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CENTRE for SUSTAINABILITY WHISTLER

Lil'wat First Nation Community Energy Baseline

Final Report – 23 February 2011

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1. Introduction

The Lil'wat First Nation[1] has been proactive in introducing alternative energy for its new public facilities to promote energy resiliency and to reduce long-term costs and Greenhouse Gas (GHG) emissions. Existing Community Plan policies support reducing energy use and promote the use of clean, low-impact energy sources. The intention of this study is to build upon this preliminary work to establish an understanding of current energy systems and the potential for moving to an energy future that maximizes benefits and minimizes impacts.

The Community Energy Baseline (CEB), which has resulted from this study, will form the basis for proceeding with Energy Efficiency and Renewable Energy (EE/RE) projects in the future. The project has been designed to consider the following community sustainability objectives:

- **Social.** Provide equitable access to clean, low cost energy that supports a high quality of life, including health promotion. 2006 Census data reveals that a significant number of households reported homes in need of major or minor repairs, which presents potential opportunities for incorporating building energy efficiency upgrades.

- **Economic.** Reduce energy costs and protect the community from potential future energy supply or price shocks. An additional benefit of exploring a sustainable energy future is to increase capacity and expertise within the community to support new energy-related businesses.

- **Environmental.** Reduce harmful emissions while ensuring that all proposed energy sources are reviewed for other environment impacts, including land, air, water, and habitat impacts.

The project team included staff and associates of the Whistler Centre for Sustainability (Mark Allison, Ted Battiston, and Dan Wilson), who are experienced in community energy planning. The Centre has collaborated on the study with Mike Wilson of Enerficiency Consulting for building evaluations. Mike is a professional engineer with extensive knowledge of alternative energy and building systems and has worked on a number of energy projects with First Nations communities.

[1] The Lil'wat Nation is governed by a Chief and Council, supported by staff. In this report, the terms "Band" and the "Administration" both refer to Lil'wat governance, while the "Community" or "members" refer to all members of the Lil'wat Nation.

1.1 Process Tasks

The study included the following tasks:

1. Meeting with staff to confirm project scope, deliverables and data requirements;
2. Reviewing existing energy policies and other factors relating to energy efficiency and energy supply in the Community Profile and Community Plan documents;
3. Reviewing existing land use plans and policies in the Community Plan document and discuss development trends with Band officials;
4. Acquiring and reviewing commercial energy usage, distribution and cost allocations from utilities and Lil'wat staff;
5. Assessing the prevalence of alternative energy such as geoexchange and biomass (e.g., wood and plant waste) sources, from local energy sources;
6. Conducting a high-level survey for up to 8 key/typical building types, selected in consultation with Lil'wat staff
7. Establishing evaluation criteria for developing future energy sources and systems in consultation with staff and community leaders.
8. Identifying potential alternative energy sources. It should be noted that, within the scope of this study, it was not possible to conduct full pre-feasibility studies of these sources, e.g., micro hydro or wind facilities. The potential sources identified were determined using professional judgment based on a general evaluation of existing local conditions.
9. Identifying potential energy policies, energy studies and funding sources to pursue in the short-, medium-, and long-term;
10. Meeting with community members to discuss and get feedback on the background information, identified energy issues, and potential policies and studies; and
11. Providing a CEB report summarizing background information, energy issues, and proposed EE/RE policies and studies.

It should be noted that the resources available for the CEB allowed for a high level analysis and, while some "low hanging fruit" EE/RE initiatives have been identified, the CEB is not intended to be an "investment-grade" document, i.e., it is not suitable for major capital investment decisions. The CEB does, however, outline a range of realistic future energy options and provide guidance on which options merit additional technical and financial analysis.

In the report, energy recommendations follow related background information. These are identified as bold italicized text, and classified as energy **Demand** measures to reduce energy use ("***Recommendation D-#:***") or energy **Supply** measures to shift to lower impact, cost-effective energy sources ("***Recommendation S-#:***") A table summarizing these recommendations appears at the end of the document, and a matrix showing how these measures support evaluation criteria is included in an appendix.

1.2 Study Area Climate and Geography

The climate within the Mount Currie area is within the transition zone that ranges from coastal marine to interior due to the effects of elevation, distance from the Pacific Ocean, and the surrounding mountain ranges of the Coast Mountains. The recorded annual mean temperature at Pemberton Meadows is 7.2^0 C with a mean daily midsummer temperature of 17.2^0 C. The average frost-free period is 110 days, roughly from the end of April to the end of September. The longest recorded period without frost in the area was recorded at Pemberton Meadows at 189 days and the shortest frost-free period recorded was 61 days. Mean precipitation from October 1 to April 30 is reported at 1024mm, but only 187 mm during the May 1 to September 30 period. Sunlight information is included below in the section on solar energy.

In general, there is a two to three month period of the year where heating is not required, including two hot summer months, but for the remaining nine to ten months, some form of heating is required during at least part of the day in most buildings.

The geography of the study area varies from low-lying flood plain, with fertile soils and a high water table that assists geoexchange, a plateau area with well-drained soils of variable depth, a ridge separating Mount Currie Town Site and Xit'olacw, and surrounding steep mountainsides with rocky ground. While these slopes shadow the eastern parts of the study area for some of the day, particularly in the winter when the sun is low in the sky, the two main centres in the community are generally open with limited tree coverage.

There are many watercourses in the study area, notably the large volume Lillooet River and the Birkenhead River flowing into Lillooet Lake, wetlands, and streams, including fish bearing and non-fish bearing streams from steeper slopes with flow volumes that vary considerably throughout the year.

Due to previous logging activities and the presence of an extensive floodplain, a significant proportion of the land directly under the control of the Lil'wat Band is relatively free of trees, but the majority of these lands are still forested and vegetated, with a mixture of young, merchantable, mature, and old growth forest. There is a mixture of deciduous and conifer trees in the lower settlement areas and conifers on the surrounding slopes. Outside of the Pemberton Valley and alpine areas, much of the remainder of Lil'wat Traditional Territory is covered primarily with conifer forests of varying age and density.

2. Existing Energy Policies and Practices

The following energy policies are included in the 2006 Lil'wat Land Use Plan:

Power Projects

There is a long history of energy projects in our Traditional Territory. A major hydroelectric facility is operated by BC Hydro on the Chekamus River and on the Bridge River system to the north. Major transmission lines cross the Traditional Territory, transporting energy to markets in the Lower Mainland and beyond. Transmission corridors have caused impacts in Lil'wat Traditional Territory, including disrupting ecosystems, increasing vehicle access to backcountry areas, spreading weeds, the introduction of herbicides, and causing visual damage.

Outside interests have promoted the development of small hydro power projects, run-of-the-river hydro-electric plants, and geothermal developments in various parts of the Traditional Territory. Many proposals have been prepared for streams in our Traditional Territory as a result of the appropriate water conditions and the closeness to major energy markets.

Power projects are viewed by some members of the Lil'wat Nation as a significant economic opportunity. However, there is a need to minimize the impacts of power projects on cultural heritage and environmental values, including the waters that maintain natural systems and fish streams. We are involved in a number of power projects in the Traditional Territory, which will help to ensure that our proprietary rights and values are incorporated into these projects.

8.2.2 Management Direction for Power Projects

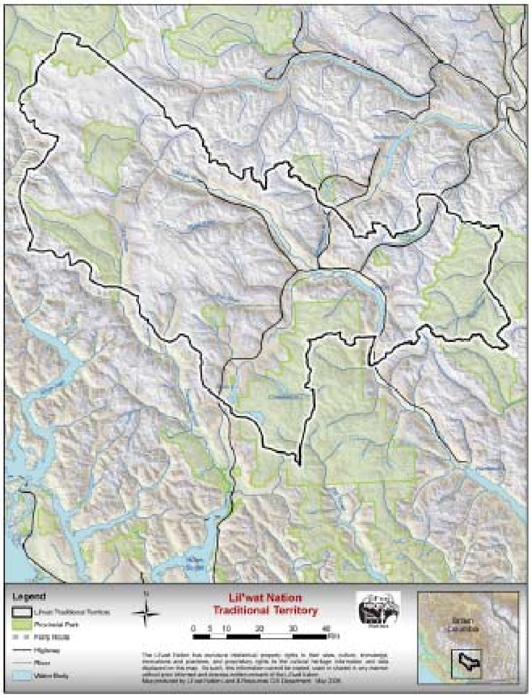
Management Strategies	***Actions***
Ensure meaningful consultation for all power projects that occur in the Traditional Territory.	*All power project-related development plans flow through the Lil'wat Land Use Referral Committee.*
Prohibit power projects in sensitive areas.	*Prohibit power projects in areas specified in Sections 10 through 15.*
Support power projects that ensure minimal environmental or cultural impacts.	*Explore "greener" forms of energy development. Require archeological and cultural assessments to be completed prior to project development. Ensure compensation and mitigation measures are included in power project planning. Undertake assessments to avoid negative impacts on environmental*

	values such as water supply and quality, fish, fish habitat, and riparian areas. Study cumulative effects on affected watersheds and our Traditional Territory.
Minimize disturbance associated with power project development and operation.	*Build transmission lines only in developed corridors. Support projects only if ecological and cultural values are managed appropriately.*
Develop economic and employment opportunities for the Lil'wat people.	*Explore opportunities to develop partnerships and joint ventures for power projects that provide benefits to our people. Develop a range of employment opportunities in the design, planning, and operation of power projects through advanced education and training. Identify opportunities for Lil'wat ownership of power project developments.*
Develop monitoring systems to assess compliance with management plans.	*Monitor construction and operation to ensure that mitigation and compensation measures are followed.*

3. Land Use and Development Plans and Policies

2006 Lil'wat Land Use Plan covers the entire Traditional Territory of the Lil'wat, shown in Figure 1 including current settlements under direct jurisdiction.

Figure 1 - Lil'wat Traditional Territory



Source: Lil'wat Land Use Plan

The following land use and development policies are included in the plan:

Land Development: The use of land for activities such as; residential development, commercial centres, golf courses, and resorts. Where development is permitted, it must be based on best management practices, using principles to limit sprawl and enable continued Lil'wat access to the land. Modern planning tools such as Smart Growth will be used to guide land development.

8.6 ***Land Development***

8.6.1 Community Perspectives

The development of lands in our Traditional Territory has been increasing dramatically in the recent past. The government of British Columbia has been providing "Crown land" for private development, which often has been inappropriate. We seek adequate consultation and accommodation and joint government planning before any new crown land is sold or changed to fee simple.

In select places, the Lil'wat are involved in land development activities in the Traditional Territory, such as the Callaghan Valley, Pemberton Valley, and Rutherford Creek. There are opportunities to use the land and resources of the Traditional Territory to support community well being, yet any development must respect Lil'wat values.

8.6.2 Management Direction for Land Development

Management Strategies	***Actions***
Undertake land development that minimizes environmental disturbance.	*Ensure that all Lil'wat Nation development is sustainable, and adheres to such concepts as Smart Growth and low impact design. Oppose land development that leads to sprawl, inefficient use of land, and dependency on motor vehicles. Seek to develop communities that focus on mixed use, pedestrian-oriented, and attractive designs. Plant native vegetation in land developments.*
Undertake culturally appropriate land developments.	*Locate developments away from culturally sensitive sites. Ensure barriers to cultural sites are not created as a result of new development.*

The Land Use plan also identifies policies for environmental protection related to development practices:

Watercourse Protection

- *Review development plans to minimize risk to water, ensuring appropriate mitigation measures are used.*
- *Require the use of best management practices to minimize risk to lakes and rivers.*
- *Prevent logging on slopes that are unstable or have high erosion risk.*
- *Prohibit impacts to stream, river and lakeside vegetation.*
- *Ensure new flood management efforts do not negatively affect water.*

Air Quality

- *Controlling burning in the valleys to avoid effects on human health.*
- *Seeking and encouraging alternatives to burning for forestry, agriculture, and home heating.*
- *Reviewing new development proposals to avoid air quality impacts.*

There are two main concentrations of development within the main community, the Lower Community (Mount Currie, shown in Figure 2) and the “New Site” (Xit’olacw, shown in Figure 3). Local services are divided between these two sites, with Lil’wat administrative offices, recreation facilities, and some commercial uses in Mount Currie, and the school, health care centre, elders centre, and community store at Xit’olacw.

Figure 2 - Mount Currie Town Site

Figure 3 - Xit’olacw

In addition to these sites, there is rural development, primarily along the Highway 99 corridor and several secondary roads, such as Ranceree Street. In general, development is low density, automobile-oriented, detached housing ranging from century-old log cabins to modern bungalows, manufactured homes and trailers, and split level and two-storey homes. There are several multi-family buildings, including townhouse complexes and the elders centre.

According to the 2009 Community Profile, approximately 50% of the population is located along Lillooet Lake Road, the Old Reserve, and IR #10, while the remaining 50% is centred at Xit’olacw, which was developed on higher ground in response to periodic flooding events in the other locations.

In addition to infill development potential in Mount Currie town site and in the rural areas, there are new streets in Xit’olacw with approximately 20-30 sites that are serviced and ready to be developed.

More spread out, low density, automobile-oriented settlement patterns with separated land uses, i.e., separated housing and employment areas, are more energy-intensive for buildings and transportation than compact, higher density centres with a mix of land uses, such as housing, institutional use, and employment uses. Compact communities facilitate walking, cycling, and transit use, have more shared walls that reduce heat loss, and have greater potential for district energy systems, as discussed below. As the photos of the sites show, Mount Currie town site, while relatively low density, has the basic structure of a compact centre, while Xit’olacw is a more suburban centre, with a street pattern that presents challenges for walking, cycling, and transit. Due to operating costs, transit frequencies are directly related to population and population densities along transit routes: The more people concentrated along a transit route, the greater the fares and the more service hours that are possible.

Potential directions about land use and development with respect to energy use are:

- Focus development at established centres and major corridors;
- Promote mixed use development where there is employment and services; and
- Provide pedestrian and bicycle amenities, such as sidewalks, paths, bike lanes, transit shelters and lighting, where appropriate, to make walking, cycling and transit use more attractive and encourage people to live in or near the centres;
- Consider infill development and multifamily residential buildings that share walls to reduce heat loss to increase densities over time that will also attract more local services, increase transit service levels, and support potential future community energy systems.

It order to address the sustainability and energy security issues related to current settlement patterns in more detail, it is suggested that the community consider public community design processes, or "charrettes,[2]" for the two main centres at Mount Currie and Xit'olacw. The purpose of these Design Charrettes would be to, in consultation with community members, identify ways to transition existing centres towards centres that are more energy and resource efficient while being more attractive places to live and work. A recent local example of this charrette process was for downtown Squamish.[3]

It is understood that, while some of these land use and development directions may not always be consistent with traditional values or personal preferences, they generally support the traditional community lifestyle of the Lil'wat. It should also be noted that the suburban development patterns that are now so common in North America, including Xit'olacw, are a relatively modern phenomenon, resulting in large part to the increasing availability of motor vehicles over the last century. Without cheap energy to power motor vehicles and heat large homes, there is a growing concern across the continent that these patterns may become unsustainable in the future.

Recommendation D-1. For future community plans and major development projects, consider developing higher density nodes with mixed uses (i.e., commercial, institutional, and residential together or close by) within the community that can better limit travel distances for services, be better served by public transit, and support potential district energy systems in the future. A design charrette is one technique to engage the community in this process.

Recommendation D-2. Consider additional multifamily residential buildings within the community. Multi-family buildings share walls, reducing heat loss to the exterior, and are supportive of potential larger-scale alternative energy systems, such as geoexchange.

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[2] http://en.wikipedia.org/wiki/Charrette

[3] http://www.sgog.bc.ca/content.asp?contentID=135

3.1 Community Profile and Land Use Plan Background Information

The community of Mount Currie has a population of 1, 522 residents living on six reserves within Lil'wat Nation traditional territory. The distribution of houses within the community, from 2006 census data, is shown in Figure 4.

Figure 4 - Location and Number of Houses, 2006

Reserve Name	IR Number	Hectares	Acres	Approx. No. Houses (2006)
Mount Currie	IR # 1	76.3	188.5	45
Mount Currie	IR # 2	42.5	105	6
Nesuch	IR # 3	368.1	909.5	41
Lokla	IR # 4	5.3	13.1	0
Challetkohum	IR # 5	0.6	1.4	0
Mount Currie	IR # 6	1,618.8	4,000	222
Mount Currie	IR # 7	129.5	320	0
Mount Currie	IR # 8	656.4	813	21
Challetkohum	IR # 9	1.5	3.7	0
Mount Currie	IR # 10	30.1	74.3	81

The following heating and energy background is included in the 2009 Lil'wat Nation Community Profile:

> *Heating and energy*
>
> *The community has ready access to the provincial energy grid, with a series of transmission lines running through the community providing electricity. Some of the distribution/transmission lines dissect rural properties and have the potential to limit housing development. Heating is a combination of electricity and wood burning stoves. The new community building on IR # 10 is installing a state of the art Geothermal System, which will provide inexpensive heating and cooling."*
>
> *The energy sector is active in the Traditional Territory with the recent development of Independent Power Projects (IPP's). Currently two projects operate in the area, the Miller Creek Power Project and the Rutherford Creek Power Project. There are no IPP projects slated to be built within the community.*

It should be noted that in addition to these nearby hydro projects, the Meager Creek Geothermal Project,[4] which has significant thermal and electrical capacity, and hot

[4] http://www.geopower.ca/meagerdescription.htm

springs near Lillooet Lake, lie within the Lil'wat Traditional Territory, but these resources are outside currently outside of direct Lil'wat jurisdiction.

The following air quality and health background related to burning was included in the 2006 Lil'wat Land Use Plan:

> *Air Quality and Health*
>
> *Mount Currie is part of the Sea to Sky Airshed, which includes Howe Sound, Squamish Whistler, Pemberton and Mount Currie. Continuous air quality monitoring is in place in Langdale, Squamish and Whistler with a non-continuous station in Pemberton at Signal Hill Elementary School. Up to date results of the Whistler monitoring station can be checked at http://seatoskyairquality.ca/.*
>
> *Air pollution from large-scale sources may occur from open burning in the forest industry, although this activity has been greatly reduced in the past few years. Every spring, some residents in the community conduct open burning of hay fields to encourage new growth and burn unwanted weed species. In addition, an estimated 75 % of homes in Mount Currie utilize wood heat for energy.*[5]
>
> *Clean air is important to the health and attractiveness of our land. Burning during inappropriate conditions can be easily avoided, yet today, causes health issues for our people. Clean air in our Traditional Territory can help to reduce the number of people affected by asthma, and support a healthy, desirable home for our people.*

The energy and environment related background was included in the 2009 Lil'wat Nation Land Use Plan:

> *Bulk water removals are a concern for our community. Water is removed from Spetch Creek, a tributary that flows into the Birkenhead River, and sold. Limited benefits for the Lil'wat Nation are gained from the removal of one of our most critical life-sustaining resources. Small hydroelectric power plants are the latest trend. Most small-hydro facilities rely on low dams or water diversion. Even these run-of-the-river facilities can cause downstream flow changes that affect fish habits and habitat. Removing water from channels harms riparian ecosystems, the plants and animals that live alongside rivers and lakes. We are involved in the planning and development of hydroelectric projects in our Traditional Territory, and, through our involvement, are working to minimize impacts on water.*

[5] 2009 Lil'wat Community Profile and discussions with staff.

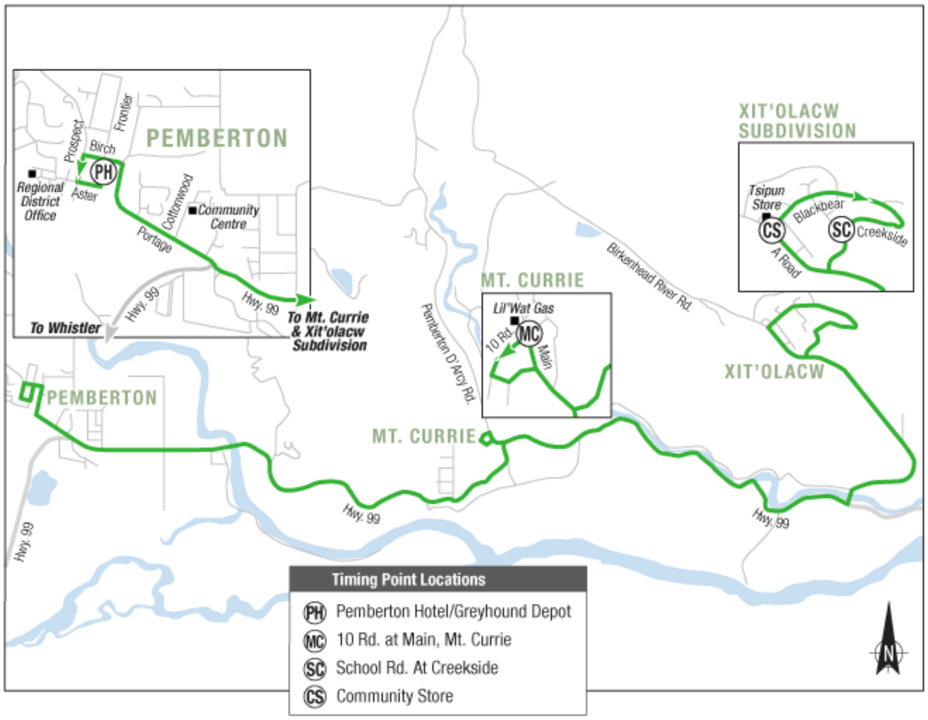
3.2 Land Use and Transportation

Land Use in the study area is supported by a road network, including Highway 99, and a number of passenger services, as outlined in the 2009 Community Profile:

> *The Mount Currie community participates in a joint service agreement with the SLRD to operate a transit service between Mount Currie, Pemberton and Whistler on the Whistler and Valley Express (WAVE) transit buses, as well as a local commuter van run by Pemberton Taxi. These services run several times a day from Xit'olacw Village, to the Lower Community, Pemberton and on to Whistler. The "Pemberton Local" (Route 100) costs $2.00 from Mount Currie to Pemberton runs, the "Pemberton Commuter" (Route 99) costs $3.00 for trips to Whistler and the Greyhound Commuter costs $4.61 for trips from Pemberton to Whistler. All costs are for a one way trip. The SLRD is working on a "Regional Transit Planning and Capital Infrastructure Service" which will better address the needs and services of all commuters in the area.*
>
> *The transit schedule can be viewed on the SLRD website at www.slrd.bc.ca (go to transit tab). The Mount Currie Administration is very involved in the delivery of these services and is an active partner with the Regional District staff.*
>
> *The Mount Currie Health Centre runs an Elder's Van, which services elders in need of transportation to and from Pemberton for doctor's appointments and other needs. This service operates a 10 passenger van and runs from 8:30 am to 4:00 pm 5 days a week. A new program called "Elder Go" offers transportation for all Elders from Pemberton, Mt Currie and up to D'arcy to drive seniors to town for groceries and social outings. This program is run on annual funding and has just completed its first year of service.*
>
> *Creekside Resources Inc. owns and operates a 15-passenger van that transports workers to and from various locations in Whistler for work. The Squamish Lil'wat Cultural Centre (SLCC) operates a 15-passenger van and transports workers from Mount Currie to the Centre in Whistler. The Xit'olacw School owns and operates a regular size school bus that is used for some community events when not in use by the school. One Pemberton taxi company and a few Whistler taxi companies provide a fare- based service for Mount Currie and the surrounding area.*
>
> *There is a lot of pedestrian traffic within the community and many people hitchhike between Xit'olacw and the Main Village into Pemberton and as far as Whistler. Safe travel options along Lillooet Lake Road within the community and towards Pemberton outside of the community need to be provided.*

There is currently limited transit service, primarily serving commuter trips in the morning and evening. The current service area is shown in Figure 5. It should be noted that fares as of December 1st, 2010 are $2.50 adult to Pemberton and $4.50 to Whistler, with 10 round trips per day between 6 a.m. and 8 p.m. being operated by Pemberton Taxi.

Figure 5 - BC Transit Routes, 2010



The community is doing an admirable job of working together to provide a wide range of transportation options that provide mobility within the community and to Pemberton and Whistler without the need to own an automobile. These services are sometimes limited to specific purposes and times of day, but allow many people in the community to access their basic services, employment, and social needs.

At the current time, a major expansion of transit services does not appear to be economically feasible, and low-energy, low-impact technology for public transit and passenger vehicle options are either limited or capital intensive, such as the use of gas-electric hybrid or hydrogen fuel cell buses. The Fraser Basin Council's E3 Fleet review program, which will be discussed later, is a good method for evaluating vehicles to identify opportunities for upgrades and replacements over time that are both cost-effective and energy efficient.

In the long term, more efficient passenger vehicles can be introduced into community vehicles as technologies and prices improve, while focusing development into established centres would support more local services to reduce the need to travel and support increased transit services. In the medium term, improved pedestrian, bicycle, and transit passenger facilities (i.e., well designed shelters, lighting and sidewalks) would encourage more residents to use these modes by increasing passenger comfort and security. In the short term, options to consider for providing greater accessibility while reducing energy usage would include:

- Partnering with regional stakeholders, such as the Jack Bell foundation,[6] for access to an expanded car/vanpooling system;
- Working with community partners to expanding the shared use of available passenger vehicles to provide increased service levels during off-peak travel periods to local and regional destinations;
- Exploring the acquisition of car/van sharing vehicles, such as the Cooperative Auto Network,[7] that would allow residents to use available transit options whenever these are possible with the option of using a shared vehicle from time to time for special purposes.

Vehicles used for these purposes should be as fuel efficient as possible.[8] In general, fuel efficiency and alternative energy sources are more available in these smaller passenger vehicles that in larger vehicles.

Current data for vehicles, including ownership numbers and type for community members and the Administration, are included below in the community energy use section.

Recommendation D-3: Improve facilities for walking, cycling, and transit users.

Recommendation D-4: Seek opportunities for expanded vehicle sharing, both by individuals and by organizations, and car and vanpooling.

Recommendation D-5: Move to more fuel efficient and alternative energy vehicles as resources permit and new technologies become available.

[6] https://online.ride-share.com/en/my/

[7] http://www.cooperativeauto.net/

[8] http://oee.nrcan.gc.ca/transportation/personal/choose_vehicle.cfm

4. Community Energy Sources and Energy Use

4.1 Overview of Community Energy Use

The community has ready access to the provincial electricity grid, with a series of transmission lines running through the community. Some of the distribution and transmission lines dissect rural properties and have the potential to limit housing development. Heating is a combination of electricity, wood burning stoves and propane. The new community building in the Mount Currie Town Site is a state of the art Geoexchange System, which provides low-cost heating and cooling.[9]

Grid electricity is supplied by BC Hydro. Overall, the community has 28 commercial and institutional accounts and 374 residential accounts. Currently, residential customers pay 6.27 cents per kWh for the first 1,350 kWh they use over a two-month billing period. Above that amount, customers pay 8.78 cents per kWh for the balance of the electricity used during the billing period. Commercial rates are quite varied depending on the specific application, with 5 different classes charged in Mount Currie.[10]

Propane is used primarily by Lil'wat Institutional buildings, but also by some multifamily residences that have propane paid for by the Administration. A handful of single family homes also have limited propane usage. Propane is supplied by Canwest Propane and purchased on a yearlong contract running from August 2010 to 2011. The price for propane is $0.529/litre plus a $10 delivery charge for each delivery. The Administration is not charged any taxes (including carbon taxes) on top of this amount.[11]

Wood is also used extensively for residential purposes and harvested in various areas in the traditional territory. Although the Lil'wat land use plan includes forestry uses, here is currently no community policy on extracting wood sustainably from surrounding forested areas for heating, and potentially other local energy purposes.

Mobile fuels on the reserve are supplied through the Lil'wat-owned gas station which supplies gasoline and diesel to Lil'wat members and Administration vehicles, as well as any other customers visiting the area. Propane at the station is currently supplied by CanWest Propane and the other fuels are supplied by United Petroleum.

Total Lil'wat community member energy use, including stationary (infrastructure, homes, buildings) and mobile (Lil'wat Fleet and band members vehicles) energy sources was 117,140 Gigajoules (GJ) in 2009, as shown in Figure 6.[12]

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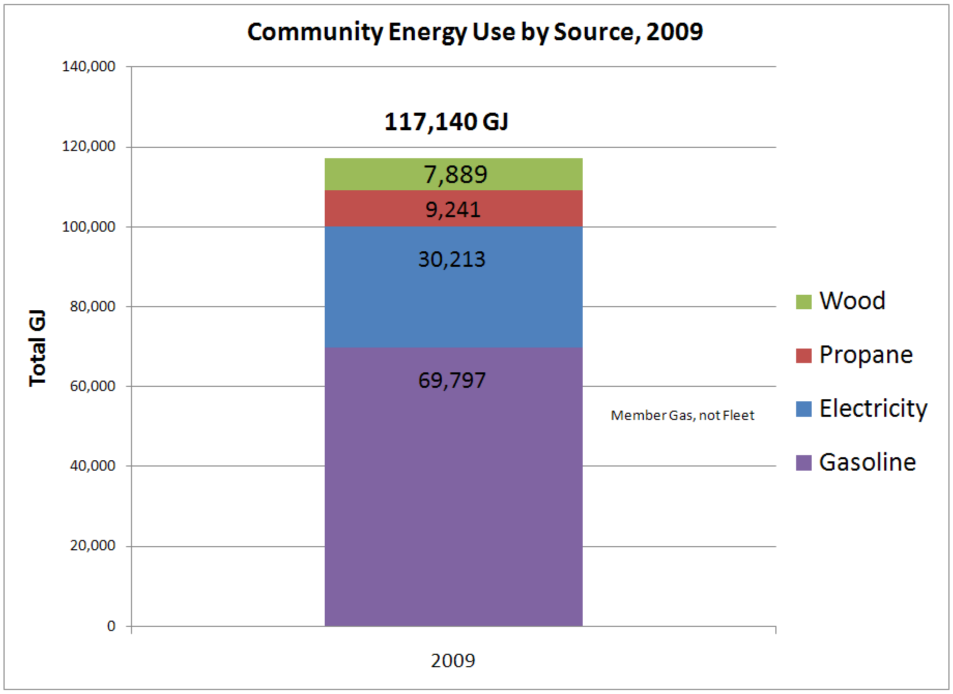
[9] Lil'wat Community Profile

[10] BC Hydro Community Accounts

[11] Conversation with Canwest Propane representative.

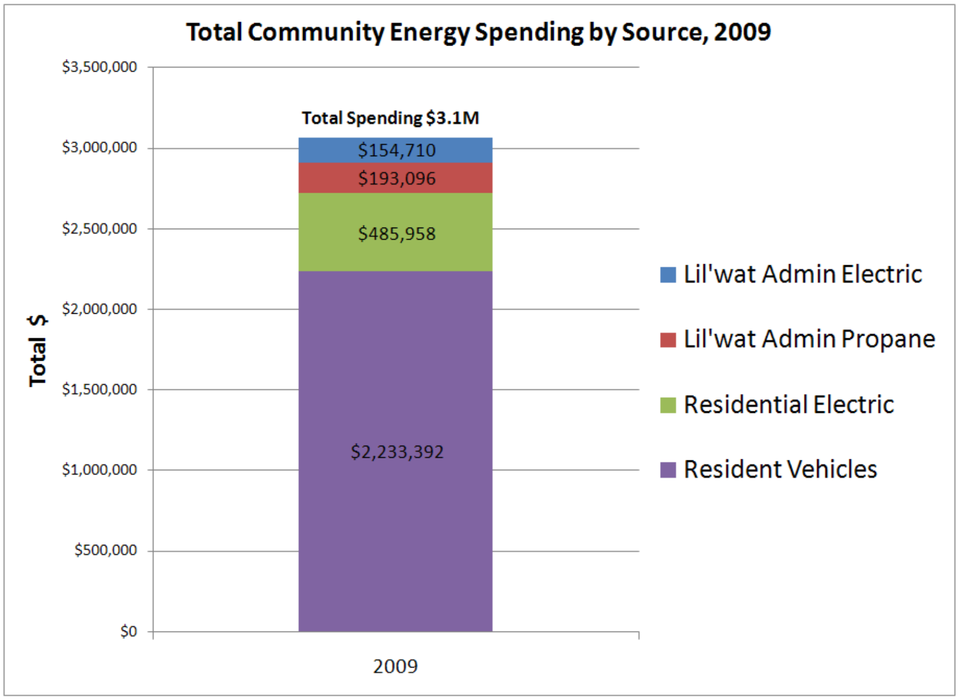
[12] A Gigajoule (GJ), is the common unit of energy use used in this report. One Gigajoule is equal to approximately 278 kilowatt-hours (kWh), the unit commonly used for electrical energy, or 1/6th of a barrel of oil. A kilowatt-hour of electrical energy would power 10-100 watt light bulbs for an hour.

Figure 6 - Community Energy Use by Source, 2009



This results in annual spending for energy of over $3.1 million, as shown in Figure 7.

Figure 7 - Community Energy Spending by Source, 2009



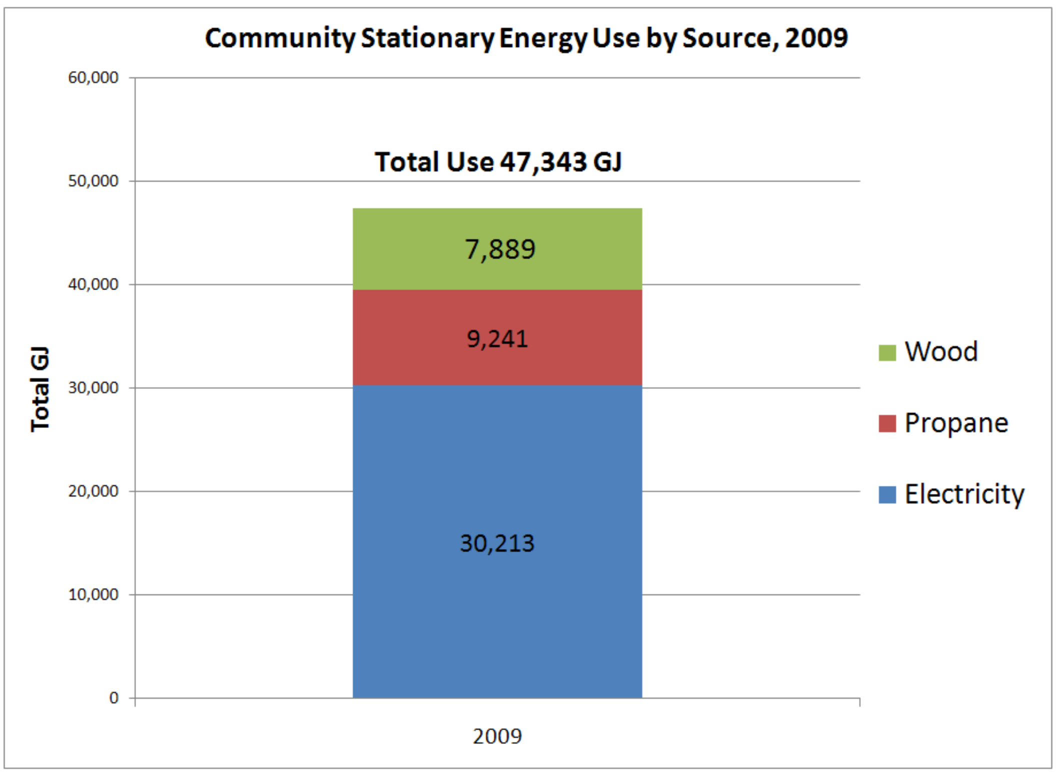
4.2 Stationary (Buildings/Infrastructure) Energy Use

4.2.1 Community Building and Infrastructure Energy Use

Lil'wat Administration and community member energy use for stationary facilities, including infrastructure, homes, and other types of buildings, resulted in 47,343 Gigajoules (GJ) of energy use for 2009.

Electricity purchased from BC Hydro makes up the bulk of stationary energy use at about 64%, or 30,213 GJ, with propane making up 20%, or 9,241 GJ, and wood for heating estimated at roughly 16%, or 7,889 GJ.[13] Energy consumption for Administration and community stationary uses is summarized in Figure 8.

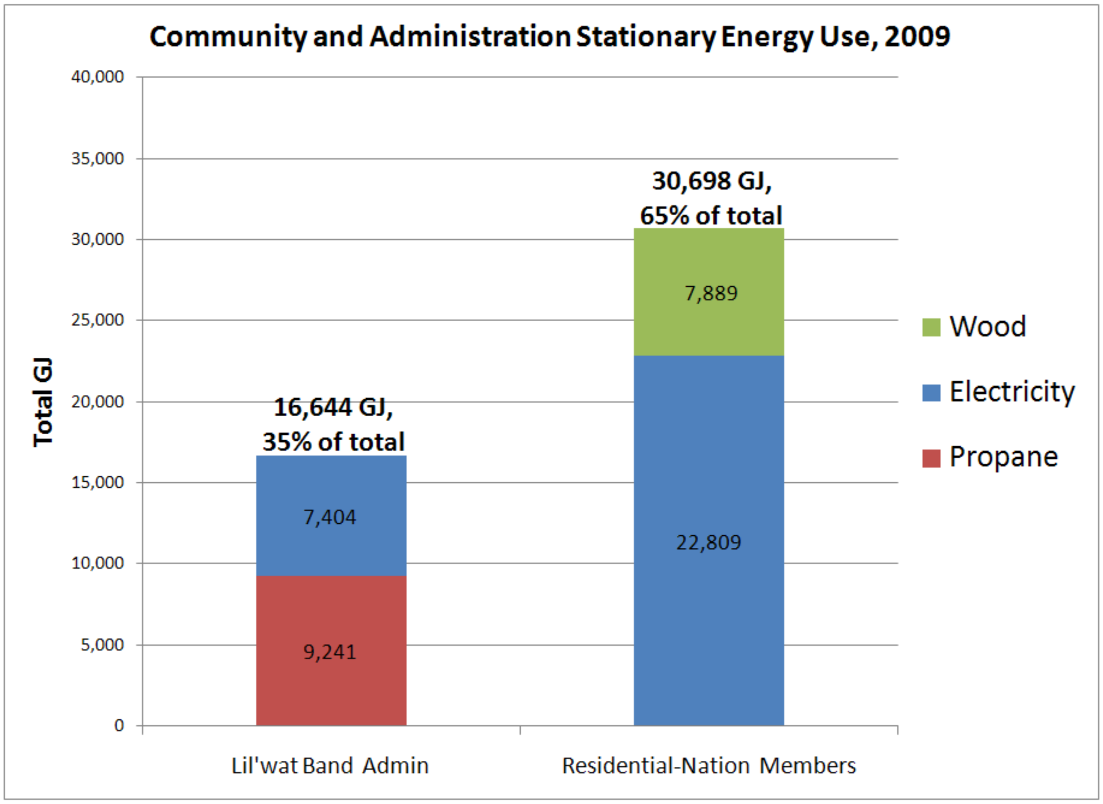
Figure 8 – Community Energy Use by Energy Source, 2009



[13] Based on multiplying the number of Lil'wat residential homes by the estimated wood energy used per residential dwelling in Pemberton Source: CEEI Report

As shown in Figure 9, the bulk of stationary energy is used by community members at 65%, with the Administration making up the difference at 35%. Electricity use in the community is mostly residential-based whereas propane use is primarily for Lil'wat Administration operations. Wood is used exclusively for community member heating and makes up roughly 26% of the total stationary energy use by members. The amount of wood used equates to roughly 438 cords of wood (1,580 cubic metres) on an annual basis, which very roughly equates 5.26 ha of forest use annually, assuming approximately 300 m^3 yield per hectare.[14]

Figure 9 - Stationary Energy Use by User and Source, 2009



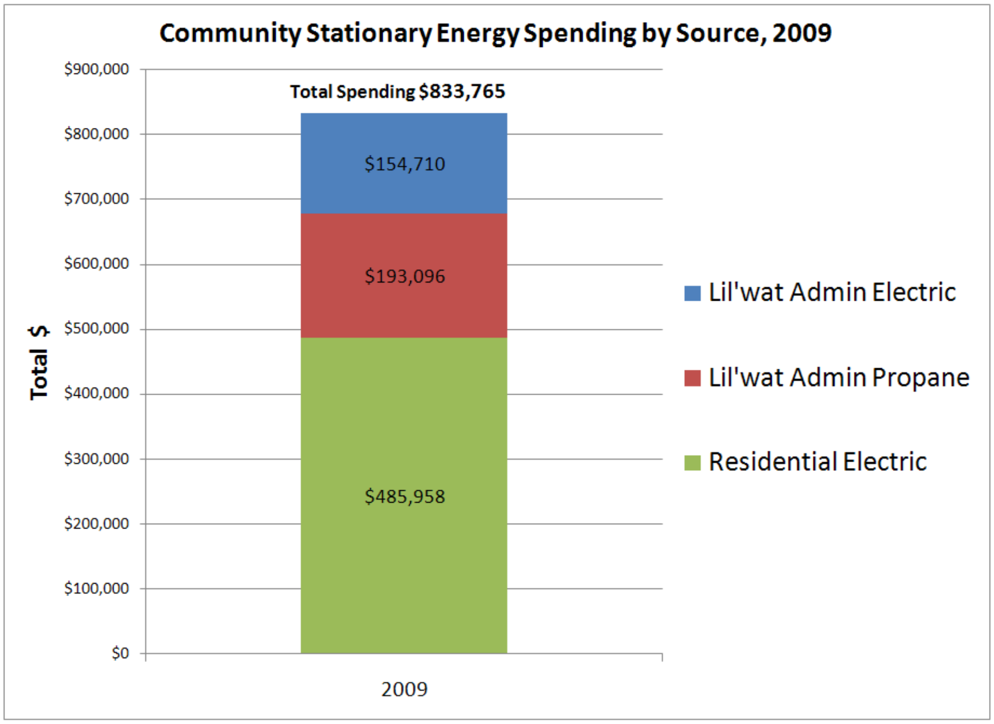
As shown in Figure 10, the overall cost of stationary energy consumption for the entire community from utilities in 2009, including the residential electric accounts, was $833,765.[15] Total costs for stationary energy use by Administration in 2009 were $347,806. Electricity consumption accounted for $154,710 or 44% of the total and propane consumption accounted for $193,096 or 56% of the total.[16]

[14] Based on Soo Timber Supply Area Analysis Report, 1999 (www.llbc.leg.bc.ca/public/pubdocs/bcdocs/333474/analysis.pdf) as no specific report for the region was found.

[15] This total doesn't include any costs for sourcing, transporting, chopping, drying wood, habitat loss or managing forest resources.

[16] This amount includes additional fees paid to BC Hydro for the overhead lighting services over and above energy consumption for lighting.

Figure 10 – Community Stationary Energy Spending by Source, 2009



4.2.2 Administration Building and Infrastructure Energy Use

The Lil'wat Housing Department manages all CMHC Social Housing Units, the Band Housing rental units, all multifamily units, the four new teacherages, and several trailers. Energy utility costs for some residences are also paid for by the Band.

Housing units outside this inventory are paid for and managed by community members. Energy utility hook-up and use costs are the responsibility of each home owner and not the Band. Each unit has a separate electrical account with BC Hydro.

Commercial buildings are owned and operated by the Lil'wat Nation Administration. The Band Administration pays the energy bills and maintenance for the facilities, but bills are attributed to the specific department budgets. While there is a movement toward more efficient energy systems and sources such as the ground source heat pump application at the new Ullus Community Complex, there is no formal building policy promoting this approach. The land use plan does, however, have a management strategy aimed at *"land development that minimizes environmental disturbance"* with additional support related to maintaining air quality.

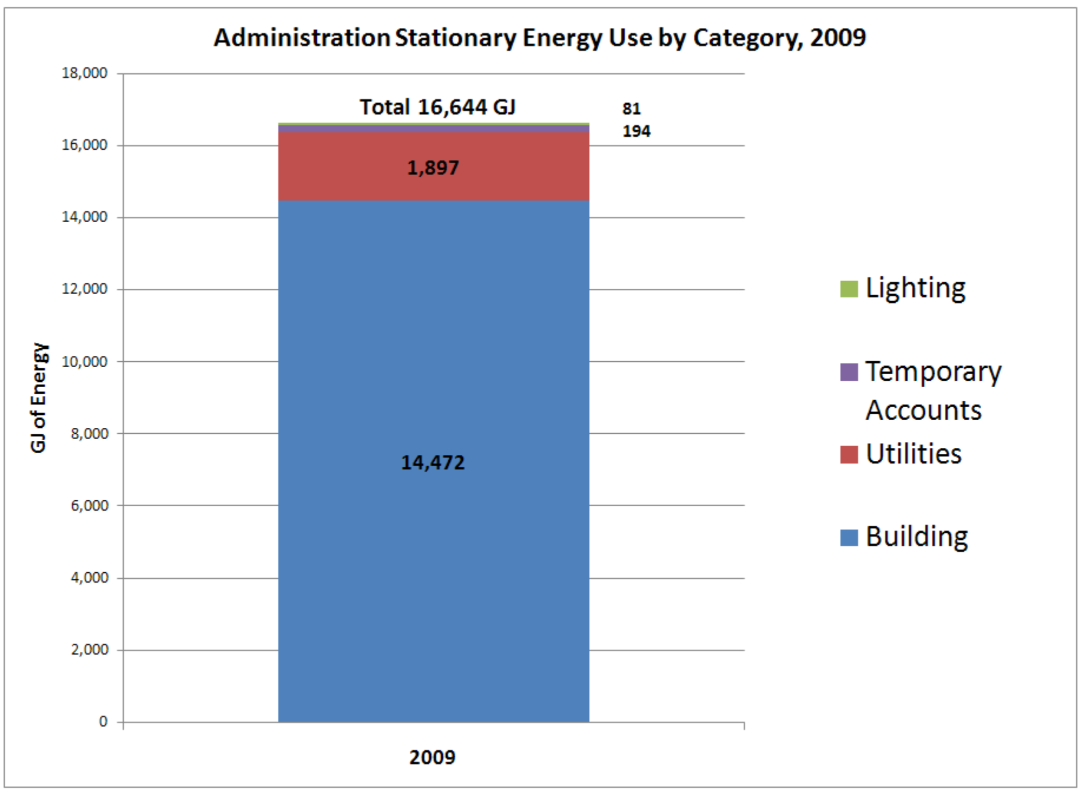
Infrastructure systems for the community, including water and sewage systems, also use a significant amount of energy. These systems are owned and operated by the band and upgraded as recommended by local staff and KWL consultants. Pump repairs tend to lead to the same type of technology systems which may be relatively inefficient single speed technology.[17] Major capital upgrades are funded by Indian and Northern Affairs Canada (INAC).

Propane is currently the major energy source within the inventory of Administration accounts making up 56% of consumption. In 2009, propane was used primarily for space heating the Xit'olacw Community School, Health Care Centre, Elder's Complex, Multi Family Units, Ts'zil Learning Centre, the Ullus Community Centre, Creekside Resources, and a few residential accounts covered by the Administration. The associated Greenhouse Gas emissions from this propane use totaled 562 tonnes.

Electricity makes up 44% of the total Administration energy use for 2009 and was used for buildings (heating, lighting, hot water, appliances, electronics, etc.), street lighting, and water utility systems.

Energy consumption by the Administration is divided into use categories, as shown in Figure 11, with buildings consuming 87% of the total energy or 14,472 GJ, utilities consuming 11.5% of the total energy or 1,897 GJ, temporary accounts using 1.2% of the total energy or 194 GJ, and street and park lighting consuming 0.5% of total energy use or 81GJ.

Figure 11 - Administration Stationary Energy Use by Category, 2009



[17] Conversation with Frank Andrews

4.3 Mobile (Vehicle) Energy Use

4.3.1 Community Vehicle Energy Use

Vehicle and transportation pattern data for Band members doesn't exist in great detail but, as noted above, there is a significant amount of pedestrian traffic within the community and many people hitchhike between Xit'olacw and Mount Currie into Pemberton and as far as Whistler. In addition, some Band organizations have vehicles for transporting staff to and from worksites and there is some public transit available. Census data for at Mount Currie Reserves shows that those commuting to work are more likely to car pool or walk to work than the BC provincial average.

Individual vehicle ownership, vehicle type, etc., for the Lil'wat may be informed to some extent by reviewing reports on the surrounding SLRD and/or Pemberton Community. Rural areas like the SLRD and Pemberton have a higher prevalence of vehicles that are categorized as Light Trucks, Vans, SUVs by ICBC than urban areas such as Vancouver. These vehicles generally have a higher vehicle kilometers travelled than large or small passenger cars and lower mileage. A large majority of vehicles in the region are gasoline powered as opposed to diesel. In 2009, Pemberton per capita vehicle ownership was 0.63,[18] higher than both Whistler and Squamish. When a similar ratio is applied to the Lil'wat population it results in approximately 950 vehicles in the community, including 395 passenger cars and 555 Light trucks, Vans, SUVs.

Initial review of this estimated number seemed somewhat high based on observations in the community so ICBC was contacted for a list of registered vehicles in the Mt. Currie Postal Code area. This report showed that there were 767 personal use vehicles registered. At 767 personal use vehicles this means approximately 2 vehicles per residential dwelling. Given that the postal code area is somewhat larger than the Lil'wat Nation community this number is likely higher than actual as well, but it confirmed that the estimate of 950 was too high. Though the ICBC number is higher than actual, we used the ICBC result to estimate fuel use as it is easy to replicate year after year for ongoing analysis.

Since Pemberton per capita energy use in 2007 from personal vehicles was 91 GJ per vehicle,[19] we applied these figures to the Lil'wat population of 767, for a total of 69,797 GJ of energy consumption from vehicles and 7,450 tonnes of Greenhouse Gas emissions. Based on a price of $1.12/litre, spending on fuels is estimated at $2.2 million dollars annually, the highest single energy use and cost in the community.

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[18] Sourced from the Provincial Community Energy and Emissions Inventories and BC Stats.

[19] Sourced from the Provincial Community Energy and Emissions Inventories and BC Stats.

4.3.2 Administration Vehicle Energy Use

A fleet of 22 vehicles ranging from passenger vans to buses and fire trucks. Of the 22 vehicles 12 are standard gas drive trains and 10 are diesel. Some vehicles are leased with some leases running out in the next couple of years and others are owned. The two fire trucks are out of date, but currently need some funding to replace them. Vehicles are used by various departments and it is each department's responsibility to determine replacement schedules and arrangements.[20] It is noted that there may be a movement toward smaller vehicles in coming year, particularly as technologies initially designed for smaller passenger vehicles are adapted to larger passenger vehicles and trucks.

To ensure that the Administration's fleet is using the best mix of energy efficient vehicles for assigned tasks, the Fraser Basin Council's E3 Fleet Program is available. An E3 fleet evaluation could be expanded to incorporate all of the service vehicles in the community, whether owned by the Administration or other service organizations.

Recommendation D-6: Conduct an E3 vehicle fleet review and implement cost-effective measures in the short term, and implement the long-term vehicle replacement strategies when possible.

4.4 Summary of Energy Sources and Energy Use

The greatest use of energy in the community is from transportation, particularly private motor vehicles, followed by building heating, cooling, and electricity. Infrastructure uses a relatively minor, but not insignificant amount of energy. While community members use wood stoves and electricity for heating, Administration buildings use propane and electricity for heating, with the geoexchange system using electricity for operating heat pumps. Besides geoexchange and biomass (i.e., wood) other alternative energy sources, such as wind and passive and active solar, are not currently being used.

The total energy used by the Administration and community members is approximately 117,000 GJ, costing $3.1 million, or approximately $2000/year for each member, which is a major cost. With the cost of fossil fuels and electricity expected to increase significantly in coming years, any cost-effective measures to reduce energy use and utilize alternative energy sources save large amounts of money and lead to large GHG reductions in the future.

[20] Conversation with Frank Andrew

4. Energy Reviews of Buildings

A high-level inspection and analysis of 4 commercial/institutional and 8 residential building types was conducted, selected in consultation with Lil'wat staff. The buildings were either significant energy users or a typical building type with potential for major energy savings. The building review documented:

1. Energy efficiency (insulation and leakages);
2. Heating systems employed, including:
    a. Biomass (i.e., wood stoves);
    b. Electricity;
    c. Fossil fuels (e.g., oil, gas, propane);
    d. Passive solar/solar orientation; and
    e. Geoexchange.
3. Opportunities for cost-effective energy upgrades.

In general, with one exception, no passive solar systems were observed, and Passive Design Guidelines, as described below, do not appear to have been applied in the siting of most buildings within the community.

5.1 Facilities (Commercial and Institutional)

This opportunity assessment examined four of Administration's facilities that were considered to be of most interest to the community. Energy consumption data and other information was provided by staff. All the buildings had a quick walkthrough site visit to look for potential savings opportunities. The buildings inspected are summarized in Figure 12:

Figure 12 - Facility Buildings Reviewed

Building	Floor Area (ft²)	Annual Energy Cost
Community School	45,493	$110,521
Health Centre/Daycare	8,748	$ 21,759
Firehall	1,248	$ 3,564
Grocery Store	6,000	$ 9,899

- Lighting
  - Replace T12 fluorescent lighting with T8 fixtures.
  - Replace incandescent lights with compact fluorescent lights
  - Use occupancy sensors
- Heating and Cooling
  - Replace zone thermostats with programmable thermostats, particularly where facilities are generally used for specific periods of the day or week.
  - Replace low efficiency boilers and furnaces to higher efficiency
  - Explore adapting the store's geoexchange system to augment the refrigeration system
- Building Envelope
  - Upgrade insulation when building envelop repairs are done
  - Replace single pane windows
  - Check weatherstripping on doors and windows frequently

For the buildings studied, recommended measures would require approximately $445,000, not including potential incentives, resulting in a $37,000 annual energy savings and a simple payback period of 12 years.

This opportunity assessment has shown that there is considerable potential for energy savings. A comprehensive retrofit is considered to be financially viable, with a reasonable financial return over the life of the project. In addition, a comprehensive energy retrofit provides an opportunity to improve occupant working conditions, replace aging equipment, reduce Greenhouse Gas emissions, and show leadership on climate change within the community.

If it is necessary to borrow funds in order to implement the recommended measures, it is important to remember that energy efficiency retrofits pay for themselves out of utility savings. Financing costs will be matched by reduced energy bills. This means that there is no impact on overall budgets.

The energy savings potential at the Community School is high enough that this building complex should be looked at in more detail by a qualified professional with expertise in energy efficiency retrofits. The boiler replacement is the largest component of the project, and it is important that the new plant be appropriately sized and designed to minimize off-cycle losses. Funding may be available from BC Hydro to help with the cost of further study.

Lighting retrofits are another major component of the recommended measures. Local lighting suppliers may be able to give more detailed recommendations and cost estimates, often at no charge. There are also firms that specialize in lighting energy efficiency retrofits, who will undertake a project in a turnkey fashion. Retrofitting all the lighting at once would be most cost effective.

Many of the measures do not necessarily require further analysis, and can be implemented by staff. These include programmable thermostats, occupancy sensors, window replacements, and weatherstripping/sealing.

Recommendation D-7: Conduct a commercial and institutional building energy efficiency upgrades identified in the building opportunity assessment.

Recommendation D-8: Conduct a comprehensive study of the community school complex to identify both energy efficiency measures and energy sources, including the potential for alternative sources such as geoexchange and passive solar space heating and hot water heating.

5.2 Residential

No individual energy consumption data was available for the homes that were looked at. However, electricity data was available for all homes in the community as a total. 2009 consumption was 6,336,000 kWh for 375 accounts, or an average of 16,941 kWh per home. Most homes in Mt. Currie will be paying for electricity in the upper step of BC Hydro’s two step rate structure, which is currently $0.0878/kWh. The average electricity cost per home would be about $1300 per year.

This consumption is significantly higher than the BC average (about 10,600 kWh per home), but less than typical for electrically heated homes in this climate(about 20,000 kWh per home). Propane data was not available, but none of the homes looked at used propane for heating. Wood consumption data is not available, but is likely to be substantial as wood stoves are found in most homes and in many cases are likely the primary source of heat.

The building types inspected are listed in Figure 13:

Figure 13 - Housing Building Types Reviewed

Home type	**Year Built**
2 Storey Bungalow	2010
2 Storey Townhouse	1984
2 Storey Bungalow, no basement	1987
Double-wide Manufactured Home	2009
1 Storey Bungalow	2003
Heritage Log Home	1905
2 Storey Bungalow	1993
Single-wide Manufactured Home	2007

General findings and recommendations from the residential reviews included:

- Building Envelope
  - Caulk and weatherstrip doors, window frames, cracks, and ceiling hatches
  - Roof, floor, and crawlspace insulation
  - Replace single glazed windows with high efficiency (“low-e”) windows in oldest homes
- Lighting and Appliances
  - Replace incandescent lamps with compact fluorescent bulbs
  - Upgrade older appliances with EnergyStar-rated appliances
  - Use motion and daylight sensors for external lighting, e.g., driveway/entrance lighting and security lighting.
- Heating

    - Replace inefficient wood stove/fireplaces with high efficiency stoves or fireplace inserts
    - Install programmable thermostats
    - Consider air source heat pumps for some applications
- Domestic Hot Water
    - Install low flow shower heads and faucet aerators
    - Insulate piping
    - Install hot water tank “blankets”

This opportunity assessment has shown that there are considerable opportunities for energy savings, including many with short to medium paybacks.

A major challenge of communities is convincing homeowners to spend significant amounts of money on energy efficiency upgrades. However, many of the recommended upgrades require a very small capital outlay, which could potentially be subsidized by the Nation. To see immediate results and set the stage for larger projects, the community may want to consider promoting a package of low cost, simple retrofits that can be carried out by Lil’wat staff or homeowners and are applicable to most homes. Such a package could include:

- Weatherstripping and sealing;
- Compact Fluorescent Lights (CFLs);
- LED holiday lights;
- Hot water tank blanket;
- Adjust DHW tank setpoints; and
- Low flow fixtures.

The material cost of such a package would likely be under $300 per home, which would likely be recovered in a few years from energy savings.

As wood stoves play such an important role in providing heating for the community, the community should investigate the potential for obtaining funding for a wood stove replacement program, as described below in proposed studies and projects.

An important part of any retrofit program would be a homeowner awareness component. Education is important for convincing homeowners to contribute, either financially or through their labour, towards the retrofit as well as ensuring that savings persist over time. Measures such as programmable thermostats, DHW tank temperature, and weatherstripping need to be maintained by homeowners to maximize their effectiveness.

There are various incentive programs available for residential energy retrofits, including the provincial government and BC Hydro. Program rules and requirements should be reviewed prior to undertaking any retrofits.

Finally, it should be noted that energy efficiency retrofit requirements are generally a symptom of applying lower building standards during construction. While at one time energy availability and costs may have been lower, and environmental impacts less well understood, we now have a clearer picture of what the energy and emissions future holds for us if we continue “business as usual” building construction techniques.

As a result of this knowledge, the use of the highest proven, cost-effective building standards available is prudent. Currently, NRCan’s Energuide 80 standard, now required for the Provincial Building Code’s “Part 9” buildings (i.e., low-rise wood frame buildings) is advised as a minimum for new construction.[21] Alternatively, the construction industry-supported BUILT GREEN Gold (Energuide 77) standard, or preferably the BUILT GREEN Platinum (Energuide 82) standard, could be considered, which have the added advantage of addressing air quality, building materials, water conservation, and waste management.[22]

Finally, advanced building construction standards, such as Leadership in Energy and Environmental Design (LEED),[23] should be considered for all new buildings, particularly for commercial and institutional buildings. LEED Gold and Platinum standards have the highest energy efficiency requirements and incorporate a wide range of sustainability considerations. Although the initial capital costs of LEED construction are higher, and the level of expertise required to oversee LEED construction is less readily available, the cost premium for new LEED buildings is now only about 2% above similar non-LEED buildings and the payback period can be as short as 5 years, after which there will be considerable long-term savings.

Recommendation D-9: Conduct residential building energy efficiency upgrades identified in the building opportunity assessment.

Recommendation D-10: Require a minimum building standard for energy efficiency of Energuide 80 in new residential building construction.

[21] http://oee.nrcan.gc.ca/residential/personal/new-homes/upgrade-packages/energuide-service.cfm

[22] http://www.builtgreencanada.ca/content.php?id=262

[23] http://www.cagbc.org/AM/Template.cfm?Section=LEED

The complete reports and reviews for specific residential and commercial/institutional buildings with detailed recommendations are included in Appendix 1 and Appendix 2.

5. Evaluation Criteria for Potential Energy Initiatives

In consultation with staff, the following evaluation criteria, in no particular order of importance, have been identified.

1. Social
   a. **Lil'wat traditional values.** Energy efficiency and supply measures should be consistent with traditional values and limit impacts on the Lil'wat's natural and cultural heritage. In particular, measures should In particular, energy measures should support the traditional Lil'wat value of K'ul'tsam', or "take only what you need."
   b. **Health and safety impacts.** Current heating sources, such as wood stoves that predominate in most residential buildings, can produce particulate matter (smoke) that may impact respiratory systems and potentially increase fire hazards in some cases.
   c. **Equity.** Energy efficiency measures, and any related health benefits and cost savings, should be readily available to all members.
2. Economic
   a. **Energy security.** How the measure promotes energy sources that are available now and into the foreseeable future to ensure local economic viability and prevent price shocks for local businesses and residents, including the potential costs of changing technology and operating costs for fossil fuels.
   b. **Capital and operating costs.** It is important not only to look at initial costs to implement energy measures, but operating costs, which result in a "full life-cycle" evaluation to determine if an investment is good in the short and long term.
   c. **Feasibility.** Not all technologies, even if efficient under certain circumstances, are appropriate for local conditions. For example, district energy systems require fairly high density development and the availability of

a reliable source of low-impact, renewable fuels. This criteria will identify if the proposal is generally feasible in the local context.

2. **Environmental.** This criteria will consider all aspects of environmental impacts, including air, water, land, and aquatic and terrestrial habitat.

3. **Flexibility.** In addition to supporting social, economic, and environmental sustainability, it is important that demand and supply options are flexible in order to avoid locking the community into solutions that are fixed and cannot be adapted to anticipated future shifts in technologies and energy sources.

6. Potential Community Energy Initiatives

The sections below provide a brief overview of a range of other potential energy sources, systems, management programs not addressed earlier in the report and their applicability in the Lil'wat study area. Appendix 3 contains an analysis of identified energy efficiency (supply) and energy source (demand) measures using the evaluation criteria above, along with analysis of energy efficiency recommendations made earlier in the report. More detailed background information on the renewable energy sources can be found at the Natural Resources Canada (NRCan) renewables web site.[24]

7.1 Biomass

Biomass is a traditional heating method for the Lil'wat, coming in the form of deadfall, agricultural waste products, waste wood, and trees cut specifically for firewood purposes.

While propane and electricity are the primary heating sources in institutional and commercial buildings, it is estimated that approximately 75% of local homes use wood stoves as their primary or secondary source of heating.

To date, local wood resources have been sufficient to accommodate the demand from local residents, particularly as new housing has tended to use electricity and air source heat pumps. Current usage indicates that the equivalent of approximately 5 ha of forest would be required each year if wood stoves continued to be the primary energy source for residential heating. This level of usage, particularly if the community grows, could be unsustainable in the long run without using sources further from the community unless a Community Forest Plan that addresses a sustainable yield for this use is in place.

[24] http://canmetenergy-canmetenergie.nrcan-rncan.gc.ca/eng/renewables/canren.html

Provided that there is relatively low growth in the community, and the local wood supply is monitored regularly, it is possible that wood stoves can continue to be a prime fuel source for the foreseeable future.

From the demand side, wood supplies can be conserved better through a conversion to high efficiency stoves which use air sources from outside of the building, convert fuel more efficiently to heat, and capture and retain a larger amount of heat within the units while reducing smoke and particulate matter, which has potential health impacts.[25]

On the supply side, an option to consider would be the preparation and implementation of a Community Forest plan, to ensure that tree cutting is controlled and that there is a constant supply of fast-growing, and preferably indigenous, trees planted and cultivated to replace and augment lost trees on those lands are considered surplus on Lil'wat needs for other uses.

Recommendation D-11: Assess wood stoves and fireplaces, and replace older, inefficient devices with new efficient stoves or fireplace inserts.

Recommendation S-1: Upgrade the Lil'wat Land Use Plan to incorporate a Community Forest Plan that ensures a sustainable supply of wood for community heating purposes.

7.2 Heat Pumps

Heat pumps work like a refrigerator in reverse. While heat is taken from the inside of a refrigerator and removed to the outside through a heat exchanger and fan, with building heat pumps, heat is taken from the outside air or ground and transferred to the inside the building. This cycle can also be reversed and used like a refrigerator to cool the inside of the building as needed in summer.

Air Source Heat Pumps

A number of Air Source Heat Pumps,[26] as shown in Figure 14 are currently being used in newer residential buildings in Xit'olacw. In general, these heat pumps are less expensive to install but also less efficient than ground source heat pumps and more dependent on the ambient temperature. In particular, in winter, air source heat pumps are less efficient on colder days and also require periodic defrosting, during which times auxiliary heating systems are required.

[25] http://www.bcairquality.ca/topics/wood-stove-exchange-program/index.html

[26] http://oee.nrcan.gc.ca/residential/personal/heat-pumps-air-source.cfm?attr=4

Figure 14 - Air Source Heat Pump

Ground Source Heat Pumps (Geoexchange)

Ground Source Heat Pumps Systems,[27] as shown in Figure 15, transfer heat contained in the ground to domestic heat or hot water. Geoexchange, where the heat is taken from the ground close to the surface that is heated by sunlight, should not be confused with geothermal, where heat is taken from deep inside the earth or locations where heat from the earth's core comes to the surface, such as in hot springs.

Figure 15 - Installing a Ground Source Heat Pump Field

As Figure 16 and Figure 17 show, although there are no known high potential geothermal heat sources located in immediate vicinity of the study area, such as those at the hot springs near Mount Meagher and along eastern Lillooet Lake, the surrounding area has been identified as having moderate potential under certain circumstances, primarily for heating purposes.

[27] http://oee.nrcan.gc.ca/publications/infosource/pub/home/heating-heat-pump/gsheatpumps.cfm

Figure 16 - British Columbia Geothermal Potential

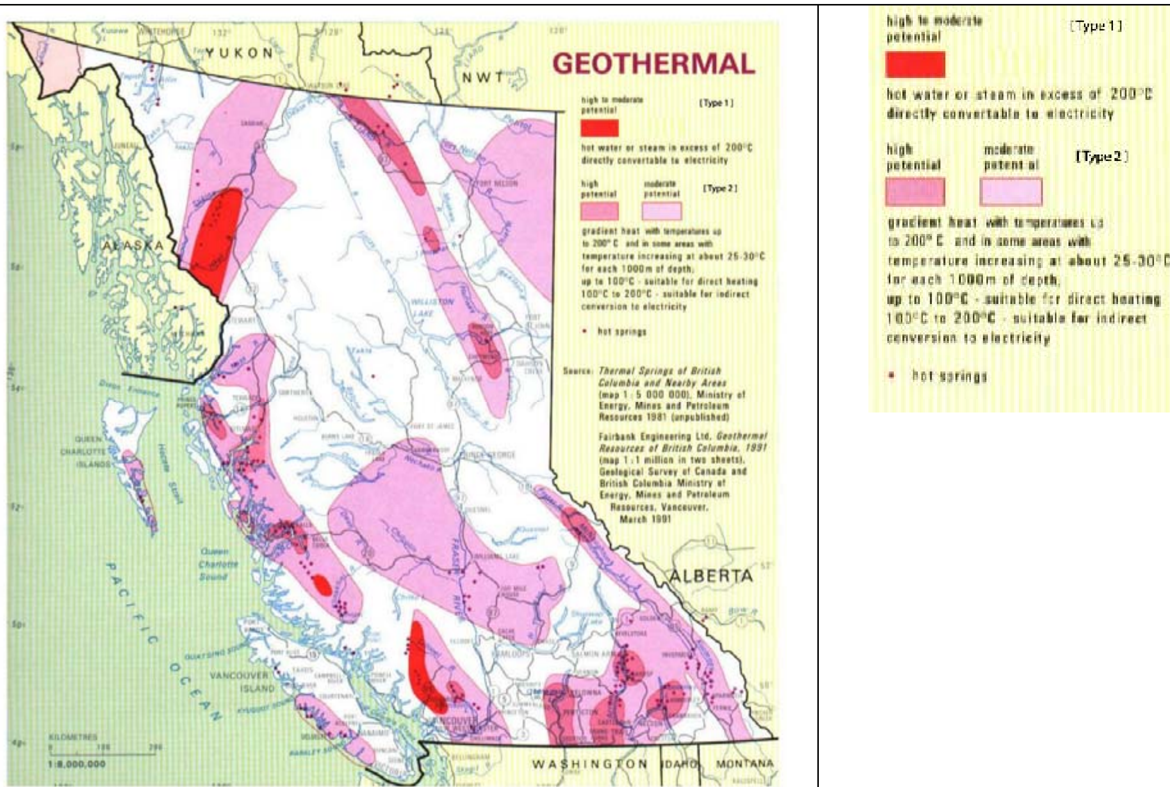
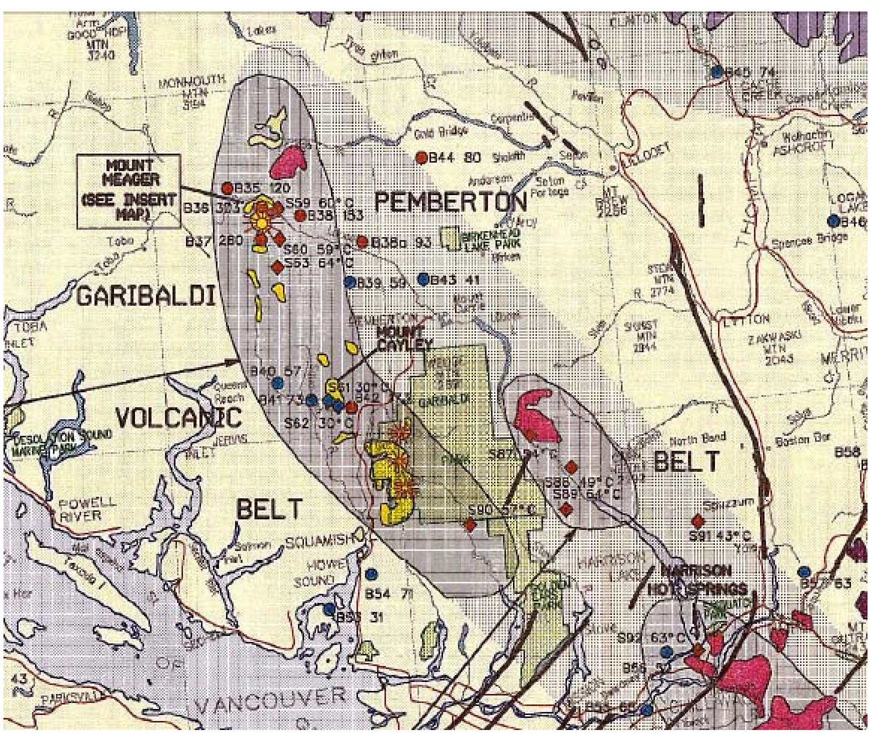
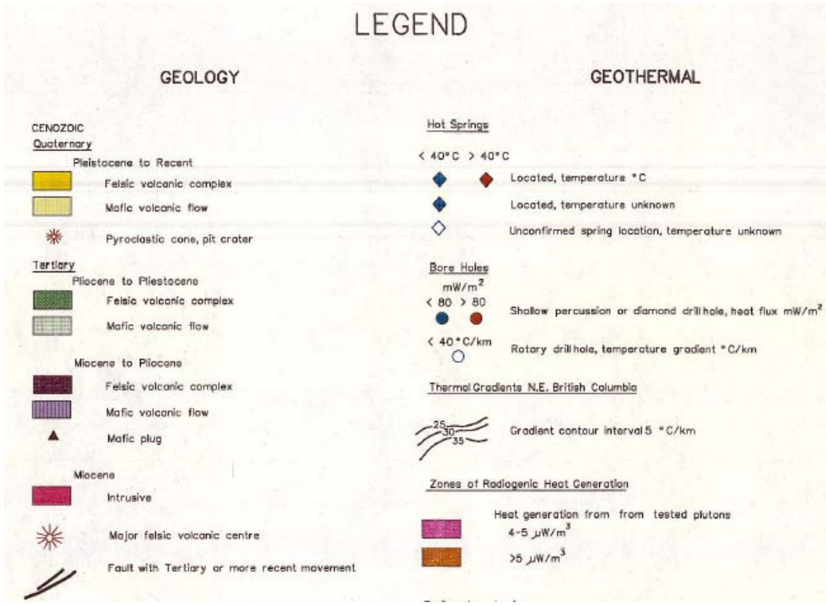


Figure 17 - Detailed Local Geothermal Potential





As demonstrated by the installation in the Band offices, geoexchange is a viable source of energy. In general, 3 to 4 units of energy is produced for every unit of electrical energy input to operate the pumps, i.e., a COP of 3 or 4 can be achieved.[28]

On average, a geoexchange system will yield savings that are about 40 percent more than would be provided by an air-source heat pump. This is due to the fact that underground temperatures are higher in winter than air temperatures and have a much greater heat capacity. As a result, geoexchange can provide more heat over the course of a winter than an air-source heat pump, but is generally more suitable for commercial, institutional, and mixed used development rather than single family homes.

Recommendation S-2: Consider retrofitting Air Source Heat Pumps into residential buildings when the cost-benefit analysis is favourable.

Recommendation S-3: Consider the expanded use of a geoexchange network in the vicinity of the Mount Currie, for the school/health care centre area, and other future mixed use development projects. When developing in the area of the existing geoexchange field, consider maintaining the area for easy access, e.g., playing fields or parking facilities.

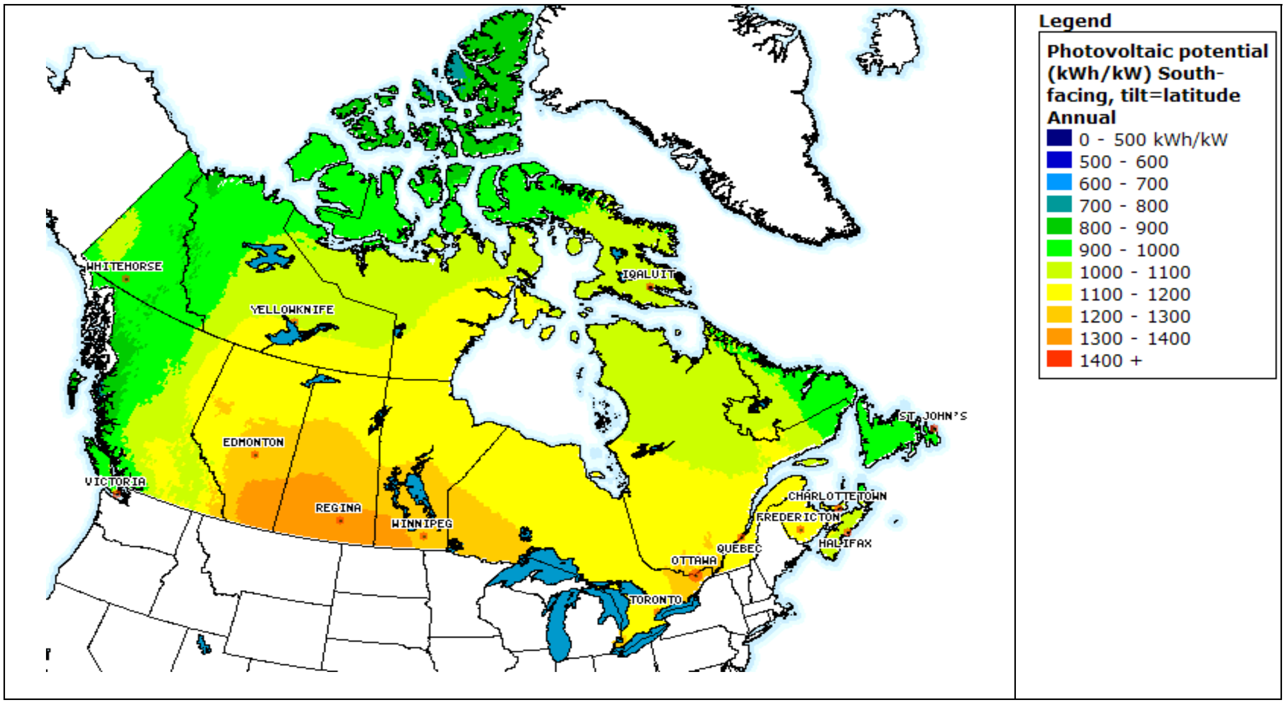
7.3 Solar

Sunlight may be the ultimate renewable energy source in that, although it is not always available, it is plentiful, free, has zero impacts, and is flexible. Besides heat, light, and electricity potential, sunlight through photosynthesis is also one of the main requirement for the growth of trees and other biomass.

[28] Coefficient of Performance (COP) is the energy output for the amount of electrical energy input.

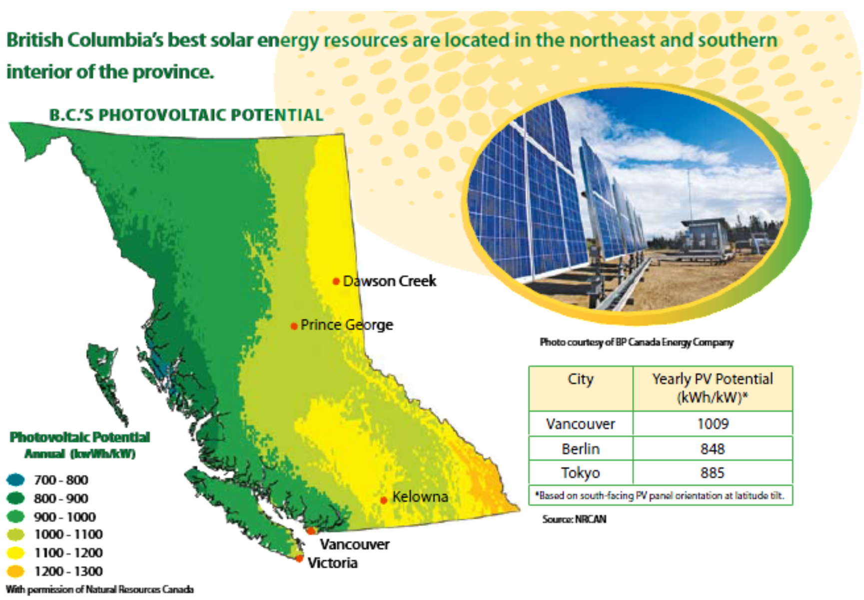
As shown in Figure 18 and Figure 19, the area near Mount Currie has some potential for solar photovoltaic and passive solar heating although, as will be discussed later, the economics of these installations are dependent on external funding and/or installing solar features into new buildings at the design phase.

Figure 18 - Canadian Solar Energy Potential



Source: Natural Resources Canada

Figure 19 - British Columbia Solar Energy Potential

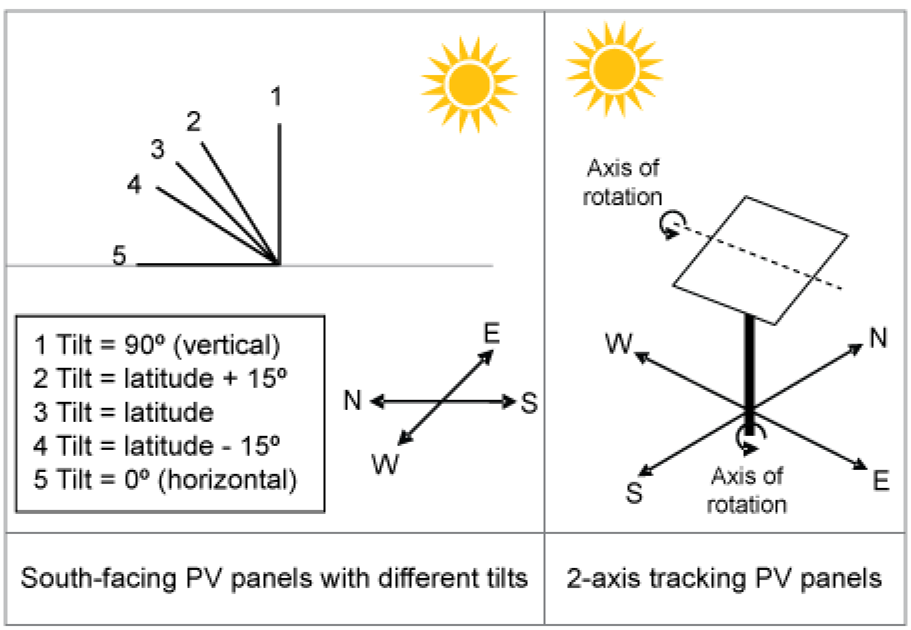


Source: Natural Resources Canada/BC Sustainable Energy Association

A number of factors affect the potential energy from solar sources, including:

- **Latitude.** The further north solar collectors are, the shorter the days and sunlight during the time of year when heat is most required.
- **Site.** Shadowing of the collectors can occur from hills and mountains or trees.
- **Orientation.** Solar collectors should face south for maximum sunlight entering.
- **Climate.** The weather affects the efficiency of solar collectors through:
  - Cloud cover, which affects the hours of direct sunlight;
  - Snowfall, which can affect maintenance and amount of sunlight entering the collector; and
  - Temperature, which can affect the time required for solar hot water panels to reach operating temperature.
- Tilt, which can cause light to be reflected rather than absorbed by solar collectors. Solar collectors should be tilted towards the sun, as is shown in Figure 20:

Figure 20 - Orientation of Solar Collectors



Source: Natural Resources Canada[29]

[29] https://glfc.cfsnet.nfis.org/mapserver/pv/index_e.php

“Tilt (degrees) = latitude” provides good year-round absorption of sunlight, as the sun is higher in the sky in the summer, and lower in the winter. Mount Currie is at located at approximately 50.3^{o} North latitude. For maximum power, although a more expensive system investment, PV panels would track the sun through sensors and motors.

While sunlight is free, many of the systems used to capture it are not. There are two general types of solar energy: passive, which provides heat and light; and active, or photovoltaic, which produces electricity. Each type is described below.

Passive Solar

Passive solar energy is primarily the use of sunlight for heating or illumination purposes. It can be either engineered, through devices such as roof-mounted solar hot water panels or advanced storage and distribution systems, or accomplished through simple site and building layout, such as solar orientation features described below under passive design guidelines. The simplest passive solar method is to focus windows towards the south of a building, install thermal blinds to keep the heat in at night, and incorporate overhangs on the roof that allow the entry of winter sunlight while blocking summer sunlight.

Communities as far north as Dawson Creek have actively promoted passive solar as one of British Columbia’s “Solar Communities.” The City of North Vancouver has successfully installed a large-scale solar hot water panel system on the roof of their new community library, as shown in Figure 21, which is estimated to provide close to 20% of the year-round energy needs of the building’s heating system. Swimming pools around British Columbia with large roof areas are also now routinely using solar panels as a cost-effective source of energy.

Figure 21 - Solar Hot Water Panels - North Vancouver

Source: City of North Vancouver

While the area has more solar potential than the west coast, it trails significantly behind other locations in western Canada, such as the Okanagan and the prairies, for the amount of available sunlight, as shown in Figure 22. Nevertheless, passive solar energy can make a meaningful contribution to the community's energy balance, particularly if this is incorporated into site and building design or subsidies are available to offset capital costs and reduce the payback period.

Figure 22 - Mean Daily Insolation (Sunlight Energy) kWh/m2

	South-facing vertical (tilt=90°)	South-facing, tilt=latitude	South-facing, tilt=latitude+15°	South-facing, tilt=latitude-15°	Two-axis sun-tracking	Horizontal (tilt=0°)
January	1.9	1.9	1.9	1.7	2.2	0.8
February	2.5	2.7	2.7	2.5	3.2	1.6
March	3.3	4.1	3.9	4.0	5.2	2.9
April	3.2	4.7	4.3	4.9	6.7	4.3
May	3.0	4.9	4.3	5.3	7.6	5.5
June	2.8	5.1	4.3	5.6	8.3	6.0
July	3.1	5.4	4.7	5.9	8.9	6.2
August	3.4	5.3	4.7	5.6	8.0	5.3
September	3.7	4.9	4.7	4.9	6.7	3.6
October	2.8	3.2	3.2	3.0	3.9	2.0
November	1.9	1.9	2.0	1.7	2.3	1.0
December	1.7	1.7	1.8	1.5	1.9	0.7
Annual	2.8	3.8	3.6	3.9	5.4	3.3

Source: NRCAN

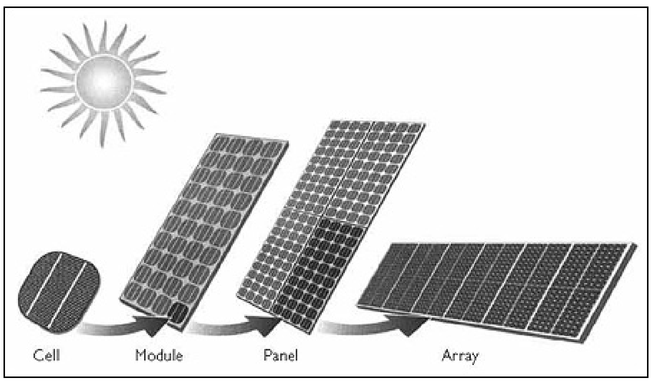
In comparison, Regina, which is a solar "hot spot" in Canada, has 5.0 kWh/m^2 annual insolation (south facing panel, tilt=latitude), or approximately 25% more insolation than in the Mount Currie area.

Sunlight can also replace artificial lighting during much of the day if buildings are designed with workspaces near windows, variable blinds for glare reduction as necessary, and potentially skylights or “light pipes” that take sunlight from the roof and transmit it to interior workspaces. While a typical solar hot water system for the average household costs approximately $7,000 to install,[30] a wide range of subsidies is available that can bring the cost down to half of that amount. Unfortunately, there is considerable volatility in the availability and amount of rebates. The cost of solar hot water systems can be greatly reduced if a building is constructed with the system in mind, i.e., “solar ready,” as opposed to retrofitting an existing building.

Active Solar (Photovoltaics, or “PV”)

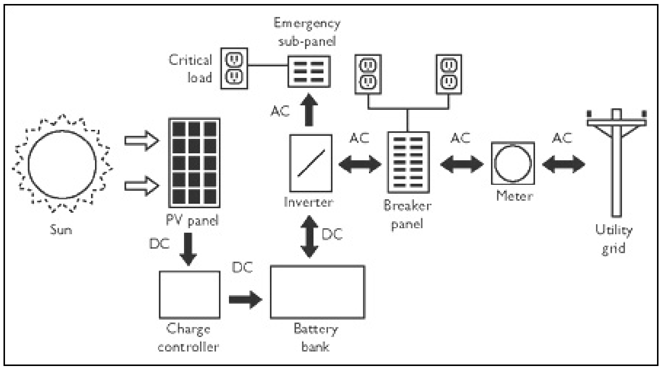
Photovoltaics is the conversion of the sun’s energy to electricity. While this form of electricity has potential in certain applications, such as safety and communications in remote areas, it is capital intensive and is not likely to become cost-competitive in the foreseeable future without significant subsidies, such as those currently offered in Ontario.[31] Solar PV systems, as shown in Figure 23, require significant amounts of energy to fabricate and have a finite lifetime. Mount Currie’s location, geography, and climate result in the area having modest potential for photovoltaics, particularly with the widespread availability of low cost, low impact hydro electricity from the BC Hydro grid. The current cost for an installed system connected to the grid, depending on system size and complexity, can range from $0.20-$0.30/kWh, which is 2 to 3 times the current rate for grid electricity.

Figure 23 - Complete Photovoltaic System



[30] http://www.solarbc.ca/learn/incentives-costs

[31] In 2009, the Ontario provincial government started offering 20-year fixed price contracts paying homeowners $0.802 for every kilowatt-hour produced from rooftop systems of less than 10 kW.



Source: CMHC[32]

In Figure 24, the potential PV energy is given, in "kWh/kW," which means the number of kilowatt-hours of electrical energy that can be expected for every kilowatt of maximum installed capacity.

Figure 24 - Photovoltaic potential (kWh/kW)

	South-facing vertical (tilt=90°)	South-facing, tilt=latitude	South-facing, tilt=latitude+15°	South-facing, tilt=latitude-15°
January	43	43	45	38
February	52	56	57	52
March	77	94	91	92
April	73	107	97	110
May	69	114	100	123
June	63	114	97	125
July	71	126	108	137
August	78	123	110	129
September	83	111	105	110
October	64	74	74	70
November	42	43	45	39

[32] http://www.cmhc-schl.gc.ca/en/co/maho/enefcosa/enefcosa_003.cfm

December	40	38	41	34
Annual	755	1042	970	1061

Source: NRCAN

In comparison, Regina, which is a solar "hot spot" in Canada, has 1360 kWh/kW annual PV potential (south facing, tilt=latitude), or about 30% more potential than in the Mount Currie area.

In general, the capital costs of solar photovoltaics are not justified given the current and anticipated costs of electricity in British Columbia for the foreseeable future, unless major sources of external funding is obtained. There are examples of this in BC for First Nations communities, most notably in the T'Sou-ke First Nation.[33]

Solar hot water heating can be feasible with a reasonable payback period, particularly if there is a significant demand for hot water and the infrastructure is incorporated into new buildings at the design stage, as opposed to expensive retrofits, and passive design guidelines are applied in building siting. There are many examples of how solar heating systems can be successfully incorporated into communities,[34] including local examples in Whistler and a First Nations example with the T'Sou-ke Nation.

Recommendation S-4: Explore opportunities for solar hot water heaters for domestic hot water and to supplement other heating systems and, if external funding is available, the installation of photovoltaic systems.

7.4 Wind

As shown in Figure 25, the area near Mount Currie has modest potential for wind. While there is significant wind at different times of the year, the area has modest overall wind potential, with greater potential on higher ridges outside of the community, which present greater construction and operational challenges. With a relatively high capital cost and unpredictable availability, wind power is not seen as a high priority for the community unless significant funding support is provided by third parties.

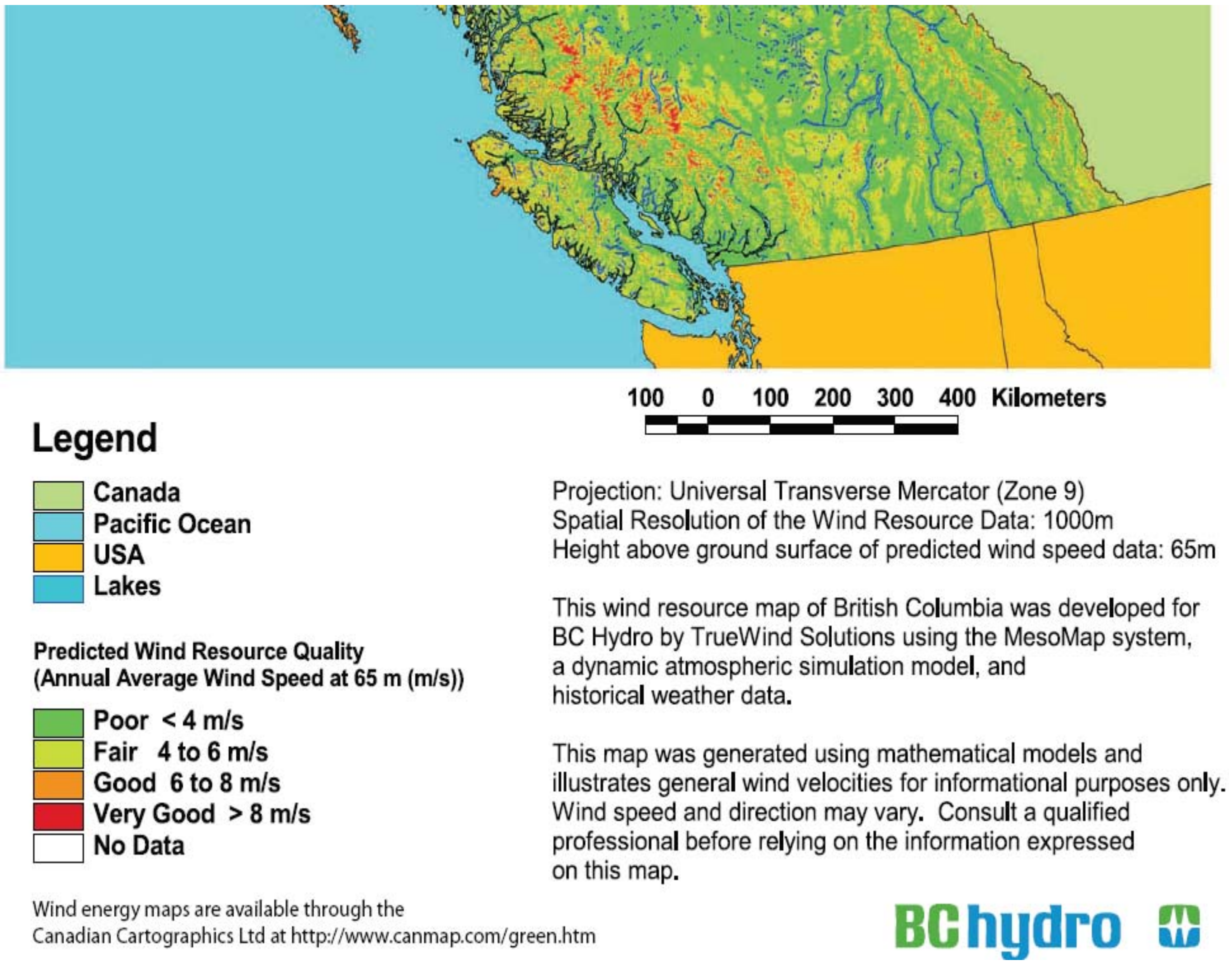
It should be noted that, the energy from potential facilities is unlikely to actually end up in the community, as energy produced would be output to the provincial electricity grid.

[33] http://www.toolkit.bc.ca/success-story/t-sou-ke-first-nation-community-sizzles-solar-power-making-hydro-meters-run-backwards

[34] http://www.solarbc.ca/

These measures could nevertheless help with local energy resiliency and as an economic development opportunity for the Lil'wat.

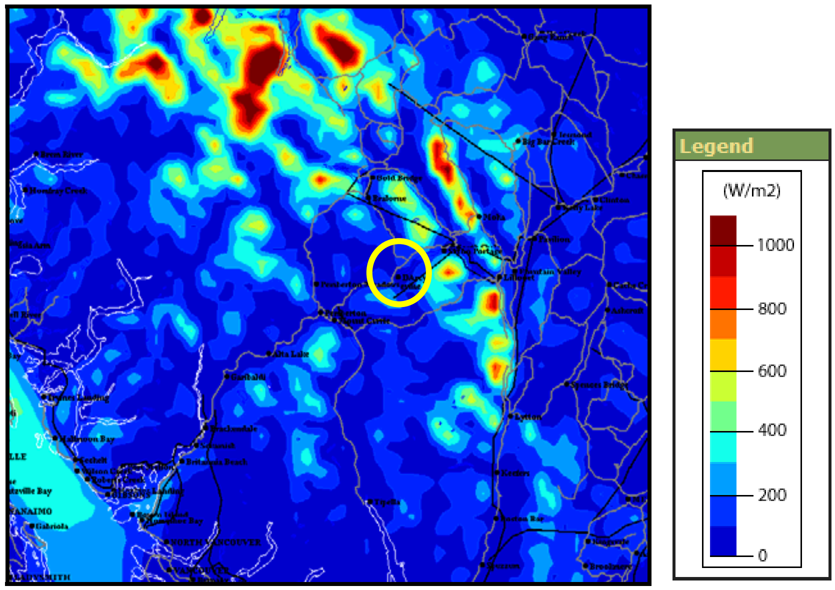
Figure 25 - Wind Resource Quality in BC



A more detailed view of Southwest BC shown in Figure 26 indicates that there is very little wind power potential in the immediate vicinity of the community, and moderate potential in surrounding higher elevation ridges, which would be extremely difficult to access for construction and operation.[35]

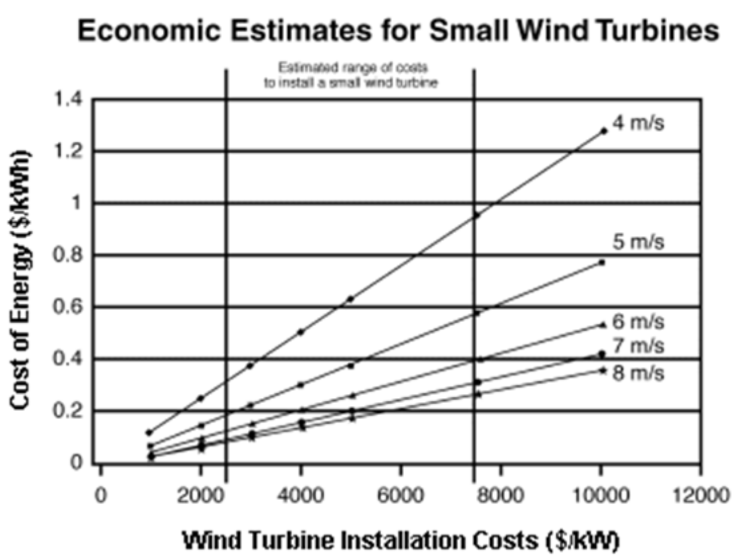
[35] http://www.windatlas.ca

Figure 26 - Wind Power Potential in Southwest BC



As shown in Figure 27, cost effectiveness of wind systems will vary dramatically depending on the scale of the installation and the strength of the local wind source, from approximately $0.10 to $1.00 for small systems.[36]

Figure 27 - Cost Range for Small Wind Systems



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36 http://www.omafra.gov.on.ca/english/engineer/facts/03-047.htm

7.5 Electricity

Electric heating and cooling can be considered as the “default,” in the absence of other energy sources. In other words, it is anticipated that there will be a sustainable supply of this resource available through the BC Hydro network for the foreseeable future.

At the moment, although fossil fuels such as natural gas would be more cost-effective for heating if available, electricity is available and more reliable and cost effective when compared to other lower-impact energy sources, such as wind or solar. It should be noted that pricing for electricity can also volatile, as for fossil fuels, and there is a potential if a recently announced BC Hydro application to the BC Utilities Commission for $6 Billions of spending to maintain and upgrade current assets is approved, that rates could increase by as much as 50% by 2015.[37] Such increases would increase the attractiveness of other renewables, particularly if grants and rebates are available and the cost per kilowatt-hour of renewables continues to fall as these technologies become more widespread and economies of scale for mass production increase.

Currently, residential customers in BC pay 6.27 cents per kWh for the first 1,350 kWh they use over a two-month billing period. Above that amount, customers pay 8.78 cents per kWh for the balance of the electricity used during the billing period. If electricity is the primary source of heating for a home, it is likely that a large proportion of household consumption will be charged at the higher rate. It is important to note that, while BC’s hydro rates are among the lowest in the world, the British Columbia Energy Plan has indicated that price signals may be considered to reduce demand in the future, which could raise electricity costs in the future. Currently, the policy is only applied in the “two step” system, where there are two prices for electricity for households, one for low to moderate consumption and one for higher consumption.

Electricity from the grid will likely be the energy source for most infrastructure needs for the foreseeable future, e.g., street lighting and pumping, although photovoltaics could be considered for some lighting applications, such as crosswalk signals, and higher efficiency pumps can be installed when the current life of existing pumps is reached. Demand reduction measures for lighting include movement and ambient light sensors to avoid lights being on when no one is present or days grow longer. Demand side measures for pumping include on-site water retention techniques and French drains to reduce the peak drainage flows requiring pumping.

Recommendation D-12: Incorporate energy efficiency measures in new and upgraded infrastructure, such a pumps and street lighting, and consider alternative energy sources, such as solar PV cells, where these sources are economically viable.

[37] http://www.bchydro.com/news/articles/press_releases/2011/capital_projects_3year_plan.html

Recommendation S-5: Continue using grid electricity for applications requiring electrical power, but significantly improve efficiencies when used for heating.

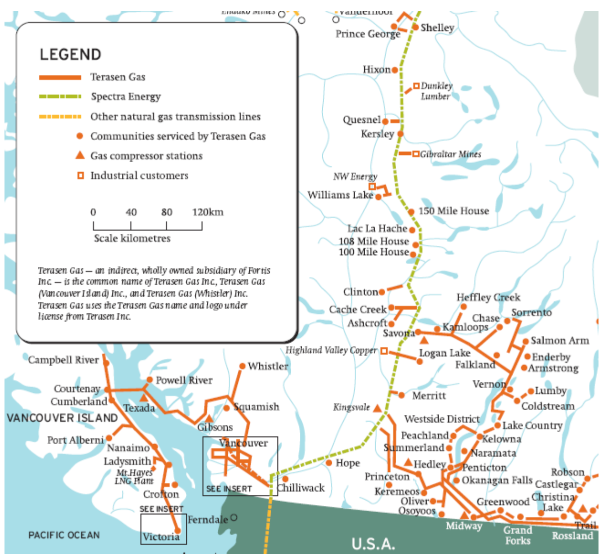
One way to help protect the community from potentially higher future energy costs for electricity is to seek a higher Coefficient of Performance (COP), which is the amount of energy output for the amount of electrical energy input. For heat pumps, the COP for air source systems is typically 2 and for ground source systems the COP is typically 3 to 4. In other words, there is a 2:1 to 4:1 gain on electrical energy input to the system. These energy cost savings, environmental benefits, and energy security benefits must be balanced against higher capital and operating costs to determine if electrically powered heat pumps are a good investment for the community.

7.6 Natural Gas

As seen in Figure 28, while not currently available in the area, Terasen has extended its natural gas network as far north as Whistler.

There would be a significant capital cost in extending the natural gas line to Mount Currie, and possible environmental impacts from construction and operation. Natural gas is also a fossil fuel that emits Greenhouse Gases and at the same time a significant community transition/investment to natural gas as short term option might prevent or delay longer-term solutions that ultimately meet more of the evaluation criteria for energy systems. Nevertheless, natural gas is expected to be available in the province as an energy resource at reasonable prices as long as transportation costs are minimal for the foreseeable future, and should not be totally discounted as an energy source for heating and transportation.

Figure 28 - Provincial Natural Gas Network



7.7 Propane

Remote communities that do not have easy access to an existing natural gas pipeline or delivery often find propane to be the most cost effective gaseous energy source. While sometimes less expensive than grid electricity which accesses most remote communities, propane has some inherent qualities making it more attractive for cooking, fireplaces and often water or space heating. Two downfalls related to propane include price instability and high carbon content (therefore high emitter of Greenhouse Gas) compared to electricity and natural gas. Propane heat has a higher Greenhouse Gas emission profile than wood heat, but generally emits less air quality contaminants. Despite some drawbacks, propane is quite attractive as a transportation fuel as it has less greenhouse and air contaminant emissions than the more commonly used gasoline or diesel fuels. Propane is used primarily by Lil'wat Institutional buildings, but also some multifamily residences that have propane paid for by the Band. A handful of single family homes also have limited propane usage.

Propane is already available in the area and is used primarily for heating and hot water. Propane systems don't have the potential to reach the efficiency levels of many electricity supplied heating systems such as heat pumps and therefore should only be pursued in building applications where it is significantly more cost effective over the life cycle of the building. Propane can add significant value to the community, however, particularly if it is used for transportation purposes especially with gas-electric hybrid options. Further analysis of these options however will be needed.

Recommendation S-6: Consider using propane for limited building applications, gradually shifting to lower impact, lower cost fuels, and consider using propane for fleet vehicle fuels.

7.8 Passive Design Guidelines

While not directly an energy efficiency measure or an energy source, passive design guidelines can have a significant impact on the energy requirements for buildings and act as an energy source, particularly supporting solar gain for heating in colder seasons.

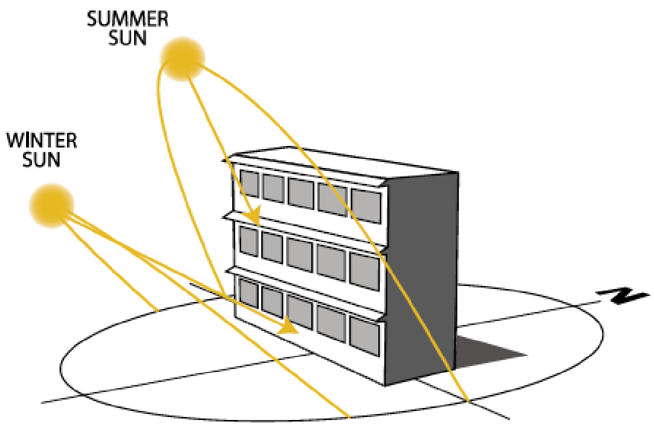
A simple measure would be the adoption the applicable sections of the City of Vancouver's Passive Design Toolkit into new land use planning processes, site design, and buildings.[38] Examples of applicable sections include:

- Orienting buildings with a southern exposure;

[38] http://www.vancouver.ca/sustainability/documents/PassiveDesignToolKit.pdf

- Placing windows primarily on the eastern, southern, and western sides of the building and minimizing windows on the northern side, as shown in Figure 29:

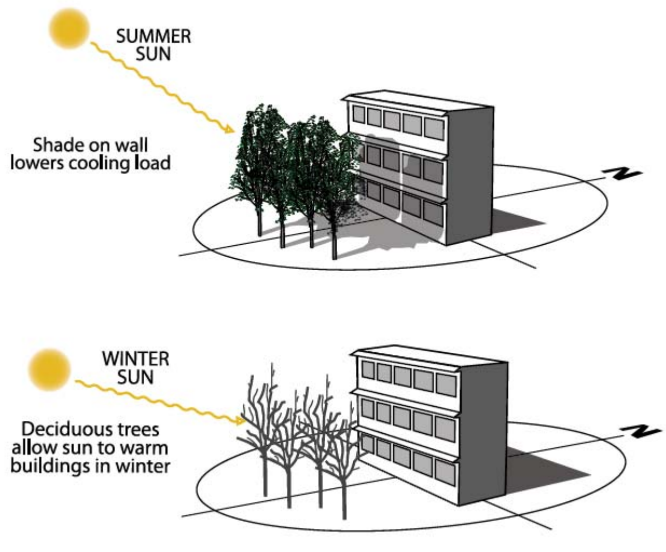
Figure 29 - Building Solar Orientation



Source: City of Vancouver Passive Design Toolkit

- Using roof overhangs, blinds, and landscaping, including the use of deciduous trees that lose their leaves in fall and winter, to block summer sun while allowing winter sun to enter and remain in buildings, as shown in Figure 30:

Figure 30 - Passive Design Principles

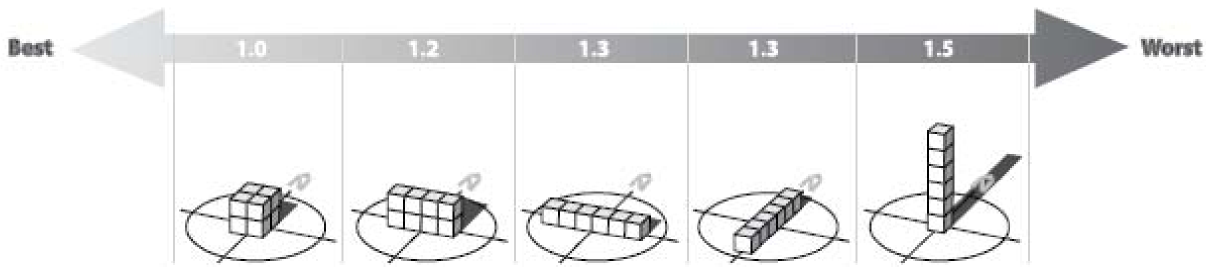


- Incorporate passive ventilation systems that remove warm air provide a flow of air through buildings in summer;

- Continue to use wood frame construction with proper insulation and moderate window surfaces (25-30%, maximum 50%) as opposed to concrete, steel and glass construction, which has very low insulation value and is subject to extreme heat loss in winter and heat gain in summer through the glass; and

- Design building shapes for maximum solar gain, as shown in Figure 31.

Figure 31 - Effects of Building Shape and Orientation



Recommendation S-7: Apply passive design guidelines wherever possible, orienting buildings for solar gain, placing most windows on eastern, southern, and western exposures while providing protection from prevailing winds and summer sun by measures such as roof overhangs and planting deciduous trees on the southern exposure.

7.9 District Energy Systems (DES)

These are energy systems in which a common energy source, such as heating or cooling water, is distributed from a one or more central locations to surrounding buildings, resulting in lower energy costs and more flexibility in future energy sources. In general, for district energy systems to be feasible, there needs to be a relatively dense and compact centre which provides sufficient floorspace to create a year-round heating and cooling load to warrant the capital investment. Buildings in the system need to be designed to connect to the energy source, e.g., have pipes and radiators for distributing the supplied hot and cold water. Another condition is the availability of a range of low-cost, reliable, and low-impact fuel sources to allow flexibility for future energy security.

Currently, the Mount Currie town site appears to be the only area within the community with the potential in the short-term for a district system, due to the presence of the existing geoexchange system, the number and proximity of existing buildings, and the potential for infill development in the future. The community plan would need to be revisited, perhaps through a community design process, known as a design charrette, which would study land uses as well as sustainability features, such as DES.

Potential DES energy sources that fit the established evaluation criteria include biomass and geoexchange and potentially solar hot water panels and waste heat recovery from wastewater treatment or sewers in the future. These sources may be augmented by propane and electricity in the short term, and potentially natural gas in the future.

Recommendation S-8: Explore District Energy Systems in conjunction with a review of the land use plan for the Mount Currie town site.

7.10 Micro Hydro Facilities

The Lil'wat Nation has water license for micro hydro on Wedge Creek, which may have a capacity of 4.8mW. The Nation also has a license on the Birkenhead River. While evaluation of this energy source is outside the scope of this study, the Lil'wat Land Use Plan suggests that, if such projects were undertaken according to community values, there may be possibilities for micro hydro within lands currently under Lil'wat direct jurisdiction as well as other locations within Traditional Territories. As these systems have major capital costs, involve significant risk, and require a high level of technical expertise to construct and maintain, it is recommended that technical and funding partnerships be considered if this energy source is pursued.

To get a sense of recent order of magnitude cost of such projects, the Fitzsimmons Creek hydro project in Whistler cost $32 million to construct in 2009 and produces 33.5 Gigawatt hours of electricity per year. At approximately $100/MWh under the BC Hydro Standing Offer Program, the simple payback to offset capital costs without operating costs or interest payments on the initial investment would be about a decade, or up to 15 to 20 years with these considerations factored in. In comparison, from existing electrical account data, the Lil'wat community uses about 8 Gigawatt hours, or one quarter of the output of the Fitzsimmons facility. As seen with the Rutherford Creek Power Project,[39] on which the Lil'wat Nation was a partner, there are benefits that can come to the community without the need to construct, own, or manage a facility, including employment with skills development and a share of operating profits. There are numerous factors that would need to be addressed in pre-feasibility and feasibility studies, including suitability of the river (e.g., flow, grade, and consistency throughout the year), water license rights, costs of conducting and implementing recommendations of an environmental impact assessment, ease of access to the construction site, distance for transmission lines, and governance, finance and ownership options.

It should be noted that, like wind, the energy from these facilities is unlikely to actually end up in the community, as energy produced would be output to the provincial electricity grid. These measures could help with local energy resiliency and, like most of the recommendations, can act as an economic development opportunity for the Lil'wat.

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39 www.bchydro.com/planning_regulatory/acquiring_power/green_ipps/project_updates/rutherford_creek.html

7.11 E3 Fleet Certification Program

As stated above, one of the most effective tools for reducing fleet energy is to undertake the Fraser Basin Council's E3 fleet certification program[40] for Administration vehicles. This process identifies the needs of an organization, "right-sizing" vehicles for these needs, and identifies measures to reduce use and use lower impact fuels.

While there is a significant investment in the existing vehicle fleet and "embodied" energy in the vehicles themselves, an evaluation of the fleet will identify opportunities for immediate upgrades and a program of vehicle replacement over time that will ensure that the fleet is the most efficient for community needs. As vehicle lifetimes are typically up to 10 years, depending on usage, and vehicle technologies are improving continuously, opportunities will occur in the medium-term to acquire vehicles using less energy, such as gas-electric hybrid vehicles, and potentially using secure, lower-impact energy sources, such as electricity, propane, or natural gas.

7.12 Education and Conservation Measures

Finally, the importance of education on conservation cannot be stressed enough. Every household in the community can make potentially significant reductions in their energy consumption and costs through a wide range of easily accessible measures. While information from these is accessible through BC Hydro's PowerSmart program, there is an important role for the local Administration, being closest to residents and businesses, to reach out and promote these measures to the community. Conducting Energuide inspections of individual houses will also help identify measures which apply to specific buildings and their financial costs and benefits. A summary of measures is in Figure 32.

Figure 32 - Household Conservation Measures

Conservation Measure	Savings – kWh/yr (approximate)	Cost to Implement	Annual Savings @ 8.78 cents/ kWh* (approximate)
Electronics			
Turn off computer when not in use	170	$0	$14
Turn off TV when not in use	170	$0	$14
Turn off a TV for 1 hour/day	50	$0	$4

[40] http://www.e3fleet.com

Turn off video game console when not in use	200	$0	$16.50
Electrical Appliances			
Hang clothes to dry 50 per cent of the time	520	$0	$43
Wash clothes in cold water	480	$0	$40
Don't use heat dry feature on the dishwasher	110	$0	$9
Adjust fridge temperature to 4°C if set at 3°C	40	$0	$3.50
Remove second fridge and get $30.00 incentive	1,200	$0	$100
Lighting			
Turn off 4 60W lights for 1 hour/day	90	$0	$7.50
Turn off 2 60W lights for 1 hour/day	45	$0	$3.50
Install 5 CFLs in high-use locations	250	$25	$21
Install 10 strings of LED holiday light	190	$70	$16
Heating/whole home			
Turn heat down 1 degree C	800	$0	$65
Install a programmable thermostat and turn the heat down 4-5 degrees overnight and when you're not at home	240	$50	$20
Install water heater blanket	150	$25	$12
Upgrade attic insulation to R40	500	$700	$41
LiveSmart BC Efficiency Program	2,500	$1,700*	$200

* 8.78 cents per kWh is the Step 2 price of the Conservation Rate as of April 1, 2010
**Estimated net cost after incentives, if applicable.

Source: BC Hydro[41]

Recommendation D-13: Conduct, in partnership with BC Hydro, a major education and conservation program in the community.

[41] http://www.bchydro.com/youraccount/content/residential_rates.jsp

7. Proposed Studies, Policies, and Funding Sources

Appendix 3 contains an analysis of a comprehensive list of potential energy efficiency and energy supply measures. Figure 33 below identifies potential policies identified in this analysis and funding sources for those measures that are considered to be highly or somewhat supportive of the established criteria, i.e., best meet the established criteria and provide the greatest benefit with the lowest impact.

Figure 33 - Summary of Proposed Initiatives

Measure	Proposed Study or Policy	Potential Funding Source(s) or Supporting Agencies
Energy Efficiency Measures		
D-1	For future community plans and major development projects, consider developing higher density nodes with mixed uses (i.e., commercial, institutional, and residential) within the community that can better limit travel distances for services, be better served by public transit, and support potential district energy systems in the future	Smart Planning for Communities The Real Estate Foundation
D-2	Consider additional multifamily residential buildings within the community. Multi-family buildings share walls, reducing heat loss to the exterior, and are supportive of potential larger-scale alternative energy systems, such as geoexchange.	
D-3	Improve pedestrian, bicycle, and transit facilities and services.	BC CIPP (Cycling Infrastructure Program), BC Transit
D-4	Explore expanded vehicle sharing and carpooling options.	Cooperative Auto Network Jack Bell Foundation
D-5	Move towards more efficient vehicles and alternative vehicle energy sources.	
D-6	Conduct an E3 Fleet Review to identify opportunities for short-term	Fraser Basin Council

Measure	Proposed Study or Policy	Potential Funding Source(s) or Supporting Agencies
	improvements and potential long-term upgrades and replacements as vehicles reach the end of their operating life.	
D-7	Conduct energy efficiency upgrades for all cost-effective measures identified in the community building inspections and Energuide audits.	BC Hydro INAC
D-8	Conduct a major energy study for the Community School facility.	INAC
D-9	Conduct detailed Energuide audits of at least one building from all typical building types in the community and implement cost-effective energy efficiency measures.	INAC
D-10	Require a minimum of Energuide 80 for new home construction.	
D-11	Assess wood stoves and fireplaces, and replace older, inefficient devices with new efficient stoves or fireplace inserts	Provincial Woodstove Replacement Program INAC
D-12	Conduct infrastructure upgrades as new projects are implemented and equipment reaches the end of its operating life.	INAC
D-13	Conduct, in partnership with BC Hydro, a major education and conservation program in the community.	BC Hydro CMHC
Energy Supply Measures		
S-1	Upgrade the Lil’wat Land Use Plan to incorporate a Community Forest Plan that ensures a sustainable supply of wood for community heating purposes.	
S-2	Consider retrofitting Air Source Heat Pumps into buildings when the cost-	EcoEnergy

Measure	Proposed Study or Policy	Potential Funding Source(s) or Supporting Agencies
	benefit analysis is favourable.	
S-3	Consider the expanded use of a geoexchange network in the vicinity of the Mount Currie, for the school/health care centre area, and in future mixed-use development projects. When developing in the area of the existing geoexchange field, consider maintaining the area for easy access, e.g., playing fields or parking facilities.	Geoexchange BC INAC
S-4	Explore opportunities for solar hot water heaters for domestic hot water and to supplement other heating systems and, if external funding is available, the installation of photovoltaic systems.	Solar BC LiveSmart EcoEnergy INAC
S-5	Continue using grid electricity for applications requiring electrical power, but significantly improve efficiencies when used for heating.	BC Hydro PowerSmart
S-6	Consider using propane for limited building applications, gradually shifting to lower impact, lower cost fuels, and consider using for fleet vehicle fuels	
S-7	Apply passive design guidelines wherever possible, orienting buildings for solar gain, placing most windows on eastern, southern, and western exposures while providing protection from prevailing winds and summer sun by measures such as roof overhangs and planting deciduous trees on the southern exposure.	City of Vancouver Guidelines
S-8	Explore District Energy Systems in conjunction with a review of the land use plan for the Mount Currie town site.	BC Hydro Real Estate Foundation INAC

8. Community Feedback

A meeting was held with key Administration staff to present the findings of the CEB and receive any feedback. Several issues were raised by staff:

- Staff felt that the estimated number of private vehicles in the community was high. Household vehicle ownership in the SLRD was likely higher than for Lil'wat households, and ICBC statistics for the Mount Currie area cover a wider area than the study area. Staff indicated that there are currently approximately 300 to 400 private vehicles in the community. Energy usage data will be adjusted accordingly address this concern once agreement is reached on numbers.

- Most members buy wood for their stoves rather than collect and chop it themselves. It is estimated that most households consume 3-5 cords of wood at $150/cord. The Band provides wood vouchers for lower income households, spending approximately $60,000 per heating season, $10-15k in peak months. Energy cost data will be adjusted accordingly when value is agreed to.

- Band has a woodstove replacement program, recently replacing 10 stoves in lower income homes for $1500 per stove. Installed cost per stove is approximately $2000. Potential funding is available from the Ministry of Health, EcoAction, and Live Smart BC.

- Newer homes with air source heat pumps are using excessive amounts of energy, with reports of up to $1200/month. It is recommended that an energy audit of at least one of these homes be undertaken to confirm this statement and, if confirmed, underlying causes determined and addressed.

- Some homes have programmable thermostats, but there are concerns that users do not know how to use them and are fully heating homes throughout the day and night when people aren't home or are sleeping. Under education and conservation measures, instruction on programmable thermostats should be included, or perhaps a staff member could be trained to work with members to program their thermostats.

9. Conclusions and Recommendations

A review was conducted of energy use in the community and a range of energy demand and supply measures were analyzed using evaluation criteria developed with staff. An important point to keep in mind is that reducing energy demand is the same as providing new energy supply, saving energy, emissions. With anticipated significant energy cost increases anticipated in coming years, and the high cost of developing alternative energy sources, the importance of energy efficiency cannot be understated. Key conclusions and recommendations of the study include:

1. Significant energy savings can be realized by relatively simple energy efficiency measures in homes and businesses. While the cost of these measures per home or business is low and the payback period is short, it is important to work with members on education and awareness of the benefits and to ensure that routine maintenance measures, such as caulking and weatherstripping.

2. While the Band is being proactive in replacing older, less efficient stoves that produce more particulate matter, one of the most significant measures that can be undertaken to reduce energy costs and improve health is an acceleration of the woodstove replacement program. With current costs, the simple payback for installing upgraded stoves is only 3 to 4 years. The local wood supply should be managed to ensure minimal environmental impacts and long-term sustainability.

3. The school and health care centre appear to be strong candidates for major energy retrofit, with a relatively short payback period, including energy demand and supply measures, e.g., boilers and furnaces. The potential for alternative energy sources, including solar hot water and geoexchange, should be considered at this time.

4. Transportation is the biggest consumer of energy, producing the greatest costs and emissions for members. The community already has a solid ethic of sharing resources to reduce the need for owning and operating private vehicles, which could be further enhanced by introducing formal carsharing, electronic or bulletin board car and vanpooling systems, and sharing existing multiple passenger vehicle use, provided that appropriate insurance and liability reduction measures are taken.

5. A review of Land Use and Development, such as conducting design charrettes with energy considerations, is a long range measure, but has significant potential for energy reduction by reducing the need to travel, promoting walking, cycling, and transit, sharing walls to reduce heat loss, and promoting district energy solutions, particularly in the Mount Currie Town Site.

6. Renewable energy sources such as solar (heating and photovoltaics), wind, and micro hydro have some potential, but require significant amounts of capital and carry a number of risks, including environmental. Photovoltaics, wind, and micro hydro would likely require funding partnerships to be economically feasible. The greatest potential for local renewable energy appears to be through biomass (e.g., wood) and solar hot water, particularly if designed and installed as part of new buildings.

7. Passive design guidelines for new buildings can reduce energy use and has potential applications for existing buildings, such as providing shade trees and overhangs to reduce summer heat while allowing winter sun to energy buildings.

8. Moving to energy efficiency and alternative energy sources has potential economic benefits for the community. In addition to reducing long-term energy costs to maintain competitive businesses, skills for these technologies are in demand.

10. Appendices

Appendix 1 - Residential Building Analysis

Appendix 2 - Commercial/Institutional Building Analysis

Appendix 3 - Evaluation of Potential Energy Demand and Supply Measures

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