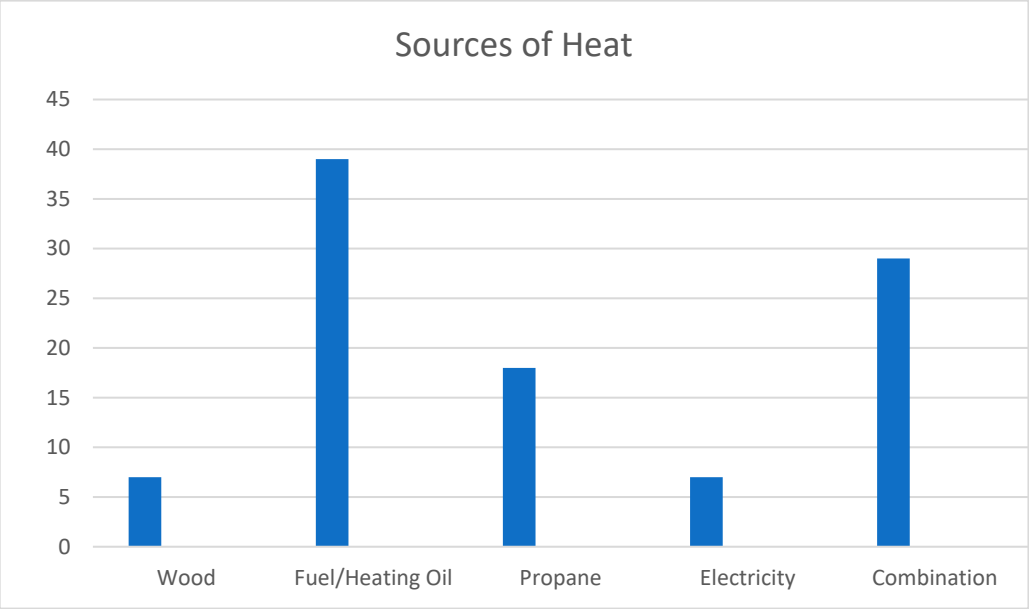
Figure 11



Sources of Heat:

Homes that participated in the survey heat their homes with wood, fuel/heating oil, propane and electricity. Among these homes 7% utilize wood, 39% utilize fuel/heating oil, 18% utilize propane, 7% utilize electricity and 29% utilize a combination of the above mentioned. (See Figure 12)

Figure12:



Preparation for Winter months:

57% of the homes do not prepare their homes for the cold expected in the winter months leaving 43% of the homes that do prepare for colder weather. (figure 13).

Figure 13:

93% cool their homes with Window A/C and Electric Fans.

99% of the homes have electric water heaters. The home located on Parmachene heats water via stove-top (see figure 14). 97% of the homes do not have an insulation blanket on their water heater (See figure 15). All water heaters did not have a timer on the water tank, but reported the water heater as on-demand.

Figure 14:

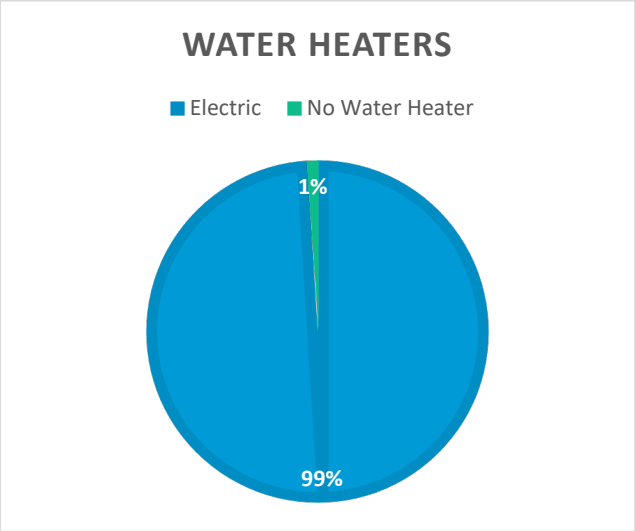
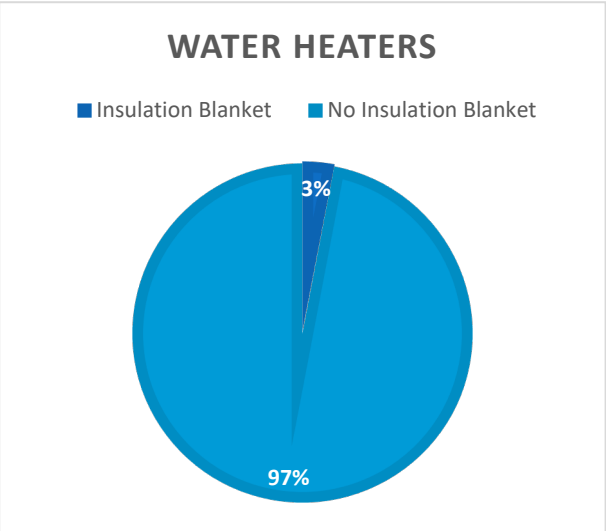


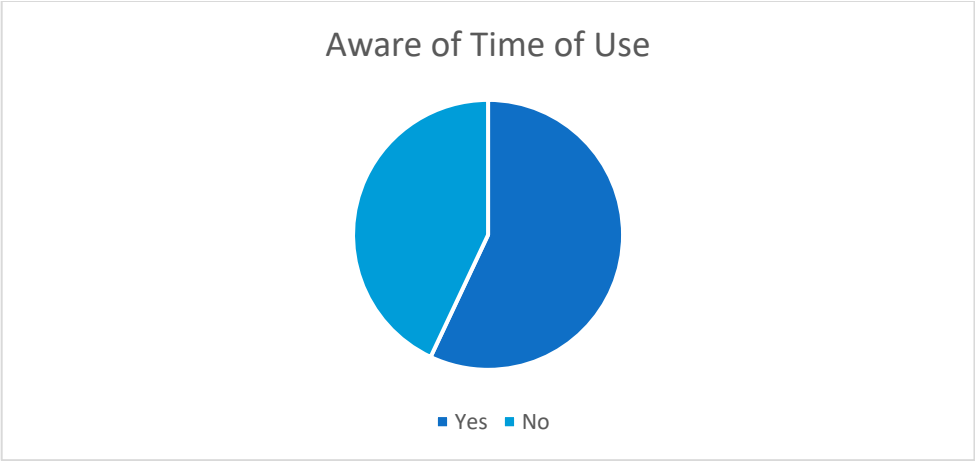
Figure 15:



Time of Use:

When collecting information from participating homes 57% reported yes as being aware of Time of Use energy saving. Leaving 43% unaware they can save energy and money during certain peak hours. (see Figure 16)

Figure 16:



Changes in Energy Use:

Survey's concluded that 68% of the homes have changed their energy use in the past 5 years. Changes made include going solar, using dryer at off-peak, utilizing clothes lines, and outdoor cooking. (see tables 17 & 18)

Figure 17:

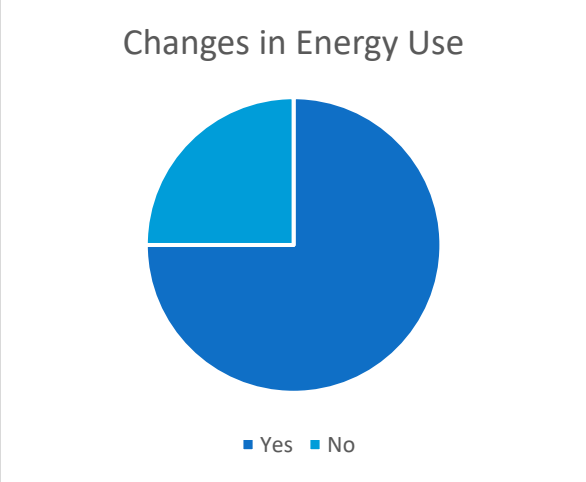
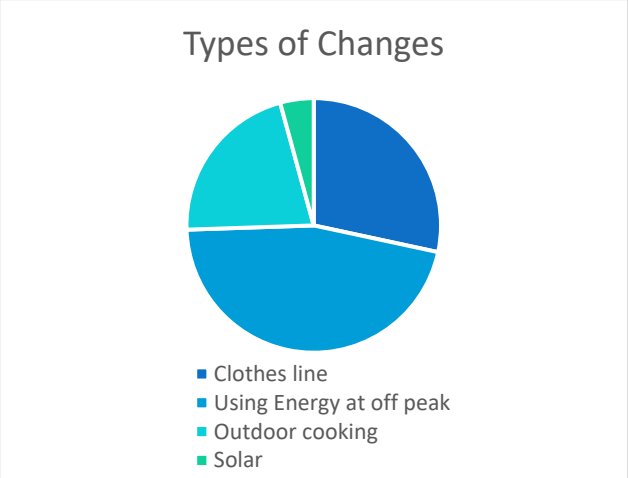


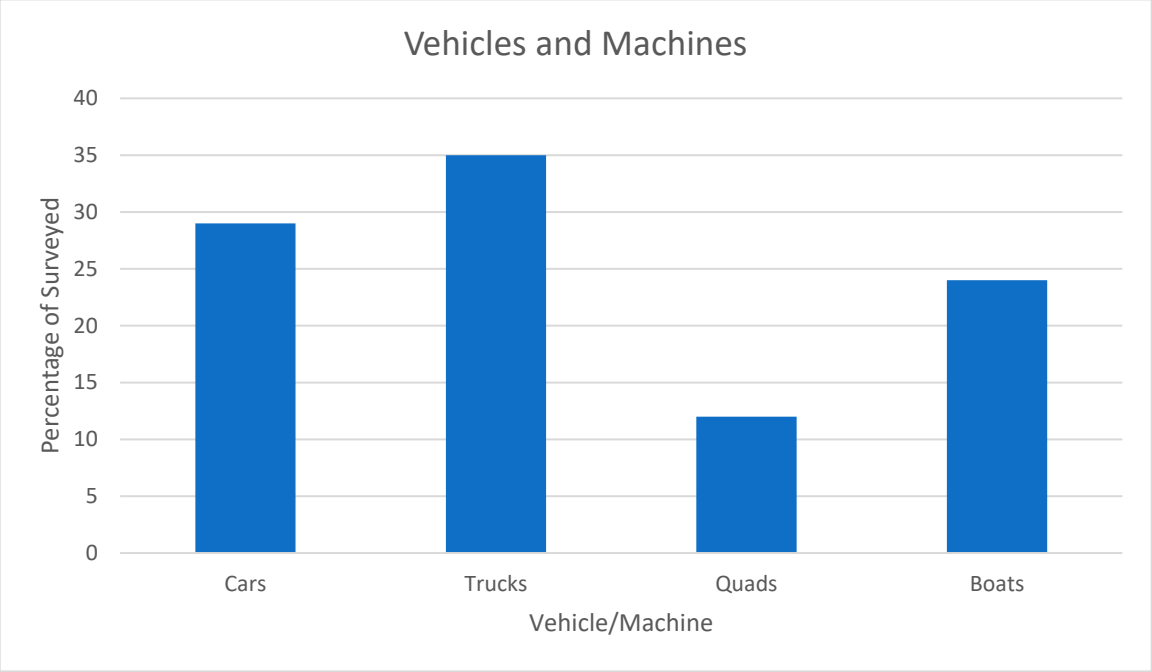
Figure 18:



Vehicles & Machines:

86% reported owning Vehicles and Machines; of that 86%: 29% owned cars, 35% owned trucks, 12% owned quads and 24% owned boats. (Figure 19)

Figure 19:



2.3 Non-Residential Energy

Building Assets

Water treatment building:

This building was last inspected on June 14, 2016 and constructed in 2008. The estimated remaining life in years, at the time, was 30 years. The asset is 245.18 square meters. It was rated a 9 in good condition at the time of inspection. The asset is a butler type of building with concrete foundation over a Water Reservoir (403000-01). There is a metal pitched roof with metal siding. Heating is by forced air electric overhead heaters and there is a diesel generator behind the building. There is a two unit engineered air distribution system located in the mezzanine, above the chemical room. The asset is located on the west side of Lift station Road (601400-01). It houses the following assets; the Water Treatment System (404000-01), the Water Reservoir and the High-Level Pump Station (406000-01). Four-unit heaters were added in the spring of 2013. The colour siding is a light blue and the colour roof is light grey. The insulation used in this building asset is unknown at this time.

Fire Hall Building:

This building was last inspected on June 14, 2016 and constructed in 1984. The estimated remaining life in years, at the time, was 20 years. The asset is 164.72 square meters. It was rated a 7 in good condition at the time of inspection. The asset is a wood framed structure with metal siding, pitched metal roof and slab on grade foundation. The building's heating is by oil fired forced air heaters and the building has two bays with a triple combination pumper and mini pumpers stored inside. The building appears to be situated too low. The FPO was constructed and added onto the firehall recently. A new furnace was installed in 2011. The asset was rated as adequately maintained and in good condition at the time of inspection.

Community Hall:

This building asset was constructed in 1960 and inspected in 2016. The estimated remaining life in years, at the time, was 20 years. The asset is 292.94 square meters. It was rated a 7 in good condition at the time of inspection. The asset is a single storey wood framed, bi-level building with a full basement and a pitched asphalt roof. Located on Ball Park Drive. The building was undergoing a renovation of washrooms, exterior walls and windows at the time of inspection. The asset required some building code related upgrades and is in good condition at the time of inspection.

Public Works Garage:

This building asset was constructed in 1998 and inspected in 2016. The estimated life in years, at the time of inspection as 17 years. The asset is 17.3 square meters. It was rated a 7 in good condition at the time of inspection. The asset consists of a stress skin steel building with a concrete pad/steel frame foundation and curved metal roof. The heating system is a forced air oil-fired system. The asset is adequately maintained and in good condition at the time of inspection.

Band Warehouse:

This building asset was constructed in 1995 and inspected in 2016. The estimated life in years, at the time of inspection was 25 years. It was rated an 8 in good condition. The asset is a pre-engineered Quonset-style building. It is insulated and heated by a forced air oil furnace. The asset is located on the west side of Mission Bay Road next to the storage trailer. This asset is well maintained.

The current annual energy consumption, in 2019, is 15,566.899kWh and costed $1, 548.46 to cool/heat.

Resource Centre:

This asset was constructed in 2000 and inspected in 2016. The estimated life in years, at the time of inspection was 25 years. It was rated an 8 in good condition. The asset consists of a wood framed building on a pressure treated crawlspace with a pitched asphalt roof. The heating system consists of a 117, 000 BTU oil furnace and HRV. The building is equipped with an EST 6616 alarm system. The asset is located on the north side of New Street East. The asset is well maintained and in good condition.

The current annual energy consumption, in 2019, was 18,539.2944kWh and costed $1, 726.93.

Pow wow Grounds storage:

This building asset was constructed in the year 1990 and inspected in 2016. The estimated life in years, at the time of inspection was 15 years. The asset is 32.26 square meters and consists of a single storey wood framed building with slab grade foundation and a pitched asphalt roof. There is no heating system in the building. The asset is located on the south side of Cultural Grounds road and is used for storage.

The current annual energy consumption for the year 2019, was 383.2086kWh and cost $27.91.

Rink:

This asset consists of a small building adjacent to a concrete cement slab. The cement slab being 319.74 square meters. The building is a pitched roof, and a wood framed building. Heat using a space heater and is 29.6 square meters.

The current annual energy consumption for the year 2019, was 3,353.2728kWh and it cost $414.66.

Garage:

This asset was constructed in the year 1998 and inspected in 2016. It is 72.89 square meters. The asset consists of a wood framed building with concrete slab and pitched asphalt roof. There is a ceiling mounted forced air propane heat and the building has electricity. The asset is well maintained and in fair condition.

Band Office:

The RRIB office was recently constructed within the last 5 years. The asset is 2 storeys high with elevator access to the second floor. The asset consists of a low-slope roof and is 344.9 square meters. There is forced air propane heat and air condition throughout the whole building. This asset is very well maintained and in very good condition.

The current annual energy consumption for the year 2019, was 80,643.52kWh and it cost $8,755.41.

Chalet & Chalet house:

The Chalet Lodge building is 344.9 square meters. The asset consists of a log/wood framed building. Heated with propane, and was recently renovated in 2018. The asset has multiple wood framed buildings surrounding, that are currently being renovated. The Chalet House is 86.3 square meters with a pitched roof and wood framed.

The Chalet Lodge's current annual energy consumption is 22, 160 kWh and it costs $4,549.37. The Chalet house is 4,031 kWh and is on tiered pricing with the RRIB.

Lake Helen Gas & Variety:

This asset has a pitched asphalt roof and consists of a wood framed building. Heated with electricity. This asset is an older building and is 66.5 square meters.

The LHGV consumed 47,036.6kWh in 2019 and costs were $4,320.98.

2.4 Non-Residential Energy Consumption

The total Non-Residential energy consumed is 1,118,314.91 kWh. This is including Transportation, heating and electricity as shown in figure 20. The total Non-residential CO2 emissions for RRIB is 293.92t CO2, as shown in figure 21 below.

Figure 20:

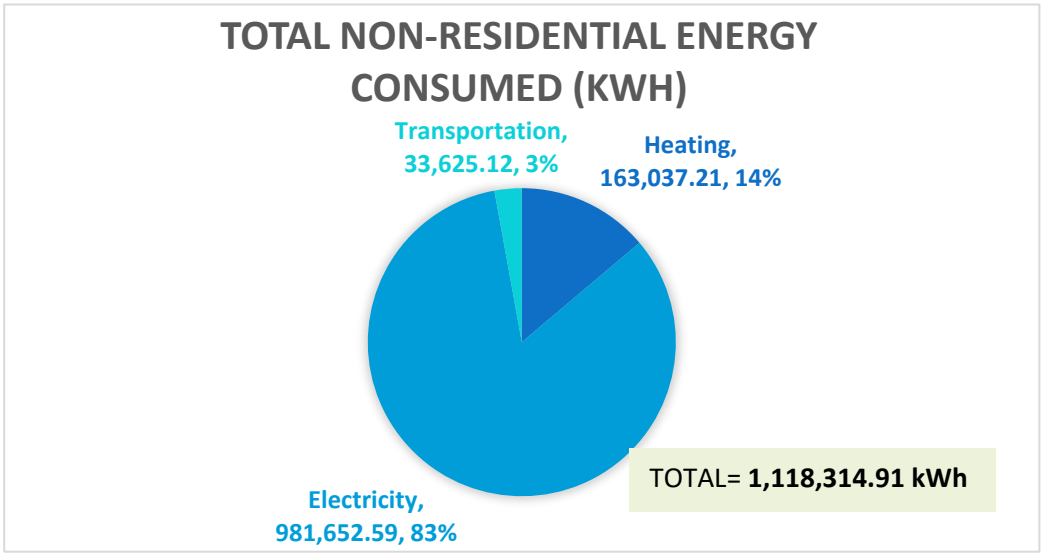
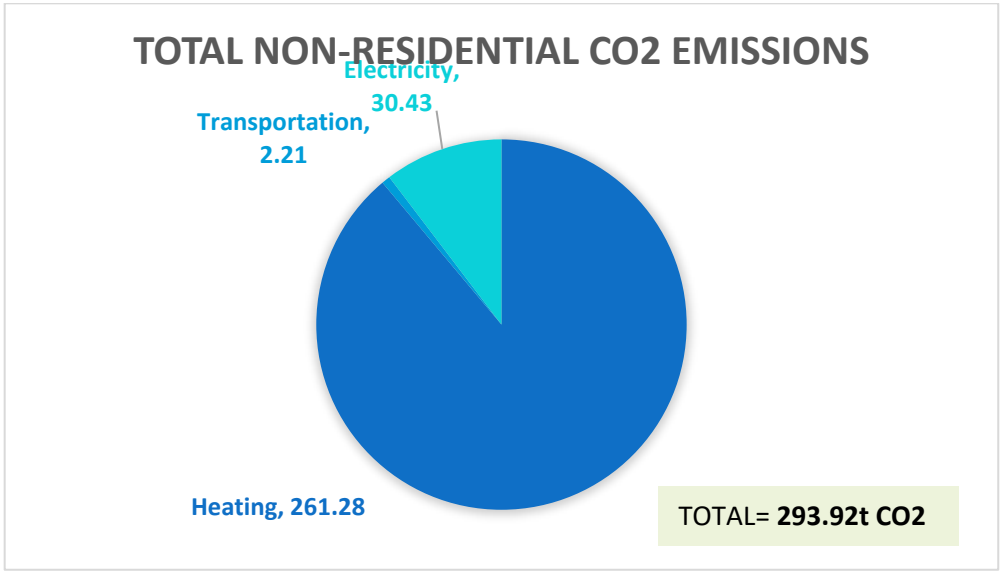


Figure 21:



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Electricity data was collected from Hydro one for all building assets. Below in figure 22 is a map of Energy consumed for Electricity. The total CO2 emissions is 30.4 tonnes of CO2, as shown in figure 23. Also shown in table 3. Original data collected included in Appendix G.

Figure 22:

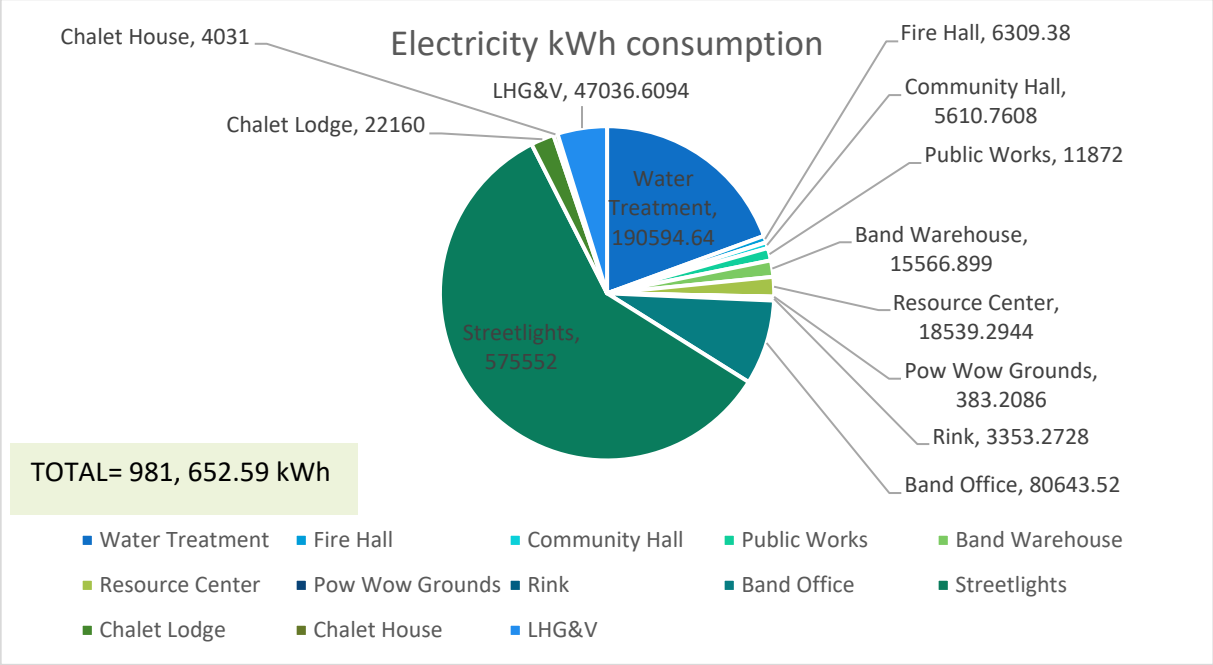


Figure 23:

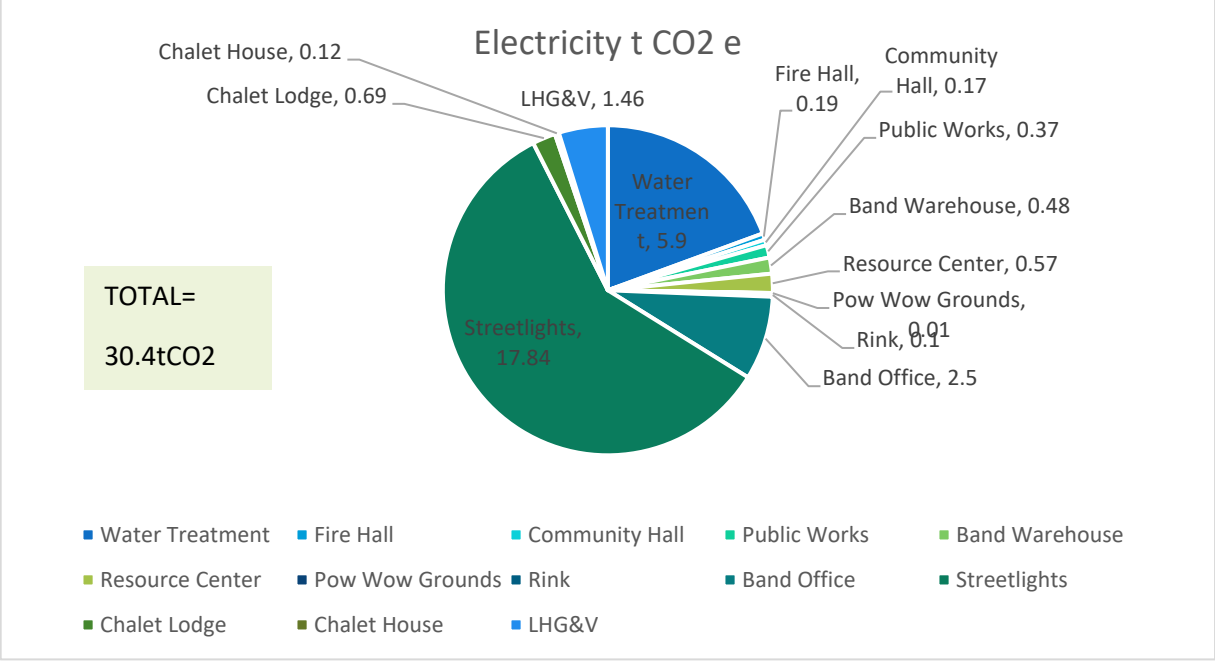


Table 3:

	Electricity Consumption/Year (KwH)	Cost/Year ($)
Water Treatment	190,594.64 kWh	$17, 594.82
Fire Hall	6309.38 kWh	$692.96
Community Hall	5610.7608 kWh	$458
Public Works	11, 872 kWh	Tiered Pricing
Band Warehouse	15, 566.899 kWh	$1, 548.46
Resource Center	18,539.2944 kWh	$1, 726.93
Pow wow Grounds Storage	383.2086 kWh	$27.91
Rink	3,353.2728 kWh	$414.66
Band Office	80,643.52 kWh	$8,755.41
Streetlights	57, 5552 kWh	Tiered Pricing
Chalet Lodge	22,160 kWh	$4549.37
Chalet House	4, 031 kwH	Tiered Pricing
Lake Helen Gas & Variety	47, 036.6094 kWh	$4320.98

The non-residential heating was calculated through Litres used for the year 2019.

The total CO2 emissions can be shown in figure 25. Calculations for both Figure 24 and 25 are shown in Appendices D.

Figure 24:

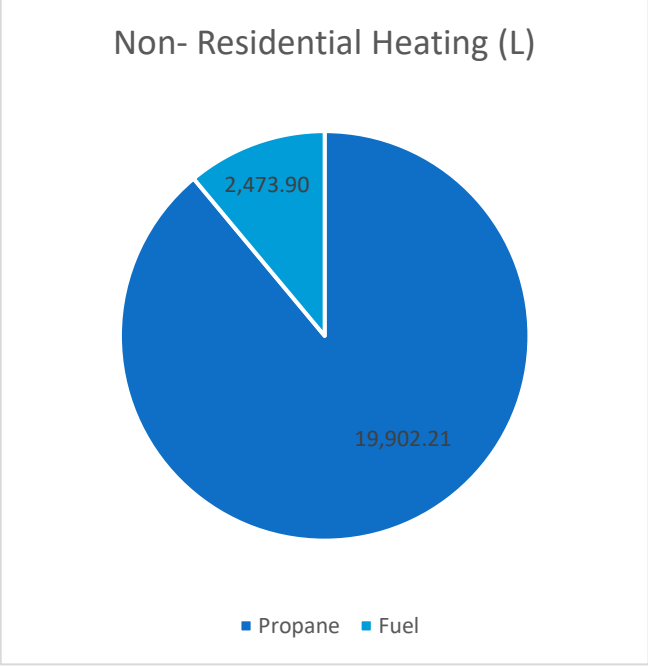
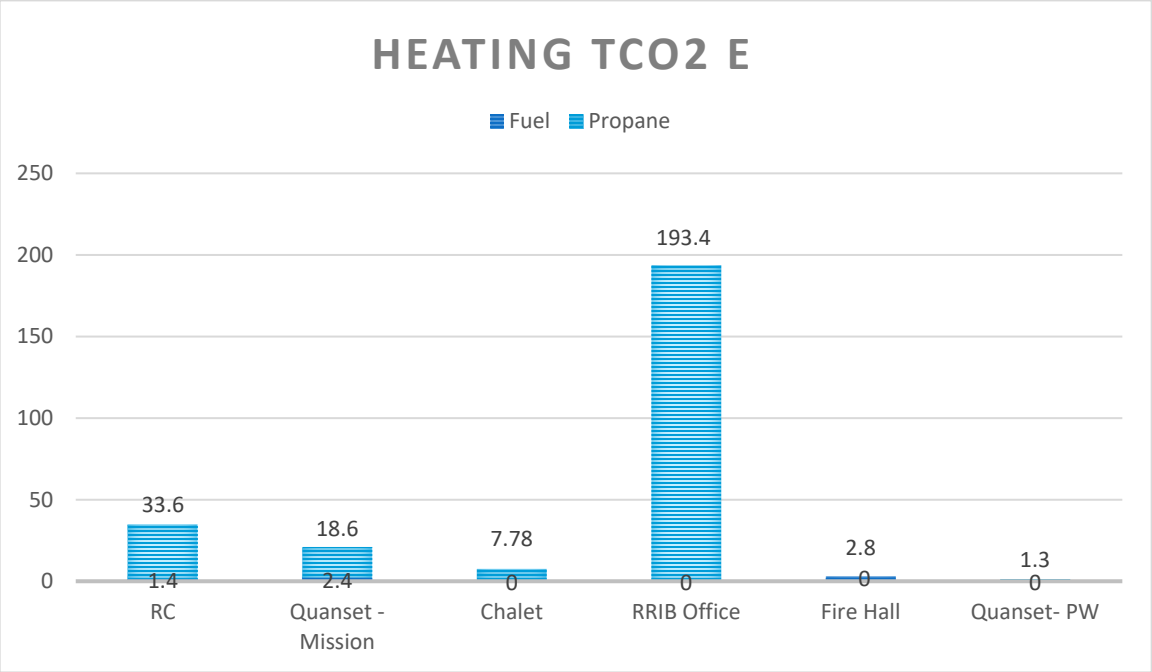


Figure 25:


HEATING TCO2 E
Fuel
Propane
250
200
150
100
50
0
33.6
1.4
18.6
2.4
7.78
0
193.4
0
2.8
0
1.3
0
RC
Quanset - Mission
Chalet
RRIB Office
Fire Hall
Quanset- PW

2.5 Non- Residential Vehicle Energy CO2 Emissions

The total charges in gas from band owned vehicles from March 2019 until February 2020 is $109, 617.88. The total energy consumed in kWh is 9,340.32. This is summarized in figure 26. The total energy emitted by band owned vehicles is 2.21 TCO2. (Figure 27). The fuel calculated for 2019 is 960.717L. This was calculated using the average 114.1 cents per L for Ontario in 2019. Calculations and tables for these can be found in Appendices I.

Figure 26:

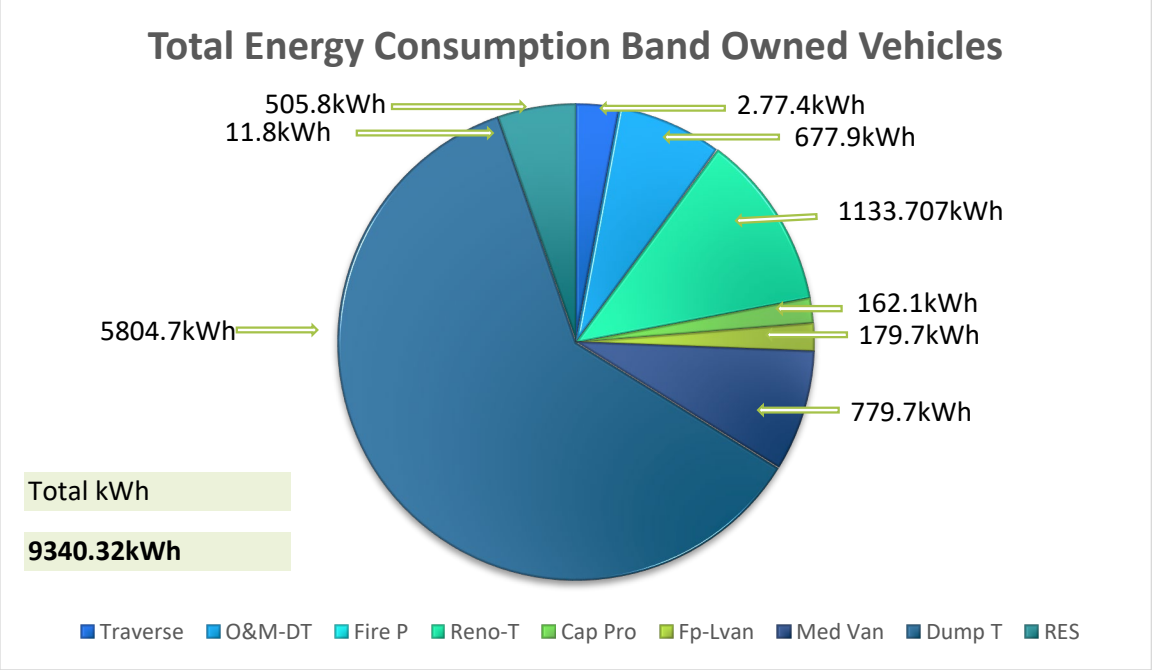


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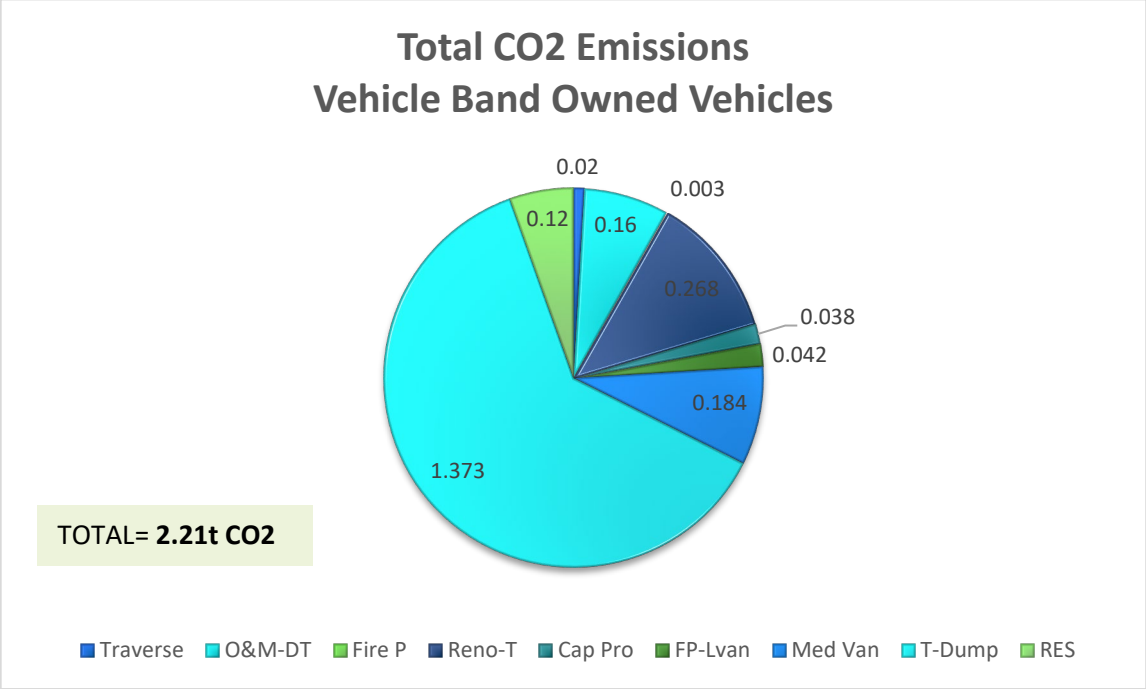
Figure 27:



The total charges for non-residential use of vehicles for the year 2019 is $109, 617.88. As shown below in table 4.

Table 4:

RRIB - Vehicle Charges
March 2019 - February 2020

	Total
Traverse	998.44
O&M Dump Trucks	7955.44
Fire Protection	137.98
Ren-Housing Truck	13305.18
Capital Projects	1902
Fire Prevention - LVAN	2108.84
Medical Van	9150.78
Trucks - Dump Truck	68123.56
RES	5935.66
Total=	109617.88

3.0 Organizational Structure Recommendations

3.1 Organizational Structure:

Internal Sources

Melissa McDonald – Energy Champion

Energy Champion will continuously look for funding sources that will benefit the RRIB on their steps towards a lighter carbon footprint. The energy Champion will be the main contact and educative source for the Red Rock Indian Band members.

Community Energy Committee

In the recommendations below, it is recommended that the community form a committee that will handle tasks that will help create a lighter carbon footprint. The committee can be the voice of the community to help bring future initiatives alive.

Youth Energy Committee

In the recommendations below, it is recommended to create a Youth committee. This committee will be responsible for getting more youth involved in taking care of the future.

External Sources

Funding Agencies

Funding agencies will play a vital role in the development of a renewable Energy System. It is important for the Community Energy Champion to put an on-going effort for opportunities for the RRIB.

Neighbouring Communities

Neighbouring communities may be an external source to achieve the RRIB goal of becoming a more energy efficient community. There are possibilities of partnerships, as well as income for shared source of Energy Systems.

Neighbouring Energy Systems

Neighbouring Energy Systems that are already in place may also be an external source. There are possibilities of partnerships to reduce the initial cost of a new Energy System.

Action Plan Steps:

1. Discover Community Priorities
2. Educate Community Members about Energy Conservation - continual
3. Apply Retro-fit programs & Current Bringing It Home to Non-Residential Sector

4. Conduct a Feasibility Study for the possible micro generations (Wind, Solar, Bio) Steps 3 & 4 can begin at the same time
5. Discover funding opportunities to support Energy System that suits RRIB

The above action steps will be a few years process. Below is an estimated time frame:

	Time Frame
Funding	Varies – dependant on funds available
Current Initiatives and Education for Community	1-2 Years
Feasibility Study	1 Year

The time frame will vary as it is dependent on funds available for project creation. There will be a continual search for funds by the Community Energy Champion to see this goal through. Sometimes funding will become available and there is a certain time frame to submit proposals.

During the current global pandemic (COVID-19) it is recognized that communities have been struggling and the focus is elsewhere. The current initiatives, Bringing It Home and Retrofit programs as well as community involvement is estimated 1-2 years. This is the case because there is hope for Community engagement through the recommendations listed in 3.2.

The feasibility study, that is a vital part of this process, will take approximately 1 year to complete. One feasibility study roughly takes 60-90 days. The feasibility study that needs to take place will be including 3 other feasibility studies, including the wind, bio and solar. This is a bit of extra time for communication with external sources in order to do a thorough study of each.

3.2 Implementation Recommendations:

The most important piece of recommendations is conducting a feasibility study for the RRIB. It is recommended that a feasibility study is done to explore micro generations of wind, solar and bio energy projects to help off-set the costs for the RRIB. This study will demonstrate the energy savings and sufficient off-set costs of each Energy System. This study must include all financial costs, including the installation process' for each system. The study should include the incremental design as well as the environmental impact.

This study is vital and needed in order to take the next steps in the Red Rock Indian Bands' future Energy Initiatives. Once this study is complete, the RRIB will then be able to decide which system is the best suited for the community. RRIB will then be able to continue their on-going search for funding specifically towards the chosen Energy System.

1. **One time or yearly Installation of device upgrades for the residents – dedicated person once a year to help community members - pilot project**
   Hiring or having a team from the RRIB install the device upgrade for the residents will ensure the residents are using the device upgrade. Having someone show the residents how to use the devices (ex. Proper instructions on how to use the timers on the extension cords). This can be a pilot project.

2. **One on One education - luncheon teachings**
   Hiring or having someone go door to door to provide updates regarding Energy Conservation. Sending out video information to Residents with quick updates on programming happening in the community. Providing luncheon gatherings with quick information regarding any Energy updates and conservation.

3. **Zoom – Adjusting to the new norm for now**
   Create zoom meetings with the community regarding energy updates & opportunities. Create incentives for members.

4. **Actively Engage Community Members**
   When engaging the community, it is common to struggle in this aspect with First Nations. Engagement within a FN community will look different from the typical community engagement. While hosting community engagements, one would agree it is difficult to get community members to attend or have an interest. An idea to actively involve members, is to send notifications via social media, or door to door reminders. It may seem like a lot of extra work, but it will be worth the turn out.

5. **Educate through targeted programming**
   Educating members and residents about Energy Conservation can be difficult, and doesn't hold a lot of interest for many people. Energy Conservation can be a dry subject; by linking this information with interesting programming it can, in return create education to the members/residents as well as engage targeted community

members. For example: Photography, poster, short story/essay contest or advertisement contest about Energy Conservation. Some other implementation techniques would be to Educate through popular blogs, or to go social with FB, INSTA, & Tik Tok or create education apps.

6. **Create an Energy Committee**
   With the high demand for other jobs created within the Red Rock Indian Band, there is no time for other staff members to take on this extra programming. Creating an Energy Committee that is available for residents to join will not only make up that time, but also actively engage members to participate in the future plans of the RRIB. This committee can be the idea creators for advertisement and active engagement. More minds will in return give you more ideas.

7. **Youth engagement – create a Youth Energy Committee**
   Youth engagement is important to inspire the future leaders and also to help diversify the community needs as a whole. Youth involvement means caring for the future and its energy consumption. A Youth committee can help with fresh & unique ideas on Energy Consumption.

8. **Network within previous Band programs and Frontline staff**
   Networking within the Red Rock Indian Band will create a togetherness that is needed among First Nations. It will also gather and provide input from the many creative minds already within the community. Utilizing previous band programs to help with educating through targeted programming can diversify the targeted residents/members of the RRIB.

The recommendations from the 2016 Energy Plan have been updated and recommended in the 2020 plan. First Nation communities are unique and require a different process to implement community plans. It is important for the residents and community members to be on board in order to move forward with Energy saving ideas that have been provided. In order for Residential and Community involvement, it is recommended that the RRIB applies for the IESO funding "Education & Capacity Building Program". It is also recommended that the RRIB implements the list of recommendations below through **Targeted Programming** explained in point 5. It is noted that the list in the RRIB 2016 Energy Plan is a lot of information for one to obtain in one sitting. By dividing the recommendations throughout programming, it will be easier and quicker for community residents & members to obtain.

4.0 OPERATIONS

4.1 Building Asset Data

Building Asset	Description	Inspection Date	Year of Construction	Est. Remaining Life	Square Meters	Condition rating
Fire Hall	Wood framed structure. Metal siding. Pitched metal roof. Slab on grade foundation. Heating: oil fired forced air. Two bays – triple combo pumper & mini pumper inside. New furnace in 2011.	2016	1984	20	164.72	7
Community Hall	Single storey. Wood Frame. Bi-level building. Full bsmnt. Pitched asphalt roof. Renos: washrooms, exterior walls & windows.	2016	1960	20	292.94	7
Water Treatment Building	Butler type – concrete foundation over a water reservoir. Metal pitched roof. Metal siding. Heat is forced air – electric overhead heaters. Diesel generator. Two unit engineered air distributed system in mezzanine. 4-unit heaters added in 2013.	2016	2008	30	245.18	9
Works Garage	Stress skin steel building. Concrete pad/steel frame foundation. Curved metal roof. Heat is forced air oil fired system.	2016	1998	17	73.14	7
Band Warehouse	Pre-engineered Quonset style. Insulated and heated by forced air oil furnace.	2016	1995	25	260.26	8
Resource Center	Wood framed building. Pressure treated crawl space. Pitched asphalt roof. Heating is 117, 000 BTU oil fired forced air and HRV. Alarm system. Two electric cooling systems.	2016	2000	25	232.2	8
Pow wow Grounds Storage	Single storey wood framed. Slab on grade foundation. Pitched asphalt roof. No heating system.	2016	1990	15	32.26	6
Storage	Wood building. Concrete block foundation. Pitched asphalt roof. No heating system. No electricity.	2016	1998	10	22.6	6

4.2 Building Occupancy Data

The operating schedules and the yearly/monthly vacancy rate are listed below. The buildings listed are the RRIB use of space that is rented out.

Buildings	Operating Schedule	Vacancy Rate Occupied Yearly
Band Office Board Room	9:00-4:00 Mon-Fri Available for use 9:00-8:00pm	80.3%
Community Hall	Available for use all hours	14.8%
Resource Center	Available for use all hours	84.7%
Chalet Lodge	Available for use all hours	12.3%

Monthly Occupied Vacancy Rate

Month 2019	Band Office	Community Hall	Resource Center	Chalet Lodge
January	61.3%	25.8%	74.2%	0%
February	78.6%	25%	103%	0%
March	87.1%	19.3%	87.1%	3.2%
April	96.7%	0%	96.7%	13.3%
May	132%	3.2%	87.1%	3.2%
June	120%	0%	53.3%	16.7%
July	64.5%	19.4%	74.1%	41.9%
August	54.8%	12.9%	83.9%	22.6%
September	60%	13.3%	90%	43.3%
October	83.9%	19.4%	67.7%	3.2%
November	46.7%	26.7%	103.3%	0%
December	58.1%	12.9%	96.7%	0%

5.0 FUNDING SOURCES

Funding	Website	Type
Hydro One – First Nation Conservation Program	Hydro-One-FNC-Program-Rules-2016-2020 (2).pdf	• Awareness/Information • Energy Conservation • retrofit
IESO – Education and Capacity Building Program	http://www.ieso.ca/get-involved/funding-programs/education-and-capacity-building-program/overview	• Awareness/Information • Energy Management and Monitoring • Financial Incentive
IESO – Indigenous Energy Project Program	https://www.ieso.ca/en/Get-Involved/Funding-Programs/Indigenous-Energy-Projects-Program/IEP-Overview	• Financial Incentive • Funding for feasibility studies
Save on Energy – Energy Managers	https://saveonenergy.ca/Business/Program-Overviews/Energy-Managers.aspx	• Energy Management and Monitoring • Financial Incentive
Save on Energy – Energy Performance Program for Multi-site business	https://saveonenergy.ca/Business/Program-Overviews/Multi-Site-Customers/Energy-Performance-Program.aspx	• Financial Incentive
Save on Energy – Home Assistant Program for Residents	https://www.saveonenergy.ca/Consumer/Programs/Home-Assistance-Program.aspx	• Advice • Financial Incentive • Retrofit
Save on Energy – Process & Systems	https://saveonenergy.ca/For-Business-and-Industry/Programs-and-incentives/Process-and-System-Upgrades	• Financial Incentive • Retrofit
Save on Energy – Retro Fit program	https://saveonenergy.ca/Business/Program-Overviews/Retrofit-for-Commercial.aspx	• Financial Incentive • Retrofit

Save on Energy – Training & Support Initiatives	https://saveonenergy.ca/Business/Program-Overviews/Training-and-Support.aspx	• Awareness/Information • Financial Incentive • Training/Technical Assistance

6.0 CAPACITY BUILDING & TRAINING REQUIREMENTS

Training Opportunities & Requirements:

The following are a compilation of training that is available, including trainings that have recently passed. The recently passed training will more than likely be available again in the new year.

The Canadian Institute for Energy Training (Virtual)

Date	Upcoming training & Online Conference Opportunities
Feb 10	**Engaging Others in Water/Climate/human rights issues (ages 11-18)** Contact: Laina Timberg Website: https://waterlution.org/waterstorytellingcontest/
MAR 9-11	**Certified Energy Auditor** Duration: 3 days 9:00am-4:30pm (CST)
MAR 9-11	**Energy Management Professional (101)** Duration 3 days 9:00am-4:30pm (CST)
MAR 22-26	**Certified Energy Manager** Duration 5 days 9:00am-4:30pm (CST)
MAR 23	**Intro to Building Energy Modelling** Duration: 1 day 9:00am-4:30pm (CST)
MAR 24-25	**Building Energy Modelling Professional – tools, software, compliance** Duration: 2 day 9:00a.m-4:30pm (CST)
MAR 30-APR 1	**Certified RET screen expert** Duration: 3 days 9:00am-4:30pm (CST)
MAR 30	**Advanced Measurement & Verification** Duration: 2 days 9:00am-4:30pm (CST)
APRIL 21-22	**Energy Efficiency for building operators & Maintenance Staff-Dollars Sense** 9:00am-4:30pm (CST)
APRIL 27-30	**Prep Course for the NRCan ERS VI5 Energy Advisor Exam** Duration: 4 day 9:00am-4:30pm (CST)
MAY 10-14	**Certified Energy Manager** Duration: 4 days 9:00am-4:30pm (CST)
MAY 17-19	**Recent Trends in Environmental Science and Engineering** Contact: Melissa Hawco Web: http://2021.rtese.com
JUNE 14-18	**Certified Energy Manager** Duration: 4 day 9:00am-4:30pm (CST)
AUG 11-13	**9th International Conference on Smart Energy Grid Engineering (SEGE 2021)** Web: www.ieee-sege.com

Appendix A: Location & Site Considerations Checklist

- Noise & Odour Sites
    - Residential buildings
    - Institutional facilities
    - Building permits
    - Certain vacant lots
    - Certain campsites/campgrounds
    - Properties used for recreations and or commercial activity
- Large wind turbines must be sited at least 550m from all non-participating noise receptors
    - Noise study report
- Locate near other renewable energy facilities

Ecological site considerations:

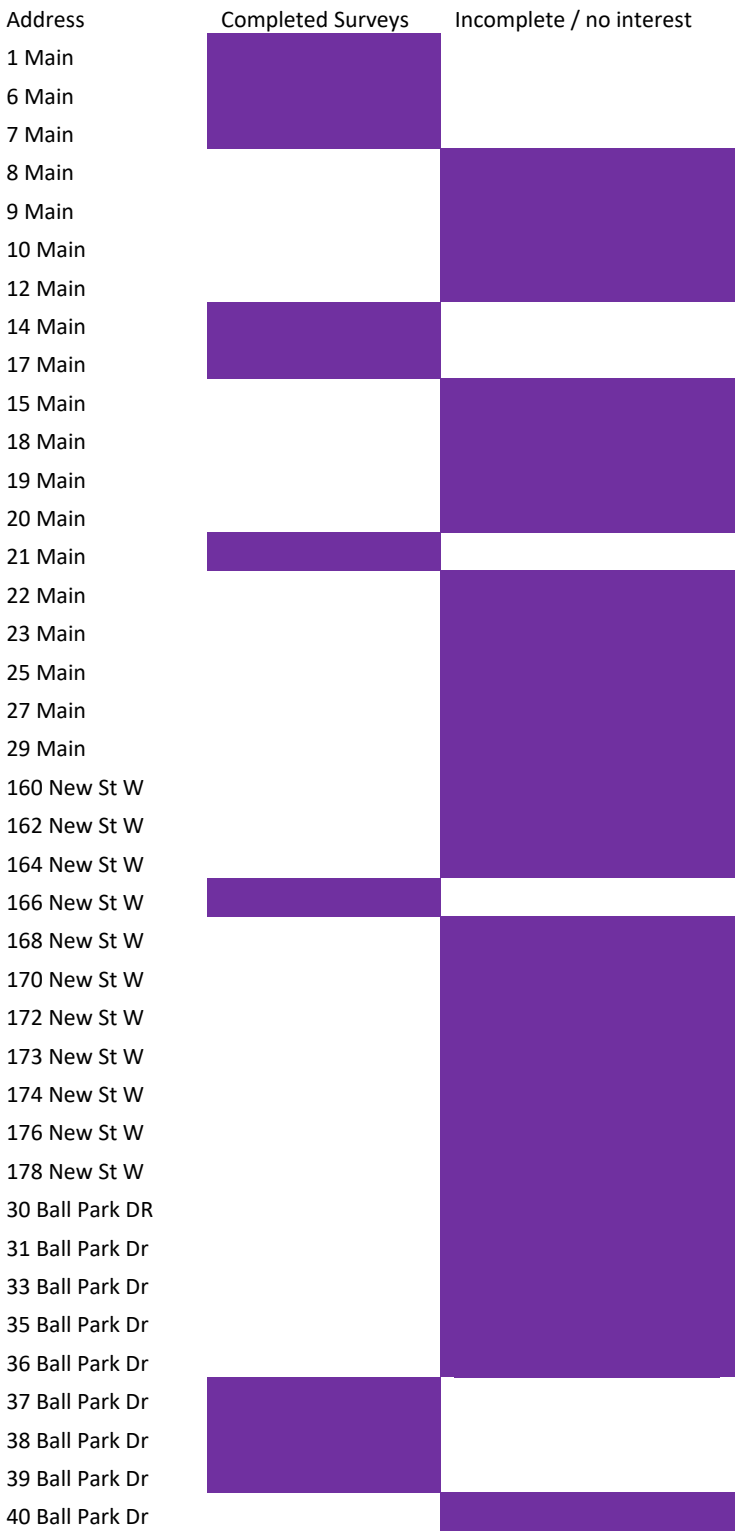
- Aquifers
- Drinking water sources
- Vulnerable areas
- Consider Environmental impacts (animal life – marine life)
- Wild life habitats
- Wild life corridors
- Known wetlands
- Woodlands
- Natural / scientific interest
- Water bodies (see page areas)
- Provincial Parks & Conservation areas

- 30m – 120m from water bodies
- 50 m – 120m from heritage features (wetlands, habitats etc.)

Infrastructure site considerations:

- Roads, highways and railways
- Blade length plus 10m away (wind)
- Airports/aerodromes and related facilities (solar may create glare to pilots and interfere with electronic navigational aid.
- Weather radar towers
- Telecommunications towers
- Aviation radar towers
- Natural gas, electrical and water sewage infrastructure
- Aggregate resources, land fill sites and petroleum wells/facilities

Appendix B: Community Contact List



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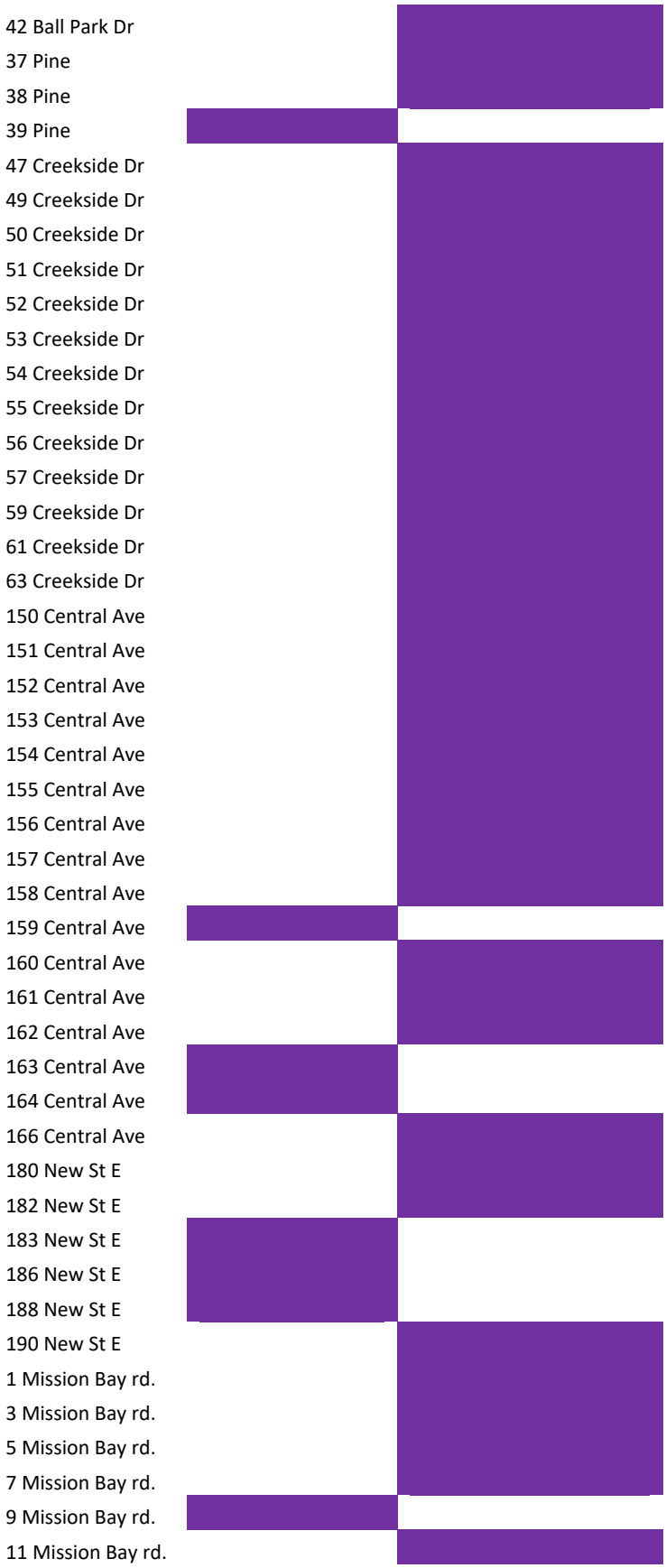

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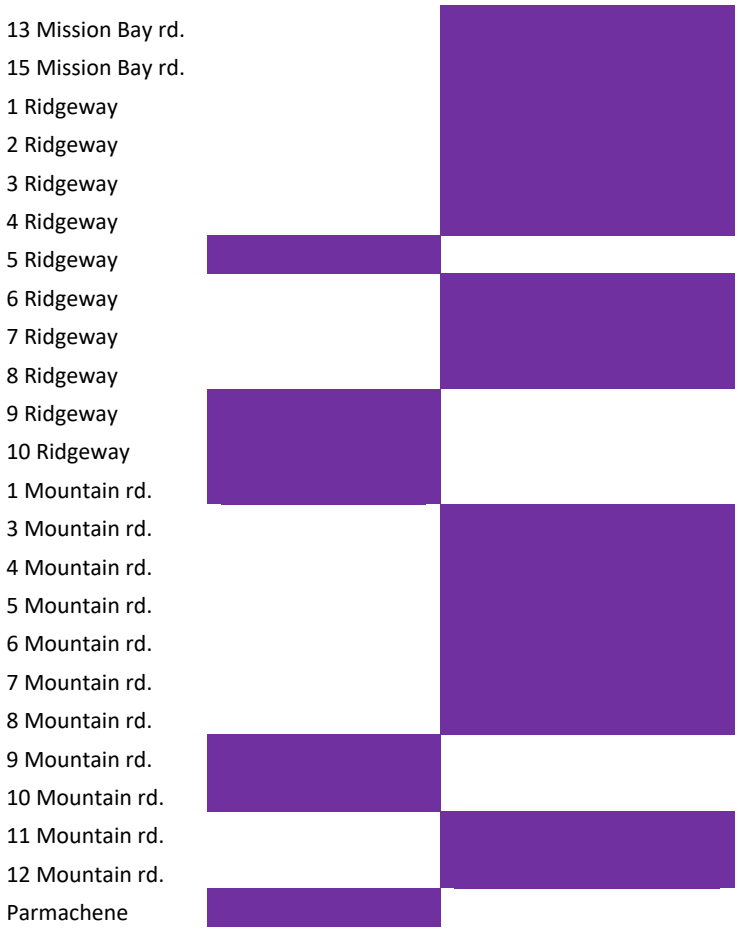
13 Mission Bay rd.
15 Mission Bay rd.
1 Ridgeway
2 Ridgeway
3 Ridgeway
4 Ridgeway
5 Ridgeway
6 Ridgeway
7 Ridgeway
8 Ridgeway
9 Ridgeway
10 Ridgeway
1 Mountain rd.
3 Mountain rd.
4 Mountain rd.
5 Mountain rd.
6 Mountain rd.
7 Mountain rd.
8 Mountain rd.
9 Mountain rd.
10 Mountain rd.
11 Mountain rd.
12 Mountain rd.
Parmachene

Age	Primary Energy	Supplier	Secondary Energy	Supplier	Additional Sources
55+	Fuel/Heating Oil	Mastrangelo Fuels	Electricity	Hydro One	No
18 +D	Propane	Superior Propane	N/A	N/A	No
18 +D	Electricity	Hydro One	N/A	N/A	Fuel/Heating Oil
18 +D	Electricity	Hydro One	N/A	N/A	Electric Heaters
18+D	Electricity	Hydro One	Fuel/Heating Oil	LHGV	Electricity
18+ D	Electricity	Hydro One	Propane	Superior Propane	No
18+ D	Propane	Superior Propane	N/A	N/A	N/A
55+	Electricity	Hydro One	Fuel/Heating Oil		N/A
55+	Electricity	Hydro One	N/A	N/A	N/A
18+D	Electricity	Hydro One	Fuel/Heating Oil	Lake Helen Gas	N/A
55+	Electricity	Hydro One	Fuel/Heating Oil		N/A
18+D	Electricity	Hydro One	Propane	Superior Propane	Electricity
55+	Electricity	Hydro One	Fuel/Heating Oil	Lake Helen	Electricity
55+	Electricity	Hydro One	Wood	Self-sufficient	Wood
18+ D	Electricity	Hydro One	Propane	Superior Propane	Electricity
18+ D	Electricity	Hydro One	Fuel/Heating Oil	Lake Helen Gas	Electricity
18+ D	Electricity	Hydro One	Fuel/Heating Oil	Peltier's Gas Bar	wood pellet
18+ D	Fuel/Heating Oil	Lake Helen Variety	Electricity	Hydro One	Electricity
18+ D	Electricity	Hydro One	Electricity	Hydro One	Electricity
18+ D	Electricity	Hydro One	Fuel/Heating Oil	Lake Helen Variety	Electricity
18+ Co	Electricity	Hydro One	Wood/fuel	Self-sufficient - Pelletier’s	Electricity
55+	Electricity	Hydro One	Fuel/Heating Oil	Delivered from Tbay	Electricity
55+	Electricity	Hydro One	Propane	Superior Propane	Electricity
18+ D	Electricity	Hydro One	Fuel/Heating Oil	Gas Stations	Fuel/Heating Oil
	Electricity	Hydro One	Fuel/Heating Oil	Lake Helen Gas & Variety	Electricity/Propane
55	Propane - Fridge/Stove		Solar	Self-Efficient	Wood

Heat Home	Wood Heat	Prepare for Cold	Cooling	Water Heater	Insulation blanket	Timer water tank	Aware of TOU
Fuel/Heating Oil	10 sticks power outage	window cling, weather stripping, draft snakes	window unit, electric fan, windows	Electric	No	automatic	Yes
Propane	N/A	Yes	open windows	Electric	No	No	Yes
Fuel/Heating Oil	N/A	No	window unit	Electric	Yes	No	No
Fuel/Heating Oil	N/A	Yes	window unit	Electric	no	no	yes
Electricity/Fuel/Heating Oil	N/A	Yes	window unit, electric fan, windows	Electric	No	No	No
Propane	N/A	No	window unit, electric fan, windows	Electric	Yes	No	Yes
Propane	N/A	Yes	window unit, electric fan, windows	Electric	No	No	No
Fuel/Heating Oil	N/A	Yes	open windows	Electric	No	No	No
Electricity	N/A	Yes	electric fans, open windows	Electric	No	No	No
Fuel/Heating Oil	N/A	No	window unit, electric fan, windows	Electric	No	No	Yes
Fuel/Heating Oil	N/A	No	window unit	Electric	No	No	No
Propane/Electricity	N/A	Yes	Window A/C, Fan, Windows	Electric	No	No	Yes
Fuel/Heating Oil	N/A	No	Window A/C, Fans, open windows	Electric	No	No	Yes
Wood	More than 5 cords	no	Electric fans, open windows	Electric	no	no	no
Propane	N/A	No	Window AC, Fans, open windows	Electric	no	no	Yes
Fuel/Heating Oil	N/A	No	Window AC, Fans, Open Windows	Electric	no	no	Yes
Electricity/Fuel/Heating Oil	135 bags	no	Window AC, Fans, open windows	Electric	no	no	no
fuel/electricity	N/A	Yes	Window AC/Electric fans/open windows	Electric	No	No	Yes
Electricity	N/A	No	Window AC/Electric fans/open windows	Electric	No	No	Yes
Fuel/Heating Oil	N/A	Yes	Electric Fans/open windows		No	No	Yes
Wood/Fuel	More than 5 cords	Yes	Window AC/Electric fans/open windows	Electric	No	No	Yes
Fuel/Heating Oil	N/A	No	Electric Fans	Electric	No	No	Yes
Propane	N/A	No	Electric Fans/Open Windows	Electric	No	No	Yes
Fuel/heating Oil	N/A	No	Window open, Electric Fans	Electric	No	No	Yes
Fuel/Heating Oil	N/A	No	Window Air Conditioning	Electric	No	No	No
Wood	More than 5 cords	Yes	Window A/C	N/A	N/A	N/A	No

Change in Energy Use	Energy Conservation	Participated in last 5 years	Concerns Hydro	Vehicles	Machines	Consumption
clothes line, off peak	No - too many	Yes	Neither	1	0	Yes
off peak, outdoor cooking	Yes	Yes	Neither - better after FN Delivery exemptions	1	1 quad 2 boats	Yes
Off peak	Yes	Yes	Neither	1	No	Yes
clothes line	Yes	No	Hydro Cost	1 car 2 trucks	1-S 1-B 2-D	Yes
off peak, clothes line, outdoor cooking	Yes	No	Both	2	2-B	Yes
clothes line, off peak,	Yes	Yes	If delivery charges will come back in the future	1 T	1-S 1-Q 1-B	Yes
outdoor cooking	Yes	No	Both - too expensive	2 T	1-S 2-Q	Yes
N/A	Yes	Yes	Both	1 T	No	Yes
clothes line, off peak	Yes	Yes	Both - we have 3 dams why do we pay so much	1 C	No	Yes
N/A	Yes	No	Both	2 T	1-S 1-B 2-D	No
N/A	No	No	Neither	No	No	No
Off Peak clothes	Yes	Yes	Neither	1 Car	2 boats	Yes
Clothes line, using dryer, outdoor cooking	Yes	Yes	Neither	1-c 2-T	no	yes
N/A	Yes	Yes	Hydro Cost	1-c	1-s	Yes
Using dryer at off-peak	yes	Yes	Hydro Cost	no	no	Yes
No	Yes	Yes	Neither	2-T	1-s 1-b	Yes
outdoor cooking	yes	yes	Neither	2-T	1-s 1-q 2-b	yes
No	Yes	Yes	Neither	1-C 1-T	1-s 2-q	Yes
Using dryer at off-peak-outdoor cooking	Yes	Yes	Neither	1-C	No	Yes
Clothesline sometimes	Yes	Yes	Neither	1-C	No	Yes
dryer at off peak/outdoor cooking	Yes	Yes	Neither	1-C 1-T	No	Yes
dryer at off peak	No	Yes	Neither	1-C	No	Yes
N/A	No	Yes	Neither	No	No	Yes
Clothesline	yes	Yes	Neither	1-C 1-T	No	No
Using dryer at off peak/outdoor cooking	Yes	No	Hydro Cost		No	Yes
Went to Solar	Yes	Yes	N/A	1-C 1-T	No	N/A

Appendix C: Wood Burn CO2 Release

Table 1											
Species	Density	Weight Per Cord	BTU's Per Cord (at 20% MC - air dryed)	BTU's per Cord (at 45% MC)	Units needed to produce 1 Million BTU's	Higher HV	Lower HV (NHV)	Units (kg)	C content (average)		CO_2 output (LHV)
	(lbs per ft^3)	(lbs)	(millions)	(millions)		MMBTUs/ton	MMBTUs/ton	1/MMBTU	Hardwood 47-50%	Softwood 50 -53%	(kg/MMBTU)
Hickory	50.9	4327	27.7	19.39	0.052	16.69	15.29	65.38	48.50%		116.27
East. Hophornbeam	50.2	4267	27.3	19.11	0.052	16.68	15.29	65.42	48.50%		116.34
Apple	48.7	4100	26.5	18.55	0.054	16.85	15.44	64.76	48.50%		115.16
White Oak	47.2	4012	25.7	17.99	0.056	16.70	15.30	65.34	48.50%		116.20
Sugar Maple	44.2	3757	24	16.8	0.06	16.65	15.26	65.52	48.50%		116.52
Red Oak	44.2	3757	24	16.8	0.06	16.65	15.26	65.52	48.50%		116.52
Beech	44.2	3757	24	16.8	0.06	16.65	15.26	65.52	48.50%		116.52
Yellow Birch	43.4	3689	23.6	16.52	0.061	16.68	15.28	65.43	48.50%		116.35
White Ash	43.4	3689	23.6	16.52	0.061	16.68	15.28	65.43	48.50%		116.35
Hackberry	38.2	3247	20.8	14.56	0.069	16.70	15.30	65.34	48.50%		116.19
Tamarack	38.2	3247	20.8	14.56	0.069	16.70	15.30	65.34	48.50%		116.19
Paper Birch	37.4	3179	20.3	14.21	0.07	16.64	15.26	65.55	48.50%		116.56
Cherry	36.7	3121	20	14	0.071	16.70	15.31	65.31	48.50%		116.15
Elm	35.9	3052	19.5	13.65	0.073	16.65	15.27	65.51	48.50%		116.50
Black Ash	35.2	2992	19.1	13.37	0.075	16.64	15.25	65.57	48.50%		116.60
Red Maple	34.4	2924	18.7	13.09	0.076	16.67	15.28	65.45	48.50%		116.39
Boxelder	32.9	2797	17.9	12.53	0.08	16.68	15.29	65.40	48.50%		116.31
Jack Pine	31.4	2669	17.1	11.97	0.084	16.70	15.31	65.33		51.50%	123.36
Norway Pine	31.4	2669	17.1	11.97	0.084	16.70	15.31	65.33		51.50%	123.36
Hemlock	29.2	2482	15.9	11.13	0.09	16.70	15.31	65.34		51.50%	123.38
Black Spruce	29.2	2482	15.9	11.13	0.09	16.70	15.31	65.34		51.50%	123.38
Ponderosa Pine	28	2380	15.2	10.64	0.094	16.65	15.26	65.54		51.50%	123.75
Aspen	27	2290	14.7	10.29	0.097	16.73	15.34	65.20		51.50%	123.12
White Pine	26.3	2236	14.3	10.01	0.1	16.67	15.28	65.45		51.50%	123.58
Balsam Fir	26.3	2236	14.3	10.01	0.1	16.67	15.28	65.45		51.50%	123.58
Cottonwood	24.8	2108	13.5	9.45	0.106	16.69	15.30	65.36		51.50%	123.41
Basswood	24.8	2108	13.5	9.45	0.106	16.69	15.30	65.36		51.50%	123.41

Wood

Residents	Cords	t CO2
1	5	12.5
2	5	12.5
3	5	12.5
TOTAL=	15	37.5

cords	MBTU	BTU	kWh e
15	300	300000	87.921

Conversion Information

1 cord = 2.5 tonnes of CO2
1 MBTU = 1000 BTU
1 cord of Birch = 20 MBTU

* the process of burning wood does not emit any additional carbon dioxide than the natural biodegradation of the wood if it were left to rot on the forest floor

Appendix D: Propane Calculations - Residential

Residents	L	BTUs	kWh e	Therms	lbs CO2	t CO2	Rounded
6	13500	319950000	93768.06645	3199.5	38394	172.773	172.8tCO2

Conversion Information

1L = 23, 700 BTU
1 Therm = 100, 000 BTU
12 lbs of CO2 = 1 Therm
1lb = 0.0045 tonne
1 BTU = 0.000293071 kWh

Propane residential tank sizes
420lb =375L X 4 = 1500L
500
Gallon = 1514L

Residents recorded that they fill up twice. Use about one and half per year.
1500/2 = 750L

Appendix E: Heating Calculations - Residential

Fuel - diesel/heating oil

Residents	L/yr	kg of CO2	t CO2	Rounded
16	21840	58094.4	58.0944	58.1t CO2

L	BTU	kWh e
21840	517608000	151695.377

Conversion Information

Average fuel tank size = 910L

1L of diesel = 2.66kgs of CO2

1kg = 0.001 tonne

*interviewed a few people from surveys they mentioned that they fill up in Sept and have to put about half a tank in around January.

Therefore, roughly 1365L per year - this is an estimate. Which depends on the measures taken to keep heat, and tips followed.

Appendix F: Hydro Electricity Data – Non-Residential

Meter: #J2919113

Usage for Wednesday July 24, 2019 - Friday January 31,2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
07/2019	148.5672	$12.54	17.65
08/2019	565.7478	$47.01	16.05
09/2019	531.3222	$43.90	12.95
10/2019	553.6026	$45.99	6.7
11/2019	646.5552	$82.78	-6.8
12/2019	748.9866	$95.20	-11.7
01/2020	654.0210	$84.37	-13.4

Meter: #J2859552

Usage for Tuesday January 1, 2019 - Friday January 31,2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1037.0238	$85.67	-17.3
02/2019	723.3972	$59.32	-17.6
03/2019	785.8398	$65.87	-9.2
04/2019	723.6720	$61.37	4.05
05/2019	775.2570	$63.77	8.25
06/2019	746.6022	$60.30	13.55
07/2019	791.2602	$67.57	18.0
08/2019	661.2498	$55.35	16.05
09/2019	661.9332	$51.97	12.95
10/2019	794.1684	$63.72	6.7
11/2019	816.3360	$106.00	-6.8
12/2019	928.4586	$120.45	-11.7
01/2020	852.6090	$109.11	-13.4

Meter: #J2918988

Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1442.3856	$120.64	-17.3
02/2019	1282.8096	$104.90	-17.6
03/2019	1507.8090	$124.82	-9.2
04/2019	1537.3812	$127.61	4.05
05/2019	1365.6108	$117.31	8.25
06/2019	1352.4516	$118.76	13.55
07/2019	1697.1408	$151.10	18.0
08/2019	1644.7092	$142.24	16.05
09/2019	1474.9938	$127.77	12.95
10/2019	1563.4080	$134.51	6.7
11/2019	1473.5964	$191.75	-6.8
12/2019	1654.1046	$213.20	-11.7
01/2020	1518.9282	$198.77	-13.4

Meter: #J2918998

Usage for Tuesday January 1, 2019 - Friday January 31,2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1779.6714	$143.28	-17.3
02/2019	1751.4672	$141.13	-17.6
03/2019	1674.3276	$134.25	-9.2
04/2019	1320.4332	$107.66	4.05
05/2019	1082.2212	$86.88	8.25
06/2019	389.5776	$32.23	13.55
07/2019	450.8832	$37.94	18.0
08/2019	539.8032	$47.23	16.05
09/2019	534.8610	$40.53	12.95
10/2019	1094.4018	$85.80	6.7
11/2019	1714.2180	$216.96	-6.8
12/2019	1926.6342	$242.27	-11.7
01/2020	1737.9378	$221.26	-13.4

Meter: #J2918942
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1112.1072	$88.34	-17.3
02/2019	952.0914	$73.96	-17.6
03/2019	804.8322	$62.17	-9.2
04/2019	735.5304	$57.67	4.05
05/2019	697.9614	$53.65	8.25
06/2019	541.5180	$42.24	13.55
07/2019	503.4900	$40.73	18.0
08/2019	474.8460	$39.33	16.05
09/2019	504.9390	$40.99	12.95
10/2019	732.7866	$57.21	6.7
11/2019	649.3080	$82.31	-6.8
12/2019	986.2866	$119.61	-11.7
01/2020	1058.8518	$126.62	-13.4

Meter: #J3207347
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1204.4322	$101.68	-17.3
02/2019	1343.5368	$112.76	-17.6
03/2019	1458.8112	$120.72	-9.2
04/2019	1319.4648	$107.82	4.05
05/2019	1256.6562	$106.60	8.25
06/2019	1359.2424	$110.67	13.55
07/2019	1175.4534	$97.59	18.0
08/2019	1072.7820	$89.25	16.05
09/2019	1182.0894	$98.05	12.95
10/2019	1372.6344	$110.50	6.7
11/2019	1423.6302	$174.46	-6.8
12/2019	1597.7862	$190.52	-11.7

Meter: #J2918954
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1240.8576	$101.29	-17.3
02/2019	958.6032	$77.51	-17.6
03/2019	1096.0002	$90.32	-9.2
04/2019	816.6654	$66.22	4.05
05/2019	954.5262	$79.57	8.25
06/2019	870.2352	$70.87	13.55
07/2019	907.3350	$75.46	18.0
08/2019	762.2484	$63.91	16.05
09/2019	620.8668	$50.71	12.95
10/2019	953.0574	$78.83	6.7
11/2019	787.3968	$100.74	-6.8
12/2019	990.5538	$124.24	-11.7
01/2020	882.8568	$112.10	-13.4

Meter: #J2918985
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1003.2516	$80.58	-17.3
02/2019	890.9610	$70.77	-17.6
03/2019	951.6168	$79.86	-9.2
04/2019	907.4448	$77.22	4.05
05/2019	877.3914	$73.96	8.25
06/2019	858.6078	$69.25	13.55
07/2019	1009.6326	$85.26	18.0
08/2019	955.7166	$77.82	16.05
09/2019	789.0198	$64.42	12.95
10/2019	746.8398	$61.28	6.7
11/2019	782.5176	$105.16	-6.8
12/2019	921.1920	$122.43	-11.7
01/2020	980.3718	$127.29	-13.4

Meter: #J3567898
Usage for Tuesday October 1, 2019 - Saturday October 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
10/2019	719.4198	$60.58	6.7
11/2019	855.4422	$110.51	-6.8
12/2019	1031.7444	$132.95	-11.7
01/2020	758.0634	$99.05	-13.4
02/2020	676.3890	$86.50	-12.15
03/2020	729.7608	$87.04	-6.45
04/2020	645.1416	$65.16	4.3
05/2020	605.4366	$61.15	9.55
06/2020	633.7002	$81.11	14.45
07/2020	864.4158	$110.65	20.8
08/2020	795.8292	$101.87	16.7
09/2020	552.9432	$70.78	10.55
10/2020	499.1490	$63.89	2.95

Meter: #J2918983
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	758.2146	$61.33	-17.3
02/2019	1623.9960	$131.37	-17.6
03/2019	1821.5040	$146.98	-9.2
04/2019	992.8710	$81.95	4.05
05/2019	553.8168	$45.64	8.25
06/2019	463.8762	$39.43	13.55
07/2019	839.2608	$71.55	18.0
08/2019	833.4108	$72.26	16.05
09/2019	526.6596	$42.80	12.95
10/2019	672.1542	$55.30	6.7
11/2019	620.6652	$80.43	-6.8
12/2019	786.7428	$99.36	-11.7
01/2020	765.2712	$98.47	-13.4

Meter: #J2740095
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1187.1126	$100.73	-17.3
02/2019	1014.3492	$81.23	-17.6
03/2019	1649.0514	$136.17	-9.2
04/2019	1575.2820	$130.25	4.05
05/2019	1884.1542	$153.83	8.25
06/2019	1189.0170	$101.76	13.55
07/2019	1013.6364	$91.36	18.0
08/2019	1101.8982	$95.53	16.05
09/2019	1371.6318	$109.70	12.95
10/2019	1500.2238	$119.40	6.7
11/2019	1545.5868	$192.82	-6.8
12/2019	2280.3606	$289.62	-11.7
01/2020	2422.1658	$311.10	-13.4

Meter: #J3787311
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1799.2794	$150.37	-17.3
02/2019	1775.8272	$145.37	-17.6
03/2019	1723.5618	$143.25	-9.2
04/2019	1642.9710	$139.55	4.05
05/2019	1727.5032	$143.86	8.25
06/2019	1604.4954	$129.05	13.55
07/2019	1862.3297	$156.03	18.0
08/2019	1678.1347	$143.88	16.05
09/2019	1471.5096	$127.77	12.95
10/2019	1626.8934	$140.94	6.7
11/2019	1820.0904	$239.51	-6.8
12/2019	1855.0320	$234.98	-11.7

Meter: #J2918039
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	2710.7388	$221.55	-17.3
02/2019	2276.9334	$184.78	-17.6
03/2019	2574.8580	$210.65	-9.2
04/2019	2914.5696	$243.30	4.05
05/2019	2722.0878	$225.92	8.25
06/2019	2540.4948	$208.13	13.55
07/2019	2231.5560	$180.41	18.0
08/2019	2350.1220	$191.73	16.05
09/2019	1438.9734	$116.55	12.95
10/2019	1771.6812	$149.57	6.7
11/2019	2050.2408	$272.07	-6.8
12/2019	2798.4810	$357.69	-11.7
01/2020	2854.4088	$374.53	-13.4

Meter: #J3567867
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	3707.4942	$306.39	-17.3
02/2019	2117.2392	$175.15	-17.6
03/2019	1218.7950	$105.24	-9.2
04/2019	1177.0494	$104.51	4.05
05/2019	1080.1044	$91.15	8.25
06/2019	799.4358	$67.70	13.55
07/2019	638.8110	$55.20	18.0
08/2019	623.0616	$54.77	16.05
09/2019	991.5624	$82.53	12.95
10/2019	1354.1928	$112.46	6.7
11/2019	1242.5862	$166.17	-6.8
12/2019	1329.2580	$172.02	-11.7

Meter: #J2918938
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	544.6164	$45.19	-17.3
02/2019	1194.4902	$95.25	-17.6
03/2019	677.1492	$54.68	-9.2
04/2019	628.7724	$51.99	4.05
05/2019	570.1428	$49.22	8.25
06/2019	541.7604	$44.60	13.55
07/2019	306.1362	$26.85	18.0
08/2019	448.9242	$37.11	16.05
09/2019	755.1120	$59.30	12.95
10/2019	789.4956	$66.17	6.7
11/2019	687.3156	$87.26	-6.8
12/2019	959.6664	$122.21	-11.7
01/2020	1205.9592	$155.16	-13.4

Meter: #J2918987
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	885.3222	$75.52	-17.3
02/2019	998.3268	$82.63	-17.6
03/2019	1111.1814	$90.73	-9.2
04/2019	1140.8676	$94.56	4.05
05/2019	915.0030	$76.02	8.25
06/2019	833.3490	$70.87	13.55
07/2019	1004.6244	$87.12	18.0
08/2019	963.4296	$79.70	16.05
09/2019	915.1290	$73.59	12.95
10/2019	722.2758	$60.80	6.7
11/2019	770.3796	$99.89	-6.8
12/2019	847.3128	$110.58	-11.7

Meter: #J2252712
Usage for Tuesday January 1, 2019 - Friday January 31,2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1320.6546	$110.84	-17.3
02/2019	1138.3470	$93.80	-17.6
03/2019	1419.7710	$119.43	-9.2
04/2019	1125.8484	$96.41	4.05
05/2019	686.5110	$61.05	8.25
06/2019	590.6508	$51.49	13.55
07/2019	706.5726	$60.52	18.0
08/2019	599.2098	$52.78	16.05
09/2019	665.1912	$54.94	12.95
10/2019	712.5702	$60.47	6.7
11/2019	828.6126	$108.17	-6.8
12/2019	915.3642	$118.67	-11.7
01/2020	794.1210	$104.15	-13.4

Appendix G: Hydro Electricity Data – Non-Residential

Name: Red Rock First Nation, Meter: #J2918989
Usage for Tuesday January 1, 2019 - Friday January 31,2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	560.8002	$47.04	-17.3
02/2019	747.6492	$64.94	-17.6
03/2019	517.1670	$43.65	-9.2
04/2019	324.4074	$27.01	4.05
05/2019	368.1696	$32.15	8.25
06/2019	279.7074	$24.48	13.55
07/2019	272.3784	$23.30	18.0
08/2019	276.8340	$23.71	16.05
09/2019	309.9540	$27.50	12.95
10/2019	381.3948	$32.88	6.7
11/2019	427.1070	$54.96	-6.8
12/2019	442.0602	$56.38	-11.7
01/2020	430.7532	$55.73	-13.4

Name: Red Rock First Nation, Meter: #J2252670
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	0.0000	$0.00	-17.3
02/2019	0.0000	$0.00	-17.6
03/2019	0.0000	$0.00	-9.2
04/2019	0.0000	$0.00	4.05
05/2019	0.0000	$0.00	8.25
06/2019	0.0000	$0.00	13.55
07/2019	383.1264	$27.89	18.0
08/2019	0.0000	$0.00	16.05
09/2019	0.0000	$0.00	12.95
10/2019	0.0000	$0.00	6.7
11/2019	0.0774	$0.02	-6.8
12/2019	0.0000	$0.00	-11.7
01/2020	0.0048	$0.00	-13.4

Name: Lake Helen Gas & Variety, Meter: #J2919117
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	4899.3354	$412.79	-17.3
02/2019	4473.2784	$374.07	-17.6
03/2019	4275.4092	$354.54	-9.2
04/2019	3718.9380	$310.60	4.05
05/2019	3584.7024	$301.15	8.25
06/2019	3787.3842	$316.99	13.55
07/2019	3455.5176	$296.55	18.0
08/2019	3248.6262	$274.92	16.05
09/2019	3808.6890	$319.41	12.95
10/2019	3717.2196	$311.72	6.7
11/2019	3772.6104	$493.73	-6.8
12/2019	4294.8990	$554.51	-11.7
01/2020	4497.5274	$588.77	-13.4

Name: Red Rock First Nation, Meter: #J3030815
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1124.1980	$92.23	-17.3
02/2019	898.1420	$72.85	-17.6
03/2019	694.4620	$56.27	-9.2
04/2019	530.3860	$43.23	4.05
05/2019	406.2260	$33.54	8.25
06/2019	186.5300	$15.34	13.55
07/2019	215.4780	$17.96	18.0
08/2019	198.9500	$16.90	16.05
09/2019	198.9700	$16.41	12.95
10/2019	359.5000	$30.39	6.7
11/2019	675.1640	$86.51	-6.8
12/2019	821.3740	$104.25	-11.7
01/2020	830.2500	$107.08	-13.4

Name: Red Rock First Nation, Meter: #J2996147
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	27304.6800	$2255.38	-17.3
02/2019	24246.8400	$1983.35	-17.6
03/2019	22284.8400	$1819.57	-9.2
04/2019	15945.2400	$1324.54	4.05
05/2019	12511.9200	$1046.88	8.25
06/2019	9601.3200	$800.85	13.55
07/2019	8985.1200	$752.32	18.0
08/2019	8753.7600	$734.03	16.05
09/2019	9239.7600	$766.73	12.95
10/2019	11026.5600	$918.09	6.7
11/2019	17296.0800	$2225.36	-6.8
12/2019	23399.0400	$2967.72	-11.7
01/2020	23600.2800	$3039.54	-13.4

Name: Red Rock First Nation, Meter: #J2998935
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	7058.8000	$633.96	-17.3
02/2019	6327.3600	$569.16	-17.6
03/2019	6373.2800	$586.36	-9.2
04/2019	6327.6800	$587.56	4.05
05/2019	7133.6800	$694.15	8.25
06/2019	7265.1200	$703.65	13.55
07/2019	9712.2400	$900.51	18.0
08/2019	9071.7600	$828.47	16.05
09/2019	7438.8800	$695.70	12.95
10/2019	6565.6000	$637.12	6.7
11/2019	6750.0000	$954.83	-6.8
12/2019	6946.8000	$963.94	-11.7
01/2020	6941.9200	$989.78	-13.4

Name: Red Rock First Nation, Meter: #J2918979
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	128.2290	$10.35	-17.3
02/2019	1017.6114	$82.53	-17.6
03/2019	424.9590	$34.42	-9.2
04/2019	7.4304	$0.64	4.05
05/2019	2.9544	$0.21	8.25
06/2019	0.0000	$0.00	13.55
07/2019	0.0000	$0.00	18.0
08/2019	0.0000	$0.00	16.05
09/2019	0.0000	$0.00	12.95
10/2019	0.0000	$0.00	6.7
11/2019	0.0000	$0.00	-6.8
12/2019	676.6710	$83.78	-11.7
01/2020	1095.4176	$139.37	-13.4

Name: Red Rock First Nation, Meter: #J2918980
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	1544.6946	$128.82	-17.3
02/2019	1762.6644	$148.05	-17.6
03/2019	2018.9826	$172.16	-9.2
04/2019	1796.0334	$153.20	4.05
05/2019	1646.7234	$143.94	8.25
06/2019	1355.9730	$114.12	13.55
07/2019	1375.8132	$119.18	18.0
08/2019	1286.5506	$110.07	16.05
09/2019	1179.2790	$101.69	12.95
10/2019	1367.1204	$118.34	6.7
11/2019	1580.2716	$207.42	-6.8
12/2019	1625.1882	$209.94	-11.7
01/2020	1528.5630	$198.10	-13.4

Name: Red Rock First Nation, Meter: #J2919116
Usage for Tuesday January 1, 2019 - Friday January 31, 2020

Month	Consumption (kWh)	Cost	Avg Temperature (°C per day)
01/2019	2359.4406	$195.16	-17.3
02/2019	1558.5216	$127.27	-17.6
03/2019	988.0830	$81.43	-9.2
04/2019	896.3550	$74.72	4.05
05/2019	969.6030	$81.90	8.25
06/2019	694.3602	$58.69	13.55
07/2019	388.1934	$34.57	18.0
08/2019	280.8288	$25.16	16.05
09/2019	289.4052	$24.33	12.95
10/2019	664.9362	$57.50	6.7
11/2019	2856.1422	$351.28	-6.8
12/2019	3621.0198	$436.45	-11.7
01/2020	3235.8888	$398.78	-13.4

Public Works Energy Consumption (kWh)

Month	kWh
Jan	545
Feb	3205
Mar	2306
Apr	725
May	2716
Jun	108
Jul	441
Aug	173
Sept	426
Oct	1081
Nov	146
Total=	11872

CHALET Energy Consumption (kWh)

Customer Activity Statement

Account Summary

DATE	CHARGE TYPE	BALANCE FORWARD	NEW CHARGES	ADJUSTMENTS	PAYMENT AMOUNT	ENERGY CONSUMED (kWh)	PEAK DEMAND (kW/kVa)	DAYS USED	READING FROM	READING TO
26-Nov-19	Payment				$899.94					
30-Oct-19	Invoice	$1,905.18	$899.94	($1,905.18)		4,000.000		92	24-Jul-19	23-Oct-19
13-Aug-19	Payment				$1,905.18					
31-Jul-19	Invoice	$0.00	$1,905.18	$0.00		9,600.000		91	24-Apr-19	23-Jul-19
13-May-19	Payment				$856.24					
30-Apr-19	Invoice	($67.06)	$923.30	$0.00		4,560.000		90	24-Jan-19	23-Apr-19
30-Jan-19	Invoice	($888.01)	$820.95	$0.00		4,000.000		92	24-Oct-18	23-Jan-19

Appendix H: Propane Calculations – Non-Residential

Propane to kWh

Building Asset	L	BTUs	kWh equivalent
Resource Centre	2,625.52	62224824	18236.22917
Quonset Hut - Mission Bay	1,455.90	34504830	10112.36503
Chalet	608.08	14411496	4223.591544
RRIB Office	15,111.71	358147527	104962.6539
Fire Hall	0.00	0	0
Quonset - PW	101.00	2393700	701.5240527
TOTAL=	19,902.21	471682377	138,236.36

Conversion from Fuel to kWh

Conversion from Fuel to kWh 3.78541L = 37.95 kWh, 1L = 10.025kWh 1kg = 0.001 tonne		
Building Asset	L	kWh
Resource Centre	527.4	5287.185
Quonset Hut - Mission Bay	911	9132.775
Chalet	0	
RRIB Office	0	
Fire Hall	1035.5	10380.8875
Quonset - PW	0	
TOTAL=	2473.9	24800.8475

Appendix I: Transportation Calculations

Transportation Emissions and Energy Consumed

	CO2 (g/km)	g/yr CO2	X Surveyed	t/yr CO2	L burned
Cars	346	5536000	38752000	38.752	16848.69565
Trucks	383	6128000	49024000	49.024	21314.78261
Quads	35	56315	168945	0.168945	73.45434783
Total=	764	11720315	87944945	87.944945	38236.93261

kWh	kg CO2 e	t CO2 e	Rounded
149953.3913	38752	38.752	38.8t CO2
189701.5652	49024	49.024	49t CO2
653.7436957	168.945	0.168945	0.2t CO2
340308.7002	87944.945	87.944945	88t CO2

	hrs per season	L gas/hr	L	kg of CO2	t of CO2	Rounded	kWh
Boats	50	30	1500	3450	3.45	3.45t CO2	13350

TOTAL CO2=	91.394945	91.4t CO2

Conversions

Ontario Average fuel cost 2019 = 114.1c/L

Average KM driven in Ontario 2019= 16,000km/yr

Average 11-30L gas/hr @ cruising (boats)

Average 20hrs-50hrs per season ONT 2019

1 Gram=0.000001 tonne

1L gas = 8.9 kWh

Average Km per yr = 1609km (2019)

Calculation:

vehicle typical CO2 emissions g/km X Km driven per year = g CO2 emissions

1 L burned gas= 2.3kg of CO2

1Kg = 0.001tonne