

Evaluation of Solar Power Options for the City of Ames

Some Ames electric customers have shown an interest in the development of a community solar photovoltaic (PV) power project in Ames. A community solar project allows electric customers the opportunity to share some of the benefits of solar power, even if they cannot or prefer not to install solar panels on their home, business, or property. Participating electric customers make contributions to support the development and construction of a larger and more economical solar power project, and in return they may receive financial benefits. Some customers with an interest in solar power may not be able to install or own their own solar array for various reasons, such as: 1) they are renters, 2) their roof or property is not suitable for a solar array, 3) they don't want the hassle of doing their own solar array, or 4) their electricity usage is too low to make a small solar array economically viable. The participating customers in most community solar projects are not considered to be investors, so that any electric bill savings they receive is not considered to be income. Typically, participating customers are limited to shares that do not exceed their annual electricity usage.

In response to this interest in a community solar project, the City of Ames (City) has contracted with Wind Utility Consulting, PC (Consultant) to evaluate options for the development of a large community solar project in Ames. Three basic options were evaluated. Option 1 is for the City of Ames (City) to develop, finance, and own the solar project. All costs would be essentially socialized or spread over all customers, just like the costs for the City's coal-fired power plant. In essence all customers would participate in the project.

The actual delivered cost of the solar power will be higher than the cost of the City's other sources of power, and there is no assurance that this solar power will ever be less expensive. Since adding the solar project will tend to raise the average cost of the City's power, a second option (Option 2) was evaluated. In Option 2 the City's electric customers would have an option to contribute financially to help offset the higher cost of power, so that other customers would have some protection from potentially higher power costs.

Since the City is a non-profit entity, it cannot take advantage of the federal income tax benefits available for solar projects. Therefore, a third option (Option 3) was evaluated; wherein a for-profit company would build and initially own the solar project, and sell the City the solar power. After six years of operation, the City would have the option of purchasing the solar project from the for-profit company at a greatly reduced cost. By initially taking advantage of the income tax credits then subsequently taking advantage of the City's low cost financing, the cost of the solar power would most likely be less than for Options 1 or 2.

Each of the three options is discussed in more detail below, along with their advantages and disadvantages.

Option 1: City-Built and City-Owned Project with All Costs Socialized

Under this option the City would build and own the project and would contract with a solar power company to construct the solar array. Since the City would own and operate the project, the capital and operating costs would be socialized, or borne by all of the City’s electric customers. The City would use the state tax credits that have already been approved for this project. This 1.5¢ per kWh 10-year tax credit would be used to offset the state sales tax that the City pays to the state. Figure 1 provides an overview diagram of this option and Table 1 lists the advantages and disadvantages of this option.

FIGURE 1 - OPTION 1

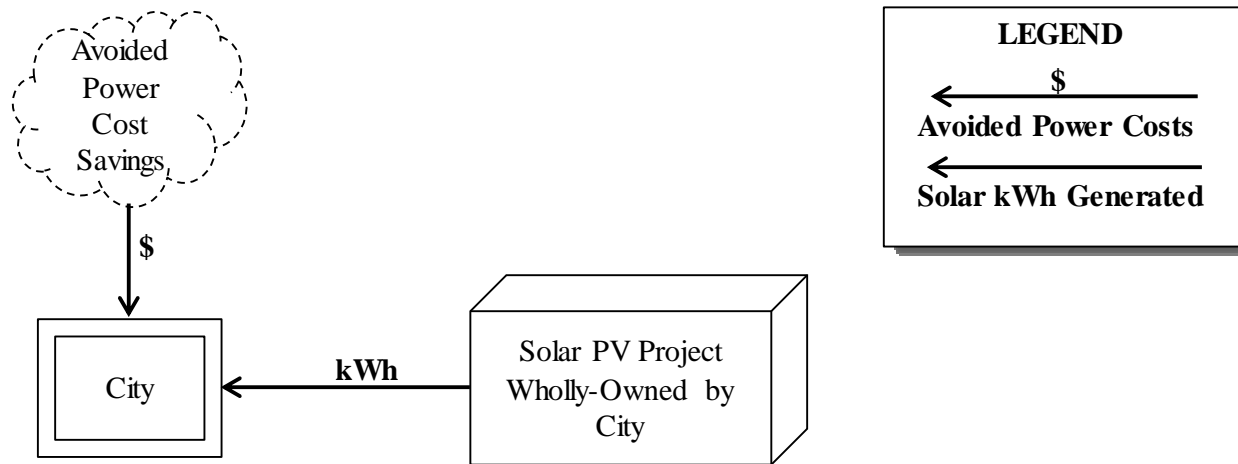


TABLE 1

Advantages	Disadvantages
Very simple structure due to City ownership.	Staff has responsibility for developing, building, and operating the project.
Simple for customers, since they have no decisions to make. All customers participate, because they all pay the cost of the solar project.	Cost of solar power will be a little higher than the other solar options, since the City cannot use the federal income tax benefits.
	Does not provide customers an option to contribute to the project and “use” solar power to meet their own energy needs.

Option 2: City-Built and City-Owned Project with Voluntary Customer Contributions

This option is very similar to Option 1 in that the City develops and owns the project. However, the City would take voluntary customer contributions to help offset the higher cost of the solar power. The contribution program could be a one-time up-front payment, which would provide the participants with the possibility of some type of monthly credit on their electric bills. An alternative contribution program could simply be a higher electric rate, which would result in monthly contributions toward the solar project. The City would use the state tax credits that have already been approved for this project. Figure 2 is an overview diagram of Option 2, and Table 2 lists the advantages and disadvantages of this option.

FIGURE 2 – OPTION 2

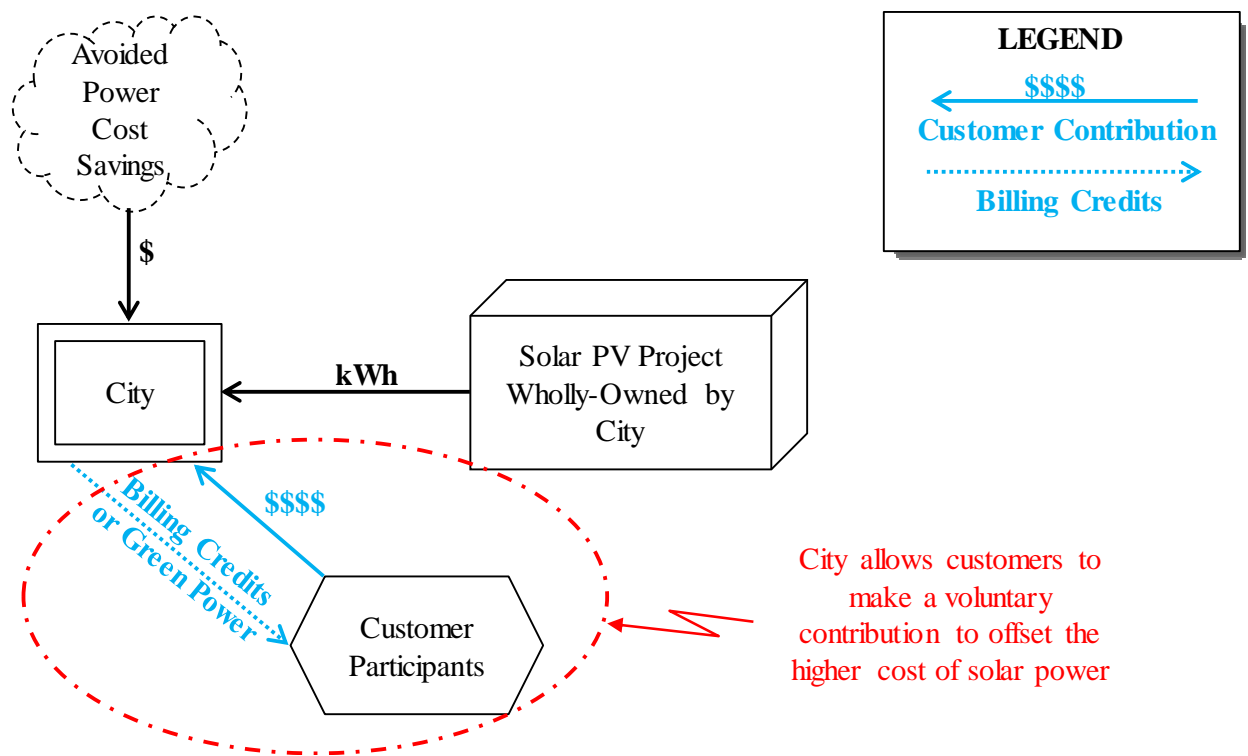


TABLE 2

Advantages	Disadvantages
Voluntary customer contributions help shield non-participating customers from the higher initial cost of solar power.	City needs enough volunteers to support the project or the project is not built.
Participants get satisfaction of contributing to solar project and using green energy.	Staff has responsibility for developing, building, and operating the project. Cost of solar power will be a little higher than other solar options, since the City cannot use the federal income tax benefits.
	Staff must keep track of participants and billing credits.

Option 3: Non-City Developed and Owned Project with Voluntary Customer Contributions

With this option, the City would request proposals to buy power using a Power Purchase Agreement (PPA) from a new solar array installed in or near the city. A for-profit company would develop, finance, and own the solar project, so that it could receive the federal income tax benefits provided to solar projects. The for-profit company could be an outside solar related company, or it could be an LLC formed, owned, and funded by a group of Ames electric customers not exceeding 34 customer-owners. This group of customers would own the solar project and would receive the federal income tax benefits. The City would allow additional customers to participate in a voluntary program to help offset the higher cost of the solar power. As in Option 2, the contribution program could be a one-time up-front payment, which would provide the participants with the possibility of some type of monthly credit on their electric bills. An alternative contribution program could again simply be a higher electric rate, which would result in monthly contributions toward the solar project. With Option 3, the City would have the option to purchase the solar project after the for-profit company fully depreciates the solar project over the course of six years. After the sixth year the purchase price would be at a greatly discounted cost. This purchase would most likely reduce the cost premium of the solar power from that point forward. As before, the City would use the state tax credits that have already been approved for this project. Figure 3 is an overview diagram of Option 3, while Table 3 shows the advantages and disadvantages.

FIGURE 3 – OPTION 3

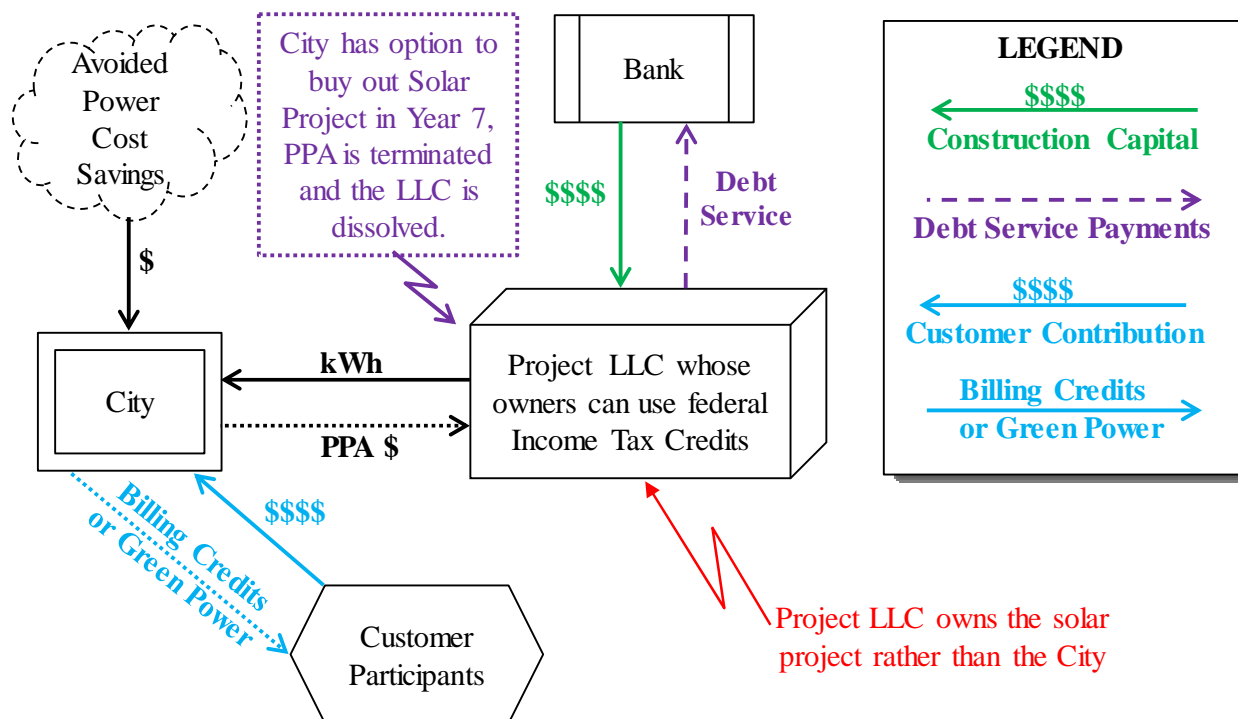


TABLE 3

Advantages	Disadvantages
Staff has no responsibility for developing, building, or initially operating the project.	Requires a Power Purchase Agreement (PPA) and an interconnection agreement.
Voluntary customer contributions help shield non-participating customers from the higher initial cost of solar power.	Staff must keep track of participants and billing credits.
Participants get satisfaction of contributing to solar project and using green energy.	If the City buys out the project, then the staff must operate it or the City could contract for this service out.
City has the option to purchase the project at a discounted cost in year 7, which would likely reduce the cost premium of the solar power.	

Financial Analysis

A simple financial analysis was done for the three basic options, based on these general assumptions:

- 1) The solar project would have an alternating current (AC) rating of 1.5 megawatt (MW). It would use solar panels having a cumulative rating of 1.95 MW direct current (DC). It would cost about \$3.9 million, or \$2.00 per watt DC.
- 2) The project would initially generate 2.7 million kWh with the output declining about 0.5% per year due to cell degradation.
- 3) The operating cost would initially be about \$45,000 per year.
- 4) The state sales tax credit would initially be about \$40,000 per year.
- 5) The solar power would have an initial estimated energy value to the City of 5.0¢ per kWh. A firm capacity value of 40% of the AC nameplate rating times \$72 per MW-Day in capacity value in MISO gives an additional value of 0.6 ¢ per kWh, for an initial total value of 5.6¢ per kWh. This was assumed to escalate 3% per year.
- 6) A for-profit company owning the solar project would receive a 30% federal investment tax credit and would use a five-year accelerated tax depreciation schedule. Bonus depreciation was assumed.
- 7) If the City opts to purchase the project after the sixth year, the buyout price was estimated to be 40% of the original cost of the project.
- 8) It was assumed that the customer contributions allowed in Options 2 and 3 would generate billing credits over a 20-year period. In this analysis, it was assumed that contributors would break even or get their original investment back in 15 years. With the additional credits received in years 16 through 20, the customers essentially earn 2.9% on their original investment over the 20-year period. This return was considered by the Consultant to be the minimum rate of return that would attract customer participation. It should be noted that even with an upfront payment along with the assumed level of billing credits, the solar project would still likely result in a net increase in cost to the City’s rate payers or a higher initial investment by the participating customers.

The results of this simple cash flow analysis are shown in the bottom two rows of Table 4 on the following page.

Comparison of the Three Options

Table 4 compares the key aspects of each of the three options.

TABLE 4

Comparison of Key Aspects of the Three Options			
	Option 1	Option 2	Option 3
	City-Owned	City-Owned with Customer Contributions	Non-City-Owned with Customer Contributions & Buyout
City Staff Resources Needed to Develop Project	Lowest	Highest	Medium
Ongoing City Management Needed	Operate Project	Operate Project, manage billing credits	Manage agreements and billing credits and eventually operate project
<u>Project Risks to City</u> Cost Overruns Poor Production	Highest Highest	Highest Highest	Lowest Lowest
<u>Use of Federal Income Tax Benefits</u>	None	None	Yes
<u>Customer Involvement</u>	None	Voluntary	Voluntary
Keeping \$ in the Community	Lowest	Medium	Highest if locally owned
25-Year Levelized Cost of Solar Power	9.5 to 11.0¢ per kWh	9.5 to 11.0¢ per kWh	7.0 to 8.0¢ per kWh
Present Value of Cost Increase to City Over 25 Years (in \$1,000,000's)	\$0.5 to \$2.0 Increase	\$0.5 to \$2.0 Increase	\$0.8 Savings to \$0.5 Increase
Notes: - The ranges shown in the costs in the last two rows of the table reflect the uncertainties in the many assumptions used in this simple cash flow analysis. - A 25-year levelizing period was used because the solar project will very likely have a lifetime of 25 years. Furthermore, PPAs often have 25-year terms. Customer billing credits were limited to 20 years, since few customers will likely take electric service longer than 20 years.			

The 25-year levelized cost of solar power may be about the same whether voluntary customer contributions are taken or not (Option 1 compared to Option 2). This is because their contributions were assumed to be returned over time, just like bond payments would be. If the

City extends the break-even period to 20 years, then it would lower the levelized cost of solar power and would reduce the cost increase to the City. The City does have some discretion on how to calculate how much is returned each year to the contributors. However, as mentioned before, if the break-even period is too long, then participation may be too low to justify building the solar project.

All three options may result in some increase in costs to the City's rate payers compared to not building a solar project, since the last row in the table usually shows an increase in the present value of the City's cost. This is often typical for solar power projects in the upper Midwest where wholesale grid prices are fairly low at this time.

Option 3 appears to be the most cost effective, based on the simple cash flow analysis. The cost effectiveness stems almost entirely from the buyout opportunity for the City. For example, the city would pay only 40% of the original cost in year seven, but the solar project would have 75% of its life remaining. This is somewhat equivalent to getting the project at roughly half price considering the remaining life of the solar project. The buyout option is driven by the ability of the for-profit company to take all of the income tax benefits over the course of six years.

Other Considerations

Ownership of Land

In all three options the land could be owned by the City, and simply leased to whoever owns the solar array project. It would take about 10 acres of land for the proposed solar project.

Emission Reduction Credits or Renewable Energy Credits

The emission reduction credits (ERCs) or renewable energy credits (RECs) should be retained in the long term by the City, regardless of the ownership of the array. Since there are currently no legal requirements for having ERCs, they have little value at this time. No value was given in the simple financial analysis.

Ensuring kWh Production Performance

If there will be a third-party owner, then the PPA can include penalties if the kWh production falls below target levels. The target level can be adjusted for the actual solar insolation received at the site, so it would not penalize the owner for overly cloudy weather. This penalty would provide an incentive for the owners to keep the project well maintained and to fix problems quickly.

Ensuring Quality Materials and Construction

If the City simply requests proposals for the construction of the project, it may not have much say about the quality and warranty of the equipment, or the robustness of the array's panel mounting design and system. Therefore, the City should specify the quality of solar panels, their warranty terms, and overall mechanical design standards in the request for proposals. This will help insure higher production and reliability.

Purchasing the Solar Array Project from Other Owners

If the City purchases the solar array after the majority of the tax benefits are captured by the initial owners (after six years), then it will most likely be able to reduce the levelized cost of the

solar array power. Of course, all of this depends upon the buyout purchase price of the solar array, the PPA rate in the initial contract, and the City's cost of money. Since all of these factors will not be known initially, the City should require the initial owner of the solar array to provide a buyout option at one or two specific times, such as after 6 years, or after 10 years. The Internal Revenue Service states that the buyout purchase price must be at the fair market value (FMV) as measured at the time of purchase. A calculation methodology for the FMV, such as a discounted future cash flow model, can be specified in the PPA contract. The Consultant estimates that the purchase price might be in the range of 35% to 45% of the original cost of the project at the beginning of year 7, with lower buyout costs thereafter. Given a minimum 25-year life, the solar array will have 75% of its projected lifetime MWh remaining at the end of six years. A buyout price of 40% represents a bargain, assuming the solar array is performing well. The City can make the determination at the time of the buyout when the purchase price is known, and there is less uncertainty about future generation costs. A buyout price of 40% was assumed in the simple financial analysis in the appendix.

Conclusions

The analysis shows that there are relative advantages for each of the options and all are feasible. If the City exclusively owns the solar project, the overall cost to the city or to the participants will most likely be higher than not having the solar project. The financial analysis shows that there may be some advantage for having a non-city for-profit entity develop and initially own the project, followed by a sale of the project to the City. However, the solar project may still increase the cost to the City's rate payers. If the City's costs increase, then electric rates would be a little higher, or the participants would not get all of their initial contributions back in the form of billing credits. The participating customers should not assume that the bill credits will provide a suitable rate of return for any of the options.

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