HARNESSING SOLAR ENERGY

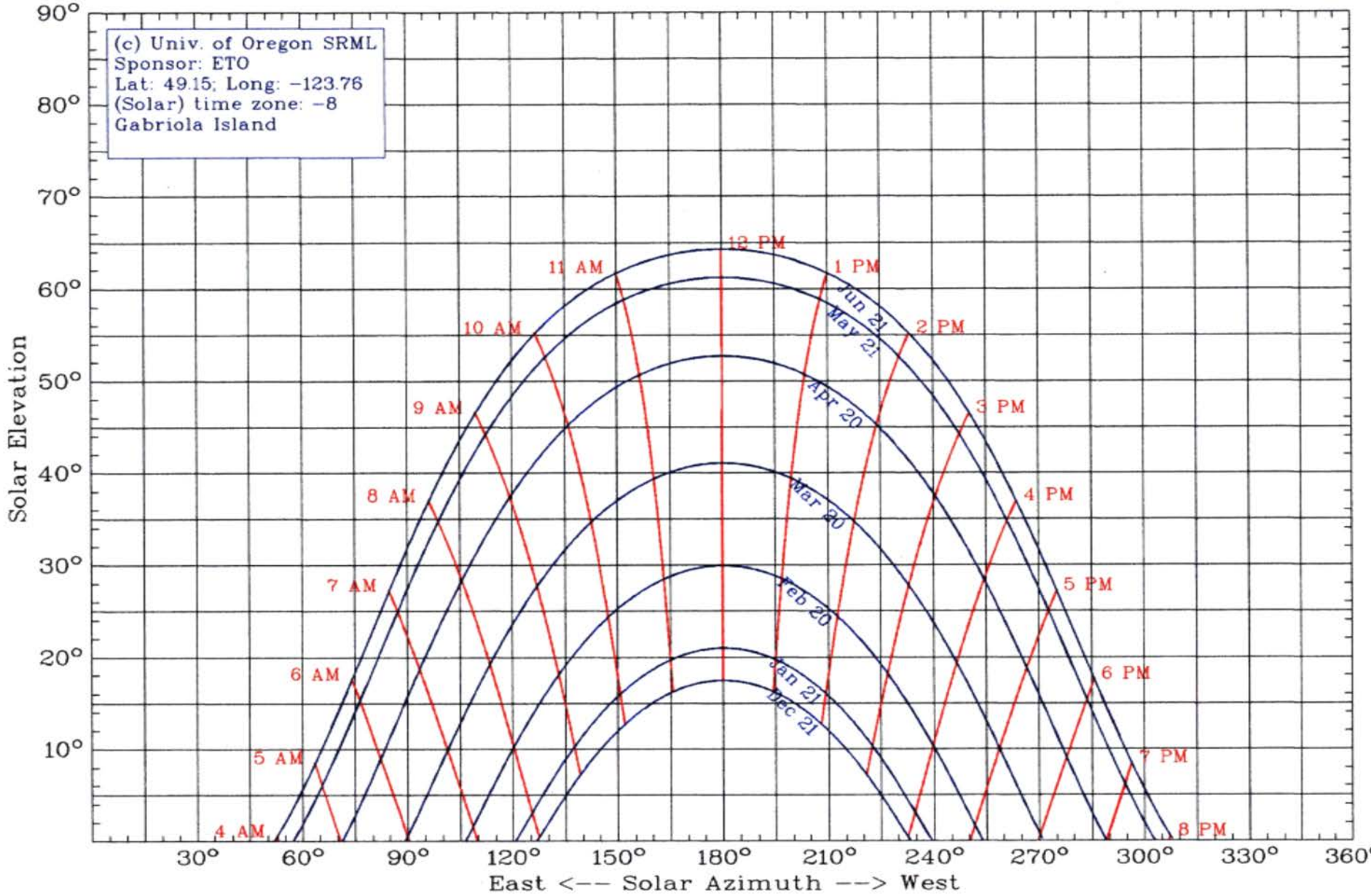
Why?
How?
When?

A course for ElderU
by Gerry Pageau, P.Eng.

Lesson 4

Output of 5.75 kW Solar Array on Sunshine Coast (Lower Rd & Hwy 101)

Solar Power Produced by Month			
	Month	**kWh Produced**	
	Jan-2015	175.7	
	Feb-2015	339.0	
	Mar-2015	513.8	
	Apr-2015	808.0	
	May-2015	1052.0	
	Jun-2015	1069.5	
	Jul-2015	1039.9	
	Aug-2015	884.8	
	Sep-2015	712.2	
	Oct-2015	449.2	
	Nov-2015	278.0	
	Dec-2015	102.9	
	Total	**7425.1**	**kWh/yr**
System peak power		5.75	kW peak
		1291	**kWh/yr per kW peak**


(c) Univ. of Oregon SRML
Sponsor: ETO
Lat: 49.15; Long: -123.76
(Solar) time zone: -8
Gabriola Island
Solar Elevation
90°
80°
70°
60°
50°
40°
30°
20°
10°
12 PM
11 AM
1 PM
10 AM
2 PM
9 AM
3 PM
8 AM
4 PM
7 AM
5 PM
6 AM
6 PM
5 AM
7 PM
4 AM
8 PM
Jun 21
May 21
Apr 20
Mar 20
Feb 20
Jan 21
Dec 21
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
East <-- Solar Azimuth --> West

Electricity Annual Price Increases

http://www.integritybc.ca/

Figure 6.5 Utility Rate Changes

	2007	2008	2009	2010	2011	2012	2013	2014	2015	Cumulative	Current Rate Index*
Manitoba Hydro	2.25%	5.00%	2.90%	2.80%	2.00%	4.40%	3.50%	2.75%	3.95% Proposed	33.7%	100
Hydro Quebec	1.90%	2.90%	1.20%	0.35%	0.40%	0.50%	2.41%	4.30%	3.90% Proposed	17.1%	104
BC Hydro	2.10%	0.83%	9.28%	7.29%	7.77%	7.07%	1.44%	9.00%	6.00%	63.2%	134
SaskPower	4.20%	0.00%	8.50%	4.50%	0.00%	0.00%	4.90%	5.50%	3.00%	34.7%	149
NB Power	5.90%	3.00%	3.00%	3.00%	0.00%	0.00%	2.00%	2.00%	2.00% Proposed	20.4%	159
NS Power	3.80%	0.00%	9.30%	0.00%	6.05%	8.70%	3.00%	3.00%	N/A	38.7%	194

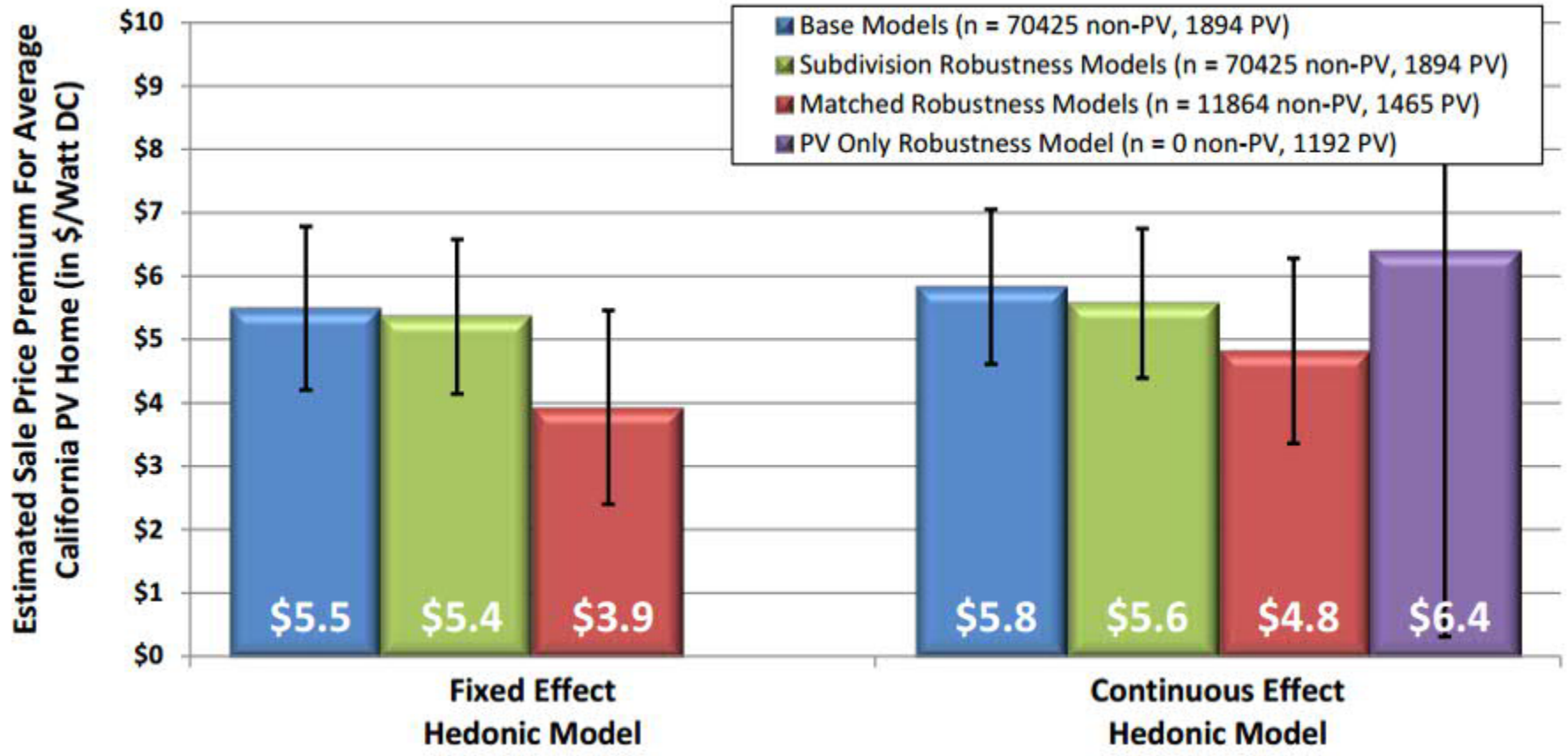
* This index is based on the Edison Electric Institute's Survey and compares the average price per kWh (in Canadian $) for the various utilities. Manitoba Hydro's average price is $0.0627/kWh. The Survey is based on 12 months data ending June 2014.

More Questions about Large Hydro

- 87% of BC's power from large dams.
- Many BC dams 30-80 years old and need upgrades.
- Costs of large dams:
  - Flooded forest & farmland
  - Estimated 0.22 kg CO2 equivalent GHG/kWh
  - Site C $8.8 billion/1.1 GW = $8/Watt (BC Hydro estimate)
  - Site C long term power cost $0.06/kWh (BC Hydro estimate)
  - Both the capital cost and ongoing power cost are likely higher.
- Solar generates after tax returns at current $3.20/Watt installed cost.
- Returns increase every year as rates rise (63% past 9 yrs, 30% next 3?)
- Adds to value of your home.

Solar Increased Home Resale Price by about $5/Watt

Figure 1: Estimated Sale-Price Premiums for California PV Homes (Hoen et al., 2011, 2013)



Note: Error bars represent the 90% confidence intervals for the underlying sale price premium (% change in sale price) and do not include variation in either the mean sale price or mean system size, both of which are used to calculate the $/watt premium.

http://emp.lbl.gov/sites/all/files/lbnl-6484e.pdf

2.3.1 Residential PV System < 10 kW Cost breakdown for a typical residential PV system under ten kilowatts in 2014.

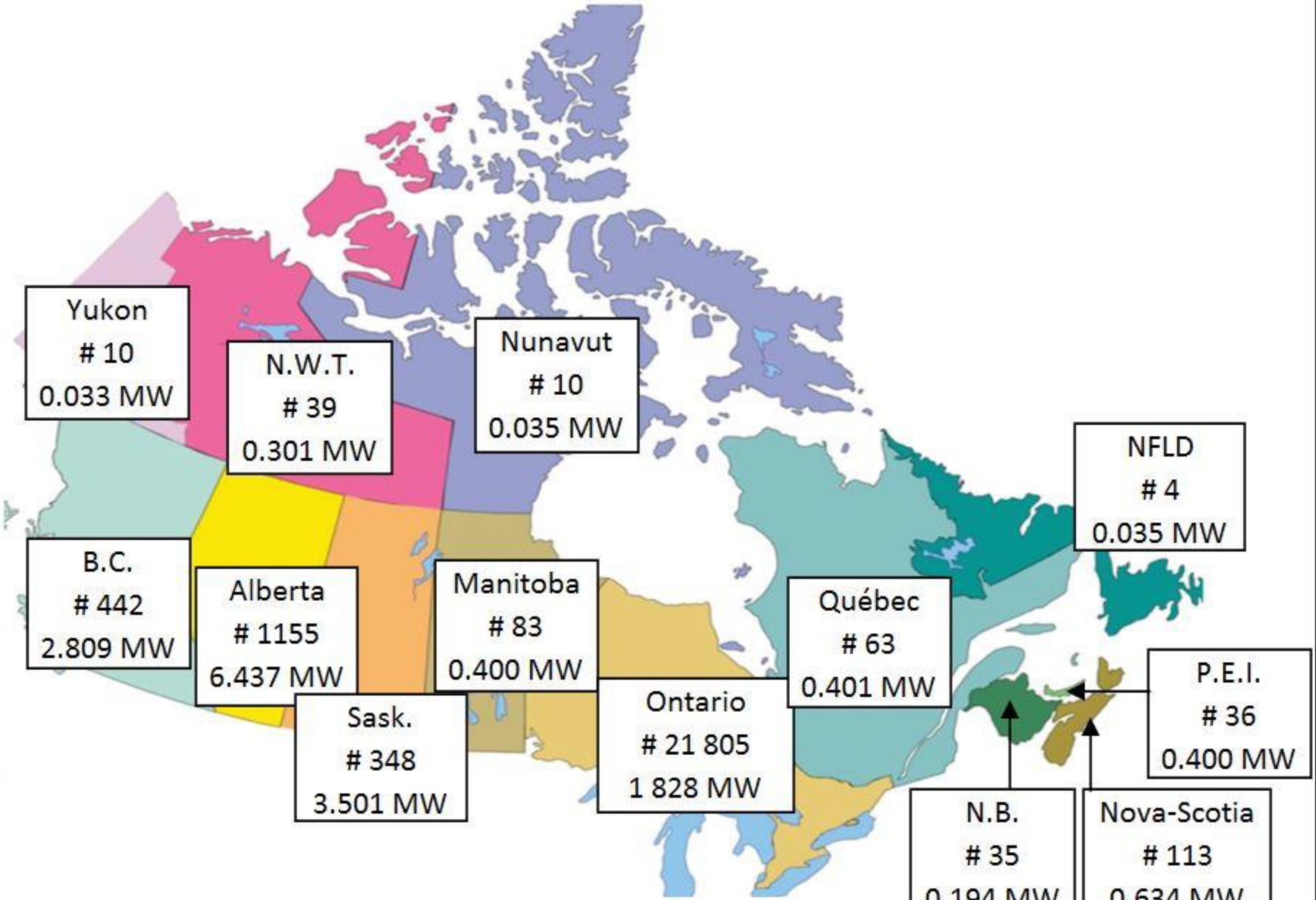
Cost category (CAD$/Watt)	**Average**	**Low**	**High**
Hardware			
Module	0,85	0,82	1,01
Inverter	0,45	0,31	0,90
Other (racking, wiring…)	0,23	0,22	0,25
Subtotal Hardware	1,53	1,35	2,16
Soft costs			
Installation	0,97	0,26	2,81
Customer Acquisition	0,28	0,11	0,45
Profit	0,73	1,07	0,28
Permits, contracting, financing	0,14	0,01	0,30
Subtotal Soft costs	2,12	1,45	3,84
Total Installed Cost	3,65	2,80	6,00

http://www.cansia.ca/solar-pv.html

National Survey Report of PV Power Applications in Canada 2014, CanSIA / NRCan / IEA

Utility Interconnected PV Systems 2014

http://www.cansia.ca/




Residential
Solar Power:
- good for the environment
- good investment where return
grows as energy cost rises