Integrating PV into Performance Contracts: Barriers and Trends

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Performance contracting, or contract energy management as it is called in the UK, refers to the practice of financing energy services based on the savings stream that those energy services are projected to generate. While performance contracts have not traditionally incorporated renewable energy systems (Goldman et al., 2002), a number of recent contracts have incorporated photovoltaic (PV) systems as part of an overall building energy service strategy. This paper presents the results of a survey of US PV performance contracts and describes how, when examined in aggregate, PV performance contracts represent an important share of new US installations. This paper will also report on the diffusion of the PV performance contracting model from the US Federal government to other sectors.

Methodology

Three sources of information were used in preparing this paper: (1) a review of the literature on performance contracting, solar energy, and energy service companies[1] (ESCOs); (2) a review of PV performance contract project case studies posted on the Internet; (3) telephone interviews with government and industry stakeholders.

PV performance contracting has emerged only in the last four years, and therefore little published literature exists. A few documents released by the Renewable Energy Policy Project (REPP) discuss the theory of bundling PV with energy efficiency in performance contracts (Stronberg & Singh, 1998; Eckhart, 1999; Singh 2001), but they do not address the subject empirically. There is a considerable amount of information available from the Federal Energy Management Program (FEMP), the US agency charged with improving the energy performance of Federal buildings, but PV performance contracting activity at the state, municipal, or private levels is not addressed

To determine the extent of PV performance contracting in the US, 32 interviews were conducted targeting Federal, state, and municipal governments, 8 ESCOs, and 3 solar contractors. Data for 18 projects completed in the period 2000-2003 were gathered. Follow-up calls were made to the ESCOs, solar installers, and government officials to verify that the data were complete and accurate. The nameplate capacities of these projects were then aggregated by year and compared to figures on total annual grid-tied US installations through 2003 (Maycock, 2004).

[1] "ESCOs are businesses that develop, install, and finances projects designed to improve energy efficiency and reduce operations and maintenance costs for its customers' facilities" (FEMP, 2004d)

The Road to PV Performance Contracting

As an emissions-free and renewable power source that produces energy where it is consumed, solar energy has been championed as a response to looming concerns of resource depletion, air pollution, global warming, national security, and energy security (Byrne et al., 1999 and 2004; STEAB, 2002; Lovins & Lovins, 1982). While PV is not directly cost-competitive with fossil fuel generation in the bulk power service market, there is a growing recognition that PV's true value can be better understood when evaluated in the context of the energy services market (Byrne et al., 1997, Perez et al., 1999). The PV value chain includes the technology's value as a peak-shaving and load management tool, as a source of emergency power, as an emission-free generation technology, and as a building component in lieu of glazing or roofing (Byrne et al., 1998). In light of these service-oriented, non-commodity contributions, Byrne et al. assert that, "price comparisons that neglect these economic and social contributions are likely to be misleading on the question of market development" (2004: 293).

While taking externalities into account and evaluating PV as a service technology can dramatically improve the economics of PV, the technology has historically not enjoyed significant market penetration in the energy services industry. From a recent study of 1,500 projects from 51 ESCOs, for example, only one was found to incorporate PV (Goldman et al., 2002). Despite this record, it is conceivable that a variety of factors may prompt ESCOs to re-examine PV as a technology option. As will be discussed below, mounting environmental and security concerns are leading large institutional customers to demand that ESCOs incorporate distributed, renewable energies into their facilities. Furthermore, the rapid change and intense competition that has recently characterized the energy services industry (Vine et al., 1998; Dayton et al., 1998) could inspire ESCOs to turn to PV as a differentiation strategy to attract customers seeking PV's specific service values (Singh, 2001). Finally, the US Federal government, through FEMP, has created conditions for PV to be evaluated as both a service technology and an energy generation technology by building managers.

While there are several different mechanisms for delivering energy service technologies (utility programs, retail distributors and installers, fee-for-service contracts, etc.), this paper uses performance contracting as the framework for examining PV's diffusion into the energy services market. In a typical performance contract, an ESCO installs energy or water saving technologies on existing buildings. The resulting utility bill savings are then used to pay back funds borrowed to finance the installations. In this way, facility managers can correct operational inefficiencies without increasing their budgets. Because ESCOs generate their revenue from a portion of the savings, they have a significant incentive to maximize project performance. While directly funding energy projects can be less expensive than performance contracting (Hughes et al., 2003), many facilities in the institutional and private sectors lack the up-front capital necessary to pay for retrofit projects (Rufo, 2001). As a result, performance contracting may be the only way that many buildings can install energy service technologies (Hughes et al., 2003).

While performance contracting has not traditionally been used to deliver renewable energy systems, there are some who have suggested that it could serve as an effective mechanism for PV deployment (Eckhart, 1999). As stand-alone projects, PV systems can be difficult to finance because their simple payback terms extend beyond the maximum terms permitted by institutional regulations (Stronberg & Singh, 1999). In performance contracts, technologies with longer paybacks, like PV, can be bundled with quicker payback technologies, such as lighting, to produce a blended payback term acceptable to the customer (Raman, 1998: 10). The Federal government encourages this synergy by allowing its facility managers to make investment decisions based on the “life-cycle cost-effectiveness” of an entire project, rather than on the basis of a single project component’s payback term (ORNL, 2003: 4). Without this provision, PV systems would be disallowed from Federal performance contracts since PV systems can have payback terms of 30-40 years, and the maximum Federal contract length is 25 years (FEMP, 2004a).

PV and the Federal Super ESPC

In addition to promoting project-based life-cycle cost analysis, the Federal government also encourages the incorporation of PV in its facilities’ performance contracts. Since 1988, performance contracts of various types have been used to attract more than $1 billion in private-sector investments for Federal efficiency upgrades (FEMP, 2002 and 2004c), with $259 million in investments in 2003 alone (FEMP, 2004c). As a result, the US Federal government has emerged as the country’s largest customer for performance contracts (Rufo, 2001) and has a potential need for an additional $5.2 billion in energy service investments (Brown et al., 2000).

The Super Energy Savings Performance Contract (ESPC) program is the most current iteration of the Federal government’s performance contracting authority (FEMP, 2004a). Managed by the Federal Energy Management Program (FEMP), Super ESPCs are umbrella contracts designed to streamline the performance contracting procurement process. Under Super ESPCs, ESCOs are awarded Indefinite Delivery, Indefinite Quantity (IDIQ) contracts that allow them to bypass the cumbersome Federal Acquisition Regulations. As a result, agencies and ESCOs are able to design and implement projects in a shorter period of time. In the late 1990s, the Super ESPC model was expanded by the creation of a ”technology-specific ESPC” that targets the inclusion of PV in performance contracts (FEMP, 2003b).

The release of Executive Order (E.O.) 13123, “Greening the Government through Efficient Energy,” in 1999 more thoroughly outlined the case for Federal PV performance contracting. E.O. 13123 sets goals for a 35% decrease in energy costs compared to 1985, a 2.5% renewable energy goal for Federal facilities, and 20,000 solar energy systems on Federal buildings by 2010 (Clinton, 1999). To achieve these targets, EO 13123 recommends that facilities maximize their use of ESPCs (Sec. 403.a), bundle energy efficiency projects with renewable energy projects (Sec. 401), and “use savings from energy efficiency projects to pay additional incremental costs of electricity from renewable energy sources (Sec. 404.c.1).”

In response to this emphasis on renewable energies, several agencies have incorporated PV into their performance contracts. Of particular note are two large-scale PV installations on military facilities in California. The first is a 750 kilowatt (kW) PV system installed at Naval Base Coronado as part of a $22 million Super ESPC. The PV panels were deployed to shade a large section of the base parking lot as a carport and thus provided value through electricity savings and as a construction material (FEMP, 2003a). The PV system, which had a 38-year simple payback as a supply technology, was advantageously bundled with other energy conservation measures, including lighting and air compressor upgrades, for an overall simple payback of 9.8 years. State rebates and Federal prepayments further reduced the project payback to 6 years and a 10-year financing term (Neeley, 2003).

The second large-scale PV performance contract was a 1.1 megawatt (MW) PV installation incorporated into the $56 million contract for the Marine Air Ground Task Force Training Command (MAGTFTC) in the Mojave Desert. The PV system was selected to help maintain combat readiness by providing emergency power, and to help shave the base's 20-MW summer peak (DOE/EERE, 2003). As with Naval Base Coronado project, the MAGTFTC PV system was advantageously bundled with other technologies, and the overall simple payback was blended to 7.4 years (Johnson Controls, 2003).

Taken together, these two projects demonstrate that PV can be deployed as an energy services technology in a performance contract: PV was effectively bundled with other technologies in both projects for an acceptable blended payback term; both projects sought to capitalize on PV's distinct service values; and both projects incorporated large-scale PV systems that rank among the biggest in the nation. In the past 4 years, the Federal government has completed eight PV performance contracts with a combined total of over 2 MW of PV. Unfortunately, the Federal ESPC authority expired in October 2003, and has yet to be renewed (FEMP, 2004b). While there is broad support for ESPC renewal, the expiration has nevertheless stalled momentum of the Federal energy services market and put a halt to new PV performance contract development.

Results from the PV Performance Contracting Project Survey

While the US Federal government has created the most clearly delineated policy for PV performance contracts, a number of state, local, and private facilities have completed performance contracts incorporating PV as well. To better examine this trend, we now turn to the results of the PV performance contracting stakeholder survey conducted in support of this paper.

The survey gathered data for 18 performance contracts that incorporated grid-connected PV systems between 2000 and 2003. In the context of the larger energy services market, 18 projects may seem like an insignificant figure. When viewed in the context of the PV market, however, the trend is more compelling. As can be seen in *Figure 1*, the megawatts of PV installed in performance contracts expanded steadily over the period 2000-2003 and has represented an increasingly significant percentage of annual US grid-connected installations. In 2000, for example, only 6.75 kW of PV capacity were installed through performance contracting. This figure represented less than 1% of the PV installed that year. In 2003, 3.36 MW of PV, or 10.5% of the year's total grid-connected capacity, was installed through performance contracts.

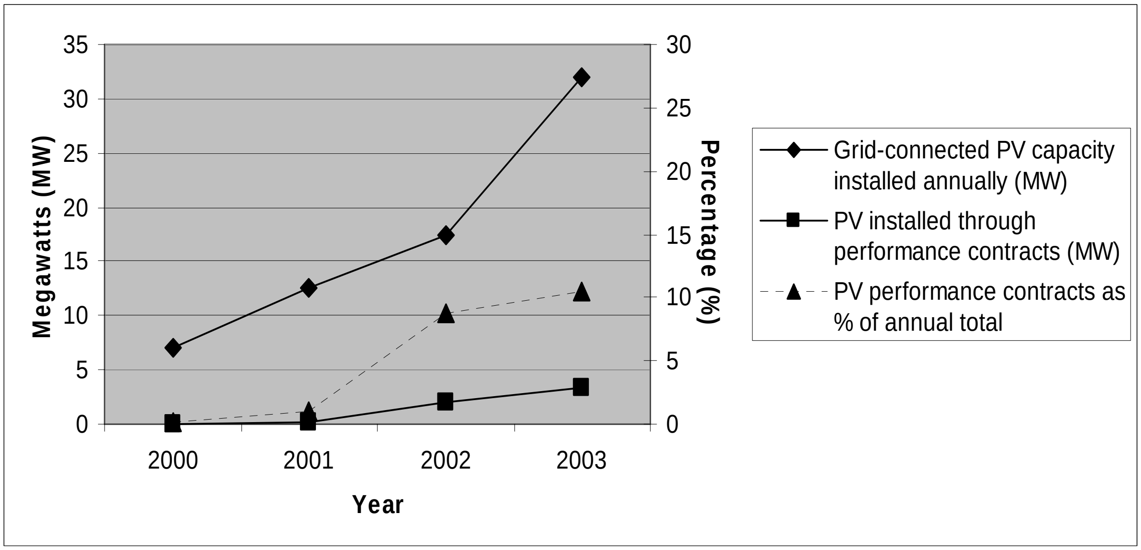

Figure 1: Grid-connected PV Installed through Performance Contracts as a Share of Annual PV Installations

Barriers to PV Performance Contracting

While these growth trends are only suggestive, it appears that this finance mechanism is emerging as a viable method for deploying PV in multiple sectors. However, the practice faces several barriers to continued growth:

1. Absence of performance contracting authority: In some states, no legal authority for performance contracting exists.

2. Low maximum contract terms: In the states where performance contracting authority is in place, maximum contract terms can vary by state. Term ceilings of 10 years or less, for example, may not allow enough flexibility to bundle PV into performance contracting. This is also true to some extent at the Federal level. While 25 years is the maximum term government-wide, some agencies have established their own, lower term ceilings (Strajnic, 2003).

3. Over-dependence on rebates: Almost all of the projects in the survey relied on rebates to drive the contract economics. A change in the policy environment could suddenly limit or eliminate available rebates. This could result in the scaling back or outright cancellation of PV performance contracts. In light of this vulnerability, PV performance contracts may have difficulty penetrating both rebate and non-rebate state markets.

4. Limiting life-cycle analysis criteria: While the Federal government encourages its facility managers to evaluate projects based on their overall life-cycle cost-effectiveness, there is no such directive in place for state and local government. Negotiations for a potential PV performance contract in New York almost collapsed, for example, because each component was evaluated separately for life-cycle cost-effectiveness (Simpson, 2004).

5. PV’s lengthy payback term: Government officials, ESCO representatives, or both may refuse to incorporate PV in performance contracts because of its lengthy payback time. Many ESCO industry representatives and clients view PV as a niche technology whose value does not offset its impact on overall contract term (Hall, 2003). As a result, other technologies with shorter-term payback technologies are often prioritized over PV (MacIntosh, 2003).

6. Decision maker reluctance: As Hughes et al. (2003) report, some institutional decision makers are fundamentally wary of performance contracting and prefer to rely on direct appropriations. Others are hesitant to enter into lengthy financing terms because existing debt may affect a facility’s ability to borrow new funds (Anderson et al. 1999).

7. Lack of inter-industry collaboration: For PV industry stakeholders, performance contracting represents a potential vehicle for their products and services. For some ESCOs, however, PV represents a technology that increases contract transaction costs without providing much perceived value to the company. When such perceptions are prevalent, the inter-industry partnerships necessary for PV performance contracts can be difficult to establish (Dominick, 2003).

While these barriers may not easily be resolved, there are a number of policy options that could mitigate their effects. The first four barriers, for example, could be lowered through regulatory directives or legislation. The remaining three barriers could be targeted by a combination of training, information dissemination, and incentives. To encourage facilities, ESCOs, and PV firms to proactively develop projects, for example, government could establish a low-interest loan fund that specifically targets PV in performance contracts (Stronberg & Singh, 1998).

Conclusions and Discussion

The survey prepared for this paper empirically demonstrates that PV performance contracting has had an increasingly significant impact on solar market development. While only 6.75 kW of PV were installed through performance contracts in 2000, that number grew to 3.36 MW in 2003, or 10.5% of the US grid-connected installations. When considered within the historical context of the performance contracting market, this result is surprising given the lack of PV performance contracts before 2000. It is possible that this trend reflects a transient policy experiment. On the other hand, it may be indicative of a change in PV’s position in the energy services market. Facilities that place value on PV’s environmental and service-oriented benefits are turning to performance contracting to overcome installation hurdles. Performance contracting allows facilities to install PV at no up-front capital cost and to blend PV’s payback term down to acceptable levels. With the Federal government pioneering the model and other sectors adopting it, PV performance contracting is poised for continued development. If stakeholders in both industry and government work to resolve the current barriers, PV performance contracting may evolve into a reliable tool for deploying PV across the institutional and commercial sectors.

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