The Role of Energy Service Companies in Accelerating Solar Technology To Market

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ABSTRACT

With Americans seeing, in the first quarter of 2008, the commodity price of oil regularly closing above $100 per barrel and regular media reports on climate change, the awareness of the financial and environmental impacts of fossil fuels is ever increasing. This article briefly discusses the financial aspects of PV systems and focuses primarily on the role of energy service companies in bringing solar technologies to market in facilities where they may otherwise be cost prohibitive. Facility owners, staff, and policy makers can learn from this article how this can be accomplished by incorporating solar PV technology into a comprehensive energy efficiency performance contract instead of installing a stand-alone PV system or entering into a power purchase agreement.

INTRODUCTION

With Americans seeing, in the first quarter of 2008, the commodity price of oil regularly closing above $100 per barrel and regular media reports on climate change, the awareness of the financial and environmental impacts of fossil fuels is ever increasing. In these times it seems the most often mentioned alternative energy source is solar energy in general and photovoltaic (PV) panels in particular. Many Americans, who are not employed in the energy industry, ask "Why can't we use more solar?" Being unfamiliar with the cost of PV systems, the different utility rate tariffs imposed on different types of facilities, and even be-

ing unfamiliar with their own cost of electricity, it is not difficult to see how purchasing and installing a PV system may seem like a foregone conclusion. If one commercial building or one house has a PV system, why not install it in every house and on every building?

The answer is that, in these times of economic uncertainty, the installation of a PV system has to make financial sense. There has to be a way for a facility owner to purchase and install the system and that system should, ideally, pay for those costs over its lifetime by offsetting electricity purchased from the utility. Various rebates and incentives are available in different areas of the United States to offset the cost of different renewable energy technologies, including PV. Although manufacturers of solar technologies are constantly working to develop more efficient products, the overall financial feasibility of a PV system is still linked to utility electric rates.

This article briefly discusses the financial aspects of PV systems and focuses primarily on the role of energy service companies in bringing solar technologies to market in facilities where they may otherwise be cost prohibitive.

ESCO BACKGROUND INFORMATION

Energy service companies (ESCOs) are typically privately held business entities that generate revenue through the avoided cost of purchasing energy. Energy savings result from providing clients with more efficient equipment and more modern operating strategies. These energy savings are ultimately avoided expenditures for the client and, in a performance contract, these avoided expenditures are the revenue stream that pays for the new equipment and the services of the ESCO.

Most ESCO work focuses on large energy users in the government as well as in commercial, industrial, correctional, and educational sectors. Large energy users are loosely defined as facilities or campuses that spend more than $1M per year on energy. The reason that ESCOs focus on large energy users is simple—there is more funding for projects. Saving a residential client 10 percent on a bill that is only a couple thousand dollars may not generate enough avoided cost to purchase a single solar panel. The avoided cost of saving a commercial client 10 percent of a $1M energy budget provides much more purchasing power.

The different utility rate tariffs between residential and non-residential energy users, particularly demand charges, are another reason that more revenue can be generated through energy efficiency at a non-residential facility.

The larger ESCOs generate these double-digit savings percentages for large energy users by providing comprehensive energy solutions. The solutions are comprehensive in that they address every way the client uses energy. A typical project might include more efficient lighting technology, HVAC technology, installing digital controls, and water conservation programs, in addition to renewable energy systems such as PV.

RENEWABLE ENERGY COSTS

Renewable energy technology is typically much more expensive than the traditional systems it replaces. For example, it is much more expensive to install a geothermal heat pump loop than to purchase a comparably sized mechanical heat pump with gas heat and DX cooling. From a thermodynamic standpoint, this is due to the relative physical equipment size and complexity required for utilizing the less "dense" energy sources such as wind and solar energy as opposed to using more "dense" energy stored in the chemical bonds of fossil fuels.

As a quick example, a PV system that generates 200,000 kWh/yr and costs $1M would take 50 years to pay for itself at a facility with an average electric rate of $0.10/kWh. A 50-year payback is often well beyond the length of time a client, in this economic climate, is willing to accept.

Rebates and incentives are in place, depending on location, at the federal and state level to help improve these economics. At the time of writing, there is a one-time 30 percent federal tax credit in the United States that applies to the net cost of solar PV systems with no cap when installed at non-residential facilities (1). It remains uncertain as to whether this credit will remain available for systems installed after 2008. A typical quote from a PV vendor may factor utility incentives, assumed utility rates and escalation, tax credits, and property value appreciation into the economics of the proposal. With all of these factors remaining unchanged throughout the life of the system, the economics do indeed improve. The important fact to keep in mind is that these figures are

developed by the technology vendor who has a financial interest in selling a particular product. These figures are typically not guaranteed, and thus, neither are the economics of the vendor's PV system.

The issues facility owners must manage when buying or leasing solar systems are discussed by Roper (2) in addition to power purchase agreements. Power purchase agreements are described as agreements where PV systems are designed, built, owned, and operated by the service provider and the client pays only for the electricity they use. Because the service provider specializes in these types of PPAs, they can purchase equipment and materials in volume and are able to market the PPAs by charging lower $/kWh rates relative to projected and/or existing rates. The following section discusses the role of ESCO services as an alternative to PPAs.

It should be noted that PPAs and ESCO services are complimentary and serve different needs. A PPA may be the right solution for a small to large facility that has no capital to contribute, is interested in acquiring a single technology, and/or would like to install a system with a specific generation capacity. ESCO services may be a better solution for larger facilities that can benefit from the revenue generated through energy savings by applying it towards renewable energy or capital improvement projects. In ESCO projects, the potential generation capacity of the system is strongly dependent on the energy usage characteristics of the facility because it is funded by energy savings. Therefore facilities that can save significant amounts of energy through efficiency upgrades can also enjoy larger PV systems. For this reason, the generation capacity of a PV system in an ESCO project, unlike a PPA, is variable until the project measures and economics are finalized and the savings remaining to finance the PV system are known.

THE ROLE OF THE ESCO IN MITIGATING RENEWABLE ENERGY COSTS

As mentioned previously, the typical function of an ESCO is to generate revenue through energy savings which can be applied to self-funding performance improvement projects. A current trend with ESCO customers is the request for renewable energy technology to be installed as part of the project. By generating savings through relatively more cost effective measures, ESCOs can improve the financial returns on renew-

able energy projects as compared with installing them as stand-alone systems.

The reason the financial returns can be improved is simple. A facility that is not performing optimally from an energy standpoint will still not perform optimally after the installation of a renewable energy project such as a PV system. If the facility is wasting energy through the lighting and HVAC systems, the PV system will simply generate electricity to make up for a portion of those losses. If facility performance is improved to optimal levels, only then does the PV system add true value to the overall energy usage pattern of the facility.

Typical ESCO projects serve to bring basic facility energy systems up to optimal performance levels. Projects are structured around energy savings such that all measures can be implemented while generating a positive cash flow based on current utility expenditures or budgets. The mix of different energy conservation measures is developed and engineered by the ESCO in cooperation with the needs and wishes of the facility owner. To keep with the current renewable energy trends, the renewable measures, such as PV systems, are incorporated into the project structure such that the overall project still nets a positive or neutral cash flow for the facility owner.

This stands in contrast to buying or leasing a stand-alone PV system as well as entering into a PPA. Until the system is paid for or the generated kWh reaches the breakeven point, those methods of acquiring a PV system still result in negative cash flows for the client, albeit less negative in a PPA relative to current energy costs if electricity generated by the PV systems is purchased at a rate lower than that charged by the utility. Still, in these cases the client is left with unaltered building performance, for better or worse.

With the right ESCOs all of the systems, including PV, are designed and built by the ESCO with the client alleviated of the need to source materials and hire a quality installer. A PV vendor may only have the expertise and interest in installing PV systems irrespective of customer needs or wishes. When an ESCO is hired, the customer can specify a solar PV system, a solar thermal system for producing domestic hot water, a solar thermal system for power generation, or any other commercially available renewable energy technology including non-solar applications. A manufacturer-neutral ESCO may also bid out the renewable projects among multiple vendors to optimize the quality and cost of the system.

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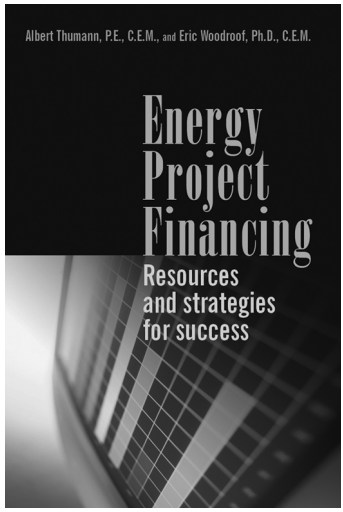

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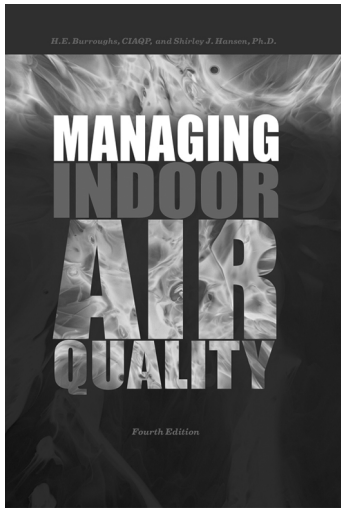

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In a performance contract the energy savings of the project are guaranteed by the ESCO, which is held liable by the client if the system performance does not meet that specified in the contract. This allows clients to specify what types of technologies they want and have the ESCO design the system, construct the system, and guarantee the performance such that the overall project generates a positive or neutral cash flow for the customer. The result is that clients, in doing business with a manufacturer-neutral ESCO, can obtain the technology upgrades they want while remaining under budget for energy costs.

Additionally, there are other less quantifiable benefits that come from partnering ESCO work with renewable energy projects. The first benefit is an improved public image. By physically seeing the PV panels, or any renewable technology, the customers and staff of a facility recognize that, in addition to helping the environment, the owner is taking steps to protect the facility balance sheet from fluctuations in energy prices. If these customers and staff can be educated, even briefly, about the role of the renewable technology as part of a greater energy services project, such as through an information kiosk near a PV array, they may truly understand the value that the PV system adds to a facility with recently optimized energy usage. The second benefit is the acquisition of renewable energy credits. In contrast to a PPA, clients entering into performance contracting projects with ESCOs are allowed to keep the renewable energy credits the system generates because it is owned by the client.

CASE STUDY

As an example of how a performance contract can use energy savings to improve the economics of solar technology, consider the project performed by NORESCO for California State University Long Beach.

CSU Long Beach has over five million square feet of space and a multimillion dollar energy budget. NORESCO has been awarded multiple phases of energy savings projects at CSU Long Beach through a competitive bidding process. As part of the latest phase, a solar PV carport was included in the project.

The carport utilizes a 115 kW_{DC} roof-mounted PV array to generate electricity and charge electric vehicles that are used by the facilities staff. The project included the construction of the actual carport as

well as the installation of the PV system. For the sake of practicality and vehicle preservation, the roof of the carport was constructed to be a watertight standing seam metal roof. Approximately 100 kW_{AC} of power is generated by over 375 PV panels which occupy approximately 11,000 square feet of roof area. The roofs are pitched at 5° for drainage, and the beams and purlins are galvanized. Electricity generated by the carport is fed into the facility power distribution network at 120V and is also used to charge electric vehicles and power fluorescent lighting that illuminates the carport.

Based on the average cost of electricity ($/kWh) and the cost of the solar carport, the simple payback would have been 59 years if the system was installed on its own outside of a performance contract. Based on the PV panel warranty of 20 years, the cost and savings without federal tax credits and utility incentives would result in an internal rate of return of –8.67 percent assuming no utility rate escalation. The internal rate of return improves to –1.60 percent with a one-time 30 percent federal tax credit and assuming the university qualifies for the performance-based incentive through the California Self Generation Incentive Program; also assuming no utility rate escalation (3). There are no state tax credits in California for solar energy, but the incentives and federal tax credit reduce the simple payback to roughly 23 years (4). Although this is a substantial improvement, it suggests that the PV system will not pay for itself before the warranty on the panels ends.

By incorporating the system into a comprehensive performance contract, the university was able to incorporate the solar carport and an additional 240 kW_{DC} of PV (installed in a different area of the campus) into a 15-year project that resulted in a net positive internal rate of return with no additional expenditures relative to the existing utility budget. The performance contract included the improvement of lighting systems and controls, installation of premium efficiency motors with variable frequency drives, upgraded energy management strategies (demand controlled ventilation, supply air differential pressure reset, etc.), and improved central plant hydronic loop pumping system. At the end of those 15 years, CSU Long Beach will own all of the upgraded equipment, including the PV systems, and will realize savings on the order of hundreds of thousands of dollars annually relative to the current utility budget.

Figure 1. CSU Long Beach solar carport during construction

Figure 2. Electric carts plugged into the carport and charging their batteries

CONCLUSION

In these times of economic uncertainty, energy security concerns, and climate change, there has been an increase in interest in renewable energy technologies. Harvesting solar energy, through photovoltaic systems or otherwise, receives, arguably, the most attention of all the current renewable energy technologies. A primary barrier to implementing solar technology on a larger scale is the financial aspect of procuring and installing these systems. It has been shown that energy service companies can provide, through guaranteed performance contracts based on comprehensive energy solutions, a means by which renewable solar energy technology can be installed with less cost to the owner than in a power purchase agreement scenario. The result can be systems that pay back in a quarter of the time required through other finance methods and, more importantly, generate a positive cash flow to the owner. Performance contracting through energy service companies is not the solution for every facility that would like to implement solar technology but, for the right facilities, it provides a unique method to overcome the primary barrier of bringing solar energy to market.

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ABOUT THE AUTHOR

Anthony Sclafani is an energy engineer for NORESCO's Energy Services group. NORESCO has built on-site energy facilities that generate more than 350 megawatts of power, and has helped customers improve energy efficiency saving over 31 billion kilowatt-hours of electricity and 71 trillion Btus of fuel—enough to provide over 1 million

homes with electricity for the next five years. Mr. Sclafani specializes in the implementation of renewable energy systems, distributed generation, cogeneration/combined heat and power, and large-scale energy efficiency solutions in performance contracting and emissions reduction projects. His experience includes all phases of project engineering from site screening through construction. He has experience providing energy solutions for industrial & manufacturing, educational (K-12 and university campuses), commercial, correctional, and government facilities.

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