OE 10-212

Clean Energy Solutions

178 Elm St.

Springvale, ME 04083

September 2, 2010

NHPUC
21 South Fruit Street, Suite 10
Concord, N.H. 03301-2429

Dear Chairman Getz, Commissioner Below and Commissioner Ignatius:

Thank you for the opportunity to have some input into the C&I Solar rebate program. My hope through this process is to share with you my experience, skill and knowledge of a technology that I believe is underutilized, unrecognized and goes mostly unrewarded. Since the US represents less that 1% of the world's solar it is no wonder that there is unawareness about it.

Of the renewables, we have put our main focus on solar thermal because it simply gives the best bang for the buck. I will attempt to show the different outputs of comparable systems (PV verses Solar Thermal) to help address this. It is difficult to get an exact apples for apples comparison but I will attempt to do this with the help of PV calc, an on line calculator which shows annual production and AC energy value. Also employed is RETScreen which is put out by Canadian Natural Resources. This has a data base of every Wx station in the world along with most of all of the panels in the world tested by either Solar Keymark in Europe or SRCC at either Bodycote in Canada or FSEC in Florida. To assist with the apples for apples comparison, the solar thermal is converted to kilowatt output as this is how it is done in Europe.

First, please notice the PV system in Concord, NH. It is priced at $6.00/watt for a DC rated 5 kw system that costs $30,000.00. Please note that for the purposes of this comparison the calculator thinks it is a residential system because C&I does not exist yet (that is not part of the equation anyway). The annual output is just under 6kw. Annual savings $908.85

Second, there is a Solar Thermal system consisting of 12 panels that is also priced at $30,000.00 So we have two systems of equal cost. However, the PV system puts out just under 6 KW while the Solar Thermal system puts out 24 KW, four times greater.

In fairness, someone from a solar company at the meeting the other day mentioned that solar thermal occasionally needs maintenance because it is a mechanical system. As far as I know, the only moving part is the pump and you can count on that being replaced somewhere in 30 years. Also, if the system is not distilled water in a drainback system, the glycol should be checked every 5 to 7 years and changed if necessary. So it is possible to incur some expense over 30 years.

The point being made here is that after 30 years of this PV system with little or no maintenance (inverters can go bad) it will yield 30x$908.85 or $27,265. Let say electricity gets more expensive and you save $50,000. On the other hand, after 30 years the Solar Thermal system will produce $200,000.00. Is it O.K.

to take some thousands (let's say 5) and keep the system refreshed. It's still a 4x'er. Tom Lane, one of the foremost authorities in the U.S. today on Solar Thermal says Drainback systems with flat plate panels and distilled water have a 120 year life!

I recently visited a Laundromat on High Street in Danvers, MA. It is owned by John Demars. He has a solar system that has been in place for 30 years. Everything is still there. The tank is the original stainless tank. Somebody did it right! It covers half of his heat load and he wouldn't have it any other way. It has paid for itself many times over.

The point is not to discourage the use of PV but to make you aware of the disparity in the rebates. If we adjust the rebate for solar thermal into kilowatts is comes out to $.3125/kilowatt. Upon the first meeting I wondered how this would work out but as I began to do the research and visit sites I realized that it's a stretch because of the abundance of natural gas. It's cheap. Cheaper than it was 10 years ago. I'm told that Pennsylvania has enough gas to power the whole east coast for the next 100 years. Distribution is a piece of cake. They drill under cemeteries, go under hazardous waste dumps and cross under harbors all without permits as they are not necessary. The by-product is stone dust and water. Today (9/2) analyst report oil headed for $60 and we're swimming in huge reserves. They can't even hold up the price of gasoline for the usual Labor Day rip off. All this is bad for Solar. As it is, most people get sticker shock when the price of the system is handed to them. And to make it more difficult the highest efficiency units are natural gas (please find RETScreen chart on Season Efficiency). Up against cheap gas and very high efficiency the paybacks are 14 to 15 years even with your proposed .07 rebate and fed 30%. I now understand why National Grid has only had a dozen projects move forward in three years even with their 50% up to $100,000 offer (only 2 this year). It just doesn't make much cents. Have you considered who will be buying these systems? We're not talking about homeowners east of Route1 who may have picked up a whopper deal on a 2KW system. It's about businesses with balance sheets.

I could sense the concern in Jack Ruderman's voice as he addressed the assembly in the end. He had the geo guy, the pellet guy and some solar contractor all wanting some of the pie (or more of the pie). At this point, I would like to move to what can be done or what I believe could be improved. I understand that I have no legislative skills and will have to trust your judgment but allow me to make a few suggestions.

1. If possible, design a program that can be changed as you choose. We'll understand. You would like to see the last dollar go out the door the day before a new batch of funds show up but this is just not an exact science. I have seen first hand where a decision is made, they camp on it, die with it and the program.
2. Consider changing the rebate to something commensurate with the outputs o f the systems whether PV or Solar Thermal. I'm not asking to change the 75/25 of PV to Thermal but if you changed the solar to 50% with a 12,500 cap as Louisiana did, you would have enough for 35 systems which is 3 times more than National Grid has done in three years with their program at 50%. Don't let 7 corporations walk away with the entire rebate program (if changed).
3. Don't establish a rebate and then say 25% which ever is less. The only way it ever gets down to 25% (or some percentage) is if the contractor cuts his prices. Do you want to discourage this? Put the rebate out and let it go. Other wise the % becomes the floor. Competition is good for us.

There is some concern about one contractor walking away with too much of the work. My personal opinion is that unless you change the rebate you have nothing to worry about. If you do change it, restrictions or quotas could be good, then more people get a chance to do and learn solar. Think it out.

Under Program Terns and Conditions

2. As far a barring an installer from future install on poor performance remember Solar is still in it's infancy here. Mistakes will be made. Give us a chance to correct our mistake. If we do not respond then take action.

Please disregard my previous comments as to the solar pathfinder. Previously I discovered a 25% shading penalty towards the solar thermal but have worked that down to about 2% which is very acceptable. It is a great tool which we use all the time. It was the software that I had issue with.

Thank you again for giving me ear at the meetings and taking time to read my comments.

Yours truly,

Douglas Gerry

Douglas Gerry

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ReCalculate

PV System

Array Type : Fixed Tilt
DC Rating(kW): 5
Derate Factor: 77 %
Tilt: 43
Direction: 180

PV System Cost

Cost: Per Watt
Cost Per Watt: $6.00
Fed Tax Rate: 30 %
Financing: Home Loan
Loan Rate 7 %
Percent Down: 20
Loan Life: 5 years %

Electric Cost

Increase Rate: 6 %
Usage Pattern: Standard
Annual Electric: Cost
Annual Cost: $2,000

ReCalculate

Data Location: CONCORD MUNICIPAL ARPT , NH (Change) Print\Save PDF

Summary | Rebates | Energy Savings | PV Watt Data | Environmental | Amortization |

Weather Station

City:	CONCORD MUNICIPAL ARPT
State:	NH
Latitude:	43.20° N
Longitude:	-71.5° W
Elevation:	106 m
DC Rating:	5.00 kW
Derate Factor:	0.77
AC Rating:	3.85 kW
Array Type	Fixed Tilt
Array Tilt:	43°
Array Azimuth:	180°

Results

Month	Solar Radiation (kWh/m2/day)	AC Energy (kWh)	AC Energy Value ($)
January	2.98	362	$56.22
February	4.12	461	$71.49
March	4.55	543	$84.27
April	5.18	576	$89.37
May	5.01	541	$83.95
June	5.32	550	$85.36
July	5.61	591	$91.73
August	5.35	567	$87.96
September	4.93	520	$80.71
October	4.01	457	$70.95
November	3.00	343	$53.22
December	2.81	346	$53.62
Annual	4.41	5,857	$908.85

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ReCalculate

Data Location: CONCORD MUNICIPAL ARPT , NH (Change)

Print\Save PDF

Summary | Rebates | Energy Savings | PV Watt Data | Environmental | Amortization |

PV System

Array Type :	Fixed Tilt
DC Rating(kW):	5
Derate Factor:	77 %
Tilt:	43
Direction:	180

PV System Cost

Cost:	Per Watt
Cost Per Watt:	$6.00
Fed Tax Rate:	30 %
Financing:	Home Loan
Loan Rate	7 %
Percent Down:	20
Loan Life:	5 years %

Electric Cost

Increase Rate:	6 %
Usage Pattern:	Standard
Annual Electric:	Cost
Annual Cost:	$2,000

ReCalculate

Main Details

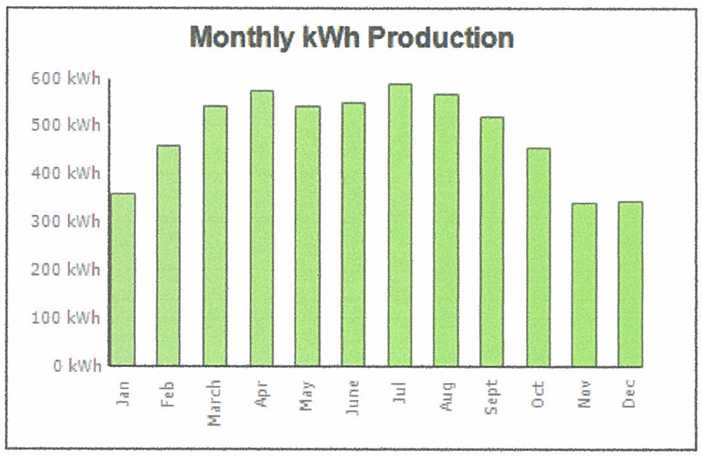
Annual kWh Production:	5,857 kWh
Payback Time:	12 years 10 months
Energy Produced %:	45.44%
Savings over 30 years:	$45,769
PV Module Space:	695ft^2

System Cost

PV System Cost:	$30,000
Price Per Watt	$6.00
Rebates and Incentives:	$13,200
Effective System Cost:	**$16,800**

Environmental

CO2 Reduced Annually:	7,839 pounds



RETScreen® Energy Model - Solar Water Heating Project

Training & Support

Site Conditions		Estimate	Notes/Range
Project name		Process Hot Water	See Online Manual
Project location		New Hampshire	
Nearest location for weather data		Concord, NH	Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.65	
Annual average temperature	°C	7.7	-20.0 to 30.0
Annual average wind speed	m/s	3.0	
Desired load temperature	°C	60	
Hot water use	L/d	2,000	
Number of months analysed	month	12.00	
Energy demand for months analysed	MWh	44.55	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Diesel (#2 oil) - gal	
Water heating system seasonal efficiency	%	60%	50% to 190%
Solar Collector			
Collector type	-	Glazed	See Technical Note 1
Solar water heating collector manufacturer		SunEarth	See Product Database
Solar water heating collector model		Empire EC-32	
Gross area of one collector	m²	3.05	1.00 to 5.00
Aperture area of one collector	m²	2.75	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.71	0.50 to 0.90
Fr UL coefficient	(W/m²)/°C	4.13	1.50 to 8.00
Temperature coefficient for Fr UL	(W/(m·°C)²)	0.00	0.000 to 0.010
Suggested number of collectors		12	
Number of collectors		12	
Total gross collector area	m²	36.6	
Storage			
Ratio of storage capacity to coll. area	L/m²	62.0	37.5 to 100.0
Storage capacity	L	2,046	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	85%	50% to 85%
Suggested pipe diameter	mm	19	8 to 25 or PVC 35 to 50
Pipe diameter	mm	38	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	0	3 to 22, or 0
Piping and solar tank losses	%	1%	1% to 10%
Losses due to snow and/or dirt	%	3%	2% to 10%
Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW_{th}	23	
	million Btu/h	0.079	
Pumping energy (electricity)	MWh	0.00	
Specific yield	kWh/m²	656	
System efficiency	%	40%	
Solar fraction	%	54%	
Renewable energy delivered	MWh	24.02	
	kWh	24,021	

Complete Cost Analysis sheet

Version 3.1

NRCan/CETC - Varennes

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Concord, NH	See Weather Database
Latitude of project location	°N	43.2	-90.0 to 90.0
Slope of solar collector	°	43.2	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations; 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type, or method for calculating cold water temperature).

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m²/d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m²/d)
January	1.00	1.91	-6.7	68.0	3.2	3.86
February	1.00	2.83	-5.1	66.0	3.4	4.73
March	1.00	3.88	0.6	64.6	3.6	4.86
April	1.00	4.73	7.0	62.2	3.5	4.84
May	1.00	5.61	13.5	65.3	3.1	5.06
June	1.00	6.08	18.4	70.6	2.9	5.20
July	1.00	6.06	21.1	72.0	2.6	5.30
August	1.00	5.30	19.8	74.6	2.4	5.14
September	1.00	4.18	15.1	76.3	2.5	4.80
October	1.00	2.91	8.9	73.1	2.6	4.22
November	1.00	1.80	3.2	73.3	3.0	3.11
December	1.00	1.52	-3.8	72.3	3.2	3.10

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m²	1.43	1.43
Solar radiation (tilted surface)	MWh/m²	1.65	1.65
Average temperature	°C	7.7	7.7
Average wind speed	m/s	3.0	3.0

Water Heating Load Calculation		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	Industrial	
Number of units	-	-	
Rate of occupancy	%	-	50% to 100%
Estimated hot water use (at ~60 °C)	L/d	N/A	
Hot water use	L/d	2,000	
Desired water temperature	°C	60	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	2.6	1.0 to 10.0
Maximum	°C	12.4	5.0 to 15.0
Months SWH system in use	month	12.00	
Energy demand for months analysed	MWh	44.55	
	million Btu	151.98	

Return to Energy Model sheet

RETScreen® Greenhouse Gas (GHG) Emission Reduction Analysis - Solar Water Heating Project

Use GHG analysis sheet? Yes

Type of analysis: Standard

Background Information

Project Information

Project name	Process Hot Water
Project location	New Hampshire

Global Warming Potential of GHG

1 tonne CH_4 = 21 tonnes CO_2 (IPCC 1996)

1 tonne N_2O = 310 tonnes CO_2 (IPCC 1996)

Base Case Electricity System (Baseline)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	T & D losses (%)	GHG emission factor (t_{CO2}/MWh)
Natural gas	100.0%	56.1	0.0030	0.0010	45.0%	8.0%	0.491
Electricity mix	100%	135.5	0.0072	0.0024		8.0%	0.491

Base Case Heating System (Baseline)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	GHG emission factor (t_{CO2}/MWh)
Heating system						
Diesel (#2 oil)	100.0%	74.1	0.0020	0.0020	60.0%	0.449

Proposed Case Heating System (Solar Water Heating Project)

Fuel type	Fuel mix (%)	CO_2 emission factor (kg/GJ)	CH_4 emission factor (kg/GJ)	N_2O emission factor (kg/GJ)	Fuel conversion efficiency (%)	GHG emission factor (t_{CO2}/MWh)
Heating system						
Electricity	0.0%	135.5	0.0072	0.0024	100.0%	0.000
Solar	100.0%	0.0	0.0000	0.0000	100.0%	0.000
Heating energy mix	100.0%	0.0	0.0000	0.0000		0.000

GHG Emission Reduction Summary

	Base case GHG emission factor (t_{CO2}/MWh)	Proposed case GHG emission factor (t_{CO2}/MWh)	End-use annual energy delivered (MWh)		Annual GHG emission reduction (t_{CO2})
Heating system	0.449	0.000	24.02		10.78
			Net GHG emission reduction	t_{CO2}/yr	**10.78**

Complete Financial Summary sheet

Version 3.1

UNEP/DTIE and NRCan/CETC - Varennes

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance

Project name		Process Hot Water	Electricity required	MWh	-
Project location		New Hampshire	Net GHG reduction	t_{CO2}/yr	10.78
Renewable energy delivered	MWh	24.02	Net GHG emission reduction - 10 yrs	t_{CO2}	107.75
Heating fuel displaced	-	Diesel (#2 oil) - gal	Net GHG emission reduction - 30 yrs	t_{CO2}	323.26

Financial Parameters

Avoided cost of heating energy	$/gal	2.629	Debt ratio	%	0.0%
GHG emission reduction credit	$/$t_{CO2}$	2.7	Income tax analysis?	yes/no	No
GHG reduction credit duration	yr	10			
GHG credit escalation rate	%	2.0%			
Retail price of electricity	$/kWh	-			
Energy cost escalation rate	%	6.0%			
Inflation	%	2.0%			
Discount rate	%	10.0%			
Project life	yr	30			

Project Costs and Savings

Initial Costs				**Annual Costs and Debt**		
Feasibility study	0.0%	$	-	O&M	$	-
Development	0.0%	$	-	Electricity	$	-
Engineering	0.0%	$	-			
Energy equipment	60.1%	$	18,017	**Annual Costs and Debt - Total**	$	-
Balance of system	39.9%	$	11,983			
Miscellaneous	0.0%	$	-	**Annual Savings or Income**		
Initial Costs - Total	100.0%	$	**30,000**	Heating energy savings/income	$	2,588
Incentives/Grants		$	14,258			
				GHG reduction income - 10 yrs	$	29
				Annual Savings - Total	$	**2,617**
Periodic Costs (Credits)						
Valves and fittings		$	250	Schedule yr # 10,20,30		
Pool heat pump compressor		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	23.3%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	23.3%			
Simple Payback	yr	6.0	Project equity	$	30,000
Year-to-positive cash flow	yr	5.0			
Net Present Value - NPV	$	30,260			
Annual Life Cycle Savings	$	3,210			
Benefit-Cost (B-C) ratio	-	2.01			

Yearly Cash Flows

Year #	Pre-tax $	After-tax $	Cumulative $
0	(15,742)	(15,742)	(15,742)
1	2,772	2,772	(12,970)
2	2,938	2,938	(10,032)
3	3,113	3,113	(6,920)
4	3,298	3,298	(3,621)
5	3,495	3,495	(126)
6	3,703	3,703	3,577
7	3,924	3,924	7,501
8	4,158	4,158	11,659
9	4,407	4,407	16,066
10	4,365	4,365	20,431
11	4,913	4,913	25,343
12	5,208	5,208	30,551
13	5,520	5,520	36,071
14	5,851	5,851	41,922
15	6,202	6,202	48,125
16	6,574	6,574	54,699
17	6,969	6,969	61,668
18	7,387	7,387	69,055
19	7,830	7,830	76,885
20	7,929	7,929	84,814
21	8,798	8,798	93,612
22	9,326	9,326	102,938
23	9,886	9,886	112,823
24	10,479	10,479	123,302
25	11,107	11,107	134,409
26	11,774	11,774	146,183
27	12,480	12,480	158,663
28	13,229	13,229	171,893
29	14,023	14,023	185,915
30	14,411	14,411	200,327

Version 3.1

NRCan/CETC - Varennes

9/2/2010; Laundromat NH

Water heating system seasonal efficiency

The user enters the average efficiency (%) of the conventional water heating system over the season of use. This value is used to calculate the financial value of the system. It has no influence on the calculation of the annual renewable energy production. Typical values range from 50 % for conventional fossil-fuel-fired water heaters to nearly 100 % for electric heaters. If a heat-pump is used as a base case (e.g. for swimming pool applications) the user will select "Electricity" as the heating fuel type and may enter values higher than 100 % to reflect the heat pump coefficient of performance (COP) (e.g. enter 225 % if seasonal COP is 2.25).

Typical values of residential heating system efficiencies are tabulated below. The efficiencies of commercial and industrial water heating systems can vary significantly depending on size, age, technology, condition, installation specifics, etc. and these are not specifically included here. However, the user may use the efficiencies of residential water heating systems as a reference for similar larger systems.

Fuel	Residential Water Heating System Type	Typical Seasonal Efficiency*
Nat'l Gas or Propane	Storage tank (conventional)	50%
	Storage tank (high-efficiency)	70%
	Instantaneous	80%
	Integrated with space heating (tankless coil)	48%
	Induced draft / direct vent (conventional)	55%
	Induced draft / direct vent (high-efficiency)	70%
	Condensing	86%
Oil	Storage tank (conventional)	50%
	Storage tank (high-efficiency)	60%
	Integrated with space heating (tankless coil)	40%
Electricity	Storage tank (conventional)	88%
	Storage tank (high-efficiency)	94%
	Instantaneous	94%
	Heat pump	190%

Typical Water Heating System Seasonal Efficiencies

*Note: The efficiency of residential water heating systems is commonly expressed in terms of the Energy Factor (EF). For the purposes of the model it is assumed that the two measures are essentially the same (except that EF is expressed as a decimal). The values in the above table are in fact EF values that were converted to percentages. Seasonal Efficiency is used here because it is a more generic term and more applicable to commercial and industrial water heating systems for which EF ratings don't exist. All shown efficiency values are approximate and typical values.