office of energy security
Minnesota Department of Commerce

Assessing the Feasibility of Third Party Owned Solar Photovoltaic Installations in Minnesota Schools

A Report to the Legislature Prepared by the Minnesota Department of Commerce Office of Energy Security as required by Minnesota Laws 2009, Chapter 37, Section 12

December 20, 2010

Mayo High School 5.8 kW PV system. Photo credit: Minnesota Student Energy Project

The Office of Energy Security wishes to thank the following participants who volunteered their time and knowledge in the stakeholder meeting and those who were interviewed as part of this report:

Bruce Dickinson..... Chevron Energy Solutions
Chris Kubesh..... Minnesota Department of Education
David Sand..... David Sand Solar
Dean Talbott..... Minnesota Power
Diane Moeller .....Kennedy Elementary School
Eric Pasi .....Innovative Power Systems
Gerardo Ruiz.....Freener-g
James Darabi.....Solar Farm
John Bulger ..... Minnesota Department of Education
John Cimino.....Milpitas Unified School District
John Jaffray.....JJR Power
Kelly Brosseth.....Killmer Electric Co. Inc
Kerinia Cusick ..... SunEdison
Kevin Johnson..... Redwing Public Schools
Mouli Vaidyanathan.....Mouli Engineering, Inc.
Patrick Santelli ..... Minnesota Schools Cutting Carbon
Peggy Knapp..... Hamline College
Rachel McLaughlin..... SunEdison
Ralph Jacobson ..... Minnesota Renewable Energy Society
Steve Adamo..... San José Unified School District
Wayne Yust.....Cambridge School District

OES would also like to acknowledge Jason Coughlin of the National Renewable Energy Laboratory for sharing his expertise during the compilation of this report.

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This report was prepared pursuant to *Laws of Minnesota 2009, Chapter 37. Section 12*, which directs the Office of Energy Security (OES) to examine the technical and economic feasibility of third party owned solar photovoltaic (PV) installations in public schools and the potential of such installations to reduce carbon dioxide emissions and provide savings to schools. In preparing this report, the Office of Energy Security consulted with stakeholders, including representatives from the Minnesota Department of Education, school districts, solar businesses, utilities, and nonprofit organizations. Interviews were conducted with experts nationwide who have experience with third party owned PV projects.

Based on the information obtained from literature reviews and discussions with industry experts and stakeholders, third party ownership model appears to be technically feasible but not economically feasible at present for Minnesota schools. Three common economic considerations that help determine the viability of a third party financed PV project were identified by schools that have completed or are considering this model:

- Schools must have little or no up-front cost.
- The cost of electricity under the third party PPA must be no greater than what schools currently pay for electricity.
- Electricity prices under a long-term PPA should be fixed or increase at a rate less than retail electricity rates, or never increase if a fixed price contract can be negotiated.

Electricity prices typically paid by Minnesota schools are low relative to the cost of solar electricity. While the third party ownership model is technically feasible and allows school districts to derive some value from federal tax incentives, it is not currently cost-competitive in Minnesota unless subsidized. Most school districts would not save money by entering into a solar power purchase agreement with a third party owner.

II. INTRODUCTION

In 2009, the Minnesota state legislature requested that the Office of Energy Security (OES) evaluate the feasibility of using third party financing to install photovoltaic (PV) systems on school buildings across the state:

> ***Laws 2009 Chapter 37***
> *Sec. 12. BULK INSTALLATION OF SOLAR PHOTOVOLTAIC PANELS ON SCHOOL BUILDINGS; FEASIBILITY STUDY AND REPORT.*
>
> *The director of the Office of Energy Security, in consultation with the commissioner of education, schools, school districts, and solar industry experts, must study the economic and technical feasibility of bulk installation of solar photovoltaic panels on school buildings in this state. The study must use a power-purchase agreement model in which a private company would pay for, install, and own the solar photovoltaic panels. No later than January 15, 2010, the director of*

the Office of Energy Security must report the results of the feasibility study, including whether the proposed model would reduce carbon emissions and result in savings to school districts, to the chairs and ranking minority members of the house of representatives and senate committees with jurisdiction over energy policy and finance.

In fulfilling this legislative mandate, OES met with representatives from the Minnesota Department of Education, school districts, schools, solar installers, and nonprofit organizations. Additionally, OES interviewed a number of solar experts nationwide who have direct experience with this business model. These experts represented entities such as SunEdison, Chevron Energy Services, and the National Renewable Energy Laboratory (NREL). SunEdison is North America's largest solar services provider. Chevron Energy Services is a national leader in clean energy development. Both companies have direct experience with third party ownership agreements for large scale PV projects for school districts: SunEdison with Montgomery County, Maryland, Alamosa, Colorado, and Anderson Union High School District in California; and Chevron Energy Services in San José and Milpitas, California. NREL is one of the U.S. Department of Energy's national laboratories and a partner with OES to the Twin Cities Solar America Cities team.

III. OVERVIEW OF THE THIRD PARTY PPA PROCESS

Third party financing of large PV systems is typically used by non-taxed entities that cannot benefit from federal tax incentives if they directly own a system. In addition, under a solar Power Purchase Agreement (PPA), one party (the host) can obtain a solar PV system on-site without the high up-front costs and project complexities that make solar projects difficult to implement. Under the terms of a solar PPA, the second party owns, operates, and maintains the PV system and sells 100% of the solar electricity produced to the host at a contracted price for a term of 20-25 years.[1] Federal solar tax incentives available to businesses can offset 50% or more of the installed cost of a PV system.[2] The developer qualifies for these incentives and passes a portion of the savings on to the host through the PPA. As a result, the third party ownership model can be a cost effective arrangement for many entities with no up-front capital investment required. There are often options to purchase the system after six years or at the end of the contract term.[3]

[1] Conversation with a solar developer. Dec 2009.
[2] Financing Non-Residential Photovoltaic Projects: Options and Implications. Lawrence Berkeley National Laboratory. Bolinger, M. January 2009. http://eetd.lbl.gov/ea/EMS/reports/lbnl-1410e.pdf
[3] Conversation with Jason Coughlin, National Renewable Energy Laboratory. Dec 2009.

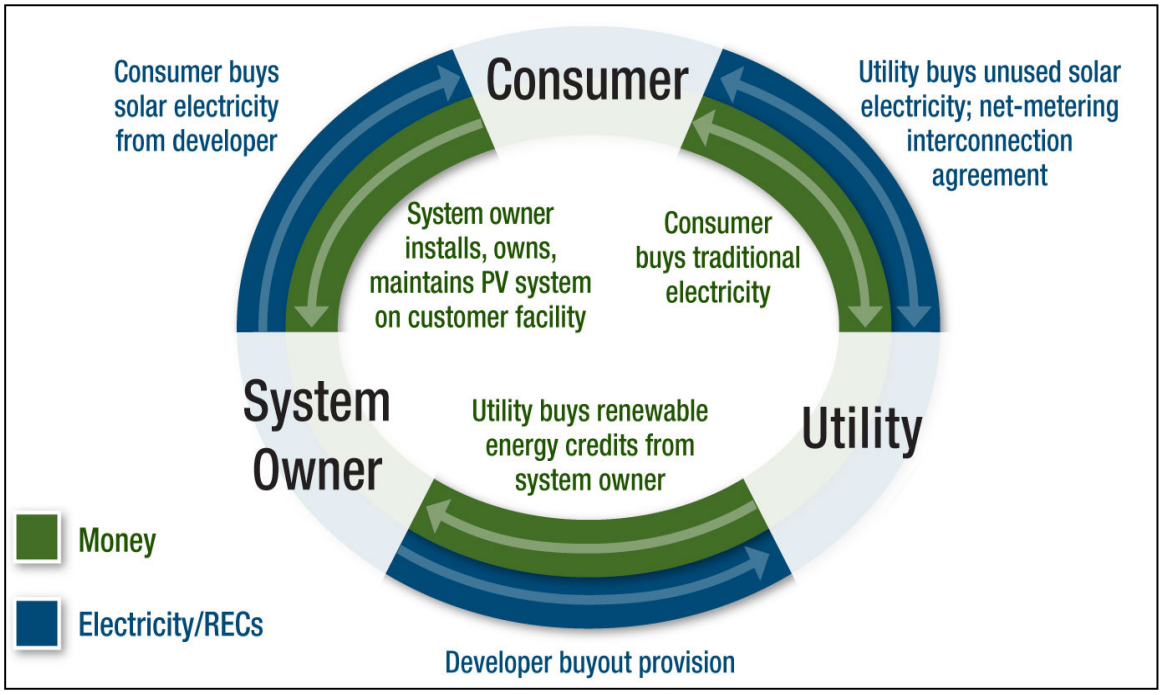


Figure 1. In the above figure, the system owner is the developer; the consumer is the host. This report discusses the considerations of using the above model with a school serving as the consumer or host. NREL 2008.

A. Advantages and Disadvantages of the Third Party PPA Model for Solar

There are both benefits and disadvantages associated with third party ownership models and solar PPAs.[4] Some of the commonly recognized benefits include:

- **Federal Investment Tax Credit:** The "Energy Improvement and Extension Act of 2008," signed into law on October 3, 2008, includes an eight year extension of the 30% residential and business Investment Tax Credit for solar systems. Third party ownership models introduce a tax paying entity, allowing the host to indirectly benefit from the federal investment tax credits, which significantly reduce the cost of a PV system.
- **Federal Modified Accelerated Cost Recovery System (MACRS):** The IRS allows taxed entities to use a five year accelerated depreciation schedule for qualified assets of a solar installation, thus reducing income subject to taxation in the early years of a project.
- **No or low up-front costs:** The initial investment costs for PV systems can be substantial. In third party ownership models, the system owner is responsible for these investments. As a result, the host as no upfront capital cost (although other transaction costs such as legal fees must be taken into account)..
- **Predictable electricity prices for 20 to 25 years:** Under the PPA, the host knows at the outset of the transaction the price it will pay for electricity over the life of the

[4] Cory, K., J. Coughlin, and C. Coggeshall. Solar Photovoltaic Financing: Deployment on Public Property by State and Local Governments. May 2008. http://www.nrel.gov/docs/fy08osti/43115.pdf

contract. The price may escalate at a specified rate or may be fixed for the life of the contract.

- **Operation and maintenance responsibility is handled by the system owner:** The system owner operates and maintains the PV system, removing this burden from the host.
- **Buyout option provides ownership potential: In the PPA,** there will likely be the option for the host to purchase the system either after some fixed period of time (6 years) as well as at the end of the transaction..
- **Production risk:** The host only pays for the electricity that is generated by the PV system. It is common to have minimum production guarantees in a PPA.

Disadvantages of third party ownership can include:

- **Ownership of the "clean" energy attributes: In that the host is not the owner of the PV system, it must expressly agree to purchase the** Solar Renewable Energy Certificate credits (SRECs) from the system owner if it wishes to make certain claims about the system such as being "solar powered" or using "clean energy". If the host chooses against purchasing the SRECs, the appropriate language to use is that the school is "hosting a PV system"..
- **Granting on-going access to site:** Ongoing site access is necessary to maintain the installed solar panels. In some cases, maintenance staff may not be comfortable with a third party accessing the facility.
- **Transaction costs:** There are transaction costs associated with drafting the PPA and associated documents which are borne by the host. The time commitment is significant during the negotiation phase of the project.
- **Contractual issues:** Contractual issues can occur since most local and state governments approve funding for operating obligations on a yearly basis rather than for the full duration of the long-term PPA. The discussion of whether or not signing a PPA constitutes a long term debt obligation is common. However, those concerns can often be addressed through specific contractual clauses (e.g. non-appropriation and non-substitution clauses.)

B. Regulatory Issues of the Third Party PPA Model for Solar

In some states, third party ownership of solar PV projects has been challenged.[5] These challenges have focused on if and how federal and state utility regulations apply to such projects. In November 2009, the Federal Energy Regulatory Commission (FERC) issued a declaratory order stating that sales by a developer of on-site solar generating projects (PPA provider) to end-use customers do not constitute the sale or transmission of electric energy under FERC's control.[6] It is possible that other federal and state regulatory issues exist that could affect the viability of third party projects in Minnesota.

[5] "Solar PV Project Financing: Regulatory and Legislative Challenges for Third-Party PPA System Owners." National Renewable Energy Laboratory. Kollins, K, K. Cory, and B. Speer. 2010. http://www.nrel.gov/docs/fy10osti/46723.pdf

[6] Federal Energy Regulatory Commission. Declaratory Order. 129 FERC 61,146. Docket No. EL09-31-000

IV. THIRD PARTY OWNERSHIP OF SOLAR PV ON SCHOOLS

There are approximately 2,000 public schools in Minnesota's 336 independent school districts, three intermediate districts, five integration districts, 13 education districts, four tribal schools, 18 cooperative districts, and 153 charter schools.[7] Statewide, there are at least 11 public K-12 schools that have on-site PV systems. The typical PV system installed in Minnesota schools to date is between 1 and 10 kW in size, is owned by the school, and was made possible through a combination of grant(s), fundraising, and donated or reduced cost labor. The concept of third party ownership of solar for schools is distinctly different from the school PV projects done to date in Minnesota.

Table 1. Minnesota schools with solar PV systems.

School	System capacity	Year completed
Battle Creek Middle School	10 kW	1994
North Shore Community School, Duluth	2.67 kW	2005
Seward Neighborhood Group	1.1 kW	2005
Willmar Junior High	2.38 kW	2007
Cuyuna Range Elementary School	1.44 kW	2008
Kennedy Elementary School	5.6 kW	2008
Lake Superior School District, Two Harbors	2.8 kW	2008
ARTech High, Northfield	2.08 kW	2008
Mayo High School, Rochester	5.82 kW	2009
Cohasset Elementary School	2.88 kW	2009
Winona Senior High School	1.1 kW	2009
Chisago Lakes School District 2144	9.9 kW	2010
Harbor City International School, Duluth	Considering PV	
Becker High School	Considering PV	
Century High School	5.5 kW	2010
John Marshall High School	Considering PV	
Eden Valley High School	2 kW	2010

Table 2. Examples of how public schools in Minnesota funds PV projects[8]

School	System Size	Grants	State Rebate	Labor	Fundraising	Total Cost
Mayo High School	5.8 kW	8 grants/ $11,550	$13,100	$11,000 (Donated)	$6,350	$42,000
ARTech High, Northfield	2.1 kW	$10,000	$4,680	Donated	$9,620	$24,300

Using the third party PPA model, a school district could enter into an agreement with a solar developer in which the developer and its investors install, own, operate, and maintain a number of PV systems at schools within the district. The schools provide the space (under a no cost lease agreement or easement) and agree to buy 100% of the electricity generated by the PV system for a fixed price per kilowatt hour.

[7] Minnesota Education Statistics Summary 2008-2009. Minnesota Department of Education. http://education.state.mn.us/mdeprod/groups/InformationTech/documents/Report/015666.pdf

[8] Office of Energy Security solar data

In markets where this business model is used for K-12 schools, the developer sells electricity to the host school at a rate at or below the cost of electricity from the local electric utility.[9] As illustrated in the Case Studies section, there are examples of school districts in other states that have effectively used the third party ownership model to install significant amounts of PV on school buildings. This demonstrates the technical feasibility of the model. However, in the absence of state or utility subsidies, schools generally do not adopt the third party ownership model because monetizing federal tax incentives is not sufficient to make solar cost competitive.

Given the transaction costs associated with negotiating and signing a PPA, as well as the benefits of economies of scale, the third party financing model is most feasible with large scale projects. While the minimum capacity varies, in general, third party financiers have historically preferred projects with capacities of 250-500 kW minimum. For a school district, this means that a successful third party financed PPA project will likely involve PV systems at a few different schools within a single district which, when aggregated, exceeds this threshold.

The research completed as part of this report identified three observations regarding schools and school districts considering hosting third party owned PV systems:

- **The price of solar electricity must be at or below the local utility's current retail rate for the school.** Schools that were interviewed both in Minnesota and elsewhere agreed that in order to gain approval for a third party owned PV system, the project must save the school money, and the savings must be realized immediately. While the terms of a PPA may be projected to save a school district money in the future by stabilizing electricity costs, this benefit is not adequate to move forward with a solar project that does not save the district money in the near term.

- **The third party owner must assume any financial risk associated with the PV project.** Schools are risk averse and would require that if a PV system did not meet expected performance standards, the school would not be financially liable for lost revenue or repair costs.

- **PV and energy related instruction in the school curriculum adds value, but is not the driving force behind implementing a project.** While curriculum development and delivery around an on-site PV system are viewed favorably, this attribute has negligible monetary value in determining the feasibility of a third party owned PV project. However, some recent changes to student standards may heighten interest in PV-related educational opportunities at the school such as a new requirement that all Minnesota high school students complete either a chemistry or physics course as part of their degree and that new science standards at high schools will require that students have some engineering coursework.[10]

[9] Conversation with a solar developer. Dec 2009.
[10] Prof. Peggy Knapp during stakeholder meeting. Jan 4, 2010.

V. MINNESOTA'S SOLAR ENVIRONMENT

As of January 2010, Minnesota ha6approximately 330 PV installations with a total installed capacity of 1.9 megawatts (MW). The average size PV system in Minnesota is 5 kW.[11] The largest system in the state is the recently commissioned 600 kW PV system at the Minneapolis Convention Center.

Incentives

In Minnesota, the state solar rebate is available to small businesses and residences. Schools are not eligible for the rebate program, but a limited amount of competitive funding will be available for schools and local governments to complete renewable energy projects in FY 2010.

Some utilities in Minnesota offer additional incentives. For example, Xcel Energy announced plans to launch a $2.25/watt incentive program in 2010 for systems up to 40 kW to purchase the solar RECs[12] and Minnesota Power offers $2/watt for PV systems up to 2 kW.[13] The Xcel Renewable Development Fund (RDF) has been a source for grants for innovative PV installations as well.[14] Finally, there are significant federal tax incentives available for residential and commercial solar installations.

Net metering

Net metering refers to an owner of a renewable energy generation system exporting excess electricity back on to the grid and receiving compensation from the utility for doing so. Some people visualize the concept as "spinning the meter backwards." Net metering caps set a limit on how large a renewable energy system can be and still receive credit for excess electricity generation. In Minnesota, the net metering cap is 40 kW.[15]

PV systems in Minnesota tend to be sized at or below 40 kW in order to align with net metering rules. If a solar consumer, such as a school, decided to install a PV system that exceeded the net metering limit, it may be prudent to size the planned peak electricity production from the PV system to be less than the baseload electricity demand at the site. That way, net metering limitations would not come into play as excess electricity is not generated.

VI. BARRIERS TO APPLYING THE THIRD PARTY PPA MODEL TO SCHOOL DISTRICTS IN MINNESOTA

In conversations with solar developers, a number of barriers were discussed which make a third party PPA finance model for PV on schools in Minnesota difficult. Solar developers indicate

---

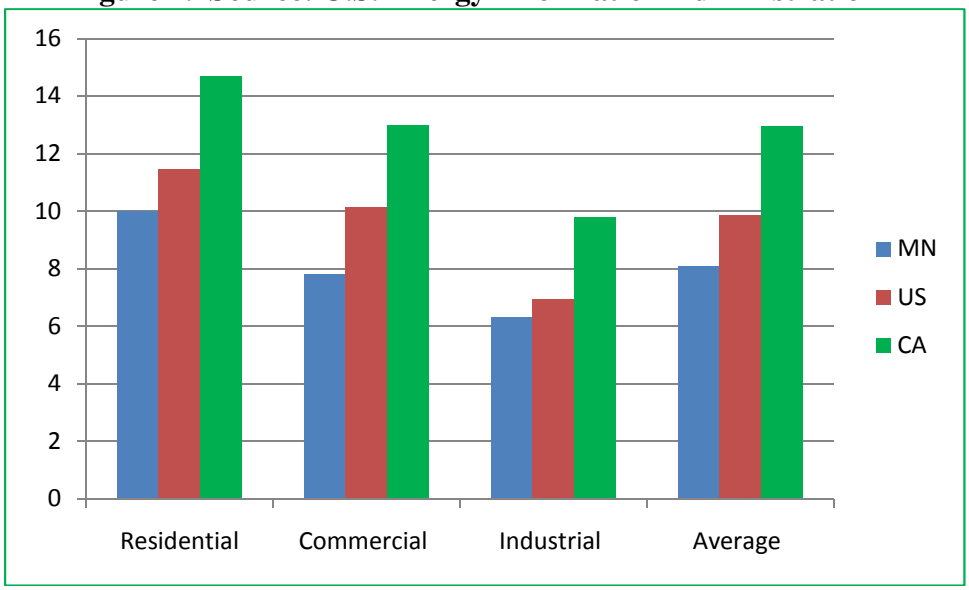
[11] Ibid.
[12] "Pending approval, Xcel to offer solar rebates in Minnesota." December 18, 2009. http://www.solarfeeds.com/getsolar/10356-pending-approval-xcel-to-offer-solar-rebates-in-minnesota.html
[13] Minnesota Power http://www.mnpower.com/powerofone/renewable_energy/solarsense/#rebates
[14] Xcel Energy Renewable Development Fund http://www.xcelenergy.com/Colorado/Company/Environment/Renewable%20Development%20Fund/Pages/RenewableDevelopmentFund.aspx
[15] Minn. Stat. § 216B.164. https://www.revisor.leg.state.mn.us/statutes/?id=216B.164

that they consider the following when determining the feasibility of entering into a third party ownership agreement with a school:

A. Electricity Prices

Electricity is relatively inexpensive in Minnesota as illustrated in Figure 2. The lower the electricity rate, the more difficult it is to competitively price a solar PPA. In addition, a critical factor in evaluating the economic benefit of a PV system is the composition of the monthly utility bill. In very general terms, if demand charges make up a significant percentage of the total bill, the economic value of the PV system is reduced.[16] Without energy storage or investments in energy efficiency to permanently lower the building's maximum load, simply installing a PV system on a school will not likely lower the monthly demand charges, given that cloud cover on one particular day can dictate the level of the demand charge for the entire month.

Figure 2. Source: U.S. Energy Information Administration[17]



B. Net Metering

Net metering policy is a factor in the economic feasibility of larger PV systems of a scale that might be installed at schools using a third party ownership model. PPA-financed PV projects completed at schools in the U.S. lend themselves to large-scale installations.[18] Installing large-scale PV systems without a net metering agreement with the local utility puts the host school district at risk given that the school must pay for 100% of the electricity generated by a third

[16] Rate Analysis of Two Photovoltaic Systems in San Diego. Doris, E., O. VanGeet, and S. Ong. July 2009. NREL. http://www.nrel.gov/docs/fy09osti/43537.pdf

[17] Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html

[18] Tracking the Sun II. The Installed Cost of Photovoltaics in the U.S. 1998-2008. Lawrence Berkeley National Laboratory. Wiser, et. al. October 2009. http://eetd.lbl.gov/ea/EMS/reports/lbnl-2674e.pdf

party owned PV system, but would not receive credit from the utility for excess generation. This could be particularly problematic if electricity demand in the host school drops significantly in the summer or during weekends when school is not in session.

Theoretically, many 40 kW installations could be aggregated across a school district. However, the transaction costs of such a project increase significantly given that there are fixed costs associated with each installation, including permitting, interconnection, installation, maintenance, and system monitoring, as well as the economies of scale of certain system components such as the inverter (e.g. fewer larger inverters versus multiple small ones). As such, there remain barriers to third party solar owners/developers to establishing a competitive electricity price for schools. For additional information on this topic, see *Net Metering Policy Development in Minnesota: Overview of Trends in Nationwide Policy Development and Implications of Increasing the Eligible System Size Cap* prepared by NREL as part of the Solar America Cities program.[19]

C. Available Subsidies

In those states with an active third party ownership solar market, there are usually subsidies available to help lower the up-front investment cost in the form of an up-front, per watt payment or an on-going payment based on system production. Third party developers doing business elsewhere that have employed the third party ownership model for their PV projects cite the importance of incentives to implement successful third party owned PV projects. Incentives and minimal transaction costs were identified by stakeholders and other experts as a key to economic feasibility until the price of PV declines or the cost of retail electricity increases. In order to absorb transaction costs, developers prefer to focus on a few larger systems rather than many small systems, so they choose school districts with incentive programs that accommodate large scale projects. According to one developer, "Fixed costs are the same at 5 kW, 40 kW, and 200 kW" [20] which leads the developer to maximize system size in order to capture economies of scale.

D. Potential for School Closings

With state and local budgets constrained in the current economic climate, along with shifting demographics, school closings are a fact of life across the country. In that a PPA is a 10-25 year contract, schools slated for closure during that time period would not be the best candidates to host a PV system. While PPAs do address the issue of the possible need to move a system to a different site, the school district would be responsible for the costs of relocating the system as well as any forgone electricity production (both as a result of the move as well as if the replacement site was not as good as the original one).

[19] Doris, Elizabeth et al. Net Metering Policy Development in Minnesota: Overview of Trends in Nationwide Policy Development and Implications of Increasing the Eligible System Size Cap. NREL. October 2009. TK1006 .D67 2009. http://www.nrel.gov/docs/fy10osti/46670.pdf.
[20] Conversation with a solar developer. Dec 2009.

E. Roof Upgrades

Not all roofs are suitable to host a PV system. Roofs that are in need of repair or are slated for a replacement are not the best candidates for PV systems until that work has been done. Structural assessments have to be done as well to confirm that the roof can support the additional weight and stress of a PV system. If the best sites for solar happen to be those that need new or improved roofs, this near term capital expense must be budgeted for accordingly.

F. Financial Condition of School District and City/County

One of the developers we interviewed highlighted the importance of the school district's financial stability and credit rating (if it has one). The investors in these third party-financed transactions are concerned about counterparty credit risk. Such risk influences the cost of capital (and whether or not financing is available at all). Therefore, it stands to reason that a school district and the city or county within which it resides should be on solid financial footing, otherwise the high cost of capital may drive up the cost of electricity in the PPA to unacceptable levels.

VII. DESIGN AND ADMINISTRATION CONSIDERATIONS FOR IMPLEMENTING SOLAR PV PROJECTS USING A THIRD PARTY OWNERSHIP MODEL

If the aforementioned barriers can be addressed, based on the stakeholder meeting, interviews with industry experts and the case studies presented in the following section, then a general outline for how a third party finance model for schools in Minnesota can be developed. For instance, cost savings are often possible if a PV system is installed at the time a building is re-roofed. In Montgomery County, Maryland, future PV installations are planned around the district's re-roofing schedule.

For Minnesota school districts that decide to explore third party solar PPA agreements, some considerations are outlined below.

Energy Efficiency

As with any solar project, energy efficiency should be considered in the planning stages prior to installing a solar PV system. The return on a solar PV investment is maximized when the building/campus hosting the solar electricity is energy efficient. B3 Benchmarking is a building energy management system for public buildings in Minnesota including state, local government, and public school buildings.[21] School districts considering a PV project should utilize B3 to help manage buildings, improve building energy profile cost effectively, and monitor the improvements with tools that include reporting and graphing, baselines, and weather normalization. To date, 312 of Minnesota's 2,000 K-12 schools have registered with B3.[22] Schools should complete energy efficiency investments either prior to the PV installations or in combination with them.

[21] http://www.mnbenchmarking.com/

[22] Per email correspondence with Leo Steidel with The Weidt Group. Dec, 10 2009.

Site Selection and Analysis
Sites throughout the district should be identified that could host medium to large size systems in order to keep transaction costs as low as possible and facilitate the economies of scale associated with bigger installations. It is important to emphasize that the third party model becomes more difficult for a district that contemplates many small PV systems (e.g. 2-10 kW). A few larger PV installations are ideal with a total project size approaching 1 MW or more.

As illustrated in the following case studies, in addition to roof tops, ground mounted PV systems (either as stand-alone systems or parking/shade structures) can often provide the necessary scale for larger projects. Solar site assessments must be conducted at the proposed sites to ensure that all of the necessary elements are in place to install a PV system. These elements would include issues such as available roof space and roof condition, orientation and slope of the roof, electricity load at the proposed site and variability of this load throughout the year; the utility rate structure at the site with regards to demand charges and per kWh charges; and issues related to interconnection. Structural analysis will be required for roof top installations as will issues related to wind and snow loading for all of the proposed PV systems. This process of site selection and analysis can be performed by a qualified third party prior to contracting with the third party developer, or it can be part of the responsibilities of the solar developer chosen under the district's normal RFP process for capital projects.

Request for Proposals
While a single school may be a catalyst for an on-site third party owned PV system, it is the school district that will likely be the contractual party to the agreement with the developer/owner of the PV system. It is important to engage the district administration early in the project and for the school district to solicit interest from schools and to identify a few candidates to serve as host sites. The proposed host schools should have appropriate siting and a plan to include the solar project as part of the curriculum.

A request for proposals should be done competitively to invite the most cost-effective pricing for the schools. OES has some examples available of RFPs issued by public entities for third party owned solar from around the country.

Economic considerations
Three common economic considerations that help determine the success or failure of a third party financed PV project were identified by schools that have completed or are considering this model:

- The ability to have PV installed on school roofs with no up-front capital cost is attractive and in the current environment, realistically, the only way to accomplish it on a large-scale.
- The cost of electricity under the third party PPA must be equal to or less than what schools currently pay for electricity. In the current economic environment, paying more for electricity under a solar PPA than the retail electricity rate is not feasible.
- Predictable electricity prices under a long-term PPA should increase at a rate less than retail electricity rates, or never increase if a fixed price contract can be negotiated.

Contract Negotiation and Documentation Process
Once a solar developer is selected, the process of negotiating the legal documents can be time consuming, costly and complex. In San José, the process took 18 months from initial discussions with Chevron to breaking ground on the first PV installation. The PPA is negotiated and signed at the district level and, among other things, should address:

- System maintenance and performance measurement
- Production guarantee from the system owner
- Party responsible for the site assessments including structural engineering review and shading analysis
- Buy out options for the school district
- Easements or no cost leases for each site with the conditions by which the solar developer can access the sites during installation as well as during the life of the contract under a system maintenance, operations, and monitoring agreement

As noted in the case studies, the third party developer will be backed by investors who will own the systems and monetize the tax benefits and other financial incentives available for PV installations in the state. It is unlikely that the district itself will have much, if any, contact with the investors, but rather will work with the solar developer directly.

OES has an example of a third party owned solar PPA from San José School District in California. This public document is available by request for those interested in seeing the terms of a recent solar PPA agreement.[23]

Classroom Impact
While the economics of a third party financed PV program are cited as a requirement, the impact of an on-site solar project goes beyond the value of the renewable energy production. PV installations sited throughout a school district create an excellent platform to introduce energy issues to both students and teachers, providing hands-on experience for an issue that is traditionally given little attention in standard K-12 curriculums. Therefore, incorporating the PV systems into the science and/or math curriculums should be a key element in any district-wide solar program. As part of its Solar for Schools program, Austin Energy in Austin, Texas states that if PV education is to be part of the curriculum, it must be planned and intentional. It is such an important part of the program that the utility budgets funding annually for the purpose of:

- Curriculum development
- Data acquisition system with web access
- Training for facility staff
- Training for teachers
- Signage
- A ribbon cutting ceremony for participating schools.[24]

[23] Inquire with Stacy Miller at (651) 282-5091 or stacy.miller@state.mn.us
[24] Libbie, L. Austin Energy. Solar America Cities Presentation. Apr 2009.

VIII. CASE STUDIES

In researching the topic of using the third party finance model for installing PV on schools, four examples were found. School districts in San José, California, Milpitas, California, Denver, Colorado, and Montgomery County, Maryland, have all installed or are in the process of installing PV systems throughout their school districts using third party financing. Each project is described below. In addition to published material on the San José project, a representative of the school district involved in the initiative was interviewed for this report.

1. San José Unified School District (SJUSD) San José, California[25]

In 2007, Chevron Energy Services entered into a partnership with the San José Unified School District (SJUSD), a district of 32,000 students, to install solar panels on school buildings. The genesis of the project was the initiative of a local high school in the district that was interested in installing PV. From there, it became a district-wide effort. SJUSD had the following goals for the project:

- deliver general fund savings
- create education opportunities
- demonstrate environmental stewardship and leadership

In partnership with Bank of America, who financed and owns the PV installations, Chevron is installing a total of 5.5 megawatts of solar on 14 different sites across the district in three phases. Four high schools will host a total of 2 MW and the remaining 10 sites will host 3.5 MW. Many of the sites are shade structures on parking lots, whereas the remainder are roof top installations. Bank of America is capturing the tax incentives as well as $11 million in incentives from the California Solar Initiative (CSI) Program.[26] Energy efficiency investments are also an important component of the program. Chevron Energy Services is under contract to operate, monitor, and maintain the installations during the life of the PPA.

Solar energy is being incorporated into the district's science curriculum, and each of the 14 sites has an educational display which includes system monitoring and real time production information. The District expects to reduce energy costs by 30% during the life of the transaction (25 years) and save $25 million dollars. In addition, 100,000 metric tons of CO_2 will be avoided during this time frame.

Key design elements of the program are as follows:

- The District signed the PPA with the solar developer and is the party responsible for purchasing the solar electricity (rather than the individual schools.)

[25] Information for this section was obtained from the Chevron Energy Services website (http://www.chevronenergy.com/case_studies/sjusd.asp), and a SJUSD press release (http://www.naesco.org/resources/casestudies/documents/SJUSD-Solar-Press%20Release-final.pdf), and a 1/7/10 interview with a representative of the school district.

[26] California Solar Initiatives Rebate Program. http://www.gosolarcalifornia.org/csi/rebates.html

- The District negotiated an easement at each of the schools with a PV installation stipulating the conditions for third party access and operation.
- From initial discussions to the first installation, the process took 18 months.
- Much coordination of labor was necessary with the selected schools during the pre-construction and construction phases since the installations took place during the school year.
- There were a few neighbors at a school concerned about the aesthetics of the solar installation. However, by showing them a computer-generated rendition, the neighbors ultimately supported the project.
- There were some schools that wanted to host PV systems but could not participate since they could site only small systems rather than large-scale capacity required for the project economics.
- There was a great deal of initial skepticism on the part of the onsite building maintenance staff that needed to be overcome. Systems are relatively hassle-free, so to date the project is meeting expectations.
- The maximum amount each system generates as a percentage of the building's electricity load is roughly 30-40%. The District has a net metering agreement with the local utility.
- The District may be interested in buying the systems outright before the end of the contract, possibly using bond financing.
- The School District contracted with a third party to independent inspections of the systems after they were installed in order to have outside verification.
- The state's net metering cap of 1 MW allows the School District to obtain full value for electricity produced but not used immediately.[27]

2. Milpitas Unified School District (MUSD) Milpitas, California [28]

In 2007, MUSD began conversations with Chevron to carry out energy efficiency investments and install PV systems on school buildings. The District had four key objectives:

- demonstrate economic leadership (general fund savings)
- demonstrate environmental stewardship
- create educational opportunities, and
- positive public recognition and community outreach

[27] Database of State Incentives for Renewables and Efficiency http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA02R&re=1&ee=1

[28] Chevron Energy Services. http://www.chevronenergy.com/case_studies/musd.asp

Solar PV array hosted by Milpitas Unified School District.
Photo Credit: John Cimino

The project consists of 3.4 MW of PV installations at all of the District's 14 sites which are guaranteed to meet 75% of the School District's electricity needs and 100% of its peak electricity needs during the summer. It took approximately one year from concept to construction. The installations themselves are designed as both shade and car port parking structures. As with San José, each site has an educational display showing system performance and additionally, there is curriculum integration with the 5th and 6th grades.[29] Bank of America financed and owns the PV installations and receives the tax benefits. In addition, the Bank received $4.2 million in CSI incentives.

MUSD projects that the system will save the District $12 million over the life of the project by reducing annual energy costs by 22%. The project will also reduce CO_2 emissions by 23,600 metric tons. The PV systems are assisting the School District in meeting California's Grid Neutral Initiative.[30] A phone interview with John Cimino, Director of Maintenance Operations and Transportation for MUSD, reveals that the system is producing more energy than guaranteed in the contract resulting in additional savings to the District. According to Cimino, the project has been a win-win for all parties involved and was a fiscally responsible venture for the District as well as an environmental stewardship measure.

[29] Cimino, J. Milpitas Unified School District Sustainability Program presentation. Milpitas Unified School District. 2009.
[30] Milpitas Unified School District Partners With Chevron and Bank of America on 3.4MW Solar and Energy Efficiency Program Expected to Save $12 Million for Education. Jun 2008. http://www.businesswire.com/portal/site/home/permalink/?ndmViewId=news_view&newsId=20080625005994&newsLang=en

Table 3. Fourteen PV sites within Milpitas Unified School District[31]

Site Location	System Size (kW)	% Energy Offset
Burnett	172	80%
Calaveras High	424	71%
Corporation Yard	181	61%
Curtner	139	77%
Milpitas High	1,002	70%
Pomeroy	210	82%
Rancho	216	80%
Randall	113	65%
Rose	159	75%
Russell	221	89%
Sinnott	195	77%
Spangler	134	76%
Weller	149	89%
Zanker	134	66%
Total	**3,453**	**74%**

3. Denver Public School District[32] Denver, Colorado

Recently announced, 16 schools in Denver will be hosting PV installations financed under a third party ownership model. The total size of the project is estimated to be 1.8 MW when completed. Individual system size will range from 100 to 300 kW. The total investment in the project is listed as $9 million. MP_2 Capital and Oak Leaf Energy Partners will develop, finance, and own the installations and sell electricity to the District under a 20-year solar PPA. The District expects to save $1 million per year in energy costs. Xcel Energy will provide financial support for the project by purchasing the Renewable Energy Certificates generated by the PV systems over the 20-year period. According to available information, the PPA price will be less than what the School District is currently paying Xcel Energy for retail electricity. Installations are expected to begin in March 2010. The project size of 1.8 MW falls below the net metering cap of 120% of a customer's average annual consumption.[33]

[31] Cimino, J. Milpitas Unified School District Sustainability Program presentation. Milpitas Unified School District. 2009.

[32] " Denver Public Schools gets primer on solar perks" Jaffe, M. Denver Post. January 5th, 2010. http://www.denverpost.com/ci_14129047?source=rss

[33] Database of State Incentives for Renewables and Efficiency http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=CO26R&re=1&ee=1

4. Montgomery County Public Schools (MCPS)[34] Montgomery County, Maryland

SunEdison[35] has a total of 2.4 MW of solar on schools in three different school districts across the country financed using its Solar Power and Services Agreement (SPSA); a 487 kW project with two schools in the Anderson Union High School District, CA completed in 2007; an 835 kW project on a single high school in Alamosa, Colorado completed in 2009; and the following project in Montgomery County, MD. For two of these projects, the parties negotiated a flat rate per kWh (with an annual escalator) for all sites in the portfolio. For the third project, each school had its own individual electricity rate with a corresponding escalator.

MCPS is collaborating with the solar energy services provider, SunEdison, on a 1.4 MW solar PV project for the Montgomery County Public School District, which is under Maryland's net metering limit of 2 MW.[36] As of year end 2009, 1.14 MW of solar capacity have been installed. SunEdison and its financial partners will finance, own, operate, and maintain the PV systems and sell electricity to MCPS under a solar PPA. The systems are expected to provide 20-40% of the peak electricity needs of the schools hosting them. Four installations are up and running on two high schools, a middle school and an elementary school, respectively. When completed, each system will be between 100-400 kW in size. The PPA itself is signed by the District's Department of Facilities Management. MCPS has a goal of incorporating solar into all new construction and integrated in the standard re-roofing schedule for existing schools.

IX. STAKEHOLDER SUGGESTIONS

The stakeholders suggested that some options may emerge for pursuing third party ownership of solar PV on schools. Stakeholders cited the following existing resources to help reduce the up-front or overall cost of third party owned solar PV for school districts:

New Rebates for Solar Photovoltaic Modules
A new 2010 Minnesota Law (Chapter 361, Section 3[37]) establishes a program to provide rebates to owners of a qualified property for install solar photovoltaic modules manufacture in Minnesota after December 31, 2009. The new rebate program is funded for $2 million in fiscal year 2011, $4 million in fiscal year 2012 and $5 million for fiscal years for fiscal years 2013, 2014, and 2015. Qualifying customers, including school districts in Xcel Energy's service territory may apply for new solar rebates.

The US Department of Agriculture Rural Energy for America Program (REAP)
Rural Minnesota businesses can apply to the USDA's competitive grant opportunity on behalf of schools in rural areas. Under a third party ownership model, REAP funds could indirectly

[34] Information for this case study came from two MUSD press releases.
http://www.montgomeryschoolsmd.org/press/index.aspx?pagetype=showrelease&id=2369
http://montgomeryschoolsmd.org/departments/facilities/greenschoolsfocus/pdf/solar09.pdf
[35] SunEdison. http://www.sunedison.com/
[36] Database of State Incentives for Renewables and Efficiency (DSIRE)
http://montgomeryschoolsmd.org/departments/facilities/greenschoolsfocus/pdf/solar09.pdf
[37] See https://www.revisor.mn.gov/laws/?id=361&year=2010&type=0.

benefit schools. As a state, Minnesota is historically successful in benefitting from REAP awards with dozens of large energy efficiency and renewable energy projects funded. To date, however, few solar projects have been completed under the program in Minnesota, although solar PV is an eligible technology.

Schools Cutting Carbon

Minnesota Schools Cutting Carbon is a three-year initiative supported by a grant from the Legislative Citizen Commission on Minnesota Resources to assist 100 Minnesota public high schools, colleges, and universities in becoming more energy efficient and reducing their greenhouse gas emissions. This project is a partnership involving OES, Minnesota Pollution Control Agency, Clean Energy Resource Teams (CERTs), U.S. Green Building Council, Will Steger Foundation, Environmental Resources Management, Inc., Project Green Fleet, and several student organizations. Supporting partners provide technical and financial assistance. Each school has formed a team of energy champions (students, faculty, building operator and administration) working to implement an action plan to save energy and reduce carbon emissions.[38]

The teams have expressed interest in installing renewable energy technology, including solar PV. Several schools have identified specific solar technologies that they would like to install, and if they obtain funding, they plan to integrate these technologies into their curriculum and highlight the benefits of renewable energy as an educational tool to all members of the school and community. The Schools Cutting Carbon program may be an existing mechanism to lead efforts to combine energy efficiency and solar to complete large scale projects.

Grid Neutral

The Minnesota Renewable Energy Society (MRES) is supportive of a statewide goal to achieve grid neutrality for school districts in Minnesota that results in net zero carbon emissions by 2020. This could be accomplished through a menu of conservation measures and technologies including solar PV. A third party financing model for solar PV projects could be one of a number of different mechanisms with each school district taking advantage of resources available locally.

A similar effort is underway in California where some school districts that have completed third party owned solar projects cite the state's Grid Neutral program as a contributing factor.[39] MRES believes that a Grid Neutral program in Minnesota would raise public and youth awareness about renewable energy and energy independence statewide while helping achieve the state policy goals of greenhouse gas emission reductions,[40] the renewable energy standard[41], and the state's newly implemented energy efficiency goals.[42]

---

[38] Second Annual Legislative Proposal Report on Greenhouse Gas Emission Reductions. Minnesota Department of Commerce and Minnesota Pollution Control Agency. Jan 2010.

[39] Milpitas Unified School District Partners With Chevron and Bank of America on 3.4 MW Solar and Energy Efficiency Program Expected to Save $12 Million for Education. Jun 2008. http://www.businesswire.com/portal/site/home/permalink/?ndmViewId=news_view&newsId=20080625005994&newsLang=en

[40] Minn Statutes 2008, 216H.02

[41] Minn Statutes 2007, 216B.1691

[42] Minn Statutes 2007, 216C.05, subdivision 2

Community Investment
Some communities may elect to leverage local resources sufficient to fund third party owned PV systems at local schools. This could be accomplished through a combination of tax incentives, utility incentives where available, grants, and private capital, much as successful community wind projects have been developed in Minnesota.

All of the stakeholder ideas presented above require an alignment of student and faculty teams, school districts, communities, and utilities working together to identify a locale's resources in order to meet common energy goals.

X. CONCLUSIONS

As demonstrated by the case studies, the third party ownership model for schools is technically feasible and is being deployed in some states. However, the use of this model for solar development at Minnesota schools will prove difficult at this time as current electricity prices paid by schools are low relative to the cost of solar electricity. Minnesota's school districts generally would not save money by entering into a solar power purchase agreement with a third party owner even with the ability to monetize federal tax incentives.

If the barriers presented in this report were no longer constraints due to increased retail electricity costs, a decrease in the cost of solar PV or other changes, Minnesota has some advantages that can be useful to the third party ownership PV model. These include the state's B3 Benchmarking for public buildings as well as certain energy policy objectives and goals.[43] In addition, as two solar developers independently stated, Minnesota has the skilled workforce to implement large scale PV projects from a technical perspective. It is reasonable to estimate that the state's workforce could more than double the PV installation capacity from the current 1.9 megawatts in a matter of months. Deploying statewide third party financed PV installations at schools could be a job creation mechanism spurring a market not only for PV, but also for energy audits and energy efficiency that could be bundled as part of PV projects.

The third party business model also offers an opportunity to direct federal solar tax incentives to school districts that would be unavailable to them otherwise. The value of the federal incentives is significant and can offset system cost by 50% or more. At some point, this level of subsidy may be adequate to allow for a competitively priced solar PPA between a solar developer and a school district that would result in saving the school district money.

Greenhouse Gas Reductions
In Minnesota, one megawatt of solar PV results in approximately 1,000 metric tons of greenhouse gas reductions annually.[44] With an installation rate of three to five megawatts of PV capacity per year being technically feasible to start, a third party ownership model for PV

[43] Minn Statutes 2008, 216H.02, Minn Statutes 2007, 216B.1691, Minn Statutes 2007, 216C.05, subdivision 2.
[44] Energy Information Administration, Form EIA-860, "Annual Electric Generator Report." Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report." Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

deployment could offset between 3,000 and 5,000 metric tons of carbon dioxide per year with additional emissions reductions due to energy efficiency measures taken.[45]

[45] Ibid.