FINANCIAL ANALYSIS

FOR PROPOSED PV SYSTEM FOR (COMPANY NAME REMOVED), CHERRY HILL, NJ

PERFORMED BY NEW JERSEY SOLAR CONSULTING

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I. INTRODUCTION

The purpose of the below work is to provide a financial comparison between bids for the proposed PV system at 1515 Burnt Mill Road. Meaningful comparison of bids requires consideration of factors from areas outside of the financial realm such as technologies employed, warrantees, experience, extra features, and testimonials. Still, a clear appreciation of the financial merits between proposals remains arguably the most important consideration. After all, return on investment is a key, if not primary, driver for employing a PV system.

One of the primary obstacles in comparing financial aspects of system proposals is the presence of varying technical specifications. In the case of (COMPANY NAME REMOVED)'s RFP, varying system sizes, panel technology, and panel tilt posed the most obfuscating issues. In our study we hope to show that bids can be compared if various assumptions are standardized. Our work yields two proposals which offer better value when considered on their financial merits alone.

In our raw data we also collected data elements such as panel type, tilt, and warranties. Though we did not pass judgment on these, they are helpful in interpretation of the results.

	Table 1: BIDDER-PROPOSED SYSTEM PARAMETERS					
		Proposal #1	Proposal #2	Proposal #3	Proposal #4	Proposal #4
PANELS	Panel Make	Kyocera	Sharp	Suntech	Solar World	Uni-Solar (**Proposal #5**)
	Panel Model	KD205-GX LP	ND 216 U2	STP270-24/Vb1	SW 175	PVL-144
	Panel Type	Crystalline	Crystalline	Crystalline	Crystalline	Thin Film
	Panel Wattage DC	205	216	270	175	144
	Panel Count	7,168	6474	5662	3,256	6945
	Panel Tilt	0	2	0	15	0
	Panel Warrantee	1 / 20* *output	25yr / 80% output	5 / 12* / 25* *output		20 yr. w/ 80% output
INVERTERS	Inverter Manufacturer	Satcon Pwr. Gate Plus	Satcon Pwr. Gate Plus	Satcon Pwr. Gate Plus	Satcon Pwr. Gate Plus	PV Powered
	Inverter Size	500 kW	375 kW	1000 & 500 kW	500 kW	260 kW
	Inverter Count	3 x 500kW	3	2	1	4
	Inverter Warantee	5 yr.	5 yr.	5 year	10 yr.	10 yr.
	Available Inverter Extensions	10, 15, 20	10, 15, 20	10, 15, 20	10, 15, 20	20
FINANCIAL INFORMATION	System Size (WDC)	1,469,440	1,398,384	1,501,874	569,800	1,000,080
	Annual Generation (kWh)	1,518,813	1,435,345	1,511,086	643,465	1,214,000
	System Cost	$8,229,000	$8,040,708	$8,320,382	$3,019,940	$5,627,251
	Cost Per Watt	$5.60	$5.75	$5.54	$5.30	$5.63
	Cost after Federal Tax Credit	$5,760,300	$5,628,495			
	SREC projected price	Variable	$450			
	SREC production / yr	1518.813	1435			
	Initial SREC yearly sales	$873,317	$645,905			
	Assumed Electricity Cost ($/kWh)	$0.1560	$0.1500	$0.1120		
	Electric Cost Savings	$236,935	$215,301			
	Annual System Degregation	0.37%				0.008
	Maintenance Cost proj.	$10,286			$3,800	
	Generation Calc Method	PVWatts	PVWatts	PVWatts	PVWatts	In-House (thin film)
	System Derate	0.77	0.77	0.77	0.77	n/a
	Projected Break-even (yr)	4.5	6.5			

II. DESCRIPTION OF THE PROBLEM AND OUR APPROACH

For this report we first extracted relevant technical specifications from within the proposals and compiled those into a table for raw comparison (see Table 1). We then adjusted the data in a second table by imposing a uniform annual A/C electric generation rate on all proposals (see Table 2). This yields a far more comprehensible, apples-to-apples comparison of key system data.

In order to make meaningful comparisons of data which have financial impact, we also discuss standard metrics and propose a re-focusing on two:

1. The problem with Cost per Watt

The metric usually employed to compare system costs is cost per installed watt ($/W), which is generally accepted as an industry standard. While this allows installers to ensure their rates are competitive, it can be less useful for system purchasers because it ignores the actual system generation. For instance, a 1kW system installed in direct sunlight will produce more electricity than the same system installed in some shade, but the cost per installed watt will not reflect the disparity in annual system generation. Similarly, a system that is angled at 15°, as one bidder proposes, will obviously produce more than a system installed at 0°, but the cost per watt will be the same (assuming equal mounting costs). Thus the 15° system will produce more but will cost the same, therefore offering greater value for the owner. As a metric, cost per watt is limited because does not reflect this.

A. Cost per annual kWh generated

Annual generation is the actual quantity of electricity produced by a system over the course of a year. From the owner's perspective, generation is the sole purpose of purchasing a PV system; every kWh a system produces is one less kWh the owner purchases from the utility. The nameplate power rating of the system (measured in watts) is less relevant than the work the system does for the owner over the course of the year (measured in kWh).

Thus in our view, a better metric for analysis for the owner is cost per annual kWh generated ($/kWh). In the (company name removed) proposals system tilt and varying panels technologies are key variables that are not accounted for by cost per watt. Cost per annual kWh generated accounts for all technological differences.

B. Capacity Factor as a Measure of Efficiency

In this report, we use the term "capacity factor" to mean the annual generation of the system (kWh) divided by the system nameplate capacity (kW). Capacity factor essentially serves as a metric for system efficiency because a higher capacity factor implies more generation for a given system size. Therefore a system with a higher capacity factor can be smaller, which should translate into lower costs for the owner, and identifying potential cost savings is principal to this report. We use capacity factor as the second of two revealing metrics in our Uniform System Generation table.

In this report, we hope to show that capacity factor and cost per kWh are more appropriate metrics of system cost and performance than the standard metric of cost per watt. In doing so, we hope to provide a more meaningful comparison between the bidder proposals than can be made from the proposals as they stand.

The table below compares system size, cost per watt, cost per annual kWh generated, and capacity factor of each proposed system.

Table 2: BIDDER-PROPOSED SYSTEM DATA					
	Proposal #1	Proposal #2	Proposal #3	Proposal #4	Proposal #5
System Cost	$8,229,000	$8,040,708	$8,320,382	$3,019,940	$5,627,251
System Size (WDC)	1,469,440	1,398,384	1,501,874	569,800	1,000,080
Annual Generation (kWh)	1,518,813	1,435,345	1,511,086	643,465	1,214,000
COST EVALUATIONS					
Cost per Watt ($/W)	$5.60	$5.75	$5.54	$5.30	$5.63
Cost per kWh ($/kWh)	$5.42	$5.60	$5.51	$4.69	$4.64
Capacity factor (kWh/kW)	1033.6	1026.4	1006.1	1129.3	1213.9

2. Standardizing Based on Uniform Generation

There are two sides to any financial decision: what you get, and what you pay for it. Purchasing a solar PV system is no different. The problem with comparing bidder proposals, as Table 2 demonstrates, is that both "what you get" (i.e. annual generation) and "what you pay" (total system cost) are inconsistent across all bidders.

To make a comparison meaningful ("apples-to-apples") we set a uniform value for "what you get" by imposing a consistent value for annual generation (see Table 3). We chose 1,519,440 kWh, the owner's total demand over the previous 12-months, but this selection is somewhat arbitrary; any standard number for annual generation will produce comparable results. In other words, it is simply a benchmark which provides a convenient means of comparison.

By using uniform system generation, capacity factor, and cost per watt, we are able to project system size and price for each proposed system. Since system generation (what you get) is made uniform, system prices (what you pay for it) can be easily compared. (See section 3)

3. Creating a Reference PV System

However, to make this comparison more useful, we calculated the specifications for a hypothetical baseline system that could serve as a reference. Our system is the "plain vanilla" version of a PV system for (company name removed)'s application. We are not attempting to produce a technical solution for this application, only a tool that allows us to see the merits of proposed systems more clearly.

As you will see below, once our hypothetical system is posed, we also standardize treatment of various incentives and other factors used for determining break even point, and other financial measures. Although most bidders did not make these financial projections, we imposed these assumptions and could then conclude how each bid system fared.

III. NEW JERSEY SOLAR CONSULTING REFERENCE SYSTEM DESIGN

We first set out to create a hypothetical standardized reference system against which other could be compared. We also imposed standard assumption for incentives and tax treatments, enabling a comparison of break-even period and other financial metrics. To create such a system, we took the factors listed below into account. Table 3 follows, utilizing the standardizations described here in detail, and can serve to summarize our findings.

1. System Sizing and Capacity Factor

   In sizing a system to be used for comparison purposes, NJSC used PVWatts and worked from the following system assumptions:

   - System weather data is Philadelphia, PA
   - DC to AC derate factor is 0.77
   - Tilt is 0° (horizontal)

   Again, this is not to imply we think the optimal system for this application has this derate factor, tilt, or resulting size. We used assumptions that we view as standard, not necessarily optimal. We assumed the full electric usage was to be covered by the proposed system, and that the utility provider could accommodate interconnection with a fully sized system. This provided a system size of **1,470 kW**, (calculated using a capacity factor of 1033.7 and 1,519,440 kWh desired generation).

2. System cost

   We assumed a cost per watt of $5.50 as a reasonably competitive industry rate. The final cost for our theoretical reference system is therefore **$8,084,630**.

3. Financial Projections for NJSC Reference System

   Our financial projections account for government incentives, electricity rates, SREC sales, and taxes. There is often a great deal of variance between PV financial projections due to the uncertainty associated with the industry. Our assumptions tend to be conservative, and are clearly stated.

   A. Incentives (assumed for our standardized system)

      Federal tax credit

      The federal business investment tax credit (ITC) was recently expanded in the by *The American Recovery and Reinvestment Act of 2009*. It gives a 30% tax credit to solar photovoltaic investments, with no maximum credit. For our projected $8,084,630 system, the tax credit is therefore $**2,425,389**. Commercial systems pl(proposal #4)d into service in 2009 are eligible for a 30% grant in pl(proposal #4) of the tax credit.[1]

Depreciation Benefits

Businesses may recover investments in certain property through depreciation reductions under the federal Modified Accelerated Cost-Recovery System (MACRS). Solar is classed as a five-year property. The federal *Economic Stimulus Act of 2008* included a 50% bonus depreciation provision (26 USC § 168(k)) for eligible renewable-energy systems. This provision was extended by *The American Recovery and Reinvestment Act of 2009*. [1,2]

Under this program, the owner is entitled to deduct 50% of the adjusted basis of the property in 2008 and 2009. The remaining 50% of the adjusted basis of the property is depreciated over the ordinary depreciation schedule.

Before calculating depreciation for such a project, including any bonus depreciation, the adjusted basis of the project must be reduced by one-half of the amount of the energy credit for which the project qualifies. In the case of solar, this is the 30% ITC. Thus the initial depreciable basis is 85% of the initial system cost. The basis for depreciation for the proposed system is therefore $6,871,935. Over the first six years after the system is pl(proposal #4)d into service, the owner can expect to enjoy **$2,748,774** in effective federal tax benefits.

B. Electricity tariffs and savings

Our projections are based on a utility electricity tariff of $0.1564 per kWh as provided by the owner. The owner will therefore save $683,748 before taxes in the first year of system service. Our projections assume the owner would otherwise depreciate these utility expenditures, so the effective value of these savings is **$410,248**.

Our extended projections assume a conservative annual tariff increase of 5%. Common state estimates are 7-10%.

C. SRECs

At the time of this writing, current SREC prices are at $675 per MWh. Since the SREC market is relatively young, and renewable energy incentives have changed significantly in the past year, it is difficult to project the price of SRECs over the course of the next 15 years.

Since SRECs represent an important part of a system's revenue stream, differing assumptions regarding SREC price have significant impact on break-even period and other financial metrics. The (proposal #1) proposal, for instance, assumes a price of $575/MWh for the first three years of system life, while the (proposal #2) proposal assumes a standard price of $450. This is largely responsible for the disparity between the (proposal #1) projected break-even period of 4.5 years and the (proposal #2) projected break-even period of 6.5 years.

To make our analysis both conservative and transparent, we assume a flat price of $450/MWh for SRECs. For the first year, our projected system generates $683,748. We assume that these revenues are taxed at a rate of 40%, so the effective benefit to the owner is **$410,248.**

D. Twenty-year system generation

We assume a system degradation of 0.7% per year. This assumption comes from a report by the U.S. Department of Energy paper that estimates the average degradation of PV cells due to weathering.[a] Based on this rate of degradation our total anticipated generation over the first 20 years of system life is **28,450,351kWh.**

E. Break-even period

The break-even period for our projected system is **5.39 years**. This is the amount of time it will take for the system to pay for itself. This does not take into account the time value of money.

F. Pretax 10-year Internal Rate of Return (IRR)

We have calculated the IRR at 10-years for our system so that the owner's investment in solar energy can be compared to other investments. Our pretax IRR is **19.35%.**

G. Net Present Value

Our financial metrics include a calculation for net present value (NPV) to compare the effect of time on the value of system revenues. This NPV calculation uses a discount rate of 6%. The net present value of our projected system is **$2,805,883**.

IV. RESULTS OF STANDARDIZING BIDDER PROPOSALS

Using this reference system, we can now standardize the bidder proposals using a uniform value for annual generation as explained in Section 1. Table 3 below shows the results of this analysis. In calculating these financial projections, we make the same assumptions as we did for the NJSC Reference System. These assumptions are presented in Table 4 for reference. For clarity, we do not show all our calculations here, only the results we found pertinent.

Using Table 3 we can see that two proposals offer exceptional value when compared to the group as a whole. These two are (proposal #4 & 5). As we saw in Section 1, these proposals have a higher capacity factor, and this advantage carries through the entire analysis.

Projections for the first 15 years of system life

STANDARDIZED	NJSC FINANCIAL PROJECTIONS BASED ON UNIFORM SYSTEM GENERATION						
		NJSC	(proposal #1)	(proposal #2)	(proposal #3)	(proposal #4)	(proposal #5)
	Annual Generation	1,519,440	1,519,440	1,519,440	1,519,440	1,519,440	1,519,440
	Initial Electric Rate ($/kWh)	$0.1564	$0.1564	$0.1564	$0.1564	$0.1564	$0.1564
	Annual Electricity Savings	$237,640	$237,640	$237,640	$237,640	$237,640	$237,640
	SREC Price	$450	$450	$450	$450	$450	$450
	Annual SREC Revenues	$683,748	$683,748	$683,748	$683,748	$683,748	$683,748
	Capacity Factor (kWh/kW)	1033.7	1033.6	1026.4	1006.1	1129.3	1213.9
	Cost per Annual kWh Generated ($/kWh)	$5.32	$5.42	$5.60	$5.51	$4.69	$4.64
	Cost Per Watt	$5.50	$5.60	$5.75	$5.54	$5.30	$5.63
	System Size (kWDC)	1,470	1,470	1,480	1,510	1,345	1,252
	SYSTEM COSTS						
	System Cost (pre FTC)	$8,084,630	$8,232,397	$8,511,803	$8,366,381	$7,131,107	$7,043,056
	Fed Tax Credit Value	$2,425,389	$2,469,719	$2,553,541	$2,509,914	$2,139,332	$2,112,917
	Cost After Tax Credit	$5,659,241	$5,762,678	$5,958,262	$5,856,467	$4,991,775	$4,930,139
	FINANCIAL METRICS						
	Break-even period (yr)	5.39	5.48	5.63	5.55	4.84	4.79
	Pretax 10-year IRR	19.35%	18.96%	18.24%	18.61%	22.18%	22.47%
	NPV	$2,805,883	$2,745,054	$2,630,034	$2,689,898	$3,198,408	$3,234,655

The table above shows that on a uniform generation basis, (proposal #4) and (PROPOSAL #5) offer the highest capacity factor, the lowest cost per kWh generated, the lowest resulting system cost, and accordingly the shortest break-even period.

A primary finding of our study is that (proposal #4) and (PROPOSAL #5) offer superior value to (company name removed).

Table 4: IMPOSED PARAMETERS	
Tax Rate	40%
Sys Degradation	0.70%
Electric rate increase	5%

Discount rate	6%

Our conclusion reached is therefore that (proposal #4) and (proposal #5) offer the best

- Capacity Factor
- Cost per Annual kWh Generated
- System Cost, and
- Break-even period.

Thus, when only considering financial factors, these two bidders appear to provide the best value for (company name removed).

V. CONCLUSION

Our challenge in performing this analysis was determining which bidder provided the best value despite varying assumptions, system sizes, and project costs. Each bidder provided different values for annual generation ("what you get") and total system cost ("what you pay"). To compare the proposals, we standardized annual generation so as to enable a meaningful price comparison.

After standardizing the systems by uniform annual generation, the two top performers in terms of price were (proposal #4) and (proposal #5). The adjusted cost for each company was more than $1 million less than the next closest competitor. Note that our approach is "technology neutral," meaning without consideration for **how** a bidder achieved higher value than their competitors. Without performing a full technical assessment, it is the conclusion of this report than both (PROPOSAL #4) and (PROPOSAL #5)-devised systems that are likely to provide superior value and we note that they each provided an approach which was substantially different than their competitors (see Table 1).

The break-even periods for both (proposal #4) and (proposal #5) were near 4.8 years. Under the same assumptions, the next nearest competitor had a break-even period of 5.5 years, further confirming our findings.

Two metrics useful in comparing solar investments to other investments are Internal Rate of Return (IRR) and Net Present Value (NPV). Pretax IRR at 10 years for both (proposal #4) and (proposal #5) are over 22%, making them very profitable investments compared to standard financial instruments. Calculated under the same conditions, the IRR for other proposals was near 18.5%. Net present values for both (proposal #4) and (proposal #5) are over $3 million.

This report therefore concludes that through financial analysis based purely on data in the bidder proposals, (proposal #4) and (proposal #5) offer (company name removed) the best values.

V. DISCLAIMER

This report was produced to the best of the abilities of New Jersey Solar Consulting, LLC, and with materials available at time of writing. No warrantee of any kind is expressed or implied. We recommend all aspects of a PV system be considered before coming to a purchasing conclusion, and that consultation with accountants and other professionals may provide additional information worthy of consideration. Our work is not intended to be definitive, but instead to provide information with which to aid in the decision making process. Finally, we are human, and cannot be held responsible for errors or omissions, though we will correct our work if any mistakes are identified.

VI. SOURCES

[1]American Recovery and Reinvestment Act of 2009, S.350, 111th Cong., 1st Sess. (2009)

[2]Economic Stimulus Act of 2008, H.R.5140, 110th Cong., 1st Sess. (2008)