

Heating System Analysis Lower Similkameen Indian Band





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Community Overview

Lower Similkameen Indian Band (LSIB) is a First Nation located in the Southern Interior of British Columbia. There are 101 homes and about 250 residents living on-reserve. LSIB has identified heating costs as a significant contributor to economic distress for band members. LSIB and Ecotrust Canada partnered to examine the current realities of household heating in the community.

Purpose

The purpose of this report is to provide LSIB with a comprehensive review of residential heating. The review will provide insights into community members perspectives as well as energy-usage rates and costs of different heating types.

The intention of the study is to:

- identify community sentiments about household heating and efficiency,
- estimate a true cost of heating for different heating sources,
- and assess the opportunities for new energy infrastructure and household efficiency improvements.

Approach

The report includes three main methods of information gathering:

1. A community survey that asks band members to share their perspectives on household heating.
2. A review of electricity usage rates and costs for residential LSIB accounts (serviced by Fortis BC).
3. Modelling household heat retention and energy efficiency using NRCan energy assessment data.



Report Highlights

Estimated Avg. Cost of Household Energy

Homes only heated with **electric radiators or furnaces** - **\$3,629** per year

Homes only heated with **heat pumps** - **\$2,474** per year

Homes only heated with **wood** - **\$1,453** per year

Questionnaire Responses

89% are interested in making improvements to their household structure

61% are interested in installing a more efficient heating system

61% say heating costs are very unaffordable or unaffordable

Electricity Costs & Consumption

From 2010 to 2018 the average **cost per kilowatt hour increased 44%**

Average annual household **electricity consumption declined 17%**

Average annual household **electricity spending increased 19%**

Notable Questionnaire Comments

‘\$1500 plus to heat a 920 ft² duplex? Something is seriously wrong with this picture.’

‘Chimney has caught on fire 4 times in the last 2 years’

‘How can an elder (80) use up \$600 a month in electricity?’

‘Our electric bill is increasing over time, despite our energy conservation methods’

‘I can and will not choose between eating or being warm.’

Cost Per Home & Financial Return for Efficiency Investments¹

Insulation Replacement: **\$1,350** estimated cost & **34%** estimated financial return

Natural Gas Furnace: **\$7,500** estimated cost & **21%** estimated financial return²

Ductless Heat Pump: **\$7,800** estimated cost & **18%** estimated financial return

Central Air Heat Pump: **\$11,800** estimated cost & **10%** estimated financial return

Pellet Stove: **\$5000** estimated cost & **7%** estimated financial return

High Efficiency Wood Stove: **\$7,000** estimated cost & **2%** estimated financial return

Doors and Windows: **\$7,125** estimated cost & **0%** estimated financial return

¹ Based on modelling NRCAN Home assessment data for LSIB households in RETScreen Expert

² Based on connection costs for the Ashnola Village Subdivision only, based on estimates provided by FortisBC.

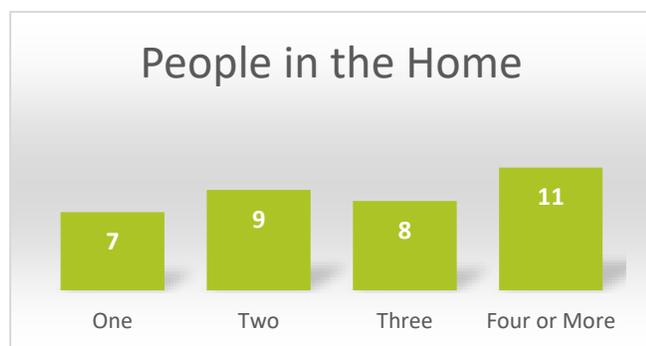


Survey Results

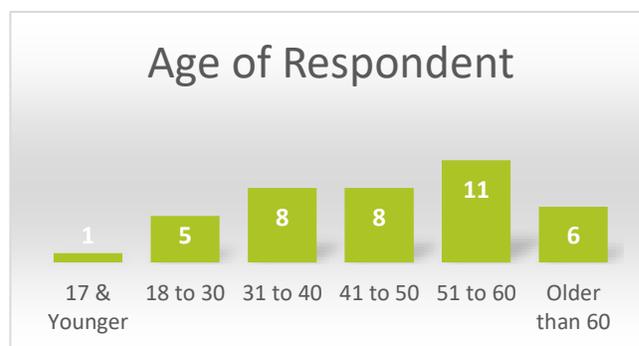
During July, August, and September 2019, a survey was delivered to band members by LSIB housing staff. It contained 20 questions and received 37 total responses. All comments, recommendations, and analysis by Ecotrust Canada in this section are based on the information received in the surveys.

About the Respondents

The graphs below highlight information about the survey respondents. Responses were received from a range of different numbers of people in the home, ages of houses and band members, and sizes of houses.



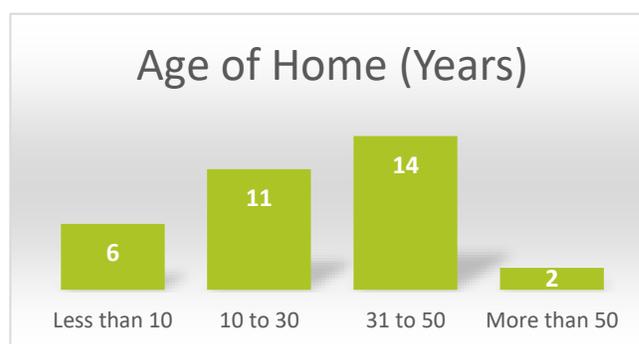
Responses from different family sizes.



Responses from members of all ages.³



Including 'other': average home size = 1700 ft².

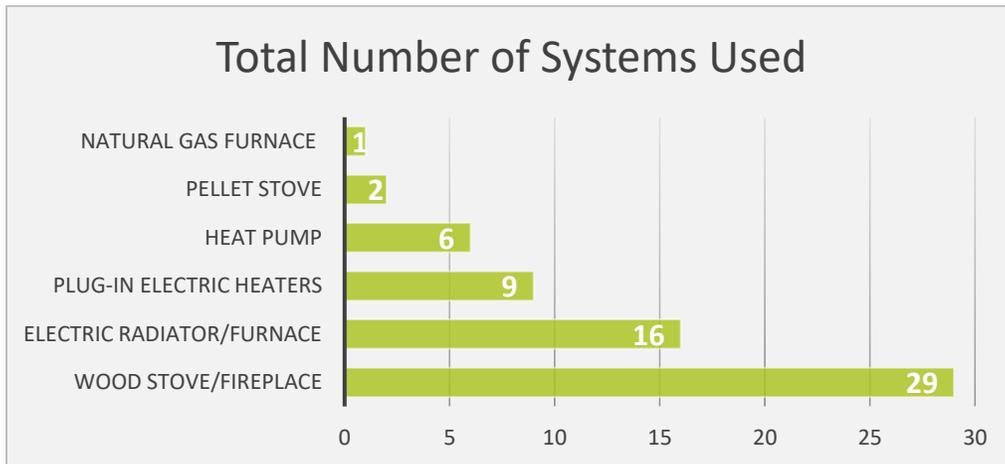


Most homes between 10 and 50 years old.

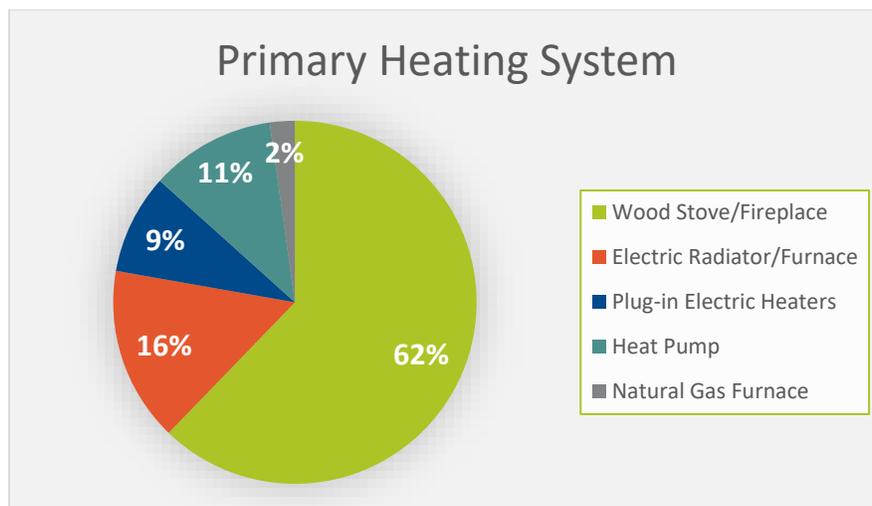
³ n=29, some survey responses came back with multiple age categories selected, likely for all residents in home



LSIB Heating Systems



Band members were asked to select **all** of the heating systems they used in their home. A total of 63 responses were selected showing that, on average, respondents use **1.7** different heating systems or methods.



Band members were asked to select their primary heating system. It should be noted that 28 respondents selected one primary system, 7 respondents selected two primary systems, one responded with three primary systems, and one did not respond.

28 members use wood as a primary source

16 members use electricity (radiator/furnace, heat pump or plug-in heater) as a primary source

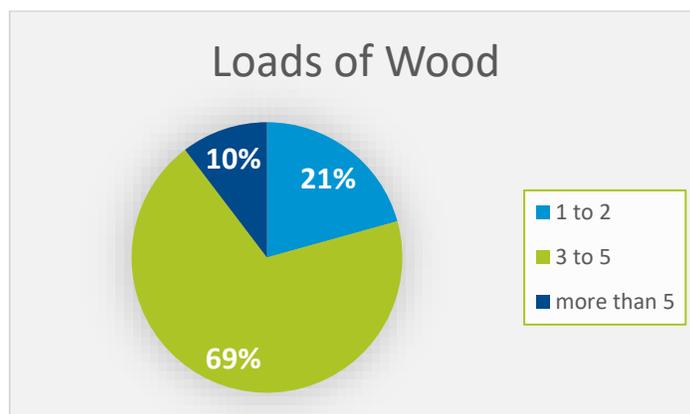
1 member uses natural gas as a primary source

0 of 2 respondents who use a pellet stove use it as a primary source



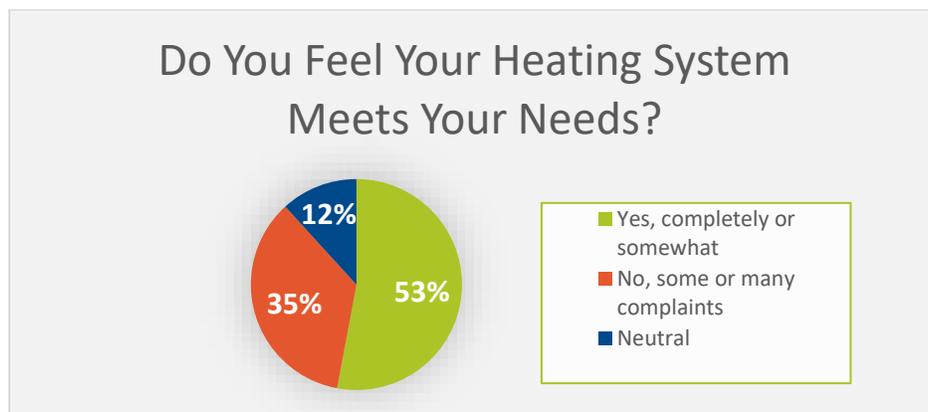
Wood Stove/Fireplace Users

LSIB supplies wood burning members with 2 loads of wood each year at a cost to the band between \$120 and \$280. In 2018, the cost was \$135/load⁴. Any loads used beyond 2 must be acquired (purchased, collected, gifted) in another way (unless the member is on social assistance, in which case they receive an additional load).



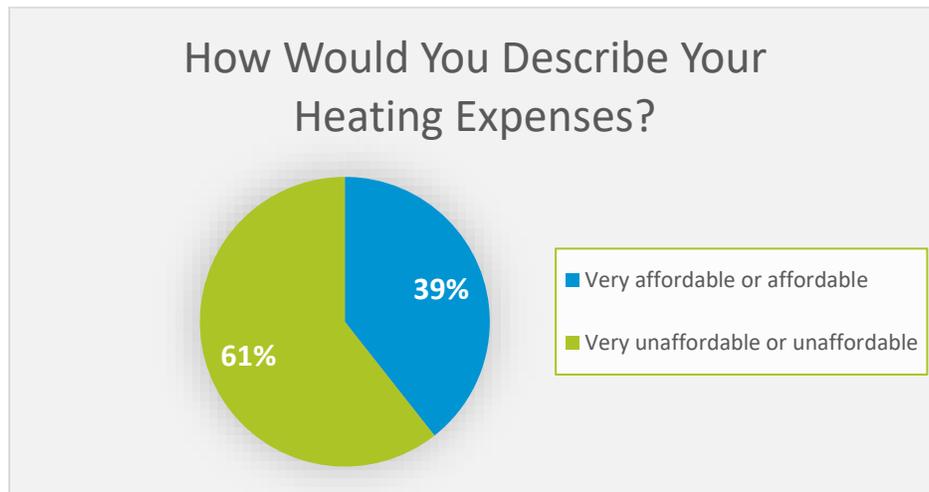
- 6 of 29 (21%)** wood users use between 1 to 2 loads per year.
- 20 of 29 (77%)** wood users use between 3 to 5 loads per year.
- 3 of 29 (10%)** wood users use more than 5 loads per year.

Feelings About Household Heating



- 18** members felt their heating system 'completely' or 'somewhat' meets their needs.
- 12** members have 'some' or 'many' complaints about their systems.
- 4** members were neutral.
- 3** members 'don't know' or did not respond.

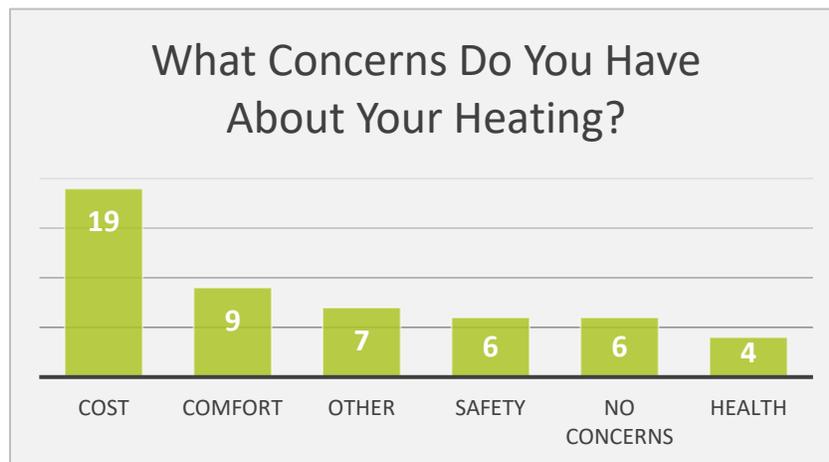
⁴ Information on cost per load incurred by the band provided by LSIB housing staff.



20 members describe their expense as ‘very unaffordable’ or ‘unaffordable.’

13 members describe their expenses as ‘very affordable’ or ‘affordable.’

3 members ‘don’t know’ or did not respond.



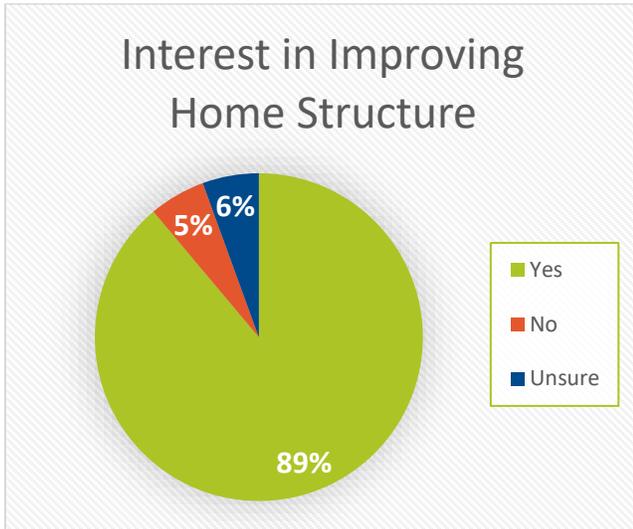
Band members were asked to select all of the concerns they have related to their heating systems.

‘Other’ responses included: **labour of using wood, wood supply, aging heating systems, insulation and chimney issues, and maintenance related concerns.**

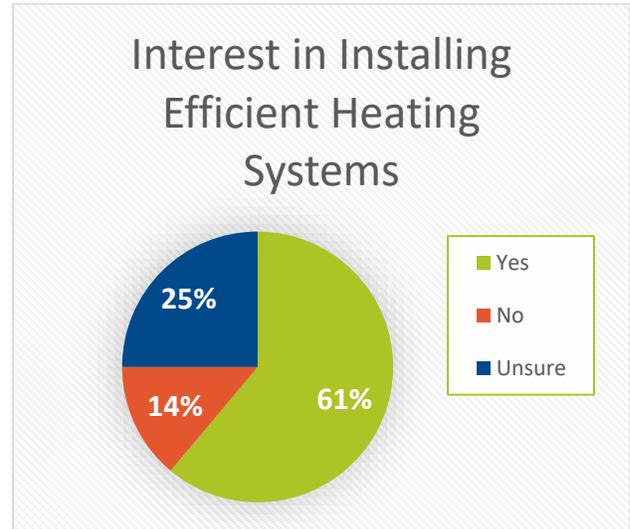
Perspectives on Solutions



Band members were asked whether they would be interested in 'installing a more efficient heating system' and 'making improvements to the structure of their homes.'



32 are interested
2 are unsure
2 are not interested
1 did not respond



22 are interested
9 are unsure
5 are not interested
1 did not respond

A very strong majority of members are interested in making improvements to their household structure. This is supported by many responses below that comment on issues related to building quality.

Most members would be interested in a more efficient heating system, though some are unsure. Communication with members about what heating systems and opportunities are available could be very helpful.



Additional Comments from Respondents

Respondents were asked to 'share more' on many questions throughout the survey. This was done to give members a change to speak more about each question if they wished. Below are some notable responses for members. This is only a small number of the responses. Additional comments from the survey can be found in Appendix VI.

When reading the additional comments, two themes are clear:

1. Cost Related Comments:

'Our electric bill is increasing over time, despite our energy conservation methods'

'I try not to use heat but when I do my bill gets higher, wood is too big for me to split'

'I live alone and my heating bill in winter has gone up to \$1200..?'

'\$1500 plus to heat a 920 ft² duplex? Something is seriously wrong with this picture.'

'How can an elder (80) use up \$600 a month in electricity?'

'As power costs seem to be increasing, along with other living expenses its inconsistent and stressful.'

'I can not afford to use the baseboards for heating - I can and will not choose between eating or being warm. The only electrical heating I use are the infrared units. I go through lots of wood and put extra clothing on to keep warm'

'Would like 'info.' I have spoken to Fortis over and over again about the high cost of my electric bill and nothing has been done for me!'

2. Building Quality and Heat Retention Comments:

'Loss of use of back two bedrooms upstairs to the south - the rooms freeze - too cold to live in'

'Two windows are broken and covered with a board + plastic'

'Chimney has caught on fire 4 times in the last 2 years'

'The home I currently stay at has these holes that let out heat outside and I would like better windows because they let out heat as well'

'The big tube going from downstairs to open roof currently stuffed with towel, covered by cardboard. was once open from basement through to roof. You could see the sky.'

'There are weather stripping seals that have pieces missing around the doors there are weather stripping seals that have pieces missing around the doors'

Survey Summary

Overall, the survey shows that there are a number of different heating situations across LSIB. Some residents seem to be satisfied with their heating systems and heating costs, while others are very unsatisfied. Some residents are clearly in very difficult situations and would benefit greatly from heating system and building envelope improvements.



Cost of Energy

Total Cost of Energy

2018 total energy costs by heating type **(21 homes)**.

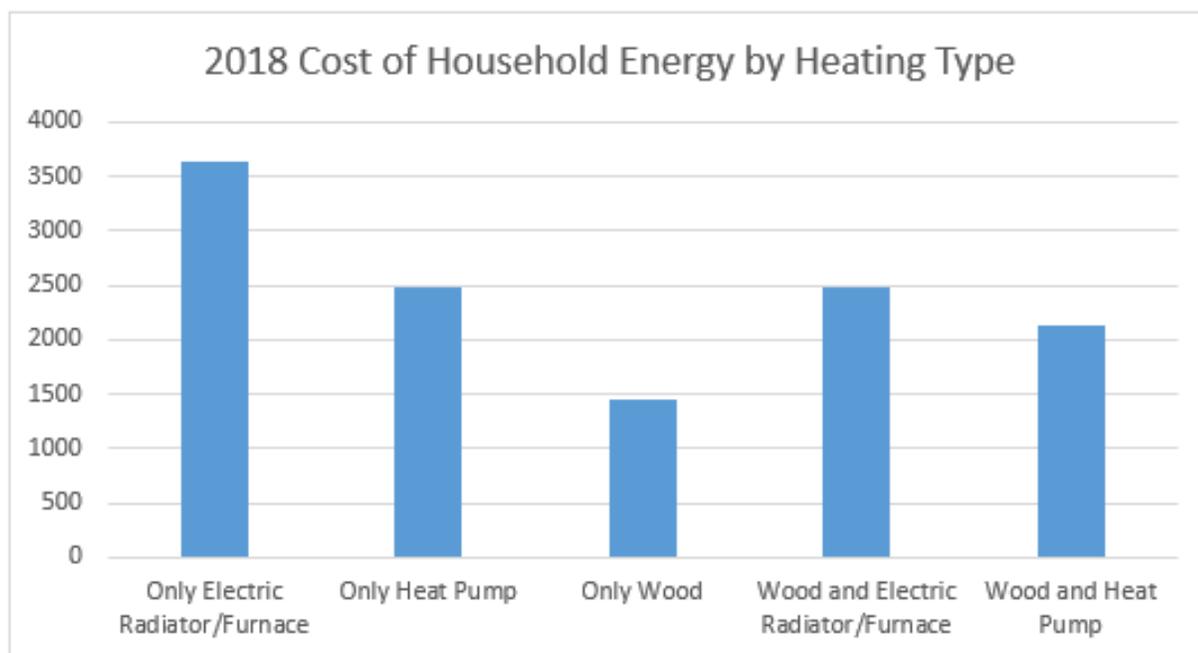


Figure 1. 2017/2018 average cost of household energy by heating type.

The following heating types made up the 21 households shown in the chart: only electric radiator or furnace (2), only heat pump (2), only wood (5), wood and electric radiator or furnace (9), wood and heat pump (3). While the number of houses in this analysis is low, the chart shows electric heat is much more expensive than wood heat and that heat pumps can reduce the cost of electricity. Energy costs by heating type are: only electric radiator or furnace (\$3629), only heat pump (\$2474), only wood (\$1453), wood and electric radiator or furnace (\$2487), wood and heat pump (\$2125).

Wood costs include the \$270 cost the band incurred for 2 loads/household in 2018. Estimated non-heating electricity cost (60% of total electricity use for homes that use electric heating) was added to this heating type given that it would be included in all others. This assumption is based on Fortis BC estimates in a 2016 BC Utilities Commission report⁵.

⁵ FortisBC Inc. Residential Inclining Block Rate Submission to the British Columbia Utilities Commission, 2016



Electricity Analysis

2017/2018 average electricity consumption: **16,453 kWh's (15 homes).**

Average consumption **declined 15%** from 2017 to 2018

2010-2018 cost of electricity per home increased **44% (10 homes).**

Average annual household **electricity consumption declined 17%**

Average annual household **electricity spending increased 19%**

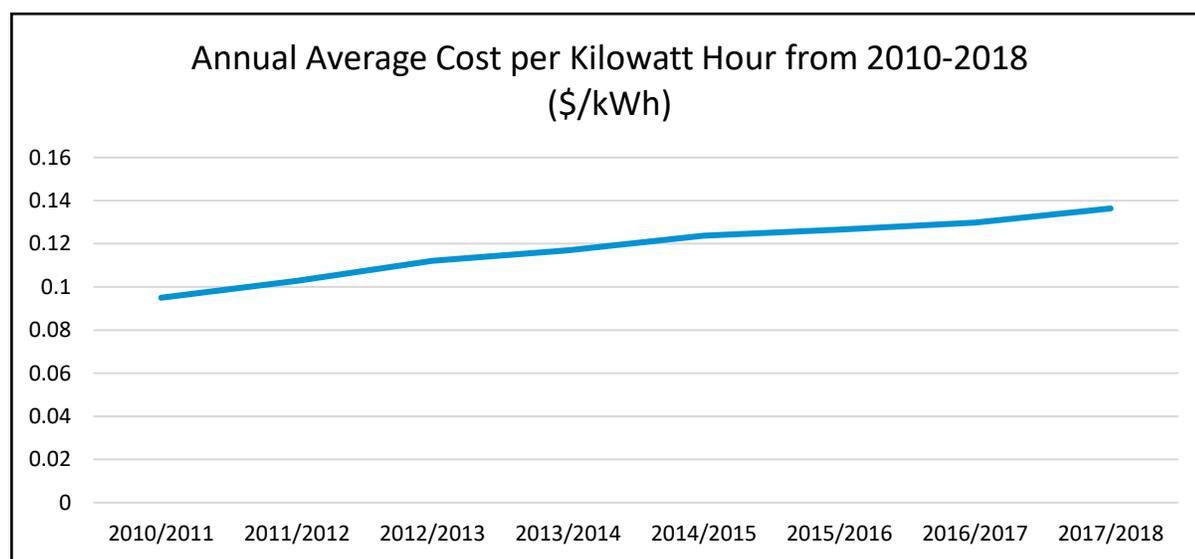


Figure 2. Annual average cost per kilowatt hour from 2010-2018 has risen 44%.

Fortis BC is currently in the middle of transitioning away from a tiered pricing structure to a flat rate structure. The tiered rate structure will be phased out by 2023 and is expected to reduce electricity costs for high consumption users (many of LSIB homes). For low consuming homes, costs may increase slightly.

Wood Heating Analysis

LSIB pays for the first two loads of wood each year (unless the member is on social assistance). **In 2018**, wood was provided to residents at a cost of **\$135/load incurred by the band**. Based on survey results, an average **market cost of wood is around \$250/load**. Most members noted they paid between \$200/load and \$300/load for market priced wood. This means wood users:

Who use **1- 2 loads** per year **did not incur a personal cost**

Who use **3 - 5 loads** per year spent between **\$250 - \$750**

Who use **more than 5 loads** per year spent **at least \$1000**



13 members recorded that they collect wood, which involves different costs such as machinery and tools needed, gas, time, and more. Rough averages from survey responses identify **180km's of distance travelled and 27 hours** of collecting time each year.

Only two of the 37 members use a pellet stove and neither use them as a primary heating source. Additionally, members mentioned that they really likes the pressed logs they received from the Red Cross in 2018. This information was gathered when participating in LSIB's Open House on October 9th, 2019. Members noted they were slow burning and long lasting. This could be a potential area of interest to LSIB.

Assumptions and Limitations

The low number of households included in some of the categories (only electric radiator or furnace, only heat pump, and wood and heat pump) may not be representative of all households of that heating type. Additionally, the categories are strongly reliant on the band members identifying their primary heating methods. This could be a possible source of error.

The assumption for non-heating electricity cost was based off of Fortis BC's 2016 estimation⁶. The calculation took 60% of the average consumption for electrically-heated LSIB homes in 2018. Some of these homes used wood for heating as well, in which case the percentage of non-heating electricity use could be higher. This estimate provides a rough idea of non-heating electricity costs, which will naturally vary for each home.

Seasonal variation is a relevant variable for the year over year comparison for LSIB homes. The Nation has experienced significant flooding, fires and power outages in recent years which could effect the energy consumption analysis.

Lastly, household size could be accounted for and may provide more detailed insights into the performance of different heating types. This could be explored in more detail and – similar to the current analysis – would benefit greatly from more households of particular heating types to analyze.

⁶ FortisBC Inc. Residential Inclining Block Rate Submission to the British Columbia Utilities Commission, 2016



Review of Heating System and Efficiency Retrofit Options

Air-Source Heat Pump Systems

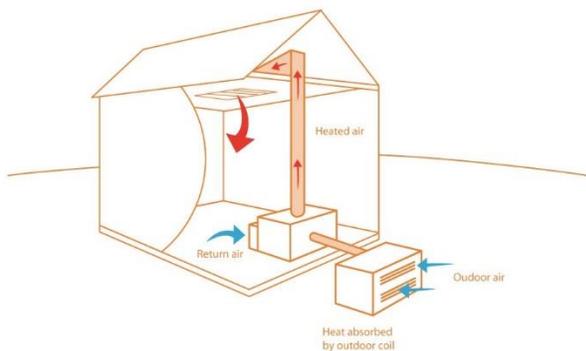


Figure 3 Outline of Airflow with Central Air Heat Pump

Heat pumps are a cost-effective heating solution that operates similar to an air conditioner - in reverse - to bring warm air from the outside into an enclosed space. Heat pumps operate at roughly 300% efficiency - generating heat with about 1/3 the fuel of conventional systems.

Within the Air-Source Heat Pump category, there are two main options to be considered: Central Air and Ductless

Central Air



Figure 4. York YZF Central Air Heat Pump Outdoor Unit

Central Air heat pumps are the most established heat pump technology option. These units are designed to deliver heat throughout an existing central air ducting system. With this method, air is delivered through existing ducts instead of adding additional units within the ducts or mounted on walls.

However, the drawback to these systems is that they are somewhat more expensive than Ductless systems.

Ductless

Ductless Heat Pumps are increasingly becoming a more common heat pump technology choice. In this method, heat is transferred using refrigeration coils to an indoor unit that is used to deliver heat inside the home.



Figure 5. Wall-Mounted Indoor Unit for Ductless Heat Pump

Ductless heat pumps deliver heat inside through a narrow refrigeration coil and this coil is used to heat air at the site of a number of indoor units throughout the home. The indoor unit can be wall-mounted, floor-mounted, or placed inside existing ducting. The small diameter of refrigeration coils makes Ductless heat pumps relatively easy and economical to install. While it is necessary to consider the placement of indoor units to ensure adequate air circulation throughout the home, it is likely that adequate air circulation can also be achieved by using the existing furnace fan.



Figure 6. Blaze King High-Efficiency Wood Stove

High Efficiency Wood Stove

High-Efficiency Wood Stoves offer efficiencies of up to 88% by burning the smoke using a catalytic combustor. This compares to efficiencies of 65-75% for older conventional models.

The major advantage of a wood stove is that fuel can be collected locally and often at relatively low cost. High Efficiency wood stoves can produce as little as 0.4 grams of fine particulate emissions per hour, and the most high-efficiency wood stoves are produced locally by Blaze King. However, these systems primarily radiate heat in one room of the house and do not include a fan or ducting system to distribute heat evenly. Retrofit installation costs can vary greatly due to the cost of venting and chimney upgrades.



Figure 7. Harman Pellet Stove

High-Efficiency Pellet Stove

High-efficiency Pellet Stoves are fueled by specially dried pellets. They feature automatic ignition, which means that heat can be provided more consistently. Some models can also be programmed to provide for more or less heat at different times of the day. And, the cost of installation is considerably lower for Pellet Stoves as they can be vented directly to the outside instead of through a chimney.

The major disadvantage of a Pellet Stove is that the specialized pellets would typically be imported, rather than making use of locally available wood.



Figure 8. Natural Gas Combustion in a Furnace

Natural Gas Furnace

Given that cost of heating was the biggest concern for LSIB residents, natural gas furnaces could be an option for certain homes – particularly those in the Ashnola subdivision – that are immediately adjacent to a gas line. The current cost of natural gas is attractive, though installation and connection costs would need more investigation. Natural Gas furnaces provide a range of efficiencies between 78% and 98%.

Building Envelope Improvements

In this study we also considered a number of opportunities for improvements to the Building Envelope that can reduce the overall energy demands of the home. These include the following upgrades:

- High-efficiency windows and doors
- Additional insulation in the attic and foundation, combined with modest air tightness improvements

Preliminary Findings

RETScreen Expert was used to model potential energy savings and cost savings from the selected efficiency retrofit project types. Each of the above efficiency or equipment retrofit opportunity was modeled, in addition to a combination of Ductless Heat Pump and Insulation Upgrades, and a combination of both Building Envelope Measures.

The preliminary results of the modeling indicate that:

- An Insulation Upgrade is the most cost-effective efficiency measure to consider pursuing. Ductless Heat Pumps and Natural Gas Furnaces also provide significant cost savings, though the latter is only economical for the Ashnola Village subdivision. The greatest cost savings could be achieved through a combination of insulation upgrades and selected heating system retrofits.
- Both Central Air and Ductless heat pumps are economically viable options to be considered, with projected rates of return between 10% and 18%. System suitability will depend in large part on home size and heat loss, as Central Air systems tend to have significantly higher capacity and are more appropriate for larger or leakier homes.
- Window & door upgrades are estimated to be roughly cost neutral with a 15-year payback period, the weakest return of all options considered.
- Natural Gas conversion is also a relatively cost-effective option for those residents in Ashnola Village that have access to a nearby pipeline. In order to sufficiently dilute connection costs, coordination among a group of homes would be required. The cost of connection has a high degree of uncertainty and would need to be confirmed through direct assessment by FortisBC if there is interest in exploring this option further. This is also the only option that would increase community GHG emissions.



- High Efficiency Wood Stoves hold some promise in reducing costs for homes with stoves already installed. However, there is a great degree of variability of installation costs. Specific estimates from qualified contractors would be necessary to determine project viability.
- Pellet Stoves could also provide a cost-effective heating option for those interested in biomass heat.



Figure 9 Estimated Retrofit Project Cost Per Participating Household

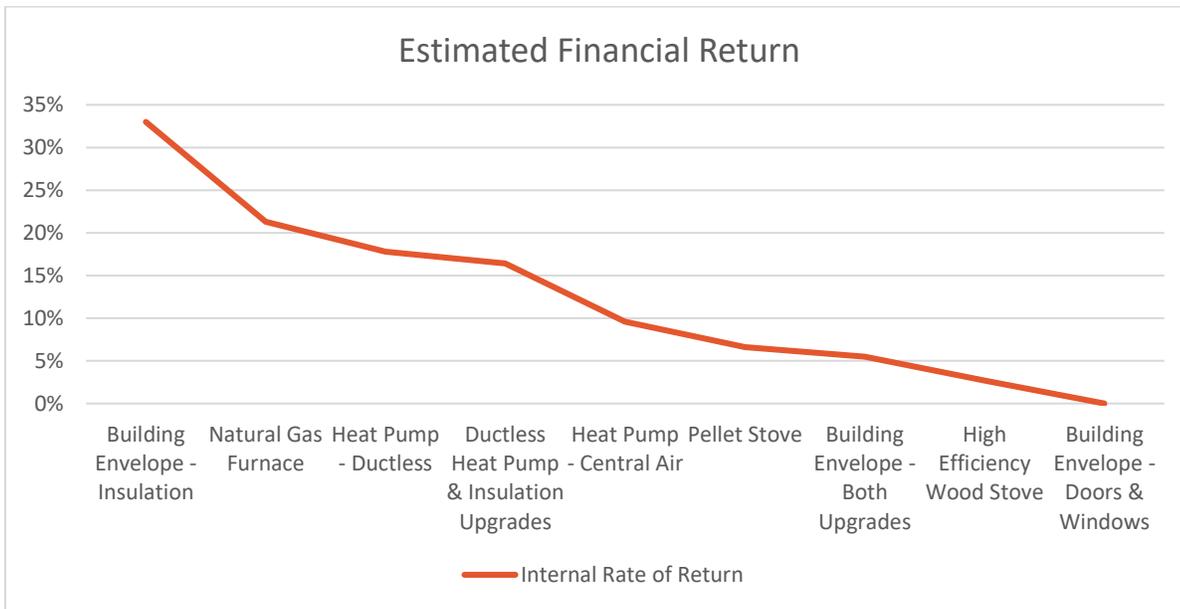


Figure 10. Estimated Rate of Return for Efficiency Investment Options

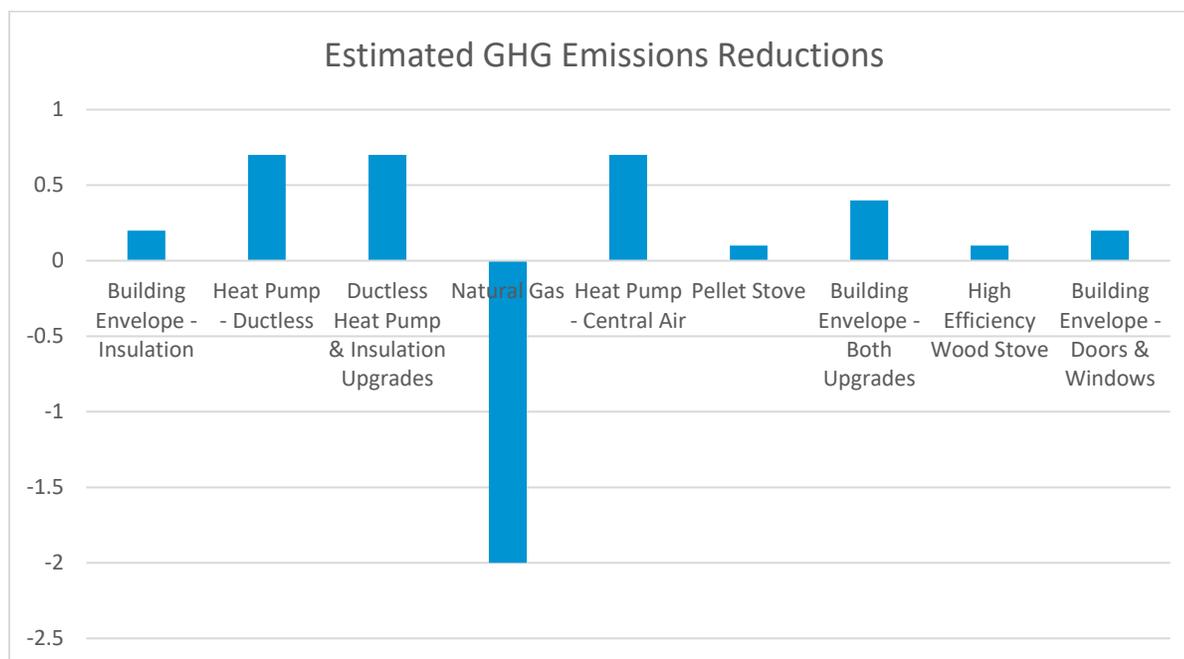


Figure 11. Estimated GHG Emission Reductions Per Home (Positive figures indicate reductions)

Detailed assumptions and sources contributing to the estimates above can be found in Appendix I and II.

Heat Map: Advantages and Disadvantages of High-Ranking Investment Options

The following table summarizes the advantages and disadvantages of each retrofit opportunity that has been assessed in this study. Green indicates a positive attribute, orange indicates neutral, and red indicates a negative attribute.

Ductless heat pumps and insulation upgrades offer the most positive impacts with the least complexity and cost. Natural gas retrofit provides an opportunity for high financial return, but also a relatively high level of complexity to coordinate pipeline connections and negative greenhouse gas emissions impacts. Pellet Stoves and High-Efficiency wood stoves will need to be assessed on a house by house basis; on average they are expected to achieve results that are not as positive as investment in Ductless Heat Pumps or Insulation Upgrades, but some homes may see better individual performance.

	Project Cost	Financial Return	Complexity	GHG Impact
Ductless Heat Pump	Med	High	Low	Positive
Insulation Upgrades	Low	High	Low	Neutral
Natural Gas Retrofit	Med	High	High	Negative
Pellet Stove	Med	Med	Med	Neutral
High-Efficiency Wood Stove	Med	Low	Med	Neutral



Possible Programs and Funding Sources

Below is a table highlighting a number of incentives and funding sources that are currently available to support project development and implementation:

Program Name	Amount	Description
Energy Conservation and Assistance Program (ECAP)	Direct support.	Basic home assessment and efficiency product installation.
Better Homes Incentives	Up to \$2,000 per home	Incentives for insulation & heating system retrofits. Available amounts are already included in preliminary analysis above.
BC First Nations Clean Energy Business Fund	\$150,000 per project	Funding available to support energy efficiency retrofits. Applications in January & May each year.
BC Indigenous Clean Energy Initiative	\$150,000 per project	Funding available to support energy efficiency retrofits. Next application in January, 2020.
Federation of Canadian Municipalities (FCM) - Green Municipal Fund	\$175,000 for plans & studies \$500,000 for pilot projects \$10 Million for implementation	Grants are available for plans, studies, and pilot projects. A mix of grants and loans are available for full project implementation. Relationship is required with regional district or municipality to be eligible.
New Relationship Trust – Capacity Initiative	\$25,000	Capacity building support can provide funding for training activities in efficiency projects.
Indigenous Services Canada (ISC)	Varies	Various programs are available to support capital projects through ISC, and housing upgrades are eligible for some of these programs.

Recommendations

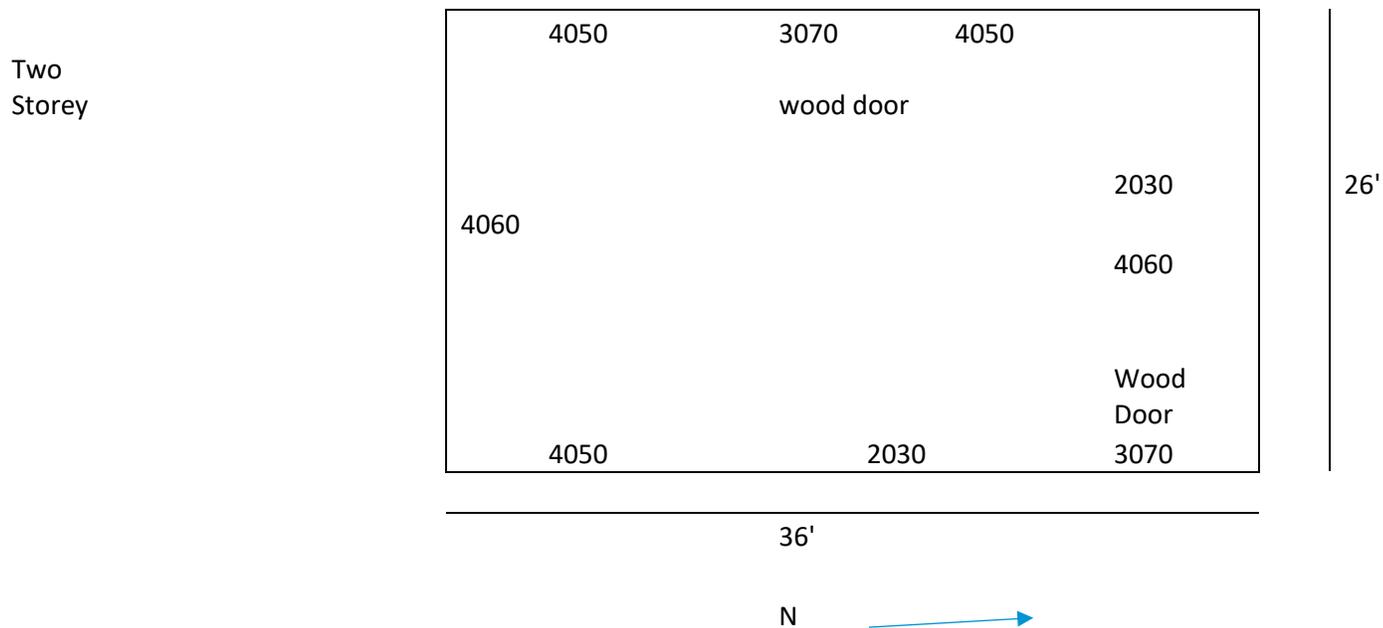
Insulation improvements and heat pump retrofits have been identified as the most promising opportunities to reduce household heating expenses across the community. We recommend that LSIB continue pursuing these opportunities with the following next steps:

- Continue engaging with FortisBC about available resources for ECAP activities and other retrofit project funding
- Develop and submit funding applications to support project planning and implementation activities for LSIB's preferred projects
- Put out an RFP to select contractors for ductless heat pump installation and building envelope improvements given that these projects provide the highest estimated return at relatively low project cost
- Aim to confirm project funding and implement retrofit activities throughout 2020



Appendices

Appendix I: Typical Home Size Assumptions



	W	H	Area (sq. ft)
N Wall	26'	17'	442
Windows			60
Wood Door			21
E Wall	36'	17'	612
Window			45
S Wall	26'	17'	442
Window			54
W Wall	36'	17'	612
window			36

Data from previously conducted home energy audits was provided from FortisBC (with LSIB staff consent). Of thirty-six homes audited, the average home size was 1819 square feet, and the median home size was 1929 square feet. We used the above dimensions for a two storey home to reflect the typical LSIB home in our energy modeling. These dimensions reflect a total floor area of 1872 square feet.



Appendix II: Key Modeling Assumptions

Building Envelope Assumptions

Envelope Component	Base Case	Upgrade Scenarios
Walls- R Value	12	12
Windows - U Value	0.5	0.2
Solar heat gain coefficient	0.67	0.67
Doors - U Value	0.5	0.2
Roof - R value	12	50
Floor - R value	12	30
Natural Air Infiltration	"Medium"	"Tight" for windows & doors
Resulting Air Infiltration	420 m3/hr	360 m3/hr

Cost & Rebate Assumptions

Type of Upgrade	Estimated Cost	Estimated Rebate	Net Cost	Costing Source
Insulation Upgrades	\$ 1,800	\$ (450)	\$ 1,350	Assured Home Insulation, Penticton
Door & Window Upgrades	\$ 7,800	\$ (675)	\$ 7,125	UK Trades, Penticton
Ductless Heat Pump	\$ 9,000	\$ (1,200)	\$ 7,800	Bella Bella Project Average
Central Air Heat Pump	\$ 12,900	\$ (2,000)	\$ 10,900	Coastal Heat Pumps
Pellet Stove	\$ 5,000	\$ -	\$ 5,000	Okanagan Home Center
High Efficiency Wood Stove	\$ 7,000	\$ -	\$ 7,000	Blaze King, Penticton

Natural Gas Estimate

	Source
New Furnace Cost	\$5,800 Furnaceprices.ca
Furnace Installation Cost	\$1,200 Furnaceprices.ca
Estimated Cost of Gas Hookup	\$500 ⁷ FortisBC
Net Cost Per Household	\$7,500

⁷ FortisBC staff estimated total cost of a new connection at \$65,000, but this would be reduced to just \$500 per home if each home in the subdivision agreed to install a new gas furnace. This is a rough estimate and costs would need to be validated by a site visit before proceeding.



Heating System Efficiency Assumptions

Heating Systems	Efficiency
Electric Furnace - Base Case	93%
Ductless Heat Pump	240%
Central Air Heat Pump	240%
Natural Gas Furnace	95%
Wood Stove - Base Case	65%
Pellet Stove	83%
Wood Stove - High Efficiency	85%

Appendix III: Fortis BC Billing Analysis

Household Cost of Energy by Heating Type

Home	Fortis Cost	Wood Cost	Assumed Electricity*	Band Wood Cost	Heating Type	Total/Home	Avg Cost/Type
1	\$3,701				only electric	3701	
2	\$3,556				only electric	3556	3629
3	\$2,958				only heat pump	2958	
4	\$1,989				only heat pump	1989	2474
5	2392	0		\$270	only wood**	2662	
6		0	\$1,009	\$270	only wood	1279	
7	753	\$375		\$270	only wood	1398	
8		\$375	\$1,009	\$270	only wood	1654	
9		0	\$1,009	\$270	only wood	1279	
10		\$375	\$1,009	\$270	only wood	1654	1453
11	2082	0			wood & electric	2082	
12	\$1,120	\$1,000			wood & electric	2120	
13	\$2,336	\$625			wood & electric	2961	
14	\$2,405	\$500			wood & electric	2905	
15	\$1,489	\$625			wood & electric	2114	
16	1113	\$625			wood & electric	1738	
17	\$1,750	\$1,000			wood & electric	2750	
18	1,910	\$375			wood & electric	2285	
19	\$3,049	\$375			wood & electric	3424	2487
20	1787	\$625			wood & heat pump	2412	
21	\$1,265	0			wood & heat pump	1265	
22	\$2,324	\$375			wood & heat pump	2699	2125

* See 'Non-Heating Electric Assumption' below for calculation.

** Heating categories are highly reliant on members identifying their primary heating source in the survey. In one instance, a response was not included in the analysis due to its high likelihood of inaccuracy.



Non-electric Cost Assumption	
2018 Average* (kWh)	14,198
Non-Electric**	8,519
Tier 1 Charge***	602.10
Tier 2 Charge***	406.59
Cost (\$)	1,008.69

* 2018 average consumption taken from 18 households.

** Non-heating electric consumption assumption (60%) taken from FortisBC Inc. Residential Inclinig Block Rate Submission to the British Columbia Utilities Commission, 2016.

*** Proportion of charges for Tier 1 rate (\$0.10394) and Tier 2 rate (\$0.14915) estimated at 68% and 32% respectively, based on average LSIB electricity spend (14,198kWh) and Fortis BC tier threshold (9,600kWh)

Average Electricity Consumption: 2017 & 2018

	kWh per Household	
	2017	2018
Household 1	17,226	15,437
Household 2	23,567	20,092
Household 3	9,612	8,033
Household 4	12,949	13,732
Household 5	13,820	11,977
Household 6	8,674	11,141
Household 7	26,805	20,734
Household 8	25,942	20,662
Household 9	15,715	14,345
Household 10	27,238	24,485
Household 11	8,694	8,165
Household 12	24,036	13,014
Household 13	18,820	16,319
Household 14	14,505	14,862
Household 15	18,687	14,307
Average	17,753	15,154
% Change 2017 - 2018		-15%

Average consumption decreased 15% between 2017 and 2018. This could be due to a number of factors such as climate variability, conservation, significant events, or forced heating reductions due to cost.



Average Cost per Kilowatt Hour for Households: 2010 - 2018

Year	Household 1			Household 2			Household 3			Household 4			Household 5		
	Cost	kWh	\$/kWh												
2010/2011	1986	21371	0.093	921	8557	0.108	2009	21796	0.092	2163	23058	0.094	2989	33143	0.090
2011/2012	2062	20059	0.103	1178	10351	0.114	2215	22157	0.100	2168	21661	0.100	3299	33331	0.099
2012/2013	2235	20017	0.112	1147	10035	0.114	2230	20194	0.110	2055	18648	0.110	3436	32596	0.105
2013/2014	2375	19695	0.121	1281	10924	0.117	2400	19908	0.121	2173	17956	0.121	3558	32497	0.109
2014/2015	2346	18629	0.126	1374	11530	0.119	1987	16317	0.122	1903	14706	0.129	3399	29948	0.113
2015/2016	2198	16776	0.131	1208	10162	0.119	1448	11926	0.121	1396	9967	0.140	3669	30913	0.119
2016/2017	2765	20090	0.138	1165	9464	0.123	1579	12428	0.127	1293	8598	0.150	3760	30658	0.123
2017/2018	3049	21830	0.140	1113	8823	0.126	1750	13341	0.131	1489	9908	0.150	2958	23302	0.127
'10/11-'17/18			50%			17%			42%			60%			41%

Year	Household 6			Household 7			Household 8			Household 9			Household 10		
	Cost	kWh	\$/kWh	Cost	kWh	\$/kWh									
2010/2011	2942	32430	0.091	1923	20507	0.094	1588	16784	0.095	1681	17955	0.094	1763	17581	0.100
2011/2012	3245	33005	0.098	1632	16064	0.102	1623	15836	0.102	1840	18137	0.101	2013	18608	0.108
2012/2013	3481	33370	0.104	1264	11388	0.111	1632	14841	0.110	2196	19678	0.112	2460	18720	0.131
2013/2014	3537	31406	0.113	1262	11088	0.114	1848	16003	0.115	2721	22496	0.121	1825	15398	0.119
2014/2015	3789	30018	0.126	1682	11317	0.149	2082	17518	0.119	2601	20915	0.124	1239	11386	0.109
2015/2016	4116	29964	0.137	1622	12902	0.126	2301	18683	0.123	1951	15414	0.127	1110	9032	0.123
2016/2017	4054	28562	0.142	1622	14608	0.111	2736	21776	0.126	2130	15928	0.134	1602	12914	0.124
2017/2018	3701	25862	0.143	2082	15030	0.139	2392	18525	0.129	2405	17570	0.137	2336	16497	0.142
'10/11-'17/18			58%			48%			36%			46%			41%

Rolling averages were used to reduce fluctuations in annual climate and/or event variability.

Appendix IV: Original Survey

Below is the survey in original form that was distributed to LSIB residents by LSIB housing staff.



Lower Similkameen Indian Band

Household Heating Survey

The purpose of this survey is to find out how you feel about your household heating systems. This survey was designed by Ecotrust Canada with support from Lower Similkameen Indian Band. It has 20 questions. Thank you very much for sharing information about your home.

Your Address: _____

About you:

1. How many people live in your home?

- One
- Two
- Three
- Four or more

2. What age group are you in?

- 17 years old and younger
- 18 - 30 years old
- 31 - 40 years old
- 41 - 50 years old
- 51 - 60 years old
- Older than 60 years old

3. How big is your home?

- About 1,600 square feet
- About 2,200 square feet
- Other: _____
- Not sure/Don't know

4. How old is your home?

- Less than 10 years old
- 10 – 30 years old
- 31 – 50 years old
- More than 50 years old
- Not sure/Don't know



Your heating systems:

5. What kinds of heating method(s) do you currently use in your home? Check all that you use.

- Wood Stove or Fireplace
- Electric Radiator or Furnace
- Plug-in Electric Heaters
- Heat Pump
- Pellet Stove
- Natural Gas Furnace
- Other: _____

6. What is your main method for heating?

- Wood Stove or Fireplace
- Electric Radiators or Furnace
- Plug-in Electric Heaters
- Heat Pump
- Pellet Stove
- Natural Gas Furnace
- Other: _____

7. If you use wood or pellets for heating, how do you get them? Check all that apply.

- I get wood from the band
- I collect wood myself
 - How many hours do you spend collecting per year? _____
 - How far do you travel to collect wood (km's)? _____
- I buy wood myself
 - How much do you spend per year? _____
- I buy pellets myself
 - How much do you spend per year? _____
- Other: _____
- I don't use wood for heating



8. If you use a wood stove or fireplace for heating, how often do you use it in the winter months (December, January & February)?

- Every day or almost every day (6-7 times a week)
- Often (3-5 times a week)
- One or two times a week
- One or two times a month
- I don't use wood for heating

9. How many loads of wood do you use per year? (load = 1 truck load from band)

- 0
- 1 – 2 loads
- 3 – 4 loads
- 4 – 5 loads
- More than 5 loads

*If you prefer to use cords (4ft x 4ft x 8ft stack), please answer here:

- # of cords per year: _____

10. Do you use an air conditioner in the summer to provide cooling in your home?

- Yes
 - How often do you use it? (# of days per week) _____
 - How much do you use it? (# of hours per day) _____
- No

11. Do you use any passive heating techniques? Check all that apply.

- Heating hot water with wood stove
- Curtains/Drapes over windows
- Keep all windows and doors closed
- Other: _____
- I don't use passive heating techniques



12. Do you use any passive cooling techniques? Check all that apply.

- Open windows in cooler times of day (early morning & late evening)
- Shaded windows
- Plug-in fans
- Other: _____
- I don't use passive cooling techniques

13. What is the source of heat for your hot water tank?

- Wood
- Electricity
- Propane
- Other: _____

14. How often do you have to maintain your space and water heating systems? (ex. repairs, cleaning, inspections)

- About every day
- About every week
- About every month
- About every year
- I haven't had to maintain my heating system

Share more if you like: _____

Your feelings about heating:

15. Do you feel your current heating system meets your needs?

- Yes, completely
- Yes, somewhat
- Neutral
- No, I have some complaints
- No, I have many complaints

Share more if you like: _____



16. What concerns do you have with your current heating system? Check all that apply.

- Cost
- Health
- Comfort
- Safety
- Other: _____
- I don't have any concerns

Share more if you like: _____

17. How do you feel about your monthly heating expenses? (All costs: Fortis bills, wood, other)

- They are very affordable
- They are affordable
- They are unaffordable
- They are very unaffordable

Share more if you like: _____

18. Would you be interested in installing a more efficient heating system in your home?

- Yes
- No
- Unsure

19. Would you be interested in making improvements to the structure of your house to improve heat retention and efficiency? (ex. Insulation, better windows and doors)

- Yes
- No
- Unsure



20. Are there any changes you would like to make to your home's heating system? Do you have any suggestions for improving energy efficiency in your home? Share anything you want about household heating in your home or community.

If you have any questions about this survey or want to share more, you can contact:

Phil at Ecotrust Canada: phil@ecotrust.ca

Trudy at Lower Similkameen Indian Band: housing@lsib.net



Appendix V: Survey Responses by Question

Below are the responses to all of the questions in the survey. Additional comments for questions can be found in Appendix VI: Additional Comments on Survey Questions.

1. How many people live in your home?			2. What age group are you in?		
	Responses			Responses %	
One	7	20%	17 & Younger	1	3%
Two	9	26%	18 to 30	5	13%
Three	8	23%	31 to 40	8	21%
Four or More	11	31%	41 to 50	8	21%
	35		51 to 60	11	28%
			Older than 60	6	15%
				39	

3. How big is your home?			4. How old is your home?		
	Responses %			Responses %	
About 1,600	12	32%	Less than 10	6	18%
About 2,200	5	14%	10 to 30	11	33%
Other	6	16%	31 to 50	14	42%
Not sure	14	38%	More than 50	2	6%
	37			33	

5. What kinds of heating method(s) do you currently use in your home? (Check all that you use.)			6. What is your main method for heating?		
	Responses			Responses %	
Wood Stove/Fireplace	29		Wood Stove/Fireplace	28	62%
Electric Radiator/Furnace	16		Electric Radiator/Furnace	7	16%
Plug-in Electric Heaters	9		Plug-in Electric Heaters	4	9%
Heat Pump	6		Heat Pump	5	11%
Pellet Stove	2		Natural Gas Furnace	1	2%
Natural Gas Furnace	1			45	
	63				

7. If you use wood or pellets for heating, how do you get them? (Check all that apply.)			8. If you use a wood stove or fireplace for heating, how often do you use it in the winter months (Dec, Jan, Feb)?		
	Responses			Responses %	
get wood from band	27		every day	28	85%
collect wood myself	13		often (3-5 times/week)	1	3%
buy wood myself	11		one or two times/week	1	3%
buy pellets myself	2		one or two times/month	0	0%
other	2		I don't use wood	3	9%
don't use wood	3			33	
	58				



9. How many loads of wood do you use per year?		
All Responses	Responses	%
0/don't use/no response	8	22%
1 to 2	6	16%
3 to 4	12	32%
4 to 5	8	22%
More than 5	3	8%
	37	

10. Do you use an air conditioner in the summer to provide cooling in your home?			
	Responses	%	
yes	24	67%	
no	12	33%	
	36		

11. Do you use any passive heating techniques? Check all that apply.		
	Responses	
heating hot water w/ wood	1	
curtains/drapes over window	34	
windows and doors closed	32	
other	2	
	69	

12. Do you use any passive cooling techniques? Check all that apply.		
	Responses	%
open windows	33	
shaded windows	30	
plug-in fans	24	
other	2	
	89	

13. What is the source of heat for your hot water tank?		
	Responses	%
electricity	34	97%
other	1	3%
	35	

14. How often do you have to maintain your space and water heating systems? (ex. Repair, cleaning, inspect)			
	Responses	%	
about every day	1	3%	
about every week	5	14%	
about every month	4	11%	
about every year	15	43%	
haven't had to maintain	10	29%	
	35		

15. Do you feel your current heating system meets your needs?		
	Responses	%
Yes, completely	9	24%
Yes, somewhat	9	24%
Neutral	4	11%
No, I have some complaints	7	19%
No, I have many complaints	5	14%
no response	3	8%
	37	

16. What concerns do you have with your current heating system? Check all that apply.		
	Responses	
Cost	19	
Comfort	9	
Other	7	
Safety	6	
No concerns	6	
health	4	
	51	



17. How do you feel about your monthly heating expenses? (all costs: Fortis, wood, other)		
	Responses	%
Very affordable	2	6%
affordable	11	31%
unaffordable	12	33%
very unaffordable	8	22%
don't know/no response	3	8%
	36	

18. Would you be interested in installing a more efficient heating system in your home?		
	Responses	%
Yes	22	61%
No	5	14%
Unsure	9	25%
	36	

19. Would you be interested in making improvements to the structure of your home to improve heat retention & efficiency?		
	Responses	%
Yes	32	89%
No	2	6%
Unsure	2	6%
	36	



20. Are there any changes you would like to make to your home's heating system? Do you have any suggestions for improving energy efficiency in your home? Share anything you want about household heating.
'to utilize the creeks for power: Ashnola - Village, Nchumpchin - near by residents (4/5 homes), Showdy - 3 homes, Susap - 5 homes. Gravity feed for outside water'
'bigger wood stove'
'fix thermostat, clean vents 2x year, install new windows with screens'
'non that I know of'
'better windows, insulation, door frames are drafty'
'new windows, have double sliders. Fix run in basement, basement bedroom gets absolutely no heat'
'alternative energy sources - wind/solar/geothermal, rain barrels, small hydroelectric turbines option etc., landscaping - trees and shrubs to help cool in summer, windscreen in winter months, explore alternative roofing options - wildfire risks, heating and cooling'
'the home I currently stay at has these holes that let out heat outside and I would like better windows because they let out heat as well'
'1) yes. 2) solar power/panels for heating home and water. new windows, properly fitted doors, proper insulation, remove mold on dry wall down stairs, investigate why water leads through the upstairs floor to the downstairs walls and ceiling. the big tube going from downstairs to open roof currently stuffed with towel, covered by cardboard. was once open from basement through to roof. you could see the sky. The roofers threw the twirly bird away and covered that with roof tiles. I suspect the 70's popcorn ceiling may have asbestos in it. The cracked peeling flooring may have asbestos in it. The walls may have asbestos. The original residents dies of cancer and other diseases (I suspect asbestos related).'
'need a wood fired boiler system. I live in a duplex and now worry that my neighbour will burn down our home if a regular wood stove is installed. We need a wood fired boiler system to resolve this real threat'
'better insulation - the house is 30 years old. Retrofit >> ? , brick foam insulation, spray foam insulation'
'better windows, some winter nights I feel a draft come through my windows meanwhile I have the woodstove going'
'major draft from windows, they are out dated - too hot in summer, insulations in walls and ceiling need inspection not happy with wind coming in especially in winter use too much to keep home warm'
'dont change anything please!!'
'now wood stove tied into ducting - an outdoor wood boiler system for heating hot water'
'i would like to install an alternative heating system (wood or pellet stove). If the power goes out in colder months we have no heat.'
'heating source wood/gas/electric grants support would be helpful. currently only a wood grant support to on-res homes. there is not grant support for electric or gas source heat systems'
'better way to circulate out air in our home'
'there are weather stripping seals that have pieces missing around the doors'
'wood heat. houe repairs to reduce cracks and drafts reduce loss of heat and cold - reduce fortis bill'
'centrail air would be interested in purchasing or other reccommendations'
'I would get a new stove, update the furnace to a more energy and cost efficient unit. The doors (front door, basement door and side door) need to be replaced or re-insulated'
'solar system, wood system, new windows, proper insulation, wood shavings, ...'
'would like 'info.' I have spoken to fortis over and over again about the high cost of my electric bill and nothing has been done for me!'
'duct cleaning, chimney cleaning, window checks'
'the heat from the wood stove doesn't reach the opposite end of the house'
'more passive heating - roof overhangs, screening the windows'



Appendix VI: Additional Comments on Survey Questions

Below are additional comments made by respondents in the 'share more' fields for certain questions. The questions below received the greatest amount of additional comments. All other comments can be found in the original survey responses held by LSIB housing staff.

15. Do you feel your current heating system meets your needs?	16. What concerns do you have with your current heating system?
better heating system for our basement	plug-in heaters for basement
i'd like my thermostat to be working in case of emergency in winter	need new windows, we have to tape every window every year
our electric bill is increasing over time, despite our energy conservation methods	electric heat does not work
i'm looking for a repair man for pellet stoves	in winter when we lose power the wood stove is all we have to keep the entire house warm - worries around power shortages, stress on appliances/electric systems
small wood stove, very old stove, no venting for air to get upstairs, all heat has to go up the steps, get past the cold cement wall, the door @ lots of draft (all the doors have draft) the windows are from the 70's, in cold season you cant use the...	wood stove makes house too hot, electric affects allergies and asthma
our heating system has had several issues since we moved in and we are the ones literally paying for the issues. We need a wood fired boiler system. Hydro is too expensive. Fortis charges more for hydro in rural communiites.	present pellet stove needs repair or I need a new stove
i cant contoll it w/ the thermostat (dont know why). 1 room upstairs, 1 room downstairs doesnt get warm	having to put some wood in every hour
i try not to use heat but when I do my bill gets higher, wood is too big for me to split	wood stove is too small - not efficient, needs rope around brim, was made in 1897, no vents to upstairs except through basement cement wall >> steps >> up only avenue of heat to go up. loss of use of back two bedrooms upstairs to the south - the rooms freeze - too cold to live in
dont want to change - leave well enough alone!	other: I question if insulation in our duplex meets code
some rooms dont heat well with the wood stove, hence the space heater	chimney has caught on fire 4 times in the last 2 years
an alternative heating source in winter like wood or pellet stove would be good when the power goes out	supply of firewood once in a while
wood stove is too small and its starting to fall apart. heat pump is only till -15	house is so small sometime I get scared to use my wood stove
our north part of house is always cold due to the wind blowing plus 3 exterior walls. our furnace hasn't been inspected by certified technicians	could be more efficient and effective - old wood stove, 20+ years
not sure yet	only source is electric
house very draft, lose heat, keep heat temp higher, too costly, would prefer wood heat option	power outage - if power goes out there is no other source of heat available to support keeping heat system operate - secondary system would assist in emergency situation
our furnace is so sol, expensive and our wood stove is broken. the vents need to be cleaned	I would rather have an external wood furnace due to fire risk
i live alone and my heating bill in winter has gone up to \$1200..??	maintenance
	wood - need more



17. How do you feel about your monthly heating expenses?	19. Would you be interested in making improvements to the structure of your home?
<p>mostly in the winter months when I use the wood furnace as power costs seem to be increasing, along with other living expenses its inconsisten and stressful - especially in a new unit. Looking for other alternative ways to power and heat/cool our home</p>	<p>better windows</p> <p>its a new home, everything is brand new</p>
<p>for our home it really depends on the weather, thus we make our daily heating or cooling sysmtem i can not afford to use the baseboards for heating - I can and will not choose between eating or being warm. The only electrical heating I use are the infrared units. I go through lots of wood and put extra clothing on to keep warm</p>	<p>two windows are broken and covered with a board + plastic</p> <p>loss of use of back bedrooms in winter, my insulation is from the 1970's and is not efficient - my doors have 1/2 inch clearance from floor - my windows have moisture on the inside of them, the windows let cold in in the winter season</p>
<p>\$1500 plus to heat a 920 sqft duplex? Something is seriously wrong with this picture. Granted my bill has improved over the years it is still too high and our heat pump is either damaged or still broken</p>	<p>already been approved, just hasn't been done</p>
<p>as long as I use wood heat only uncertain</p>	<p>my home is very efficient apply for ECAP</p>
<p>think my biggest bill was \$600 for 2 months</p>	<p>would be nice to have our insulation re-done and new windows - our home is 21 years old now</p>
<p>gas is affordable but our furnace & hot water wank needs to be updated - they are 20+ years old - there is no gas system supports available</p>	<p>would prefer housing to make better improvements</p>
<p>smart meter, tier system, not consumer friendly cost effective how can an elder (80) use up \$600 a month in electricity?</p>	<p>for sure, windows, doors, insulation</p>
<p>with the bands two loads. if the band didn't it would be difficult</p>	