HAÍŁZAQV COMMUNITY ENERGY PLAN

Ḱíkila qn̓ts ḱála'áx̌v

PROTECTING OUR WORLD

Prepared by
Haíłzaqv Climate Action Team

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Executive Summary

Yi yáu ẇáẇáx̌vtus,

We are proud to share with you the Haíłzaqv Community Energy Plan (HCEP), *Ḥíkila qn̓ts ḥála'áx̌v - Protecting our world.* This plan is a major step towards our community transition away from diesel. A critical transition to protect our homelands and waterways, for our future generations. The plan lays out clean energy solutions for and by the Haíłzaqv Nation. As Haíłzaqv people our way of life is deeply impacted by the changes in our environment caused by climate change. This plan represents healthier homes, affordable energy, greater food security, clean jobs, economic opportunities and a sustainable future for our people.

With the full support of Haíłzaqv Tribal Council, the guidance of our community engagement sessions, and support from our partner organizations, we created this plan to embody the Haíłzaqv Nation's clean energy vision. We've taken many steps towards our vision, with many of our homes experiencing lower energy bills, better air quality, more efficient homes and heating systems. We've begun discussions on how to best utilize the excess energy from Ocean Falls, and other opportunities to re-think energy systems in our community. From electric vehicle infrastructure to vertical farming, the Haíłzaqv Climate Action Team and this HCEP are finding ways to build our clean energy future.

Building on our work to date, we developed this plan to chart our course for the next 10 years, with regular updates and revisions afterwards to keep our energy vision current and ambitious. As we implement the next 10 years of this plan, we look forward to further discussions and engagements with the community to shape the Haíłzaqv Nation's clean energy future.

Ǧiáxsix̌a to all of you who participated in this journey and provided the vision for the HCEP. Together, we will continue to build a sustainable energy future that upholds our ǧvi̓l̓ás.

Ǧiáxsix̌a,
The Haíłzaqv Climate Action Team

Community Overview

Wágḷísḷa (Bella Bella)

Population 2400

Location Haíłzaqv Homelands (Campbell Island, Central Coast of British Columbia)

Transportation Access and Options

Wágḷísḷa (Bella Bella) is only accessible by sea or air. Most supplies are transported via ferry, from Port Hardy or Prince Rupert. Ferries are once per week for most of the year, in July & August the ferries are every other day. Marine barges are another option. There are five regularly scheduled flights a week between Bella Bella and Vancouver. Chartered flights are available to Port Hardy.

Haíłzaqv Energy Vision

The Haíłzaqv Nation is practicing clean energy sovereignty and resiliency by utilizing wind, sun, earth, and water. We will create a sustainable future in accordance with our ğvi̓ḷás and Haíłzaqv worldview.

Geographical Information

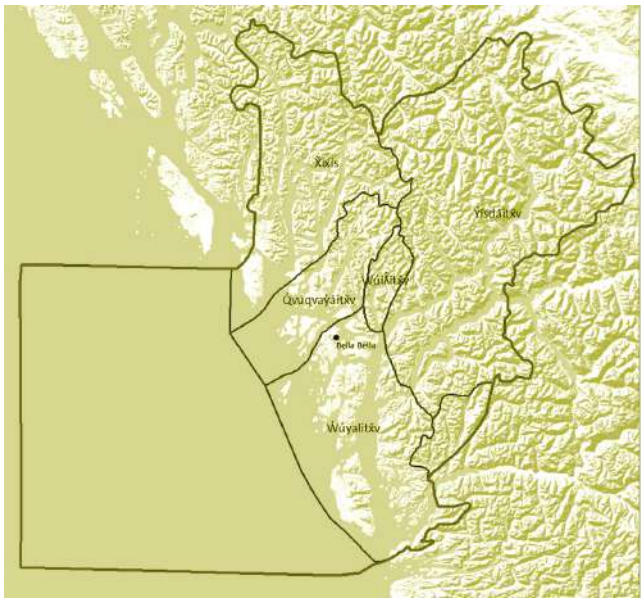
Longitude/latitude
52.1605° N, 128.1456° W

Elevation 21m / 69ft

Title & Rights Holders
Haíłzaqv Nation

Haíłzaqv Homelands & Waterways
35,736 sq km

Environmental Issues



Haíłzaqv Energy Goals

To adapt to climate change by creating and implementing a community energy plan as Haíłzaqv people with specific policies, targets, and strategies.

To educate and engage the Haíłzaqv community to ensure ownership of our collective climate action work.

To create equitable access to clean energy for all Haíłzaqv, derived from the gifts of the creator in the Haíłzaqv Homelands.

To increase human wellbeing through transformation to a carbon-neutral community.

To cultivate the abundance of the Haíłzaqv homelands for future generations by living in balance and exercising Haíłzaqv sovereignty.

Energy Challenges

Vulnerability of microgrid and aging infrastructure

Diesel back-up generator cannot power village

Energy inefficient homes consume double the amount of energy as the rest of the province

Future increased energy demand

Mission

Through community guidance and data analysis, the Haíłzaqv Community Energy Plan outlines a pathway to clean energy sovereignty and resiliency. Haíłzaqv Nation will create our own clean energy future to hík̓ilaxsi qn̓ts ʔála'áx̌v - protect our world.

Climate Action Team

Leona Humchitt
Climate Action Coordinator

Q̓átuw̓as (Jessica Brown)
Community Engagement Coordinator

Ayla Brown
Clean Energy Advisor

Eryn Stewart
Energy Mentor

Michael Vegh
Community Energy Planner

Zuleika Bhamji
Executive Assistant

Total Energy Use

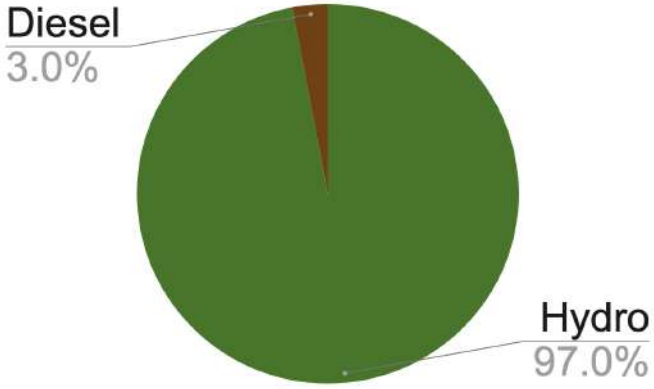
This section contains summary information on energy generation, consumption, and cost in Wáglísḷa (Bella Bella).

Electrical Consumption

Electricity is used in Wáglísḷa (Bella Bella) comes from the sources shown below.

Hydro 8999 MWh

Diesel 278 MWh



Community Load

The community load is a measure of the power consumed over a specific period of time, the average and highest amount (peak) of electricity load is shown below.

Average ### kW **Peak** 3,700 kW

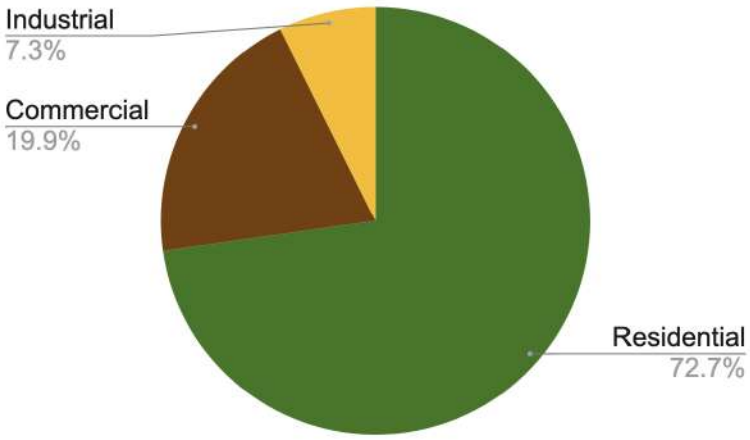
Electricity Consumption by Customer Type

Electricity users in Wáglísḷa (Bella Bella) are residential, commercial, and industrial.

Residential 6710 MWh

Commercial 1839 MWh

Industrial 677 MWh



Annual Fossil Fuel Use

Fuel is used to generate electricity, provide heating to buildings, and power vehicles. The amount of energy used for each category in Wáglísḷa (Bella Bella) is shown below.

Electricity 27,800 litres

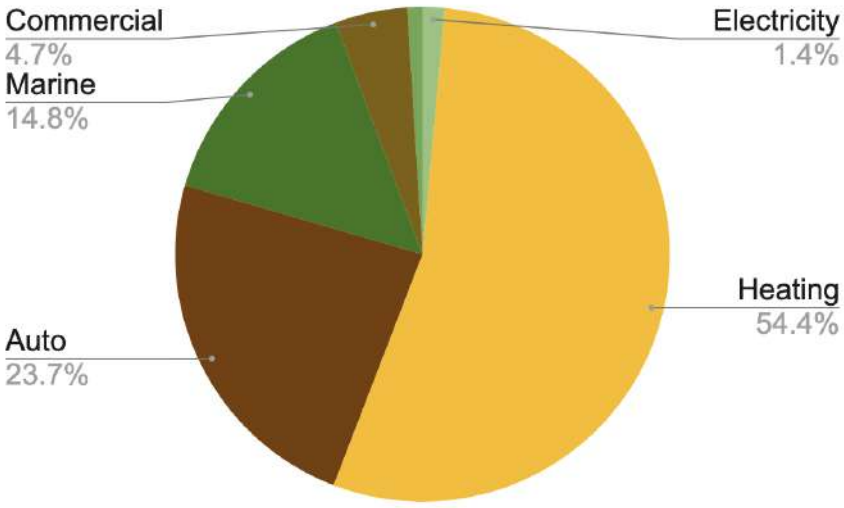
Heating 1,048,800 litres

Auto 456,000 litres

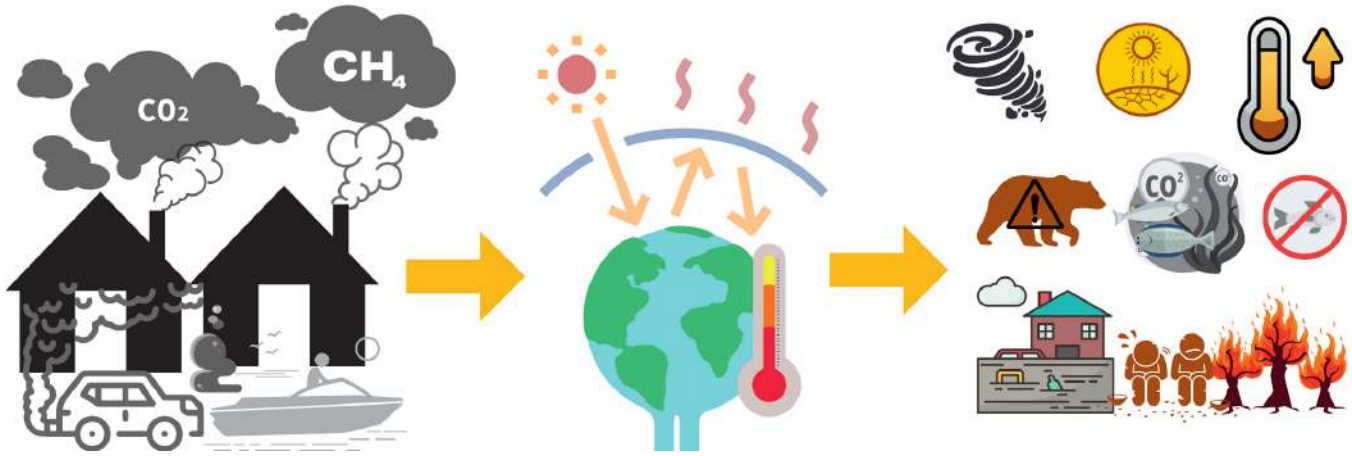
Marine 285,000 litres

Commercial 91,200 litres

Other 19,000 litres



Wáglísḷa (Bella Bella) uses 1.9 million litres of fuel per year



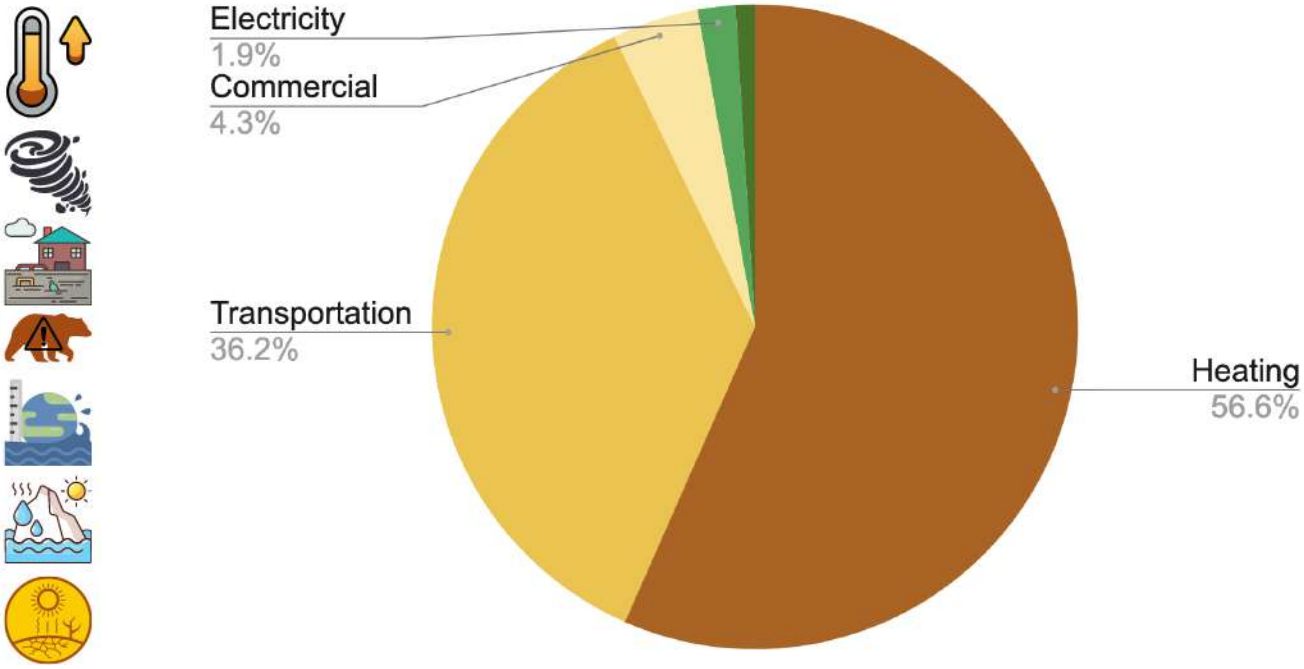
Greenhouse Gas Emissions (GHG)

When fuels such as diesel, gas, and wood are burned harmful greenhouse gases, such as carbon dioxide (Co2e), are released into the atmosphere.

Greenhouse Gas Effect & Climate Change

The greenhouse effect is when gases in Earth's atmosphere trap the Sun's heat. Human activities are changing Earth's natural greenhouse effect causing climate change. Climate change includes rising average temperatures, extreme weather events, shifting wildlife populations and habitats, rising seas, ocean acidification and a range of other impacts.

Wágḷísḷa (Bella Bella) Greenhouse Gas Emissions



Bella Bella emits 5235 tonnes of Co2e every year.
5,136 tonnes of Haíłzaqv emissions are from burning fossil fuels.

Heating	2968 tonnes of Co2e
Transportation	19000 tonnes of Co2e
Commercial Activities	226 tonnes of Co2e
Electricity Generation	99 tonnes of Co2e
Other	51 tonnes of Co2e

Hálżaqv Action Plan

To be Haíłzaqv is to act and speak correctly, as human beings in balance with the natural and supernatural world; to live in accordance with our ğvi̓ḷás. Living up to our responsibilities means taking immediate and meaningful action on climate change.

For Our Future Generations

Over two years, the Haíłzaqv community has collectively selected these 10 climate solutions to protect the abundance of our homelands and waterways for future generations. Together we will accomplish our vision of a carbon neutral community.

Haíłzaqv Climate Solutions

TOTAL GHG REDUCTION: 24,258 TONNES

TOTAL COST: $19,609,952

CONSENSUS ★★★★★★★★★☆

SUPPORT ★★★★☆☆☆☆☆☆

CONFLICT ☆☆☆☆☆☆☆☆☆☆

APPROVAL ★★★★★★★★★★

EFFICIENT HOME HEATING SYSTEMS	SWITCH 100%	$1,600,000.00	10500t GHGs
RENEWABLE DIESEL	SWITCH 100%	$200,000.00	5425t GHGs
SOLAR PROJECT	DO 50%	$6,037,500.00	3750t GHGs
RETROFITTING COMMUNITY HOMES	RETROFIT 100%	$10,000,000.00	3150t GHGs
FOOD SOVEREIGNTY	LOCALIZE 75%	$425,250.00	1125t GHGs
PASSIVE HOUSE KIT	SPEND 75%	$215,625.00	0t GHGs
CAPACITY DEVELOPMENT STRATEGY	SPEND 75%	$93,750.00	0t GHGs
ELECTRIFICATION OF MARINE VEHICLES	ELECTRIFY 50%	$750,000.00	200t GHGs
RETROFITTING COMMUNITY BUILDINGS	RETROFIT 75%	$194,077.00	73t GHGs
COMMUNITY TRANSPORT	ELECTRIFY 75%	$93,750.00	35t GHGs

1. Introduction

1.1. What is the Haíłzaqv Community Energy Plan?

The Haíłzaqv Community Energy Plan (HCEP) is a comprehensive plan to address our Nation's energy needs, challenges, opportunities, and recommend options for energy efficiency and clean energy projects. The HCEP includes recommendations on utility services (electricity or heating fuels), clean transportation, food security and more.

The HCEP provides an understanding of the current energy demands and needs, and also charts a path to more efficient, higher quality, and lower emission energy sources. This path will be created by community input, technical expertise, and analyzing current trends and opportunities.

The purpose of developing this HCEP, and keeping it up to date, is to:

- Build community awareness on energy issues and environmental impacts of energy supplies through community meetings and educational activities,
- Identify potential job opportunities and other economic benefits in the energy sector
- Consult with the Haíłzaqv Nation members on their specific objectives related to energy and develop a community vision in support of shared objectives;
- Estimate the current community energy demand and forecast future energy demands;
- Evaluate clean energy resource potential;
- Assess the environmental, social, and economic feasibility of energy supply options for meeting the energy needs of the community; and
- Develop a long-term energy action plan for the community that includes actions on both energy efficiency and energy supply projects, and that can be updated regularly.

The HCEP is forward-looking and requires many assumptions for predictive purposes. There is a degree of uncertainty associated with these assumptions and considerable opportunity for actual outcomes to diverge from those predicted. This CEP is therefore intended as a first approximation, to be revisited as newer and more in-depth information becomes available.

1.2. Haíłzaqv Climate Action Team

Leona Humchitt

Climate Action Coordinator

The process is being led by Leona Humchitt. She is working to collaborate with staff from all departments.

’Qátuẃas (Jessica Brown)

Community Engagement Coordinator

’Qátuẃas provides all communications and community engagement during this process.

Ayla Brown

Clean Energy Advisor

Ayla provides strategic advice for the Haíłzaqv Climate Action Team.

Eryn Stewart

Energy Mentor

Eryn works for the ICE Social Enterprise and provides energy mentorship to the team.

Michael Vegh

Community Energy Planner

Michael is the lead author and analyst of the Haíłzaqv Community Energy Plan.

Zuleika Bhamji

Executive Assistant

Zuleika provides administrative and organizational support to the team.

1.3. Haíłzaqv Climate Action Community Advisory Board

The Heiltsuk Climate Action team is grateful for the leadership and guidance of our Community Advisory Board:

Yíḿás Wígvilba Wákas Harvey Humchitt

Yíḿás λálíyasila Frank Brown

Kvíkvn̓áx̌nux̌v Margaret Brown, Member of Ẇiúḿaqs (Matriarch) Council

Káníłm̓i Connie Newman, Member of Ẇiúḿaqs (Matriarch) Council

Yáláƛi Megan Humchitt, Heiltsuk Tribal Councillor

Kanilh'u Brenda Humchitt, Educator

Robyn Dixon, Haíłzaqvl̓a Specialist

Astrid Wilson, Youth Representative

The Haíłzaqv Climate Action Team (HCAT) and Community Advisory Board have been and will continue creating climate solutions for and by Haíłzaqv people. We created the Haíłzaqv Community Energy Plan to be aligned with the Comprehensive Community Plan (CCP).

HCAT has and will continue to work with the community to:

Build long term sustainability for future generations

Move towards renewable sources of energy

Create economic opportunities

Ensure affordability through renewable energy solutions

Reduce and possibly eliminate dependence on diesel

Examine energy demand

1.4. Key Terms

Ğvi̓ḷás	A sophisticated system of laws to govern our territory, manage relationships, organize behavior and resolve conflicts, guide ceremonial proceedings, prior to settler contact Exercised and sustained us for over 700 generations, and still today Protects our land, water, and resources. Dictates interdependent and intimate relationships with our ecosystems
Haíłzaqv Worldview	Cyclical worldview passed down through the generations, everything is connected Intrinsic values we inherit to take care of our land, water, and resources and in return, they will take care of us. Inseparable relationship with the land, water, and resources, determined by the seasons Our oceans, rivers and lakes are our pantries and the forests are our pharmacies. The animals are our relatives.
Clean Energy	Renewable, zero-emission sources that are generated from the Gifts of our Creator – the Sun, the Wind, the Water, and the Earth. Clean energy is often thought of as a new technology, however, harnessing nature's power has long been used for heating, transportation, lighting, and more. The Haíłzaqv Climate Action community engagement process identified solar, wind, and bioenergy as the top three clean energy choices of community members.

2. Sustainable Development Vision & Energy Goals

2.1. Vision

The Haíłzaqv Nation is practicing clean energy sovereignty and resiliency by utilizing wind, sun, earth, and water. We will create a sustainable future in accordance with our ğvi̓ḷás and Haíłzaqv worldview.

> My vision for clean energy is environmental and climate justice for our nation with equity in energy accessibility and in consumption.
>
> **- Haítzaqv community member**

2.2. Mission Statement

Through community guidance and data analysis, the Haíłzaqv Community Energy Plan outlines a pathway to clean energy sovereignty and resiliency. Haíłzaqv Nation will create our own clean energy future to ḥíkilaxsi qn̓ts ḥála'áx̌v - protect our world.

2.3. Goals

1. To adapt to climate change by creating and implementing a community energy plan as Haíłzaqv people with specific policies, targets, and strategies.
2. To educate and engage the Haíłzaqv community to ensure ownership of our collective climate action work.
3. To create equitable access to clean energy for all Haíłzaqv, derived from the gifts of the creator in the Haíłzaqv Homelands.
4. To increase human wellbeing through transformation to a carbon-neutral community.
5. To cultivate the abundance of the Haíłzaqv homelands for future generations by living in balance and exercising Haíłzaqv sovereignty.

3. Community Profile & Expected Growth

3.1. Culture

Haíłzaqv oral tradition states that the original Haíłzaqv ancestors were set down by the Creator in various areas in the territory, which is now referred to as the Central Coast of British Columbia. An archeological excavation and study of ancient remains within Haíłzaqv territory in 2019 affirmed our oral history of our occupation for at least the last 14,000 years.

We affirm our ğvi̓ḷás, the laws of our ancestors as the paramount principle to guide all resource use and environmental management, including our energy systems. Ğvi̓ḷás refers to our "power" or authority over all matters that affect our lives, and has been described as the ethos of our people. It is a complex and comprehensive system of laws that embodies values, beliefs, teachings, principles, practices, and consequences.

Ğvi̓ḷás governs our relationship and responsibilities to land and resources, with sustainable use and management being enforced by certain practices and teachings. Inherent to our ğvi̓ḷás is the understanding that all things are connected and that unity is important to maintain. Throughout the development of the Haíłzaqv Community Energy Plan, our team was committed to upholding and demonstrating our ğvi̓ḷás, both now and in the future.

> When the sun was created, it was too hot and it burned the world so they created a new sun and put it higher up in the sky. That helped things grow and bring life to the world and brought the world out of the darkness. Utilizing solar is our modern day dependency on the sun.
>
> **- Haítzaqv community member**

3.2. History

Originally our ancestors occupied more than 50 major villages spread across our vast territory. They used the intricate network of waterways to travel from well-established winter villages to numerous seasonal camps situated on salmon streams, along ancient trading routes, and on far-flung outer islands. When Europeans arrived in the eighteenth century there were several Haíłzaqv villages on the various islands near the present-day location of Bella Bella.

In 1833 the Hudson's Bay Company established Fort McLoughlin, a heavily fortified fur trading post, on what is now McLoughlin Bay on Campbell Island. The Haíłzaqv already had a well-established trading network on the coast, but the Hudson's Bay Company sought to supersede Indigenous people as intermediaries in the fur trade wherever possible. Still, the officers at Fort McLoughlin found the Haíłzaqv would not allow themselves to be pushed aside.

Despite initial hostilities, within a few years a new Haíłzaqv village was established near Fort McLoughlin. The Haíłzaqv became well known as skilled and savvy traders and developed a lucrative, if uneasy, business relationship with the fort.

The Haíłzaqv knew the village as Q̓íc, but Europeans recorded various other names for the village, perhaps derived from the local geographical name Pélbála, that eventually gave rise to the modern English name Bella Bella. Members of Haíłzaqv-speaking tribes from across the region who gradually relocated to the village over the next sixty years became known as the Bella Bella Indians.

When Fort McLoughlin closed in 1843 Europeans abandoned the site. The village of Q̓íc remained and the Haíłzaqv continued to trade with the steamship-based trading system that replaced the fort.

In the winter of 1862, a devastating smallpox epidemic took a massive toll on the Haíłzaqv population across our territory. Many villages were wiped out entirely, and most others didn't

have enough people left to sustain them. Survivors from the various Haíłzaqv tribes gradually amalgamated at Bella Bella, which is centrally located in Haíłzaqv territory.

In 1866 European traders reoccupied the fort site at McLoughlin Bay and established a small store and a post office. Then, in 1880, Old Bella Bella (Q̓ḶC) became the focus of Methodist mission work on the central coast. The villagers were encouraged to abandon their traditional big houses and seasonal camps in favor of European-style houses.

However, because most of the suitable building area on McLoughlin Bay was “claimed” by the Hudson’s Bay Company, there was a scarcity of land on which to build such houses. By the turn of the century, most of the diminished Haíłzaqv population resided in Old Bella Bella (Q̓ḶC), which had become crowded.

In 1897 the Haíłzaqv, making the decision to move, surveyed a new townsite three kilometers north of McLoughlin Bay. This place was known to the Haíłzaqv as Wágḷísḷa (meaning “river on the beach or the running of water over part of a beach, along with other variations”). Building progressed quickly and by 1900 the people of Q̓ḶC had relocated to the new village, which boasted large European-style houses and Haíłzaqv-run businesses. This new community was called New Bella Bella, present day Bella Bella, BC.

For a time, the prosperous new Haíłzaqv village was a busy centre of trading and shipping activities on the coast. Within a decade the village was the second largest on the coast, with a hospital, school, sawmill, fire hall, wharf, warehouse, and planked roads with street lights. Residents contributed to, and shared in, the success of nearby ventures like Ocean Falls and Namu.

In 1914 a cannery was built on Denny Island. The store and post office at McLoughlin Bay were moved to the small town that grew around the cannery. Along with the post office went the name “Bella Bella”, which was inherited by the new Denny Island settlement.

As the century progressed, diminishing resources and the decreasing dependence of industry on remote communities caused New Bella Bella's existence to become more isolated and precarious. Ocean Falls and Namu eventually became ghost towns and the cannery on Denny Island fell into ruin. The community on Denny Island relocated to nearby Kliktsoatli Harbour, where an airstrip was built in WWII, becoming Shearwater. In 2021, the Haíłzaqv Nation bought back Shearwater Marine Resort reclaiming part of Denny Island from settler ownership.

Today the Q̓Íc village site is known as Old Bella Bella or Old Towns. McLoughlin Bay, connected now by road to Bella Bella, is the site of the BC Ferries terminal, a Haíłzaqv fish processing plant, a few homes, and a salmon hatchery. The old Hudson's Bay Company land is now owned by the Haíłzaqv Nation.

Bella Bella (Wágḷísḷa) was revitalized by the building of an airport and BC Ferries terminal and continues to grow and prosper. Today this vital, contemporary community is still referred to as Wágḷísḷa and more broadly known as Bella Bella. Our community is proud to have the only library on the central coast, a community school kindergarten to grade 12, a local college, cultural center, fitness center, hospital, saw-mill, and numerous Haíłzaqv owned and operated businesses.

In October of 2019, we opened our new λiáć̓i (big house) the Gvúkva'áus Haíłzaqv (house of the Haíłzaqv). This house is a living symbol and home of our cultural and language revitalization work that continues everyday within our community.

We honour our history in the Haíłzaqv Community Energy Plan by creating a future that upholds our values as we continue to adapt and thrive in our homelands.

3.3. Location & Geography

The Haíłzaqv people are the main descendants of Haíłzaqvḷa-speaking people and identify as being from one or more of five tribal groups: Ẇúyalitx̌v, Q̓vúqvaỷáitx̌v, Ẇu̓íx̌itx̌v, Ỳísdáitx̌v, and X̌íx̌ís.

Our territory encompasses 35,553 square kilometers. It extends from the southern tip of Calvert Island, up Dean and Burke Channels as far as Kimsquit and the head of Dean Inlet to the northeast, and up the Mathieson and Finlayson Channels to the north.

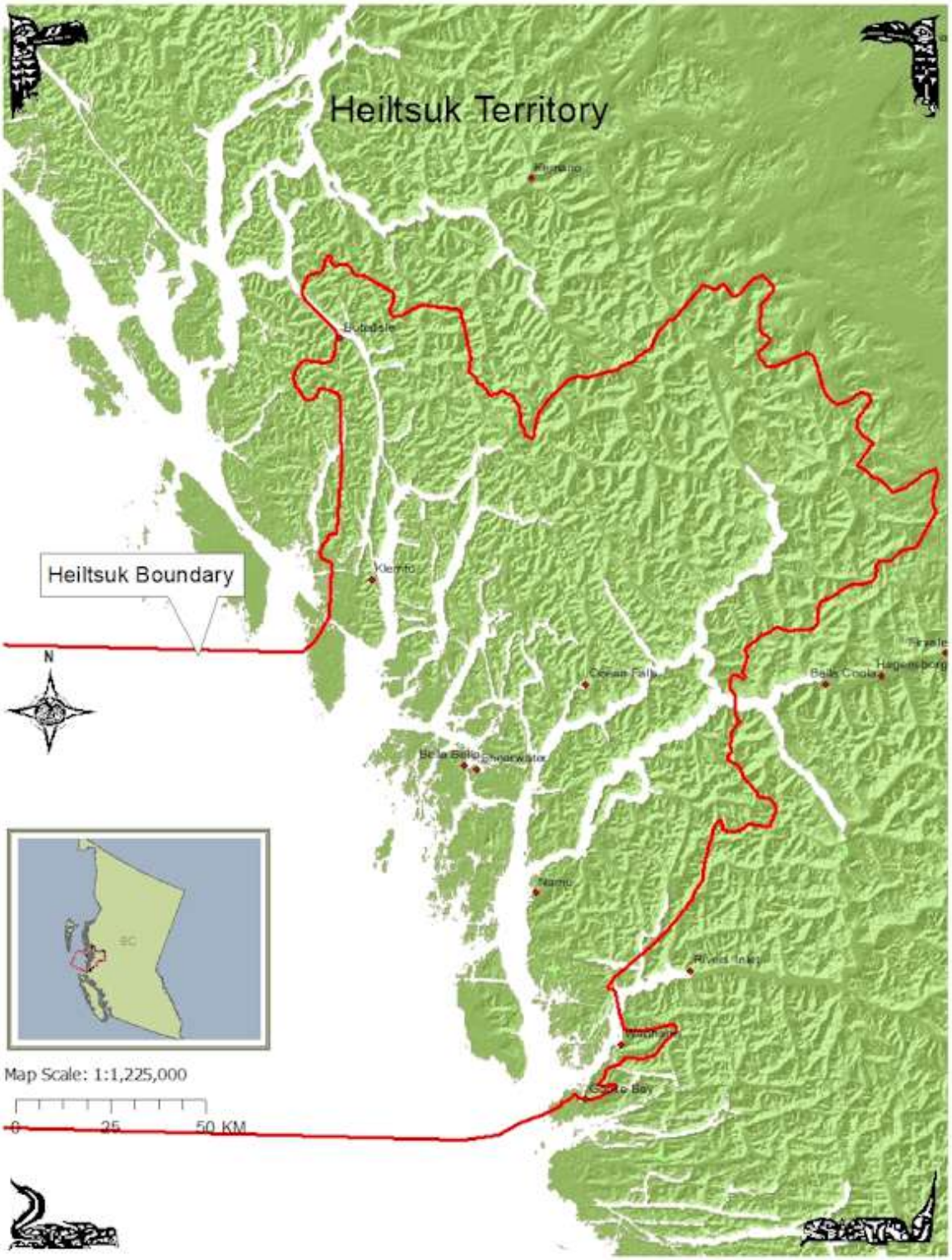
> Our ancestors depended on the wind and sun for many things, drying food, travel, change of seasons which brought resources at different times of the year. Our language has so many names for the wind and many different interpretations, showing its importance.
>
> **- Haítzaqv community member**

Our people practice a system of governance based on our ğviḷás (traditional laws) that have been upheld by our Hereditary Chiefs since time immemorial through to the present day. The Haíłzaqv governing body is comprised of elected Chief & Council, who make decisions in collaboration with the Yíṃás (Chiefs) and Ẇiúm̓aqs (Matriarch) Council.

For the past decade the Haíłzaqv, along with other coastal First Nations, have strengthened the connections between our community, our environment, and our economy. We remain steadfast in our conviction that the environment should not be sacrificed to build a healthy coastal economy.

The Haíłzaqv have led the way in Land and Marine Use Planning, which is integral for our Nation in asserting our rights and community values on developments within Haíłzaqv ancestral territory.

We have embedded our Nation's leadership and lessons learned into the Haíłzaqv Community Energy Plan.



3.4. Local Environment

Bella Bella is Located in the *Coastal Western Hemlock Zone* in the heart of the “Great Bear Rainforest”. This expansive territory is an area where mountains and ocean dominate, creating the coastal climate and ecology. There is a wide array of biodiversity and ecosystems. We are blessed with wind torn outer islands, surrounded by glistening blue ocean and sandy beaches; to majestic fjords that dive deep into the Pacific Ocean. It is a vibrant territory that supports massive grizzly bears, coastal salmon eating wolves, tiny herring, and 9 different species of starfish (the most in the world), and everything in between.

The Coast Mountains form a barrier between warm air flowing in from the Pacific and the continental air masses of the province’s interior. As Pacific air pushes over the mountain barrier, it drops much of its moisture as rain or snow, producing one of the wettest climates in Canada. The mild Pacific Ocean moderates temperatures, resulting in cool summers and mild winters.

Bella Bella is also in the *Very wet Hyper maritime* sub-zone of the Coastal Western Hemlock (CWH) Zone, with a mean annual precipitation of 2951mm. Mean annual temperature is about 8°C and ranges from 5.2 to 10.5°C among the CWH subzones. The mean monthly temperature is above 10°C for 4-6 months of the year. The mean temperature of the coldest month is 0.2°C and ranges from -6.6 to 4.7°C among the subzones. Mean annual precipitation for the zone as a whole is 2228 mm, and ranges from 1000 to 4400 mm (and probably more in some areas).
Moreover, climate change is bringing more intense storm surge, winds, and precipitation to our territory. Our infrastructure must be considerate of this precipitation regime, and the intense winds brought in during winter storms that can reach up to 100 Km/h. The energy solutions and recommendations in the Haíłzaqv Community Energy Plan are considerate of the local environment and adapting to the anticipated impacts of climate change (see section 4).

3.5. Governance & Public Services

Haíłzaqv Tribal Council, alongside our Yím̓ás and Ẃiúm̓aqs council, are the leading governing bodies in Bella Bella. The mission of the Heiltsuk Tribal Council is to embrace our traditional and modern practices and protect our way of life. Together we will ensure equality through transparency and accountability. Our elected and traditional leadership guide our nation and play a major role in upholding our Ğvi̓ḷás across all our territory. Our governing bodies create opportunities for the Haíłzaqv people to thrive and embody our Haíłzaqv values. The Haíłzaqv Community Energy plan is inclusive of feedback and guidance from our elected and traditional leadership.

3.6. Economy

The Haíłzaqv's dynamic and diverse economy reflects who we are, our history, and our vibrant relationship with our territory. We are constantly engaged in new community economic development opportunities, while continuing to build on the foundations of our traditional economy.

Since 2006, the Heiltsuk Economic Development Corporation (HEDC) has existed to manage the economic and business interests of the Haíłzaqv Nation in Bella Bella. HEDC looks after the key community businesses that include forestry, fisheries management, the Wágḷísḷa Band Store, the Bella Bella Airport, the local freight company, the liquor store, fuel company, and cable services for television and internet.

Heiltsuk Tribal Council also holds an Economic Development portfolio, which is assigned to elected Councilors and has HTC employees. This portfolio works closely with HEDC to ensure a comprehensive vision of our Nation's economic future.

HEDC has supported this Community Energy Plan by providing data on fuel purchases in Bella Bella from Lama Pass Fuel Station. These fuel purchases represent consumption for all local automotive and marine transportation, as well as heating oil and propane from April 2019 - April 2021.

> I am confident that we can produce sustainable initiatives that can aid in neighbouring nations, [creating] positive externalities around the world.
>
> **- Haítzaqv community member**

3.7. Expected Growth

Bella Bella's current population is about 1600 people. From 2006 to 2016, First Nations on-reserve population grew twelve percent[1]. Following this same trend, by 2031 Bella Bella should expect at least 192 additional members living on-reserve, bringing the total population to an estimated 1792. Assuming these members are a household of four, this represents demand for an additional forty-eight homes in our community, resulting in higher overall energy demand for households, transportation, and goods into the community.

The Heiltsuk Tribal Council Housing Department also has a waitlist of 150 applicants seeking their own rental units. These applicants include:

- Thirty-five applications for three bedrooms homes, an average of 4-8 people per application
- Forty applications for two-bedroom homes, an average of 4-6 people per application
- Seventy-five applications for one-bedroom homes, average 1-2 people per application

These applications represent 150 additional homes demanding the energy requirements of 375-670 people. While this will reduce some energy demand in the homes that these people currently live in - assuming most of the applicants currently live in Bella Bella - this will result in a net-increase net increase energy demand for Bella Bella homes as each new home will

[1] Statistics Canada. Aboriginal On-Reserve Population Growth https://www150.statcan.gc.ca/n1/en/pub/41-20-0002/412000022021001-eng.pdf?st=I1LZsuEf. 2016.

require a baseline amount of heat and electricity, which will be in addition to the fluctuating demand of individuals throughout the day, week, and year.

The Haíłzaqv Community Energy plan is considerate of the demand for at least two hundred additional households in our community, and future versions of this document will need to update household demand and the associated energy requirements.

4. Climate Change Impacts

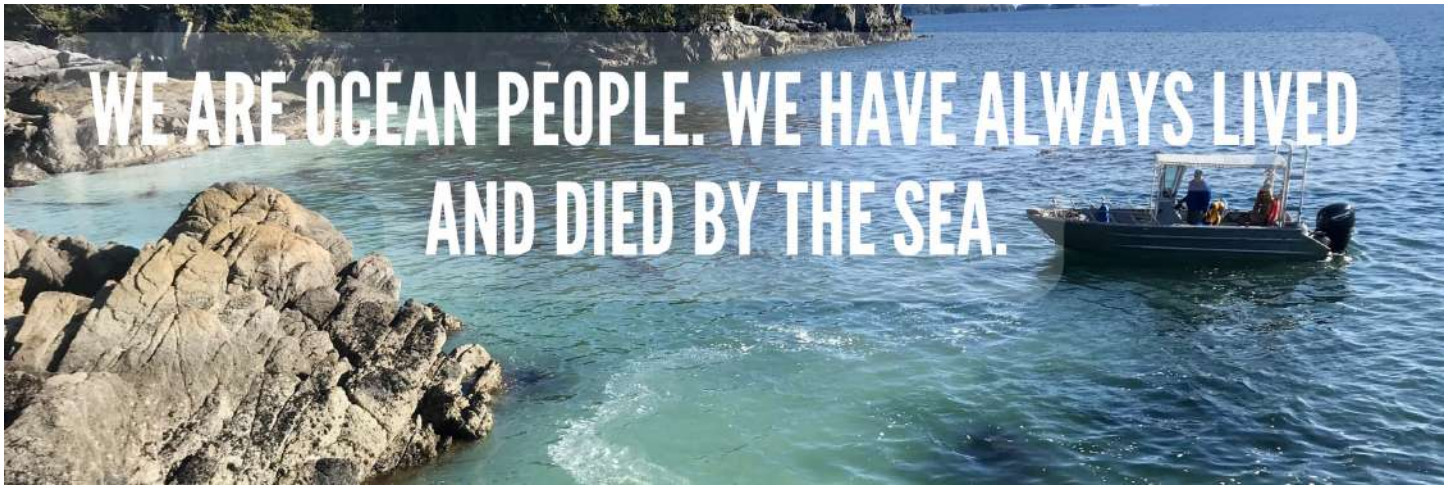
4.1. Sea Level Rise and Storm Surge

Sea-level rise and storm surge are some of the greatest climate impacts that Bella Bella will experience towards our infrastructure. According to a Coastal Vulnerability Study[2], the anticipated sea level rise for Haíłzaqv is 0.69m by 2100, and extreme storm events could generate a 0.6 m water level increase and wave heights as high as 1.5 m, resulting in a wave runup to an elevation of 7.6 m.

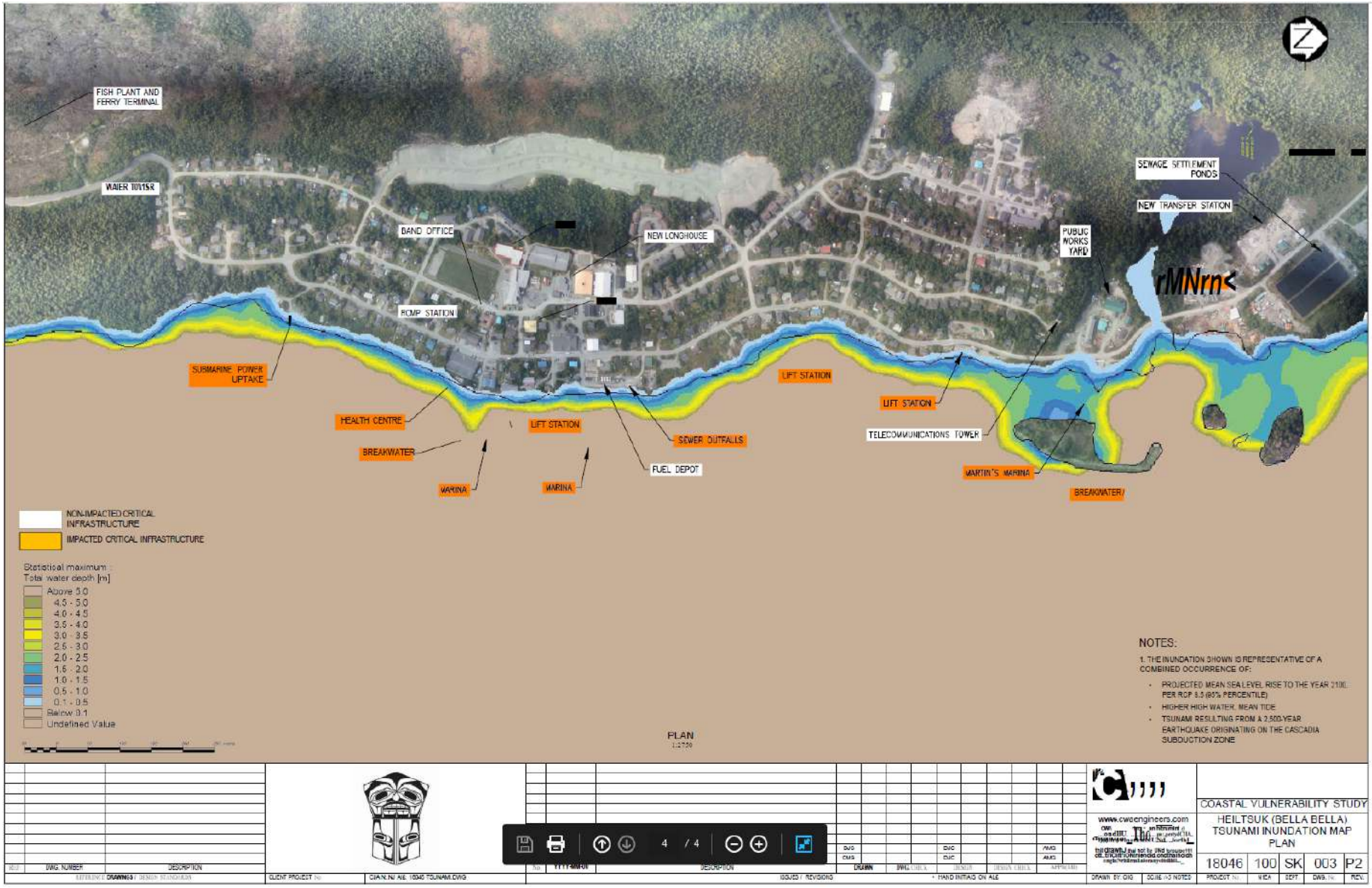
The following low-lying infrastructure would be impacted by these events:

- Submarine Power Uptake
- Hospital
- Marinas
- Fuel Depot
- Lift Stations
- Sewer Outfalls

A portion of the road adjacent to Martin's Marina will also be inundated, limiting access to the airport. These potential realities must be considered for any infrastructure in Bella Bella, including those related to the HCEP.



[2] CWA Engineers Inc. *Coastal Vulnerability Study – Year 3 – Phase 1 – Engineering Evaluation Heiltsuk.* 2019


FISH PLANT AND FERRY TERMINAL
WATER TOWER
BAND OFFICE
NEW LONGHOUSE
RCMP STATION
SEWAGE SETTLEMENT PONDS
NEW TRANSFER STATION
PUBLIC WORKS YARD
SUBMARINE POWER UPTAKE
HEALTH CENTRE
BREAKWATER
MARINA
LIFT STATION
SEWER OUTFALLS
FUEL DEPOT
MARINA
LIFT STATION
LIFT STATION
TELECOMMUNICATIONS TOWER
MARTIN'S MARINA
BREAKWATER
NON-IMPACTED CRITICAL INFRASTRUCTURE
IMPACTED CRITICAL INFRASTRUCTURE
Statistical maximum
Total water depth [m]
Above 5.0
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
1.5 - 2.0
1.0 - 1.5
0.5 - 1.0
0.1 - 0.5
Below 0.1
Undefined Value
NOTES:
1. THE INUNDATION SHOWN IS REPRESENTATIVE OF A COMBINED OCCURRENCE OF:
• PROJECTED MEAN SEA LEVEL RISE TO THE YEAR 2100 PER RCP 8.5 (95% PERCENTILE)
• HIGHER HIGH WATER, MEAN TIDE
• TSUNAMI RESULTING FROM A 2,500-YEAR EARTHQUAKE ORIGINATING ON THE CASCADIA SUBDUCTION ZONE
PLAN
4 / 4
www.cweengineers.com
COASTAL VULNERABILITY STUDY
HEILTSUK (BELLA BELLA)
TSUNAMI INUNDATION MAP
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18046
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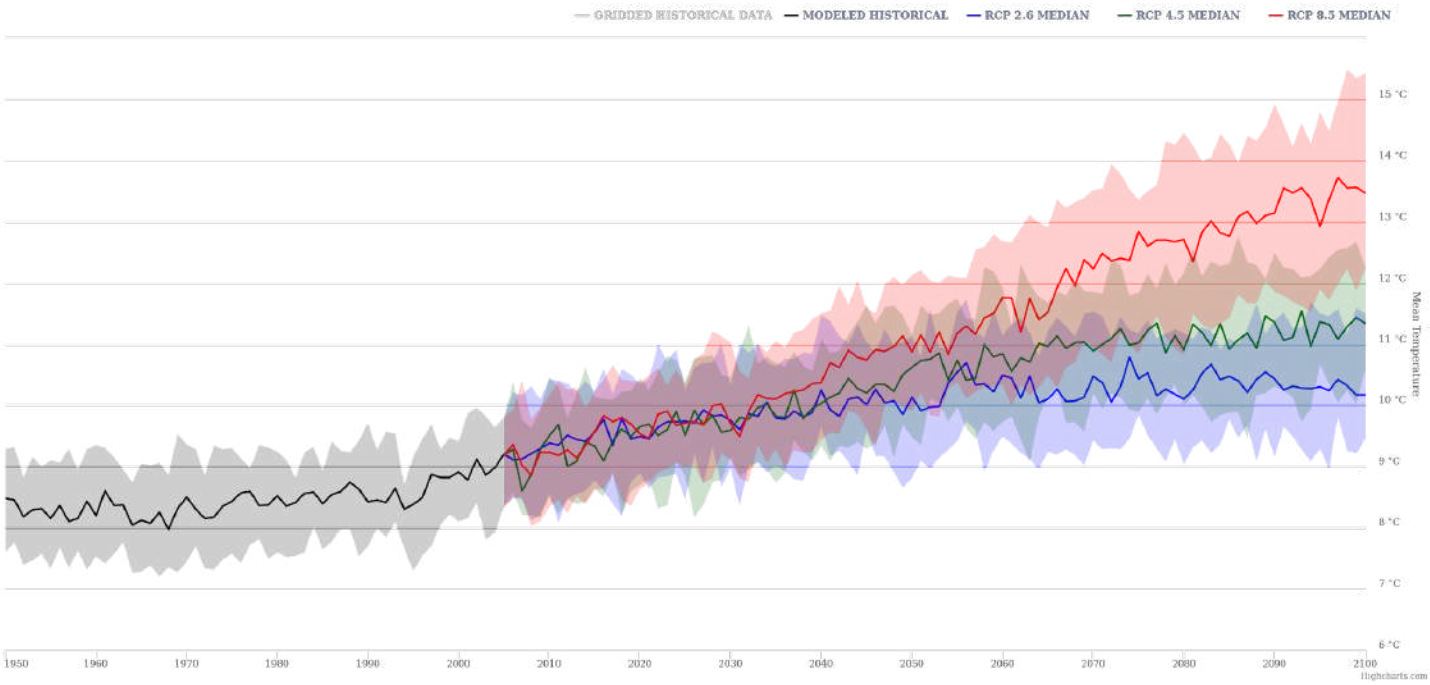
4.2. Temperature



Using publicly available data[3], Bella Bella's mean temperature was calculated from 1950- 2100 over a number of possible future scenarios:

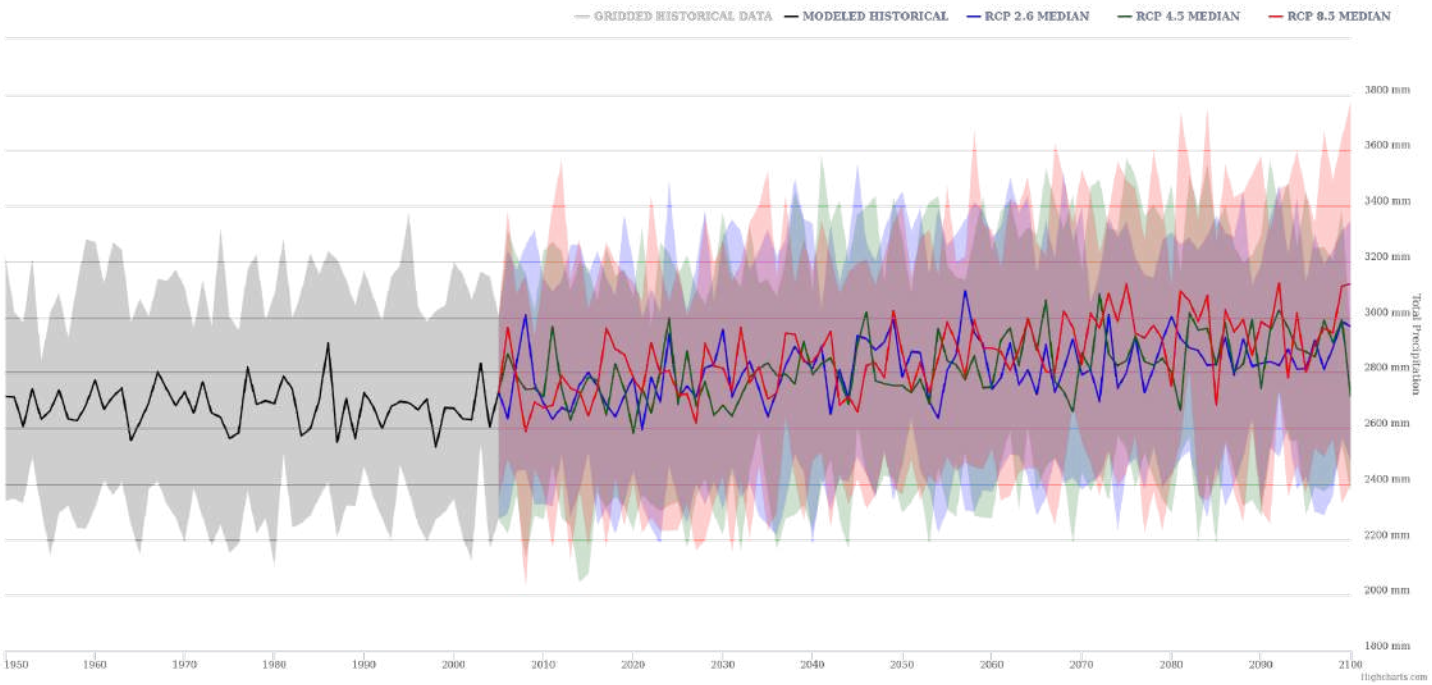
- **RCP 2.6 Median (Blue):** Future temperatures is global warming is kept below 2.6 degrees Celsius
- **RCP 4.5 Median (Green):** Future temperatures is global warming is kept below 4.5 degrees Celsius
- **RCP 8.5 Median (Red):** Future temperatures is global warming is kept below 8.5 degrees Celsius

Mean temperature describes the average temperature for the 24-hour day. The average temperature is an environmental indicator with many applications in agriculture, engineering, health, energy management, recreation, and more.

3 https://climatedata.ca/explore/location/?loc=JDJYY&location-select-temperature=tx_max&location-select-precipitation=r1mm&location-select-other=frost_days

These results show that all future scenarios show a high variation of temperature regimes under different global average temperatures. Any future energy systems and related infrastructure must be considerate and designed with these potential temperature regimes over the life cycle of each system.

4.3. Precipitation



Using publically available data[4], Bella Bella's mean temperature was calculated from 1950-2100 over a number of possible future scenarios:

- **RCP 2.6 Median (Blue):** Future temperatures is global warming is kept below 2.6 degrees Celsius
- **RCP 4.5 Median (Green):** Future temperatures is global warming is kept below 4.5 degrees Celsius
- **RCP 8.5 Median (Red):** Future temperatures is global warming is kept below 8.5 degrees Celsius

4 https://climatedata.ca/explore/location/?loc=JDJYY&location-select-temperature=tx_max&location-select-precipitation=r1mm&location-select-other=frost_days

Total Precipitation describes the total amount of precipitation (rain and snow combined) that falls within the selected time period. Precipitation significantly impacts water availability, agricultural practices, electricity generation and wildfire suppression.

These results show that all future scenarios show a low variation of precipitation regimes under different global average temperatures. Any future energy systems and related infrastructure must be considerate and designed with these potential precipitation regimes over the life cycle of each system.

5. Methodology

5.1. Community Engagement

The Haíłzaqv Climate Action Team (HCAT) created opportunities for active community involvement through multiple platforms. HCAT has set a new standard for community engagement for the Haíłzaqv Nation. As a team we are especially proud of our community engagement having had to navigate the added challenges the global pandemic Covid 19 has created. We are so proud that over 1,000 Haíłzaqv descendants engaged to make the Haíłzaqv Community Energy Plan a reality.

Overview of Community Engagement Strategy:

- Two online zoom visioning sessions
- Utilization of ethelo the online consensus building survey platform
- Ethelo Haíłzaqv Clean Energy Plan Survey 1
- Ethelo Haíłzaqv Climate Solution Survey 2
- In person one-on-one advertised coffee shop sit-ins to help with survey completion
- Community Open House with refreshments and survey help offered
- Two online zoom sessions that aligned with the Ethelo Haíłzaqv Climate Solution Survey 2. These zoom sessions focused on prioritization of 12 climate solutions that were brought forward from the visioning sessions and survey 1.
- Virtual Facebook live updates of the two Community Energy Survey results with engagement prize draws
- Active Instagram: @heiltsukclimateaction, Facebook: @hailzaqvclimateaction, and YouTube: @Haíłzaqv Heiltsuk Climate Action updates
- Heiltsuk Tribal Council electronic mailing list updates, subscribe here: https://heiltsukclimateaction.ca/connect-with-us
- HCAT website: www.heiltsukclimateaction.ca
- Urban Haíłzaqv Open House in Vancouver, BC
- 3 HCAT Newsletters that were delivered door to door in Bella Bella: https://heiltsukclimateaction.ca/newsletters

5.2. Community Energy Demand Data

HCAT collaborated with multiple organizations to gather data on Haíłzaqv Nation's energy demand and associated greenhouse gas emissions.
Community Energy Demand Data sources included:

- Local electricity consumption from Ocean Falls, provided by BC Hydro.
- Bella Bella Fuel Station quarterly reports on fuel purchase orders of gasoline (marine and automotive), diesel (marine and automotive), propane, and oil.
- Fuel consumption estimates from Innes Hood Consulting Inc.
- Housing demand from the Heiltsuk Housing Department.
- Statistics Canada on-reserve population growth estimates.

Based on this data, Haíłzaqv Nation's future energy demand over the next 10-20 years was estimated, allowing for the HCEP to anticipate the future requirements from our energy systems.

5.3. Time Frame, Scope and Review Periods

We have created the HCEP with a scope focused on the next 10 years, 2021 - 2031. The HCEP is forward looking and includes many projections into the future based on currently available data. These projections are inherently limited and have many embedded assumptions, which at the time were inalienable components. There is an inherent uncertainty associated with these assumptions and thus an opportunity for actual outcomes to diverge from those predicted. The HCEP is therefore intended as a first approximation based on current data, which will be revisited as updated information becomes available.

To reduce the uncertainty of projections, the data and associated projections in the HCEP will be updated every 5 years. Throughout these 5 years, indicators to measure the success in achieving the HCEPs goals and measurable outcomes will be created. These indicators will be created based on community input and finalized by the HCAT. These indicators will be capable of measuring how effective Haíłzaqv Nation has in achieving HCEPs goals and measurable outcomes.

Between years 4 and 5 (in this version, 2025 - 2026) the finalized indicators will be utilized, and a progress report should be created that outlines if targets have been fully achieved, partially achieved, or no progress has been made. The progress report will also include wherever necessary - or be followed by discussions to identify - required changes to the implementation process or an indicator(s) to achieve an HCEP goal or measurable outcome. Required changes will have community input and finalized by the HCAT.

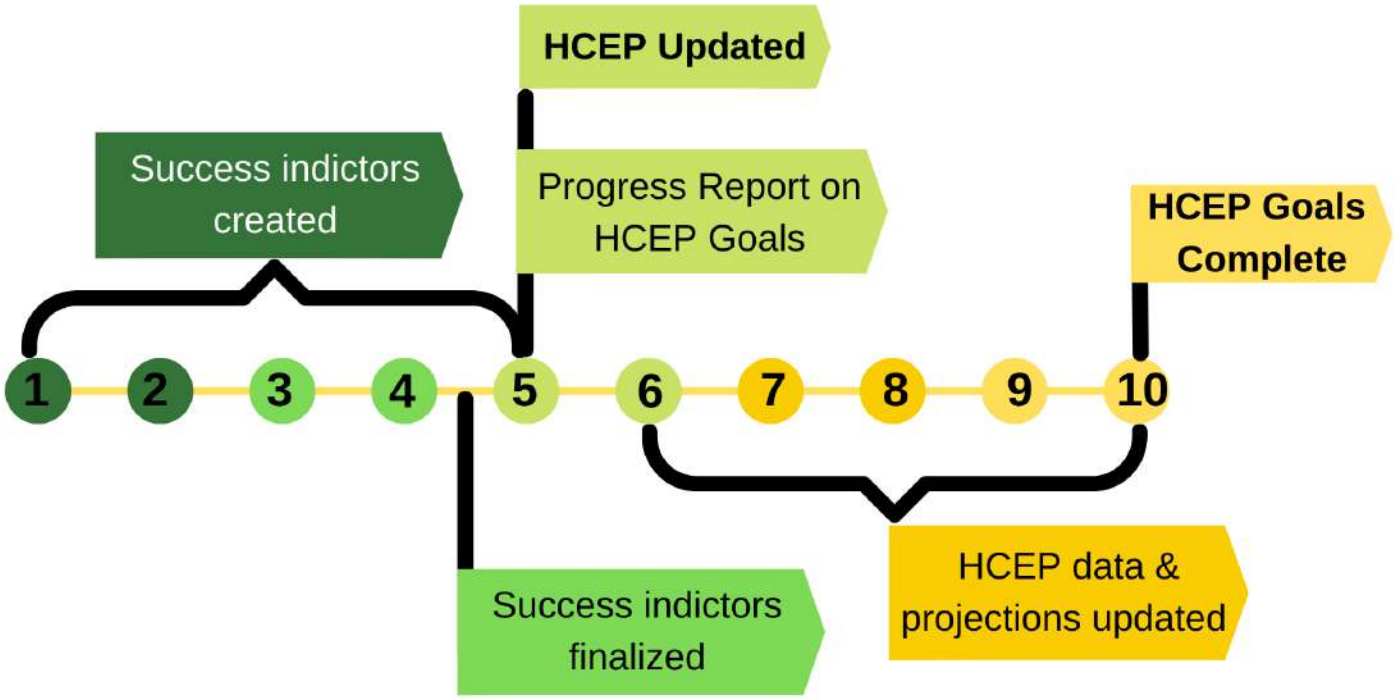
Between years 6 and 10 (in this version, 2027 - 2031), the data and associated projections in the HCEP will be updated. The finalized indicators will also be reviewed by the HCAT to determine if new or altered indicators should be created. If any new or altered indicators are required, they will be created based on community input and finalized by the HCAT. These indicators should be capable of measuring how effective Haíłzaqv Nation has in achieving HCEPs goals and measurable outcomes.

In year 10 (in this version 2031) most if not all of the goals and measurable outcomes should be completed. A progress report will be created that outlines if targets have been fully achieved, partially achieved, or no progress has been made. The progress report will also include wherever necessary - or be followed by discussions to identify - required changes to the implementation process or an indicator(s) to achieve an HCEP goal or measurable outcome. Year 10 will require updating the list of goals and measurable outcomes. The updated list will include any goals and measurable outcomes that have no progress or are partially completed. The updated list will also include new goals and measurable outcomes based heavily on community input. To gather community input please see the “Community Engagement " section for replicable formats. New data on energy consumption should also be gathered, estimated, and interpreted in the HCEP.

Significant changes in Bella Bella’s energy demand may also warrant an update to the HCEP. These changes would represent a significant alteration to the current energy system supply or demand and will be considered on a case-by-case basis. Changes that might warrant an update to HCEP include, but are not limited to:

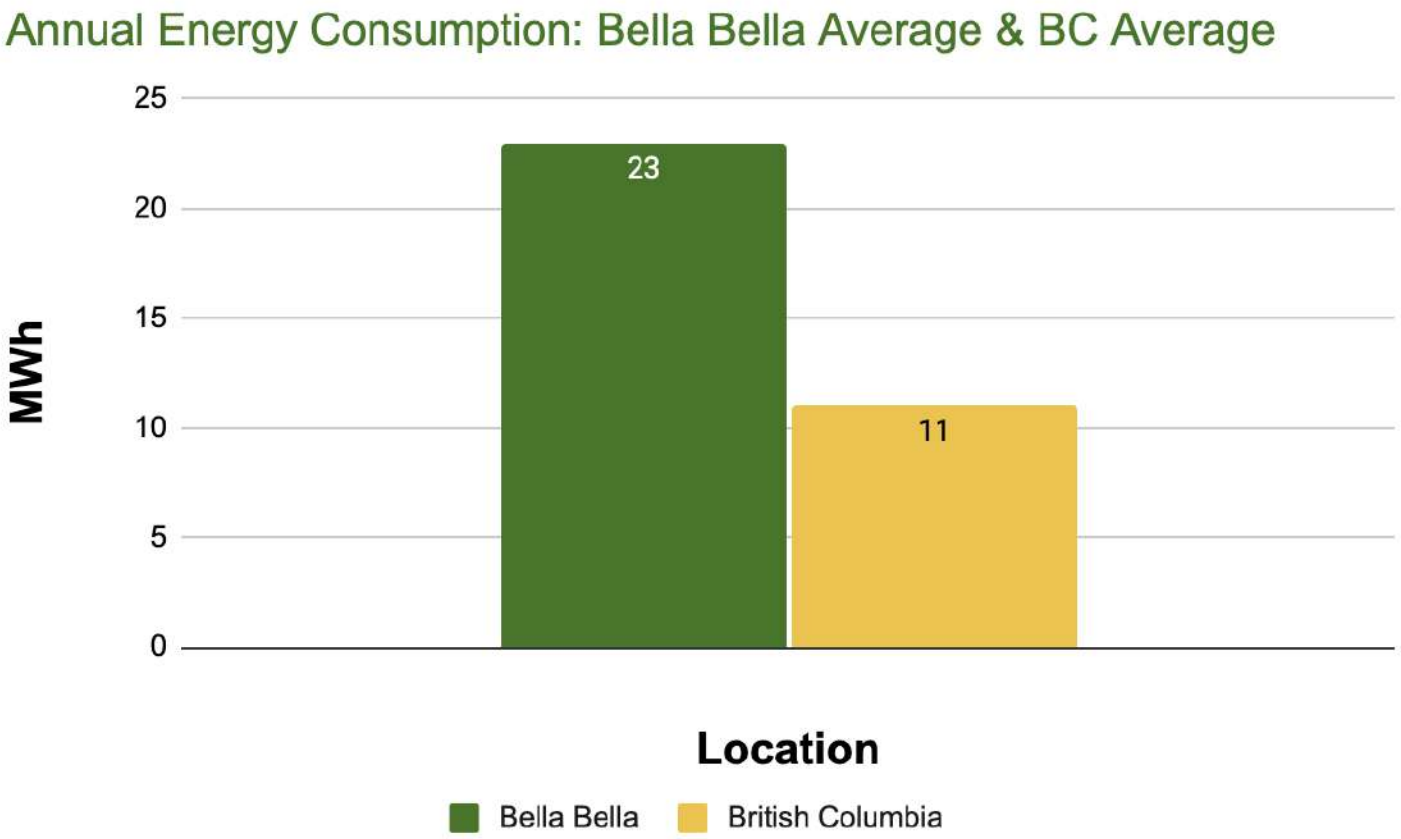
- Significant changes in the population
- Completion of a major energy project
- Changes to community energy policies
- Major infrastructure projects drawing significantly more energy from local energy systems.

The HCAT will continue to monitor major milestones in our community that require an update to the HCEP, and gather important information for the 5 year updates



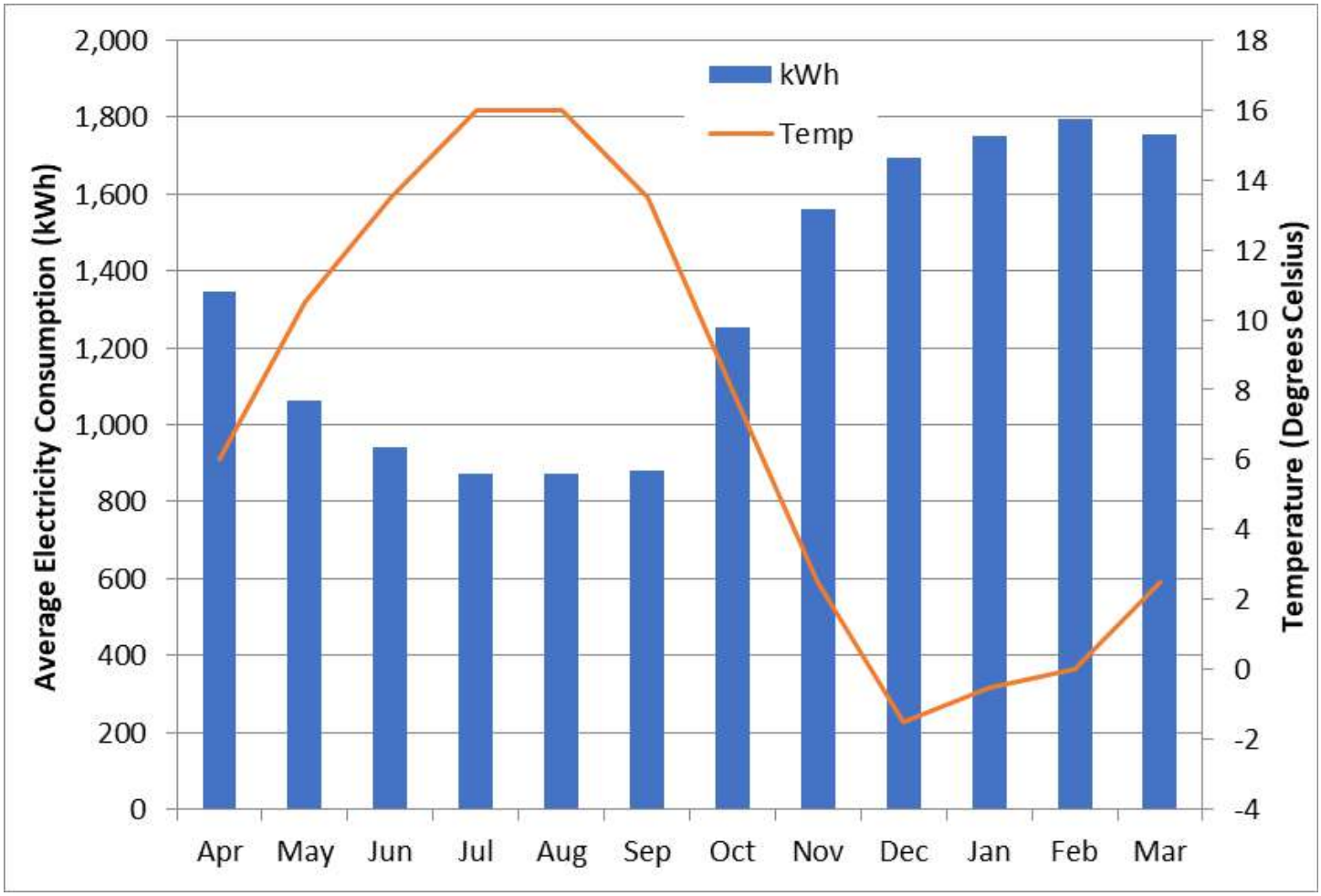
6. Energy Profile

6.1. Current Electricity Energy Demand

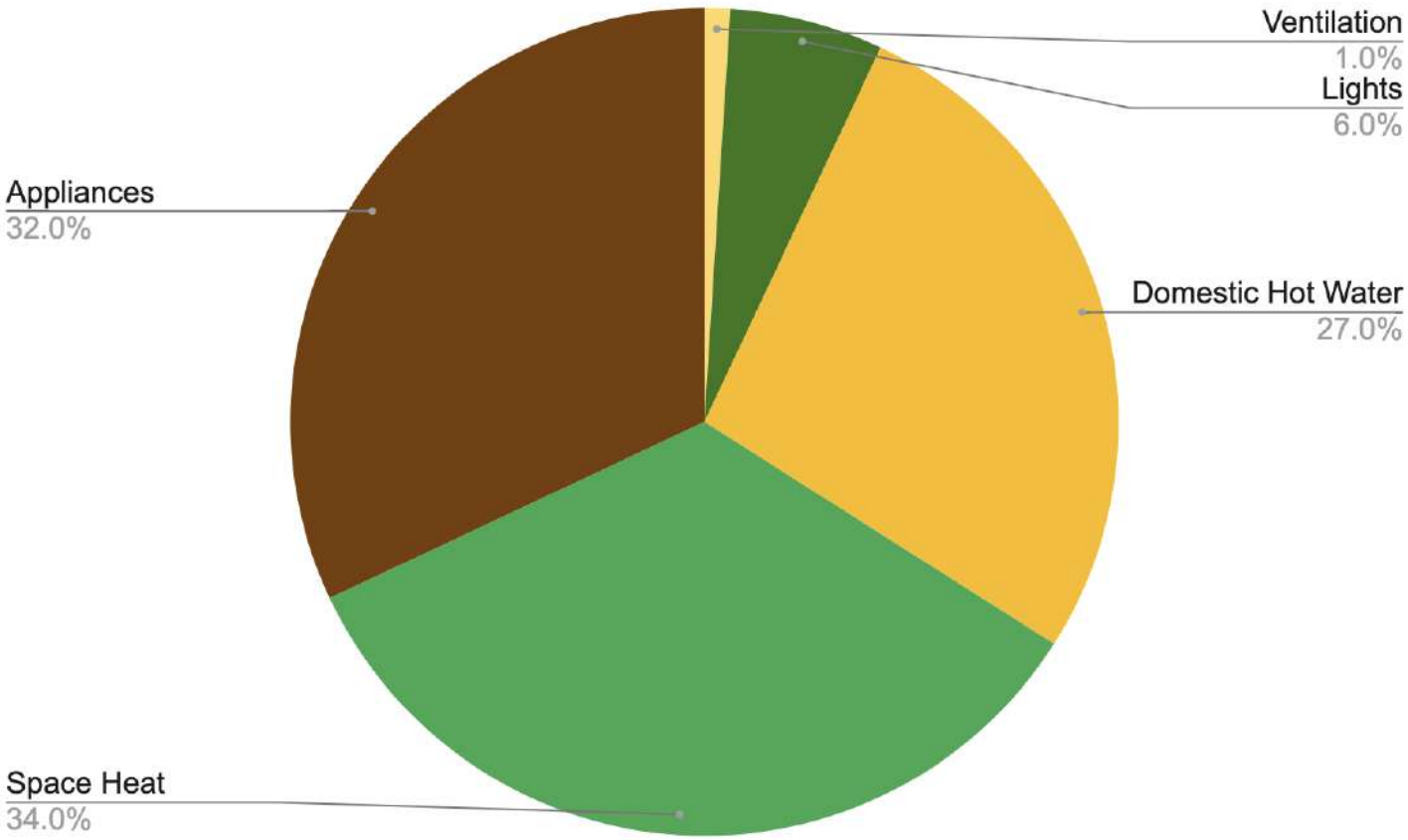


The average Bella Bella home consumes double the amount of electricity than the average home in British Columbia, 23 Megawatt Hours (MWh) compared to 11. This is likely caused by overcrowded conditions in homes, with many people having their energy needs being met per home, a lack of energy efficiency upgrades, and the high-speed winds that quickly remove heat from homes. Another likely reason is the amount of fridges and freezers utilized to store foods and goods gathered from Haíłzaqv territory, many of which could be energy inefficient.

The average Bella Bella home consumes double the amount of electricity than the average home in British Columbia.



Average residential electricity consumption follows a typical seasonal pattern where usage drops off as the weather warms up in summer, then as fall and winter arrive, the consumption increases.

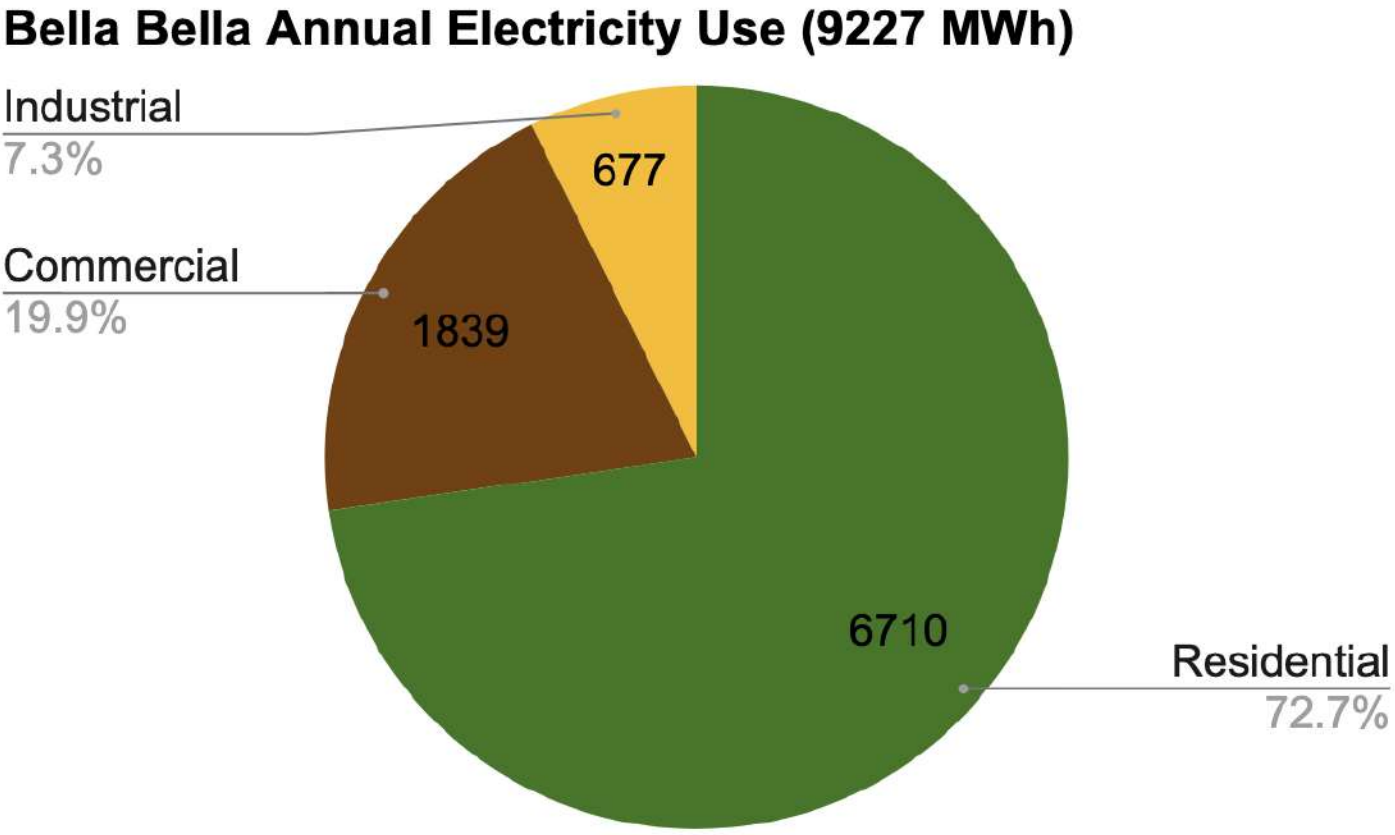


Based on models of Bella Bella home energy consumption[5], space heat is the largest end use and is estimated by calculating the weather sensitive portion of load and reflects the entire residential sector (electric and non electric heated homes). Appliance and domestic hot water are also significant end uses, followed by lighting and ventilation.

6.1.1. Annual Electricity Demand

Electricity demand in Bella Bella is consumed exclusively in our homes and buildings. Though there are few electric vehicles in our community, they represent a relatively minor amount of electricity consumption. Moreover, these vehicles currently are charged from people's homes, which would be captured in the dataset below.

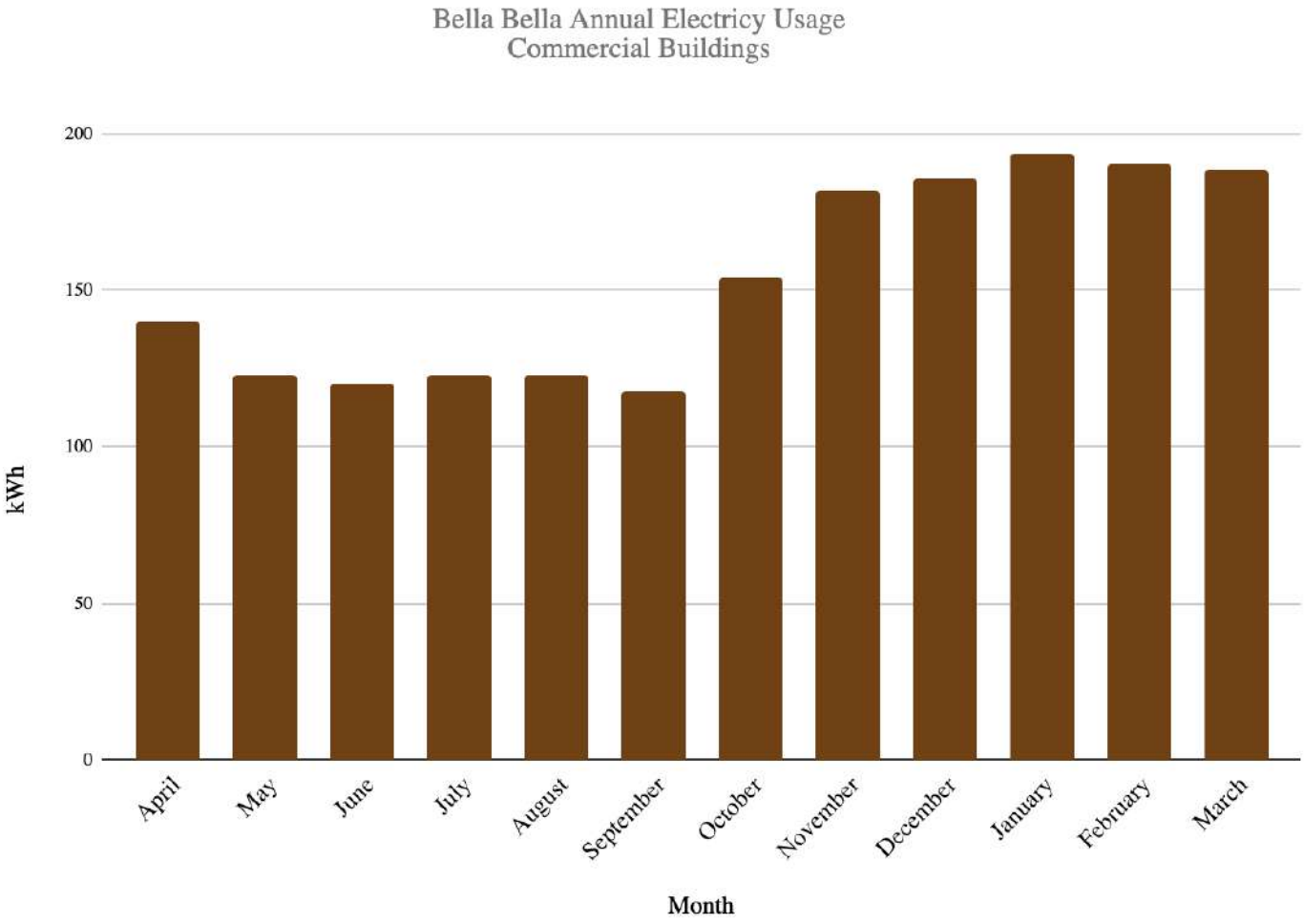
[5] BC Hydro, Bella Bella Electricity Profile, 2022.



On an annual basis, Bella Bella consumes 9,277 MWh of electricity across our commercial, industrial, and residential buildings. As demonstrated in the graph above, residential buildings are the largest demand on our local electrical grid, representing 72.7% (6710 MWh) of our electricity consumption. Commercial buildings consume 19.9% (1,839 MWh), and the remaining 7.3% (677 MWh) is used by our Industrial buildings.

The following sections provide a monthly breakdown on each of these categories. These monthly breakdowns also highlight how the demand for electrical energy varies across the year, with the lowest demand from April-September and the higher demand from October-March. These changes in demand represent the increased need during winter months, which is likely from greater heating needs and more time indoors.

6.1.1.1. Commercial Buildings



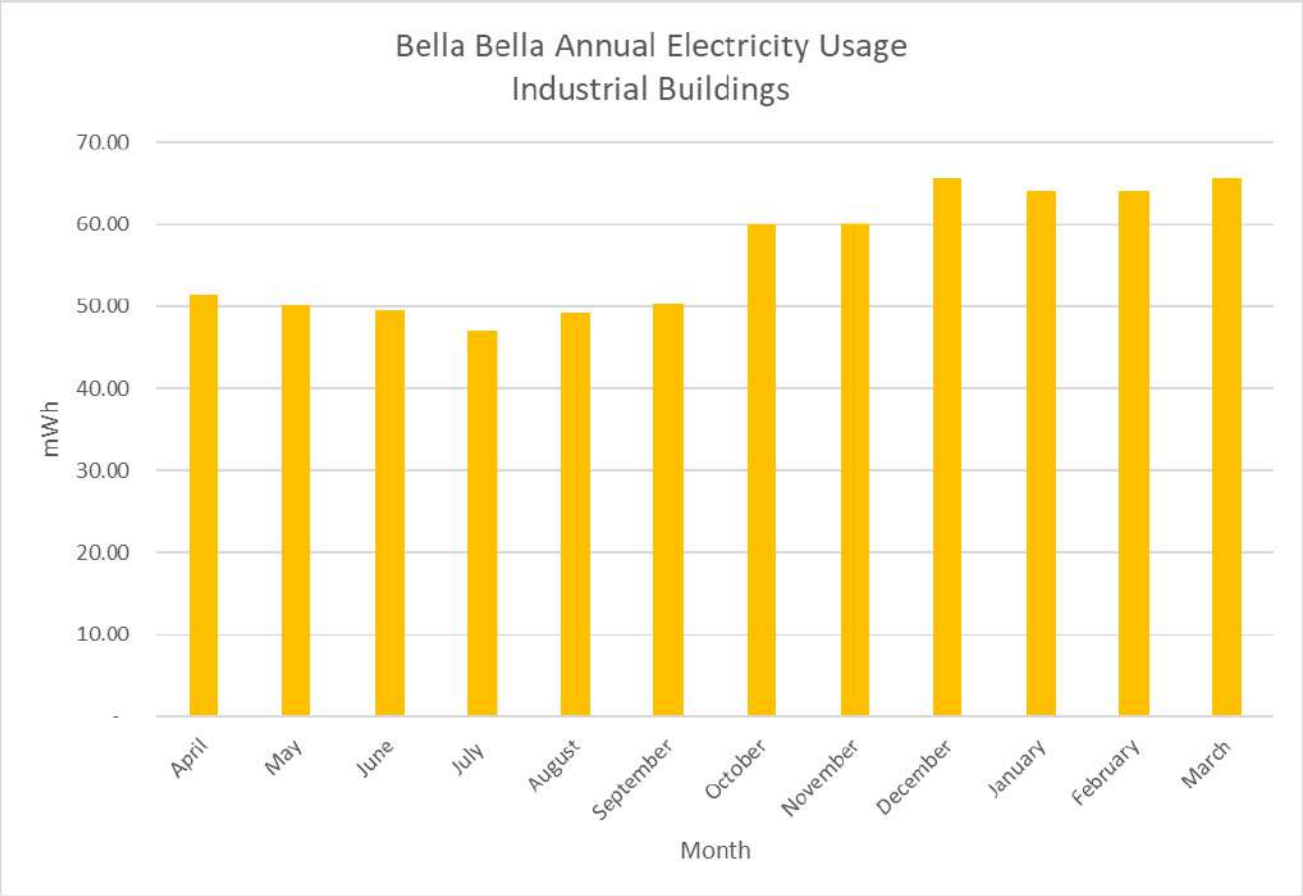
Bella Bella Commercial Buildings' annual electrical consumption varies across the year.

April – September	below 150 MWh/month
October-March	above 150 kWh/month

Similar to the residential sector, there is a strong seasonal pattern in consumption which highlights the significant use of electric space heat in the community.[6]

[6] BC Hydro, Bella Bella Electricity Profile, 2022.

6.1.1.2. Industrial Buildings



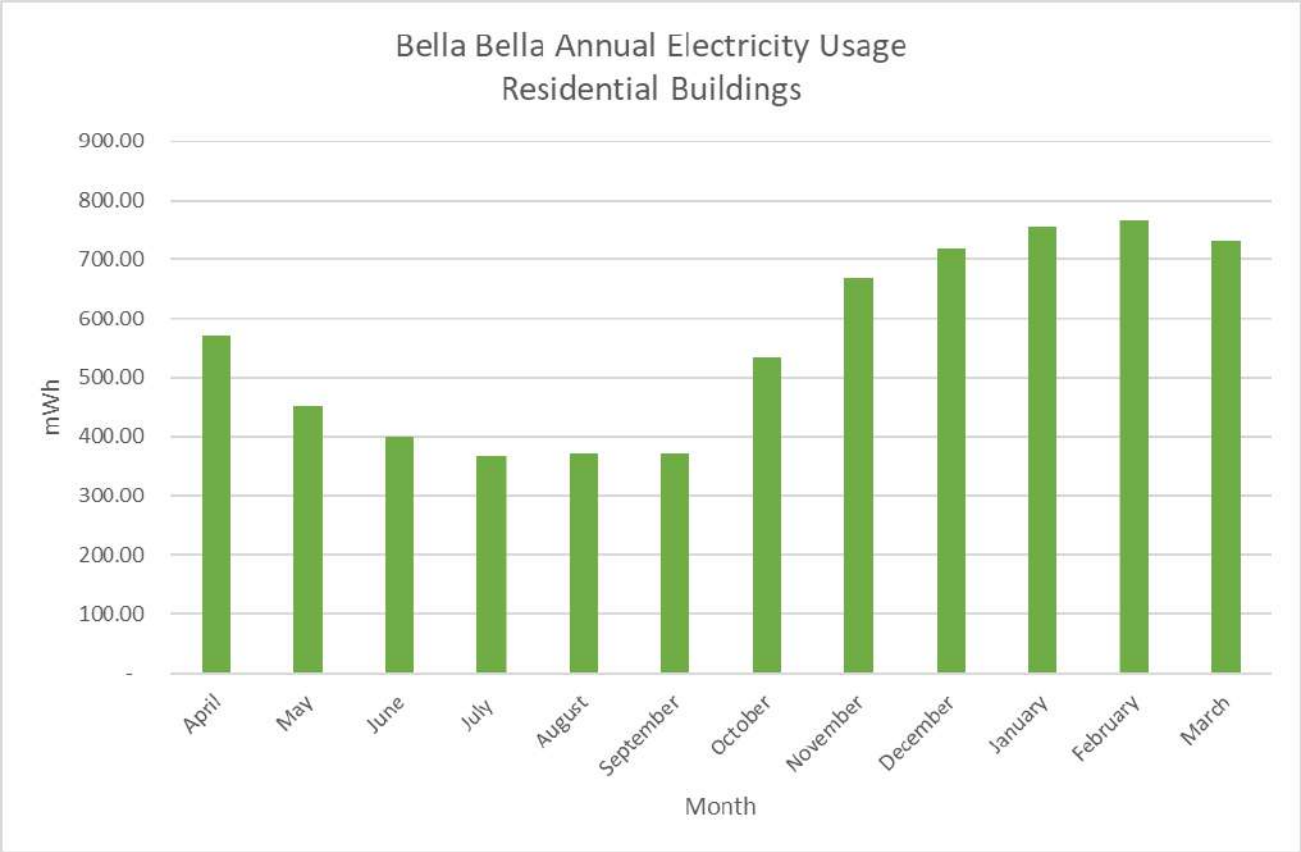
Bella Bella Industrial Buildings average electrical consumption varies across the year

April – September	around 50 MWh/month
October-March	60 - 65 MWh/month

Electricity use in from industrial customers is less impacted by weather suggesting loads are primarily related to process loads, lighting and equipment[7].

[7] BC Hydro, Bella Bella Electricity Profile, 2022.

6.1.1.3. Residential Buildings



Bella Bella homes have the greatest variation in electricity consumption across all 3 categories

May – September	below 500 MWh/month
April, May and October	500-575 MWh/month
November – March	ranges from 650 - 875 MWh/month

6.1.2. Emissions from Electricity

The greenhouse gas emissions for electricity were calculated using the electricity emission factor in *2018 B.C Methodological Guidance for Quantifying Greenhouse Emissions*. While

Haíłzaqv is not connected to the provincial grid, it obtains electricity from BC Hydro's non-integrated grid-supplied primarily by Ocean Falls small hydro system, with diesel backup generators. This system is assumed to produce similar emissions as the provincial grid, which is primarily hydroelectric generation with some fossil fuel generation.

Bella Bella consumes 9,277 MWh (MWh), or 9.28 Giga-Watt hours (GWh) of electricity. Using the BC Hydro Emission Factor of 10.67 tonnes CO2e per Gigawatt-hour (GWh), Bella Bella emits 99.02 tonnes CO2e per Gigawatt-hour (GWh). This is a low total emission, especially considering the energy yield provided by this system. However, it is worth recording how emissions from electricity continue to rise as we electrify transportation and home heating systems, though it will still be a net-reduction of emissions when displacing fossil fuel demand.

6.2. Annual Fuel Demand

Annual Fuel Demand was estimated based on:

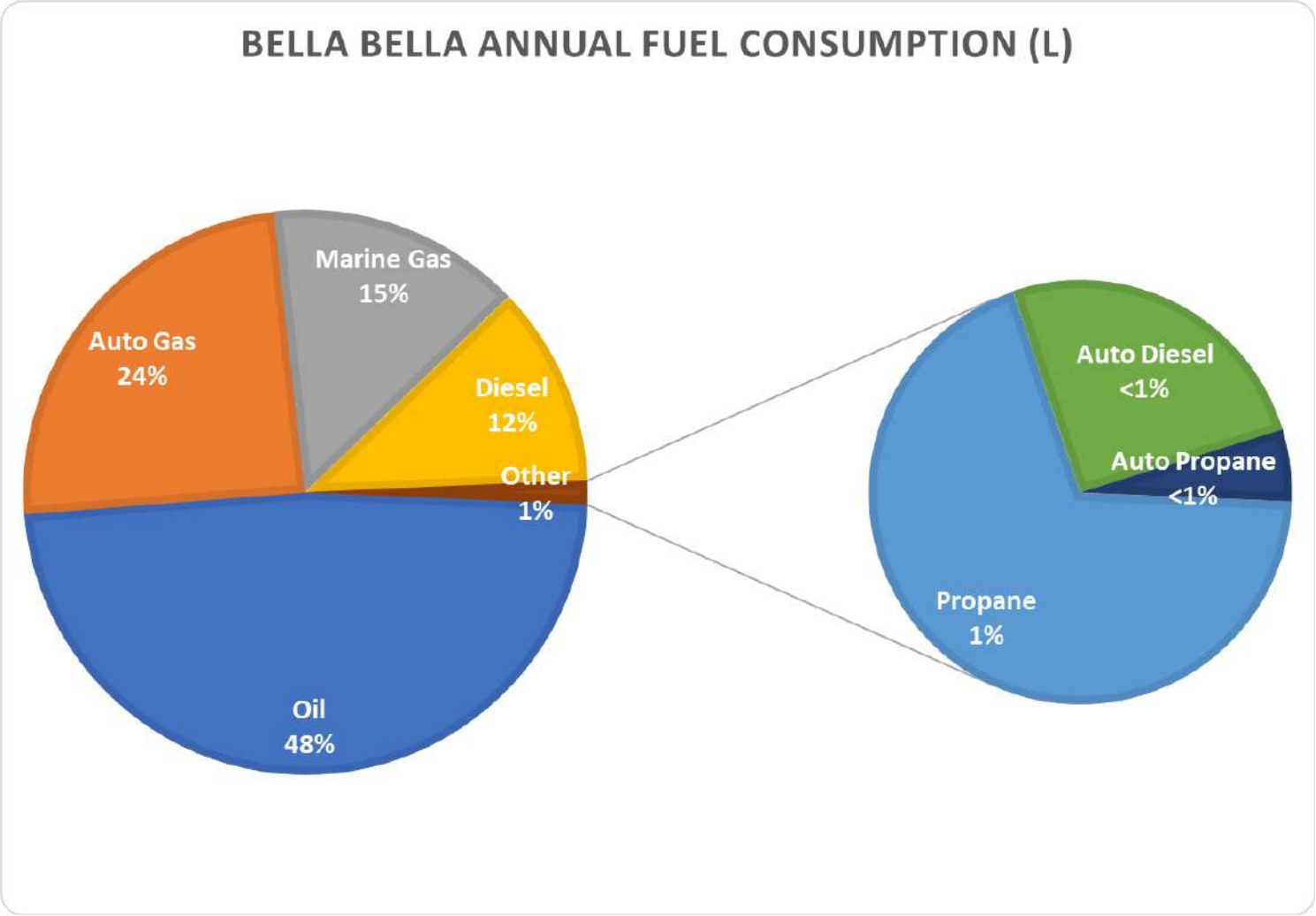
- 2 years of Bella Bella Fuel Station quarterly reports on fuel purchase orders of gasoline (marine and automotive), diesel (marine and automotive), propane, and oil.
- Oil consumption estimates from Innes Hood Consulting Inc.

Each fuel categories end-uses are assumed below

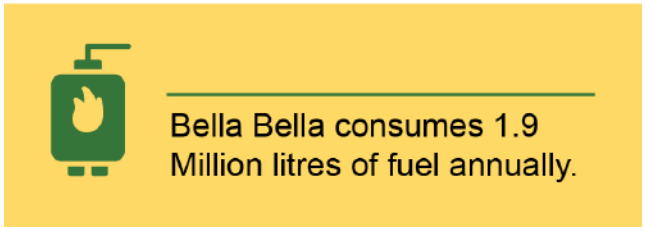
Fuel Category	End-Uses
Oil	Home and building heating
Auto Gas	Vehicle transportation
Marine Gas	Marine transportation
Diesel	60% for home heating, 40% for community building heating and contractor activities (heavy equipment) in the community.
Propane	Assumed to be used in homes and the Hospital.
Auto Diesel	Diesel for transportation, possibly includes marine fuel.
Auto Propane	Propane for transportation, likely machinery.

> I know it is extremely doable to get Heiltsuk off of fossil fuels with our culture, ways of being and knowing.
>
> **- Haítzaqv community member**

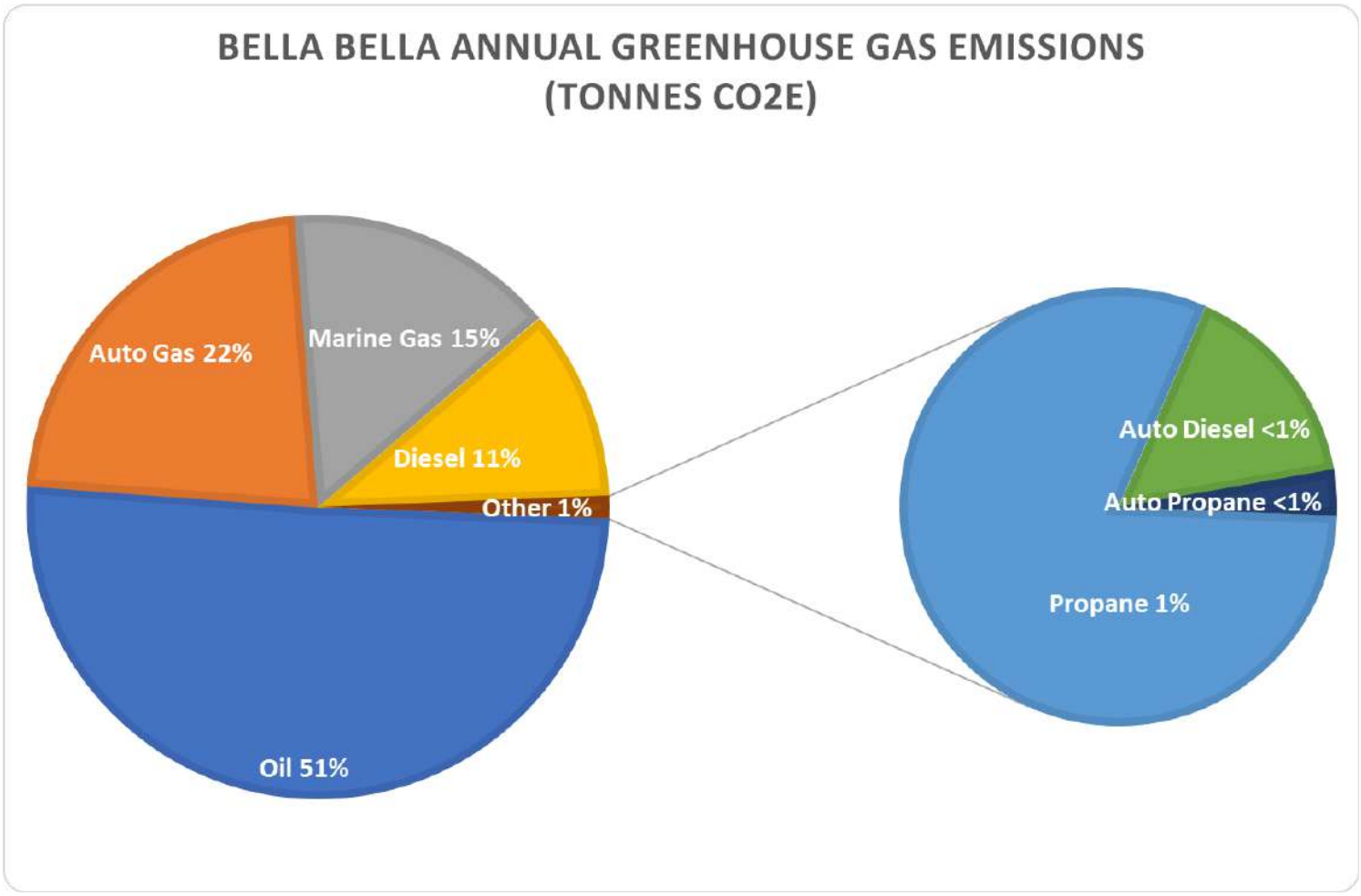
6.2.1. Consumption (Litres)



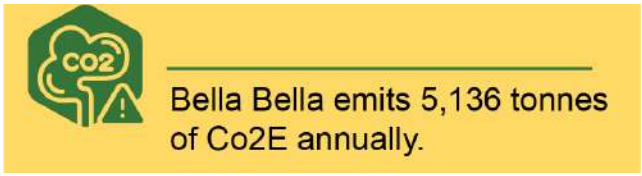
Bella Bella consumes 1.9 Million litres of fuel annually. Oil is 48% of fuel consumed in Bella Bella and is the largest category. Oil is used to heat many homes and key buildings in the community. Auto gas is 24% and the second largest category, which is used to support the vast majority of vehicle transportation fuel consumption. Marine gas is 15% of fuel consumed, which is used by both local and traveling boats. Diesel is 12%, of which 60% is for home heating and 40% for community building heating and contractor activities (heavy equipment) in the community. The remaining 1 percent is mostly propane, followed by auto diesel and auto propane, respectively.



6.2.2. Greenhouse Gas Emissions (Tonnes Co2E)



Greenhouse gas emissions of Bella Bella fuel consumption was calculated using publicly available conversion data[8]. The unit of measure is *Tonnes Carbon Dioxide Equivalent* (Co2Et), which aggregates all the greenhouse gas emissions associated with each fossil fuel and represents them as being equivalent to carbon dioxide as a greenhouse gas.



Bella Bella emits 5,136 tonnes of Co2E annually. 51% of these emissions come from oil, which is used to heat homes and buildings. 22% of emissions comes from auto gas, which is vehicle transportation in and around the community. Marine Gas is 15% of emissions, meaning that marine transportation is our 3rd highest emitting sector. Diesel is 11%, of which 60% is for home heating, with the other 40% for community building heating and contractor activities (heavy equipment) in the community. The remaining 1% is largely propane, followed by auto diesel and auto propane, respectively.

6.2.3. Oil Heating

Oil Heating is both the largest category of fuel consumption and the majority of emissions in Bella Bella. This category heats many of our communities' homes and major buildings.

There are many opportunities for the HCAT and Heiltsuk Nation to reduce our oil consumption. One initiative already taking place is the installation of heat pumps within homes across the community, which has not only reduced emissions but saved homeowners money. Additional initiative includes further fuel switching in homes, such as installation of catalytic wood stoves, which are much more energy efficient than conventional wood stoves. Firewood can also be sourced locally from residents, with the overall supply requirements reducing dramatically annually. These residential fuel switching initiatives could also reduce emissions from diesel related to home heating.

[8] Ministry of Environment and Climate Change Strategy. *2018 B.C Methodological Guidance for Quantifying Greenhouse Emissions: For Public Sector Organizations, Local Governments and Community Emissions.* 2018.

Our large buildings in our community, such as our school and bighouse, are also heated by oil. These larger buildings could offset some of their heating demand by also converting to heat pumps in certain segments of each building. Battery bank storage or solar installations could offset the electricity demand from fuel switching these buildings. Further research will be required to understand the feasibility of these options.

6.2.4. Gasoline

The second largest category of emissions is gasoline from our vehicles. Fortunately, many non-emission or low-emission vehicles are becoming commercially available, with decreasing prices annually. Given the short distances driven within Bella Bella, and the massive change we would see in our fossil fuel consumption, the adoption of electric vehicles by many people is quickly becoming a more viable option. However, some barriers to adoption remain, including:

- **Charging infrastructure:** both locally and in connecting communities like Prince Rupert, Terrace, Port Hardy and Campbell River)
- **Costs:** Many electric or hybrid vehicles have higher “sticker prices” when compared to gasoline models. Although maintenance costs are lower, access to servicing is less certain when coming from a remote community, creating a resistance to adoption.
- **Repairs:** battery-banks within electric or hybrid vehicles requires a unique skill set and tools not typically seen in remote communities. High initial purchase costs compared to fossil fuel vehicles, increase in electricity bills (despite savings in gasoline consumption)
- **Utility:** many electric vehicles are compact or SUV sized, with many people need trucks with high performance while retaining enough range to travel outside of Bella Bella

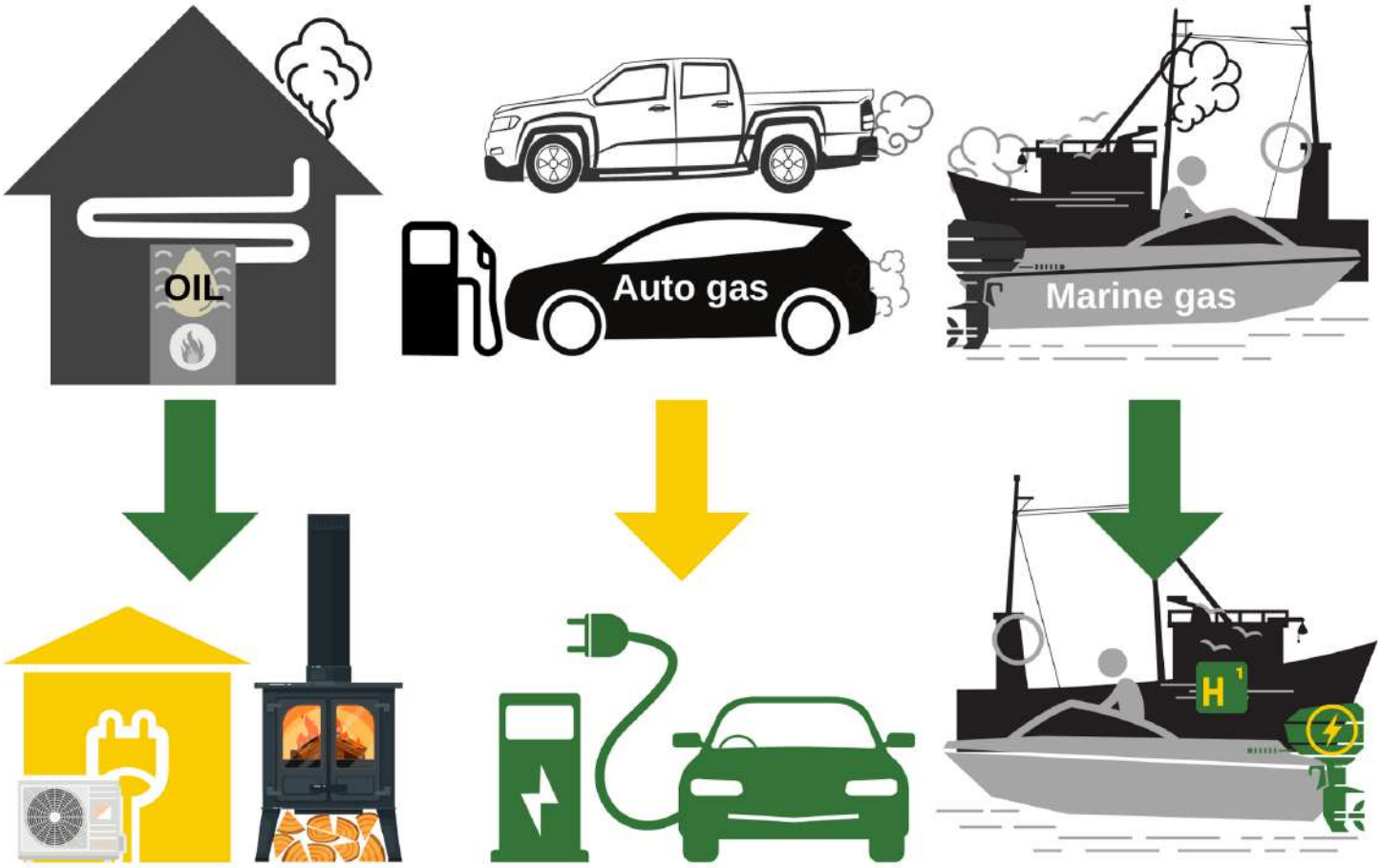
  Nevertheless, non or low emitting vehicles are available in a greater variety every year. Moreover, many nations (including Indigenous Nations) recognize the need to embody their values in their way of life and to address climate change impacts.

  Heiltsuk Nation can become proactive in the change to electric vehicles by both installing electric vehicle infrastructure (i.e. fast charging stations) within town, and purchase electric vehicles for use by major entities in town (e.g. Heiltsuk Tribal Council,

Hailika'as Heiltsuk Health Centre Society, Elder's Building, etc.). By taking these proactive steps, Haíłzaqv Nation can both reduce its greenhouse gas emissions while also providing a transportation system that reflects our ğvi̓ḷás.

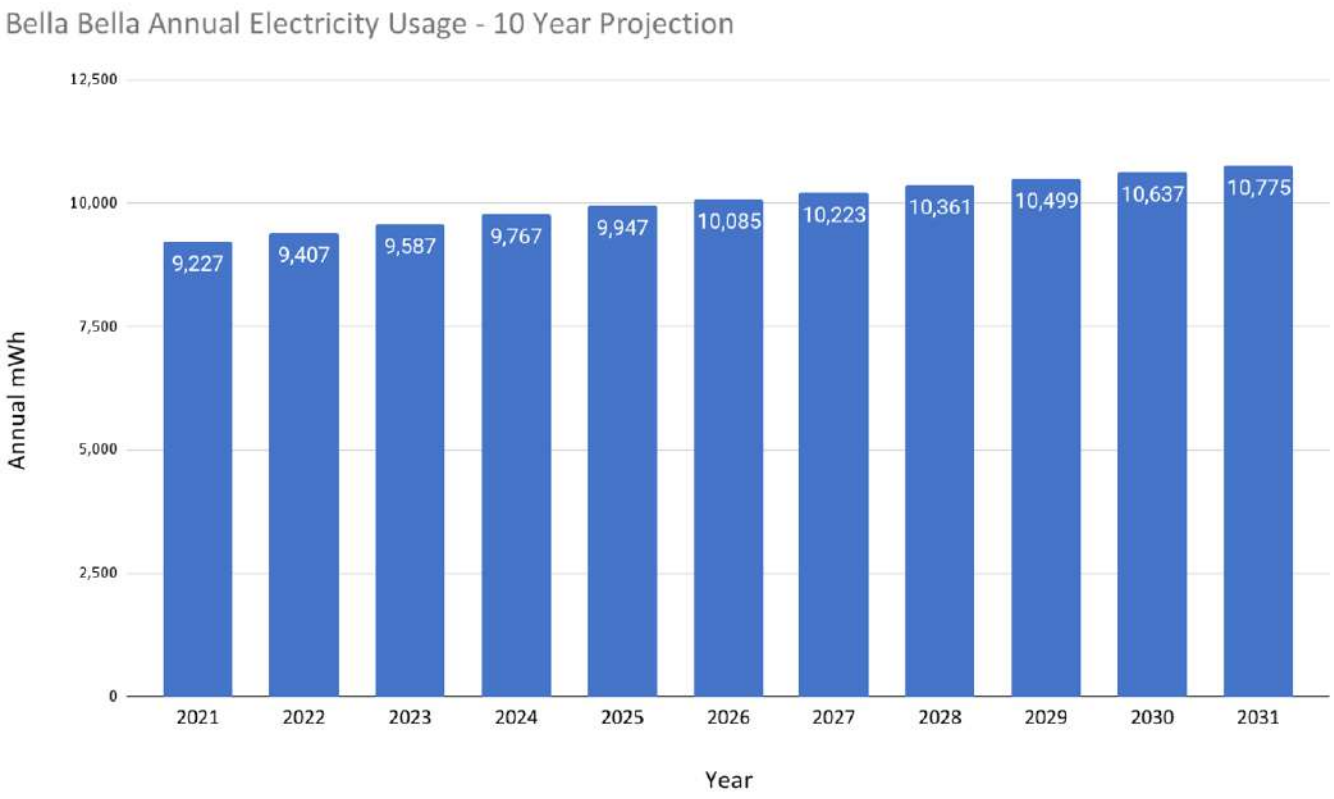
6.2.5. Marine Gas

Marine Transportation is the third largest section of emissions in Bella Bella
This represents another opportunity for changes in our transportation systems. However, infrastructure and technology for fully electric marine transportation is not as readily available when compared to electric vehicles, while often being cost prohibitive. Interim solutions, however, may serve as a placeholder until greater solutions are available. For example, the use of an electric "kicker" motor when trolling, or the local use of biodiesel can reduce emissions significantly in this sector. Further research must be done, and future versions of the Community Energy Plan should consider the technological advances and policy regulations associated with this sector.



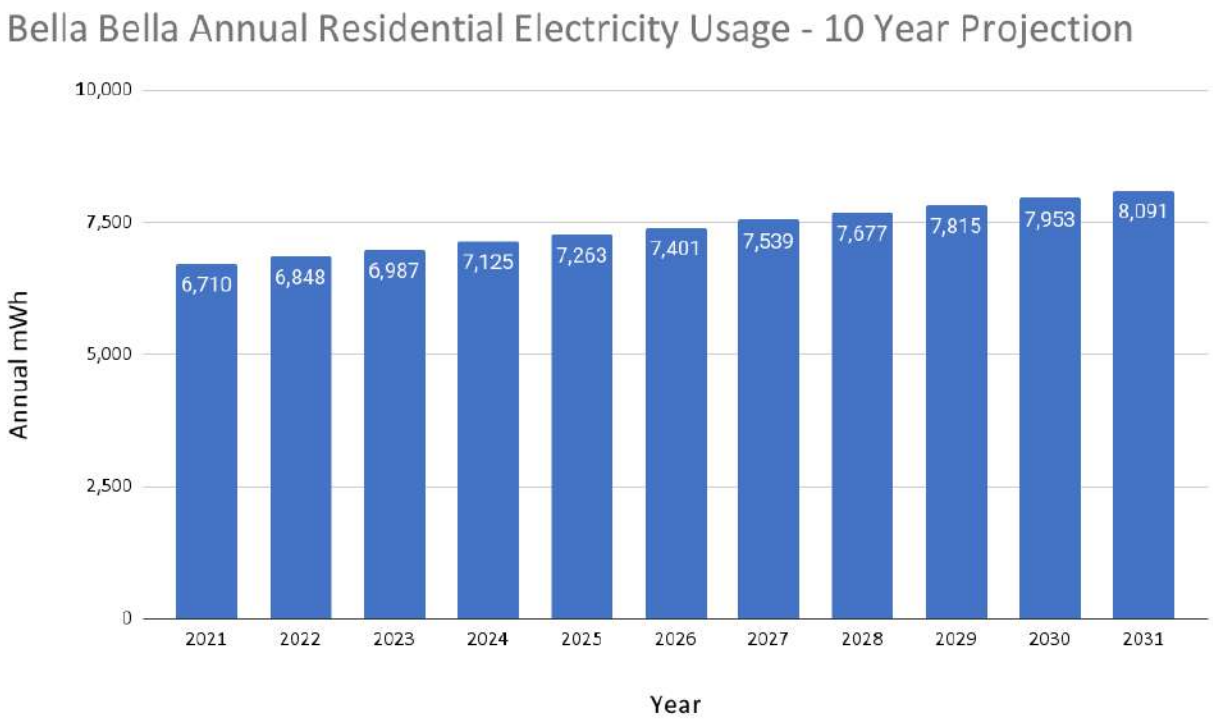
6.3. Electricity Demand - Near Term

6.3.1. 10 Year Projection



By 2031, Bella Bella will require at least an additional 1,548 MWh of electricity annually to meet our new buildings and services. This should be considered a minimum, as this does not account for any additional buildings that have not been identified at this time. This represents a 17% growth over a ten year period. The sections below provide further detail on the categories of buildings projected growth.

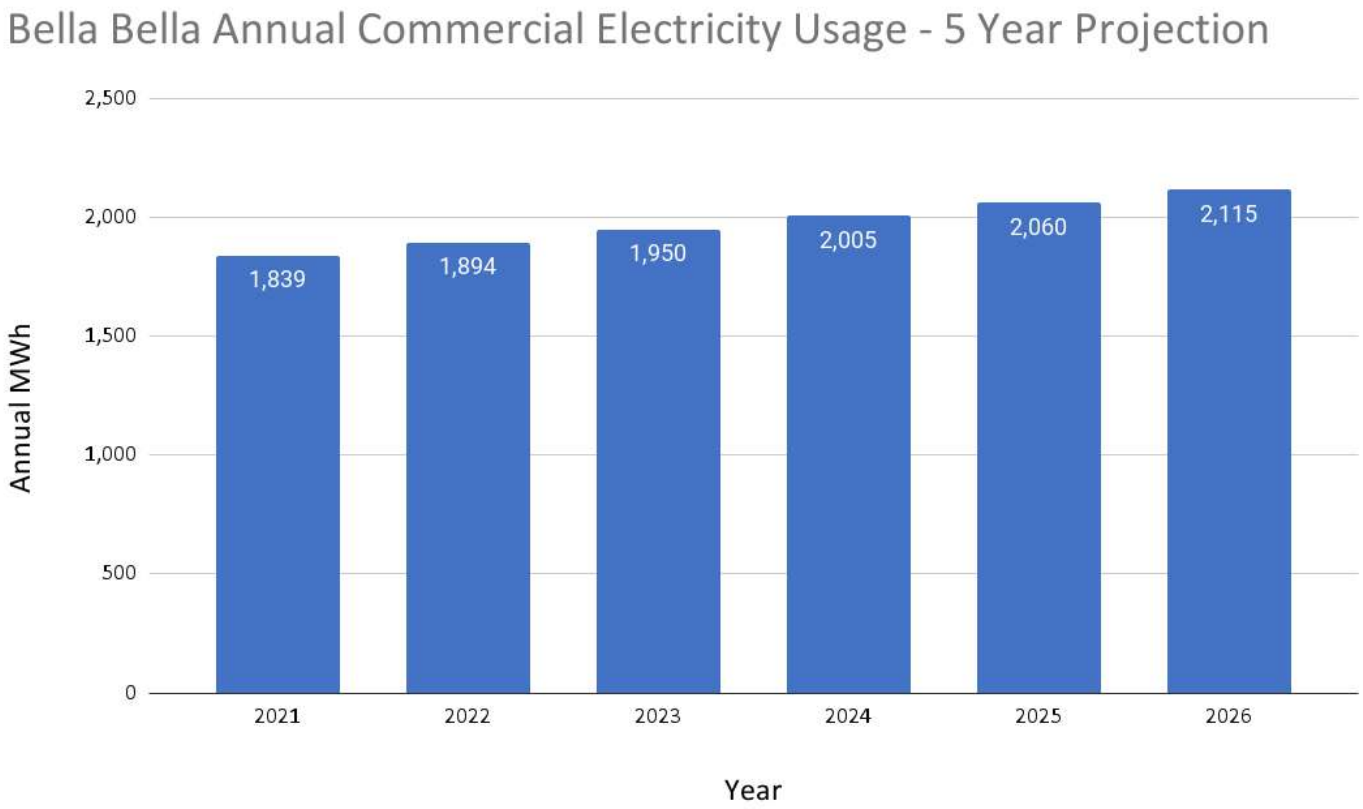
By 2031, Bella Bella will require at least an additional 1,548 MWh of electricity annually to meet our new buildings and services.



To meet our current housing demand, Bella Bella will have to build at least 200 homes. With 486 homes currently in Bella Bella, this represents a 41.15% growth in this category, both the number of homes and the annual electricity consumed. Bella Bella homes currently use 6,710 MWh of electricity annually.

The graph above assumes that these 200 homes could be built over 20 years at a rate of 10 homes per year. This represents an increase of 2.06% per year, which results in an additional 1,381 MWh required annually by 2031. As a result Bella Bella homes will require 8,091 MWh of electricity annually in 10 years.

6.3.2. Commercial Buildings



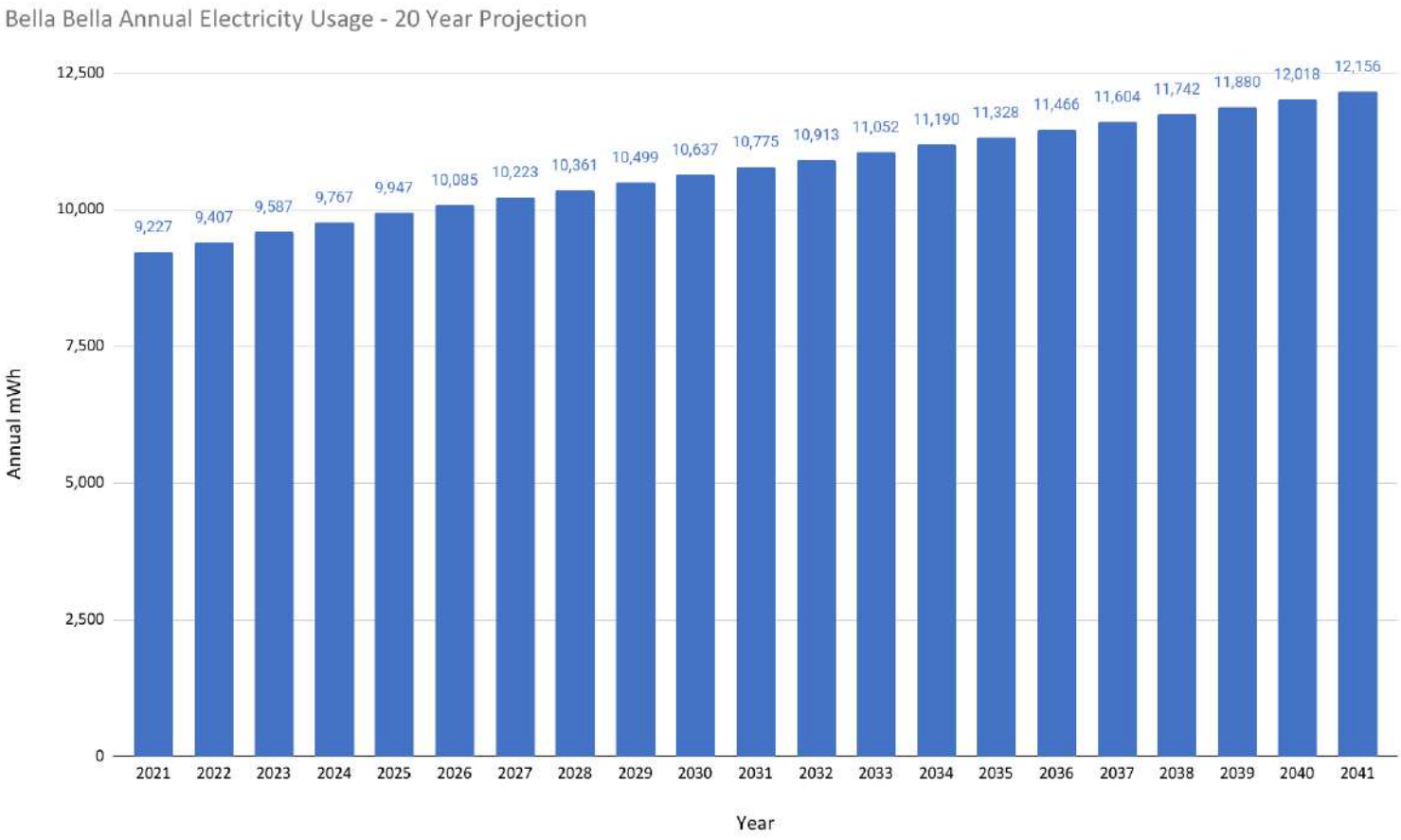
Haíłzaqv Nation is currently planning at least 5 major commercial buildings are completed within the next 5 years. These projects include:

- Hospital
- Elder's Long Term Care Facility
- Governance Building
- Language Nest
- Civic Centre

Based on current average commercial building annual electricity usage, this represents an additional 15% growth. Assuming these buildings will be completed over 5-years leads to a 3% growth annually. By 2025, this would result in an additional 275 MWh annually, with a 2,115 MWh total demand from our commercial buildings.

6.4. Electricity Demand - Long Term

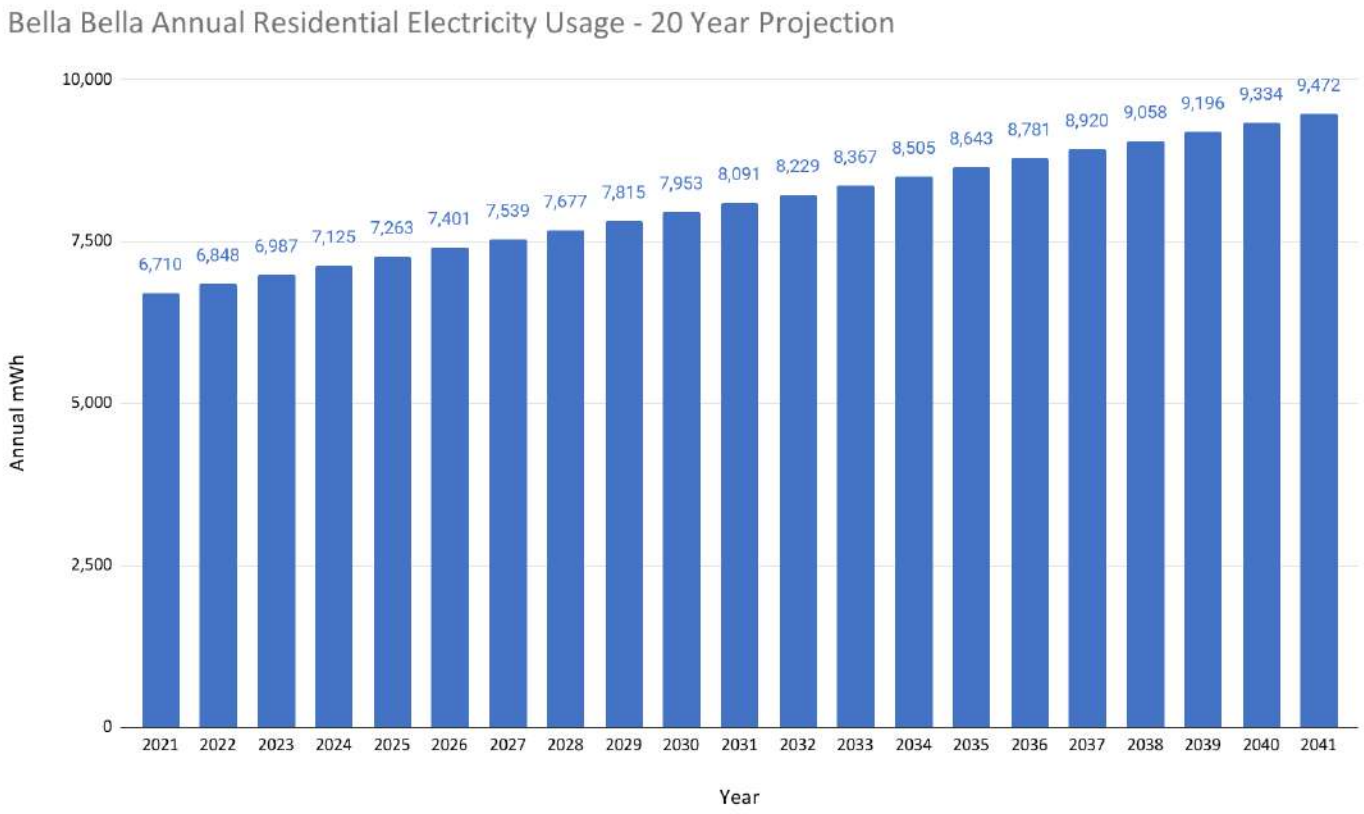
6.4.1. 20 Year Projection



By 2041, Bella Bella will require at least an additional 2,929 MWh of electricity annually to meet our new buildings and services. This should be considered a minimum, as this does not account for any additional buildings that have not been identified at this time. This represents a 32% growth over a twenty-year period. The sections below provide further detail on the categories of buildings' projected growth. Note that there is no data on future industrial buildings and there is no forecasted growth for this category, but current demand is included in the combined category projections.

By 2041, Bella Bella will require at least an additional 2,929 MWh of electricity annually to meet our new buildings and services.

6.4.2. Residential Buildings



As outlined in section 5.5.1, Bella Bella will have to build at least 200 homes to meet the current housing demand. This trend assumes all of this demand will be met within 20 years. This is considered a long-term time electricity demand projection as it extends beyond the scope of the HCEP. However, given that we understand the total current demand and that we assume it will take 20 years to meet, we can naturally project this category further.

The graph below continues the assumption of 2.06% annual growth in electricity demand in our residential buildings. In 2021, Bella Bella homes used 6,710 MWh of electricity annually. By 2041, an additional 2762 MWh will be required annually for our homes, with a total demand of 9,472 MWh of electricity annually.

7. Energy Projects

The following section outlines current and future energy projects and initiatives within Heiltsuk Nation. Categories include:

- Demand Side Management
- Fuel Switching
- Infrastructure

7.1. Demand Side Management

The HCAT has collaborated with many partners to create solutions to increase energy efficiency in our homes and buildings, while also decreasing costs to homeowners. These efforts result in a decrease in electricity demand without reducing results from local electrical energy systems. This collectively is known as “demand side management”. The section below outlines demand side management solutions to date, while also outlining future demand side management opportunities.

7.1.1. Home Energy Audits

The first step to improving energy efficiency in homes is understanding areas of improvement. To create this understanding, Home Energy Audits were conducted in Bella Bella homes that were interested in participating. The Audits involve a 1–3-hour site inspection of each home, conducted by a certified Energy Advisor and highlighting areas for light retrofits (door draft blockers, LED light switching, sink aerators, etc.) and deep retrofits (installing energy efficient windows, insulating walls, replacing siding, energy efficient appliances, etc.). Each home received an audit report that includes renovation recommendations, energy ratings, and building envelope information. Depending on the number of assessments completed at a time, reports could be expected one to three weeks after the site inspection.

26 Home Energy Audits were completed in March 2021 as prior to heat pump installations. Home Energy Audits results found that air sealing had the second largest energy savings potential for homes. The assessments found, on average, completing comprehensive air sealing in a home can reduce annual energy consumption by up to 15.4GJ/year, which is

equivalent to around $500 in savings per year. Air sealing was the top recommended project for 21 of the 23 homes. Air sealing would also improve the comfort of homes by retaining warm air for longer periods of time and preventing cool, outside air from entering at high rates.

Next Steps

One Haíłzaqv member is currently going through Energy Advisor training and certification process and could be available to complete most of the assessments. This member would need to shadow a fully certified advisor to start but would be able to complete the work alone thereafter. The Haíłzaqv Climate Action team will work to bring this auditing expertise into the community by training further community members and make Home Energy Audit available to all homes in Bella Bella.

7.1.2. Eco Kits

Many homes in our community need large and small improvements to improve building quality, household comfort, and energy efficiency, which were identified in many homes during the Home Energy Audits. Eco Kits have been able to address many of the light retrofits required to make homes more energy efficient.

Items included in the Eco Kits:

Products	#	Products	#
LED light bulbs	25	Door threshold	2
LED night light	1	Backer rod (package)	1
Kitchen faucet aerators	1	Cauk (tube)	1
Bathroom faucet aerators	2	Low expansion spray foam (can)	1
High performance showerhead	1	Draft proofing foam tape (roll)	1
Door sweeps	2	Window film (roll)	1
Outlet gaskets (10 per pack)	3	Smart strip	1
Pipe wrap for hot water tank	3	Fridge thermometer	1
Dryer rack for clothesline	1	Attic hatch insulation	1
Combination CO/smoke monitor	2		

Completing all of these small upgrades could save hundreds of dollars in annual energy costs for each home. 100 Ecokits have been distributed to homes. Installing Eco Kits into all of our homes would help increase energy efficiency and reduce heating issues. This would improve home comfort, reduce energy use, and help homeowners save hundreds of dollars in annual energy bills. Installing Eco Kits would involve hiring and training Haíłzaqv members to support installation work. The Haíłzaqv Climate Action Team has funding in place to pay for this work.

Next Steps

The Haíłzaqv Climate Action Team will work with homeowners and renters to install Eco Kits in interested homes and ensure adequate funding is available.

7.1.3. ICCP Stream 1

Haíłzaqv Climate Action Team are participants in BC Hydro's Indigenous Communities Conservation Program (ICCP) stream 1. This stream provides the funding for Eco Kits, as well as salary support for training Haíłzaqv workers on both how to install Eco Kits and conduct Home Energy Audits.

Next Steps

Haíłzaqv Nation will continue to access this partnership support funds and training to ensure both Home Energy Audits and Eco Kits are available to all interested homes.

7.1.4. ICCP Stream 2

Haíłzaqv Climate Action Team are participants in BC Hydro's Indigenous Communities Conservation Program (ICCP) stream 2. This stream provides the rebates for deeper retrofits outlined in the table below, as well as training in "Best Practices for Air Sealing and Insulation Retrofits".

Rebates available in this program include:

Category	Retrofit / Upgrade	Rebate Amount (max/home)
Health and Safety	Renovation-enabling Activities (e.g. drywall/soffit repair, mould remediation, radon, asbestos, pests, etc.)	$1,000
Building Envelope	Attic insulation and draft proofing	$1,800
	Basement/crawl space insulation and draft proofing	$2,000

	Exterior wall cavity insulation	$2,000
	Exterior wall sheathing insulation	$2,000
	Other insulation	$1,500
	Windows/Doors	
	• Tier 1	$100 per w/d; Max$2000
	• Tier 2	$200 per w/d Max $,4000
Ventilation	Bathroom fans, ducts and installation	$1,200

Next Steps

The Haíłzaqv Nation will continue to access this partnership support funds and training to ensure rebates are received for all deeper retrofits to interested homes.

7.1.5. Retrofitting Community Buildings

Our buildings, just like our homes, can be made more energy-efficient through shallow and deep energy retrofits. Community buildings will require energy audits to be done. These can be done by certified energy advisors or done by someone with training, which the HCAT has already begun identifying interested Haíłzaqv members to receive this training and conduct these audits.

Retrofits can have a wide set of impacts when compared to other demand side management opportunities. It can:

- Improve the quality of community buildings
- Make buildings last longer and more climate-resilient
- Reduce the cost of operating community buildings through lower utilities
- Create local jobs and skills
- Reduce greenhouse gas emissions
- Reduce or even eliminate reliance on shipped-in fossil fuels

- Increase the sense of community pride

Next Steps

Shallow and deep-energy retrofits on community buildings in Bella Bella over a 5- year period. The aim would be to improve the energy efficiency of the buildings by at least 30% and transform their heating source from fossil fuel to renewable electricity. This project would include:

- Energuide Energy Audits and retrofit energy models for all four buildings
- Planning retrofits around an essential set of measures based on energy modelling
- Hands-on training for local construction crews on energy-efficient retrofits and constructions
- Implementing the retrofits, including replacing outdated boilers with zero-emission heating systems
    - Training for building employees around energy efficiency

7.2. Fuel Switching

The HCAT has collaborated with many partners to create solutions to switch our buildings and transportation to low or no emission fuel sources. These efforts reduce our communities emissions, while providing cost savings.

7.2.1. Heat Pumps

Heat pumps have been installed in many Bella Bella homes, displacing heating oil furnaces, our communities most greenhouse gas intensive source of heat. Since May 2021, 154 heat pumps have been installed. This represents a third of homes in our community. One home switching to heat pumps eliminates five tonnes of greenhouse gas emissions annually. Therefore, 770 tonnes of greenhouse gas emissions are abated per year when compared to heating oil furnaces. Moreover, Heat and electricity bills on average per annum were $3,600 per home in Bella Bella. After switching to a heat pump those bills decreased household energy spending by more than $1,500 per year.

Next Steps

The HCAT will continue to work with our valued partnerships to secure further funding for installation of Heat Pump in all interested Bella Bella homes.

7.2.2. Catalytic Wood Stoves

Many community members have expressed interest in catalytic wood stoves during our community engagement sessions. These wood stoves are much more efficient than non-catalytic wood stoves, which are the vast majority currently in Bella Bella. Catalytic wood stoves require much less wood due to longer burning times, which not only provides more efficient heat but also reduces the amount of labour time required to prepare enough firewood annually. This would provide an alternative fuel that has lower emissions and capable of providing a higher quality heat.

Next Steps

Further research on this option for heating in Bella Bella is required. The HCAT will work to identify partnership opportunities for feasibility studies, research and implementation of catalytic wood stoves where applicable.

7.2.3. Electric Vehicles & Community Transportation

Electric vehicle (EV) projects can unlock a variety of opportunities for people to become directly involved in the clean energy transition away from fossil fuel dependence. Using EVs will not only offset the environmental impact of gas-burning vehicles, but also stimulates conversations about how people use fossil fuels for their everyday needs.

Based on our community engagement survey, we are aiming to electrify 75% of our community transportation. Gradual implementation will ensure that the challenges are addressed at a small scale so that a larger future roll-out will be more successful in the future. Moreover, this approach will allow for further advancement in EV technologies that can meet our unique environmental and rural realities.

Next Steps

Install 10 (ten) EV chargers in our community and deploy 6 (six) EVs to serve the community. The scope of the project would include the following infrastructure:

1. Six Level 1 charging units to be equipped with the vehicles.
2. Four Level 2 charging units to be installed at central locations in the community for shared use.
3. Three sedan-style, four-door electric cars for in-community travel purposes.
4. Two SUV style EVs for travel in the community and out into the surrounding lands where off-road conditions may cause issues for cars to travel safely.

These charging stations will enable the transition to zero-emission vehicles such as electric cars, trucks and boats. This will encourage the uptake of zero-emission vehicles which make no pollution or noise, improving the quality of life for the community while reducing energy costs.

At this point in time rebates for Indigenous communities are up to 90%. These high rebates may not be around much longer, and the community would have to bear the cost of upgrading its transportation infrastructure.

With all-new technologies, there are always some risks involved. The station could break down and replacement parts could be expensive or take a long time or receive/ install. The percentage of the rebate value could decrease or our project may not get approved. However, Electric Vehicle adoption has been increasing globally, and greater choices in the EV market are coming year after year, making this initiative a highly-feasible option for Haíłzaqv Nation.

7.2.4. Electrified Vessels

The Haíłzaqv people are ocean-going people, who have lived and died by the sea for thousands of years. Our livelihoods are linked to the ocean through fishing, guiding, tourism, research, conservation and transport. Switching to electric modes of transport on the water will bring our community back into alignment with our Haíłzaqv value.

Community engagement sessions revealed a majority of respondents support the electrification of at least 50% of our local fleet, with a particular interest in the sea bus from Shearwater to Bella Bella.

Bella Bella is aiming to switch marine vessels to electric from gas/diesel wherever possible, with greater opportunities available over time. This will significantly reduce our greenhouse gas emissions because, as explained in section 5.1.3.4, marine transportation represents the third largest sector of transportation emissions. In addition to reducing emissions, the price of electricity from Ocean Falls is cheaper than gas and diesel, reducing fuel costs.

Electrification of Vessels in Bella Bella has two viable solutions in the near future:

1. Electrification of Campbell Island - Denny Island Seabus
2. Electric “Trolling” Motors for personal vessels

Electrification of marine vessels will require the installation of charging infrastructure at Martin’s Dock and the Government Wharf.

Although the technology available today is viable as a trolling motor and for sea bus electrification, however, further feasibility research is required for the additional weight of the batteries required to run the motors, the tested reliability and the cost still make this technologically prohibitive to many Bella Bella residents as a primary motor. This transition will provide an understanding of the feasibility of electric marine transportation in our community. Switching to electric boats will result in lower maintenance costs, though maintenance expertise will be required, and related opportunities must be available for our interested community members.

Despite the current challenges, successfully electrifying 50% of our marine vessels is a priority due to the major offsetting of emissions from our community while reducing the operating costs for local boat owners, all the while providing a quiet and non-emitting source of fuel.

The HCAT will work to identify partnership opportunities for feasibility studies, research, and implementation of electrified vessels.

Next Steps

1. Partner with the Province of BC to cost share the conversion of the seabus and trolling fleet.
2. Pilot Project for 1 year to trial electric systems in Haíłzaqv Homelands and installation of charging infrastructure.
3. Evaluate pilot project.
4. Expand electric options to all businesses and boat owners in Bella Bella, through available provincial subsidy programs.
5. As boats are replaced, ensure electric options are considered.
6. Within 5 years, up to 50% of boats operating in Haíłzaqv Homelands are electric.
7. Work with industry operators to mandate electrified marine vessels of their fleets.

7.2.5. Hydrogen-Fuel Systems

Hydrogen fuel systems are an emerging technology that could help our nation meet our clean energy goals. Hydrogen energy is considered by some to be the missing piece in renewable energy systems. It can be utilized in heavy-duty machinery - such as commercial fishing vessels and BC Ferries - while also being capable of renewable energy storage, making any wind/solar/tidal energy project much more reliable.

Hydrogen as an industry, and within Indigenous communities, is in its preliminary stages; however, the Province of British Columbia is eager to identify nations that would be interested in exploring this opportunity further via feasibility studies, capacity building and projects in 2030, as outlined the in BC Hydrogen Strategy[9] .

[9] Clean BC, *B.C. Hydrogen Strategy: A sustainable pathway for B.C.'s energy transition.* 2021. *https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/electricity/bc-hydro-review/bc_hydrogen_strategy_final.pdf*

Next Steps

Haíłzaqv Nation will engage Clean BC to understand the applicability of Hydrogen fuel systems in Haíłzaqv Territory.

7.2.6. Bio-Diesel

Bio-Diesel would be a relatively simple switch to a much cleaner fuel. Certain lubricants could also be substituted. Biodiesel is made from upcycling waste and plant materials, and has a proven track record of being simple, effective, and affordable. If all, or most, Bella Bella diesel vessels and trucks switched to renewable diesel over six months for example, studies show that their collective carbon emissions would drop by 60-90% and marine toxicity by similar ranges or more.

This initiative would bring biodiesel fuel to the Bella Bella fuel dock for local boat owners to test, evaluate and use instead of the dirty diesel that we now use. If adopted to substitute our diesel needs, an 80-100% reduction in air pollution from diesel-burning, while also reducing any potential toxic runoff in the water (salt and fresh) down to nearly zero, increasing the safety of seafood and marine life.

This is a simple switch to reduce our greenhouse gas emissions and bring our community more in line with living in balance with the natural world. This will also reduce marine toxins and allow us to be more respectful of our ocean resources and relatives.

Next Steps

- Establish an evaluation team that will oversee the delivery and loading of a substantial supply of renewable diesel into one of Bella Bella's empty fuel tanks.
- Do a controlled test with 50% of local fishing and other diesel vessels (possibly including the Klemtu & Shearwater water taxi) over 6 months to closely observe safety, emissions, performance, efficiency, and any other issues the team determines to be important.
- Search the scientific literature for other scientific studies (e.g. CARB California Air Resources renewable diesel Multimedia study), interview managers of the City and Port

of Vancouver two year renewable diesel implementation, and interview Capt. Wilcox for a long term perspective to gain further insights.

- Upon concluding the study, the team would write up and present a report to the Heiltsuk Tribal Council and members. This report would also be shared with other First Nations, and ideally with other Central Coast ports, marinas and resorts.

7.2.7. Back-Up System (Displace Diesel)

Although Bella Bella buildings are primarily powered by hydroelectric energy, we still utilize a diesel generator in the event of a power outage, which happens frequently in the winter months. Moreover, homeowners will utilize gas or diesel generators to power their homes during an outage, representing a hidden category not easily distinguished amongst our emissions data.

Moreover, the backup system will reach its cautionary upper threshold upon the completion of our Governance Building, creating an opportunity to create a new backup system. The new system should be placed within Bella Bella, at an adequate height above sea level, and utilize renewable energy. Battery and hydro storage may be good options but a solution will require feasibility assessments.

Next Steps

The HCAT will look for partnerships to conduct a feasibility study of renewable energy back-up energy systems for emergency use in Bella Bella.

7.3. Infrastructure

This section will outline infrastructure related to utilizing our clean energy systems, creating new energy efficient homes and utilizing roof-top solar.

7.3.1. Food Security

The Covid 19 crisis highlighted our lack of food security and has had major impacts to our Nation that are compounded with climate change. Failures in the fisheries due to commercial overfishing and climate change are putting a major stress on our protein resources. Moreover, due to our remote location, Bella Bella does not receive quality produce year-round.

Given these realities, the HCEP will work to advance 2 food security opportunities

- Creating a vertical-farm system to produce fresh and nutritious vegetables and fruit.
- Creating a land-based aquaponics system to support the production of freshwater fish, such as tilapia or sturgeon, while also creating high quality produce.

These initiatives would provide abundant high quality produce, while also creating a high-value commodity in sturgeon or tilapia farming. Moreover, since this is a land-based system, this would not impact our wild salmon populations.

This industry has the potential to create many highly skilled jobs, training opportunities and food to sell to both local restaurants and our own tourism industry. Moreover, advances in this area would reduce our Nations' greenhouse gas emissions by reducing the dependence on GHG-intensive produce that travels hundreds of kilometers to reach our community, producing local food from zero-emission sources, while at the same time giving us abundant healthy food.

Haíłzaqv Nation is fortunate to have Qqs Projects Society's *Granny's Kitchen* providing our community with high-quality, locally produced food. In 2020, Qqs Projects Society produced a Heiltsuk Food Security Plan[10]*,* which provides 25 community-based recommendations to advance culturally relevant food security initiatives for the Haíłzaqv Nation. We are also fortunate for our Waglisla Band Store, which brings in a large assortment of goods and produce for our Nation. As the primary source of food for all community members, any food security initiatives should be inclusive of the Waglisla Band Store.

[10] Qqs Projects Society. *Ḵúsƛ̓ƞts pípuẇís (We will not be hungry): Planning Toward Heiltsuk Food Security.* 2020. Not published.

Next Steps

The HCAT will explore ways to partner and collaborate with Qqs Projects Society and the Waglisla Band Store to increase food security and sovereignty.

7.3.2. Passive House Kit

The Haíłzaqv Housing Department seeks to develop a set of house plans and a kit of parts that will empower Haíłzaqv people to build our own homes with our own wood.

Our partners at RDH Building Science will prepare detailed plans for our community's unique passive-house design, along with a comprehensive list of required components, and an illustrated book providing step-by-step instructions on how to assemble the kit house.

We will identify which components can be supplied locally: For example, our sawmill will provide framing, decking, flooring, and siding. Our partners in Vancouver will then purchase all the remaining components, ship the kit to Bella Bella, and deliver hands-on training to our builders during construction.

Overtime, based on feedback from people dwelling in the homes, the kit will be perfected and more homes will be built with this model. Once a replicable model has been created, Haíłzaqv builders will begin training other First Nations to build their own kit homes.

The Haíłzaqv Kit House creates a pathway for families to construct a single-family home in two seasons thereby qualifying for funding, while also enabling the community to resume its tradition of wood construction. At the same time, the Haíłzaqv Kit House carves a pathway for economic development. These homes will be built with Haíłzaqv wood and Haíłzaqv labour. Over time, the community will begin to export knowledge and components to other Coastal First Nations, empowering them to build their own kit homes.

Next Steps

This project will proceed through four stages:

1. House Planning

The Haíłzaqv Climate Action Team is currently proposing a $32,000 planning process, seeking $25,000 from the Federation of Canadian Municipalities (FCM) Sustainable Affordable Housing Fund (SAHF) and $7,000 from other sources. Activities to include a planning charrette and a community feedback session in Bella Bella. Deliverables to include a Schematic Design for the Haíłzaqv Passive House Kit.

2. Kit Design

Kit Design: We propose a $250,000 study process, seeking $125,000 from SAHF and $125,000 from other sources. Bella Bella activities to include discussions with Haíłzaqv about which materials can be provided locally (e.g., our sawmill will provide framing, decking, flooring, and siding.) Our partners in Vancouver will then purchase all the remaining components, ship the kit to Bella Bella, and deliver hands-on training to our builders during construction., and customized Passive House Trades Training. Vancouver activities include discussions with potential vendors for components, assembly, and shipping of the kit. Deliverables from consultants to include Design Development, Construction Drawings, an uncommonly detailed materials and components list, a bespoke Passive House Trades Training curriculum, and a complete draft of the Assembly Instructions Book for the Haíłzaqv Passive House Kit.

3. Pilot Construction

We propose a $625,000 pilot project, seeking $500,000 from SAF and $125,000 from other sources. Activities to include assembly of local components in Bella Bella, purchase of kit parts in Vancouver, shipping of kit to Bella Bella, of Haíłzaqv builders during assembly, filming of training (for future use), completion of one house in Bella Bella, post-construction revisions to plans and instructions based on lessons learned, distribution of revised plans and instructions, and certification to the international Passive House standard. Deliverables to include a certified Passive House to be owned by the Haíłzaqv Housing Department and rented at agree-upon rates to a local family.

4. Kit Replication

Overtime, based on feedback from people dwelling in the homes, the kit will be perfected and more homes will be built with this model. Once a replicable model has been created, Haíłzaqv builders will begin training other First Nations to build their own kit homes. Activities may include training of a team of Haíłzaqv builders to train other First Nations, or establishment of a Haíłzaqv-owned business in Vancouver to supply kits, or other options.

7.3.3. Net Zero Homes

Sustaingineering, Indigenous Engagement Team [IET] in partnership with the Builders Without Borders Foundation propose to develop guidelines for “Net Zero” homes based on the proven successful “Tiny Homes” currently being built in Bella Bella.

Our team will work very closely with designated individuals in Bella Bella who are familiar with the community's energy and water requirements on necessary local fact-finding and response to questions.

Our team propose to study and develop a plan for appropriate “Net Zero” systems and design methods including but not limited to following:

- Atmospheric Water Generation
- Grey Water Recycling
- Rainwater Collection
- Water conservation and usage.
- Solar Power and other clean energy solutions
- Heat pump usage optimization
- Net Zero waste management; upcycled, recycled, composted, etc.
- Wind, bioenergy, tidal power usage
- Implementation of “Passive House” Structural Design, working with Scott Kemp, Architect of the “Tiny Homes”.
- Improved “building envelope” design and construction

Next Steps

The Haíłzaqv Climate Action Team will continue to work with these partners to identify the Net Zero home opportunities in Bella Bella

7.3.4. Off-Grid Solar: Major Buildings

Bella Bella has major buildings that are not only critical to community function, but also have large energy requirements. Off-grid solar energy that is produced by and used for these buildings can offset demand on the Ocean Falls hydro plant, allowing for the available power supply to meet housing current and upcoming housing needs. Moreover, the current backup generator system is near capacity, further outlining the need to diversify our energy systems.

Major buildings currently in the community are:

- Bella Bella Community School
- Bella Bella Community Hall
- Waglisla Band Store and Liquor Store
- Bella Bella Fish Plant
- Heiltsuk Economic Development Corporation Building
- Heiltsuk Tribal Council Building
- Heiltsuk Water Treatment Plant
- Elders Building
- Bella Bella Community Hospital
- Heiltsuk Integrated Management Department
- Solid Waste Facility

Future major buildings known to date are:

- Haíłzaqv Governance Building
- Elders Long-Term Care Facility
- Haíłzaqv Language Building
- New Hospital
- Civic Centre

Next Steps

The HCAT will work to identify partnership opportunities for feasibility studies, research and implementation of off-grid solar energy systems on the buildings mentioned above and diversify our energy systems.

8. Renewable Energy Generation Opportunities

Haíłzaqv Nation, Bella Bella, is seeking to gain a better understanding about the different renewable energy systems that can be used for electricity generation, transport electrification and buildings and industrial heat. The HCAT's objective is to enhance our sovereignty and leadership in the renewable energies sector, as well as, to reduce Greenhouse Gas emissions and create profit from the social and economic benefits from renewable energy projects.

Through the following sections, we will identify several renewable energy systems and draw up a complete review of each technology's features and applications. This will help us to decide on the possibility of implementation of renewable energy projects by assessing the available local renewable resources, systems scale and siting options.

8.1. Utility Requirements/Needs

This section aims to establish an inventory of possible renewable energy systems for Bella Bella community and to assess the availability of natural resources for clean energy projects, such as solar irradiance, wind speed, biomass, etc. in the territory. This allows us to identify the most suitable opportunities of renewable energy projects for the Haíłzaqv Nation community.

The list in this section has been restricted to market-ready, proven technologies that could generate or store electricity at the community scale, including:

- Small and Micro Hydro
- Solar Photovoltaics
- Wind

- Biomass
- Geothermic
- Hydrogen
- Storage technologies

8.2. Hydro Energy

8.2.1. What is Hydro Energy?

Hydro power refers to the process of utilizing flowing water to drive a turbine and generate power. Hydro technologies are highly scalable, but the most applicable types for First Nations and local governments are micro hydro (<2 MW of installed capacity) and small to medium hydro (2–50 MW of installed capacity). The size of the hydro project depends on the characteristics of the water source and the surrounding terrain.

Most small and micro hydro projects use a technique called “run-of-river”. Its principle is described as follows [1]:

1. Water is collected at the intake pipe.
2. Water travels down the penstock to the power station.
3. Water flowing through the power station turns a turbine to create power and then is discharged back into the stream.
4. The power is sent to the grid.

Hydro projects can be constructed on different types and sizes of rivers and streams, but the optimal characteristics are steep, deep and narrow water bodies [1]. It is also important that the water flow is substantial year-round if the site is to produce power consistently.

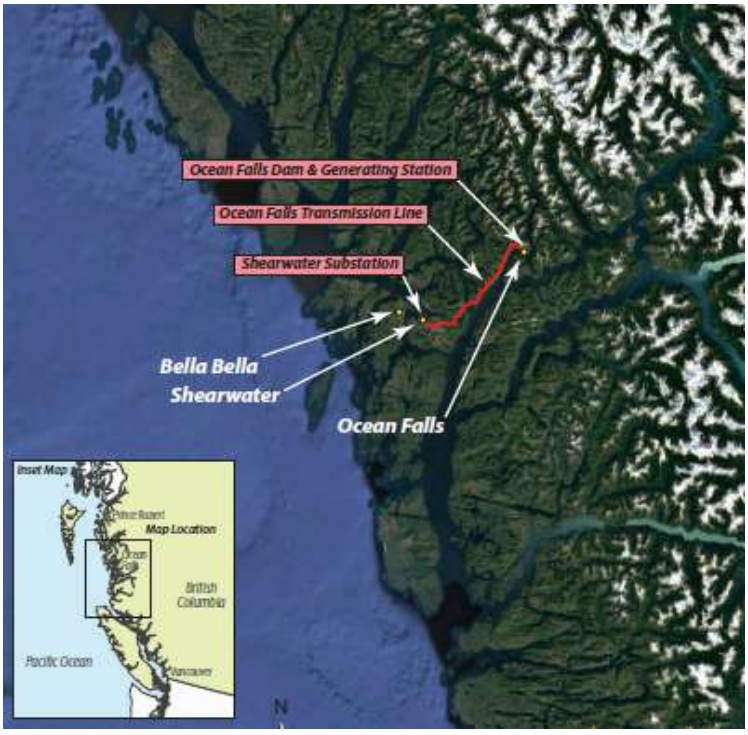
The planning, construction, operation, and associated financial and environmental costs of a run-of-river hydro project are highly site-specific. Therefore, it is necessary to conduct a careful analysis for each potential site.

8.2.2. Hydro Energy in Bella Bella

Bella Bella is noted for its abundance of rainfall, with an average annual precipitation of 2.95 meters, and of water resources, such as rivers, streams, lakes, snowmelt and glacial runoff. These water resources are essential for residents (fishing, drinking water), hydroelectric generation and other commercial activities (tourism).

Currently, the electricity in Bella Bella is provided by hydro power from a local hydro dam located in Ocean Falls, approximately 50 km to the East. Figure 1 illustrates a map showing the location of Bella Bella and the Ocean Falls Facilities.

Owned and operated by Boralex, the Ocean Falls Hydroelectric station supplies electricity to BC Hydro who uses this electricity to serve customers in the communities of Bella Bella and Shearwater within a BC Hydro non-integrated area (BC Hydro's Rate Zone IB). 97% of the electricity consumed by the Bella Bella Non-Integrated Area (NIA) customers comes from Ocean Falls station and the remaining 3% of consumed electricity is supplied by BC Hydro itself through its back-up diesel generating station at Shearwater [2].



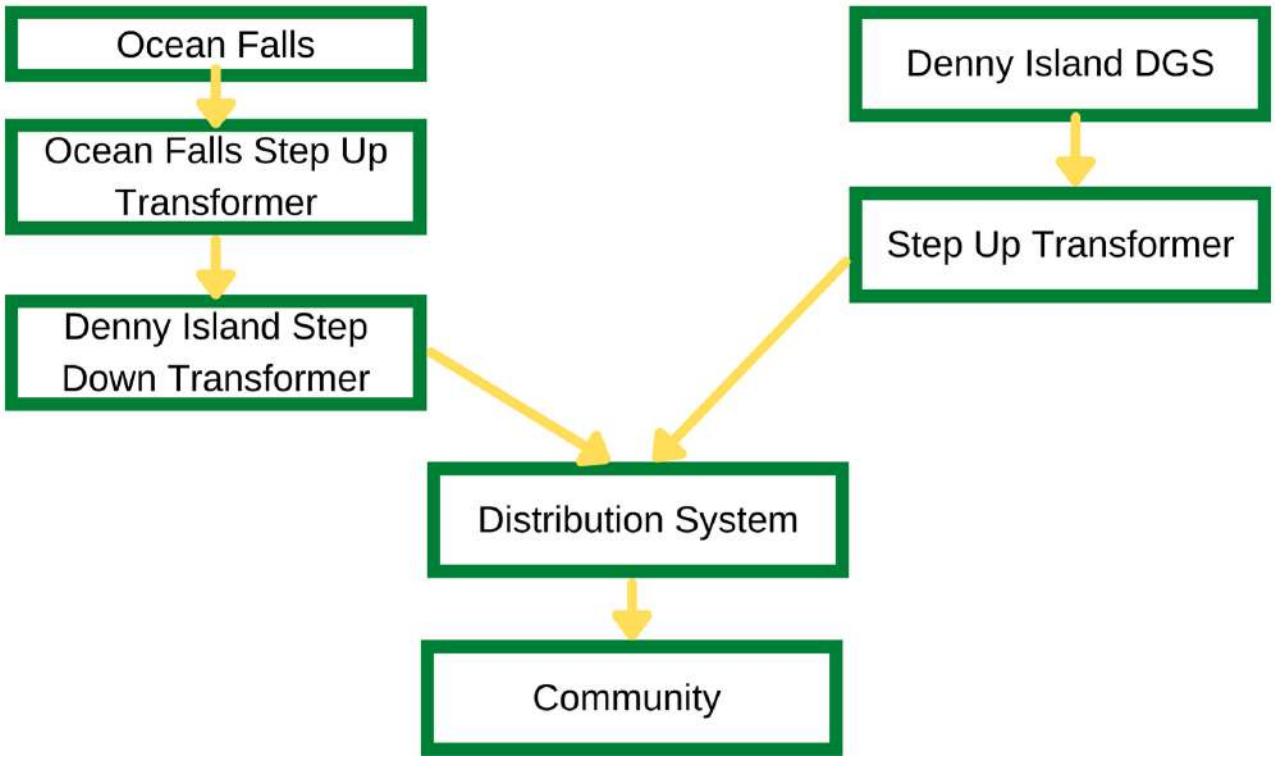
Map of location of Bella Bella and Ocean Falls Hydroelectric facility [2]

To date, no official hydrology study or water data are available to make an accurate estimation about the hydraulic resources in Bella Bella and surrounding areas. However, according to Boralex [2], the precipitation at watershed area (comprising Link Lake, Link River, Braden River, and their tributary streams, as well as a portion of Martin Lake that drains into Link Lake) combined with the dam's storage can supply continuously about 50 cubic meters per second of water, of which only 16.6 cubic meters per second are currently used for electricity generation by Ocean Falls facility.

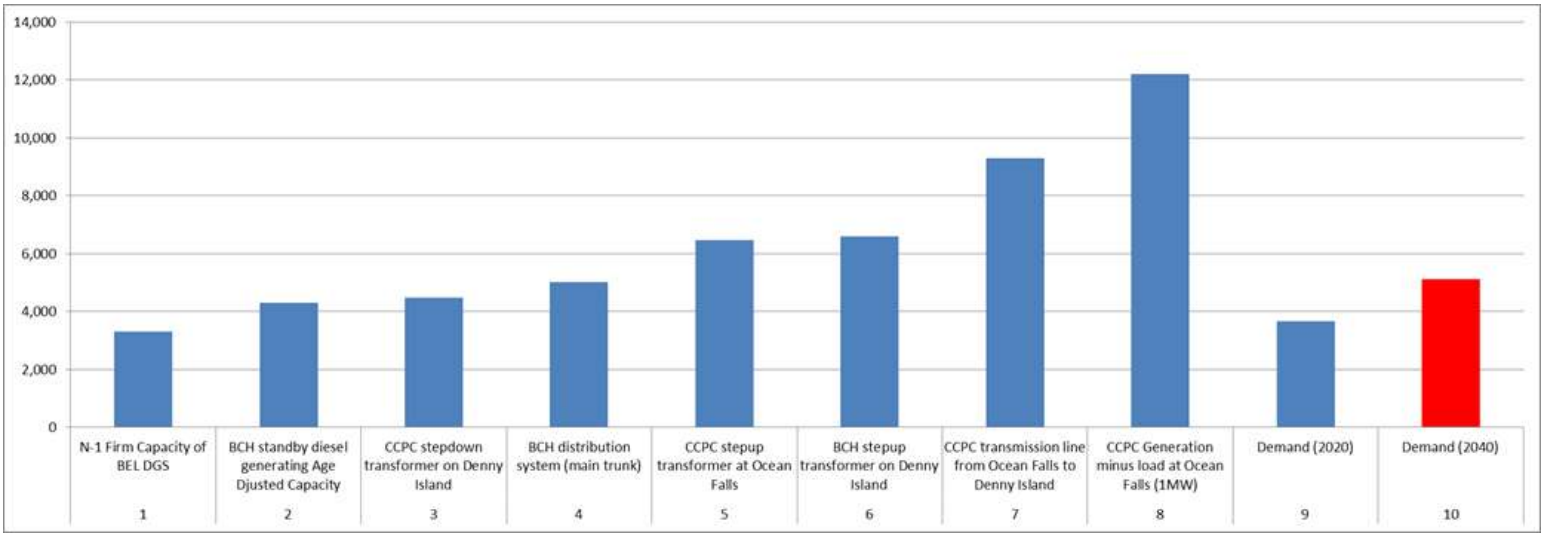
Furthermore, although the installed effective capacity of Ocean Falls is 12.2 MW, the electricity generation is limited to only maximum 6 MW under several licenses issued by the Province of British Columbia [2]:

- 2 water licenses to generate energy using water flows limited to 16.6 cubic meters per second diverted from Link River.
- 2 storage licenses to access 260,181,000 cubic meters of annual storage in Link Lake.

Bella Bella Energy System Diagram



Electricity is provided by BC Hydro using electricity generated at the Ocean Falls Boralex facility and local diesel generators for back up. Remote and non-integrated communities, like Bella Bella, pose unique challenges and opportunities in terms of energy supply and security. Our Isolated microgrid may be prone to power quality issues as supply infrastructure ramps up or down to accommodate changing loads. Due to the remote location, fuel for diesel generation must be shipped in, adding to the cost and vulnerability of providing electricity. A block diagram of the electricity infrastructure is presented in Figure above.



System Constraints Vs. Demand 2020 and 2040. Innes Hood Consulting Inc.

Energy consumption in the fiscal year of 2020 was 13.2 GWh and peak demand was 3,700 kW. With the projected development identified in the table above, consumption is projected to increase to 22 GWh by 2030 representing an increase of 60%. Peak demand is projected to increase to 5.7 MW by 2030, exceeding the age adjusted capacity of the BEL DGS in 2025 (Figure 33). By 2040, annual consumption will be 24 GWh and peak demand will be 6.3 MW. In addition to generation capacity constraints, the step up transformer at Ocean Falls (T 10) and the step down transformer at Denny Island (T20) also face capacity constraints.

8.2.3. Hydro Project One Pager

Cost [1]	● Capital*: $1,300 to $4,000 per kW installed. ● Annualized Operation & Maintenance: 2-3 % of capital cost per year.
LCOE [3]	0.03 – 0.15 $/kWh*
Lifetime	Highly site-specific. Average lifetime: Up to 100 years.
Complexity	Requires skilled people for the engineering design. Complex and robust civil and mechanical engineering during installation. Electricity may be firm or intermittent, depending on stream flow, and seasonal variation.
Environmental impact	Diversion of river flow. Construction may impact the surrounding area (water, soil, trees).
GES	Electricity production from Hydro is carbon free. Life Cycle Analysis[11]: 24 gCO2e/kWh
Jobs	May result in the creation of new jobs during installation and operation.
Risks	Health and safety risks are rare. Dam rupture may occur due to siltation and erosion.

* These values are estimated; the real costs may be out of this range depending on specific-site characteristics and logistic expenses.

8.2.4. Next Steps

Heiltsuk Nation should continue to maintain Boralex Ocean Falls as the principal source of electricity and discuss with Boralex and BC Hydro about their effective ability to supply the community with the future demanded electricity in 20 years. To ensure our energy sovereignty, our Nation can negotiate several ways of partnerships with Boralex,

11 https://www.world-nuclear.org/information-library/energy-and-the-environment/carbon-dioxide-emissions-from-electricity.aspx#ECSArticleLink1

especially if significant investments will be needed by Boralex to upgrade the Ocean Falls facility due to its old age (most of its parts are over 100 years old.).

As a step towards energy autonomy, the community can consider the possibility of installing new micro and small hydro energy infrastructures. However, this option will not contribute to GHG emissions reduction.

Furthermore, it will require more human and financial resources and may take a long time to perform a technical and economical feasibility study:

- Do an inventory of streams/rivers water sources with sufficient flows in 8–10 months of the year and with adequate height of vertical drop.
- Collect water data by conducting an hydrology study or by placing instream monitoring equipment for a year to assess the water flow and determine whether it is fast enough to produce power.
- Other factors should be considered:
    - Climate change impact on precipitation and water flows,
    - interconnection to the grid and resilience issues,
    - site accessibility constraints, costs.

8.3. Solar Energy

8.3.1. What is Solar Energy?

Solar photovoltaic (PV) power is the conversion of sunlight into electricity via solar cells within a solar panel or module. A PV system does not necessarily need bright sunlight, it can also generate electricity on cloudy days with diffuse light conditions. At ground level, after the radiation has traversed the atmosphere, the maximum available energy is around 1,000 W/m2 on a clear day which can be partially converted (around 20%) to electricity through PV cells. Hence, one square meter of PV panel can generate between 100W and 300W depending on the PV cells technology.

The capacity of PV installations varies from hundreds of Watts to hundreds of Megawatts and it may be mounted in different configurations (rooftops, ground mounted, floating).

8.3.2. Solar Potential in Bella Bella

Bella Bella is among the least sunny regions in Canada, as shown in Figure 2 presenting the annual photovoltaic potential in Canada. However, Bella Bella receives around 1200 kWh/m2/year of Global tilted irradiation at optimum angle[12], which is almost the same amount of solar radiation as Germany, the world's leading nation in the use of PV per capita.

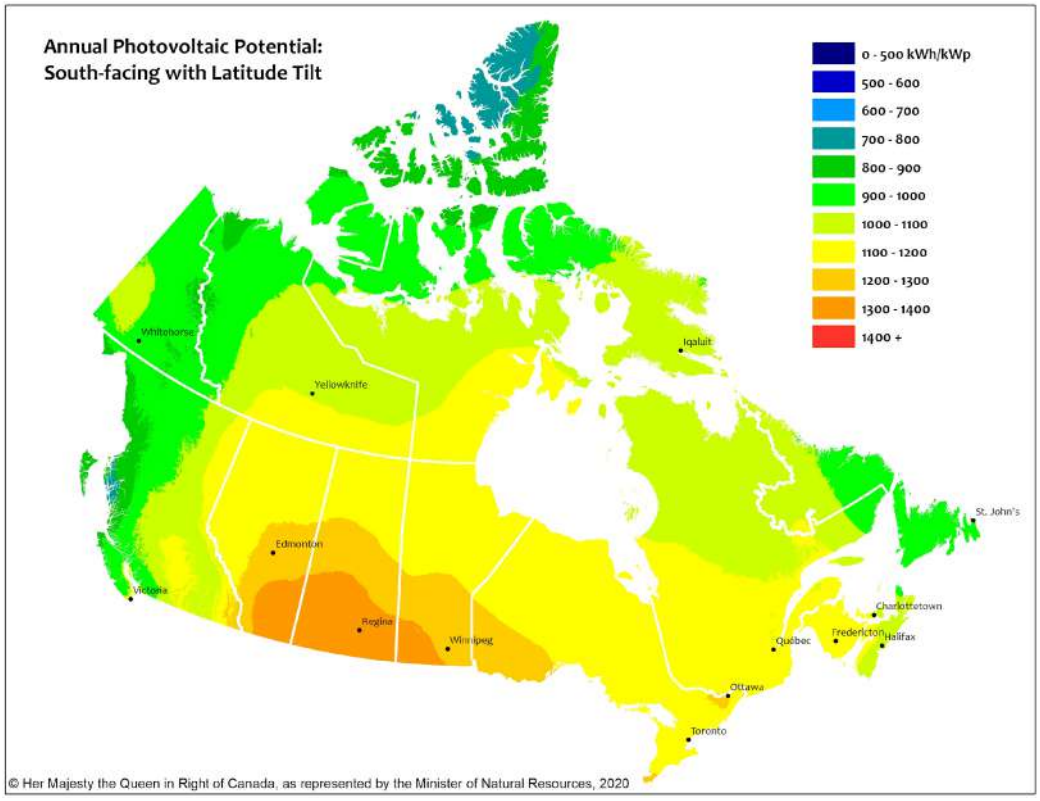


Figure 2 : Annual Photovoltaic Potential: South-facing with Latitude Tilt[13]

[12] https://globalsolaratlas.info/map

[13] https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/solar-photovoltaic-energy/tools-solar-photovoltaic-energy/photovoltaic-potential-and-solar-resource-maps-canada/18366

With 1200 kWh/m2/year of Global tilted irradiation at optimum angle, this leads to generate about 1020 kWh/year per 1kWp of installed PV capacity. In terms of PV generator area, 1020 kWh/year needs about 5 m2 of PV cells area if we consider a 20% of cell conversion efficiency.

In terms of land occupation, 1kWp of PV ground installed capacity requires around 175 ft2 (16.25 m2) of ground area. The required area for other capacities is more or less linear with that rate. The capacity factor of solar PV in Bella Bella is around 11%.

Several tools and websites are available to estimate the solar potential of an area and to calculate the output electricity of a PV system for different configurations: small residential, medium size commercial, ground mounted large scale, and float large scale. A simulation of a PV system of 50kW to install on the roof of a medium size building in Bella Bella, as located in Figure 3, can be done on GlobalSolarAtlas Website. The solar irradiation is presented in Figure 4. Sunlight day ranges from 7 to 16 hours. The average global titled irradiation is 3.23 kWh/m2/year; it ranges between 1.2 kWh/m2/day in December to 4 kWh/m2/day in July.

Figure 3. Proposed location for a roof-mounted PV system in Bella Bella (Global Solar Atlas)[14]

Map data — Per year

Specific photovoltaic power output	PVOUT specific	1021.5	kWh/kWp
Direct normal irradiation	DNI	908.2	kWh/m²
Global horizontal irradiation	GHI	1004.1	kWh/m²
Diffuse horizontal irradiation	DIF	525.2	kWh/m²
Global tilted irradiation at optimum angle	GTI opta	1191.5	kWh/m²
Optimum tilt of PV modules	OPTA	38 / 180	°
Air temperature	TEMP	8.7	°C
Terrain elevation	ELE	20	m

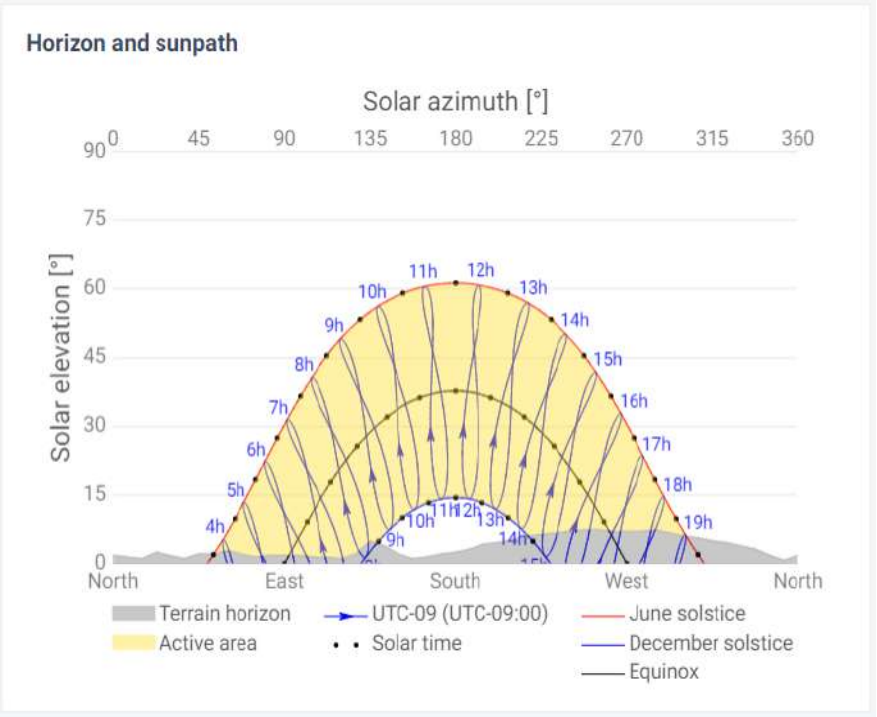


Figure 4 : Solar irradiation data in Bella Bella (Global Solar Atlas)[15]

The total electricity generated by this PV system is estimated at 47.03 MWh/year and the monthly and hourly average output power profiles are shown in Figure 5. The solar PV system

[14]https://globalsolaratlas.info/detail?c=52.163086,-128.145233,17&s=52.16338,-128.145344&m=site&pv=medium,180,38,50

[15]https://globalsolaratlas.info/detail?c=52.163086,-128.145233,17&s=52.16338,-128.145344&m=site&pv=medium,180,38,50

is more productive in summer, almost 70% of annual production is generated from April to September. By analyzing the electrical load data of Bella Bella, it can be conducted that this production can fully meet the electrical demand of a few key commercial and industrial buildings. Consequently, roof-mounted small PV installations are considered as an interesting option for off-grid application for commercial and industrial buildings.

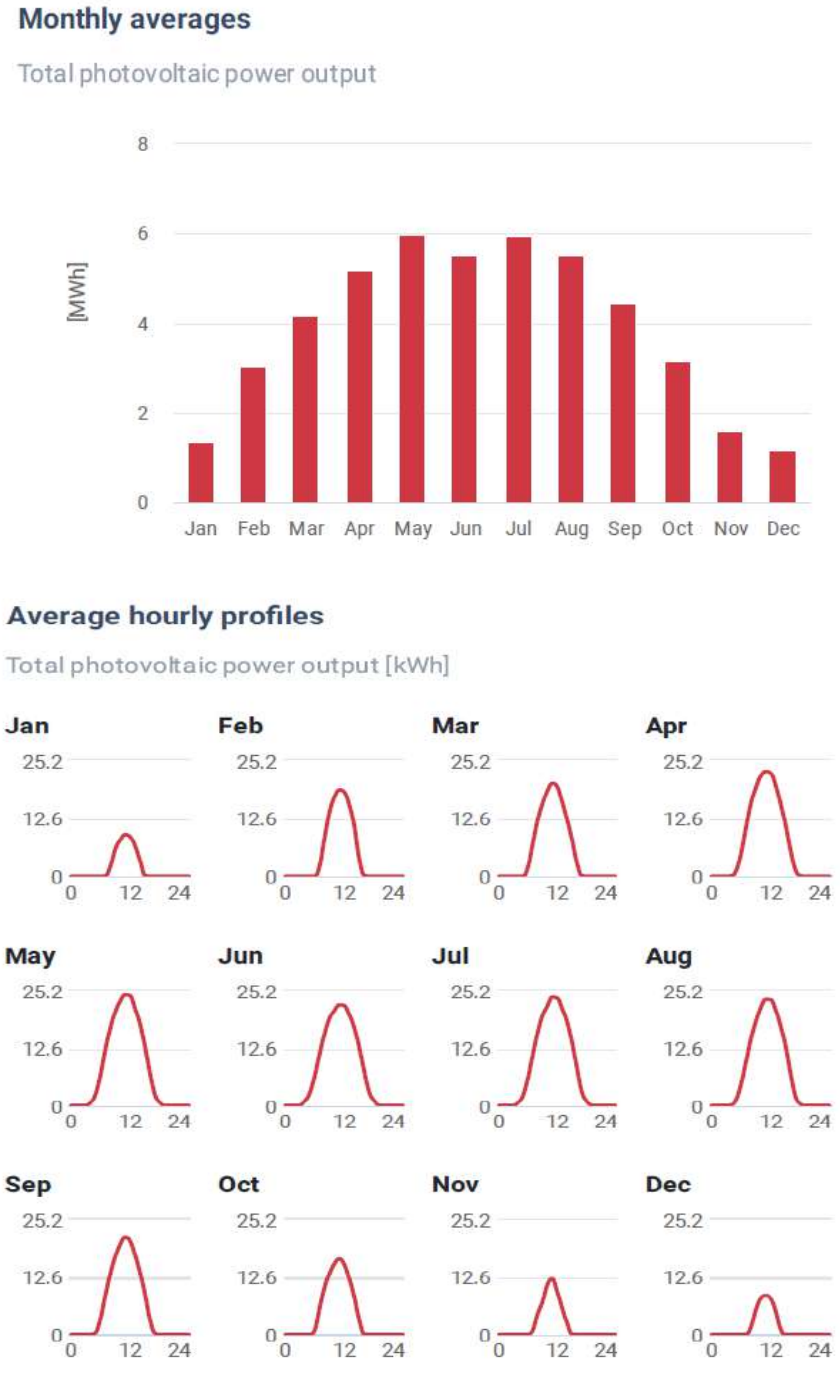


Figure 5. Average monthly and hourly power generated by the PV system (Global Solar Atlas)[16]

8.3.3. Technical Aspects

- **Level of technological maturity:** Reliable technology for a penetration rate of 10% or less for low inertia grids.
- **Impact on local Grid:** Considerable impact on the grid at high penetration rate in case of grid-connected PV installations due to meteorological intermittences of solar irradiation.
    - Storage solutions are recommended to mitigate this impact.
- **Storage requirements:** Batteries are needed for short term storage (night time). For long periods with less sunshine (winter), other storage methods can be used, like hydrogen-based solutions, water pumping or compressed-air.
- **Adaptation to cold climate:** Solar panels operate in cold climates and their efficiency is higher in cold temperatures. However, attention should be given to snow that may cover the solar panels and reduce the energy production. It is preferred to install them at high tilt angles, near altitude angle or slightly more for snow self-shedding. Otherwise, snow should be removed from PV panels.
- **Land use:** The size of a solar farm of 1MW is estimated at 4 or 5 acres for each megawatt (15000 m2 - 20000m2).
- **Shading:** The site, either ground based or rooftops, should be an unobstructed area from trees and buildings because shading reduces the output of PV cells. Moreover, panels should not shade each other. Panels should be installed at the optimum tilt and south oriented for fixed tilt in order to maximize the annual received solar radiation, or with East-West orientation to smooth the production curve during the day.
- **Construction:** Panels can be installed on ground or directly on the roofs of buildings and facades. Solar panels should be ideally installed near the point of use.
    - The transportation of the equipment is easy, even in case of road constraints, they can be transported by plane or by boat.

[16] https://globalsolaratlas.info/detail?c=52.163086,-128.145233,17&s=52.16338,-128.145344&m=site&pv=medium,180,38,50

- **Maintenance and training:** Maintenance consists of removing snow, and cleaning the solar panels, if necessary, for optimal extraction. Defective photovoltaic panels should also be replaced when necessary. No moving parts, so less maintenance than any other renewable energy system.
- **Lifespan:** 25 years for photovoltaic panels and 5 years for solar inverters.

8.3.4. Social and Environmental Impacts

- Solar PV projects create local job opportunities mainly during the construction phase. Electrical, mechanical and civil skills are required in the construction. PV solar installations require fewer jobs during operation and maintenance depending on its size.
- Solar PV systems don't release greenhouse gasses.
- The amount of land required for PV systems is considerable, which can disrupt the ecosystem.
- PV panels are made up of chemicals that must be properly disposed of after use. Recycling and disposal solutions should be taken into consideration during the feasibility study of PV solar projects.
- No noise.

8.3.5. Solar PV Project One Pager

Cost [1]	• 1000 - 1450 $/kWp * for large scale ground based (≥ 1MW) • 2000 - 3000 $/kWp * for residential applications (≤ 250 kW)
LCOE [3]	• 0.06 – 0.3 $/kWh
Time	for large scale ground based • Data collection and engineering: 12 – 24 months • Site preparation: 1 – 3 months • Construction: 3 – 8 months • Operation and maintenance: 25 – 30 years For residential applications (1kW – 10kW)

	● Consultation and engineering: 1 – 3 months ● Construction: 1- 4 weeks ● Operation and maintenance: 25 – 30 years
Complexity	Requires skilled people for the engineering design. Simple installation and does not require special training. Simple to operate and maintain. At high penetration rates, the complexity of the integration is high.
Environmental impact	PV installation is silent and does not release greenhouse gasses. It takes up a lot of space. PV panels must be properly disposed of after use.
GES	PV installation can offset carbon emissions of diesel generation. Life Cycle Analysis: 41 gCO2e/kWh [17]
Jobs	Solar PV projects create local job opportunities during the construction phase. Both qualified and non-qualified people are required.
Risks	Health and safety risks are rare. They usually occur when installing panels on roofs or at heights. Some minor risks of fire if the modules are not installed and insulated properly.

* These values are estimative; the real costs may be out of this range depending on specific-site characteristics and logistic expenses.

8.3.6. Next Steps

Data collection and detailed feasibility studies should be performed to establish whether the solar PV projects are affordable, reliable and competitive for Bella Bella. These are some of the subjects that should be considered:

- Review the characteristics of the local electric grid and the future trends for renewable energy integration: current grid status, acceptable penetration rates for renewable energies, grid-connected or off-grid applications issues. Requirements and constraints for net metering systems.

[17] https://www.world-nuclear.org/information-library/energy-and-the-environment/carbon-dioxide-emissions-from-electricity.aspx#ECSArticleLink1

- Examine the energy profile of main consumers: annual demand, load curve.
- Establish a strategy for solar PV: large-scale ground mounted or distributed PV systems on building roofs/facades.
- Conduct a feasibility study for solar PV systems for DC charging stations for electric vehicles.

In the short term, small-scale PV projects (<100kW) are a promising option for Bella Bella. Solar panels can be installed on buildings roofs and facades and used to partially supply the electrical needs of these buildings. This type of system offers many advantages for Bella Bella community:

- It can help reduce the electricity bills,
- This kind of system is scalable and modular,
- Lower logistic constraints because of their size and modularity,
- Ease of installation and operation, and
- Less maintenance labor is required
- Another interesting option for the short term is the deployment of DC EV chargers using solar PV and batteries. This is a promising option for reducing GHG emissions.

By mid-term (by 2030), Bella Bella can consider installing PV solar panels for major buildings. In the long-term, Bella Bella can study the feasibility of implementing medium-scale PV farms (<1MW) to diversify their energetic sources while taking in consideration the grid stability constraints.

8.4. Wind Energy

8.4.1. What is Wind Energy?

Wind turbines produce electrical energy from the rotation of the blades (kinetic energy) due to the forces exerted by the wind. It is an intermittent renewable source which depends on atmospheric conditions (fluctuating wind).
We distinguish wind turbines by their sizes. Small wind turbines are characterized by:

- Suitable for winds between 10 km/h (3 m/s) and 90 km/h (25 m/s).
- Their rated power varies from 0.3 kW to 300 kW.
- The dimensions of their towers vary between 2 m (0.3 kW) and 40 m (300 kW) and rotor diameters vary between 2 m (0.3 kW) and 36 m (300 kW).

Small wind turbines are generally used to supply remote or isolated regions with low electrical needs, or certain mines and industries. The smaller size of these turbines (compared to large turbines) is an advantage for transportation and installation in these areas. Nevertheless, throughout the past years, small wind turbines have faced some difficulties and challenges, they appear not mature enough nor ready for the Canadian harsh climatic conditions. Moreover, there are few technology providers with proven products in the market (currently working in isolated, cold climate sites).

8.4.2. Wind Potential in Bella Bella

Siting and compatible land use will be a major part of assessing the compatibility of wind in a community. Generally, the wind resources are potential at sites with the following characteristics [1]:

- Coastal or lakeside
- On a ridge, perpendicular to prevailing winds
- Flat or gently rolling ground
- At least 10 metres above any physical wind barriers located within a 100 meter radius
- Experience average annual wind speeds >18km/hour (> 5m/s)

Wind potential is limited in Bella Bella, but it may be suitable for small wind turbines. As shown in Table 1 and Figure 6, the average wind speed in the village at @50m elevation is 5.5 m/s. Some local sites around the village have an important wind potential (red points in Figure 6): at 4 km North-West of the village on the top of mountains, average wind speed is 7 m/s and wind potential is 850 W/m2 @50 m high.

Table 1. Wind potential at particular locations and elevations in Bella Bella [18]

		@10 m	@50m	@100m
Near Bella Bella Village	Av. Wind Speed (m/s)	3.5	5.5	6.4
	Wind Potential (W/m^2)	150	400	550
Around Bella Bella Village (4 km on top of mountains)	Av. Wind Speed (m/s)	6	7	7.8
	Wind Potential (W/m^2)	630	800	900

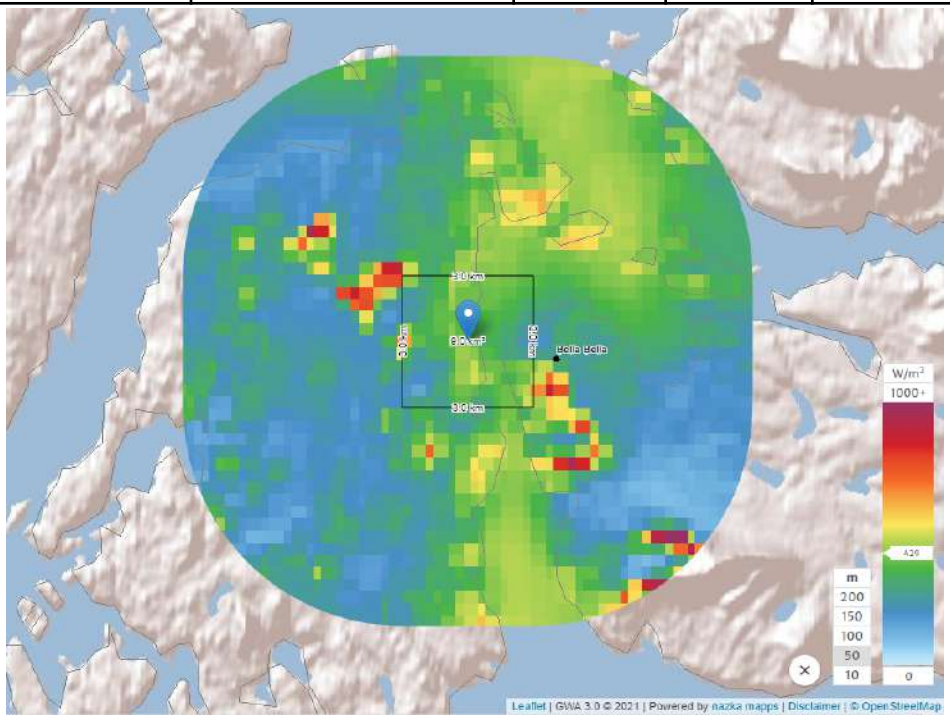


Figure 6. Wind Energy Potential in Bella Bella [19]

In this map it is clear that the most suitable locations for wind turbines are far away from Bella Bella, where the wind potential is high. Although this can be seen as an advantage to minimize nuisances to the population, there are just a few sites where the resource is high enough and close to the village. The wind turbines should not be placed too close to the airport because they may create hazards to aviation.

[18] https://globalwindatlas.info/
[19] https://globalwindatlas.info/

8.4.3. Technical Aspects

- **Capacity factor:** 30% to 50% for class-III wind turbines.
- **Level of technological maturity:** limited penetration rate of 10% or less. Storage technologies may raiserise the penetration rate. Low technological readiness for small and medium-size wind turbines (1 to 900 kW)
- **Impact on local Grid:** Considerable impact on the grid due to annual and instantaneous variation of wind speed. Short term storage solutions are recommended to mitigate this impact.
- **Storage requirements:** Storage can be used to alleviate the constraints of intermittent weather conditions. It is essential if the penetration rate of wind power on the grid is high.
- **Adaptation to cold climate:** Small wind turbines are generally not equipped with technologies to deal with frost and very cold weather, although some technologies are in development.
- **Land use:** The space between the turbines varies depending on the diameter of the rotor.
    - The lateral distance between 2 turbines is approximately 3 times the diameter while the distance in the direction of the wind is at least 6 times the diameter.
    - For a wind farm with 2 rows of 5 turbines (100 kW each, diameter of ~ 30 m), you would need a field of 0.972 km², the equivalent of 18 football fields.
    - The floor space remains accessible for people and wildlife.
- **Construction:**
    - Wind turbines must be anchored and stabilized to withstand powerful winds and blizzards.
    - Wind turbines must respect the maximum height or distance constraints imposed by surrounding airports without interfering with navigation corridors.
    - The transport of bulky and heavy components must be done to the site by boat.
    - It may be necessary to add power lines and construct new roads.
    - In most cases, a crane is required. There are some mid-size wind turbines with self-erecting towers which are shipped in 40’ containers.

- **Maintenance and training:** wind turbines generally require preventative maintenance check-ups two or three times per year. The need for these check-ups increases as the turbine ages.
    - O&M requires expert rope access technicians or platforms, heavy machinery required for the replacement of major components.
    - O&M Required training: confined space, first aid, work at heights, mechanical and electrical skills.
    - O&M costs constitute a sizable share of the total annual costs of a wind turbine. For a new turbine, O&M costs may easily make up 20-25% of the LCOE over the lifetime of the turbine.
- **Lifespan:** 20 to 25 years before a repowering is required. It is worth noting that roads and power lines have a longer lifetime.

8.4.4. Social and Environmental Impacts

- Sound and vibrations near wind turbines can be disturbing (no direct impact on hearing health).
- Visual impact / visual pollution
- Ice throws a risk in winter.
- Safety risks may occur during the construction and maintenance phases. They also depend on the size of the WT.
- Risk of collisions for birds and bats.
- Less than 500 m² / 100kW is permanently deteriorated (flora).

8.4.5. Wind Turbines Project One Pager

Cost [1]	• 1450 $ to 4500$ /kW_p * installed • O&M: Size dependent, typically 1–3 percent of capital cost per year
LCOE [3]	• 0.03 – 0. 6 $/kWh *
Time	• Data collection and engineering: 12 – 24 months

	● Site preparation: 1 – 3 months ● Construction: 1 – 3 months, there could be interruptions of construction activities due to meteorological conditions, so duration may be longer. ● Operation and maintenance: 20 – 25 years
Complexity	Required training: confined space, first aid, work at heights, mechanical and electrical skills. O&M requires expert rope access technicians or platforms, heavy machinery.
Environmental impact	Risk of collisions for birds and bats. small turbine (100kW) requires at least 1,600 m^2, Visual impact / visual pollution / noise nearby the WT.
GES	Wind turbines can offset carbon emissions of diesel generation. Life cycle analysis: 11 gCO2e/kWh[20]
Jobs	Wind turbine projects create local job opportunities mainly during the construction phase. Both qualified and non-qualified people for the construction and rope access technicians are required.
Risks	Health and safety risks are rare and generally occur during the construction and maintenance phases. Ice throwing in winter.

* These values are estimated; the real costs may be out of this range depending on specific-site characteristics and logistic expenses.

8.4.6. Next Steps

Potential for wind energy in or around Bella Bella is not very high, and these findings do not create a rationale for taking steps towards launching wind turbine projects. If wind projects are to be considered.further detailed studies should be performed in site specific areas to assess the reliability of wind turbine technology for Bella Bella community.. Small wind turbines are more appropriate based on the community electrical needs and their lower risk on the local grid compared to large wind turbines. However, the experience of small wind turbines in remote areas in Canada has not been rewarding.

[20] https://www.world-nuclear.org/information-library/energy-and-the-environment/carbon-dioxide-emissions-from-electricity.aspx#ECSArticleLink1

Moreover, installing large wind turbines in place of the existing hydro station will not provide additional benefits in terms of GHG reduction. Hence, Bella Bella community should strike a fair balance between the wind resources in the region, the future community needs in electricity and the available market-proven turbine technologies.

For any potential wind energy projects that purpose, the following actions should be carried out:

- Seek for relevant information about wind resources in Bella Bella or install wind measurement stations (10, 50, 100 m high) to collect measurements for at least one year.
- Work with BC Hydro to assess the possible wind energy penetration rate and the interconnection requirements for the local distribution grid.
- Conduct a technical and economical study for a wind energy project in Bella Bella.

8.5. Biomass Energy

8.5.1. What is Biomass?

Biomass is renewable organic material that comes from different sources, including:

- Wood and wood processing wastes ;
- Agricultural crops and waste materials;
- Biogenic materials in municipal solid waste—paper, cotton, and wool products, and food, yard, and wood wastes;
- Animal manure and human sewage.

Biomass is converted to energy through various processes, including:

- Direct combustion (burning) to produce heat;
- Thermochemical conversion to produce solid, gaseous, and liquid fuels;
- Chemical conversion to produce liquid fuels;
- Biological conversion to produce liquid and gaseous fuels.

Direct combustion is the most common method for converting biomass to useful energy. All biomass can be burned directly for heating buildings and water, for industrial process heat, and for generating electricity in steam turbines.

Biofuels can also be used for heating, transportation and for electricity generation.

Several biomass advantages and disadvantages are listed in Table 2 .

Table 2. Advantages and disadvantages of biomass

Advantages	Disadvantages
● Waste reduction ● Mature and reliable technology ● No impact on the electricity network ● Firm energy production ● Creation of local jobs ● Valorization of wood	● Biomass fuel transportation, ● Smog formation

Most biomass conversion technologies are capable of producing a combination of heat and electricity. These technologies are often referred to as “Combined Heat and Power” (CHP) or “Cogeneration”, and currently available systems can be extremely efficient.

For small-scale CHP systems sized for individual buildings, product vendors and installers generally recommend that CHP systems should be scaled to meet the demand for heat rather than the electricity demand. In general, facilities that have a simultaneous electric and thermal demand for at least 4,000 hours per year, such as a greenhouse, are good candidates for exploring CHP opportunities.

An important part of the success of a biomass energy project is that a consistent supply of fuel must be available over the life of the facility. Market availability and price of biomass can

fluctuate, so an important factor is the ability to secure access to the required biomass supply at a reasonable price over the long term, from 20 to 30 years. Furthermore, the price depends highly on transportation and logistics (accessibility constraints, storage space, etc.)

8.5.2. Biomass Potential in Bella Bella

Wood waste is the largest biomass resource and includes forestry residue left by logging operations, lumber mills (e.g., bark, sawdust), municipal wood waste (including construction and demolition wood), and wood from other operations, such as road maintenance and even backyard tree trimming.

The Heiltsuk Economic Development Corporation (HEDC) developed a business plan which seeks to maximize the benefits of their forest resources. Several opportunities were outlined and a feasibility study of a small sawmill to supplement Bella Bella community lumber needs and sell these products on the market was performed. The objective was that this sawmill would operate a dryland sort and a biomass project to effectively deal with wood waste. The study concluded that the resulting sawmill residuals could be utilized in a biomass boiler to provide thermal energy to potential dry kilns, mill buildings, nearby housing or other uses such as greenhouses or firewood drying sheds [4].

The amount of sawmill residue available, the biomass broiler size estimates and technical and economic values of the broiler are presented in the feasibility study.

- Residual Biomass Availability:
    - The sawmill will produce 5000-foot board meters (fbm) of lumber and 13.2m3 of sawmill waste will be generated [4]. Additionally, biomass will be generated through log trimming and pieces of bark. This offers the potential for further development of biomaterials.
    - This sawmill will produce a total of 1,485 Oven Dried Tonnes (ODT) of sawmill residues that would incorporate 28,215 GJ or 7,870 MWH of energy [4].
- Boiler Technical and Economic Values:
    - The estimated boiler capacity/size is 1,000 kW, with a net thermal efficiency of 70% (assuming 50% moisture content of input chips).

    - The boiler capital cost will be approximately $1.25 Million, calculated from $1,250/kW installed [4].
- Advantages [4]:
    - The energy rate for all costs is $.084 kWh, which is lower than current heating oil cost of $0.156 kWh.
    - A payback time of 3.8 years was estimated.
    - Carbon offsets of 1,350 tonnes CO2eq per year (0.25 kgCO2eq/kWh for heating oil) are estimated.
    - A bioenergy project in Bella Bella would significantly reduce heating and power costs for the community and create five jobs.

8.5.3. Technical Aspects

- **Capacity factor:** 20% to 95%.
- **Level of technological maturity:** Reliable technology.
- **Impact on local Grid:** Low impact on the electrical grid. The stability is comparable to that of a diesel power generator.
- **Storage requirements:** Required storage for biomass fuel to ensure continuous operation.
- **Land use:** Required space is similar to that of gas turbine power plants plus the space for combustible material storage.
- **Construction:**
    - Plant which requires a lot of logistics and expertise to prepare the ground and set up the plant.
    - The transport of bulky and heavy components must be done to the site by boat.
- **Maintenance and training:**
    - Requires management of combustion and fermentation residues.
    - Requires transport to bring wood if the resource is lacking, which may generate extra costs.

8.5.4. Social and Environmental Impacts

- Emissions of contaminants to the atmosphere with combustion.
- Smog formation.

8.5.5. Biomass Project One Pager

Cost [1]	• 3750 - 5000* $/kWp
LCOE [3]	• 0.06 – 0.15* $/kWh
Time	for large scale ground based • Data collection and engineering: 1 – 3 months • Site preparation and construction: 1 – 24 months • Operation and maintenance: 30 – 40 years
Complexity	The Plant construction and commissioning requires a lot of logistics and expertise to prepare the ground and set up the plant. Ensure continuous procurement of biomass fuel.
Environmental impact	Emissions of contaminants to the atmosphere with combustion. Smog formation. Size (footprint): 100 m2 to several acres; land area is needed for the plant, access roads, storage facilities, and feedstock handling.
GES	Biomass can offset carbon emissions of diesel generation 230 gCO2e/kWh
Jobs	Biomass creates local job opportunities. Process engineering, Electrical, mechanical, forestry and civil skills are required. Both qualified and non-qualified people are required.
Risks	Breathing risks due to smog. Local air gas emissions,

* These values are estimated; the real costs may be out of this range depending on specific-site characteristics and logistic expenses.

8.5.6. Next Steps

- Bella Bella has a large demand for lumber and timber products. The local sawmill is beneficial for Bella Bella and nearby markets because it will reduce material transportation costs.
- Explore the possibility of a biomass combined heat and power unit.
- Further investigation is required to identify all potential biomass sources and the best candidates for thermal and electric load.

8.6. Geothermal Energy

8.6.1. What is Geothermal Energy?

Geothermal energy comes from the heat contained within the rock and fluid in the earth's crust. It's a source of clean, renewable energy with a small environmental footprint.

Geothermal energy can be used directly to provide heat or indirectly to produce electricity. Direct uses include heat for buildings, agriculture—such as greenhouse heating—or industrial uses like pulp and paper processing. Geothermal energy can also be used on a smaller scale by geoexchange (heat pump) systems in buildings and homes.

Medium temperature geothermal energy can be used to provide heat to buildings or for commercial and industrial purposes including:

- Hot spring bathing and health spas
- Greenhouses
- Aquaculture
- Pulp and paper processing
- Drying lumber
- Pasteurization
- District heating systems
- Geoexchange Systems

Geoexchange systems, also known as "geothermal heat pumps", are the most efficient means of heating and cooling a building and providing hot water. The earth's surface under the frost line maintains a nearly constant temperature (10 – 16°C), remaining warmer than the air above it in the winter and cooler in the summer. Using low temperature geothermal energy, a geoexchange system transfers heat stored in the earth or in ground water into a building during the winter and transfers it back into the ground during the summer.

Geoexchange systems can be used anywhere in B.C. Unlike other kinds of geothermal heat, shallow ground temperatures are not dependent upon tectonic plate activity or other unique geologic processes. Thus, geothermal heat pumps can be used to help heat and cool homes anywhere.

Geothermal costs are still relatively high compared to other heating technologies. It is necessary to perform comparative study with other heating technologies to decide about its economic efficiency. It may be useful to install one geothermal system for multiple buildings connected by a heat circuit.

8.6.2. Next Steps

Geothermal should be analyzed among the scope of building renovation and energy efficiency measures. Next steps consist on:

- Assess heating demand for buildings of Bella Bella community,
- Conduct a long-term comparative study between one central geothermal system vs distributed air thermo-pumps,
- Perform technical feasibility study of central geothermal heating system if this alternative remains competitive out of the previous step. The study should cover analysis of the ground source, logistics, feasibility of a centralized heating system, etc.

Geothermal should be also compared to biomass because both of them are useful for building heat.

It is necessary to ensure proper insulation of the buildings before analyzing the relevance of using a renewable energy source for space heating.

8.7. Hydrogen

8.7.1. What is Hydrogen?

Hydrogen is not an energy source but an energy carrier, thus it must be produced from another substance. Hydrogen can be produced from a variety of sources including water, fossil fuels, or biomass and used as a source of energy or fuel. It is useful for energy transportation and long-term storage. It has an important potential for clean mobility in the near future.

Hydrogen is the most abundant element in the universe, accounting for about 75% of all mass. In its natural and gaseous state, hydrogen is invisible, odorless, tasteless, and non-toxic, making it difficult to detect. Like electricity, hydrogen is an energy carrier that transports usable energy created elsewhere to another location. Hydrogen has the highest energy density per mass of any fuel; the energy in 1 kg of hydrogen is the same as approximately 2.8 kg of gasoline.

Table 3. Advantages and disadvantages of hydrogen

Advantages	Disadvantages
● Versatile energy carrier ● Carbon-free at point of use ● Can be produced from variety of feedstocks ● Can be transported for long distances ● Highest energy per mass of any fuel	● Low volumetric energy density ● Overall efficiency for green H_2 end-to-end electricity conversion :10%-30% ● Production cost ● Distribution and storage cost

Most of the hydrogen produced today is made from fossil fuels. In 2018, 48% of total hydrogen produced worldwide was derived from natural gas [5]. Canada has the potential to produce vast amounts of hydrogen from natural gas (blue Hydrogen) coupled with Carbon Capture Utilization and Storage (CCUS).

8.7.2. Hydrogen Production and Costs

Hydrogen is a chemical energy carrier that can be made from a variety of feedstocks, including water and electricity, fossil fuels including natural gas and crude oil, biomass, and as a by-product from industrial processes. The various ways hydrogen is produced, from input feedstocks to output bulk gas, are known as its production pathways. These pathways are presented in Table 4.

Table 4. Common Hydrogen Feedstock and Production Pathways Being Researched and Deployed [5]

	Production Process	Feedstock & energy source	Pros and Cons	Examples
GREY	 Produced by steam methane reformation without carbon capture and sequestration (CCS)	**Feedstock:** natural gas, gasified coal	Pros: lowest cost, abundant Cons: highest carbon intensity	Canada produces approximately 3 million tonnes of grey hydrogen per year primarily for industrial use.
BLUE	 Produced from fossil fuels by steam methane reformation, pyrolysis or other processes with carbon capture and sequestration (CCS).	Feedstock: natural gas, coal, crude bitumen	Pros: low-cost, abundant, low CI, pyrolysis offers scale and siting flexibility Cons: SMR pathway siting is constrained by CCUS, feedstock is not renewable	Alberta's Quest project
GREEN	 Produced from water by electrolysis using renewable electricity such as hydroelectricity, wind or solar.	Feedstock: Water Energy source: Renewable electricity	Pros: lowest carbon intensity, scalable Cons: highest cost, opportunity cost - competes with electrification demand	Air Liquide's 20 MW electrolyzer plant in Becancour, Projects developing in BC to support hydrogen fueling network.
NUCLEAR	 Produced from water by electrolysis or high temperatures from nuclear energy	**Feedstock:** Water **Energy source:** Uranium / nuclear electricity	**Pros**: low carbon intensity **Cons:** limited availability and siting constraints	Feasibility study planned in Bruce County.

Figure 7 compares projected bulk hydrogen production costs (not including distribution costs) by different pathways projected over time from a range of international and Canadian studies. By 2030, the cost of Steam Methane Reforming (SMR) and Carbon Capture Utilization & Storage (CCUS) hydrogen is expected to be in the range of ~$1.00 - $2.00/kg-H2 when produced at scale (>100 tons per day) in Canada based on studies out of Alberta and British Columbia, while the cost of electrolysis from dedicated renewables shows potential to be in the $3.20/kg-H2 range in that timeframe.

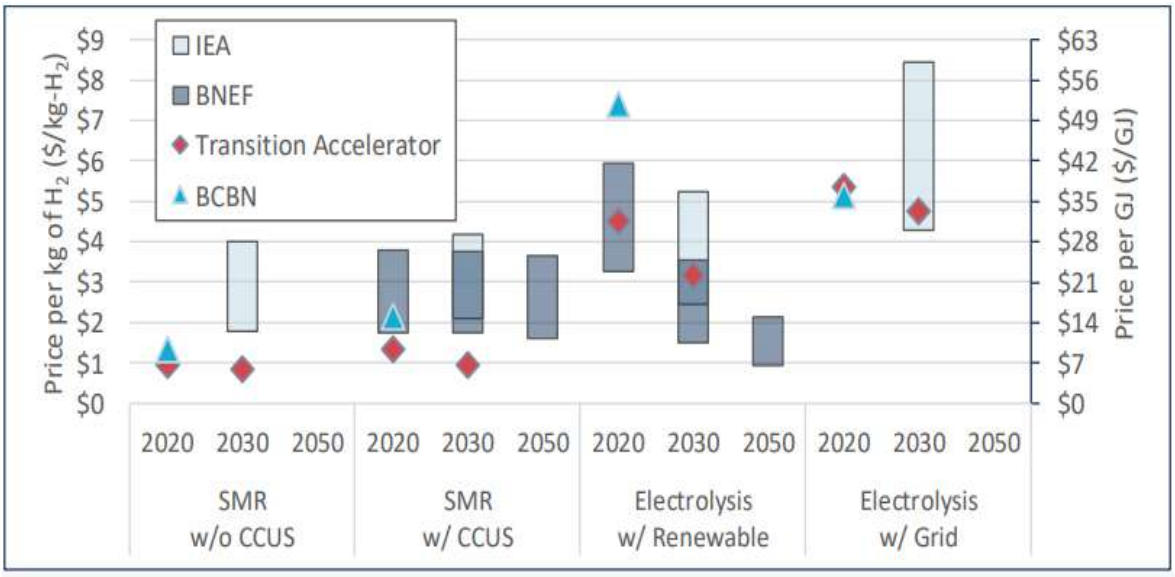


Figure 7. Hydrogen Production Pathway Costs in 2020, 2030, and 2050 [5]

Figure 8 presents carbon intensities for hydrogen from different production pathways in Canada. The recommended threshold for GHG intensity is set at 60% below the intensity of hydrogen produced from natural gas, currently set at 36.4 gCO2e/MJ [7].

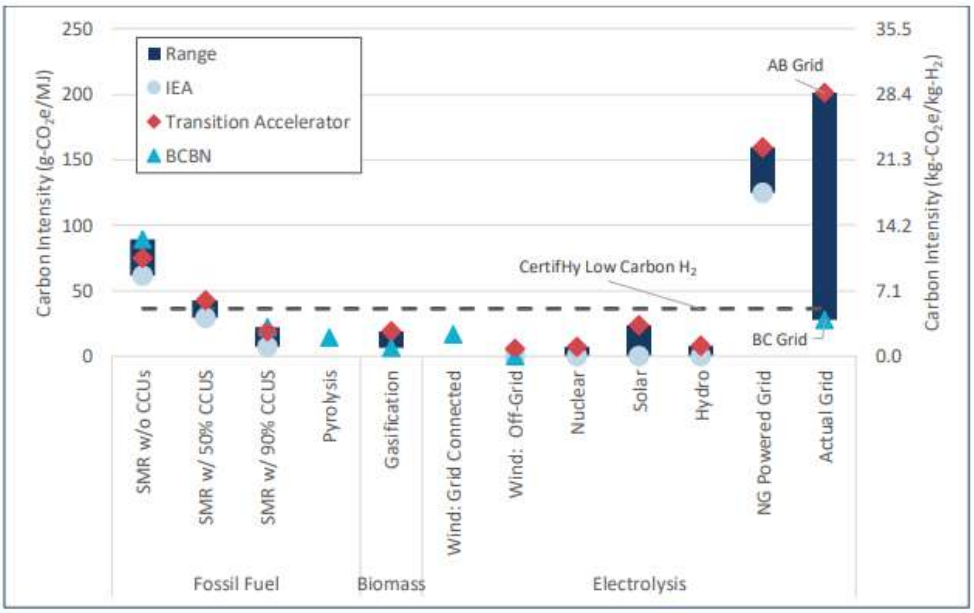


Figure 8. Carbon intensities of Hydrogen from different production pathways in Canada [5]

8.7.3. Hydrogen End Uses

The potential for hydrogen use in Canada is as diverse as the pathways to create it. Hydrogen can be used as a fuel for long-range transportation and power generation, to provide heat for industry and buildings, and as a feedstock for heavy industrial processes, like steel and cement making [5] [6] [7]:

- **Transport:** fuel cell vehicles and co-combustion engines.
- **Power production:** fuel cell generators or hydrogen turbines.
- **Heating:** high grade heat for industrial processes (cement, steel), burned directly or as natural gas/H2 blend in boilers, furnaces or fuel cell cogeneration systems.
- **Feedstock for products and chemicals:** fossil fuel refining and upgrading, ammonia / fertilizer, steel, food hydrogenation, chemicals, liquid synthetic fuels.

Hydrogen is useful for Bella Bella mainly in two sectors:

- **Transportation:** Hydrogen can replace carbon fuels for heavy and light transportation. Marine transportation should be powered by hydrogen.
- **Long term Energy storage:** deployment of renewable energy sources in the local electricity mix requires short and long term storage to mitigate daily and seasonal

intermittence of renewable sources. Hydrogen is a solution for seasonal storage. This option should be analyzed regarding the electric mix and penetration rate of intermittent renewable sources such as solar and wind.

8.7.4. Next Steps

- Survey of heavy-duty vehicles for auto and marine transport and assessment of actual and future transportation needs: number of vehicles and marine vessels, community transportation, energy demand for transportation, etc.
- Survey of existing or future nearby hydrogen stations for supply (see the map of BC-Wide Hydrogen Stations Estimated by 2040 in FCEVs in Section 8.2.3).
- Analysis of Hydrogen logistics for transportation: availability of Fuel Cells (FC), Fuel Cell Electric Vehicles (FCEV), costs, etc.
- Technical and economical feasibility study of long term energy storage with hydrogen.
- Feasibility study for local production and storage of green hydrogen.

8.8. Storage Technologies

There are many different storage technologies, each with their strengths and weaknesses. Technical characteristics of storage technologies are given in Table 5.

Choosing the most suitable technologies for applications in the community of Bella Bella must take into account maturity, lifespan and other specific factors such as:

- Size of local demand on energy storage,
- Time scale: short, medium or long term storage according to energy consumption profile and electric generation characteristics,
- Maintenance: low and simple maintenance that can be performed with local human resources,
- Logistics: continuous procurement of storage equipment’s (batteries, etc.) and spare parts,
- Space and local grid connection: available space for energy storage systems and connectivity to the local electric grid.

Battery and hydrogen storage technologies are suitable for land and marine transport needs in Bella Bella such as Electric Vehicles (EVs) and Fuel Cell Electric Vehicles (FCEVs). Other storage technologies should be deeply analyzed for residential demand depending on the renewable renewable energy production mix that will be deployed in the future.

The selection of the most convenient storage technology for Bella Bella Needs is inseparable from demand analysis, future needs and renewable energy resources deployment study.

At this level, given that Bella Bella seeks to electrify partially or totally its land and marine transportation, Li-ion will be useful for Battery Electric Vehicles (BEV). This technology is mature and widely commercialized notably with EVs. Special considerations should be taken for its supply chain, maintenance and life cycle (recycling, environment protection, etc.)

Table 5. technical aspects of energy storage technologies [8] [9] [10] [11]

Technology	Capacity (MW)	Discharge Depth	Efficiency	Durability years (cycles)	Autonomy	Cost USD/kWh (2018[43])	Cost USD/kW (2018 [43])	Response time	Maturity*
Battery Lead-acid	0–40	50%	80–90%	3–15 (<5 000)	s − h	200–400 (549)	300–600 (2 149)	5–10 ms	Mature
Battery lithium-ion	0–100	80%	85–95%	5–15 (1 000–20 000)	min − h	600–3 800 (469)	900–4 000 (1 876)	20 ms –s	Commercial
Compressed Air Large scale	5–1,000	100%	40–70%	20–40 (> 13 000)	1–24 h+	2–120 (105)	400–1 000 (1 669)	1–15 min	Mature
Compressed Air small scale	-	100%	50%	20–40 (> 13 000)	-	-	500	1–15 min	Mature
Fly-Wheel	0.001−20	100%	70–95%	15+(> 100 000)	ms−15 min	1 000–14 000 (11,520)	250–350 (2,880)	< 4 ms –s	Mature
Thermal storage (Aquifer)	0–5	-	50–90%	10–20 (–)	1–8 h	20-50	-	-	Development
Thermal storage (High temperature)	0-60	-	30–60%	5–15 (> 13 000)	1–24 h+	30-60	-	-	Development
Hydro-pumped	100–5 000	100%	65–85%	40–60 (> 13 000)	1–24 h+	5-100 (165)	2 000–4 300 (2 638)	s – min	Mature
Hydrogen	0–500	-	25–58%	5–20+(1 000–20 000)	sec−24 h+	15 (32**[42]**)	500–10 000 (5 873**[42]**)	s – h	Commercial
Supercapacitor	0–0,3	-	90–95	20+(> 100 000)	ms−60 min	300–2 000 (74,480)	100–450 (930)	8 ms	Development

* **Development**: technology in research and development phase. **Commercial:** technology already available on the market, but few projects have been completed. **Mature**: technology already established in the industry and deployed in several projects.

8.9. Clean Mobility

This section aims to explore existing technologies for clean mobility and their technical aspects. Two main options are being deployed for no emission transportation: Electric Vehicles (EVs) and Fuel Cell Electric Vehicles (FCEVs). Furthermore, this section presents the provincial program for clean mobility deployment in the near future in British Columbia, as well as, available federal and provincial incentives applicable to Bella Bella for clean mobility.

8.9.1. ZEV In Canada

Transportation accounts for approximately 25% of Canada's greenhouse gas emissions (GHG), of which almost half comes from passenger cars and light trucks.

The Government of Canada has set federal targets for zero-emission vehicles to reach 10% of light-duty vehicles sales per year by 2025, 30% by 2030 and 100% by 2040. Canada considers battery electric vehicles (BEV), fuel cell electric vehicles (FCEV), and plug-in hybrid electric vehicles (PHEV) as Zero Emission Vehicles (ZEVs). BC has led provincially with the adoption of ZEV purchase incentives and sales regulations, and has started to deploy hydrogen fueling infrastructure and FCEVs in limited quantities.

To date, approximately 110 light-duty vehicles are in operation in Canada, supported by 3 retail fueling stations in BC, 1 in Quebec, and 1 in Ontario. Four new stations are under development in BC, which will represent an important milestone as vehicle Original Equipment Manufacturers (OEMs) have indicated that 7-8 stations are needed in a region for coverage and redundancy to enable wider rollout of vehicles. BC also just announced funding for an incremental 10 new stations to continue to expand the network. It is expected that an additional ~150 LD vehicles will be shortly deployed as the new stations come online.

8.9.2. Electric Vehicles (EVs)

The benefits of EVs include:

- Cost savings: The fuel cost of EVs in BC is equivalent to about $0.20 per litre of gasoline. Maintenance costs of EVs are half those of gasoline vehicles [12]. On a lifecycle cost basis, EVs are already typically competitive with conventional internal combustion vehicles. Also, the purchase and lease costs of EVs are declining, making them more and more competitive. Lower-cost EVs will further accelerate their adoption.
- Improved performance: EVs typically have superior handling and produce almost no noise pollution. .
- Reduced GHG emissions, better air quality and improved health. EVs' lifecycle GHG emissions are about 90% less than fossil-fuel vehicles when charging on clean electrical grids like BC's (Lifecycle emissions include resource extraction, manufacturing, operations and disposal of vehicles).

Industry average EV battery costs have declined from about $1,200/kWh in 2010 to $135/ kWh in 2020 and are projected to decline with technology improvements and economies of scale [13].

8.9.2.1. Charging Stations

There are different "levels" of EV supply equipment [14], summarized in Table 6.

- **Level 1 (120 VAC):**
  - Level 1 charging uses 120-volt (V) alternating current (AC), delivered by a standard three-prong household plug. Generally, EVs come with a Level 1 charger as standard equipment. Level 1 can be sufficient, however, it is too slow. New Level 1 outlets are rarely installed for EV charging, but existing outlets can sometimes provide economical access to charging where Level 2 is not available.
- **Level 2 (208/240 VAC):**
  - Most multi-unit residential buildings (MURB) add Level 2 charging, which can provide a sufficient rate of charging.
- **Level 3 (DC Fast Charging):**

- DC fast charging (DCFC) provides high-speed rates of charging, but is expensive ($40,000 to $100,000+ per charging station), and therefore is usually used only for public charging stations, and not usually in MURBs [14].

Charging stations may be supplied by photovoltaic energy. In that case, a PV system will not require inverters to convert DC to AC current but only batteries to storage DC power. Then, EV can be directly charged from PV batteries.

Table 6. Charging levels for Electric Vehicles [14]

TYPE	Voltage (V)	Power Output (kW)	Speed of Charge	Vehicle Range Added per Hour of Charging (km)	Cost
Level 1	120	1.44–1.92	Slow	3–8	$–$$
Level 2	208–240	≤19.2	Medium	~15–120	$–$$$
DC Fast Charge	200–600	<400	Fast-Very Fast	~150 – 2500	$$$$ – $$$$$$

8.9.2.2. Provincial Incentives

The Government of BC offered incentives for EVs and EV charging infrastructure [14], as described in Table 7.

Table 7. Provincial incentives for EV and EV charging infrastructures

Area of incentive	Funding
The EV Ready rebate	75% of the costs to a maximum of $3,000 for an approved EV Ready plan, 50% of the costs up to a maximum of up to $600 per EV Ready parking space, max electrical infrastructure rebate of up to $80,000 per MURB complex.
The EV Charger rebate	50% of the costs of installing Level 2 EV chargers, up to $2,000 per charger and $14,000 per Multi-Unit Residential Buildings (MURB) complex.
electric vehicles	up to $5,000 for the purchase or lease of a new battery electric or plug-in hybrid electric vehicle, up to $6,000 for a hydrogen fuel cell vehicle.

8.9.2.3. Federal Incentives

The Zero Emission Vehicle Infrastructure Program (ZEVIP) is a 5-year $280 million program ending in 2024 and its objective is to address the lack of charging and refueling stations in Canada.

Table 8. Federal incentives for EVs infrastructure

Type of Infrastructure	Output	Maximum Funding
Level 2 (208 / 240 V) connectors	3.3kW to 19.2kW	Up to 50% of total project costs, to a maximum of $5,000 per connector
Fast charger	20kW to 49kW	Up to 50% of total project costs, to a maximum of $15,000 per charger

8.9.3. Fuel Cell Electric Vehicles (FCEVs)

Hydrogen can be used directly as a fuel in fuel cell electric vehicles and is becoming an attractive zero-emission alternative for transportation, especially for heavy-duty vehicles that require energy dense fuels and where batteries have limitations. Furthermore, Fuel cell light-duty passenger vehicles and transit buses are commercially available today and deployed in limited numbers in Canada.

FCEVs can offer advantages in remote and Indigenous communities in colder climates where battery chemistries are negatively impacted. Fuel cells do not suffer the same inherent performance degradation in cold temperatures, and waste heat from the fuel cells can be used for cabin heating to further differentiate extended range of FCEVs in these cold climates.

British Colombia has published the 2018 Fast Charging Network Study to outline the approximate location and number of public fast charging sites and ports as well as hydrogen stations to facilitate safe, convenient zero emission vehicle (ZEV) travel across B.C. through 2040 for light-duty vehicles [15].
In total, approximately 194 fast charging sites are needed to facilitate travel across the province and 6,710 ports across 400 sites will be needed by 2040 to support the expected EV population. Approximately 82 hydrogen fuelling sites comprising 141 hydrogen stations are needed by 2040 as well to support FCEVs across the province.

The nearest hydrogen fuelling sites to Bella Bella will be Bella Coola (100 km) and Port Hardy (165 km) according to [15].

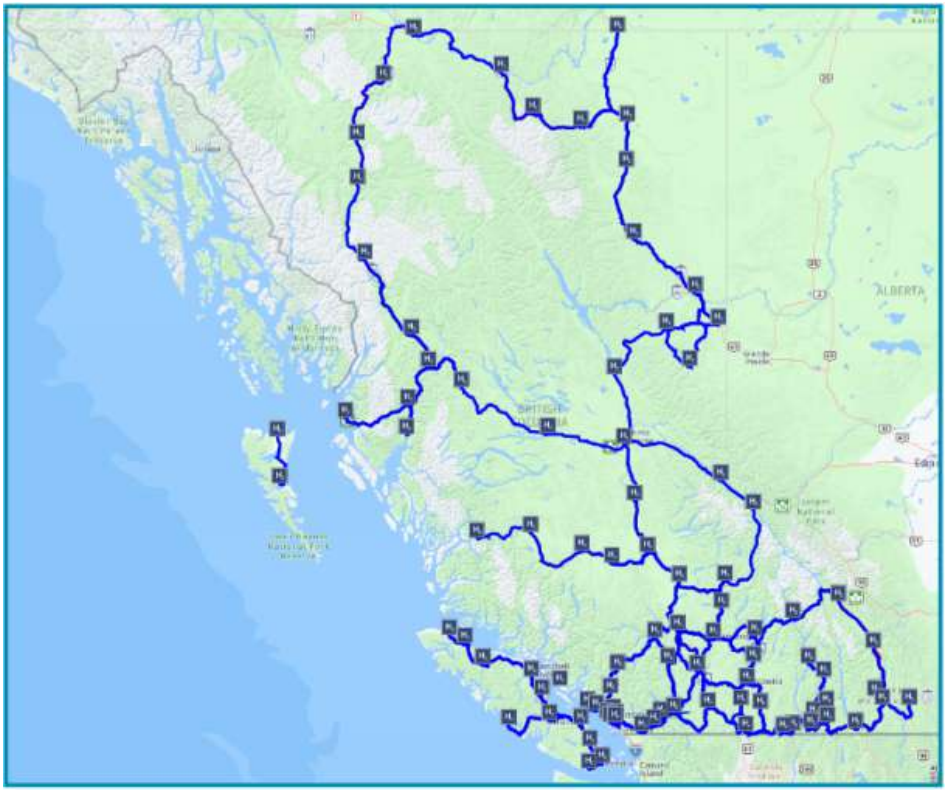


Figure 9 : Map of Hydrogen Stations Estimated by 2040 [15]

8.9.4. Next Steps

Next steps consist of:

- Survey of heavy-duty vehicles for land and marine transport and assessment of actual and future transportation needs: number of vehicles and marine vessels, public transportation, energy demand for transportation, etc.
- Estimation of GHG from transportation and avoided GHG after transport electrification.
- Economical assessment of EVs and FCEVs transition: costs of EVs infrastructure, costs of EVs, EV batteries, FC batteries, etc.
- Analysis of FCs availability and supply,
- Analysis of EVs and FCs life cycle: supply, maintenance, recycling, etc.
- Feasibility study for local production and storage of green hydrogen.

8.10. Regulatory Framework of Energy Projects

8.10.1. Energy Policies

During the last decades, British Columbia emphasized a shift towards clean energy through several policies and initiatives that could be beneficial for Bella Bella's energetic future.

8.10.1.1. Clean BC Roadmap to 2030

British Columbia launched, in October 2021, the CleanBC Roadmap to 2030[21] that updates the initial CleanBC plan to put the province on a path that will reduce pollution and build a cleaner, stronger economy for people throughout B.C. This plan puts greater focus on transitioning away from fossil fuels and adopting clean energy solutions. It aims to attract investment and build opportunities for British Columbians and to embody B.C.'s commitment to meet the climate targets.

The CleanBC Roadmap to 2030 includes a series of actions across eight pathways [16]:

- Low Carbon Energy,
- Transportation,
- Buildings,
- Communities,
- Industry, including Oil and Gas,
- Forest Bioeconomy,
- Agriculture,
- Aquaculture and Fisheries,
- Negative Emissions Technologies.

The Roadmap actions [16] include:

- Doubling the target for renewable fuels produced in B.C. to 1.3 billion litres by 2030;
- An accelerated zero-emission vehicle (ZEV) law (26% of new light-duty vehicles by 2026, 90% by 2030, 100% by 2035);

[21] https://cleanbc.gov.bc.ca/

- Complete B.C.'s Electric Highway by 2024 and a target of the province having 10,000 public EV charging stations by 2030;
- Actions to support mode-shift towards active transportation and public transit;
- Stronger methane policies that will reduce methane emissions from the oil and gas sector by 75% by 2030 and nearly eliminate all industrial methane emissions by 2035;
- Implement programs and policies so that oil and gas emissions are reduced in line with sectoral targets;
- New requirements for all new buildings to be zero carbon and new space and water heating equipment to be highest efficiency by 2030;
- Implement a 100% Clean Electricity Delivery Standard for the BC Hydro grid;
- Support for innovation in areas like low carbon hydrogen, the forest-based bioeconomy and negative emissions technologies.

8.10.1.2. Clean Energy Act

The 2010 Clean Energy Act[22] introduced British Columbia's energy objectives, including the goals of:

- Generating at least 93% of electricity from clean or renewable resources and to build the infrastructure necessary to transmit that electricity;
- Taking demand-side measures and energy conservation, including the objective of the authority reducing its expected increase in demand for electricity by the year 2020 by at least 66%;
- Reducing BC greenhouse gas emissions by 2020 to at least 33% less than the level of those emissions in 2007, and by 2050 to at least 80% less than the level of those emissions in 2007;
- Encouraging communities to reduce greenhouse gas emissions and use energy efficiently;
- Fostering the development of first nation and rural communities through the use and development of clean or renewable resources.

[22] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/10022_01

The 2010 CEA also provided for the creation of the First Nations Clean Energy Business Fund (FNCEBF).

8.10.1.3. First Nations Clean Energy Business Fund (FNCEBF)

The FNCEBF[23] promotes increased Indigenous community participation in the clean energy sector within their asserted traditional territories and treaty areas.

The fund provides:

- Revenue sharing agreements with First Nations where there are provincial water and/or land rentals from renewable energy projects undertaken in their territory,
- Capacity funding for the implementation of project feasibility studies and financial analysis of potential projects, community energy planning or engaging with project proponents, and
- Funding for financially viable renewable energy projects through an electricity purchase agreement.

Fund eligibility criteria restricts to projects located in British Columbia and applicants to Indigenous communities in British Columbia falling into one of the following categories:

- A First Nation “band” as defined by the Indian Act;
- An Indigenous governing body, however organized and established by Indigenous peoples.
- The fund appropriation is limited to a maximum of $50,000 per eligible applicant.

8.10.1.4. The Net Metering Program

The Net Metering program[24] is designed for customers who generate electricity for their own use and it is possible to feed the electricity’s excess back to the grid and get a bill credit towards future electricity use.

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[23] https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations/first-nations-clean-energy-business-fund

[24] https://www.bchydro.com/work-with-us/selling-clean-energy/net-metering.html

The following criteria are mandatory for electricity generators to participate in the Net Metering Program:

- Be owned or leased by the customer
- Connect to BC Hydro distribution system
- Use a clean or renewable resource as defined by the Clean Energy Act (such as solar, wind, hydro, etc.)
- Have an aggregate nameplate capacity of no more than 100 kW

As of June 2021, over 3,700 customers have been participating in the net metering program, most of them with solar photovoltaic systems.However, for projects located in Non-Integrated Areas, BC Hydro will perform a deeper and more detailed technical review of all net metering applications because the NIA systems comprises various resources (including diesel, existing or proposed IPP renewable generation and new intermittent renewable energy via net metering).

BC Hydro strongly recommends that NIA customers do not purchase their generating equipment until their net metering application is accepted by BC Hydro.

8.10.1.5. BC Hydro's Integrated Resource Plan

The BC Hydro's Integrated Resource Plan (IRP)[25] outlines how BC Hydro plans to provide reliable, affordable and clean electricity to meet customers' evolving electricity needs. It considers BC Hydro's 20-year projections of electricity demand in B.C and includes BC Hydro's planning objectives: keeping costs down for customers, reducing greenhouse gas emissions through clean electricity, limiting land and water impacts, and supporting the growth of B.C.'s economy.

[25]https://www.bchydro.com/toolbar/about/planning-for-our-future/clean-power-2040.html?utm_source=direct&utm_medium=redirect&utm_content=cleanpower2040

8.10.1.6. BC Hydro's Electrified Plan

In September 2021, BC Hydro launched its Electrification Plan by offering customers incentives, tools and support to help them to provide clean electricity and to reduce the time of their connection to the grid.

The Electrification Plan[26] will encourage and incentivize residents and business to switch from fossil fuels to clean electricity while encouraging economic development and is expected to result in an additional 3,100 gigawatt hours of load and greenhouse gas emission reductions of 930,000 tonnes per year by the end of 2026.

Electrification Plan focuses on three keys areas [17]:

- **Buildings:** Residential and commercial buildings in B.C. represent almost 11% of the province's total emissions, mostly due to heating. BC Hydro encourages the introduction of new heat pump rebates and the increasing of energy efficiency standards that advance electrification for builders and developers.
- **Transportation:** the transportation account for about 40% of B.C.'s greenhouse gas emissions. BC Hydro plans to encourage clean transportation by expanding its fast charging network, with an objective of 325 charging stations at 145 sites across the province by the end of 2025. BC Hydro plans also to introduce new programs to support commercial fleets, including large trucks and buses, to switch from carbon-emitting gasoline and diesel to clean electricity.
- **Industry:** This sector also accounts for about 40% of greenhouse gas emissions. BC Hydro will provide incentives to businesses interested in making the switch to clean electricity. The Electrification Plan also includes incentives to attract new clean industry to B.C., such as hydrogen production, carbon capture, synthetic fuel production and data centers.

[26]https://www.bchydro.com/toolbar/about/planning-for-our-future/clean-power-2040.html?utm_source=direct&utm_medium=redirect&utm_content=cleanpower2040

8.10.1.7. BC Hydrogen Strategy

B.C. is the first province in Canada to release a hydrogen strategy. The B.C. Hydrogen Strategy[27] outlines how the Province will support the development of production, use and export of renewable and low carbon hydrogen for the next 10 years and beyond. It complements the federal hydrogen strategy and it includes 63 actions to undertake over the short term (2020-2025), medium term (2025-2030) and long term (2030-beyond). These include:

- incentivizing the production of renewable and low-carbon hydrogen;
- developing regional hydrogen hubs where production and demand are co-located;
- financial supports for deploying fuel cell electric vehicles and infrastructure;
- expanding the use of hydrogen across different industrial sectors and applications;
- promoting the adoption of hydrogen in areas where it is most cost-effective in terms of emission reductions;
- creating the B.C. Centre for Innovation and Clean Energy to drive the commercialization of new hydrogen technology; and
- establishing ambitious carbon-intensity targets and a regulatory framework for carbon capture and storage.

8.10.1.8. Clean BC Go Electric Commercial Vehicle Pilots

The CleanBC Go Electric Commercial Vehicle Pilots program[28], launched in 2021, supports the switch to zero-emission commercial vehicles of all types, including trains, ships, trucks, construction and agricultural equipment, along with the necessary charging and fueling infrastructure.

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27 https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/electricity/bc-hydro-review/bc_hydrogen_strategy_final.pdf

28 https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/clean-transportation-policies-programs/clean-energy-vehicle-program/commercial-vehicles/17208-53529

8.10.1.9. Indigenous Forest Bioeconomy Program (IFBP)

The IFBP[29] supports the development of an Indigenous bioeconomy under the following objectives:

- Grow the B.C. bioeconomy through innovation and partnerships
- Provide economic opportunities for Indigenous and rural communities in developing the forest bioeconomy to establish a broad range of partnerships and collaborations
- Support Indigenous Peoples in economic development opportunities in the natural resources sector that reflect Indigenous interests and support self-determination

Projects have numerous environmental, economic, social and cultural benefits. By utilizing forest biomass and residuals from conventional harvesting for novel high-value applications, the program supports forest sector transformation with full participation of Indigenous peoples.

8.10.2. Permitting Requirements

This section provides an overview of provincial, federal and local regulations that could be required in order to proceed with a renewable energy project.
In fact, there are many provincial ministries, federal departments and agencies involved with permitting and approvals. The B.C. government has created FrontCounter BC, a single window of service, where citizens and businesses can obtain all necessary information about the authorizations required to start or expand a clean energy project.

Table 9 lists the principal Acts and Statutes that a clean energy project developer shall consult at earlier stages in order to ensure that the project complies with various legal requirements.

[29] https://www2.gov.bc.ca/gov/content/industry/forestry/supporting-innovation/ifb/ifbp

Table 9. List of applicable acts and legislations for renewable energy projects

Type	Act/legislation	Details
Federal statutes and permits	***Federal Real Property and Federal Immovables Act***[30]	The acquisition, administration and disposition of real property by the Government of Canada (i.e. the tenuring of federal Crown land) is done pursuant to this *Act.*
	Navigation Protection Program/Transport Canada[31]	Energy projects may affect transportation systems in the air and on the water and should be reviewed by Transport Canada's Navigation Protection Program to determine if any approvals are needed before starting.
	Canadian Environmental Protection Act[32]	According to this Act, energy projects may be required to prepare and implement a pollution prevention plan.
	Fisheries Act[33]	If the project is located near water or may affect the fish habitat, an approval from the Department of Fisheries and Oceans is required.
	Species at Risk Act[34]	This Act contains prohibitions to kill, harm or take specific species considered as Endangered, Threatened or Extirpated.
	Migratory Birds Convention Act[35]	This Act imposes measures to mitigate the project's impacts to migratory birds and their habitat during construction, operation and decommissioning.
	Canadian Environmental Assessment Act[36]	A description of the project must be submitted to the CEA Agency for review to

[30] https://laws-lois.justice.gc.ca/eng/acts/f-8.4/page-1.html
[31] https://tc.canada.ca/en/programs/navigation-protection-program/navigation-protection-program
[32] https://laws-lois.justice.gc.ca/eng/acts/c-15.31/
[33] https://laws-lois.justice.gc.ca/eng/acts/f-14/
[34] https://laws.justice.gc.ca/eng/acts/S-15.3/
[35] https://laws.justice.gc.ca/eng/acts/M-7.01/

		determine if a federal environmental assessment is needed.
Provincial Statutes and permits	***Land Act***[37]	The Land Tenures Branch should be contacted to get the necessary permits for the project's land.
	Agricultural Land Commission Act[38]	It prohibits the use of agricultural land within the Agricultural Land Reserve for non-farm use without permission.
	Water Sustainability Act[39]	It is the principal law for managing the diversion and use of water resources. It lists the necessary licenses and use approvals for projects using water resources.
	Water Protection Act[40]	It defines limits for bulk water removal.
	Fisheries Act[41]	It presents the Fish Protective Devices for Dams or hydraulic projects.
	Environmental Assessment Act	Environmental Assessment is required for power plants with capacity > 50 MW and for a transmission line equal to or greater than 40 kilometers in length.
	Environmental Management Act[42]	This Act regulates industrial and municipal waste discharge, pollution, hazardous waste and contaminated site remediation.
	Forest Act[43]	Permits are required to cut, damage, destroy and remove Crown Timber.
	Heritage Conservation Act[44]	Permits are required when the project may alter a heritage site or object.

[36] https://laws-lois.justice.gc.ca/eng/acts/c-15.21/
[37] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96245_01
[38] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/02036_01
[39] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/36_2016
[40] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_96484_01
[41] https://www.bclaws.gov.bc.ca/civix/document/id/92consol16/92consol16/79137
[42] https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/laws-rules/environmental-assessment-act
[43] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96157_00
[44] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96187_01

	Wildlife Act[45]	This Act aims to protect wildlife specimens.
	Park Act[46]	This Act imposes permits if any project works will occur in Parks.
	Geothermal Resources Act[47]	This Act regulates proponents who propose to install wells or other facilities to use the geothermal resource to produce energy.
Local legislation	***First Nations Land Management Act***[48]	The FNLMA allows First Nations to develop and implement their own policies for administering their lands, based on their own rules and customs.
	The Heiltsuk Land Use Plan [19],	The Land use plan sets the locations where development can and cannot occur within the territory as well as the environmental standards that the community follows. To manage the land use in a way that is compatible with Haíłzaqv values and needs, the Haíłzaqv Territory is subdivided into 2 types of areas of land [19], as illustrated in Figure 10: 1. Cultural and Natural Areas are managed to maintain their natural and cultural values, while maintaining or enhancing traditional use and minimizing adverse impacts. These areas will be kept largely in a natural or wilderness condition, although low-impact tourism and access may be permissible. 2. Ecosystem-based Management Areas are managed according to EBM principles and practices. These areas provide appropriate opportunities for resource development while maintaining or enhancing opportunities for traditional use

[45] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96488_01
[46] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96344_01
[47] https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96171_01
[48] https://laws-lois.justice.gc.ca/eng/acts/F-11.8/

		and minimizing adverse impacts on natural and cultural values. Bella Bella and Ocean Falls are within the Ecosystem-based Management Areas.

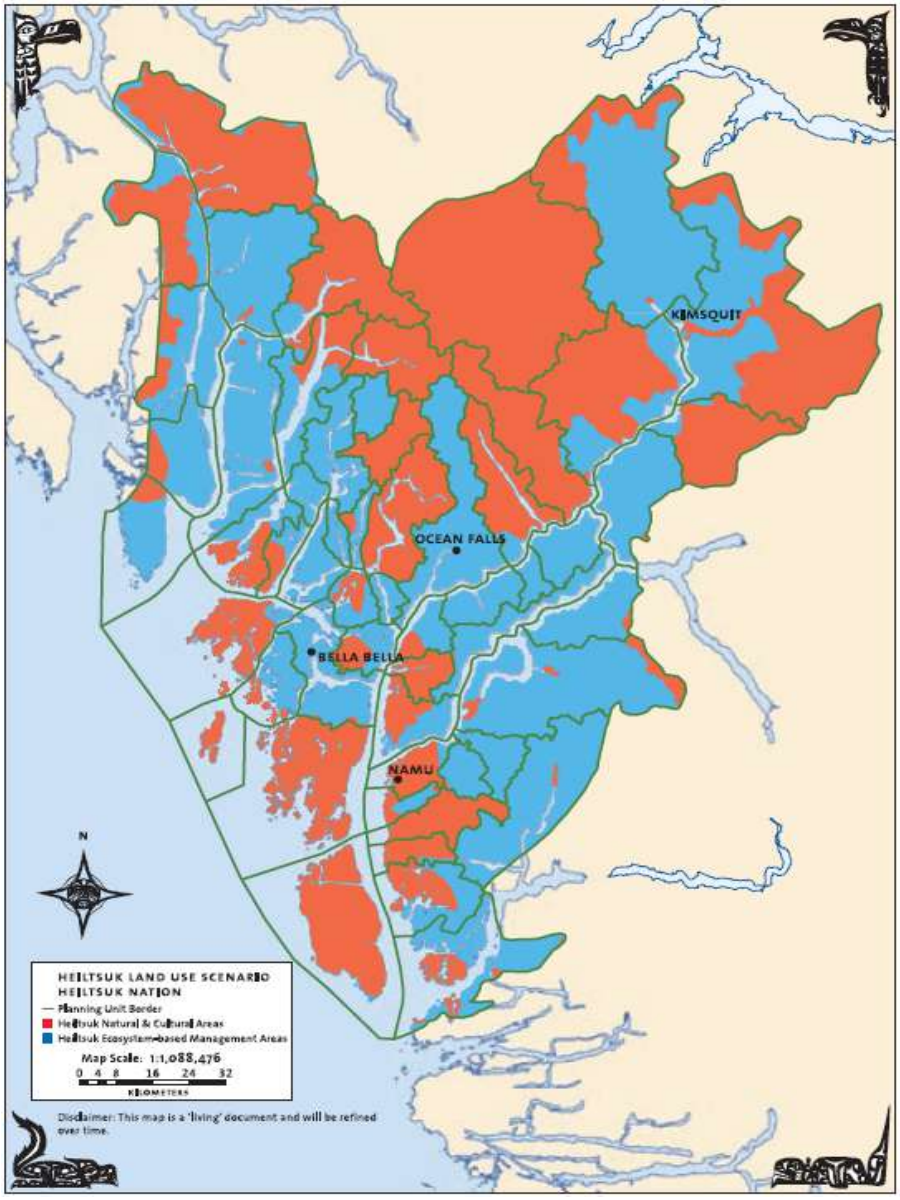


Figure 10. Distinct planning areas of Haíłzaqv territory [19]

The regulatory process and applied laws to a renewable energy project vary depending on the renewable resource to be used and its location[49]. For example, if the project is to be entirely or partially located on provincial Crown land, a Land Act tenure is necessary.

Furthermore, for wind energy, the regulatory process begins with the submission of an investigative permit that allows to conduct studies to identify potential monitoring sites for the wind resource. Then, an application for a license of occupation is submitted to authorize the installation of monitoring equipment such as wind towers that contain anemometers and other instruments to collect data. If monitoring confirms that the resource potential is sufficient, an application for a license of occupation to construct a wind facility would then be submitted.

The table below sets the different permits and authorizations needed throughout a renewable energy project life.

Table 10. Permits and licenses required for each type of renewable energy project

Types of renewable energy projects	Applications of licenses and permits	Details
Common licenses and permits for all types of renewable energies projects	Land Authorizations and Permits	- ***Investigative License of Occupation***: required to use a Crown Land to do appraisals, inspections, surveys, field studies, analysis, etc. Delivered by Land Tenures Branch. License lasts 5 years and can be for an area up to 5000 ha. $500 a year annual rental. - ***General Area License of Occupation***: For tenure/footprint (Footprint can include powerhouse, penstock, intake, etc. or temporary construction areas such as laydown and spoil areas.

[49] https://portal.nrs.gov.bc.ca/web/client/home

		- ***License of Occupation***: if a land is needed for a work camp.
	Right of Way	- ***Statutory ROW*** is needed to put in transmission lines. - ***Statutory ROW*** is needed for penstock or tunnel and headpond if using Crown Lands.
	Forest Authorizations and Permits/Tenures	Approvals are required to cut, damage, destroy and remove Crown Timber whether it is for Roads, constructing project works and installing infrastructure. Requirements for Planning, design and construction to Protect Forest Roads and Timber Tenures are presented in [21]. - ***Occupant license to Cut or Free Use Permit***: Need it to cut and remove less than 50 m3 of merchantable timber. - ***Works Permit***: If the project needs to carry out works within a Forest Service. - ***Third Party Road Use Agreement/ Road Use Permit***: To use a road where there is already a primary road user (already has a road permit for a non service road).
	Archeology permits	***Inspection/Investigative Site Alteration, Alteration permit***: are required under Heritage Conservation act to alter a heritage site or object.
	Road and Highway Permits	According to the BC Transportation Act, permits are needed to use, impact, or

		connect to highways, secondary roads or public rights of way. This can be for temporary or permanent use. - ***Access Permit***: Is needed to construct any roads that originate off any roads maintained by the Ministry of Transportation. - ***A license of occupation*** will be needed for roadways and bridges leading to the project site. - ***Utility Permit***: Needed if you are constructing or maintaining power lines within the existing Ministry of Transportation highway right of way.
	Parks and Protected Areas	If there is any proposed works in Parks, permits must be obtained [50].
	Regulation of Air Safety and Navigable Waters (Transport Canada)	Clean energy projects may affect transportation systems in the air and on the water, such as wind towers, equipment for tidal or wave energy, dams, bridge crossings, antennas, cable crossings and buildings. Transport Canada's Navigation Protection Program will review the project to determine if approvals are needed. If the project is within the list of Scheduled Waters, an approval of Navigation Protection Program (NPA)[51] Transport Canada is needed.

[50] https://bcparks.ca/permits/
[51] https://tc.canada.ca/en/programs/navigation-protection-program/navigation-protection-program

	Migratory Bird Convention Act and Regulations	If the project has any impacts to migratory birds and their habitat, the proponent must propose measures to mitigate adverse effects during construction, operation and decommission.
	Wildlife Regulations	***Wildlife Sundry permits*** are required to capture and/or collect specimens for scientific and other non-recreational purposes.
	Fisheries and Oceans Canada approvals	If the project is near water, it requires to follow the DFO's process to evaluate the project's potential impacts for fish and its habitat and to get the necessary approvals. - If harmful impacts cannot be mitigated, it is needed to have authorized Harmful Alteration, Disruption of Destruction of fish habitat (HADD) and to propose a sound plan to create fish habitat elsewhere. -
	Miscellaneous permits	If the project needs a camp, it may need A Food Premises Permit, Refuse Permit, Fuel Storage Registration, Effluent Discharge Permit, Air Discharge Permit. ***Mineral Reserve Tenure***: it is possible to apply for Mineral Reserve Tenure to prevent any mining claims from being staked in or near the project.
	British Columbia's Environmental Assessment Act	Environmental Assessment Process is required for: * Power Plants *w*ith capacity > 50 MW. * Modification of an existing facility that results in the facility having a capacity that

		has increased by more than 50 MW of electricity. * New electric transmission line of >500 kV and >40 km in length on a new right of way. * Modification, extension or replacement of a facility with a voltage of >500 kV or higher and 40+ kms or longer; or addition of a transmission line within the right of way occupied by the existing facility.
	Federal Environmental Assessment	The Federal Environmental Assessment must be applied to a project if it falls in definition of the Regulations Designating Physical Activities. Ministers can also designate a project to fall under the Canadian Environmental Assessment Act (CEAA). CEAA will apply if: * Building project or transmission line in wildlife area of migratory bird sanctuary * Fossil fuel generating project >200 MW * In stream tidal generating project over 50MW * A new hydroelectric facility >200 MW * Any expansion of projects to > 50 MW for tidal and >200 for fossil fuel or hydroelectric dams If a project is reviewable under CEA, it will typically require a BC EA.
Specific Licenses for wind energy projects	Land Authorizations and Permits	- ***Investigative permit*** is needed to conduct studies to identify potential monitoring sites for the wind resource. - ***License of occupation*** is required to authorize the installation of monitoring equipment such as wind towers that

		contain anemometers and other instruments to collect data.
	Regulation of Air Safety	For Wind Power Projects, Transport Canada's Navigation Protection Program approvals are required to install wind towers and turbines.
	Acoustic Assessments	An acoustic Assessment may be needed for Wind Power [22].
Specific Licenses for water run of river projects	Water Licensing	Water licenses are needed for power production, water storage and industrial or commercial use. In order to get water license impacts on third parties, public safety, environment protection and other water users must be identified. - If the project land is appurtenant to the water, land authorizations should be also obtained. For Crown land tenure, an Investigative License application is sufficient to apply for a water license. - If the project has a headpond area or reservoir, a License of Occupation is needed. - If there is stored water, then a ***permit over Crown Land*** is needed as a part of the project water license. - If the project uses storage, then a ***storage purpose Water License i***s needed. - A ***temporary License*** is needed for Workers Camp. - An ***approval or notification for Changes in or about a stream*** is needed to make

		changes in and about a stream, such as stream crossings for road access. - An ***approval for diverting water*** during construction for short term use is also needed.
	Fisheries Regulations	Need DFO to authorize any work that may generate a harm alteration, disruption or destruction of fish habitat (obstructing fish passage, entrainment of fish at intake causing mortality, insufficient flows for protection of fish or sudden flow changes causing stranding) and for any work in water, within 30 meters of water or that may affect water quality or quantity. DFO's Project Notification and Review Application form should be completed for all waterpower projects.
Specific Licenses for biomass energy projects	Fuel supply Licenses	- An application should be submitted to FrontCounterBC. It includes fuel supply sources, locations and amounts. - If using standing timber, locations, volumes and species must be identified and license agreements will be issued to move Crown timber from forests.
Specific Licenses for geothermal energy projects	Geothermal resources use authorizations	Permits must be obtained and the proponents must demonstrate diligent use of the geothermal resource.

8.11. Partnerships

Our community can consider partnerships with different stakeholders to establish its energetic strategy and to develop clean and renewable energy opportunities. These stakeholders can include residents, other neighbouring communities, BCHydro, Boralex LP, governmental agencies for regulatory affairs (permitting, environment, funding), private business, non-profit organizations, governmental organizations such as first respondents (fire, police and medical).

There are several roles that the community can take in clean and renewable energy projects, from being 100% owner of a project to any other share that the community should negotiate:

- **Owners and lead project developers:** The community can develop energy projects by herself in all phases (design, construction, operation) and owns 100% of projects. This option offers a simple structure and low administration costs. However, in this case, the community is the sole responsible and it is exposed to all risks if the project fails or defaults on financial obligations.
- **Equity owners:** If a clean energy developer approaches the Haíłzaqv Nation to do a project within our territory, we can negotiate with the developer to own a part of the project, as an equity owner. In this case, the Haíłzaqv Nation will negotiate the way to bring equity into the project. However, we should have a deep understanding of projects' financial models and possess strong negotiations capacities.
- **Resource royalty sharing:** If the community does not want to take risks, there is the opportunity to negotiate a resource royalty sharing agreement. To determine the fair share of royalties and better negotiate it, the community should understand the investments and the profit that the project will make.

8.11.1. Next Steps

- Develop a partnership strategy to build relationships with all Stakeholders before starting a project (at the project scoping and pre feasibility stage). This strategy should consider the community's requirements, needs and desires.

- Identify the key community Stakeholders and obtain information on each one. Focus on issues and difficulties that Stakeholders may have had in the past with similar projects and on other communities' experiences in renewable energies.
- Identify the Stakeholders roles, objectives and expectations in the project.
- Create a map of the business environment.
- Meet with the stakeholders and discuss the project development and different ways they can participate in it. Discuss other specific issues: employment, opportunities for them and for the community, training.
- Develop a Memorandum Of Understanding ("MOU") to guide the relationship between the parties. The contents of an MOU include its scope, the project definition, the parties and their respective responsibilities and roles, the duration of the agreement.
- Assess the possible business models that could be used for a specific project: Sole Proprietorship, Partnership, Public-Private Partnership, Corporation, Limited Liability Company (LLC) and Co-operative. Identify the advantages and disadvantages for the community and seek the advice of a business planner before deciding.
- Develop and negotiate a financial partnership with some of the Stakeholders. For example, the community can study the possibility to take part of the ownership of the Ocean Falls Hydroelectric station and to undertake negotiations with Boralex LP and assess the fair share that can hold.
- Develop a preliminary public information program explaining the project development phases and activities from the concept to construction and to operation phases.

8.12. Energy Development process

The realization of a renewable energy project represents the culmination of a considerable effort which includes the commitment of human and financial resources from the beginning. The project development process is different depending on the size, type and location of the renewable energy project.

8.13. Minor Capital Projects

Minor Capital Projects are defined as small clean energy projects or installations, such as installation of rooftop solar panels on community buildings and energy efficiency upgrades to homes. The development of these projects needs, firstly, a site resources assessment and a technical design and feasibility study and then a financial study to have accurate cost estimates. The implementation of these projects is simple and does not need large human resources and time. Heiltsuk nation will need to Identify engineering companies to design and install minor capital projects as needed.

8.14. Major Capital Projects

Major capital projects refer generally to large-scale renewable energy generation projects; such as wind farms. The development process of these projects comprises several phases and may last for several years (up to 40 years).

8.14.1. Resource Evaluation

During the resource evaluation phase, a potential renewable resource is reviewed and observed in a specific site to determine if the resource is of sufficient quantity. The resource assessment phase may take several months or years to obtain more reliable information and its cost is highly variable depending on the type of resource. For example, wind resource assessments require the installation of relatively inexpensive wind monitoring towers while testing for geothermal energy relies on costly test well drilling.

At the end of this phase, if sufficient resources are not available, the project will be abandoned or another location will be chosen.

8.14.2. Techno-Economical Feasibility and Design

This includes the development of all technical and economic aspects of the project, as well as undertaking project planning by identifying the necessary human and financial resources. In

addition, at this phase, seeking for funding options with financial institutions and/or private investors begins.

8.14.3. Regulatory Approval

The regulatory approval process includes several permits as outlined in Section. Therefore, it is important to take in consideration that the regulatory approval process may take a long period and should be planified and done attentively.

8.14.4. Construction

The construction phase of the project can begin once all required approvals are issued and funding is obtained. The timeline of this phase depends on the nature, size and scope of the project and the specific environmental conditions.

This stage has several steps: planning, site preparation and construction. Planning is a critical element to organize all project activities and identify who will undertake the work and define the schedule. The site preparation includes activities such as timber harvesting, land clearing, road building and other activities to facilitate the construction. Then, the construction of the project is undertaken in accordance with the final design and permit conditions.

Throughout the construction phase, environmental compliance and monitoring are required because many disturbances may occur and other permits may be required.

8.14.5. Operation

Once construction is complete, the power plant operates for a long period. The operation life of each component in a renewable energy project is different, 25-30 years for Wind and solar projects and 30-40 years for a biomass project. The operation phase includes also the monitoring and performance analyzing, conducting environmental surveys and performing maintenance activities.

The community and the project proponent should consider delivering training to staff who will operate the plant and manage the project and to putting in place a safety plan.

8.14.6. Dismantling and Restoration

Once the operation period is ended, the provincial regulation requires the process of dismantling, reclamation and restoration. The dismantling involves the removal of the project infrastructure and the reclamation is the process of restoring back the land that has been altered for the project purpose to its original condition. The objective of reclamation is to protect the environment from the onset of the project.

In general, this phase requires a closure and reclamation plan, which is developed and agreed upon by the proponent, government agencies and the community. It includes activities of dismantling the facilities and returning the site to a safe, stable and reclaimed state. These actions may take several years to complete.

8.15. Renewable Energy Development Recommendations

8.15.1. Actual Energy Status Analysis

Electricity demand for Bella Bella community is 9,777 MWh /year distributed as follows: 73% residential, 20% Commercial and 7% for industrial sector. The monthly demand is lowest in summer, 530MWh/month in June and July, and highest in winter, 1000 MWh/month in January and February. This fact is not favorable for utility scale solar energy unless long-term storage is deployed. Electric demand growth is estimated at 1.6%/year.

GHG emissions from electricity are low, around 93 tCO_2 eq/year, thanks to hydro power from Boralex hydro station which feeds most of the electricity demand of Bella Bella. Emissions from auto and marine transportation sectors are respectively around 1168 tCO_2 eq/year and 1318 tCO_2 eq/year. Residential heating emissions are around 2596 tCO_2 eq/year.

Figure 11 illustrates a graphical map of the energy profile of Bella Bella, allowing a clearer idea about the distribution of the energy consumption as well as the GHG emissions by specific

sectors and fuels. It shows that more than 70% of energy consumption comes from fuels use, whereas electricity represents only 34% of the community energy consumption. Furthermore, heating and transport (auto and marine and marine) are the most- energy consuming sectors, with respectively 33% and 32% of total energy consumption and they represent also the main source of Greenhouse Gas emissions by almost 97%.

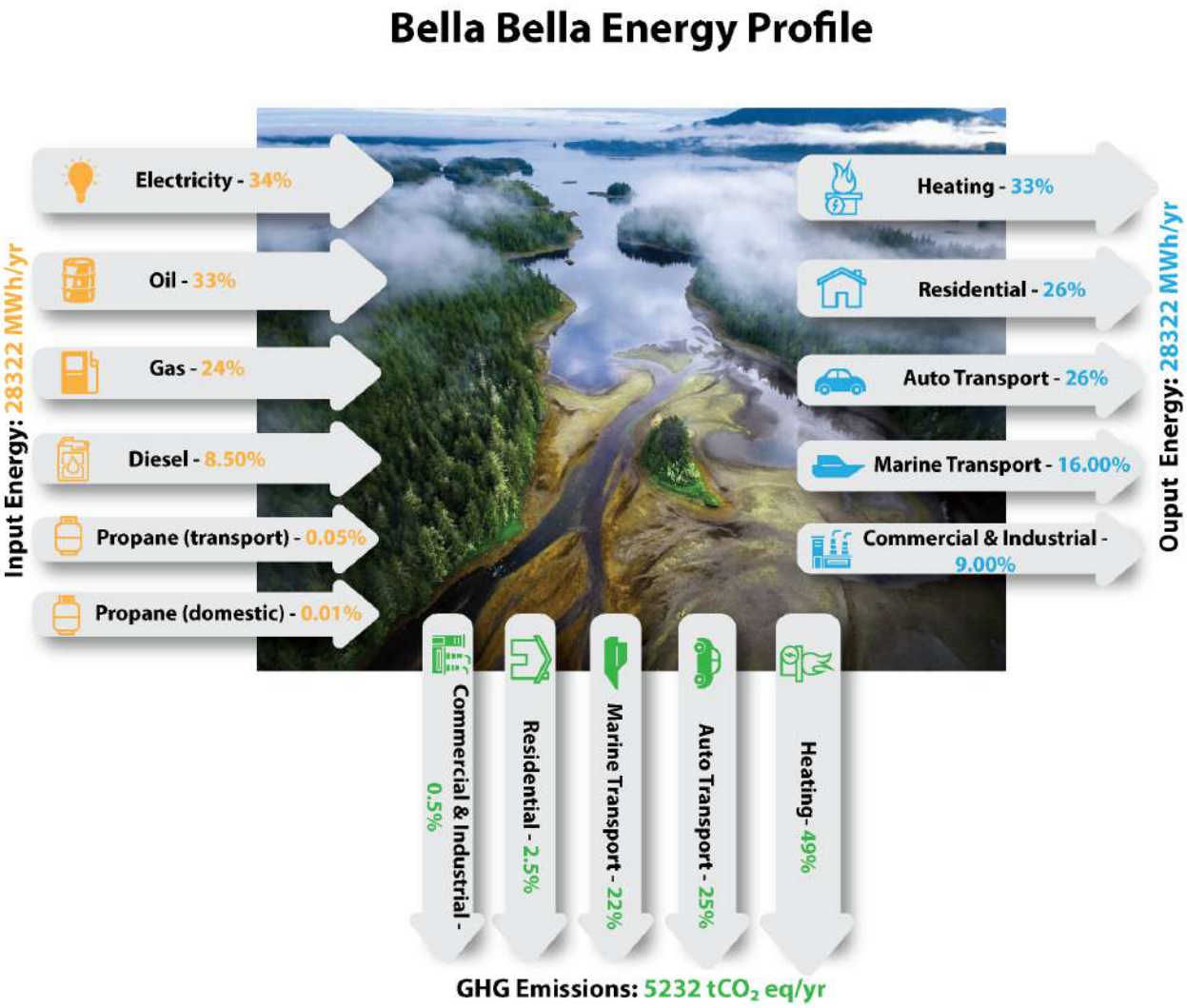


Figure 11. Bella Bella Energy profile

Lately, Bella Bella community has undertaken actions to reduce energy consumption mainly in the residential sector: Home energy audits, airtightness improvement and heat pump installations (1/3 of homes are now equipped with Heat pump). ICCP Stream 1&2 programs for building renovation aim to reduce the residential energy consumption by 40%. This may lead to reducing the total electricity demand of Bella Bella by 30%. Hence, this energy consumption

saving in the residential sector will widely absorb the energy demand increase in the future. Therefore, total electricity demand of Bella Bella in the next 10 years will decrease by 15% approximately.

In the mobility sector, Bella Bella community is aiming to electrify 75% of land transportation and 50% of marine transportation, Based on its community engagement survey. Marine transportation represents 50.64% of fossil fuel consumption and 49.78% of all transportation emissions. The community is planning to install 10 EV chargers and deploy 6 EVs to serve the community. The community is also aiming to electrify major buildings with solar energy.

8.16. Recommendations

8.16.1. Electricity Generation

- New large-scale renewable energies infrastructures can be installed either to replace back-up diesel generators or/and to increase the total electricity production to meet the future electrical demand. In order to justify this action, a review of the current and future Diesel Generators capacities and the ability of Ocean Falls hydro facility to fulfill the future Bella Bella's load should be conducted. Otherwise, new large-scale renewable energy projects would not make a significant contribution to the GHG reduction target.
- Technical and economical feasibility study should be performed for a micro-grid in Bella Bella, comprising several scenarios of different energy systems. Hydro power is recommended considering its relative stability, then solar and wind energy.
    - Deeper investigation on available renewable resources: In case of lack of existent information, install monitoring and measurement instruments.
    - Wind and solar energy should be studied with storage options (batteries, hydrogen) in order to have low impact on the local grid stability.
    - Partnerships with different stakeholders (capacity building, financial partnerships, etc.)
    - Challenges: renewable integration rate, sites availability and accessibility, costs, funding

- Small-scale renewable energy projects should be taken into consideration with careful attention. PV solar systems are the most recommended thanks to its advantages: easier installation, less O&M requirements
- Conduct feasibility study of small-scale solar PV projects for major buildings: electric demand analysis of selected buildings, available areas on rooftops/facades or nearby, grid connection or off-grid with storage, cost of kWh, etc.
- Permitting requirements should be taken into consideration at early stages of projects, at pre-feasibility study stage.

8.16.2. Transport

- EV can be an important GHG reduction driver. It is to note that federal and provincial government instances offer several funds and rebates, which makes transport electrification more relevant and a priority for the short term
- Survey of heavy-duty vehicles for land and marine transport and assessment of current and future transportation needs: number of vehicles and marine vessels, public transportation, energy demand for transportation, etc.
- Technical and economical assessment of EVs and FCEVs transition: costs of EVs infrastructure, costs of EVs, EV batteries, FC batteries, avoided GHG, etc.
- Analysis of EVs and FCs life cycle: supply, maintenance, recycling, etc.
- Hydrogen can be used for transport. A technical and economic study for Hydrogen supply should be performed: hydrogen supply from nearby stations or local production and storage of green hydrogen.
- Conduct a feasibility study for a solar PV system for DC charging stations for Electric vehicles.

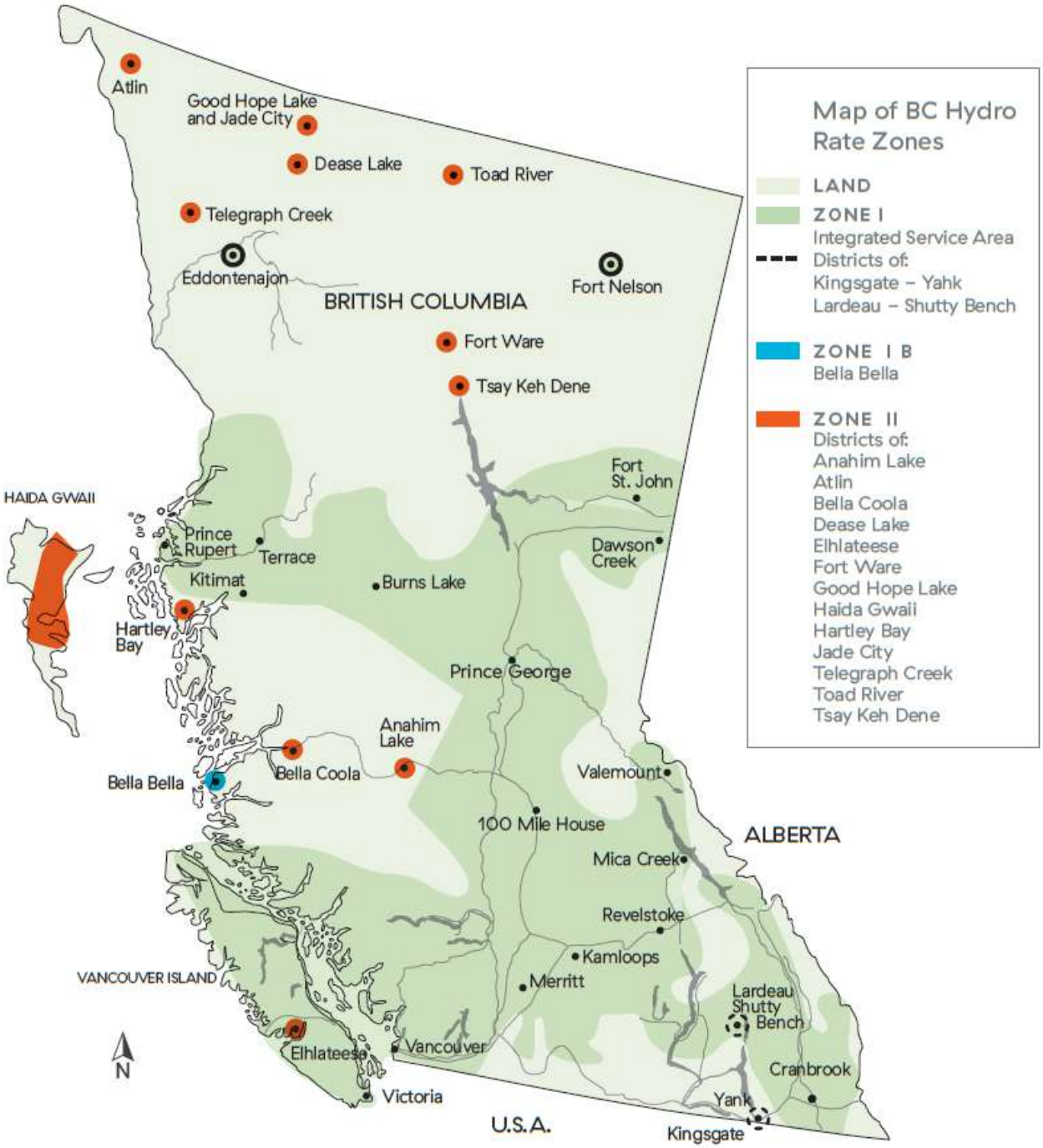
8.16.3. Heating

- Complete the energy efficiency measures first, then investigate the need for alternative heating sources, by assessing the heating demand of buildings.

- Consider Biomass and geothermal energies for heating, and perform a comparative study of the use of both technologies in heating.
- Further investigation is required to identify all potential biomass sources.
- Explore the possibility of a biomass combined heat and power unit with the local sawmill.
- Conduct a long-term comparative study between one central geothermal system vs distributed air thermo-pumps.
- Perform technical feasibility study of central geothermal heating system if this alternative remains competitive out of the previous step. The study should cover analysis of the ground source, logistics, feasibility of centralized heating system, costs, etc.

8.17. Energy Supply Source and Regulation

All renewable energy is provided by hydropower from a local hydro dam located in Ocean Falls. Owned and operated by Boralex, the Ocean Falls Hydroelectric Site has rates regulated by BC Hydro. Bella Bella and Denny Island are set at Zone 1B rates, the only such rate in British Columbia. A map outlining BC Hydro rates is provided below.


Map of BC Hydro Rate Zones
LAND
ZONE I
Integrated Service Area
Districts of:
Kingsgate – Yahk
Lardeau – Shutty Bench
ZONE I B
Bella Bella
ZONE II
Districts of:
Anahim Lake
Atlin
Bella Coola
Dease Lake
Elhlateese
Fort Ware
Good Hope Lake
Haida Gwaii
Hartley Bay
Jade City
Telegraph Creek
Toad River
Tsay Keh Dene
Atlin
Good Hope Lake and Jade City
Dease Lake
Toad River
Telegraph Creek
Eddontenajon
BRITISH COLUMBIA
Fort Nelson
Fort Ware
Tsay Keh Dene
Fort St. John
HAIDA GWAII
Prince Rupert
Terrace
Dawson Creek
Kitimat
Burns Lake
Hartley Bay
Prince George
Anahim Lake
Bella Coola
Bella Bella
Valemount
100 Mile House
ALBERTA
Mica Creek
Revelstoke
Kamloops
VANCOUVER ISLAND
Merritt
Lardeau
Shutty Bench
Elhlateese
Vancouver
Cranbrook
Victoria
Yank
U.S.A.
Kingsgate
N

9. Energy Efficiency and Renewable Energy Funding

9.1. BC Community Climate Funding Guide

Clean BC has created a comprehensive search tool to discover funding opportunities across provincial and federal government departments and non-profits.

To access the tool, visit the BC Community Climate Funding Guide:https://communityclimatefunding.gov.bc.ca/.

The Haíłzaqv Climate Action team will continue to use this tool and our partnerships to secure further funding opportunities.

10. Community Engagement

10.1. Community Engagement Overview

The Haíłzaqv Climate Action Team (HCAT) created opportunities for active community involvement through multiple platforms. HCAT has set a new standard for community engagement for the Haíłzaqv Nation. As a team we are especially proud of our community engagement having had to navigate the added challenges the global pandemic Covid 19 has created. We are so proud that over 1,000 Haíłzaqv descendants engaged to make the Haíłzaqv Community Energy Plan a reality.

Overview of Community Engagement Strategy:

- Two online zoom visioning sessions
- Utilization of ethelo the online consensus building survey platform
- Ethelo Haíłzaqv Clean Energy Plan Survey 1
- Ethelo Haíłzaqv Climate Solution Survey 2
- In person one-on-one advertised coffee shop sit-ins to help with survey completion
- Community Open House with refreshments and survey help offered
- Two online zoom sessions that aligned with the Ethelo Haíłzaqv Climate Solution Survey 2. These zoom sessions focused on prioritization of 12 climate solutions that were brought forward from the visioning sessions and survey 1.
- Virtual Facebook live updates of the two Community Energy Survey results with engagement prize draws
- Active Instagram: @heiltsukclimateaction, Facebook: @hailzaqvclimateaction, and YouTube: @Haíłzaqv Heiltsuk Climate Action updates
- Heiltsuk Tribal Council electronic mailing list updates, subscribe here: https://heiltsukclimateaction.ca/connect-with-us
- HCAT website: www.heiltsukclimateaction.ca
- Urban Haíłzaqv Open House in Vancouver, BC
- 3 HCAT Newsletters that were delivered door to door in Bella Bella: https://heiltsukclimateaction.ca/newsletters

10.2. Demographics

HCEP community engagements included participation from a diverse range of community demographics, including:

- Nínúẖaqḷa - elders
- Youth
- On and off-reserve members and homeowners
- The Haíłzaqv Climate Action Team
- Stewardship staff
- Traditional Knowledge Keepers
- Yi̓íḿás - Chiefs
- Ẇiúḿaqs - women of high rank
- Heiltsuk Tribal Council staff
- Bella Bella Community School Students

10.3. Workshops

In February 2019, a BC Hydro crew visited Bella Bella to train a local crew to install Eco Kit into every home in Bella Bella. The BC Hydro Eco Kit is filled with items to make our homes more energy efficient. The local crew was trained to complete installations and survey each home for the Heiltsuk Housing Department. However, due to COVID 19 the Eco Kit installation continues to be on hold for the community of Bella Bella.

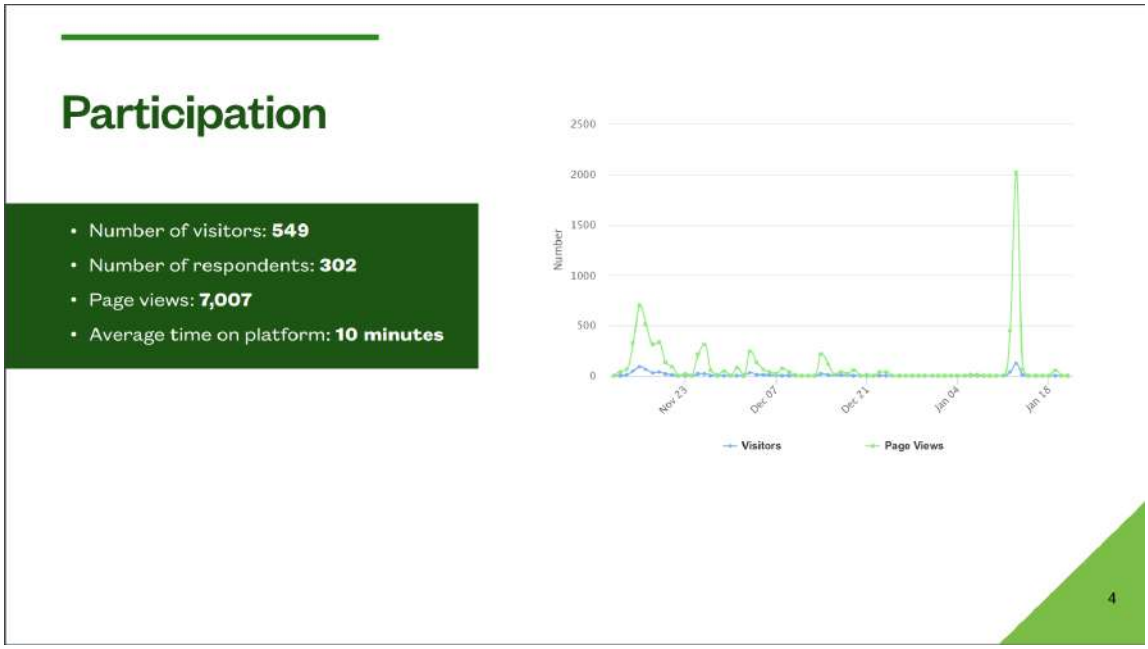
Also in early February 2019, HCAT hosted energy efficiency workshops for the local Housing, Capital, and Eco Kit Installation crews. This was the beginning of our community engagement process just before we found the need to adapt to virtual meetings as a result of Covid 19. Ian Scholten, Indigenous Clean Energy/Bringing It Home representative and Gail Lawlor of Energy Matters attended as resource staff to support the energy literacy of the Haíłzaqv Nation.

HCAT hosted a community dinner, followed by an energy efficiency workshop that was well attended by the Haíłzaqv Nation. Attendees were very engaged and actively participated in breakout sessions, learning about the importance of energy efficiency. Lawlor facilitated the workshop House as a System. The theme was that each house works as a system. Changes to one component of the system will affect the air, heat and moisture flows of the home. Understanding the building science principles of air, heat and moisture flow helps avoid moisture and mold problems, provide improved indoor air quality and occupant comfort, protect the integrity of the structure, and lead to lower energy bills. This workshop tied into our “Eco Kit” campaign that again was delayed due to Covid.

10.4. Ethelo Survey 1

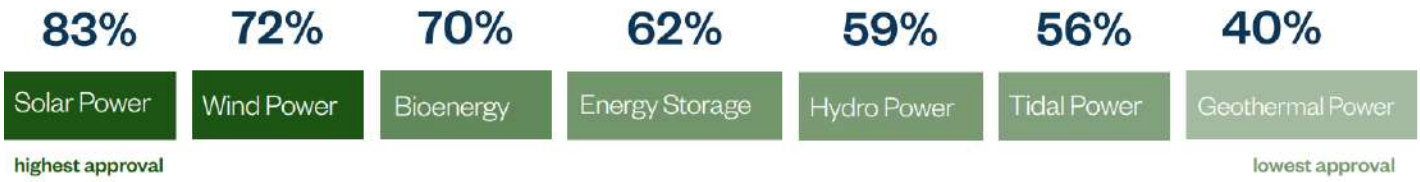
From November 16, 2020 to January 13, 2021, the Haíłzaqv Climate Action Team used a carbon emission simulation exercise powered by Ethelo to gather public feedback in order to help evaluate, which climate solutions should be implemented to transition the community off of diesel fuel. The purpose of this program was to give residents a say in ensuring the solutions to be implemented are chosen in a fair, effective way, with proven community buy-in.

The process educated residents on aspects of the Haíłzaqv Climate Action Team's various proposed solutions, such as the associated difficulty level and the potential efficacy of implementing each solution. Phase 1 survey also allowed community members the chance to share their personal perspectives on local climate solutions, including how much they thought their Community Energy Plan could and should focus on various ways the community could cut our emissions. Ethelo used the results to generate a particular set of climate actions that are predicted to have the most community support. 302 Haíłzaqv members participated in the phase 1 survey. Further details are in figure 1.



10.4.1. Overview of Results

The Ethelo platform identifies the policy options with the least polarization. The platform considers not only participant's likes, but also their dislikes, and uses these to identify where there is community consensus and where there is potential conflict. Approval is the percentage of people who gave a positive vote rather than a neutral or negative vote. Approval above 50% is a traditional "majority".



10.5. Ethelo Survey 2

During the late summer and early fall of 2021 (August/September), the Haíłzaqv Climate Action Team used a carbon budgeting process powered by Ethelo to gather public feedback to help evaluate, which climate solutions should be implemented in our Community Energy Plan. The purpose of this engagement was to ensure community members had a say in choosing the solutions the community would implement and that it was done in a fair, effective manner.

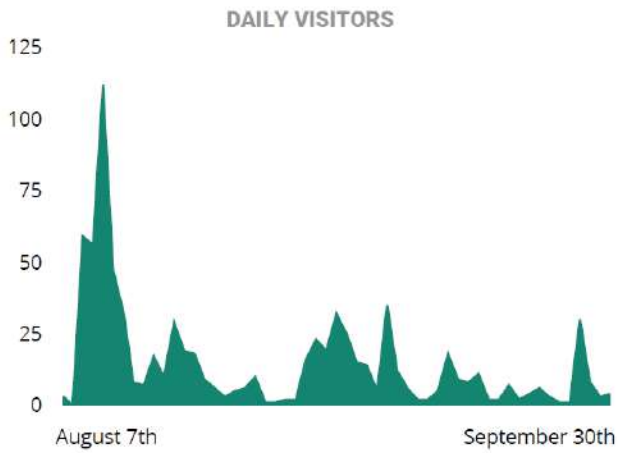
The process educated and engaged the community to ensure ownership of their collective climate action work. Haíłzaqv were tasked with creating their own plan to reach the community's goals. Alongside costs and greenhouse gas emissions reduction, each proposed solution had a score for difficulty, jobs created, wellbeing, community support, risk and innovation.

Ethelo used the results to generate a particular set of actions that will empower the Haíłzaqv Nation to practice clean energy sovereignty and resiliency by utilizing wind, sun, earth, and water, in accordance with our ğvi̓ḷás and cyclical worldview.

Participation

During the 8 weeks that the engagement was live, the online platform garnered

- **11,413 page views**
- **3,890 unique visitors**
- **463 unique local participants**
- **416 completions (≥ ⅓ of engagement completed)**
- **820 comments**
- **9-minute average visit length**



10.5.1. Overview of Results

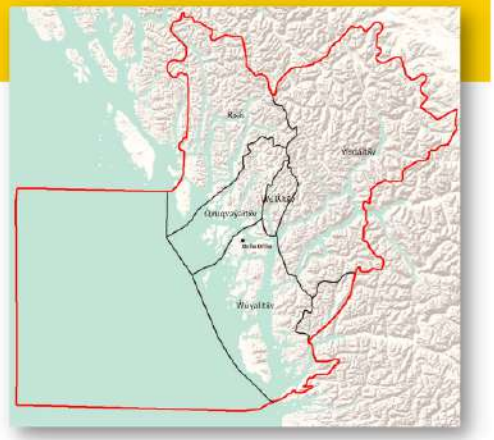
Based on the input from community members, the graphs below illustrate the 2 most supported scenarios.

The following terms and metrics are used in these graphs:

- **Consensus:** a measure of the overall strength of the decision, considering both support (higher is better) and conflict (lower is better).
- **Support:** the average value of the votes, where the value of a totally opposing vote is 0 and a totally supportive vote is 100.
- **Conflict:** the level of disagreement in a group. Higher conflict scores represent internal resistance and risk of failure.
- **Approval:** the percentage of people who gave a positive vote rather than a neutral or negative vote. Approval above 50% is a traditional “majority”

Haíłzaqv Climate Solutions

TOTAL GHG REDUCTION: 24,258 TONNES
TOTAL COST: $19,609,952



CONSENSUS ★★★★★★★★★☆

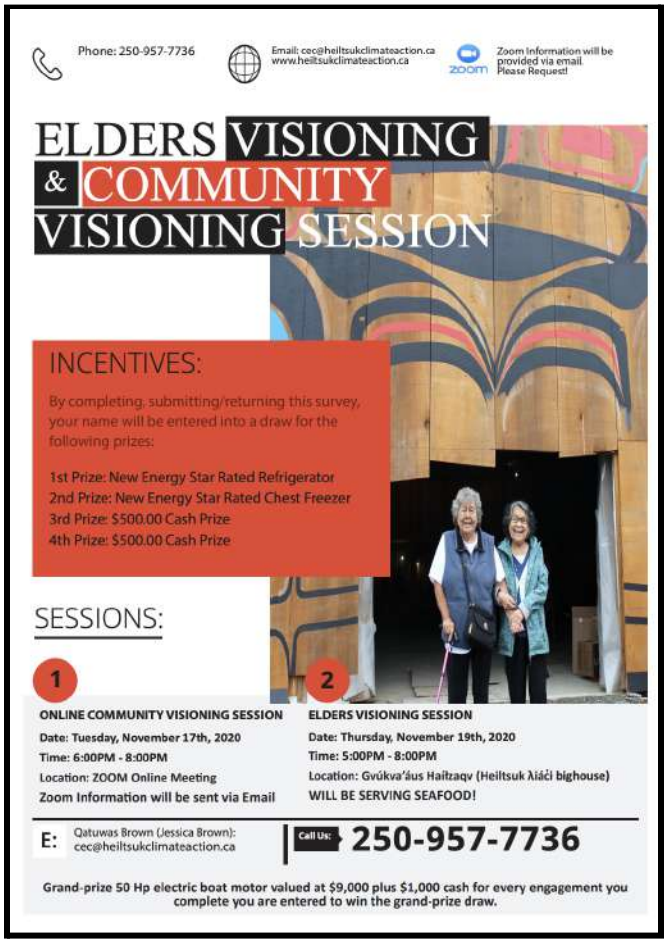
SUPPORT ★★★★☆☆☆☆☆

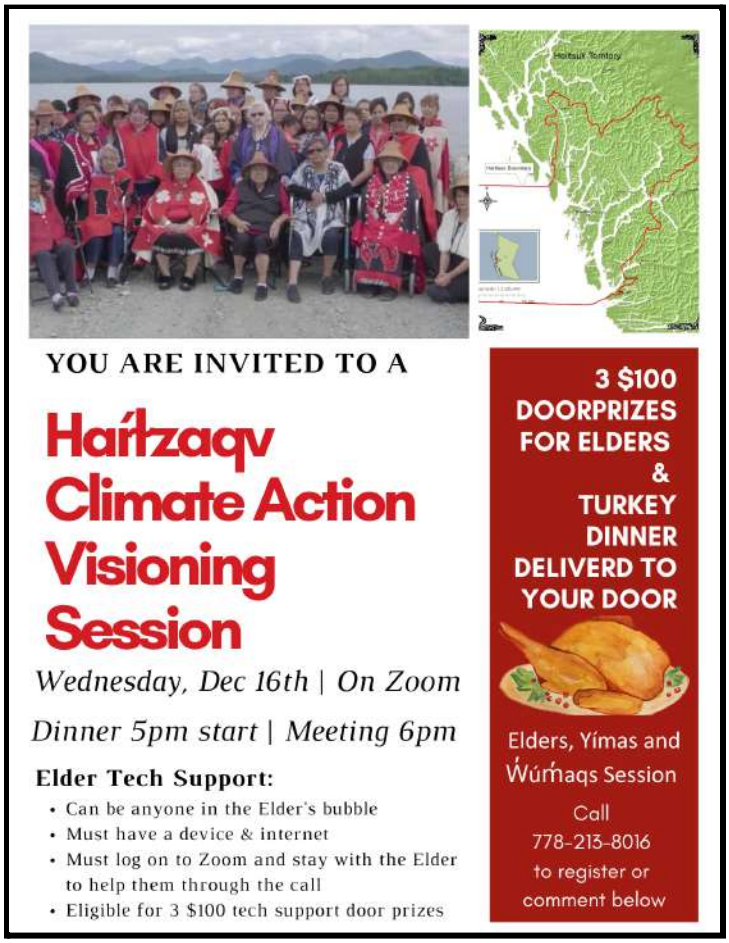
CONFLICT ☆☆☆☆☆☆☆☆☆

APPROVAL ★★★★★★★★★

EFFICIENT HOME HEATING SYSTEMS	SWITCH 100%	$1,600,000.00	10500t GHGs
RENEWABLE DIESEL	SWITCH 100%	$200,000.00	5425t GHGs
SOLAR PROJECT	DO 50%	$6,037,500.00	3750t GHGs
RETROFITTING COMMUNITY HOMES	RETROFIT 100%	$10,000,000.00	3150t GHGs
FOOD SOVEREIGNTY	LOCALIZE 75%	$425,250.00	1125t GHGs
PASSIVE HOUSE KIT	SPEND 75%	$215,625.00	0t GHGs
CAPACITY DEVELOPMENT STRATEGY	SPEND 75%	$93,750.00	0t GHGs
ELECTRIFICATION OF MARINE VEHICLES	ELECTRIFY 50%	$750,000.00	200t GHGs
RETROFITTING COMMUNITY BUILDINGS	RETROFIT 75%	$194,077.00	73t GHGs
COMMUNITY TRANSPORT	ELECTRIFY 75%	$93,750.00	35t GHGs

10.6. Online Sessions





Over 70 turkey dinners were delivered door to door to our nínúħaqɬa (elders), yi̓íḿás (chiefs), and ẇiúḿaqs (women of high rank) who engaged in an online visioning session for our Haíłzaqv Community Energy Plan. The conversation was filled with laughter, lessons, and thoughtful engagement on the collective Haíłzaqv planning and action towards energy sovereignty.

Saturday January 30th 2021 Facebook Live Event

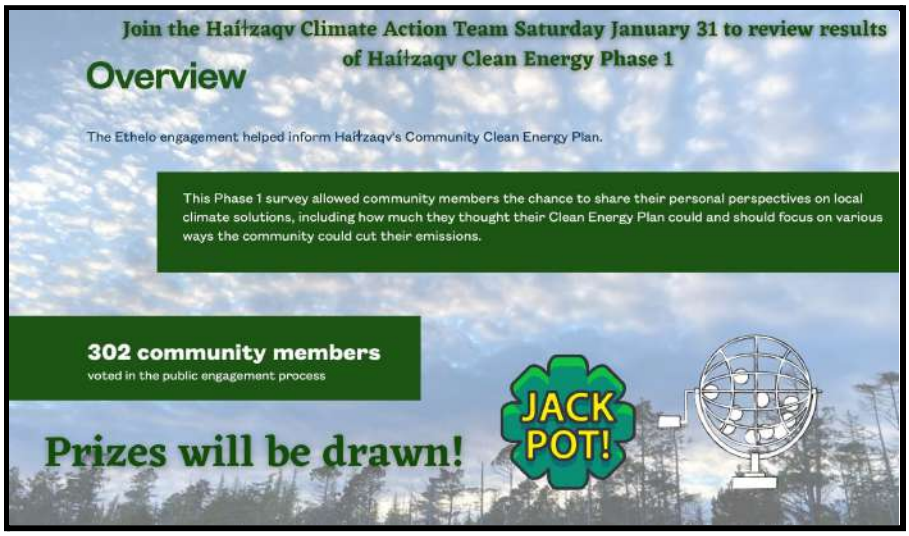
The following prizes were drawn live:

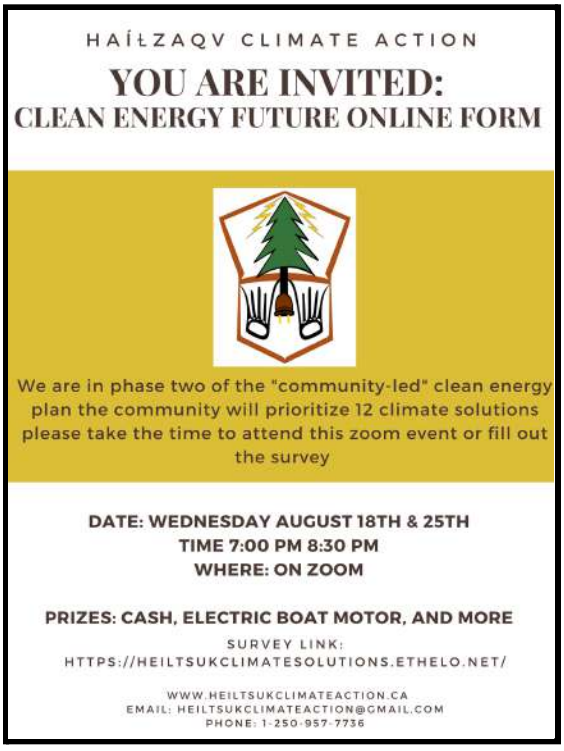
1st Prize: New energy star rated refrigerator - Glenna Hunt

2nd Prize: New energy star rated chest freezer - Vern Wilson

3rd Prize: $500 cash - Eunice Windsor

4th Prize: $500 cash - Doris Humchitt





10.7. Informational Community Videos

The Haíłzaqv Community Energy Plan Community engagement strategy included promotional/ educational videos for the virtual comprehensive of the Community Energy Surveys. All videos can be found on YouTube: *Haíłzaqv Heiltsuk Climate Action*. These videos were also shared on our website, www.heiltsukclimateaction.ca, instagram, and facebook.

Haíłzaqv Climate Action Introduction Engagement Video

Electrification of Marine Vessels: Haíłzaqv Climate Solution

Community Transportation: Haíłzaqv Climate Solution

Retrofitting Community Homes: Haíłzaqv Climate Solution

Capacity Development Strategy: Haíłzaqv Climate Solution

Food Sovereignty: Haíłzaqv Climate Solution

Renewable Diesel: Haíłzaqv Climate Solution

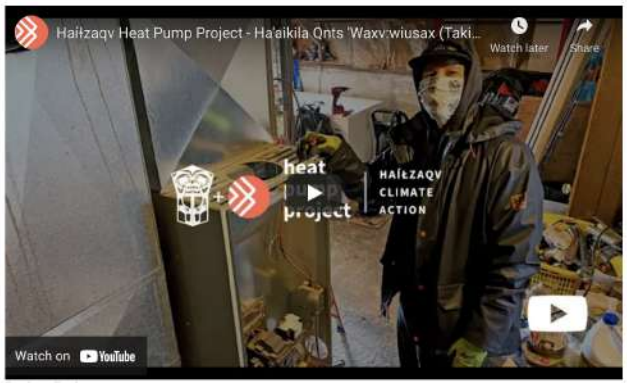
Solar Project: Haíłzaqv Climate Solution

BioPower Eco-Village: Haíłzaqv Climate Solution

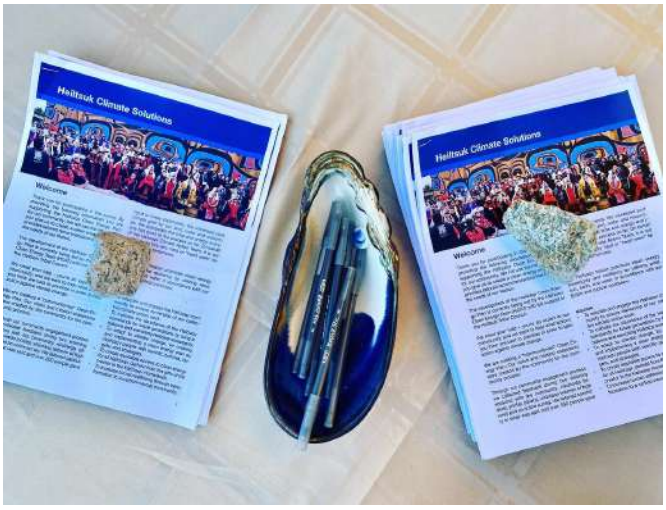
Haíłzaqv Energy Sovereignty: Climate Solution

Home Heating Systems: [Haíłzaqv Heat Pump Project – Ha'aikila Qnts 'Waxv:wiusax (Taking Care of Our Land)]

[Passive House Kit: Haíłzaqv Climate Solution]



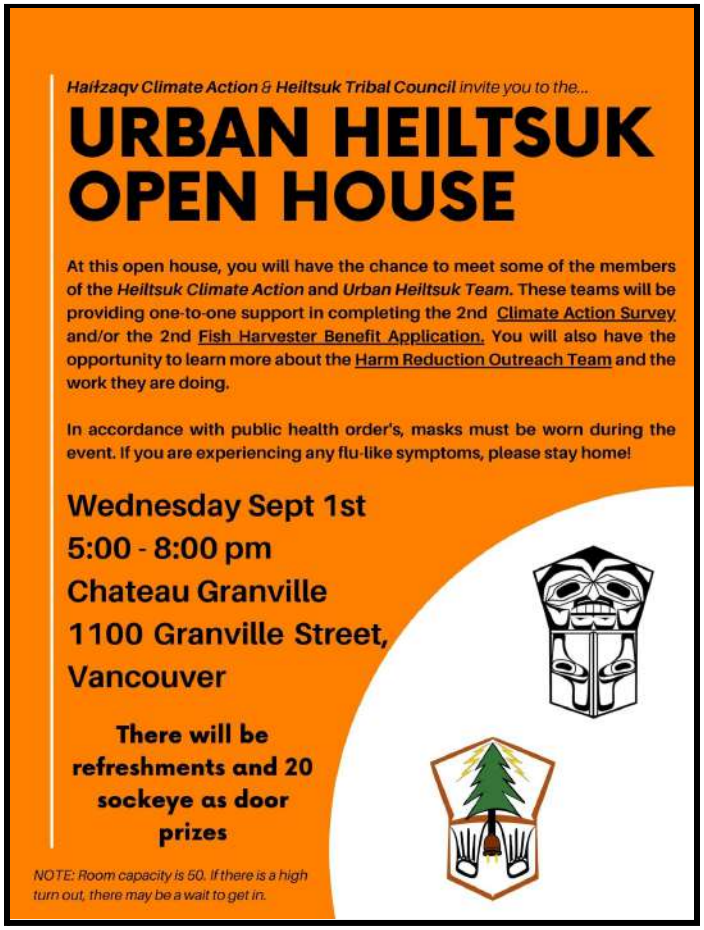
10.8. In Person Events for Survey Support



August 20th, 2021 **Community Open House** with refreshments and survey help offered.

In person one-on-one advertised coffee shop sit-ins to help with completion of surveys.

Haíłzaqv nínúħaqḷa (elders) completing the Ethelo Haíłzaqv Climate Solution Survey 2. This session focused on prioritization of 12 climate solutions that were brought forward from the visioning sessions and survey 1. Our nínúħaqḷa shared, “we want it all” and actively voted for all 12 projects.



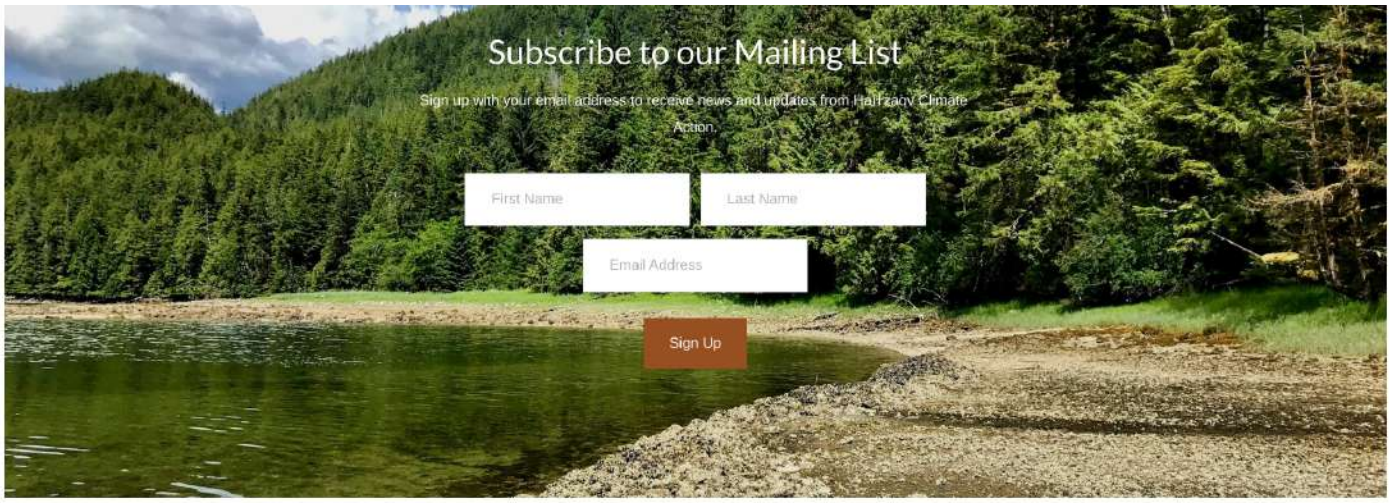
“You are Haíłzaqv wherever you are”

Over half of our membership live urbanely in the lower mainland. To honour the unity we have as one Nation, HCAT hosted an open house in Vancouver on September 1, 2021 providing our urban membership an opportunity to have a voice, and give valuable input by filling out the second Ethelo survey “Haíłzaqv Climate Solutions”.

10.9. Community Clean-Up Challenge

10.10. Haíłzaqv Climate Action Website/ Newsletters

To keep members updated on all climate action-related initiatives in community we created the website https://heiltsukclimateaction.ca



Three HCAT newsletters were delivered door to door/ put in PO mailbox boxes in Bella Bella. These newsletters were also posted on the website and social media sites.

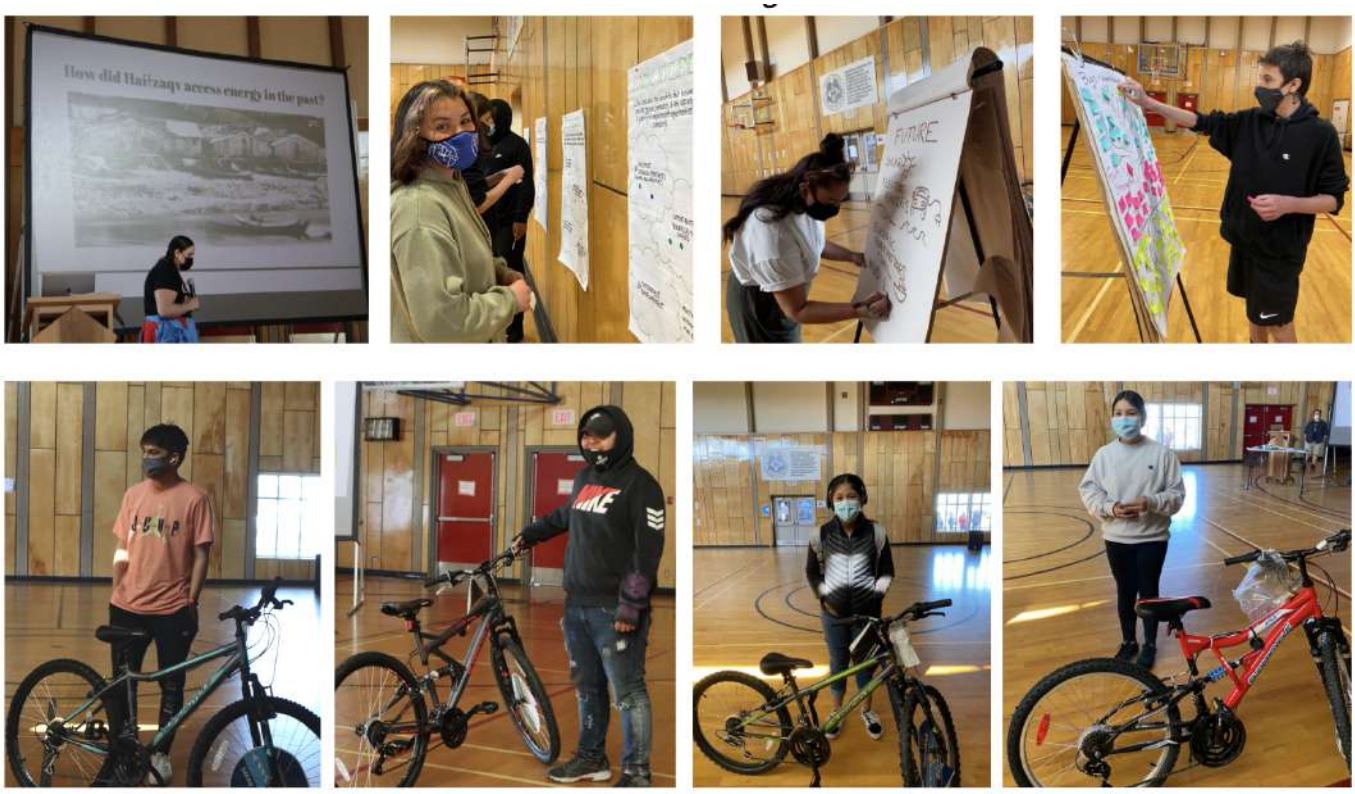
10.11. Youth Engagement at the Bella Bella Community School

The Haíłzaqv Climate Action Team spent Earth Day 2021 with the Bella Bella Community School High School students. The students had the opportunity to contribute to the Community Energy Plan through an active visioning and engagement session. The shared student perspective was that our community needs to refocus on the green economy and move away from resource extraction.

Háiḱaʼnakvḷa: to rise higher and higher

Our young people created an *"Energy Conservation Plan for the Bella Bella Community School"* working in breakout groups, each group providing five ways we can conserve energy in the school. A major topic of discussion was replacing the boiler room run off fossil fuels. This is one of the school's highest costs each year. Our young also brought forward how they deserve meaningful work in line with our Haíłzaqv values, in the Haíłzaqv homelands, which was a clear reminder these young people will all benefit from our collective climate action solutions.

Four bikes were drawn and gifted to the students for being a part of the solution. Our future is in good hands.



10.12. Haíłzaqv Climate Strike

In September of 2019, the Haíłzaqv Climate Action Team supported Haíłzaqv youth from the Bella Bella Community School with the global #climatestrike against climate change. Haíłzaqv

leadership collectively worked to uplift the Haíłzaqv youth and encourage them to continue on the trajectory of stewarding our land and waterways.

To uplift the voices of our youth, we organized a community lunch at the local community hall. Haíłzaqv yííḿás (hereditary chiefs) were in attendance and gave their heartfelt gratitude and full support to the youth.


Singing in our ancestral language that comes from the earth, our Haíłzaqv youth led the community in a march around the village. The young people were armed with posters with calls to action for the government to address the concerns of climate change. Elders, matriarchs, and mothers pushing babies in strollers showed up in full support of the #climatestrike.

10.13. Community Engagement Conclusion

Through our community engagement process, we collected feedback. We listened carefully to what was said and over one thousand people gave input to these statements. We witnessed your climate grief for our land, water, and resources. We appreciate the time and energy everyone has given to the process so far. On behalf of the Haíłzaqv Climate Action Team, it is our honor to do this very hard or “heart work” for our children’s tomorrow. All the community input gathered from these engagement sessions have assisted in developing the strategic direction and objectives of the Haíłzaqv Community Energy Plan.

11. Action Plan

Based on the information presented in the Haíłzaqv Climate Action Plan, the Haíłzaqv Climate Action Team has created the following recommended measurable outcomes over the next 10 years.

Sector	Area	Goal	Action	Next Steps
Buildings	Energy Efficiency	75% of buildings in Bella Bella will have received energy efficiency upgrades and become more suited for the local environment	Shallow Retrofits	1. Provide all community buildings shallow energy retrofits.
			Deep Retrofits	1. Provide all community buildings deep energy retrofits.
	Energy Systems	50% of all major buildings in Bella Bella have off-grid solar systems for at-source consumption	Off-Grid Solar	1. Develop feasibility studies for most energy intensive buildings in the community. 2.Secure funding for Off-Grid Solar Projects to offset energy demand from local buildings
Homes	Energy Efficiency	100% of homes in Bella Bella will have received energy efficiency upgrades and become more suited for the	Home Energy Audits	1. Complete Home Energy Audits in all Bella Bella Homes. 2. Training 2 Haíłzaqv members to complete home energy audit training and certification

			Shallow Retrofits	1. Provide all homeowners and band rental units that have completed a Home Energy Audit with an Eco-Kit to complete shallow energy retrofits.
			Deep Retrofits	1. Provide all homeowners and band rental unis that have completed a Home Energy Audit and installed their Eco-Kits with deep retrofits required, as identified in their Home Energy Audit
			Fridges and Freezers	1. Provide all homeowners and rental units with a $400 rebate to purchase high-efficiency fridges and freezers
	Heating Systems	All homes in Bella Bella will have a zero-emission, high-efficiency heating system.	Heat Pumps	1. Convert all homes from fossil-fuel intensive fuel sources to heat pumps
			Catalytic Wood Stoves	1. Provide all interested homes with a high-efficiency catalytic wood stove
	New Homes	The Passive House Kit complete feasibility and ready to scaled for production	Passive House Kit	1. Complete Passive House Feasibility period and scale up to meet housing demands.

Transportation	Boats	50% of personal marine vessels in Bella Bella will have electric motors, either a kicker or main moto	Electric Kicker Motor	1. Conduct feasibility study and pilot project of electric kicker motors in Haíłzaqv Territory, using the Shearwater trolling fleet 2. Secure funding for that incentives the adoption of electric kicker motors by local boat owners 3. Install charging infrastructure at Martins and the Government Dock
	Vessels and Fleets	A strategic plan will be completed with a path to implementing low or zero-emission transportation into Bella Bella by boat or plane.	Hydrogen Powered Vessels	1. Conduct feasibility study of hydrogen motors on large vessels operating in Haíłzaqv territory, especially the local sea-bus, charter vessels, and BC Ferries vessels
	Vehicles	50% of Haíłzaqv Tribal Council owned vehicles will be electric	Band-Owned Fleets	1. Seek a BCR for the purchase of electric vehicles, as they need to be replaced, to service the needs of all major entities in Bella Bella.
		75% of vehicles in Bella Bella will be electric or non emitting	Personal Vehicles	1. Seek out funding sources to incentivize the purchase of electric vehicles.
	Charging Infrastructure	Electric vehicle infrastructure for public use will be installed and available in Bella Bella	Charging Stations	1. Secure funding for charging infrastructure in Bella Bella for both Marine vessels and vehicles
Economy	Energy Sales	Haíłzaqv Nation successfully create a sustainable economy of scale that utilizes clean energy	Selling Back to the grid	1. Collaborate with other Indigenous communities securing economic opportunities in energy generation.

	Bio-Diesel	Low emission transition fuel options	Fuel companies switch from conventional diesel to biodiesel	1. Conduct feasibility of study of converting to renewable diesel 2. Switch Haíłzaqv owned fuel companies, both the the Shearwater and Bella Bella, to renewable diesel
Food	Food Production	75% of produce needs are met by locally grown, zero or low-emission food systems	Aquaponics	1. Conduct a feasibility study on a tilapia aquaponics system in Bella Bella.
	Food Sovereignty		Vertical Farming	1. Collaborate with Qqs Projects Society. 1. Conduct a feasibility study on vertical farming systems in Bella Bella.
			Capacity Building	1. Conduct a skills-inventory 2. Create skilled-labour pool in Bella Bella to maintain and create vertical farming systems
Infrastructure	Energy Delivery	Haíłzaqv Nation's infrastructure will be use non-emitting energy sources	Energy Delivery Bottlenecks	1. Understand what sectors of the grid are their energy delivery limitations.
	Backup Generator		Denny Island Diesel Generator	1. Understand total output capability of Denny Island Diesel Generator 2. Create backup renewable-energy storage facility in Bella Bella
	Operations and Maintenance		O&M Costs	1. Secure funding for O&M Costs of energy systems
Energy Supply	Renewable Energy		Local Energy Cost Reduction	1. conduct feasibility studies for local-source renewable energy systems that can reduce $/kWh

	Production			
	Bio-Diesel	75% of Diesel demand is met by renewable diesel sources	Switch to renewable diesel	1. conduct feasibility studies for utilization and possibly local production of renewable diesel fuel.
	Láuqv (Ocean Falls)	Bella Bella has access to affordable, resilient and reliable clean energy	Total Output	1. Create a partnership with Boralex to understand total energy output and limitations
Capacity Building	Mentorship	The Climate Action & Capacity Development Strategy is completed and underway.	Mentorship	1. Provide mentorship opportunities to energy champions and interested community members
			Youth Internship	1. Provide a Climate Action Youth Internship to a Haíłzaqv person under 30 annually.
	Jobs		Professional Development	1. Provide professional development opportunities related to climate action for Haíłzaqv members.
			Skilled-Labour	1. Conduct a skills-inventory 2. Create skilled-labour pool in Bella Bella to maintain and create renewable energy systems energy systems
	Education		Education and awareness	1. Hold educational and awareness events for Haíłzaqv people.
			Technical Skills Development	1. Conduct a skills-inventory on technical skills required for a clean energy project. 2. Provide training opportunities for technical skills

12. Conclusion

The Haíłzaqv Nation, like many other Indigenous Nations, is on the forefront of climate impacts. We must ensure our energy systems are sustainable, resilient, and empowering. The Haíłzaqv Climate Action Team has created this plan based on deep community input, locally sourced data, and the expertise of our team. The projections and recommendations in the Haíłzaqv Community Energy Plan provide our Nation with a pathway to achieve energy systems that embody our ğvi̓ļás.

Ğiáxsix̌a to all of our community members and partners that have contributed to the Haíłzaqv Community Energy Plan. The Haíłzaqv Nation will move forward to create a sustainable world for all future generations.

13. Community Energy Plan Supporting Statement

We, The Heiltsuk Climate Action Team, have had the privilege to complete this Heiltsuk Community Energy Plan on behalf of our people. We have created this plan to embody Haíłzaqv Nation's clean energy vision. We are grateful for the full support of Haíłzaqv Tribal Council, the guidance from our community engagement sessions, our Community Advisory Board and support from our partner organizations.

This is a path to sustainability for our people that will create healthier homes, affordable energy, greater food security, clean jobs, and economic opportunities. Taking action on this plan will create a better future for our people and homelands. We are dedicated to taking on this work with our Nation and partners.

We, The Heiltsuk Climate Action Team fully endorse the Heiltsuk Community Energy Plan and the recommendations within. We commit ourselves to working with meaningful partners and to Ḥíkila qn̓ts n̓ála'áx̌v - Protect our world.

Signed,

The Heiltsuk Climate Action Team

Leona Humchitt	Ayla Brown	'Qátuẃas (Jessica Brown)
Zuleika Bhamji	Eryn Stewart	Michael Vegh

New Haíłzaqv Climate Action Logo - Designed by Ýx̌vmi (Shirl Hall)

Artist Description:

"The surrounding ƛ̓áaqva (copper) represents the authority and boundary of the Haíłzaqv Territory. The lightning represents ẇúğm̓í (creator's) electricity, as we move through our own electricity. The sacred dn̓ẏ́ás (red cedar tree) is of great importance to the Haíłzaqv providing our shelter, clothing, transportation and oxygen. The human hands represent our responsibility and stewardship for the planet."

Wálas ğiáxsix̌a Ýx̌vmi Shirl Hall