FEASIBILITY ANALYSIS

FOR PROPOSED PV SYSTEM FOR (CLIENT NAME REMOVED), CLAYTON NJ

PERFORMED BY NEW JERSEY SOLAR CONSULTING

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1. INTRODUCTION

The purpose of this feasibility study is to examine the costs, practicality, and likely outcome of a solar photovoltaic (PV) installation at (Client Name Removed), LLC of Clayton, NJ. The report addresses the following concerns:

1. The suitability of the proposed sites for solar PV
2. The suitability of the proposed structures intended to house the system
3. The approximate system size recommended for the application
4. A cost estimate for such a system
5. An explanation of financial considerations
6. A financial projection of return on investment for the system purchase

The studies in this report were were made independently and then compared with the proposal of (Installer Name Removed), the installer being considered by (Client Name Removed). Where significant differences appear, this report highlights those differences and attempts to explain their origins. In the conclusion, recommendations and a summary judgment is rendered.

2. BACKGROUND

(Client Name Removed), owned by Ms. Michelle Doyle (hereafter referred to as “the owner”), is interested in installing a PV system at (address removed) in Clayton, NJ. The system is to be placed upon the roofs of two buildings yet to be built. These structures are referred to in this report as the “storage building” and the “retail building.”

A 50kW PV system has been proposed by an installer, (Installer Name Removed), Inc.. New Jersey Solar Consulting was in contact with (Installer Name Removed) during the evaluation of the solar installation project, and this report reflects the understanding of (Installer Name Removed)’s proposal as of 22 July 2009.

The owner has indicated interest in applying for a U.S. Department of Agriculture REAP Grant. It is our understanding that this independent feasibility proposal will be used to satisfy an application requirement for the grant.

Arial View – From left to right, not the three yellow pins. A) Proposed PV location 1, "Storage Barn." B) "Existing Electric Meter." C) Proposed PV location 2, "Retail Area." The two locations will have new structures, each of which feed an electric meter at the location of the existing meter (which will be replaced by the utility company to install a "net meter.").

3. SITE ANALYSIS

3.1. <u>Shading</u>

During a site visit, New Jersey Solar Consulting performed a Solar Pathfinder shading analysis for the both proposed building sites. Both sites had excellent solar resources, with shading at the fringes of daylight hours. In our judgment, site efficiency at both locations after shading is 93-97%.

(Installer Name Removed) likewise performed a Solar Pathfinder analysis, and also came to the conclusion that the proposed sites have excellent solar resources.

Storage Barn

Retail Location

The above Solar Pathfinder images show nearly perfect solar radiation at each of the proposed construction locations. How can you tell? The device has a plastic dome which sits above latitude specific graph paper. Reflections from nearby objects would obstruct the graph paper if they existed. The Retail Location has a tiny amount of shading which will occur after 7:00 in the summer, as shown by the dark area on the right of the device. Notwithstanding, both locations are nearly perfect for solar PV.

3.2. Panel Orientation

The proposed azimuth of both buildings is 149.8 degrees. That is, the buildings will face about 30 degrees east of due south. (This was calculated from true south, not magnetic south, which is off by nearly 13 degrees). Though not optimal in their orientation, it is the opinion of this report that the proposed positioning of these buildings is suitable for solar.

3.3. Panel Inclination

Ideal roof inclination for a PV system is usually equal to the latitude of the site. At the proposed site, this is 39.65 degrees. The roof inclination for the proposed storage building is 18.4 degrees and for the proposed retail building is 26.5 degrees. The mounting system proposed will place the panels at the same angle as the roof on which it rests. As with panel orientation, this deviation from the ideal reduces total system output to a degree, and accounted for in the system output calculations.

3.4. Rooftop physical assessments

The proposed rooftops have a total area of 4,403 ft^2 suitable for solar (i.e. facing south). In regard to total area, this should be sufficient, but (Installer Name Removed) has yet to propose a panel layout, so final layout should be confirmed. The total area of the proposed system is 3755 ft^2. (See section 4.2. for more details on system physical characteristics.)

The proposed retail building has a two-tier roof design. If (Installer Name Removed)'s panel layout includes panels on the lower roof, as we anticipate, the owner and system manager should be conscious of any shading issues that arise on the small lower section. Note that partial system shading can affect the whole system's output. We doubt this will become an issue, but (Installer Name Removed)'s panel layout diagram (which was unavailable at time of writing) should be checked for this point.

4. ANTICIPATED SYSTEM INFORMATION

4.1. System sizing

The owner's electrical usage from April 2008 until April 2009 was 48,341kWh. To meet this demand, a PV system sited on his property would be sized at 40.8kW.

However, the owner plans to put an additional 30hp (22.37kW) pump into service. The owner will use this pump 12 hours per day for five months of the year. By our calculations, this adds 40,266kWh to the owner's annual electricity demand. The energy analysis conducted by (Installer Name Removed) reaches a similar estimate for additional load from the pump. We therefore expect total demand to exceed 80,000kWh. For reference, a PV system generating 80,000kWh annually would be roughly 70kW.

However, the State of New Jersey caps the system size eligible for a solar rebate at 50kW, and therefore (Installer Name Removed) has sized the system according to that constraint. Space and owner budget limitations may also have played a role in this sizing decision. Additional PV installations can be considered at a future time if so desired.

4.2. System Weight Considerations

The weight of a single panel of the proposed system is 37 lbs. The weight density of the proposed system is 2.46 lbs per ft^2. As a reference, one foot of snow (equivalent to about one inch of water) weighs around 5 lbs per ft^2.[2] That is to say that pitched roof mounted PV systems generally do not impose a large burden on a building's structure. However, the two proposed buildings do need to be checked for their ability to bear the additional load, and a structural engineering report will be necessary to satisfy building officials. In addition to the sheer load, a means of attachment must be specified by the structural engineer such that the load is distributed between supporting members.

Structural analysis of the proposed buildings and recommendations if any is beyond the scope of this study but could be provided additionally by New Jersey Solar Consulting.

4.3. Cost

NJ Clean Homes cites $8-$10 per installed watt of solar as typical for residential installations.[3] The US Department of Energy found the average installed cost from 2006-2007 in New Jersey to be $8.10 per watt.[4] Larger installations enjoy lower fixed costs per watt, so they generally cost less. A 50kW system at $8 per watt would cost $400,000.

The price quoted by (Installer Name Removed) for their proposed system is $361,160, or $7.22 per watt. It is this report's opinion that this price is competitive with market rates.

5. FINANCIAL PROJECTIONS

The financial projections provided below assume no USDA REAP Grant. It is included in the Summary of Incentives, but has been excluded in the calculations. In their proposal (Installer Name Removed) does the same.

5.1. Summary of incentives

5.1.1. NJCEP rebate

PV systems installed in the State of New Jersey are eligible for a rebate through the New Jersey Clean Energy Program (NJCEP). The rebate is based on the rated DC capacity of the system. For non-residential systems between 10kW and 50kW, the rebate is $1.00 per watt. The 50kW system proposed is therefore eligible for **$50,000** in New Jersey rebates. This rebate should be reported as taxable income by the recipient. Please contact a tax professional for advice on taxes. [3]

5.1.2. 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. The ITC is applied before any state rebates are accepted, so the credit is for 30% of the entire initial system cost. For the proposed $361,160 system, the tax credit is therefore **$108,348**. Commercial systems are eligible for a 30% grant in place of the tax credit.[6]

5.1.3. 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*. [6,7]

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. This basis is calculated after any state rebates. The basis for depreciation for the proposed system is therefore $256,986. Over the first six years after the system is placed into service, the owner can expect to enjoy **$89,945** in effective federal tax benefits.

5.1.4. USDA REAP Grant

A final source of government incentive is the U.S. Department of Agriculture's Rural Energy for America Program (REAP). REAP promotes energy efficiency and renewable energy for agricultural producers and rural small businesses through several avenues, one of which is the distribution of grants for renewable energy systems.

These incentives are available to agricultural producers and rural small businesses to purchase renewable energy systems, and are set at 25% of the total cost before other incentives. For our proposed system, this could be worth **$90,290**.[8]

5.2. Initial system cost after incentives

The table below describes the value of the incentives for comparison with the initial cost of the system.

Initial Cost	**$361,160**
NJ Rebate	
Rebate per watt	$1.00
Net NJ rebate revenue	**$50,000**
Federal Tax Credit	
Tax credit rate	30%
Total tax credit	**$108,348**
MACRS	
Initial depreciation basis	$256,986
Lifetime effective value	**$89,945**
USDA REAP Grant (Pending)	
Grant rate	25%
Total grant	**$90,290**

The cost of the proposed system after government incentives (excluding the REAP grant) and taxes **$130,367**. The MACRS is dispersed over six years; the owner will receive $53,967 in tax benefits the first year, and $35,978 over the course of the next five years.

The sole discrepancy between the numbers presented here and those presented in (Installer Name Removed)'s proposal occurs in the treatment of the MACRS. The proposal seems to treat the entire first-year bonus depreciation ($128,493) as a tax credit, while in fact it is only a tax deduction, therefore worth 65% less given the owner's tax bracket. The owner's accountant should be aware that the effective first-year depreciation value, including depreciation from the standard schedule, is $53,967, 60% of the total MACRS benefits.

The New Jersey State Gross Income Tax Act was amended in 2004 by P.L.2004 to decouple New Jersey depreciation from federal MACRS. Assuming a state income tax rate of 9%, the owner will also achieve state depreciation benefits of $2,250.[5]

5.3. <u>SREC Analysis</u>

The majority of the anticipated revenue stream derived from a PV system comes from the sale of Solar Renewable Energy Credits (SRECs). A clear understanding of the role SRECs play in solar finance is essential to the profitable management of a PV system in New Jersey.

5.3.1. Introduction to SRECs

A Solar Renewable Energy Credit (SREC) is a tradable certificate that represents the clean energy benefits of 1MWh of electricity generated from a solar energy system. The Board of Public Utilities (BPU) verifies the generation of solar electricity and awards SRECs accordingly. SRECs are traded on a market that enables individuals and institutions to invest in clean energy efficiently. A PV system produces SRECs for the first 15 years of its useful life, after which the State awards standard Renewable Energy Credits instead, which are worth significantly less.

The SREC market is driven primarily by electricity suppliers who are required to purchase SRECs annually under New Jersey's Renewable Portfolio Standard (RPS). By purchasing SRECs, utilities can support clean energy without actually owning renewable energy systems.

5.3.2. Anticipated SREC Price

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. Efforts have been made to secure SREC price, but uncertainty in the market means investors are hesitant to accept offers of terms longer than 3-4 years.

In addition to the forces of supply and demand, the price of SRECs is largely determined by the level of the Solar Alternative Compliance Payment (SACP) for the New Jersey RPS. The SACP is the minimum payment per MWh suppliers must pay if they fail to obtain SRECs sufficient to cover their RPS obligation. In this way, the SACP acts as a ceiling for SREC prices. The SACP schedule for the next eight years is as follows:

SACP, per MWh	
2008-2009	$711
2009-2010	$693
2010-2011	$675
2011-2012	$658
2012-2013	$641
2013-2014	$625
2014-2015	$609
2015-2016	$594

After these eight years, the BPU will reassess the program and set a new schedule for the SACP.[9]

Over this time period the SACP decreases, and SREC prices are likely to decrease accordingly. While the price is currently higher, many analysts use a price of $475 per MWh in their solar financial projections. This may be based on the PSEG loan program, which will guarantee borrowers a price of $475 for ten years. The calculations of (Installer Name Removed) and the calculations found in this report both use this figure.

5.3.3. Projected SREC revenue

The proposed system is projected to produce over 54 SRECs annually. At an average price of $475 each, which would generate **$25,650** revenue per year.

For the purposes of presenting a conservative financial analysis, this report assumes SREC revenue to be taxable like any comparable source of income. Our calculations apply a 44% tax rate (35% federal, 9% state) to SREC revenues. This is one major difference between the financial analysis presented here, and that provided by (Installer Name Removed).

After taxes, therefore, annual SREC revenue is expected to be **$14,364**. (Installer Name Removed) projects revenue, excluding any taxes, to be $25,861.

5.4. Energy savings

The system is designed to produce 54,932kWh annually. The average price per kWh the owner paid between April, 2008 and April, 2009 was $0.172. If 5% is taken as a conservative annual rate of increase for electricity prices, the price for the first year of operation may be around $0.181 per kWh.

Based on a projected price for electricity and 54,932 kWh saved in the first year, we project first year energy savings to be **$9,960**. If purchased from a utility, this purchase would be counted as a business expense, and the resulting tax deduction would be worth $4,382. Therefore, the effective energy savings from the first year are **$5,577**.

(Installer Name Removed)'s proposal projects savings in 2010 to be $5,592. This calculation likely assumes a 7% rate of inflation for electricity.

5.5. Annual financial projections

Please refer to table below, which outlines our projections both with and without making use of the REAP grant.

Our projections to those presented by (Installer Name Removed) mainly in the treatment of taxation. Neither New Jersey Solar Consulting nor (Installer Name Removed) are tax professionals. We have presented our understanding of the taxes the owner is likely to incur. The areas in which our projections differ from (Installer Name Removed) are:

- Treatment of depreciation benefits: We view the federal depreciation benefit as a deduction rather than a credit. Its value to the owner is therefore worth 35% of the post-incentive basis. (Installer Name Removed) views the entire value of the basis in the owner's benefit.
- Taxation of SRECs: We apply a 44% tax to SREC revenues, while (Installer Name Removed) does not.

There is accordingly a large disparity between our calculated payback period and that of (Installer Name Removed). We calculate a payback period of 6.7 years, while (Installer Name Removed) projects a payback period of roughly 3.7 years.

Our total projected SREC revenue over the life of the system is $349,133 before taxes. (Installer Name Removed) predicts $367,955. This may be because our model incorporates a higher rate of system degradation.

The financial projections below include the purchase of two inverters in year ten, the year the inverter warranty expires. We assume a total cost of $40,000. Inverter prices are falling, so it is difficult to project prices ten years into the future.   However it is important to consider an expenditure of this magnitude near the tenth year of service. The owner will presumably deduct cost this from his tax return, making the net cost after taxes $22,400. It is unclear whether (Installer Name Removed) accounts for this cost, but the increase in Cumulative Out of Pocket Cash Flow is relatively constant, indicating their proposal may exclude it.

The costs presented below ($202,812 without REAP Grant, $112,522 with REAP Grant) differ from the $130,367 offered in section 5.2 because the latter includes the MACRS. The table below distributes the MACRS over the first six years of system life.

Initial Cost	($361,160)
Federal ITC	$108,348
NJ Rebate (after taxes)	$32,500
REAP Grant	$90,290
Price after upfront incentives, no REAP Grant	($220,312)
Price after upfront incentives, with REAP Grant	($130,022)

Projections for the first 15 years of system life

Yr	Generation (kWh)	Projected Price of Electricity ($ per kWh)	Effective Utility Savings	Projected SREC Price	SRECs produced	After-tax SREC Revenue	MACRS	Maintenance	Net profit after taxes, no REAP Grant	Net profit after taxes, with REAP Grant
0									($220,312)	($130,022)
1	54932	$0.18	$5,578	$475	54.9	$14,612	$53,967	($1,500)	($147,655)	($57,365)
2	54547	$0.19	$5,816	$475	54.5	$14,510	$14,391	($1,500)	($114,438)	($24,148)
3	54166	$0.20	$6,064	$475	54.2	$14,408	$8,635	($1,500)	($86,831)	$3,459
4	53786	$0.21	$6,322	$475	53.8	$14,307	$5,181	($1,500)	($62,521)	$27,769
5	53410	$0.22	$6,592	$475	53.4	$14,207	$5,181	($1,500)	($38,041)	$52,249
6	53036	$0.23	$6,873	$475	53	$14,108	$2,590	($1,500)	($15,970)	$74,320
7	52665	$0.24	$7,166	$475	52.7	$14,009	$0	($1,500)	$3,705	$93,995
8	52296	$0.26	$7,472	$475	52.3	$13,911	$0	($1,500)	$23,588	$113,878
9	51930	$0.27	$7,791	$475	51.9	$13,813	$0	($1,500)	$43,692	$133,982
10	51567	$0.28	$8,123	$475	51.6	$13,717	$0	($22,400)	$43,132	$133,422
11	51206	$0.30	$8,470	$475	51.2	$13,621	$0	($1,500)	$63,723	$154,013
12	50847	$0.31	$8,831	$475	50.8	$13,525	$0	($1,500)	$84,579	$174,869
13	50491	$0.33	$9,207	$475	50.5	$13,431	$0	($1,500)	$105,717	$196,007
14	50138	$0.34	$9,600	$475	50.1	$13,337	$0	($1,500)	$127,154	$217,444
15	49787	$0.36	$10,010	$475	49.8	$13,243	$0	($1,500)	$148,907	$239,197

6. CONCLUSIONS

PV systems in New Jersey enjoy strong state financial incentives and generally make sound financial sense. The proposed system herein is no exception. The owner can expect the system to pay for itself within six years even without the REAP grant, and after only three years with. At that point much of his electric utility bill will be paid for and she will enjoy an SREC revenue stream which will render a profit beyond savings. This is all the case with our more conservative treatment of MACRS as described above. If tax treatment of MACRS does, in fact, turn out to be as (Installer Name Removed) describes, indeed return on investment will be accelerated.

Since the owner proposes to construct new buildings the orientation of these buildings could be placed at other than the 30 degree deviation from true south, or a compromise thereto. If she chooses to do so a further improvement in system output will result, increasing her revenue stream from sale of SRECs and further covering her surplus electric bill considering installation of her new pumps.

Structural considerations obviously warrant investigation and are probably required by local building officials. They are generally not an issue with new construction, but were not investigated in this report.

7. 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. Payment for this report signifies acceptance of these terms. As usual and customary, we recommend consultation with your accountant and attorney before deciding if the proposed system described is right for you. Our work is not intended to be definitive, but instead to provide information with which to aid in the decision making process.

7. SOURCES

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[2]National Ag Safety Database, “Snow, Ice Raise Concerns About Excessive Roof Loads on Farm Buildings,” http://www.nasdonline.org/docs/d001201-d001300/d001299/d001299.html

[3]New Jersey Clean Energy Program, “Costs, Incentives, Savings,” http://www.njcleanenergy.com/renewable-energy/technologies/solar/costs-incentives-and-savings/costs-incentives-and-savings

[4]Science Daily, “Cost Of Installed Solar Photovoltaic Systems Drops Significantly Over The Last Decade,” http://www.sciencedaily.com/releases/2009/02/090219152130.htm

[5]New Jersey Department of the Treasury, “Gross Income Tax Depreciation Adjustment Worksheet GIT-DEP,” http://www.state.nj.us/treasury/taxation/index.shtml

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

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

[8]United States Department of Agriculture, “Rural Energy For America Program Grants/Renewable Energy Systems/Energy Efficiency Improvement Program,” http://www.rurdev.usda.gov/rbs/busp/9006grant.htm

[9]Database of State Incentives for Renewable Energy, “New Jersey Incentives/Policies for Renewables & Efficiency,” http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NJ05R&re=1&ee=1