THE MUNICIPALITY OF THE VILLAGE OF LIONS BAY

CLIMATE ACTION COMMITTEE MEETING

OF THE VILLAGE OF LIONS BAY
HELD ON TUESDAY, NOVEMBER 2, 2021 at 7:00 PM
COUNCIL CHAMBERS, 400 CENTRE ROAD, LIONS BAY
VIA ZOOM VIDEO CONFERENCE

TO JOIN THE MEETING, CLICK HERE: https://us02web.zoom.us/j/82547923073
TO JOIN VIA PHONE, DIAL 778-907-2071 AND ENTER MEETING ID: 825 4792 3073

AGENDA

1. Call to Order

2. Appointment of Recorder

3. Approval of the Agenda
THAT the agenda be adopted, as submitted.

4. Public Questions & Comments

5. Approval of Minutes

A. Minutes from the September 21, 2021, Climate Action Committee Meeting (page 3)
THAT the September 21, 2021, Climate Action Committee Meeting Minutes be approved, as circulated.

6. Business Arising from the Minutes

A. Resolutions from the October 5, 2021 regular Council Meeting

i. THAT Council directs staff to publish a call for a new Climate Action Committee member in the Village Update.

ii. THAT Council update the POL-2002 -Purchasing Policy to consider the immediate and future impacts of purchases through their consumption and eventual end-of-life stage to reduce environmental impacts; AND

THAT Council directs staff to amend POL-2002-Purchasing Policy to include language similar to that of the District of Squamish, specifically with the following information:

I. Ensures that Suppliers are contributing to the advancement of the community
socially, economically, culturally, and environmentally;

II. Works with current and future Suppliers on reducing GHG emissions in the delivery of goods, services and construction;
III. Encourages (or requires) the use of materials and products that have less embodied carbon; and
IV. Values Suppliers who demonstrate commitment to ethical sourcing and procurement
practices, through corporate social procurement policies or certifications including
but not limited to Fair Trade, Ocean Wise Seafood, CSA, Forest Stewardship Council,
or organic certification; AND

THAT Council directs staff to work with the Committee to provide feedback regarding the proposed changes.

iii. THAT Council direct staff to provide the Climate Action Committee with the grant application for the Klatt building upgrades for the purpose of investigating synergies with green building upgrades and concurrent grant opportunities.

iv. THAT Council receives the Climate Action Committee Recommendations for Council Strategic Planning report; and
THAT Council provides direction to the Committee outlining how the Committee can support the recommended strategic commitments outlined in the report presented at the October 5, 2021 regular Council meeting.

7. Unfinished Business

8. New Business

i. GHG Reduction Analysis and Roadmap to Net Zero – C. George (Page 7)
Recommendation:
THAT the Climate Action Committee recommends to Council THAT Council directs staff to work with the committee to procure quotes on clean energy alternatives and create a roadmap to Net Zero Emissions.

ii. Solar Panels – J. Povill (Page 13)

9. Public Questions & Comments
10. Adjournment
11. Next Meeting - TBD

THE MUNICIPALITY OF THE VILLAGE OF LIONS BAY

CLIMATE ACTION COMMITTEE MEETING

OF THE VILLAGE OF LIONS BAY
HELD ON TUESDAY, SEPTEMBER 21, 2021 at 7:00 PM
COUNCIL CHAMBERS, 400 CENTRE ROAD, LIONS BAY
VIA ZOOM VIDEO CONFERENCE

MINUTES

In Attendance:

Committee: John Povill
Greg Weary
Clara George
Christina Lee
Coucillor Cunliffe
Councillor Barmeier

Council: Mayor Mclaughlin

Regrets: Ruth Simons

1. Call to Order
J. Cunliffe called the meeting to order at 7:04 p.m.

2. Appointment of Recorder
J. Cunliffe was appointed as the recorder.

3. Approval of the Agenda
Moved/Seconded
THAT the agenda be adopted, as submitted.

CARRIED

4. Public Questions & Comments
N/A

5. Approval of Minutes

A. Minutes from the August 25, 2021, Climate Action Committee Meeting
Moved/Seconded
THAT the August 25, 2021, Climate Action Committee Meeting Minutes be approved, as circulated.

CARRIED

6. Business Arising from the Minutes

7. Unfinished Business

A. Request for Decision: Green Purchasing Policy (Christina Lee)

Moved/Seconded

THAT the Climate Action Committee recommends to Council THAT Council update the POL-2002 -Purchasing Policy to consider the immediate and future impacts of purchases through their consumption and eventual end-of-life stage to reduce environmental impacts; AND

THAT Council directs staff to amend POL-2002-Purchasing Policy to include language similar to that of the District of Squamish, specifically with the following information:

I. Ensures that Suppliers are contributing to the advancement of the community socially, economically, culturally, and environmentally;

II. Works with current and future Suppliers on reducing GHG emissions in the delivery of

goods, services and construction;

III. Encourages (or requires) the use of materials and products that have less embodied

carbon; and

IV. Values Suppliers who demonstrate commitment to ethical sourcing and procurement

practices, through corporate social procurement policies or certifications including but not limited to Fair Trade, Ocean Wise Seafood, CSA, Forest Stewardship Council, or organic certification; AND

THAT Council directs staff to work with the Committee to provide feedback regarding the proposed changes.

CARRIED

B. Climate Action Committee Report and Recommendations for Council Strategic Planning Report

The Committee changed the order of the priorities in the report to:

- Update the POL-2002 Purchasing Policy to employ green procurement best practices
- Urgently replacing the use of fossil fuels
- Immediate replacement of fossil fuel heating/ cooling infrastructure with heat/cooling pump in Village buildings.
- A commitment to electrifying the village fleet
- Maximizing energy efficiency in all new Village building upgrades.

- Reprioritizing infrastructure projects based on increasing risks.
- Minimizing risks to the village from Wildfires

Moved/Seconded
THAT the Climate Action Committee recommends to Council THAT Council receives the Climate Action Committee Recommendations for Council Strategic Planning report; and
THAT Council provides direction to the Committee outlining how the Committee can support the recommended strategic commitments outlined in the report presented at the October 5, 2021 regular Council meeting.

CARRIED

C. New Committee Member
Moved/Seconded
THAT the Climate Action Committee recommends to Council THAT Council directs staff to publish a call for a new Climate Action Committee member in the Village Update.

CARRIED

8. New Business

A. Klatt Building/Beach Park Grants

The thought behind this is that the CAC would like to be able to offer direction through a green lens. Simple things such as what kind of haulers are being used, electric tools, clean building material etc. Request that staff ask designers to look for sustainability opportunities.

Moved/Seconded
THAT the Climate Action Committee recommends to Council THAT Council direct staff to provide the Climate Action Committee with the grant application for the Klatt building upgrades for the purpose of investigating synergies with green building upgrades and concurrent grant opportunities.

CARRIED

B. Request by John Povill that Water Security be on our next agenda. Discussion on the Ice Stupah to be included.

C. Request by Greg Weary for a copy of the 2020 Community Wildfire Protection Plan, as well as a status report on the application for the Community Resilience Program Grant. This is a follow up on the original Wildfire Protection Plan that was created in 1986.

D. Verbal Update - Transfer Station, Jaime Cunliffe

Nai indicated that they are still in negotiations with the new Waste providers. It was discussed that things such as batteries, lightbulbs, soft plastics, crinkly plastics, styrofoam (white and coloured) would be collected. If room permits perhaps cardboard, for excessive amounts. Suggested by John Povill that cooking oil be collected as well. Suggested by Clara George that we have a donation bin as well.

9. Public Questions & Comments

N/A

10. Adjournment

Moved/Seconded
THAT the meeting be adjourned.

CARRIED

The meeting was adjourned at 8:20 p.m.

_____ _____

Mayor Corporate Officer

11. Next Meeting – October 12, 2021 at 7:00 p.m.

Date Approved by Committee	

THE MUNICIPALITY OF THE VILLAGE OF LIONS BAY

Type	**Request for Further Research**		
Title	**GHG Reduction Analysis & Roadmap to Net Zero**		
Author	**Clara George**	**Reviewed By:**	**Name**
Date	**Oct 26, 2021**	**Version**	
Issued for	**Nov 2, 2021**		

Recommendation:

(1) THAT the Climate Action Committee recommends to Council THAT Council directs staff to work with the committee to procure quotes on clean energy alternatives and create a roadmap to Net Zero Emissions.

Attachments:

Please see attached PDF

Background and Key Information:

The 2020 CARIP report submitted by the Village has the liners of fuels purchased by the Village.
Using available Canadian Carbon Calculators - I was able to estimate the total GHG emissions at 54.862 tCO2 , as well as the % from each fuel.

Heating oil - 10.487 tCO2. = 19% of total emissions
Gasoline - 15.3 tCO2 = 28% of total emissions
Diesel - 25.85 tCO2 = 47% of total emissions
Propane - 3.225 tCO2 = 6% of total emissions

Council Strategy or OCP Considerations:

Although this report needs to be updated to embrace new technology, such as cleaner renewable fuels - the intent is still valid.

- GHG reduction is a goal in OCP as stated on page 29, Under Section 9: Pursuant to Section 877(3) of the Local Government Act, local governments are required to incorporate within their official community plans targets, policies, and actions for the reduction of greenhouse gas emissions.
-
- Targets include (under Section 9.01):
- a) Reducing 30% reduction due to change over of vehicles - smaller engine sizes.
- b) 11% reduction assuming oil heat users convert to an alternative renewable energy source.

Financial Considerations:

Based on 2020 data, the cost of switching to Renewable Diesel should be between $5000 and $5,500. This needs to be confirmed by staff, in discussion with fuel supplier per my previous report.

Committee and Staff need to explore the true cost of switching oil heating at the municipal hall to clean electric heat pumps and/or renewable solar panels.

Committee and Staff need to itemize and quantify which items are being run on propane and gasoline; and work towards a comprehensive cost analysis and plan to decarbonize.

Options:

(1) Do nothing: Purely based on Municipal Fuel Consumptions as outlined in the 2020 CARIP report - the estimated GHG emissions are 54.863 tCO2 annually. This will likely continue and grow if not addressed.

(2) Diesel represents 47% of the Villages' emissions.

By replacing Diesel with Renewable Diesel - we would immediately reduce our Diesel related emissions by 90%. Eliminating 23.26 tCO2 annually. The cost per ton of CO2 reduced is $218.45.

(3) Further Reductions:

Replace Oil heating with Clean and/or Renewable Energy (19% reduction)

Replace gas powered tools/vehicles with electric. (28% reduction)

Replace propane powered items with electric (6% reduction)

Preferred Option: 2 & 3
(2) By immediately switching to renewable Diesel - the Village would have a 44% reduction in GHG emissions in 2022 over 2020. The cost per tonne CO2 reduced works out to +/- $220, at today's cost of fuel. This difference will go down as Carbon Taxes go up.
No additional infrastructure is required.

(3) Replacing the use of oil, gas and propane will lead us to a Net Zero.

Legal Considerations: n/a

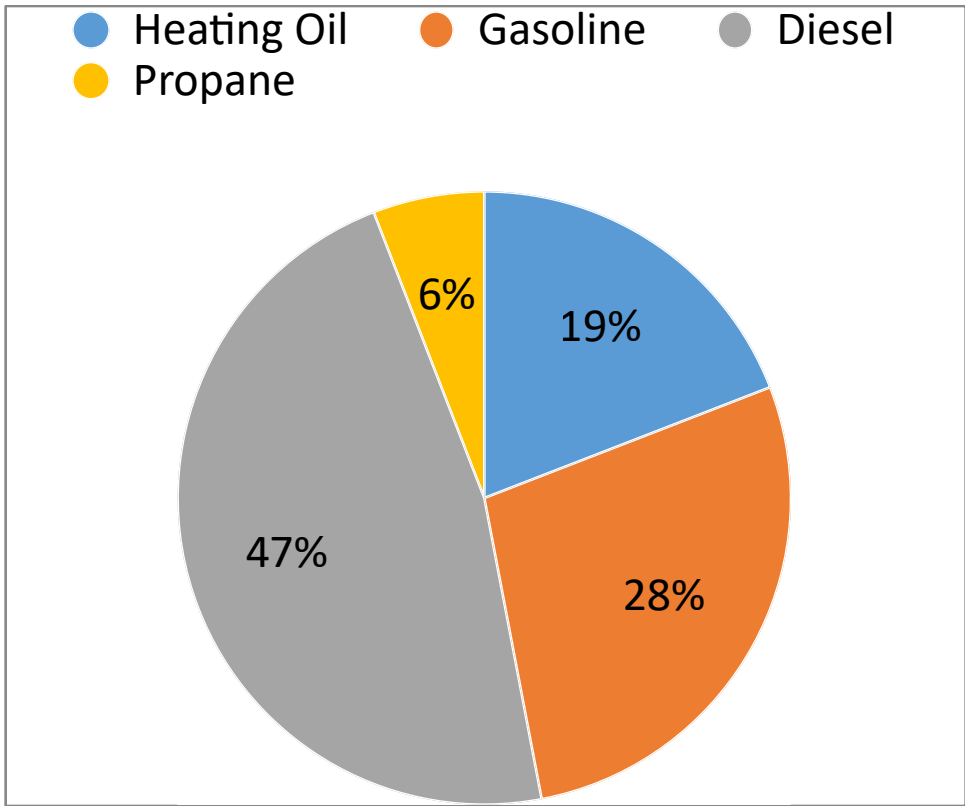
Follow Up Action:

1) Meet with Suncor to establish costs, contract etc for Renewable Diesel
2) Get Bids for Oil Furnace conversion to Electric Heat Pump
3) Establish gas powered items and budget for electrification.
4) Establish propane powered items and budget for electrification.

Communication Plan:
This is already a village mandate.

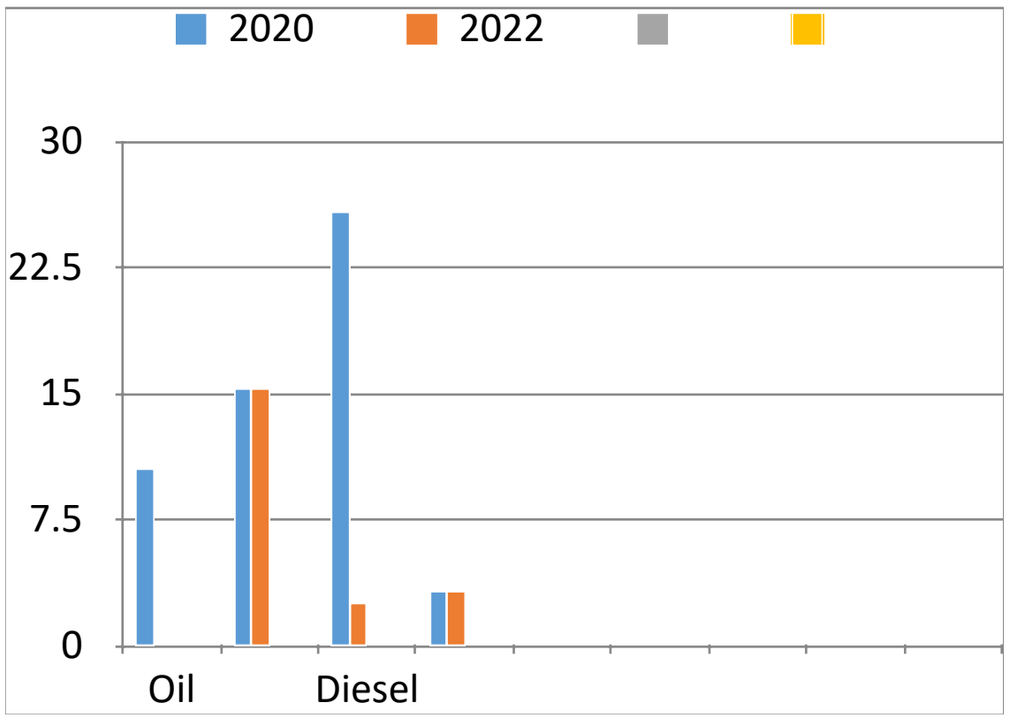
Lions Bay Emissions Overview

2020	tCO2	Litres Purchased
Heating Oil	10.487	3,952.8
Gasoline	15.3	5,009.0
Diesel	25.85	7,413.0
Propane	3.225	2,083.2



Potential GHG reductions

	2020	2022		
Oil	10.487	0		
Gas	15.3	15.3		
Diesel	25.85	2.585		
Propane	3.225	3.225		



Reduction Strategy

Fuel	2020	2022	Annual Cost	Action	Cost / tonne of CO2
Oil	10.487	0	Unknown	Replace Oil Heating with Electric	
Gas	15.3	15.3	Unknown	Identify & Electrify Gas Powered Items	
Diesel	25.85	2.585	$5,082.40	Switch to Renewable Diesel	$218.46
Propane	3.225	3.225	Unknown	Identify and Electrify Propane Powered Items	

2020 CARIP					GHG Emissions / tCO2	% of total Emissions	Potential Reductions	Reduction in tCO2	% Reduction in CO2	
Carbon Tax Calculation				Calculators:	https://www.carbonindependent.org/15.html					
					https://www.saanich.ca/EN/main/community/sustainable-saanich/climate-change/carbon-fund-calculator.html					
					https://www.e3fleet.com/emissions_calculator.html					
Flashpoint Fuels (was EBCO Petroleum Inc.)										
January 1 to December 31, 2020										
Date	**Invoice #**	**Litres**					Convert to Electric Heat Pump			
2-Jan-20	7588	957.1			2.539					
13-Feb-20	261976	917.4			2.434					
19-Mar-20	7993	677.5			1.797					
11-Jun-20	88637	623.6			1.654					
12-Nov-20	9294	777.2			2.062					
		3,952.8			**10.487**	**19.12%**	0	-10.487	-100.00%	
Supersave Fuels										
January 1 to December 31, 2020										
		Litres								
Date	**Invoice #**	**Gas**	**Diesel**							
Gasoline										
23-Mar-20	93551	1,117.0			3.39					
8-Jun-20	94346	1,083.0			3.39					
16-Jul-20	94849	574.0			1.74					
21-Sep-20	95711	1,094.0			3.32					
25-Nov-20	96485	1,141.0			3.46					
		5,009.0			**15.3**	**27.89%**	15.3	0	0.00%	
Diesel							**Purchase Renewable Diesel**			
23-Mar-20	93552		1,512.0		5.27		0.527			
16-Jul-20	94850		563.0		1.96		0.196			
21-Sep-20	95712		1,991.0		6.94		0.694			
25-Nov-20	96486		2,301.0		8.03		0.803			
23-Dec-20	97013		1,046.0		3.65		0.365			
			7,413.0		**25.85**	**47.12%**	2.585	-23.265		
				5,082.4						
				Add cost for RD						
Superior Propane										
January 1 to December 31, 2020										
Date	**Invoice #**	**Litres**								
2-Jan-20	28038380	137.4			0.213					
2-Jan-20	28038381	621.9			0.963					
2-Jan-20	28038382	1,083.4			1.677					
13-Mar-20	29186638	990.5			1.533					
5-Aug-20	30729407	1,460.0			2.260					
1-Nov-20	31658861	623.2			0.965					
		2,083.2			**3.225**	**5.88%**	3.225	0	0.00%	
		TOTAL EMISSIONS FROM FUEL SOURCES:			54.862	100.00%	21.11	-33.752	-61.52%	

Lions Bay Climate Action Committee

Draft Executive Summary

Solar Panels for Municipal Buildings and Off-Grid Standby Power

Prioritizing solar panel installation for municipal buildings in Lions Bay is somewhat problematic in that, as a matter of GHG reduction, we are already served by BC Hydro, which provides essentially carbon-free electricity to the Village. Accordingly, one could logically argue that expenditures for reductions in carbon emissions would be better spent elsewhere, like energy efficiency retrofits and transitions from oil heating to heat pumps.

That said, there are other points to be made as part of a larger context of measures needed to cope with increasingly severe and unstable weather patterns that can be expected as our climate emergency worsens.

More frequent, longer duration power outages are likely to be inevitable and, as the Village electrifies, such disruptions will prove to be increasingly problematic, affecting residents' ability to keep themselves warm, their food cold, and their EVs charged, among other things.

It may therefore make sense to make further exploration of solar panels and other power generation solution for our municipal buildings as part of a larger strategy for making the Village more energy efficient, independent and resilient so as to cope with the potential for extended BC Hydro power outages.

What measures might we explore?

1 - Solar for our municipal buildings.

> This was our original proposal. Scott Elston, of Alternative Power Systems, did a survey of our buildings and their siting and prepared an extensive evaluation of potential costs and benefits which the Council has yet to consider. He was, and presumably still is, prepared to make a presentation of this information to the Council – not a sales pitch, but an explanation of what is needed in order to make an informed decision on doing this with any contractor – if Council will agree to accept a delegation. Council had previously agreed to accept a delegation from another solar contractor I'd contacted, but that event got cancelled in the early response to COVID. I do not understand why the Council was willing to accept that delegation but has not been willing to entertain this one.

2 – Fuel cells for our municipal buildings.

- Green hydrogen fuel cells are clean energy that are probably not cost effective for the village right now, but they very well could be in the near future.

- As production of fuel cell power sources and green hydrogen scale up, their costs will come down as with any burgeoning technology.

- At the same time, BC Hydro rates are expected to climb dramatically due to major cost overruns on the Site C dam project. At some point, power from fuel cells could be cost competitive or even cheaper than power from BC Hydro.

- Fuel cell generation is available 24/7 as a backup, and entirely local, allowing municipal buildings to be fully powered up for emergency shelter and services when the grid is down.

- Fuel cell power co-generates heat that can be used for heating space and water in our municipal buildings.

- Here's a link to an overview of stationary fuel cell power generation.

3 – Community solar co-op

- The City of Nelson, BC, launched Canada's first community solar garden in 2017 with the intent of providing the community at large a way of investing in local solar power at a smaller scale than installing panels a full array on their own homes. The project was successful enough that the City of New Westminster essentially copied it in 2019.

- Residents were offered the opportunity, on an entirely voluntary basis, to invest in any number of solar panels designated to be part of the community array with the benefit of annual rebates on their electricity bills based on the number of solar panels they'd purchased. These investments provided the seed funding to qualify for applicable grants at minimal expense to the city.

- Creating a similar project here could lower BC Hydro bills for participants and contribute to a clean energy mindset for residents who are not currently in a position to add solar panels to their homes.

4 – Lions Bay variant -- Community fuel cell stack for the Village.

This may be entirely pie-in-the-sky and I don't believe it is available yet on any kind of cost-effective basis, but it is something to watch in the coming years. Fuel cells stacks can be installed at any scale and new ones can be coupled with existing stacks if the need for additional power expands.

- I believe that the Village has previously investigated the feasibility of microhydro generation for the community and found it unsuitable. Fuel cells could be an alternative approach to backup local generation energy independence for short term emergencies.

- If, at some future point in time fuel cells proved to provide power more cheaply than BC Hydro, it might be possible for Lions Bay to emulate the Nelson community power model by inviting residents to invest in a proportional share of a large scale community fuel cell capable of providing lower cost electricity and an annual dividend/rebate to the investors.

- As with the Nelson project, these initial investors would provide the seed money to enable the Village to apply for grants that would substantially subsidize the cost of installing the fuel cells. Additional fuel cells could be added in the future if more residents wanted to participate in the program down the road.

- With the potential for wildfires or other disasters to the north and south of Lions Bay, having locally sourced power could be vitally important in a village that can only be accessed by a single road.

Funding for any of these projects could conceivably be augmented through Federal grants. Here is a current list of projects currently supported by potentially applicable grants, with application information available here. Additionally, the Federation of Canadian Municipalities also offers advice and funding assistance.

Design 1 Lions Bay Hall (Broughton Hall), Village of Lions Bay

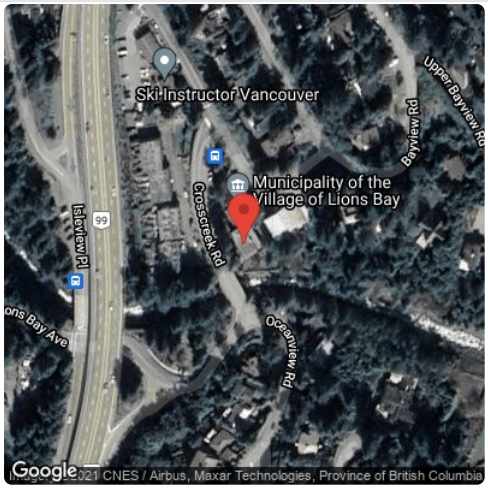
Report

Project Name	Lions Bay Hall (Broughton Hall)
Project Address	Village of Lions Bay
Prepared By	Scott Elston scott@alternativepowersystems.ca

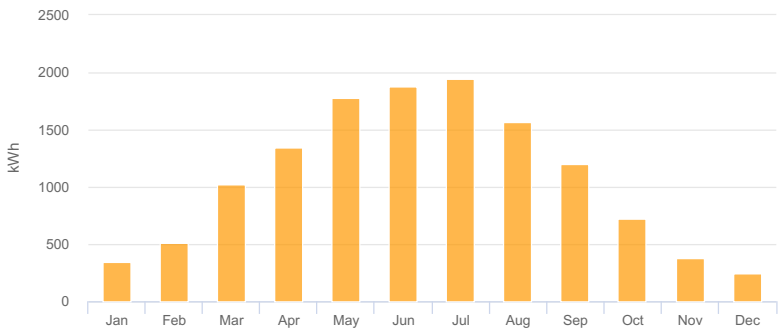
System Metrics

Design	Design 1
Module DC Nameplate	15.2 kW
Inverter AC Nameplate	15.4 kW Load Ratio: 0.99
Annual Production	12.93 MWh
Performance Ratio	67.8%
kWh/kWp	851.6
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	8ab6c1dc12-d6b09898f2-d64b51de0f-2475be9f8d

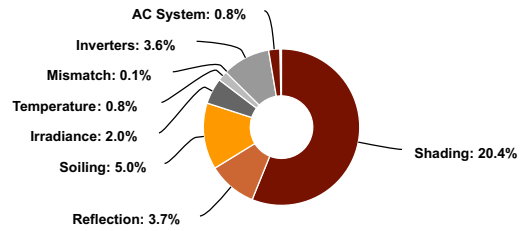
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,180.4	
	POA Irradiance	1,257.0	6.5%
	Shaded Irradiance	1,000.3	-20.4%
	Irradiance after Reflection	963.5	-3.7%
	Irradiance after Soiling	915.3	-5.0%
	Total Collector Irradiance	**914.9**	**0.0%**
Energy (kWh)	Nameplate	13,900.5	
	Output at Irradiance Levels	13,629.0	-2.0%
	Output at Cell Temperature Derate	13,519.8	-0.8%
	Output After Mismatch	13,510.5	-0.1%
	Optimal DC Output	13,510.5	0.0%
	Constrained DC Output	13,527.1	0.1%
	Inverter Output	13,037.2	-3.5%
	Energy to Grid	**12,927.8**	**-0.8%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.6 °C
	Avg. Operating Cell Temp		16.2 °C
Simulation Metrics			
	Operating Hours		4581
	Solved Hours		4581

Condition Set

Description	Condition Set 2
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
5	5	5	5	5	5	5	5	5	5	5	5

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
CS1H-345MS (Mar 2020) (1000V) (Canadian Solar)	Folsom Labs	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
IQ7A-72-2-INT (Enphase)	Folsom Labs	Spec Sheet

Components

Component	Name	Count
Inverters	IQ7A-72-2-INT (Enphase)	44 (15.4 kW)
AC Branches	10 AWG (Copper)	5 (777.1 ft)
Module	Canadian Solar, CS1H-345MS (Mar 2020) (1000V) (345W)	44 (15.2 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	1-1	Up and Down Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	146°	2.0 ft	1x1	44	44	15.2 kW

Detailed Layout

Design 1 Lions Bay Hall (Broughton Hall), Village of Lions Bay

Shading Heatmap

Shading by Field Segment

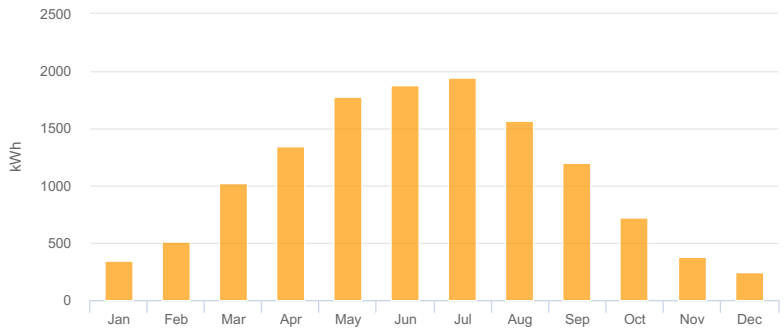
Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	Avg TSRF [2]
Field Segment 1	10.0°	146.0°	44	15.2 kWp	1,000.3kWh/m^2	12.9 MWh[1]	90.3%	79.6%	71.9%
Totals, weighted by kWp			**44**	**15.2 kWp**	**1,000.3kWh/m^2**	**12.9 MWh**	**90.3%**	**79.6%**	**71.9%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,391.9kWh/m^2 at 37.8° tilt and 182.1° azimuth

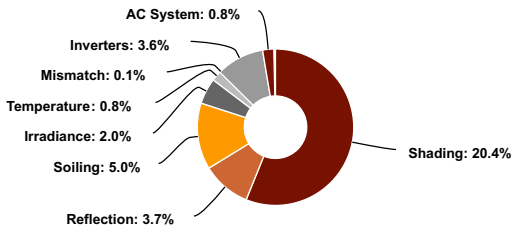
Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	79%	79%	80%	79%	81%	83%	81%	77%	77%	79%	78%	78%
Solar Access, weighted by kWp	**78.7%**	**79.5%**	**80.3%**	**78.7%**	**80.7%**	**82.9%**	**80.8%**	**76.6%**	**77.1%**	**78.8%**	**77.9%**	**78.3%**
AC Power (kWh)	**345.3**	**506.6**	**1,023.0**	**1,349.7**	**1,773.4**	**1,880.1**	**1,941.7**	**1,561.7**	**1,196.8**	**726.1**	**379.3**	**244.2**

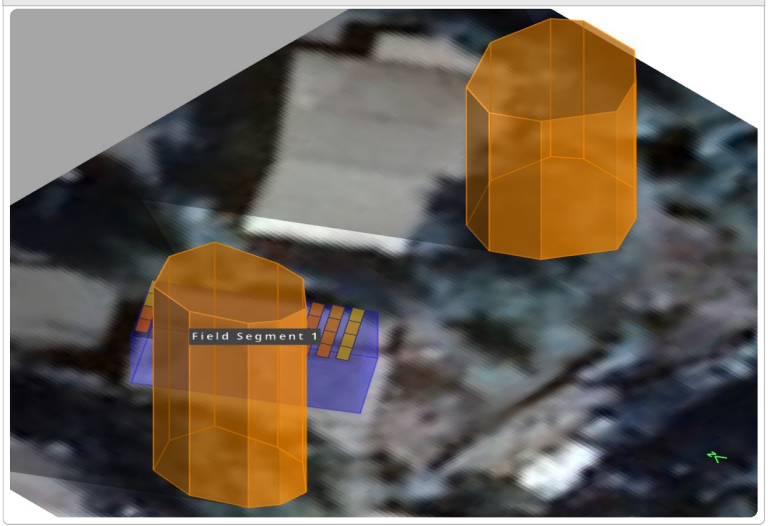
Monthly Production



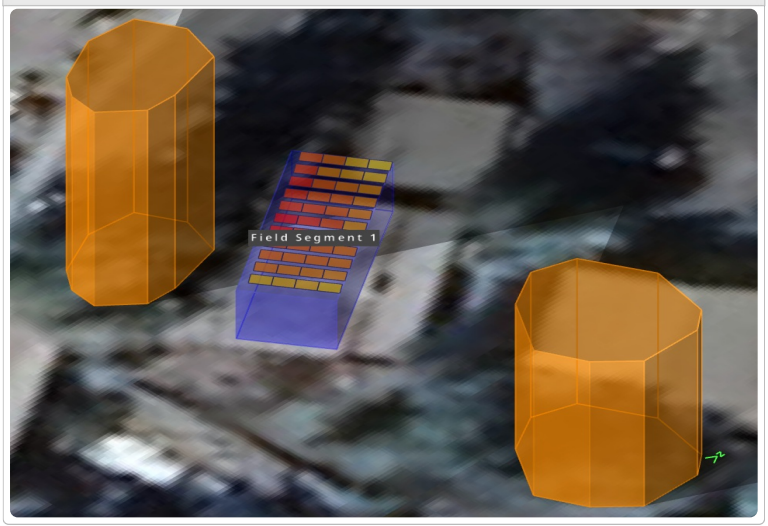
Sources of System Loss



Southwestern Angle



Southeastern Angle



Design 1 Lions Bay Fire Hall (Klatt Building), Village of Lions Bay

Shading Heatmap

Shading by Field Segment

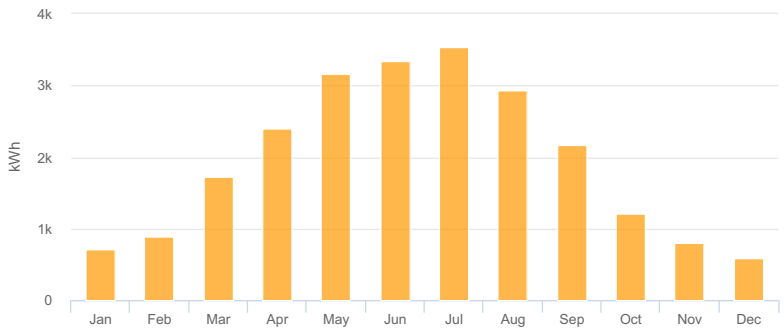
Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	Avg TSRF [2]
Field Segment 1	30.0°	238.0°	77	26.6 kWp	1,098.1kWh/m^2	23.5 MWh[1]	92.3%	85.5%	78.9%
Totals, weighted by kWp			**77**	**26.6 kWp**	**1,098.1kWh/m^2**	**23.5 MWh**	**92.3%**	**85.5%**	**78.9%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,391.9kWh/m^2 at 37.8° tilt and 182.1° azimuth

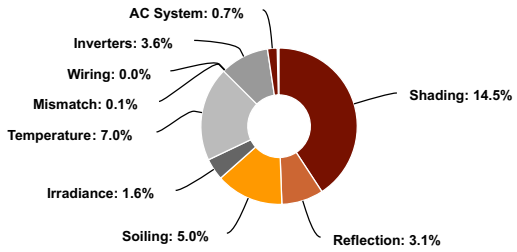
Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	78%	74%	77%	87%	91%	92%	92%	89%	79%	71%	77%	82%
Solar Access, weighted by kWp	**78.4%**	**74.1%**	**76.5%**	**86.8%**	**91.4%**	**92.2%**	**92.4%**	**89.2%**	**79.1%**	**71.1%**	**77.0%**	**82.4%**
AC Power (kWh)	**717.0**	**895.7**	**1,723.3**	**2,404.0**	**3,159.3**	**3,348.2**	**3,542.0**	**2,931.4**	**2,166.3**	**1,216.9**	**792.8**	**583.9**

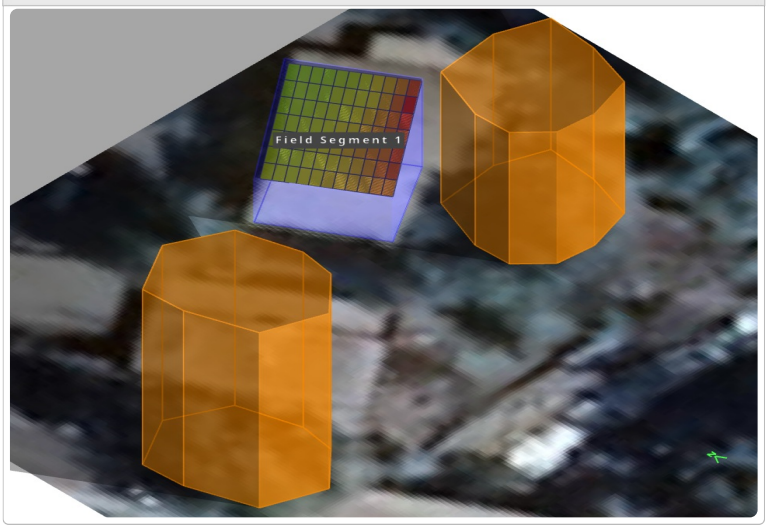
Monthly Production



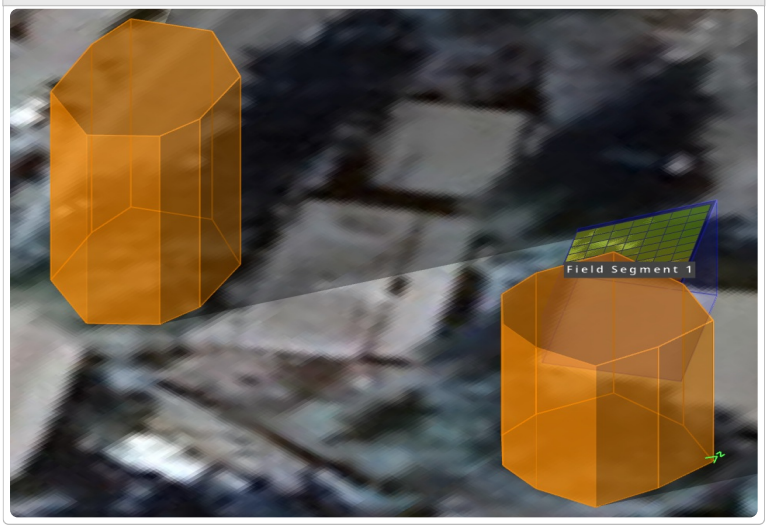
Sources of System Loss



Southwestern Angle



Southeastern Angle



Design 1 Lions Bay Fire Hall (Klatt Building), Village of Lions Bay

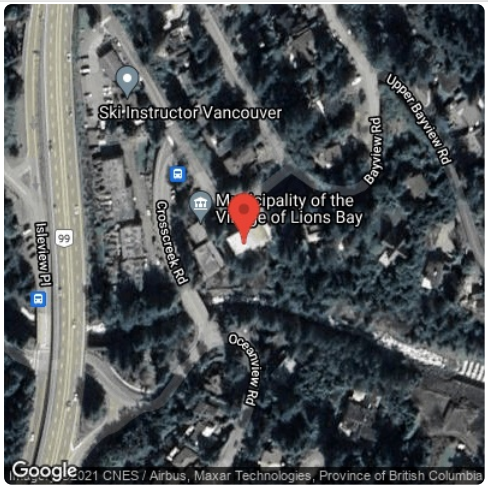
Report

Project Name	Lions Bay Fire Hall (Klatt Building)
Project Address	Village of Lions Bay
Prepared By	Scott Elston scott@alternativepowersystems.ca

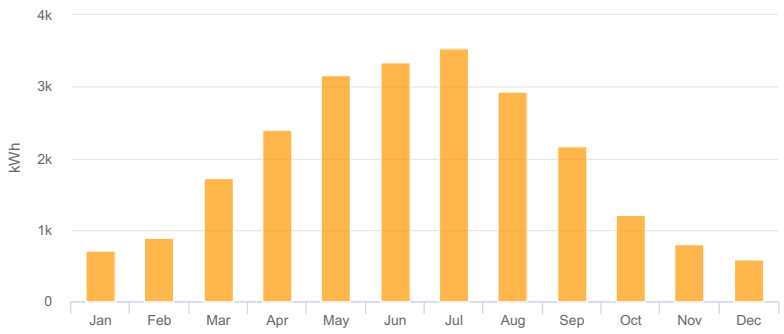
System Metrics

Design	Design 1
Module DC Nameplate	26.6 kW
Inverter AC Nameplate	26.9 kW Load Ratio: 0.99
Annual Production	23.48 MWh
Performance Ratio	68.8%
kWh/kWp	883.9
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	8ab6c1dc12-d6b09898f2-d64b51de0f-2475be9f8d

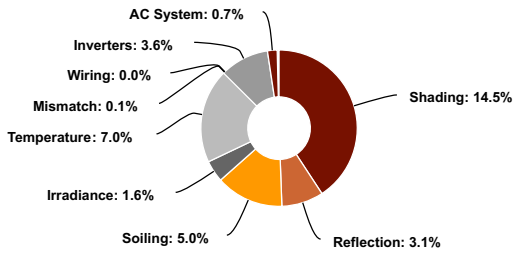
Project Location



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,180.4	
	POA Irradiance	1,284.9	8.9%
	Shaded Irradiance	1,098.1	-14.5%
	Irradiance after Reflection	1,064.2	-3.1%
	Irradiance after Soiling	1,011.0	-5.0%
	Total Collector Irradiance	**1,008.1**	**-0.3%**
Energy (kWh)	Nameplate	26,804.5	
	Output at Irradiance Levels	26,375.3	-1.6%
	Output at Cell Temperature Derate	24,524.0	-7.0%
	Output After Mismatch	24,508.2	-0.1%
	Optimal DC Output	24,508.2	0.0%
	Constrained DC Output	24,541.3	0.1%
	Inverter Output	23,649.7	-3.5%
	Energy to Grid	**23,480.7**	**-0.7%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.6 °C
	Avg. Operating Cell Temp		22.8 °C
Simulation Metrics			
	Operating Hours		4581
	Solved Hours		4581

Condition Set

Description	Condition Set 2
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
5	5	5	5	5	5	5	5	5	5	5	5

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
CS1H-345MS (Mar 2020) (1000V) (Canadian Solar)	Folsom Labs	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
IQ7A-72-2-INT (Enphase)	Folsom Labs	Spec Sheet

Components

Component	Name	Count
Inverters	IQ7A-72-2-INT (Enphase)	77 (26.9 kW)
AC Branches	10 AWG (Copper)	8 (671.8 ft)
Module	Canadian Solar, CS1H-345MS (Mar 2020) (1000V) (345W)	77 (26.6 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	1-1	Up and Down Racking

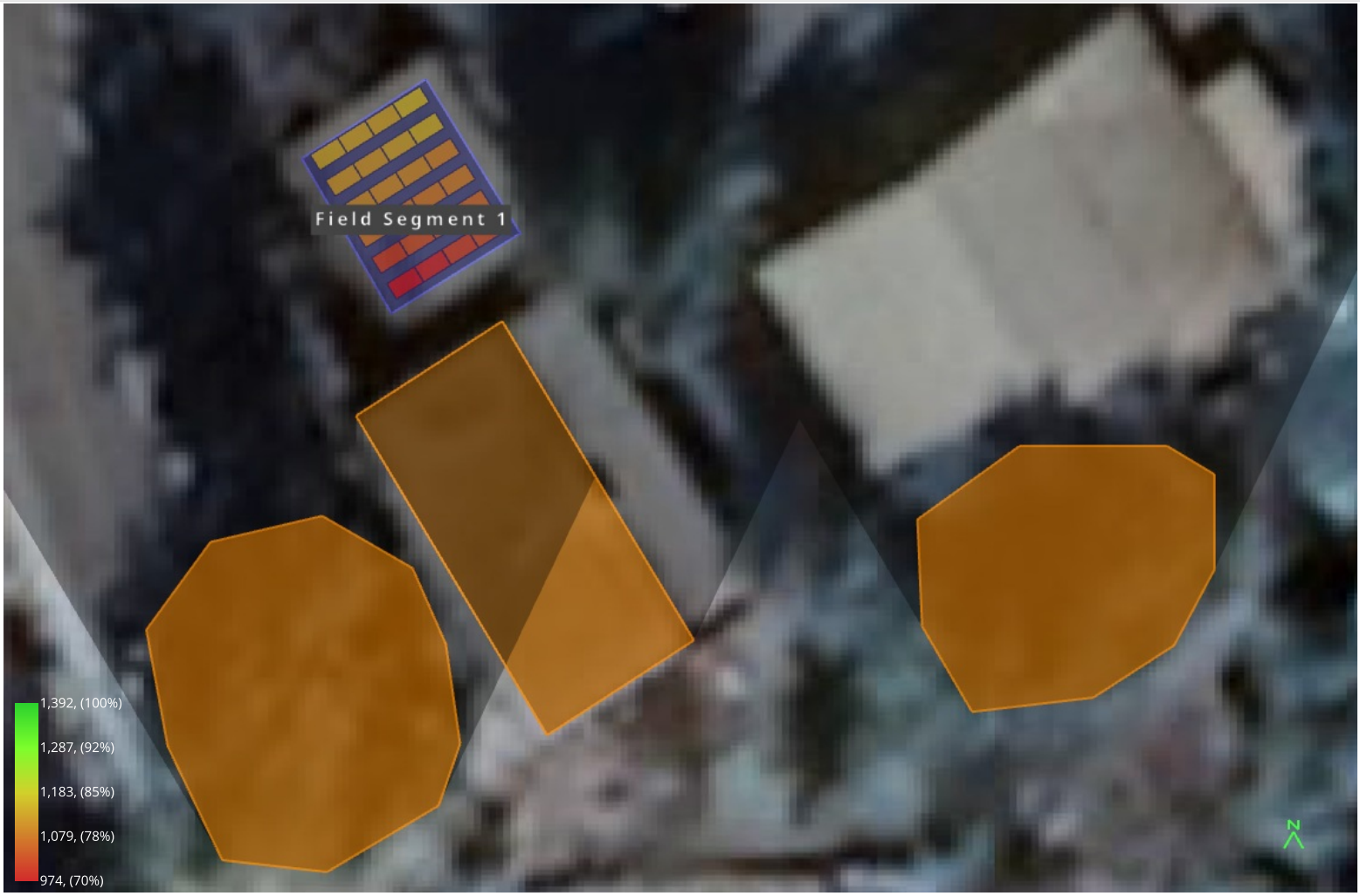
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Portrait (Vertical)	30°	238°	0.0 ft	1x1	77	77	26.6 kW

Detailed Layout

Design 1 Lions Bay Village Office, Village of Lions Bay

Shading Heatmap



Shading by Field Segment

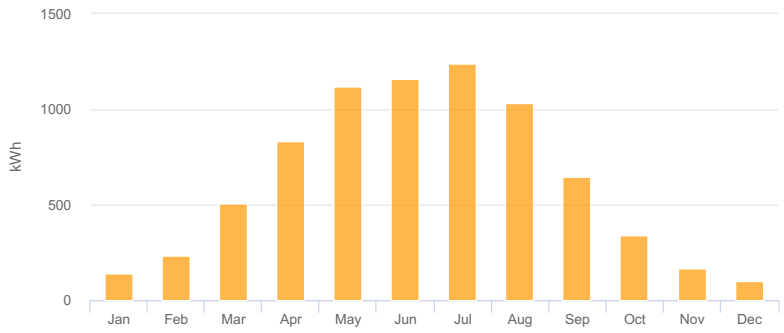
Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	Avg TSRF [2]
Field Segment 1	10.0°	148.0°	24	8.16 kWp	1,085.9kWh/m^2	7.51 MWh[1]	90.5%	86.2%	78.0%
Totals, weighted by kWp			**24**	**8.16 kWp**	**1,085.9kWh/m^2**	**7.51 MWh**	**90.5%**	**86.2%**	**78.0%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,391.9kWh/m^2 at 37.8° tilt and 182.1° azimuth

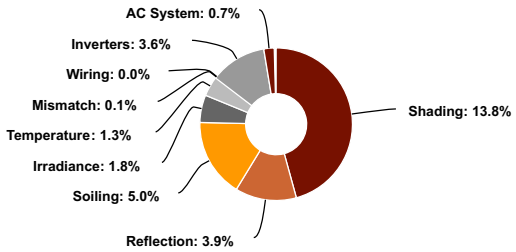
Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	59%	68%	74%	90%	95%	95%	96%	94%	77%	69%	65%	63%
Solar Access, weighted by kWp	**59.1%**	**67.8%**	**74.2%**	**90.2%**	**94.9%**	**94.8%**	**95.8%**	**93.8%**	**77.5%**	**69.5%**	**64.9%**	**62.8%**
AC Power (kWh)	**136.8**	**230.6**	**505.6**	**832.4**	**1,123.0**	**1,158.1**	**1,241.7**	**1,030.9**	**643.5**	**341.5**	**167.7**	**103.1**

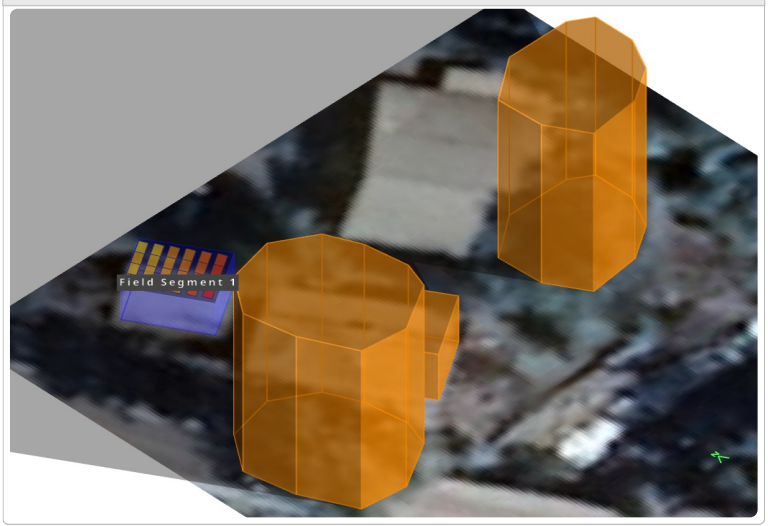
Monthly Production



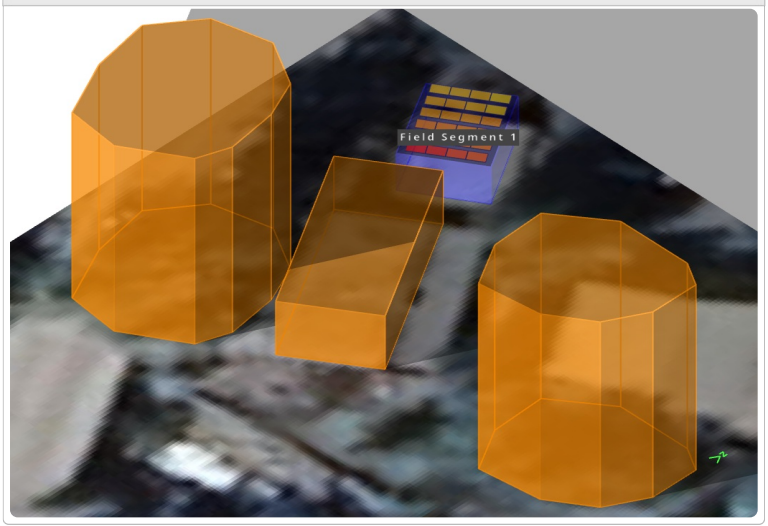
Sources of System Loss



Southwestern Angle



Southeastern Angle



Design 1 Lions Bay Village Office, Village of Lions Bay

Report

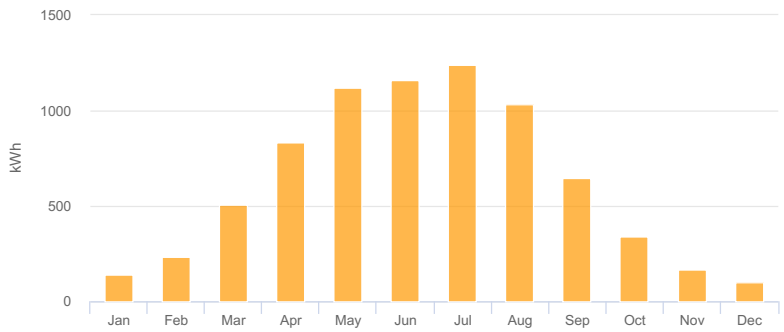
Project Name	Lions Bay Village Office
Project Address	Village of Lions Bay
Prepared By	Scott Elston scott@alternativepowersystems.ca

System Metrics

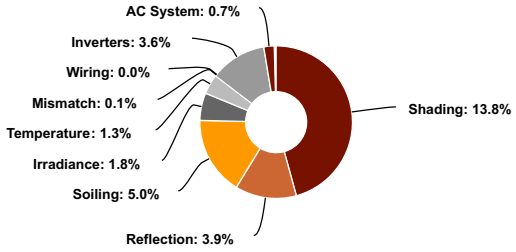
Design	Design 1
Module DC Nameplate	8.16 kW
Inverter AC Nameplate	8.38 kW Load Ratio: 0.97
Annual Production	7.515 MWh
Performance Ratio	73.1%
kWh/kWp	920.9
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Simulator Version	8ab6c1dc12-d6b09898f2-d64b51de0f-2475be9f8d

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,180.4	
	POA Irradiance	1,259.0	6.7%
	Shaded Irradiance	1,085.9	-13.8%
	Irradiance after Reflection	1,043.4	-3.9%
	Irradiance after Soiling	991.2	-5.0%
	Total Collector Irradiance	**990.8**	**0.0%**
Energy (kWh)	Nameplate	8,090.4	
	Output at Irradiance Levels	7,948.8	-1.8%
	Output at Cell Temperature Derate	7,845.0	-1.3%
	Output After Mismatch	7,839.8	-0.1%
	Optimal DC Output	7,839.8	0.0%
	Constrained DC Output	7,848.9	0.1%
	Inverter Output	7,565.2	-3.5%
	Energy to Grid	**7,514.7**	**-0.7%**
Temperature Metrics			
	Avg. Operating Ambient Temp		10.6 °C
	Avg. Operating Cell Temp		16.6 °C
Simulation Metrics			
	Operating Hours		4581
	Solved Hours		4581

Condition Set

Description	Condition Set 2
Weather Dataset	TMY, 10km Grid, meteonorm (meteonorm)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
5	5	5	5	5	5	5	5	5	5	5	5

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
CS1H-340MS (Mar 2020) (1000V) (Canadian Solar)	Folsom Labs	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
IQ7A-72-2-INT (Enphase)	Folsom Labs	Spec Sheet

Components

Component	Name	Count
Inverters	IQ7A-72-2-INT (Enphase)	24 (8.38 kW)
AC Branches	10 AWG (Copper)	3 (202.2 ft)
Module	Canadian Solar, CS1H-340MS (Mar 2020) (1000V) (340W)	24 (8.16 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	1-1	Up and Down Racking

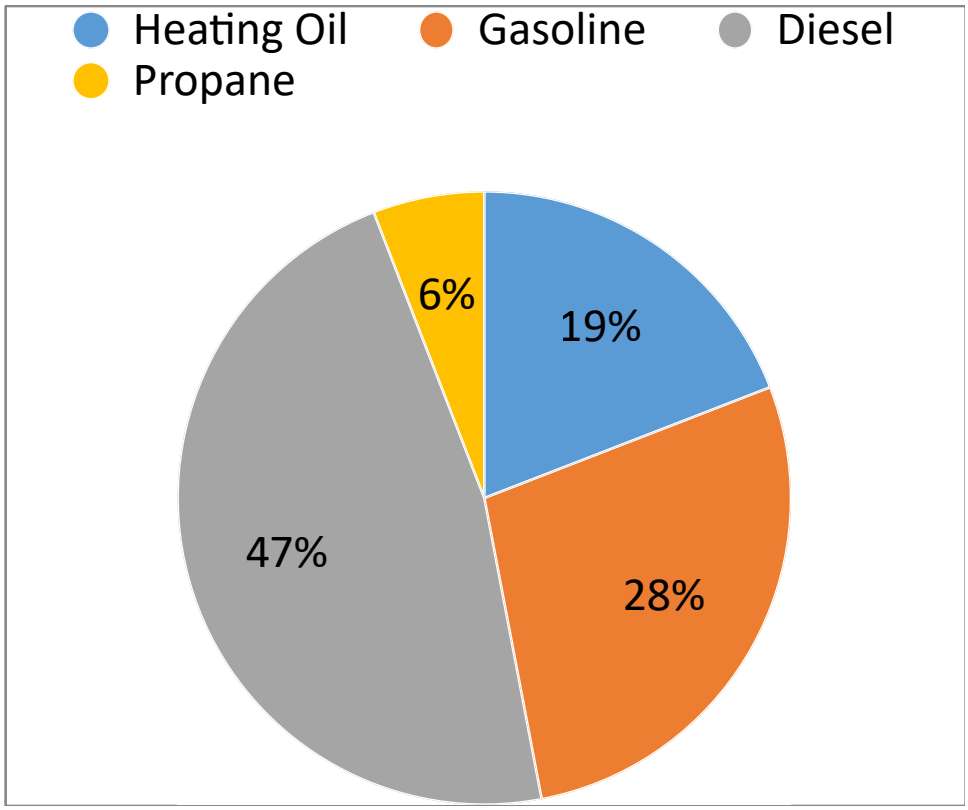
Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	148°	2.0 ft	1x1	24	24	8.16 kW

Detailed Layout

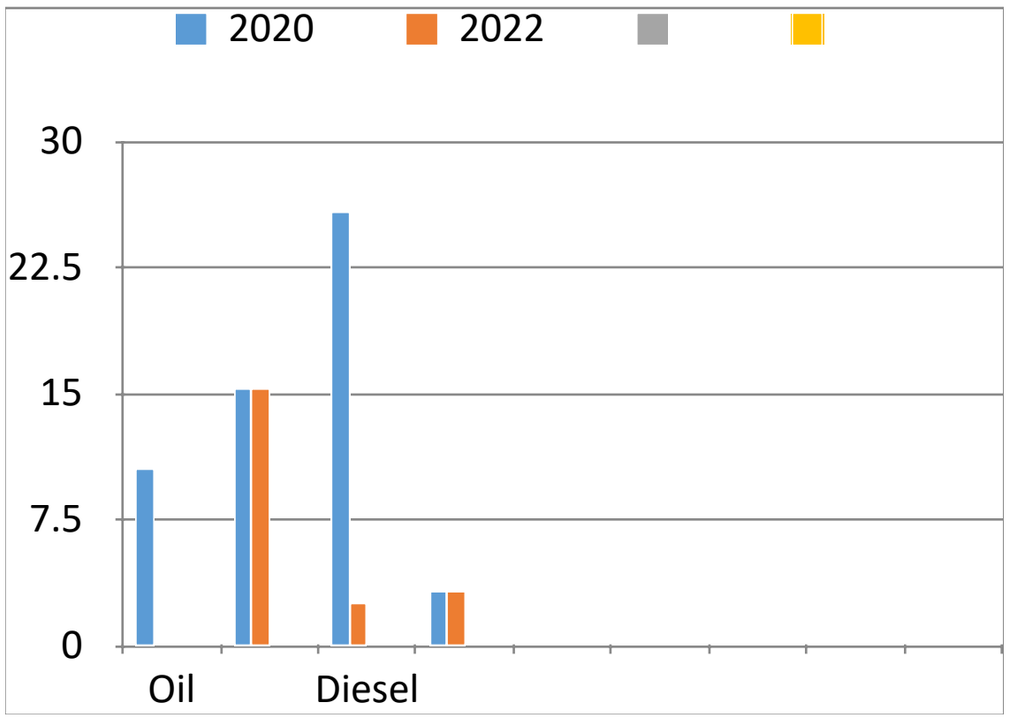
Lions Bay Emissions Overview

2020	tCO2	Litres Purchased
Heating Oil	10.487	3,952.8
Gasoline	15.3	5,009.0
Diesel	25.85	7,413.0
Propane	3.225	2,083.2



Potential GHG reductions

	2020	2022		
Oil	10.487	0		
Gas	15.3	15.3		
Diesel	25.85	2.585		
Propane	3.225	3.225		



Reduction Strategy

Fuel	2020	2022	Annual Cost	Action	Cost / tonne of CO2
Oil	10.487	0	Unknown	Replace Oil Heating with Electric	
Gas	15.3	15.3	Unknown	Identify & Electrify Gas Powered Items	
Diesel	25.85	2.585	$5,082.40	Switch to Renewable Diesel	$218.46
Propane	3.225	3.225	Unknown	Identify and Electrify Propane Powered Items	

2020 CARIP					GHG Emissions / tCO2	% of total Emissions	Potential Reductions	Reduction in tCO2	% Reduction in CO2
Carbon Tax Calculation				Calculators:	https://www.carbonindependent.org/15.html				
					https://www.saanich.ca/EN/main/community/sustainable-saanich/climate-change/carbon-fund-calculator.html				
					https://www.e3fleet.com/emissions_calculator.html				
Flashpoint Fuels (was EBCO Petroleum Inc.)									
January 1 to December 31, 2020									
Date	**Invoice #**	**Litres**					Convert to Electric Heat Pump		
2-Jan-20	7588	957.1			2.539				
13-Feb-20	261976	917.4			2.434				
19-Mar-20	7993	677.5			1.797				
11-Jun-20	88637	623.6			1.654				
12-Nov-20	9294	777.2			2.062				
		3,952.8			**10.487**	**19.12%**	0	-10.487	-100.00%
Supersave Fuels									
January 1 to December 31, 2020									
		Litres							
Date	**Invoice #**	**Gas**	**Diesel**						
Gasoline									
23-Mar-20	93551	1,117.0			3.39				
8-Jun-20	94346	1,083.0			3.39				
16-Jul-20	94849	574.0			1.74				
21-Sep-20	95711	1,094.0			3.32				
25-Nov-20	96485	1,141.0			3.46				
		5,009.0			**15.3**	**27.89%**	15.3	0	0.00%
Diesel							**Purchase Renewable Diesel**		
23-Mar-20	93552		1,512.0		5.27		0.527		
16-Jul-20	94850		563.0		1.96		0.196		
21-Sep-20	95712		1,991.0		6.94		0.694		
25-Nov-20	96486		2,301.0		8.03		0.803		
23-Dec-20	97013		1,046.0		3.65		0.365		
			7,413.0		**25.85**	**47.12%**	2.585	-23.265	
				5,082.4					
				Add cost for RD					
Superior Propane									
January 1 to December 31, 2020									
Date	**Invoice #**	**Litres**							
2-Jan-20	28038380	137.4			0.213				
2-Jan-20	28038381	621.9			0.963				
2-Jan-20	28038382	1,083.4			1.677				
13-Mar-20	29186638	990.5			1.533				
5-Aug-20	30729407	1,460.0			2.260				
1-Nov-20	31658861	623.2			0.965				
		2,083.2			**3.225**	**5.88%**	3.225	0	0.00%
		TOTAL EMISSIONS FROM FUEL SOURCES:			54.862	100.00%	21.11	-33.752	-61.52%

Estimate

12.93 MWh Annually

Date: 06/18/221

PROJECT TITLE: Lions Bay - Broughton Hall

PROJECT DESCRIPTION: 15.4kW Grid-Tied Solar System

APS-Alternative Power Systems
(a division of the Olson Group)
4472 Hilltop Road , Sechelt
T 604.885.0599
F 604.885.6298
Scott@AlternativePowerSystems.ca
www.aps.solar

Canadian Solar Cs1h-340W, 120 Cell, 25 Year Power Warranty	44	$186.00	$8,184.00
Enphase IQ7A - 349W Microinverters 25 Year Warranty	44	$184.00	$8,096.00
Enphase Trunk Cable	44	$31.80	$1,399.20
Enphase End-Caps	3	$13.74	$41.22
Enphase Terminal Cap	15	$15.11	$226.65
EcoFoot 2+ , 10 Degree	60	$32.61	$1,956.60
Microinverter T-Bolt w/Nut	44	$1.50	$66.00
EcoFoot Clamp Kit	110	$27.83	$3,061.30
EcoFoot Wind Deflector	44	$16.49	$725.56
Ballast Block- Concrete	240	$3.70	$888.00
Enphase ECU Monitoring Software / Hardware	1	$896.00	$896.00
Shipping and Handling	1	$542.00	$542.00
Installation of 15.4kW system includes: BC Hydro application, labour, connection and permit.	1	$6,192.00	$6,192.00
$2.09 Per Watt Installed			$32,274.53
		GST	$1,613.73
		Total	**$33,888.26**

1. **Alternative products may be provided due to supplier availability.**
2. **100kW system size is the largest system under a net-metering agreement.**
3. **Estimates are for specific customers and considered confidential.**

Prices are valid for the specified customer for one month. Estimate is for product, installation and permit. Bundled systems are PST exempt. Application for BC Hydro grid-tie /net metering approval will be completed after the quote is accepted. Thank You.

Estimate

23.48MWh Annually

Date: 06/18/2021
PROJECT TITLE: Lions Bay - Fire Hall
PROJECT DESCRIPTION: 26.9kW Grid-Tied Solar System

APS-Alternative Power Systems
(a division of the Olson Group)
4472 Hilltop Road , Sechelt
T 604.885.0599
F 604.885.6298
Scott@AlternativePowerSystems.ca
www.aps.solar

Canadian Solar Cs1h-340W, 120 Cell, 25 Year Power Warranty	77	$186.00	$14,322.00
Enphase IQ7A - 349W Microinverters 25 Year Warranty	77	$184.00	$14,168.00
Enphase Trunk Cable	77	$31.80	$2,448.60
Enphase End-Caps	11	$13.74	$151.14
Enphase Terminal Cap	20	$15.11	$302.20
Kinetic Rail	56	$32.61	$1,826.16
Kinetic Joiners	42	$5.87	$246.54
Kinetic End Clamps	28	$4.79	$134.12
Kinetic Mid Clamp	140	$4.86	$680.40
Microinverter T-Bolt w/Nut	77	$1.50	$115.50
S5 Roof Clamps	308	$12.40	$3,819.20
Kinetic L feet	308	$4.20	$1,293.60
Enphase Combiner	1	$1,230.00	$1,230.00
Enphase ECU Monitoring Software / Hardware	1	$896.00	$896.00
Shipping and Handling	1	$542.00	$542.00
Installation of 15.4kW system includes: BC Hydro application, labour, connection and permit.	1	$8,256.00	$8,256.00
$1.87 Per Watt Installed			$50,431.46
		GST	$2,521.57
		Total	**$52,953.03**

1. **Alternative products may be provided due to supplier availability.**
2. **100kW system size is the largest system under a net-metering agreement.**
3. **Estimates are for specific customers and considered confidential.**

Prices are valid for the specified customer for one month. Estimate is for product, installation and permit. Bundled systems are PST exempt. Application for BC Hydro grid-tie /net metering approval will be completed after the quote is accepted. Thank You.

Estimate

7.5 MWh Annually

Date: 06/18/221
PROJECT TITLE: Lions Bay - Office
PROJECT DESCRIPTION: 8.38kW Grid-Tied Solar System

APS-Alternative Power Systems
(a division of the Olson Group)
4472 Hilltop Road , Sechelt
T 604.885.0599
F 604.885.6298
Scott@AlternativePowerSystems.ca
www.aps.solar

Canadian Solar Cs1h-340W, 120 Cell, 25 Year Power Warranty	24	$186.00	$4,464.00
Enphase IQ7A - 349W Microinverters 25 Year Warranty	24	$184.00	$4,416.00
Enphase Trunk Cable	24	$31.80	$763.20
Enphase End-Caps	3	$13.74	$41.22
Enphase Terminal Cap	5	$15.11	$75.55
EcoFoot 2+ , 10 Degree	35	$32.61	$1,141.35
Microinverter T-Bolt w/Nut	24	$1.50	$36.00
EcoFoot Clamp Kit	52	$27.83	$1,447.16
EcoFoot Wind Deflector	24	$16.49	$395.76
Ballast Block- Concrete	140	$3.70	$518.00
Enphase ECU Monitoring Software / Hardware	1	$896.00	$896.00
Shipping and Handling	1	$542.00	$542.00
Installation of 8.38kW system includes: BC Hydro application, labour, connection and permit.	1	$5,192.00	$5,192.00
$2.37 Per Watt Installed			$19,928.24
		GST	$996.41
		Total	**$20,924.65**

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