Vancouver Island's (almost) First Solar Strata

MARCH 7, 2020

University of Victoria Retirees Association

HES PV

PTTP POWER TO THE PEOPLE

Topics Today

The building

Electricity estimate & generation

Finances

Pitch to the owners & decision process

Publicity

Challenges & Results

Lessons learned

System design & Installation

Technical details

About me

Energy geek

Sales career

Passion for energy conservation and climate change

Landlord owner 2007 - 2016

Strata council 2009 - 2016

BC Sustainable Energy ASSOCIATION

Central Park Strata, Victoria

1977 wood frame

4 storeys

64 suites

Low end, young and old

Half rented

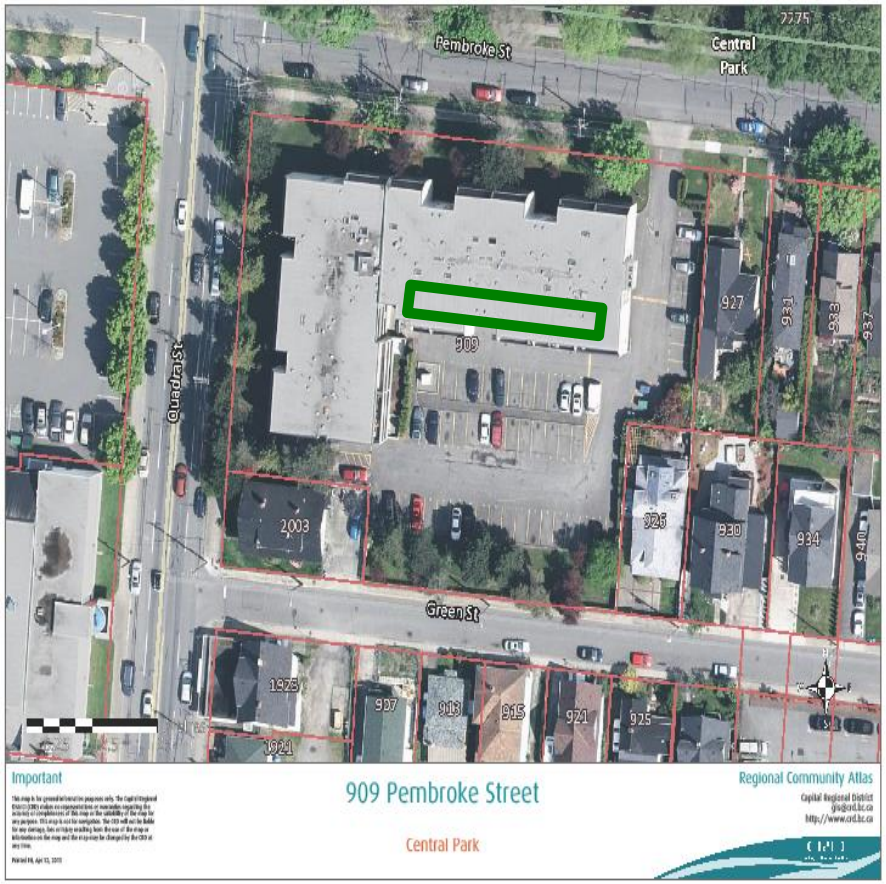
Good condition

2013 Depreciation Report

$100K Reserve fund (2014)

Why on Central Park ?

- Big flat roof
- NO shade
- Easy run down side of building
- Space in electrical room
- Roof shade for south suites



Solar Hot Water ?

20 flat plates, 3 x 120 gal tanks: $80,000

Capital Regional District: extended 25% Rebate to MURBs to March 2015

CRD: Analysis of savings - $2,100 / year @ $12.74/GJ in 2014

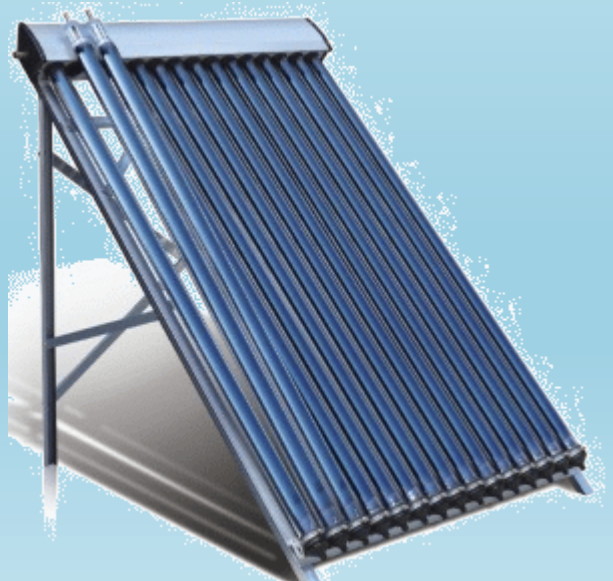
Actually reduces carbon emissions from natural gas

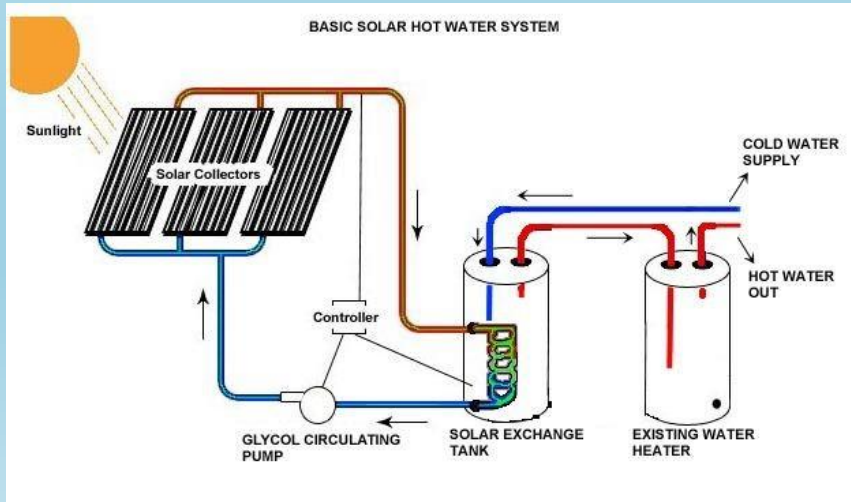
Vancouver Island gas price down 31% in 2015 for small commercial

Balance supply / demand

When do we use it ? – one ‘dumb’ gas meter

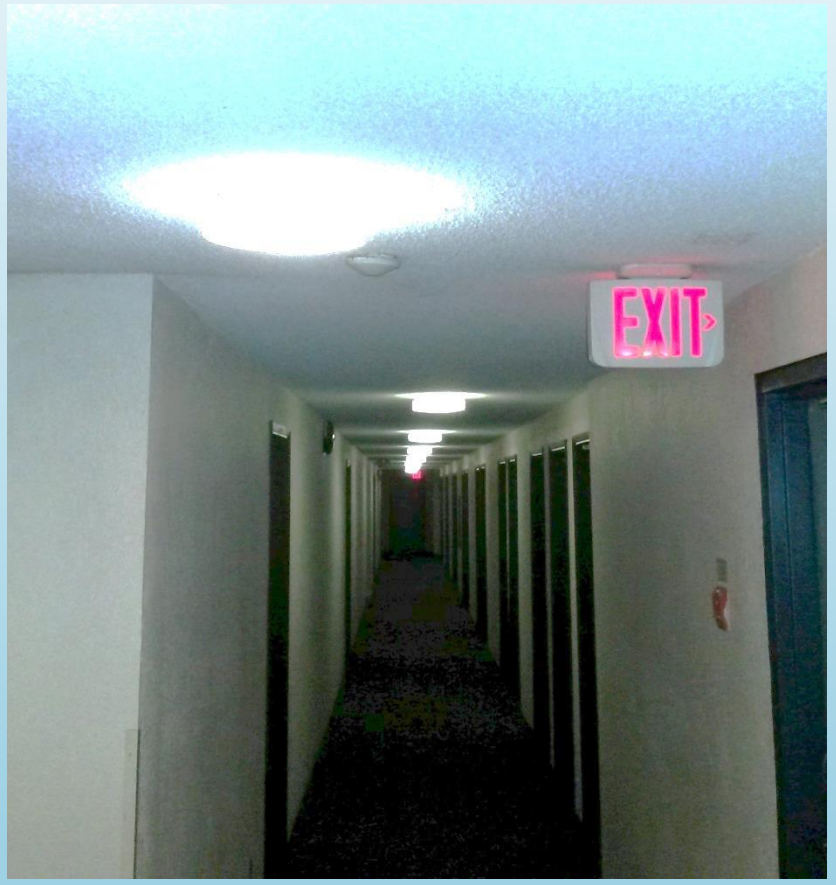
More pumps and maintenance a challenge with a strata





Common Area Loads

- Hallway lights
- Outdoor lights
- Ventilation fans
- Washing machines
- Baseboard heat (rarely)
- NOT suites



Grid Tied PV System

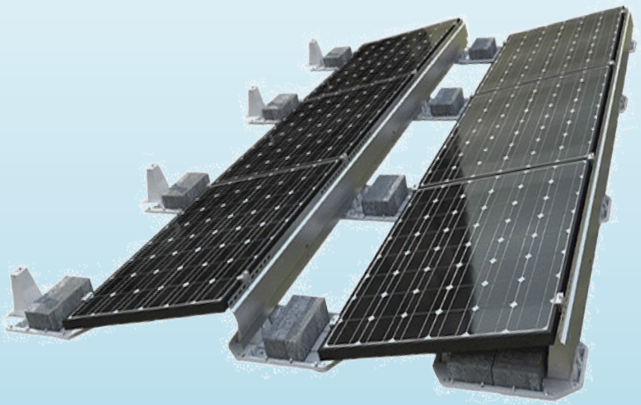
60 x 245w Hanwha panels

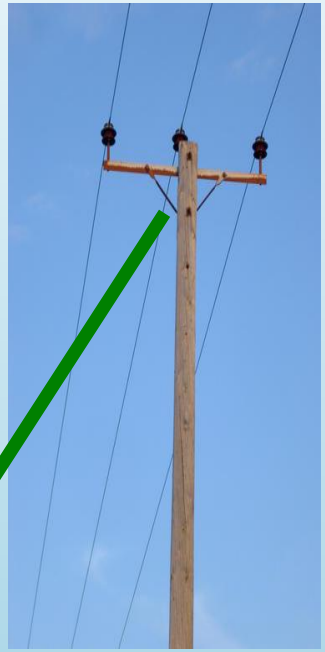
14.7 kW

No batteries !

Installed May/June 2015

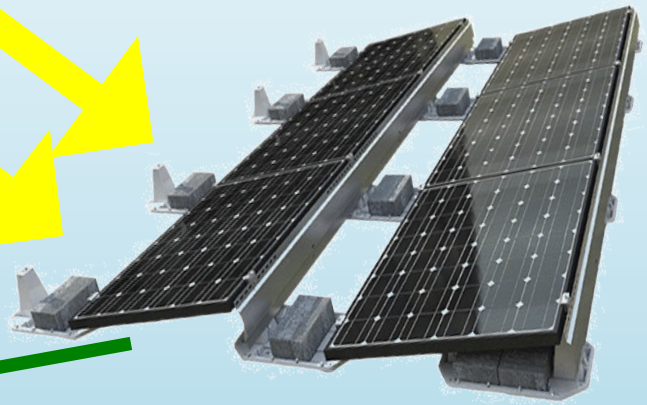
Functioning well in 2020

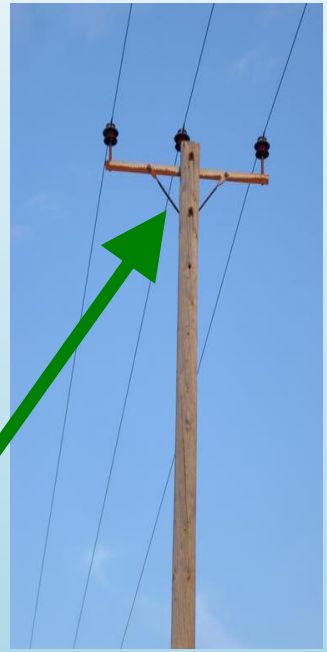


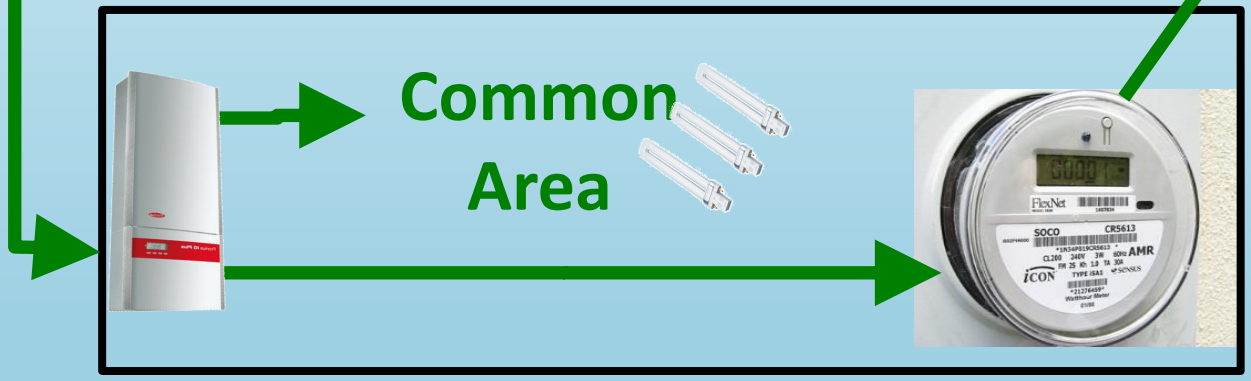


Common Area

Meter



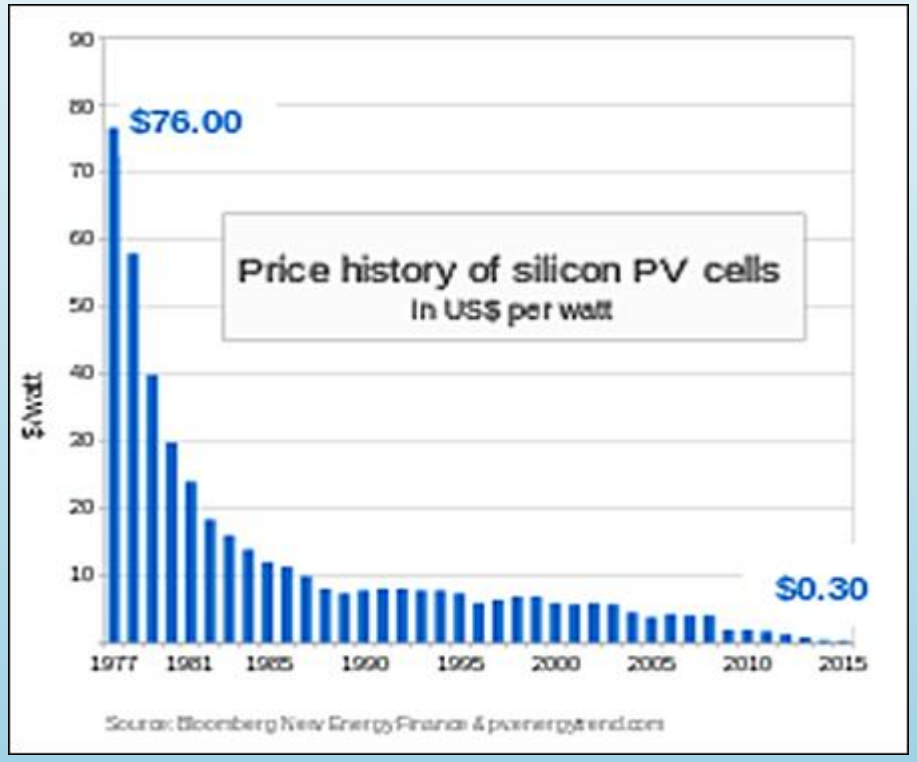




Inverter

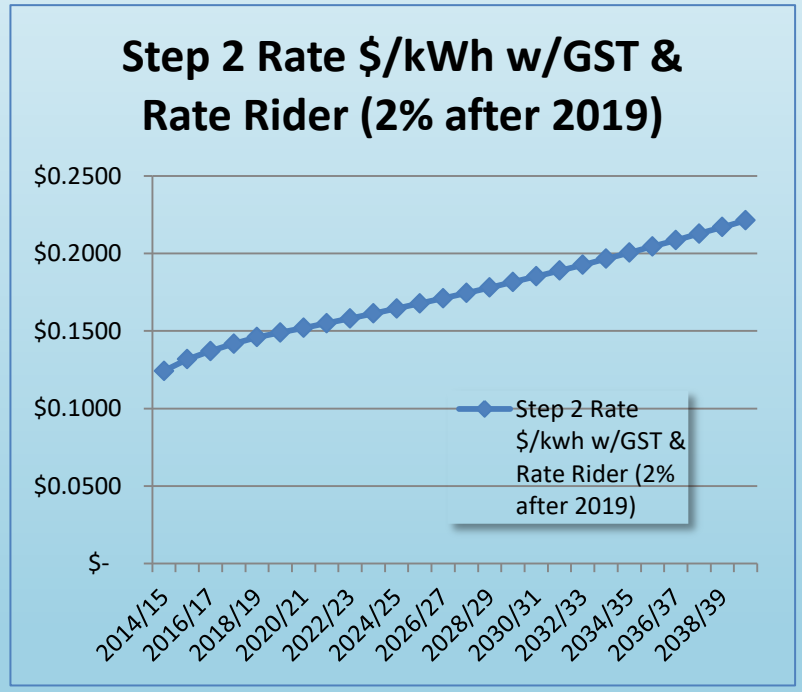
Meter

Finances



Fixed Price, all in: $ 3.00 /watt

Step 2: $0.1317 / kWh in 2015



BC Hydro Net Metering Program

System Size

Lots of roof area

Not too big - must keep *buying* power

Under $1,000 per unit

Limited choices of 208V/3 phase inverters – 10 or 11.4 kw

Proposed 48 or 60 panels - $40,100 or $46,270 incl GST & permit

Council favoured bigger one

What's a watt ?

The *rate* of electricity use

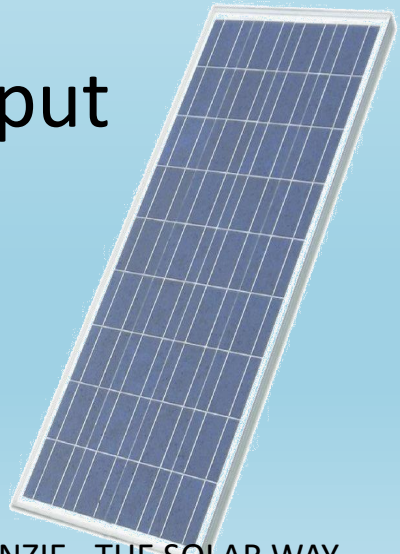
Regular hallway light bulb = 13 watts

Run it for one hour = 13 watt-hours

Run it for 77 hours = 1,000 watt-hours = 1 kilowatt-hour (kWh)

Solar panel = 245 watts at maximum output

60 Solar panels = 14,700 watts = 14.7 kilowatts



Full power for one hour = 14.7 kWh

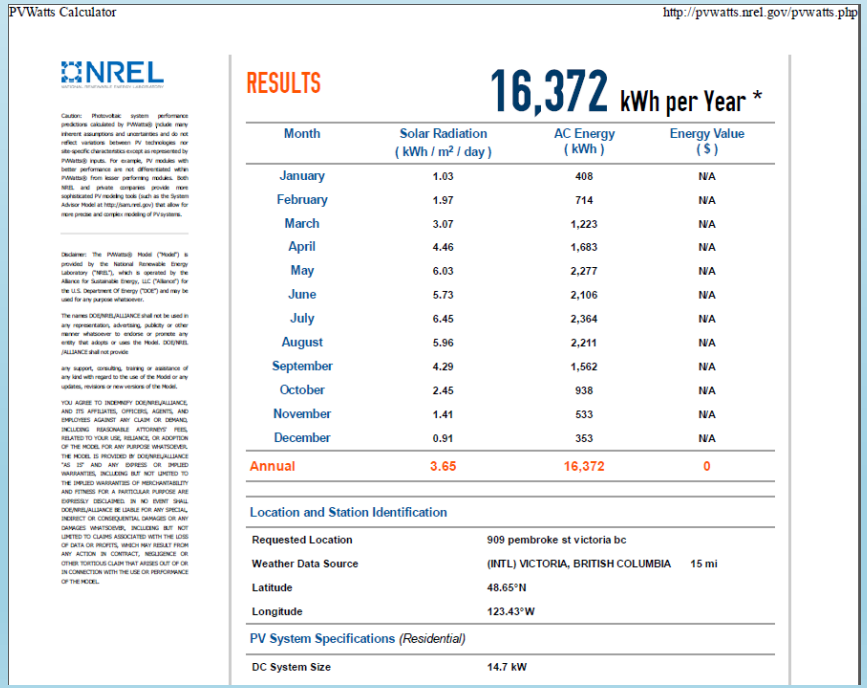
How much electricity (1) ?

HES-PV ‘Round Number’ : 1,100 hours of max. power / year

14.7 kilowatts X 1,100 hours = 16,170 kilowatt-hours / year

How much electricity (2) ?

Estimate from pvwatts.nrel.gov detailed calculator based on Victoria location, YYJ airport weather: 16,372 kWh / year


PVWatts Calculator http://pvwatts.nrel.gov/pvwatts.php

NREL

RESULTS **16,372** kWh per Year *

Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Energy Value ($)
January	1.03	408	N/A
February	1.97	714	N/A
March	3.07	1,223	N/A
April	4.46	1,683	N/A
May	6.03	2,277	N/A
June	5.73	2,106	N/A
July	6.45	2,364	N/A
August	5.96	2,211	N/A
September	4.29	1,562	N/A
October	2.45	938	N/A
November	1.41	533	N/A
December	0.91	353	N/A
Annual	3.65	16,372	0

Location and Station Identification

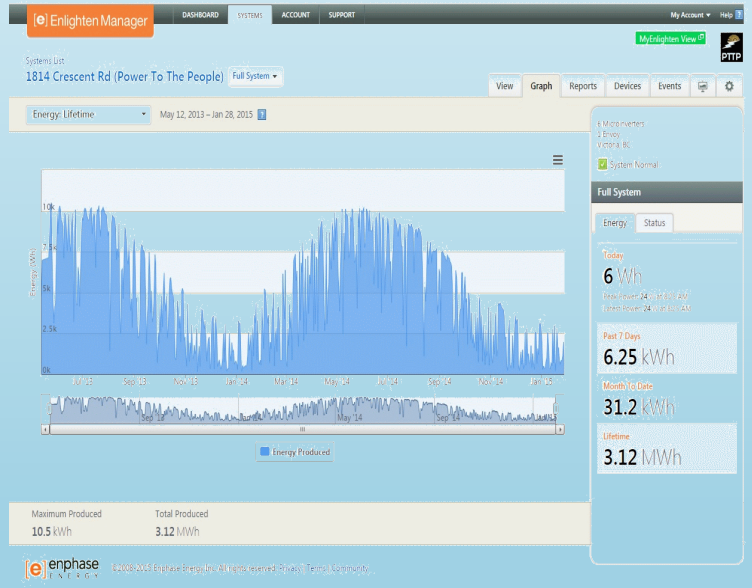
Requested Location	909 pembroke st victoria bc	
Weather Data Source	(INTL) VICTORIA, BRITISH COLUMBIA	15 mi
Latitude	48.65° N	
Longitude	123.43° W	

PV System Specifications *(Residential)*

DC System Size	14.7 kW

How much electricity (3)?

Actual 2014 results from 6 x 250w panels at 1814 Crescent Road, Ross Bay, 20° slope: 1,835 kWh / yr



Adjusted to 60 x 245w panels: 18,000 kWh/yr

How much annual savings ?

Electricity (kwh)/year X Cost per kWh = $Savings

2015: 16,225 kWh/year X $.1317 / kWh = $2,136

2019: 16,225 kWh/year X $.1489 / kWh = $2,369

2025: 16,225 kWh/year X $.1644 / kWh = $2,668

Cost ?

$46,271.50 *Complete*

Includes panels, wiring, inverter

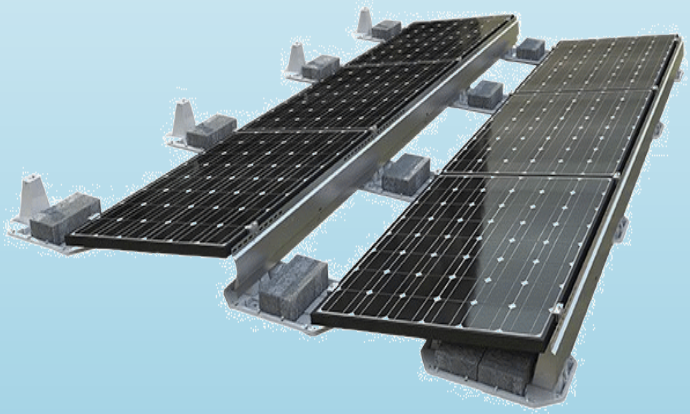
Includes 5% GST

Solar systems are PST Exempt

Includes electrical permit

Includes labour, installation

Includes mounting brackets, bricks to hold them down



Strata Process

Straw vote at 2011 AGM

Meeting with supplier September 2014

Investigation of Solar Hot Water

Lots of calculations, investigation, gathering info

Discussion with strata council

Fixed price proposal from HES-PV and P2TP

Information meetings with owners

Chats with owners in hallways and parking lot would have been valuable

Strata Process continued

Strata council meeting pre-AGM to decide which system to propose

Detailed description for owners in AGM package

Information meeting with owners

Support from Property Manager – Dockside Green ?

February 2015: Strata Annual General Meeting

- 15 minute presentation
- Electrician present , honest answers, passion
- Lots of questions, answer EVERY concern
- Most no's were proxies – can't argue with them
- 75% needed - Vote was 18-6

Pitch to Owners

Kilowatt hours, PV, net metering lesson

Proven system, millions in operation

Absolutely fixed price quote, no extras (except engineering)

No holes in the roof

Warranties, expected lifetimes, zero maintenance

Save some money – 4.5% return

Dividend, not payback

“What is the payback on the granite countertops ?”

Opinion from REALTOR® (next slide)

Investment in the Building

From: Donna Curtis [mailto:donna@lprealestate.ca]
Sent: 2015-Feb-17 17:35
To: 'Bruce Mackenzie'
Subject: RE: Solar at 909 Pembroke

You asked me to comment on the effect that installing the solar system as attached to your email would have on the saleability of a unit at 909 Pembroke.

It is my opinion the effect on a potential buyer would be a positive one in that this is a progressive and innovative strata that is obviously being proactive in its responsibilities as custodians of their building. I am also of the opinion that once potential b ir banks for financing became aware of this approach to managing the costs it would have a ve effect on sales.

I believe that it will certainly make t er to sell and as the general public become more familiar with the cost saving features of sol a positive effect on sales prices as well. I personally commend you to for taking this st ge you to let other strata's know what you are doing and the positive effect it has on your bottom l

As you are aware
do to improve the

Warmly
Donna Curtis
Associate Broker,
donna@lprealest
LP REAL ESTATE G
RE/MAX Camosu
www.lprealestate

It is my opinion the effect on a potential buyer would be a positive one in that this is a progressive and innovative strata that is obviously being proactive …

How much per unit ?

System Size: 14.7 Kw (60 panels) - 11.4 kw Inverter Annual output: 16,225 kWh	Building Total	Per Unit (varies with unit area)
Total installed cost, with tax	$46,271.50	$555- $865
Install cost per month, repaid over 60 months	$771.97	$9.25 - $14.42
Forecast Annual Common Area Energy Savings in 2015 Simple Return on Investment (ROI): 4.9%	$2,100	$25-$39
Forecast Annual Common Area Energy Savings in 2030 Simple Return on Investment (ROI): 6.3%	$3,000	$35-$55

Single Family

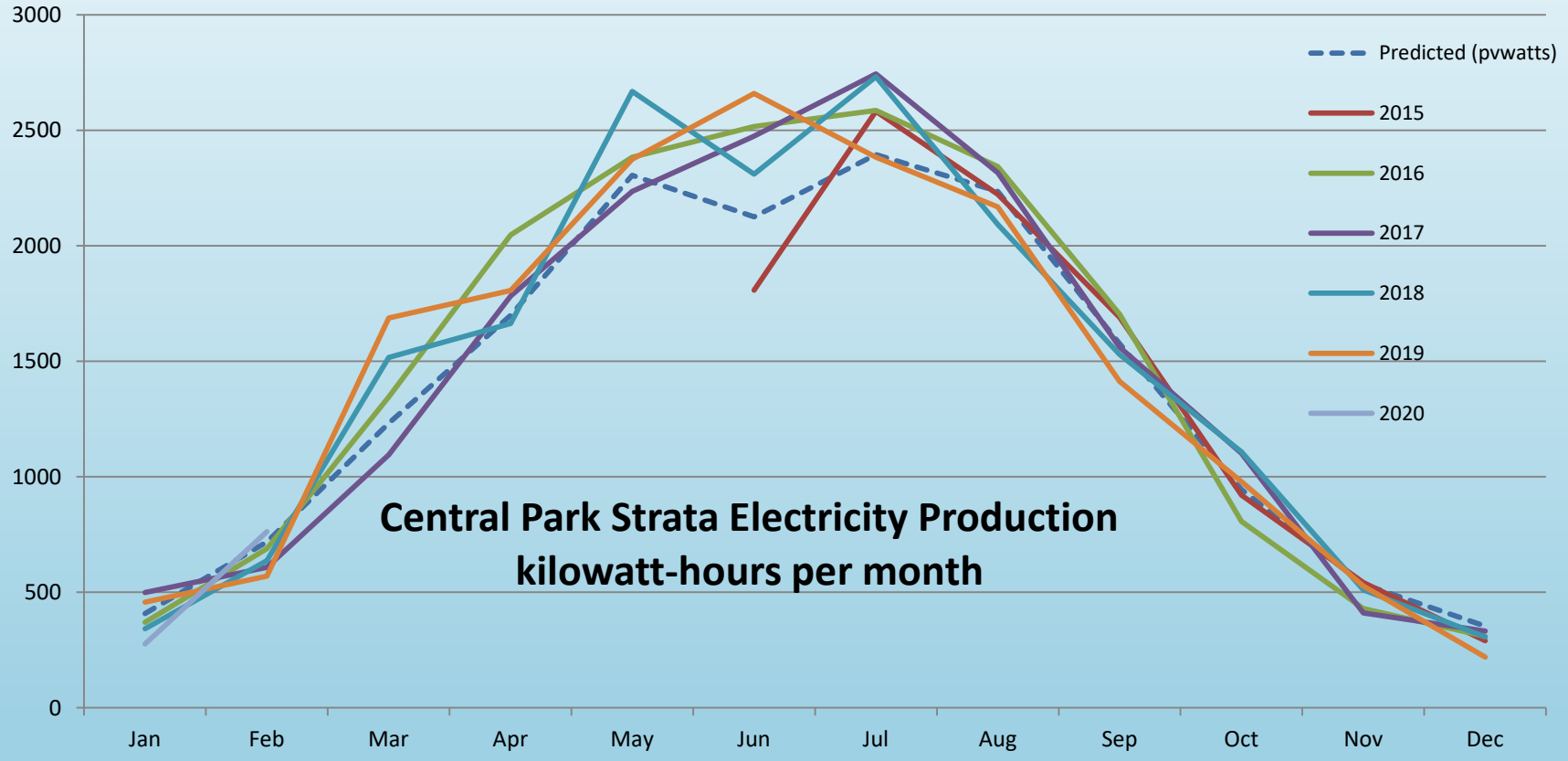
- $5,000 - $10,000
- Paid up front or financed

Strata

- $735 per owner
- Paid over 5 years

BRUCE MACKENZIE - THE SOLAR WAY

Results 2015 – 2020



Results 2015 – 2020

Month	Predicted (pvwatts)	2015	2016	2017	2018	2019	2020	System Cost	Estimated Savings	Years running	Annual ROI
Jan	408		369	499	342	458	276	$47,000	$10,731	4.75	4.81% Running total
Feb	718		689	607	637	570	762	$47,000	$9,401	4.00	5.00% Full years
Mar	1231		1345	1095	1516	1687					
Apr	1699		2047	1782	1664	1806					
May	2304		2383	2236	2667	2374					
Jun	2125	1808	2516	2474	2309	2659					
Jul	2394	2582	2585	2744	2731	2383					
Aug	2235	2222	2342	2316	2093	2167					
Sep	1576	1689	1703	1561	1529	1413					
Oct	945	920	807	1102	1107	978					
Nov	534	542	429	410	511	527					
Dec	354	291	310	332	307	220					
		Yr. Ending	2016	2017	2018	2019	2020	Total	Average		
	16524	Jul-Jun	17595	16868	17599	17832		52063	17354		
	100%		106%	102%	107%	108%		105%	105%		

5% simple Return On Investment - 'Dividend'

5% more electricity than predicted by pvwatts

What about today ?

	2015
Price / installed watt	$ 3.00
kWh / year / installed watt	1.100
Step 2 electricity price / kWh	$ 0.1317
Value of electricity generated	$ 0.1449
Annual rate of return ‘dividend’	4.8%
Simple payback (years)	21

Reality Check

Does it reduce GHGs ?

93% 'clean' electricity in BC – 9 kg CO2e/MWh ➔ 150 kg/year

2.6 kg CO2/l diesel ➔ saving ~60 litres diesel / year

Site C – do we need more electricity ?

Greenhouse Gas Intensities

Category	GHG Intensity by Calendar Year (t CO_2e/GWh)					
	2007	2011	2012	2013	2014	2015
Total BC Hydro electricity generation	5	4	4	5	4	4
BC Hydro fossil fuel electricity generation	568	589	594	569	593	576
Total electricity generation	23	9	9	12	11	9

Notes:

- GHG intensities are reported in carbon dioxide equivalent metric tonnes per gigawatt hour (t CO_2e/GWh).

Lessons learned

Look for efficiency first – LED exterior lights

Have ALL the facts ready for owners

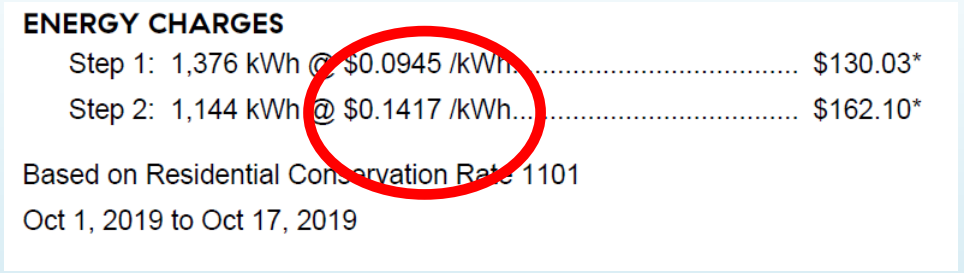
Check the measurements for the roof plan

Financial return not big for everyone

Owners wanted to ‘do something’

Electric vehicles will actually save GHGs

Follow us ?


ENERGY CHARGES

Step 1: 1,376 kWh @ $0.0945 /kWh $130.03*

Step 2: 1,144 kWh @ $0.1417 /kWh $162.10*

Based on Residential Conservation Rate 1101

Oct 1, 2019 to Oct 17, 2019

Energy efficiency ? LEDs, ventilation …

What rate(s) (per kWh) are you paying for power in the common areas ?

How much power does your building use in the common areas ? What does it cost annually ?

What i… owner…

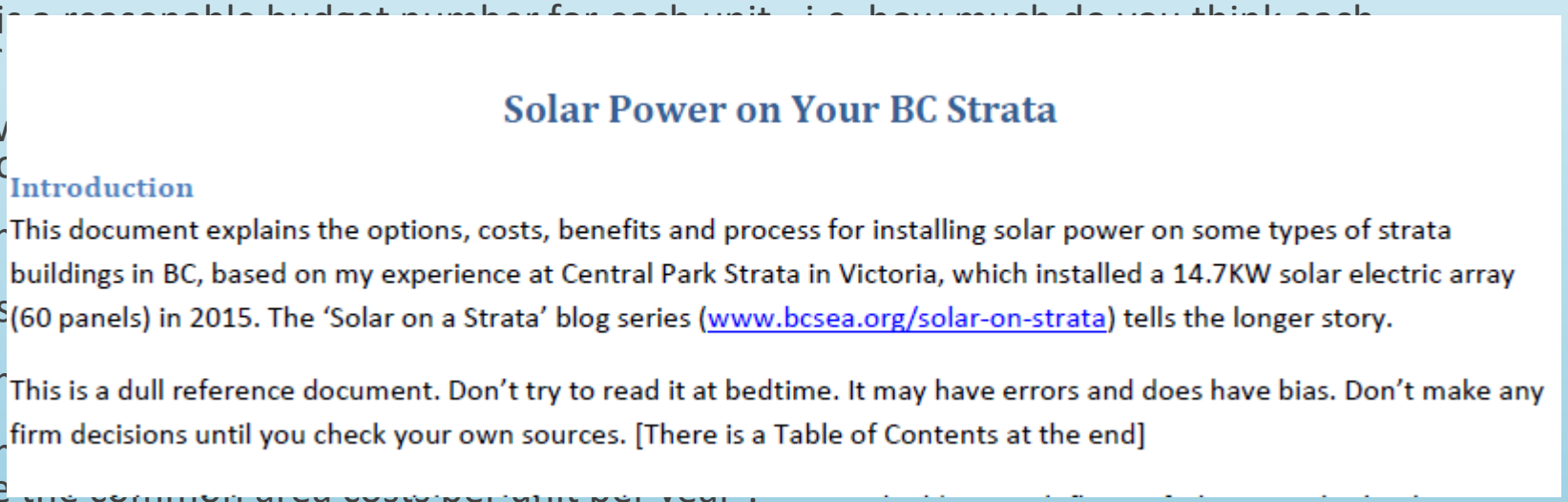
How w… back t…

How m…

What s…

How m…

How m… reduce…


Solar Power on Your BC Strata

Introduction

This document explains the options, costs, benefits and process for installing solar power on some types of strata buildings in BC, based on my experience at Central Park Strata in Victoria, which installed a 14.7KW solar electric array (60 panels) in 2015. The 'Solar on a Strata' blog series (www.bcsea.org/solar-on-strata) tells the longer story.

This is a dull reference document. Don't try to read it at bedtime. It may have errors and does have bias. Don't make any firm decisions until you check your own sources. [There is a Table of Contents at the end]

How much will the system cost ?

What's the return on investment (i.e. $$ saved per year / cost of system) ?

Is the roof strong enough ?

Now – The Gory Details ?

Common Area Power use

PIP grant 2009:

- LED exit signs
- CFL exterior floods
- CFLs in lobby
- Saved 13,678 kWh/year

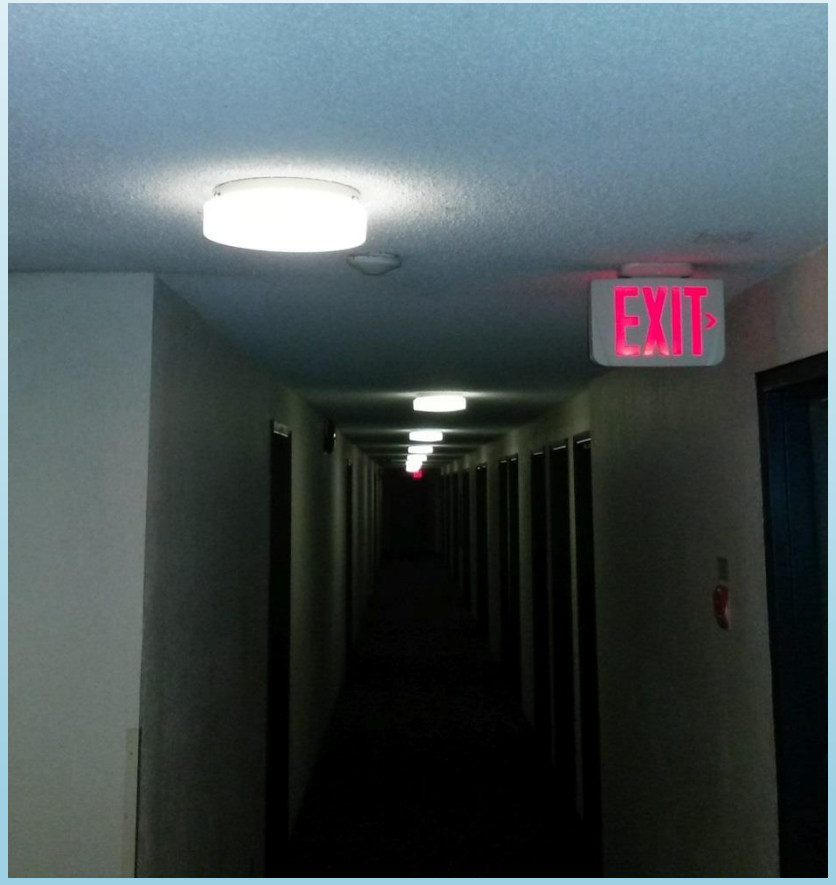
Dog dish 13w hallway lights

BIG parking lights

2013: 48,042 kWh

2014: 48,461 kWh

2014: $5,011



First Ballasted System in Victoria?

No holes in roof !

Structural Engineering – Dead Load

Ballasted system

Net dead load of 6-7 lb/sq. ft.

Roof extra capacity – 2x10 @ 16” o.c.

Structural engineering cost:

- Levelton estimate: approx $4,500
- Herold final invoice: $388.50

Structural Engineering – Seismic

Specific to ballasted systems on flat roofs

STRUCTURAL ENGINEERS ASSOCIATION OF CALIFORNIA

STRUCTURAL SEISMIC REQUIREMENTS AND COMMENTARY FOR ROOFTOP SOLAR PHOTOVOLTAIC ARRAYS

By

SEAOC Solar Photovoltaic Systems Committee

Report *SEAOC PV1-2012*
August 2012

Structural Engineering – Wind

Specific to ballasted systems on flat roofs
Applied by HES-PV

STRUCTURAL ENGINEERS ASSOCIATION OF CALIFORNIA

WIND DESIGN FOR LOW-PROFILE SOLAR PHOTOVOLTAIC ARRAYS ON FLAT ROOFS

Prepared by

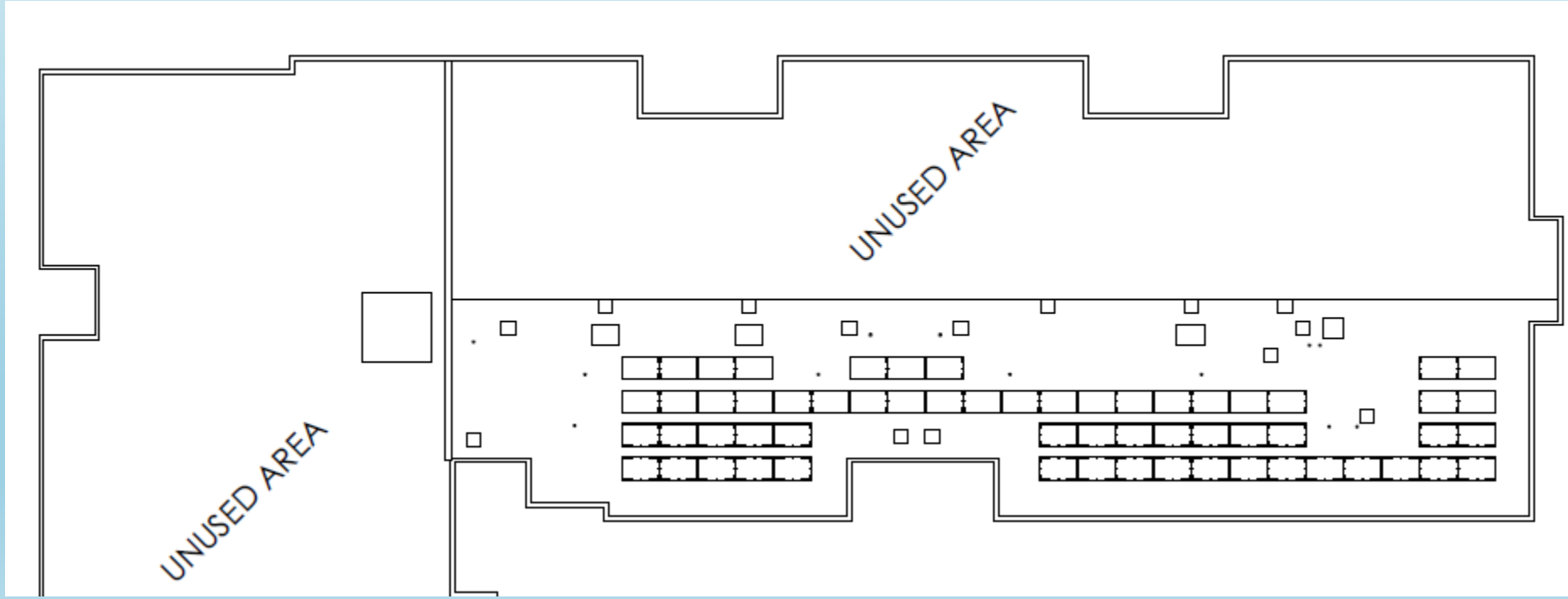
SEAOC Solar Photovoltaic Systems Committee

Report *SEAOC PV2-2012*
August 2012

Installation Process

Roof layout

Electrical room temperature



Installation Process

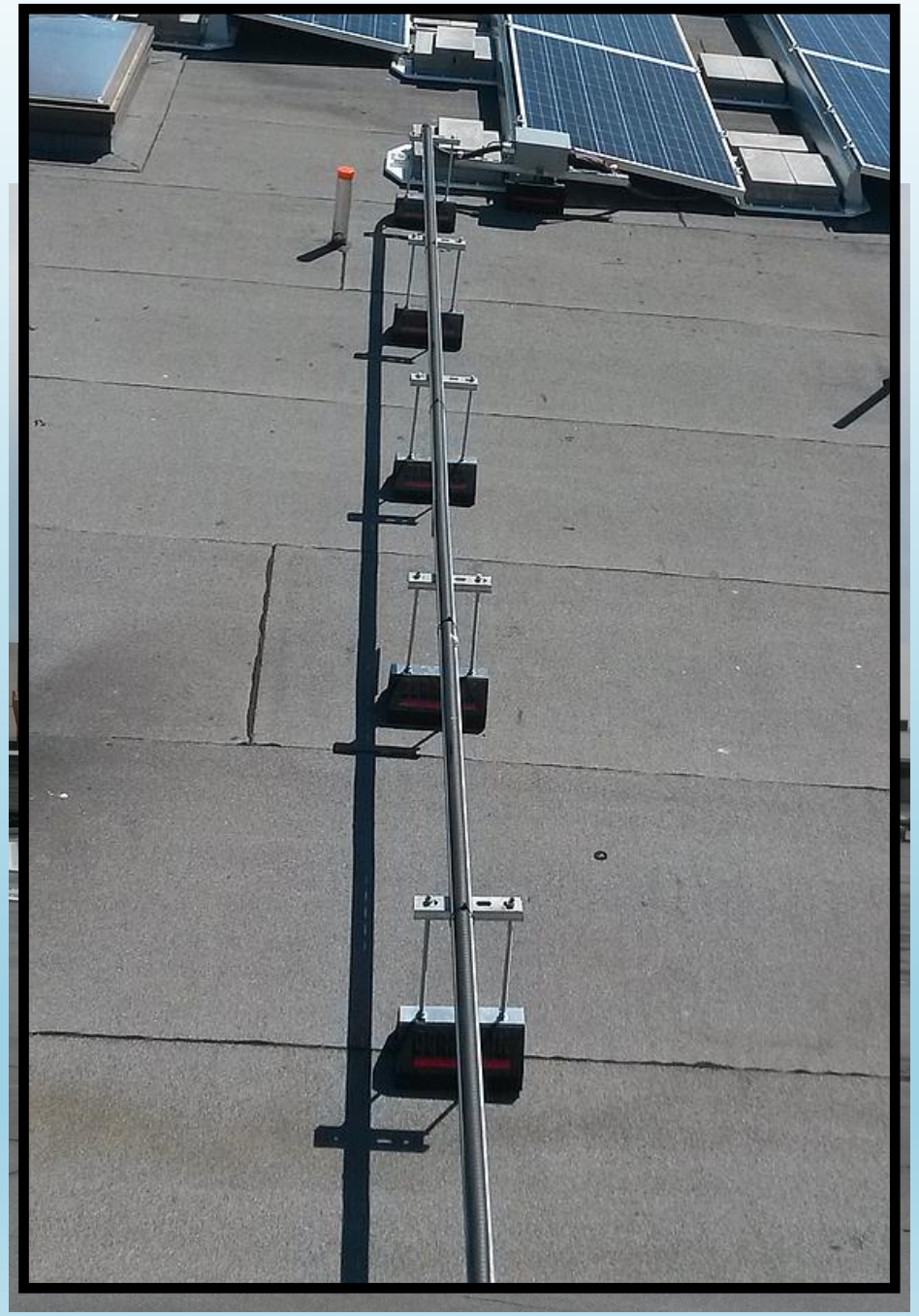
Five strings of 12 panels

Crane to lift panels

How to lift 700 patio bricks ?

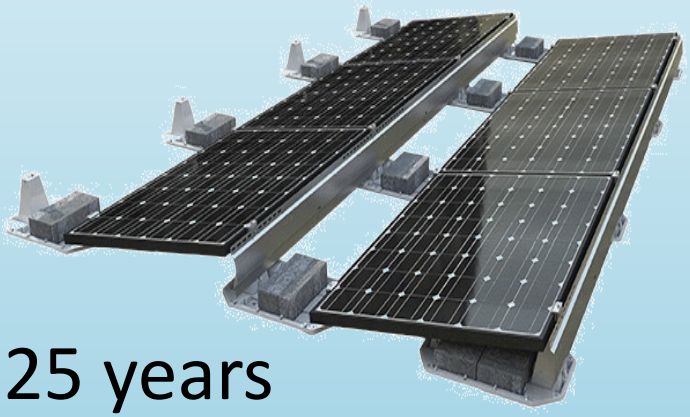
Pallets ? How many ? Where to put them ?

Several weeks wait for rubber support blocks for conduit



Maintenance

Wash once / year with the roof skylights



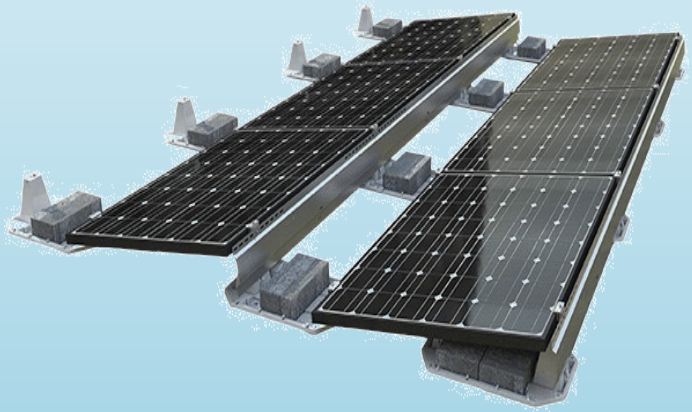
Warranty:

- Inverter: 15 years
- Panels: > 82% output after 25 years
- The rest is ‘just’ wiring

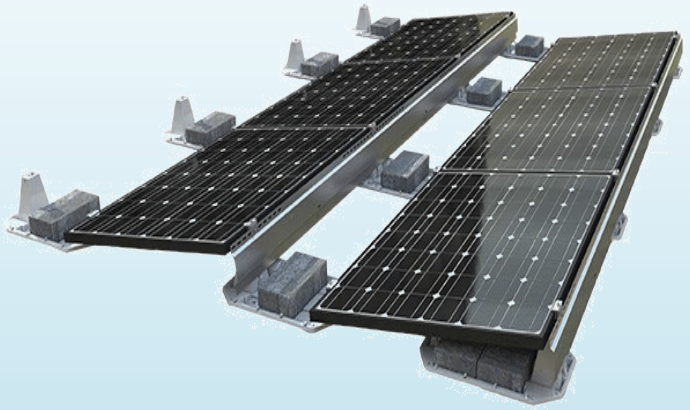
Replace the roof ?

Just unplug and lift the panels, move the brackets

No holes in the roof



Weight



1 Panel: 18 kg (40 pounds)

1 Panel: 1 metre (3 feet) x 1.6 metres (5 feet)

About 4 pounds / square foot

Victoria snow: 42 pounds / square foot

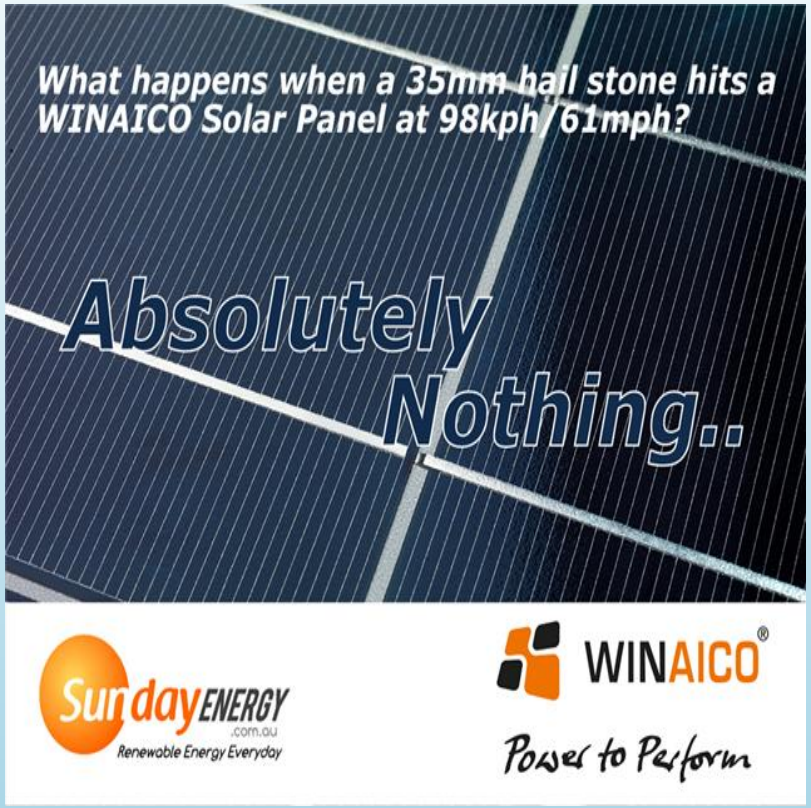
Damage

Rated for 1 inch hail stones

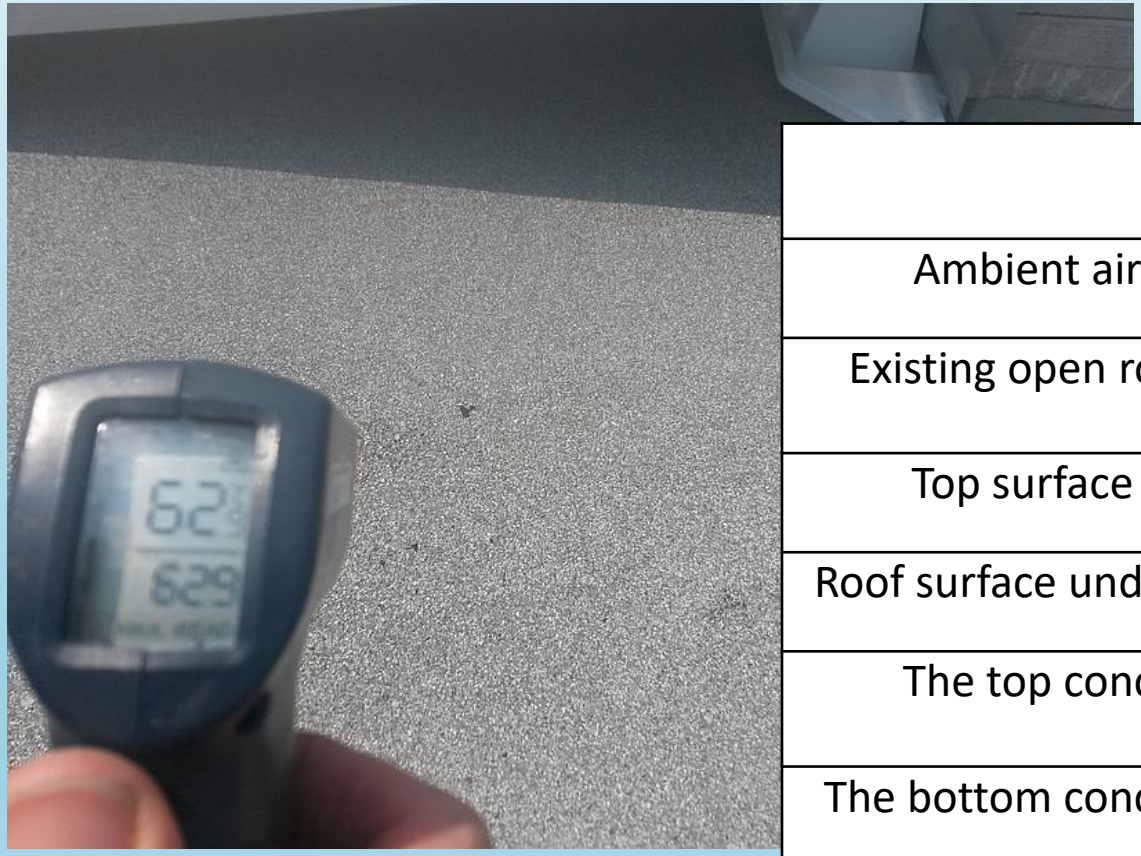
Rated for hurricane winds (low to the roof)

Mike ?

Earthquake rated by Structural Engineers Association of California



Roof Temperature in Sun



Reading	Temperature (°C)
Ambient air temperature	about 27
Existing open roof surface in full sun	about 62
Top surface of the panels	about 50
Roof surface under the panels	about 38
The top concrete pad in a ballast stack	43
The bottom concrete pad in a ballast stack	38

Internet Connection

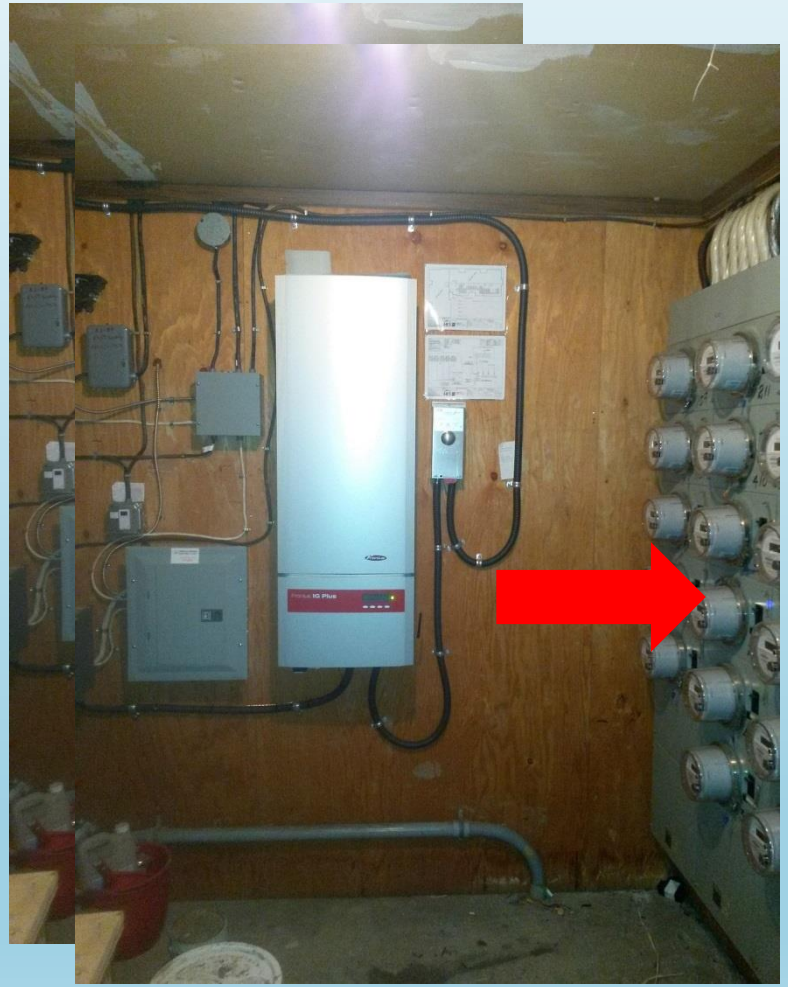
Fronius Data Manager on inverter

$60-70/month from Telus or Shaw (1/3 of net benefit)

Borrowed Internet from nearby suite

Nowhere to run a wire

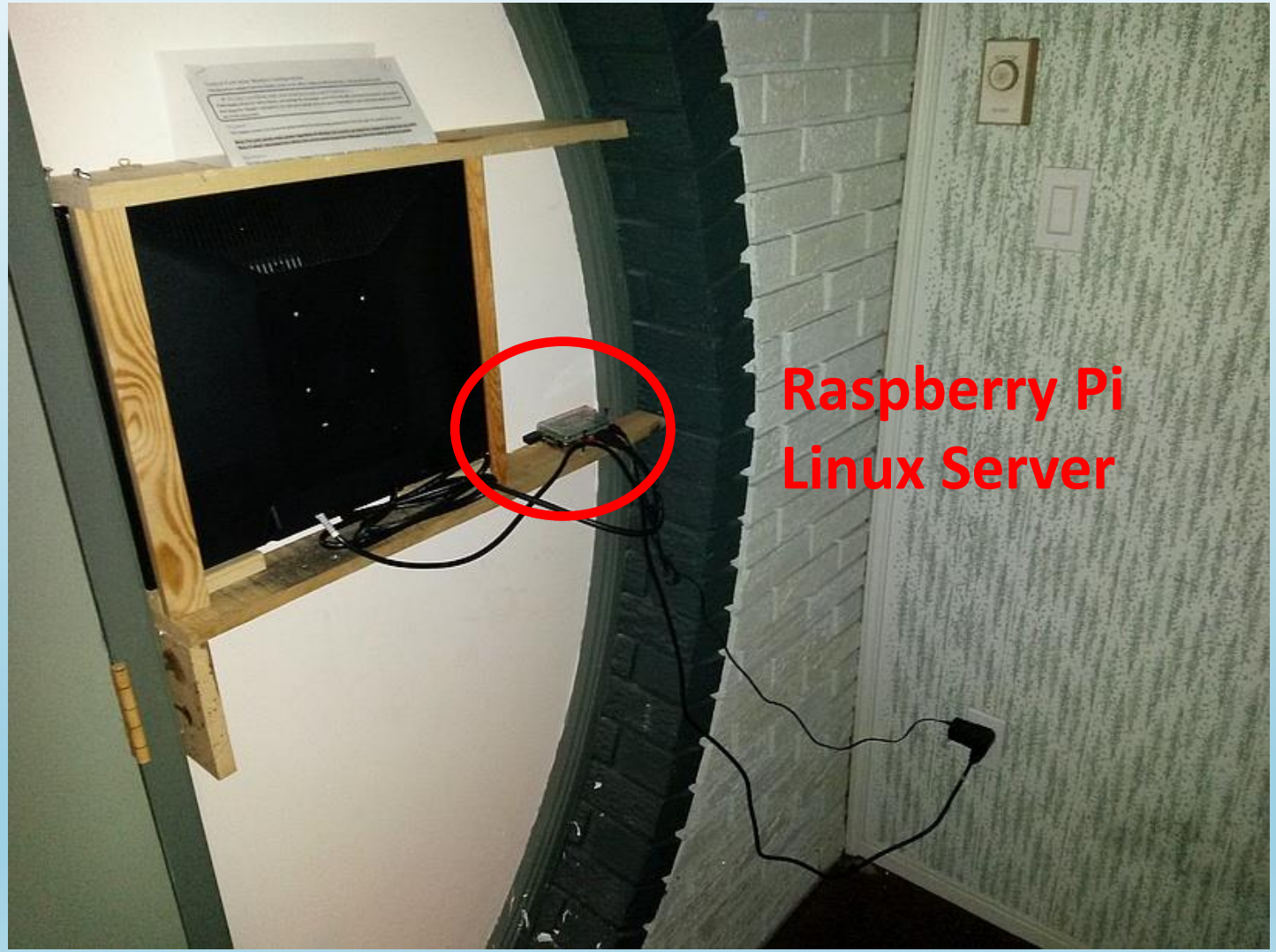
Internet Connection



Internet Connection

Publicity – Lobby Display

Publicity – Lobby Display

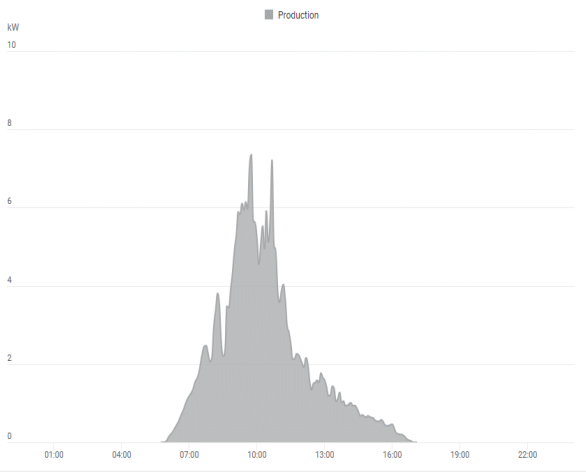


Fronius Central Park Strata - Victoria END DEMO

CURRENT POWER

Offline

ENERGY BALANCE TODAY



05.03.2020

DAY | MONTH | YEAR | TOTAL

EARNING

Total

11,372.84 CAD

CO_2 SAVINGS TOTAL

967.65 kg

CENTRAL PARK STRATA - VICTORIA

VICTORIA

FORECAST.IO

4°

and falling

Partly Cloudy

Wind: 1 m/s (W)

Today	Sat	Sun	Mon	Tue	Wed	Thu	Fri
8°	8°	7°	8°	9°	10°	9°	8°
3°	3°	1°	1°	2°	5°	5°	4°

My PV systems › **Central Park Strata - Victoria**

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Publicity – Times Colonist & Victoria News

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TIMES COLONIST

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B.C. National World

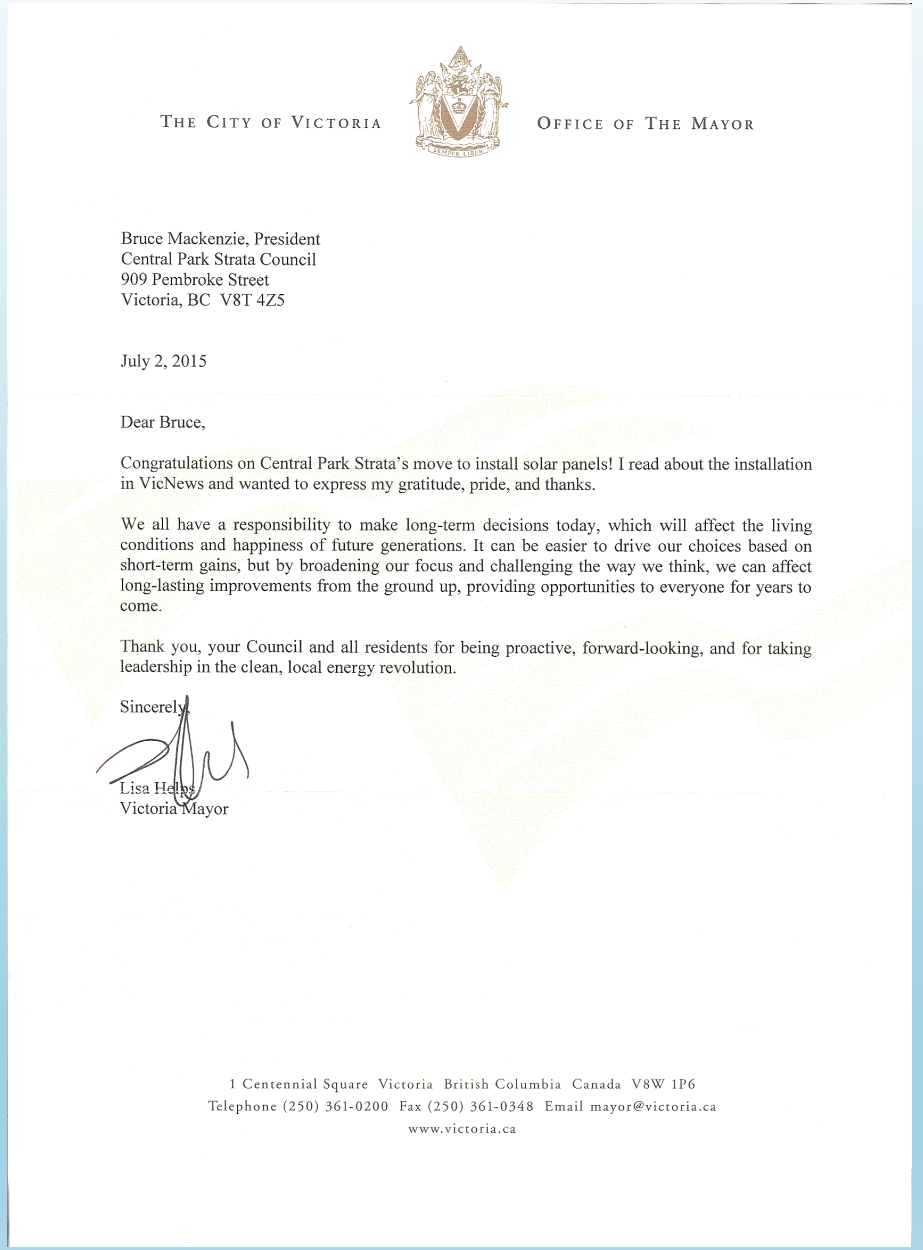
LATEST NEWS:
Grateful Dead's Victoria link: biggest box set in rock history

Victoria condo powers up with strata-initiated solar project

CARLA WILSON / TIMES COLONIST
JUNE 13, 2015 06:00 AM

Email Print

Publicity – Mayor's Letter



THE CITY OF VICTORIA OFFICE OF THE MAYOR

Bruce Mackenzie, President
Central Park Strata Council
909 Pembroke Street
Victoria, BC V8T 4Z5

July 2, 2015

Dear Bruce,

Congratulations on Central Park Strata's move to install solar panels! I read about the installation in VicNews and wanted to express my gratitude, pride, and thanks.

We all have a responsibility to make long-term decisions today, which will affect the living conditions and happiness of future generations. It can be easier to drive our choices based on short-term gains, but by broadening our focus and challenging the way we think, we can affect long-lasting improvements from the ground up, providing opportunities to everyone for years to come.

Thank you, your Council and all residents for being proactive, forward-looking, and for taking leadership in the clean, local energy revolution.

Sincerely,

Lisa Helps
Victoria Mayor

1 Centennial Square Victoria British Columbia Canada V8W 1P6
Telephone (250) 361-0200 Fax (250) 361-0348 Email mayor@victoria.ca
www.victoria.ca

BRUCE MACKENZIE - THE SOLAR WAY

Publicity – Mayor's Letter

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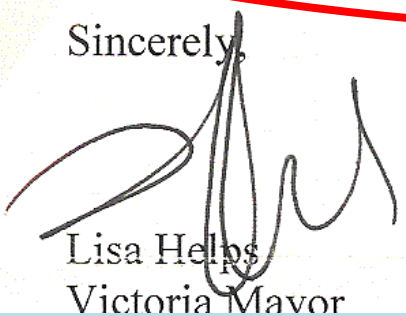
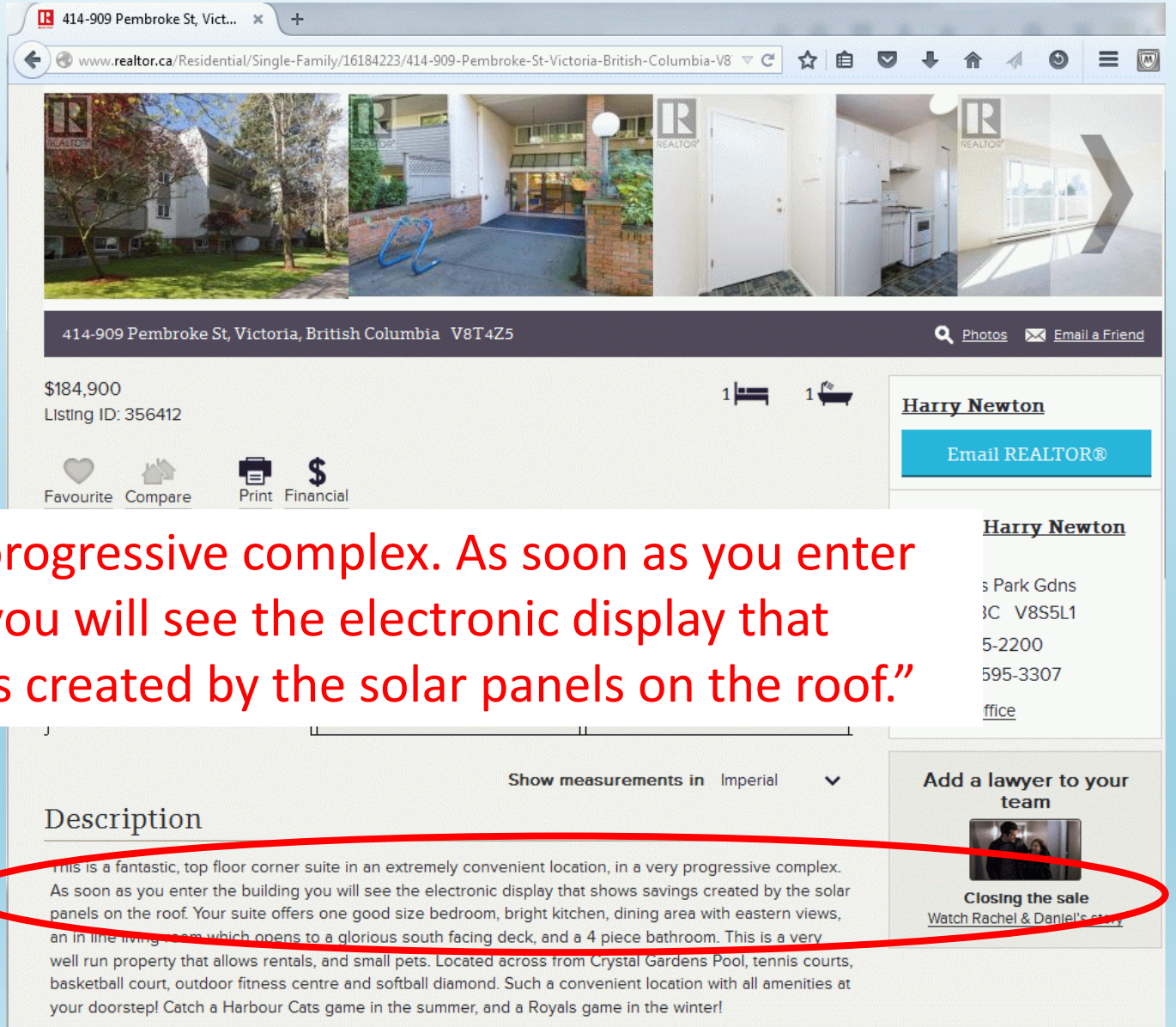


Lisa Helps
Victoria Mayor

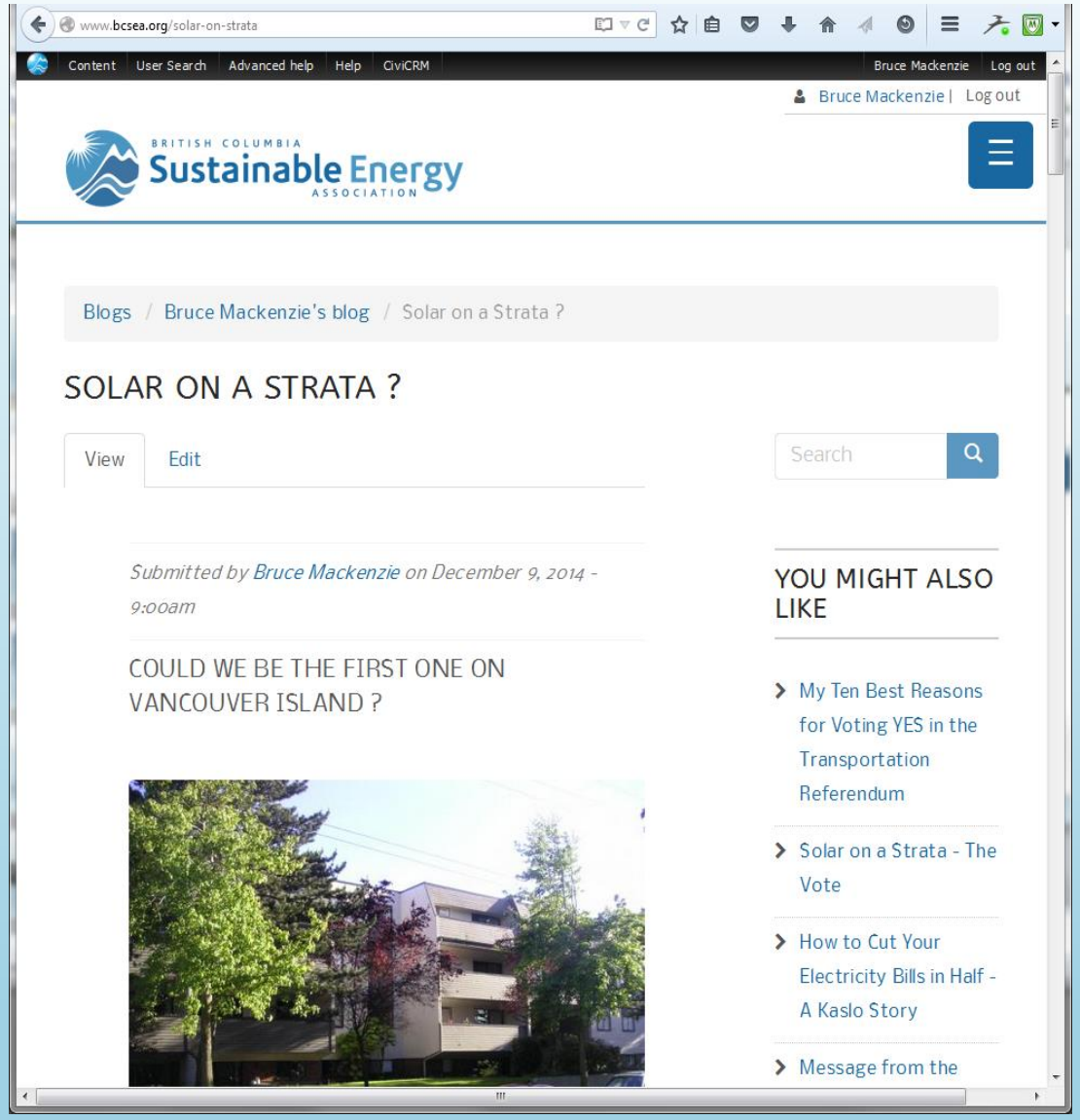
Publicity – Multiple Listing Service



"… in a very progressive complex. As soon as you enter the building you will see the electronic display that shows savings created by the solar panels on the roof."

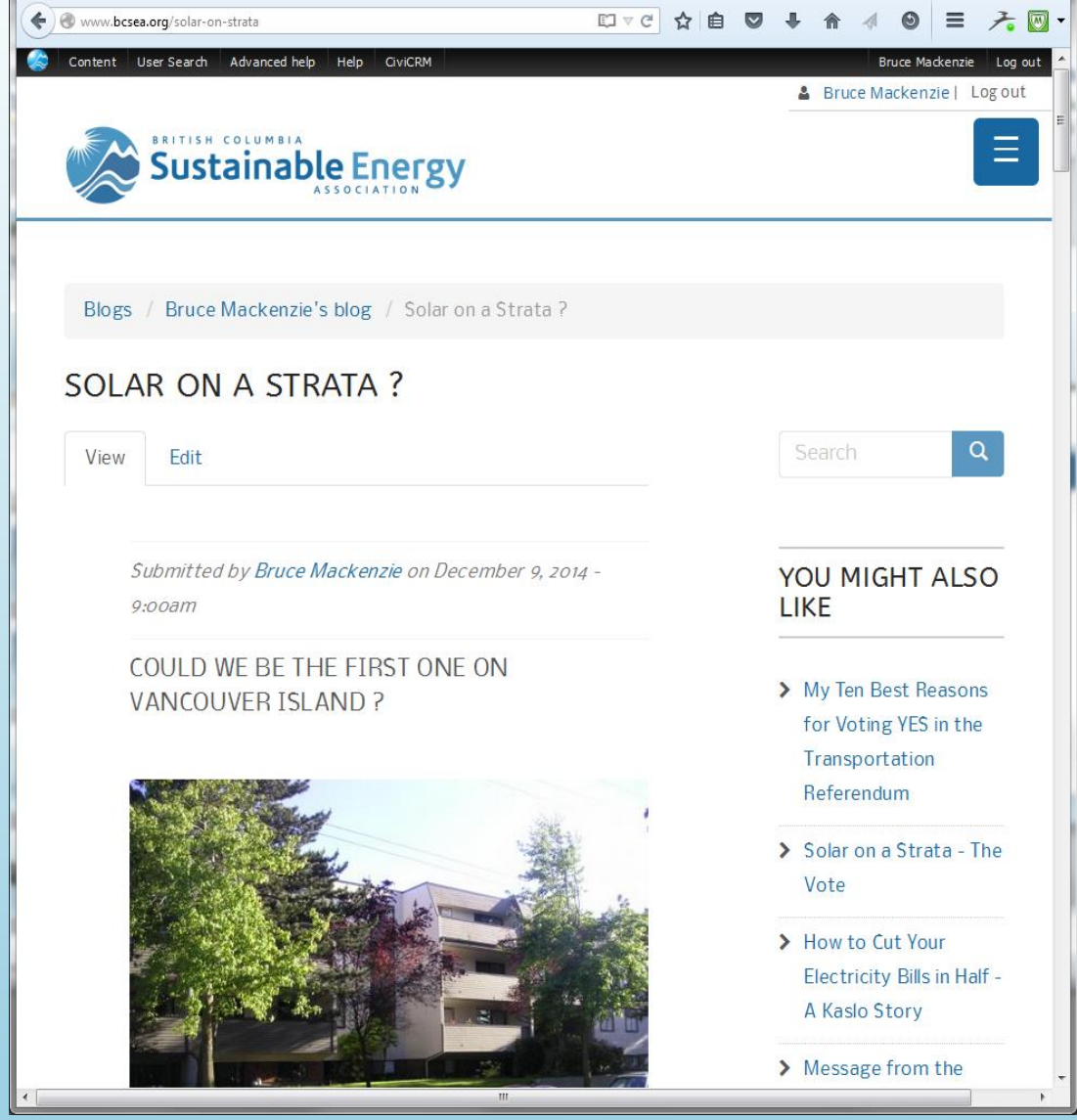
Publicity – BCSEA blog

19 pages of excruciating detail for future stratas



www.bcsea.org/solar-on-strata

- Join Us !



More Info:
www.bcsea.org/solar-on-strata

The Numbers:

- Grid-tied / Net-metered
- 60 panels (14.7 kw)
- 16,000 kWh / year
- Powers common areas (~ 1/2)
- $2,100 power savings / year 2015/16
- $47,000 system cost – average $750 per suite
- 5.0% Return On Investment (ROI)