Valuation of Solar Arrays and Cell Towers

Cy Bailey Senior Appraiser, DA
Barb Schlesinger District Advisor
Teri Gildersleeve, Property Valuation Operations Chief, DA

April 16th

Version: 4-2019b

VERMONT
DEPARTMENT OF TAXES

1

Valuation of Solar Plants

2

Valuation of Solar Plants

The valuation of solar plants has been codified by the Legislature in 32 VSA § 3481(1)(D). The Lister/Assessor shall use the PVValue tool to determine Assessed Value. This workshop is designed to provide guidance to the local Lister/Assessor. It's important to keep in mind that the assessment is the Average Value indicated by PVValue Tool and set in the grand list at 70%. The Assessed Value will remain unchanged for the life of the project.

3

Rates & Expenses for PV Value

- 50,000W (50kW) exemption on net metered projects
  - None on commercial projects (speed/ppa)
- Derate factor calculation
  - Default (.77) or
  - Installer furnished value, or
  - AC capacity / DC capacity
- Operation & Expense – DC Watt Size (before 50K exemption)
  - 55 cents p/w systems up to 100kW
  - 40 cents p/w >100kW
- New discount rate 13.31 (to arrive at Average 13.50)

4

Rates & Expenses for PV Value

- New net metered (utility rate) credit 19 cents – 1/1/2015
- credit @ 19 cents p/watt or
  - Contract price with inclusion of contract
- 70% of Average Value indicated by Photo Voltaic Value
- (**PVValue**) set for 25 yrs (does not change)

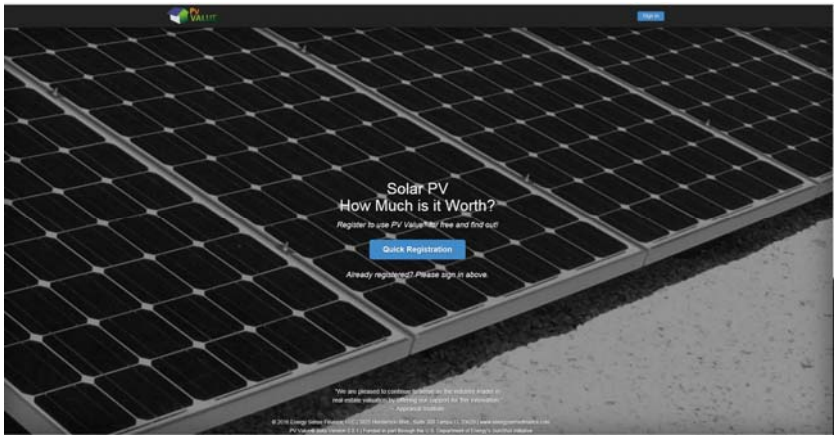
5

Rates & Expenses for PV Value

- Category 1: 15kW or Less (located anywhere)
  - Rate: 19.00 cents
- Category 2: >15kW and </= 150KW on a preferred site
  - Rate: 18.919 cents
- Category 3: >150kW and </= 500kW and on a preferred site
  - Rate: 16.910 cents
- Category 4: >15kW and </=150kw and not on preferred site
  - Rate: 14.919 cents

6

PV Value



7

PV Value

04/13/2015 09:49:24 Beta Version 0.8.1

Income Approach Method

Subject Property Data

Property		Solar Resource		O & M Expense	
Address:	1266 US-5	System Size:	488200 watts	Inverter Size:	494000 watts
City:	St Johnsbury	Module Warranty Yrs:	25	Inverter Warranty Yrs:	15
State:	VT	System Age Yrs:	1	Inverter Age Yrs:	1
Zip Code:	05819	Remaining Yrs:	24	Inverter Replaced:	No
Property Type:	commercial	Derate Factor:	0.83	Replacement Cycle Yrs:	15
PV Project Type:	existing	Degradation Rate:	0.25	Replacement Cost ¢/W (survey):	35
PV Ownership:	owned	Array Tilt:	22.6	User Replacement Cost ¢/W:	40
		Array Azimuth:	180	O & M Expense (future):	$195,280.00
		kWh Produced/Year:	717,683	O & M Expense (discounted):	$33,167.73

8

PV Value

Discount Rate

Discount Rate High:	13.56 %
Discount Rate Avg:	13.50 %
Discount Rate Low:	13.44 %
FNM 30yr Rate:	3.37
FNM Date:	April 13, 2015
User Input Rate (WACC):	13.31 %
Min Basis Points:	12.5
Max Basis Points:	25

Estimated Value of Energy

Low Estimated Value: $1,083,596.62

Avg Estimated Value: $1,087,209.22

High Estimated Value: $1,090,845.29

Utility Rate

NREL Utility Co:	Central Vermont Public Service Corp
NREL Utility Rate:	13.63 ¢kWh
User Input Rate:	19.91 ¢kWh
Utility Rate Used:	19.91 ¢kWh
EIA Escalation Rate:	2.32 %(CAGR)
User Input Esc Rate:	0.00 %(CAGR)
Escalation Rate Used:	0.00 %(CAGR)

9

PV Value

Estimate of Accumulated Energy Production

		Low Estimated Value		Avg Estimated Value		High Estimated Value	
Year	Annual kWh	Annual Value	Accumulated Value	Annual Value	Accumulated Value	Annual Value	Accumulated Value
1	715,889	0.00	0.00	0.00	0.00	0.00	0.00
2	714,095	142,176.23	142,176.23	142,176.23	142,176.23	142,176.23	142,176.23
3	712,300	125,016.75	267,192.99	124,950.67	267,126.90	124,884.65	267,060.88
4	710,506	109,927.58	377,120.57	109,811.39	376,938.29	109,695.38	376,756.26
5	708,712	96,659.02	473,779.58	96,505.81	473,444.09	96,352.92	473,109.18
6	706,918	84,991.46	558,771.04	84,811.88	558,255.98	84,632.78	557,741.96
7	705,124	74,731.79	633,502.83	74,534.47	632,790.45	74,337.78	632,079.74
8	703,329	65,710.18	699,213.02	65,502.04	698,292.49	65,294.66	697,374.40
9	701,535	57,777.29	756,990.31	57,563.83	755,856.31	57,351.26	754,725.66
10	699,741	50,801.76	807,792.07	50,587.32	806,443.63	50,373.89	805,099.55
11	697,947	44,668.11	852,460.18	44,456.04	850,899.67	44,245.09	849,344.64
12	696,153	39,274.75	891,734.93	39,067.63	889,967.30	38,861.70	888,206.34
13	694,358	34,532.38	926,267.31	34,332.10	924,299.40	34,133.10	922,339.44
14	692,564	30,362.44	956,629.75	30,170.39	954,469.79	29,979.65	952,319.09
15	690,770	26,695.85	983,325.60	26,512.97	980,982.76	26,331.44	978,650.54
16	688,976	23,471.89	973,629.77	23,298.78	971,113.81	23,127.03	968,609.83
17	687,181	20,637.14	994,266.91	20,474.10	991,587.91	20,312.43	988,922.27
18	685,387	18,144.52	1,012,411.52	17,991.75	1,009,579.66	17,840.26	1,006,762.53
19	683,593	15,953.03	1,028,364.55	15,810.27	1,025,389.93	15,668.86	1,022,431.39
20	681,799	14,026.06	1,042,390.61	13,893.19	1,039,283.12	13,761.65	1,036,193.04
21	680,005	12,331.76	1,054,722.37	12,208.48	1,051,491.61	12,086.51	1,048,279.55
22	678,210	10,842.05	1,065,564.42	10,727.99	1,062,219.60	10,615.20	1,058,894.74
23	676,416	9,532.23	1,075,096.65	9,426.97	1,071,646.57	9,322.93	1,068,217.67
24	674,622	8,380.60	1,083,477.25	8,283.67	1,079,930.24	8,187.92	1,076,405.58
25	672,828	7,368.04	1,090,845.29	7,278.98	1,087,209.22	7,191.03	1,083,596.62

Use of this form is subject to the PV Value® terms of use agreement | www.pvvalue.com
©2014 Energy Sense Finance, LLC | 3825 Henderson Blvd., Ste. 300, Tampa FL 33629 | www.energysensefinance.com

10

NOTES Page:

See PV-603 for Solar Instuctions

Solar Definitions

Alternating Current (AC) — A type of electrical current, the direction of which is reversed at regular intervals or cycles. Electricity transmission networks use AC because voltage can be controlled with relative ease.

Azimuth – The orientation of the total array in relationship to the sun. Ideal orientation is 180°

Direct Current (DC) — A type of electricity transmission and distribution by which electricity flows in one direction through the conductor, usually relatively low voltage and high current. DC must be converted to alternating current, its opposite.

Electrical Grid – Sometimes simply called "the grid," this term refers to the system that delivers electricity from suppliers to consumers. Electrical grids are made up of generating stations, transmission lines, and distribution lines. Generating stations produce the electrical power, which is carried over high-voltage transmission lines to demand centers. Distribution lines then move the electricity from the demand centers to individual customers.

Escalation Rate – Is the anticipated change in electricity cost.

CPG – Certificate of Public Good given from the Public Utility Commission (formerly Public Service Board)

Derate Factor - PVWatts **Definition**: The **derate factor** compensates for the loss electrical production due to a multitude of factors which can range from tree shading to loss of power when converting DC power to AC power. The assessor is concerned with the loss of electricity when converting from DC power to AC power.

Discount Rate – In commercial real estate the discount rate is used in a discounted cash flow analysis to compute a net present value. Typically, the investors require rate of return is used as a discount rate, or in the case of an institutional investor, the weighted average cost of capital.

Group Net Metered - Group net metering means that more than one account with the utility can share the benefit of a single solar array. The specifics of how group net metering work depend on the laws and regulations of the state.

Inverters –A solar inverter converts direct current (DC) power to alternating current (AC) electricity, either for individual solar panels or for grid-connected solar power systems. DC power produced by a solar array must be converted to AC electricity, so it can be used in household appliances — without an inverter, the energy from your solar panels cannot easily be put to use.

Kilowatt/Kilowatt Hours – kW – Kilowatts or 1000 Watts. A kilowatt (kW) is a measure of power — the *demand* at any given time. A kilowatt-hour (kWh), on the other hand, is a measure of energy — the *consumption* of power over a period of time. A kWh is the power demand (kW) multiplied by the total amount of time the power is being used (in hours). So, if a 30-watt bulb is running for 24 hours, 720 watt-hours or .72 kWh is consumed (30 watts times 24 hours).

The average household consumes about 30 kWh per day. If your solar panels receive five hours of peak sunlight per day, you need 6 kW of output (30 kWh divided by 5 hours — that's your demand) to cover 100% of your energy use. A typical solar panel can produce between 250 and 270 watts of peak power during ideal conditions, which means you'll need about 24 solar panels to make a 6-kW array.

Solar Definitions

Megawatt/Megawatt Hours – One megawatt (MW) is equal to one thousand kilowatts (kW). One megawatt hour (MWh) is equivalent to 1,000 kilowatt-hours (kWh) continuously consumed in an hour. One MW

Net Metering– a utility billing mechanism available that offers a credit to residential and business customers who are making excess electricity with their solar panel system and sending it back to the grid. With net metering, the homeowner is only billed for the "net" energy used each month, that is, the difference between the energy produced by the solar power system and the energy consumed by the house over the monthly billing period.

Operations and maintenance (O&M) – The ongoing operational needs of a solar system, including cleaning, repairs, replacement of parts, bill management and so on; primarily refers to larger-scale commercial and utility-scale solar systems.

Photovoltaic (PV) – The term *photovoltaic* (PV) comes from two root words: "photo" (light) and "voltaic" (voltage). In physics, "photovoltaic" refers to anything that produces electricity when exposed to light or other radiant energy. Solar cells, solar modules, and solar panels are often referred to as P V cells, PV modules, and PV panels to express how their electricity is produced.

PPA – Power Purchase Agreement

PUC (formerly PSB public service board)- The Public Utility Commission is an independent, three-member, quasi-judicial commission that regulates the siting of electric and natural gas infrastructure and supervises the rates, quality of service, and overall financial management of Vermont's public utilities: electric, gas, energy efficiency, telecommunications, cable television (terms of service only, not rates), water and large wastewater companies.

Solar Array – A solar array is a collection of solar panels wired together to create the desired energy output. The typical residential solar array consists of 20–25 solar panels to cover 100% of its energy consumption.

Solar Lease – This payment option has similar benefits and drawbacks as a PPA, but instead of paying a specified rate with the solar provider (e.g., $0.16 per kWh), you make a monthly payment to the solar provider. You can think of it as a way to make a lower monthly payment for cleaner electricity. For more information on a solar lease and what it is, check out How to Pay for Solar.

Solar Plant – For purposes of the Uniform Capacity Tax (UCT), a group of solar-generating facilities is considered one "plant" if the group is part of the same project and uses common equipment and infrastructure such as roads, control facilities, and connections to the electric grid. Each plant should have one CPG for the entire plant

Solar Renewable Energy Credit (SREC) – An SREC is another way to monetize energy reduced by solar and other renewable energy sources. A solar producer earns one SREC for everyone thousand Kilowatts produced. The SRECs are sold on the open market.

Speed - In 2005, the Vermont General Assembly established the SPEED Program to encourage the development of renewable energy resources in Vermont as well as the purchase of renewable power by the state's electric distribution utilities.

Tilt – the angle at which solar panels are mounted to optimize the energy yield.

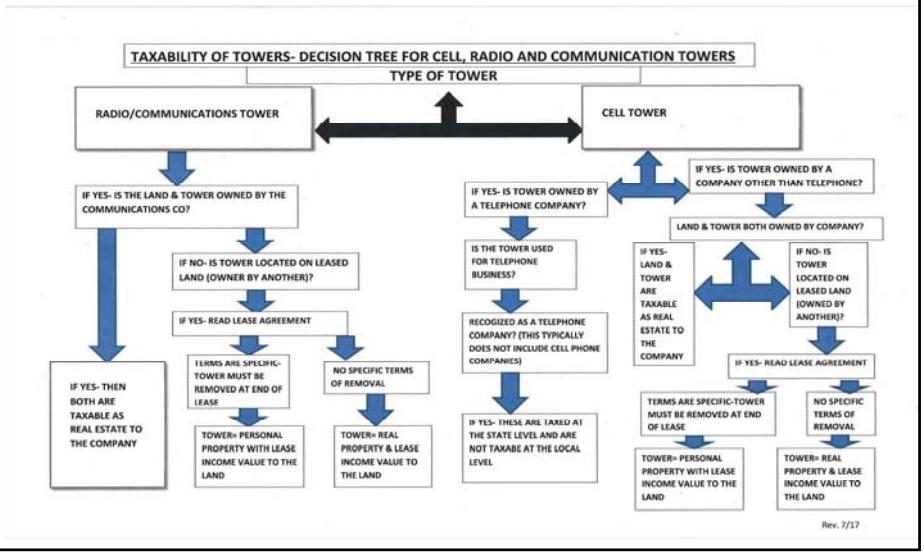
Utility Rate – The utility rate is the rate provided to the producer by the utility. It can vary now based on location and siting of the plant.

NOTES Page:

Cell Towers and Cell Tower Leases

12

Can a Cell Tower be taxed in your Municipality?



13

Types of Cell Towers

14

Types of Cell Towers

Lattice Towers

Lattice towers are freestanding and segmentally designed with rectangular or triangular base steel lattices. This type of tower construction can be useful in situations which require modifications such as mounting large number of panel or dish antennas. They can be used as electricity transmission towers, radio towers or as an observation tower. The Eiffel Tower is a famous example of a lattice tower.

Lattice

- 200 - 400 feet
- Also called self-support
- Typical use: telephony

15

Types of Cell Towers

Guyed Towers

Guyed towers can be lightweight to heavyweight towers often seen as slender steel structures. Commonly seen in the tower industry, guyed towers are designed to provide maximum strength, efficiency and versatility with easy installation. They are supported by one or more levels of braided or stranded steel guy cables that anchor to the ground.

Guyed

- 200 - 2,000 feet
- Typical use: television and radio broadcasting, paging and telephony

16

Types of Cell Towers

Monopole Towers

Monopole towers work well when space is limited, zoning is difficult or harsh weather conditions need to be considered. Designed as a single-pole that can be a tubular section design or a formed, tapered pole, they are the least intrusive – making them the most popular tower types in the wireless communication industry. Because of the single-pole design, it advantageously reduces visual impact and results in a shorter construction time (and typically cost) compared to traditional lattice structures. Many monopoles can also be designed as stealth, camouflage towers.

Monopole

- 100 - 200 feet
- Typical use: telephony

17

Types of Cell Towers

Camouflage or Stealth Towers

Camouflage towers are typically used in urban areas when the need to reduce visual impact on the environment is a concern. They are often seen in the form of artificial pine trees, palm trees, clock towers, steeples and even in the form of artificial cacti.

Stealth

- Range in size
- Generally used to maintain aesthetic quality of area
- Particularly useful in areas with strict zoning regulations

18

Types of Cell Towers

19

Types of Cell Towers

20

Types of Cell Towers

21

Cell Tower Construction Cost

22

Cell Tower Construction Cost

- Cell Tower Costs vary widely depending on the type and location of the tower.
- Information regarding Cost can be found in M&S section 67 page 6 which gives a wide range of values based on height diameter. Local Contractors are the best source of cost information.
- The internet is a source of information an example

	US	LatAm	Africa	India
Typical Tower Construction Cost	$225-$275K	$125-$150k	$150-$175k	$30-$50k

23

Cell Tower Construction Cost

RADIO AND TV TOWERS

Radio and television towers are individually designed for the location, considering climatic conditions such as ice, wind, seismic and antenna loads. Costs are typical cost ranges excluding extremes. Due to the number of variables involved, we would suggest that whenever possible, manufacturers', installers' or contract costs be obtained.

Included in the costs are concrete footings, erection, painting, guy wires, lighting, platforms, and designers' fees. Antennas and transmission cables are not included. Multiple antenna installations and mono-poles will tend to be at the high end of the range.

SELF-SUPPORTING TOWERS

HEIGHT (FEET)	COST RANGE	HEIGHT (FEET)	COST RANGE
50	14,500.00 – 23,300.00	225	133,000.00 – 148,000.00
75	29,400.00 – 44,300.00	250	143,000.00 – 164,000.00
100	46,600.00 – 68,250.00	300	152,000.00 – 185,000.00
150	91,500.00 – 124,000.00	350	175,000.00 – 214,000.00
200	125,000.00 – 141,000.00	400	196,000.00 – 242,000.00

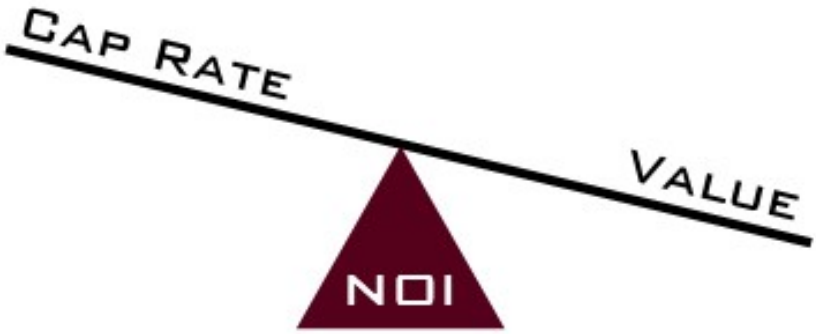
TRIANGULAR GUYED TOWERS

(Price per linear foot, up to 400 feet high)

10" Ham radio*, police and fire bands	92.50 – 134.00
20" Taxi and public service bands	139.00 – 201.00
24" Radio, V.H.F., U.H.F. bands	175.00 – 263.00
30" Cellular applications	211.00 – 350.00
40" Microwave towers	263.00 – 427.00
54" Master TV systems	427.00 – 950.00

24

Cell Tower Income Approach



25

Cell Tower Income Approach

- The **Income Approach** is a real estate appraisal **method** that allows investors to estimate the value of a property by taking the net operating **income** of the rent collected and dividing it by the **capitalization** rate.

26

Cell Tower Income Approach Leases

The cell tower lease recorded in the Town Clerks typically does not include the amount of the monthly rent. A copy of the lease should be viewed, or a copy obtained from the property owner(lessor).

Lease will usually define the base monthly payment and specify an amount when there are additional users added to the tower.

27

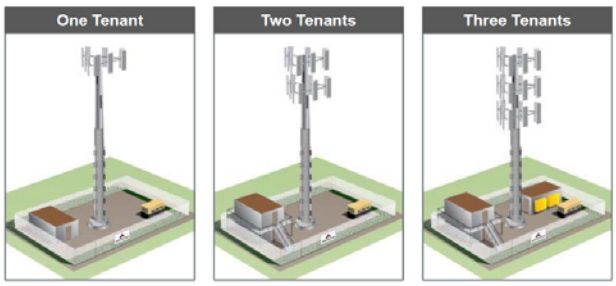
Cell Tower Income Approach Leases

Sample Monthly Lease

$2000 base monthly rent

$500 per additional user

Two Users Gross Monthly Rent $2500



28

Cell Tower Income Approach

Computation for Land Cap Rate for Cellular/Wireless Manangement Sites Build Up Method

Risk - free rate using 30 years T-Bond 3/30/17	2.99%
Allowance Risk	3.00%
Allowance Liquidity	1.50%
Allowance for Management	1.00%
Allowance for Taxes* (may be adjusted if needed) (Average Municipal and Non-Residential Education Tax Rate)	**2.05%**
Estimated Discount Rate for Land (Calculated)	10.54%
Estimated Discount Rate for Land Rounded to:	**11.00%**

Monthly Rent						
Base Rent** (includes Tower and 1 user (co-locator)						**2,000**
Co-locators or additional users	1	x	$500	=	$500	
						Total Value
Total Monthly Rent	$2,500					**272,700**

Calculation Example	
Base Rent**	$2,000
(2) Co-locators (2 x $500 each)	$1,000
Total Monthly Rent	$3,000

Total Monthly Rent (Base rent plus additional co-locators $2,000 + $1,000= $3,000)
Total Value: $3,000 x 12 months = $36,000 / .10 = $360,000
(Total Value Equals Total Monthly Rent times 12 months divided by Discount Rate)

29

Cell Tower Income Approach

Capitalization Rate

- Monthly Rent $2500
- Annual Rent $30,000
- NOI $30,000/Sale Price $275,000= Cap Rate .109

Gross Rent Multiplier

- Gross Rent Multiplier
- 275,000 / 2500 = 110

30