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Could what that ESCO sales rep said really be true?
Savings realization rates in ESPC versus bid-to-spec projects

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ABSTRACT

Claims that savings realization is greater in energy savings performance contracts (ESPCs) are rampant – at least among energy service company representatives and other ESPC cheerleaders. But hard supporting evidence for these claims has been virtually non-existent. The Department of Energy's Federal Energy Management Program uses its Compliance Tracking System (CTS) database to document the performance of federal buildings and projects towards meeting various federal energy-saving goals. This paper focuses on preliminary analysis from CTS to understand and compare the performance of federal ESPCs with projects that have been implemented with more conventional government appropriations funding. The authors have found preliminary evidence using CTS that shows markedly higher savings realization rates among ESPC projects than appropriations-funded ones. There are numerous caveats to the data comparison that clamor for further study, but the difference is still intriguing. If borne out, this finding will provide concrete support to the idea that ESPCs' guarantees and measurement and verification, long touted by energy service companies (ESCOs) as offering savings assurance, may truly yield substantial benefits. If ESPCs actually do perform better (i.e., have higher realization rates and savings persistence) than conventional bid-to-spec projects, the perceived premium for conducting them may look like a very good deal after all.

Introduction

Federal facility managers are challenged daily with maintaining aging buildings. Additionally, they are faced with congressional mandates to reduce energy use. he Energy Independence and Security Act of 2007 (EISA) requires federal agencies to reduce energy intensity 30 percent by the end of fiscal year (FY) 2015 (compared to an FY 2003 baseline). In order to comply with these mandates, federal agencies resort to various mechanisms to help fund energy projects and reduce operational expenses. Primarily because of the large federal deficits the government has run for the past decade, appropriated funds for conducting energy projects are scarce. Consequently, federal facilities often resort to alternative financing.

Energy savings performance contracting (ESPC) is one of the most common of these alternative procurement mechanisms. ESPCs allow agencies to acquire performance-based services to implement equipment and systems that reduce energy use and O&M expenses through projects designed, installed, and financed by energy service companies (ESCOs). In this way, paid-from-savings ESPC projects allow agencies to reallocate some of their utility and O&M expenses to pay for energy system infrastructure improvements rather than fuel and electricity.

This paper looks at how ESPC projects perform in comparison with projects that have been implemented using appropriated funds. The authors analyzed data from the Federal Energy

Management Program's (FEMP) Compliance Tracking System (CTS) database in order to assess savings realization and persistence of both ESPCs and projects that have been implemented more conventionally, using congressionally appropriated funds.

Background and Literature Review

ESPC, in which an ESCO provides financing, engineering expertise and project management for the implementation of energy, water and operational cost conservation measures in exchange for repayment and profit from cost savings, has been increasingly prevalent in the American energy economy since its inception in the late 1970s and early 1980s. In its earliest manifestation, ESPC was offered as "shared savings," in which both customer and ESCO divided, by predetermined formula, the project's savings. In a period of rising energy costs (due primarily to oil embargoes and nuclear plant cost overruns), the shared savings industry boomed. As energy costs leveled or even declined, however (and at least one major player in the industry declared bankruptcy amidst a scandal about projects that saved little energy but generated lucrative federal tax credits for the ESCO), "shared savings" fell into disrepute and customer skepticism was heightened (Hansen 1993).

The ESCO industry responded with changes in offerings that moderated that skepticism, and ameliorated the messy squabbling over measurement of savings shares at the end of each performance year that had come to characterize too many ESPCs. In a relatively short time, most of the contracts in the market were using "guaranteed savings," with more stringent and transparent measurement and verification (M&V).

The ESCO industry and the volume of ESPCs have grown steadily since. In the mid-1980s, state legislatures began passing legislation authorizing their own agencies and municipal governments to engage in performance contracting for energy, water and operational savings (Hansen 1993). Statutory authorization was essential because ESPC requires execution of a debt instrument, entails capital funding outside the normal capital budgeting process, and differs from normal least-cost procurement (with terms specified in detail prior to competitive bidding) for products and services. ESPC with guaranteed savings was authorized for federal agencies in the Energy Policy Act of 1992; shared savings had been available to federal agencies since the 1980s, but the pace of adoption had been very slow (Thumann and Hoshide 1994).

In 1990, the total known volume of ESPCs nationally was a few hundred million dollars. Since then, project volume has grown steadily, to an estimated $5.3 billion in 2011. A recent LBNL study documents about 9% annual growth for the three years from 2009-2011, a much faster rate of increase than U.S. GDP, and projects that at these growth rates industry revenue could reach $7.5 billion in 2014 and triple by the end of the decade. Almost 85% of these revenues are from the public and institutional (healthcare, college/university) markets, as opposed to the private sector (Stuart et. al 2013).

Federal ESPC Projects and History

Federal use of ESPC accelerated with the promulgation of program regulations by DOE in 1995 and the 1998 streamlining of ESPC contracting into blanket indefinite delivery indefinite quantity (IDIQ) contracts with pre-selected ESCOs, and the issuance of Office of Management and Budget policy to support their use.

ESPC is seen as a vital tool in efforts to reduce federal energy and water use, and its use

in buildings has accelerated rapidly. In the first five years after being fully operational (1999-2003), ESPC accounted for fully half of federal spending on federal energy and water savings projects. Appropriated funds accounted for only 22% (the remainder was attributable to conservation spending by utilities, which can also offer paid-from-savings projects to federal facilities) (FEMAC 2004). These proportions have become slightly more skewed towards ESPC in the past decade, with the conspicuous exception of 2010 and 2011, when there was a huge influx of appropriated funds to federal agencies through the American Recovery and Reinvestment Act of 2009 (ARRA 2009).

ESPCs are fixed-price contracts that, in federal facilities, can have terms of up to 25 years. The federal agencies incur costs for procurement and project management that are similar to conventional "bid-to-specification" projects, but do not incur the capital costs (unless they find it advantageous to leverage the ESPC with appropriated funds they would have otherwise expended on a portion of the ESPC's scope).

Per the authorizing statutes, following the implementation of an ESPC, the government is never supposed to pay more to the ESCO and its utilities (and related O&M), combined, than it would have paid for utilities (and related O&M) had it not entered into the ESPC; in other words, the government stays fiscally "whole" with these projects even while it saves considerable energy (about 20% per ESPC site, on average) In addition to generating energy, water and dollar savings, years of deferred energy related maintenance at federal facilities have been effectively addressed by ESPC.

Despite a slow start and a hiatus when the statutory authority lapsed due to a sunset provision at the end of FY 2003, ESPC has made an enormous contribution to the federal government's energy-cost reduction goals, as depicted in Figure 1, below.

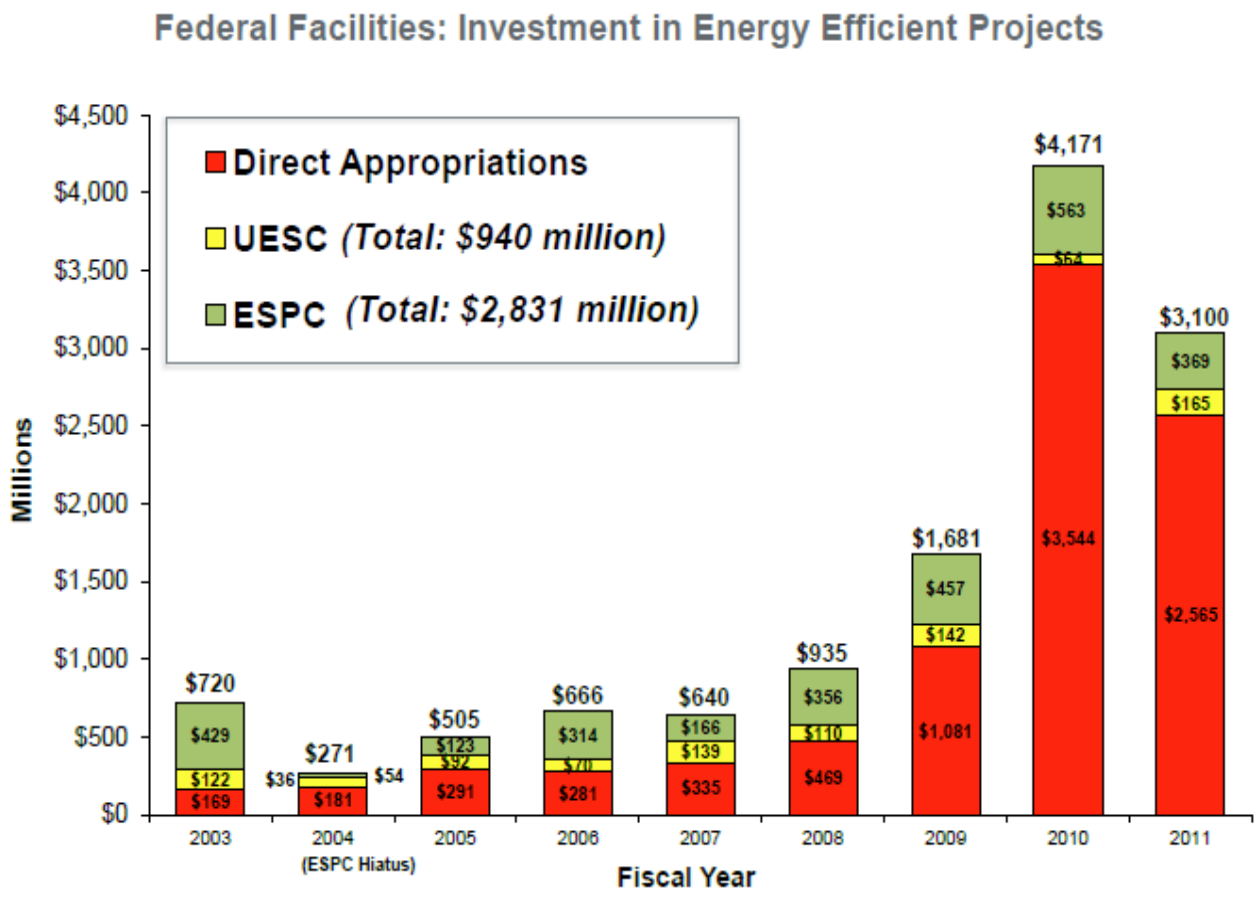

Figure 1: Federal spending for conservation goals 2003-2010 (Unruh 2012). UESC stands for utility energy service contracts, another alternative financing method.

ESPC projects have been implemented by 20 different federal agencies and departments in 47 states, and for US facilities overseas. More than 600 federal ESPC projects, altogether representing more than $6 billion in private-sector funds, were awarded through 2013, with more than a billion dollars in additional projects now in development. These projects are guaranteed by their ESCOs to pay for themselves, with nearly $15 billion in energy and operational cost savings.

Despite the heavy use of ESPC in the federal sector, some degree of skepticism remains. M&V is conducted by the ESCOs themselves, which some consider to be a "fox guarding the henhouse" arrangement. The FEMP program maintains what some perceive as the most robust M&V standards of any large-scale public ESPC program, based on the International Performance Measurement and Verification Protocol (IPMVP 2012). Yet some federal agencies maintain M&V practices that are even more stringent, and assert that many ESPCs have underperformed on their savings guarantees (Lally 2008).

Additionally, it is not rare to hear from federal personnel involved in energy management that energy conservation projects will be cheaper, and possibly even perform better, if conducted by in-house staff through conventional bid-to-specification contracting with appropriated funds. An analysis conducted by Oak Ridge National Laboratory found that even where sufficient in-house personnel are available, ESPCs often provide a better deal to the government (putting aside any differences in realization rates) than projects conducted with appropriated funds. This

is primarily because of lost savings suffered due to the sometimes multiple year waits for congressional appropriations to materialize for these projects, along with other inherent delays in the bid-to-spec process (as opposed to the design-build one employed with ESPC). A request for funding an engineering study must be prepared, then funds received and the engineering study competitively bid and executed. The executed study results in a specification for a project, for which funds are requested. When funds are appropriated, bids for the specified project are let, and a contractor selected. There is little or no incentive for the selected contractor to find additional energy conservation measures (ECMs) or savings. And the process typically takes twice as long as an equivalent ESPC, during which time the excess energy cost attributable to old or outdated equipment continues to be lost (Shonder, Hughes, and Atkin 2006).

EISA Section 432 and the Compliance Tracking System

This study examines another aspect of potential comparisons between appropriated and ESPC projects, using data that only recently have been available due to the reporting requirements of EISA Section 432, which requires the federal agencies (e.g., the General Services Administration or Department of Interior) to perform comprehensive audits on their facilities that collectively comprise 75% or more of their annual energy consumption. The act also requires that agencies report on any energy conservation projects they have completed.

EISA directs a comprehensive approach for evaluating and deploying energy and water efficiency and conservation measures (ECMs) in federal buildings and monitoring project and building performance. Two general frameworks, one for managing energy and water efficiency projects and one for monitoring performance, are included within the statute (USDOE 2012). The annual building performance monitoring framework provides ongoing performance monitoring and disclosure of results, supported by existing metering requirements and ongoing benchmarking of individual buildings against similar buildings over time to indicate potential for additional ECM opportunities and corrective action for ECMs that are not persistent in saving energy and water. Under the performance monitoring framework, ECMs are monitored and findings inform the next round of facility evaluations (USDOE 2012). Importantly, though, ESPC projects' M&V is conducted by the performing ESCOs, while non-ESPCs are measured generally by in-house agency staff (or O&M contractors).

The Compliance Tracking System (CTS) database was developed for the collection and reporting of data needed for the demonstration of federal compliance and progress toward meeting all energy and water efficiency requirements outlined in EISA 432. Among other things, CTS captures the following key information:

- Results from audits conducted pursuant to the statute.
- Project data from ECMs implemented by the agencies, including project cost, funding sources, and estimated energy and water savings.
- Savings findings, along with the M&V option used to assess those savings (specifying the date at which the measurements were taken).
- Benchmarking data for metered buildings that are "covered" facilities (representing at least 75% of an agency's total building energy consumption) per EISA 432.

Results

The data analysis for implemented projects involved cleaning to ensure that data were devoid of any missing and erroneous values. Some of the ESPC data from CTS are replaced with data from ESPC final proposals, as well as post-installation and annual M&V reports. This information was used to resolve some of the inconsistencies in CTS. Next, the collected and cleaned data were separated into two sets, one comprising ESPC and the other non-ESPC projects.

ESPC projects. ESPCs generally include multiple ECMs. CTS sometimes separates the energy savings associated with individual ECMs in ESPC but not always – sometimes, ESPC savings are represented *en masse*, and these were not excluded from the analysis. Site energy savings for the 49 ESPC projects as documented in CTS were determined (in MMBtu) as well as water savings (in kgal) (Figure 2). The total "estimated" energy savings (ESCOs show these figures in their proposals but generally guarantee about 95% of them) for these projects is over 1,449,000 MMBtu. The reported savings as documented through annual M&V reports is roughly 1,481,000 MMBtu, for a realization rate of 102% (ratio of actual to proposed savings).[1] The realization rates for ESPC water measures were found to be 122%, with a reported savings of almost 527,000 kgal compared to an estimated performance of roughly 420,000 kgal (Figure 2, below).

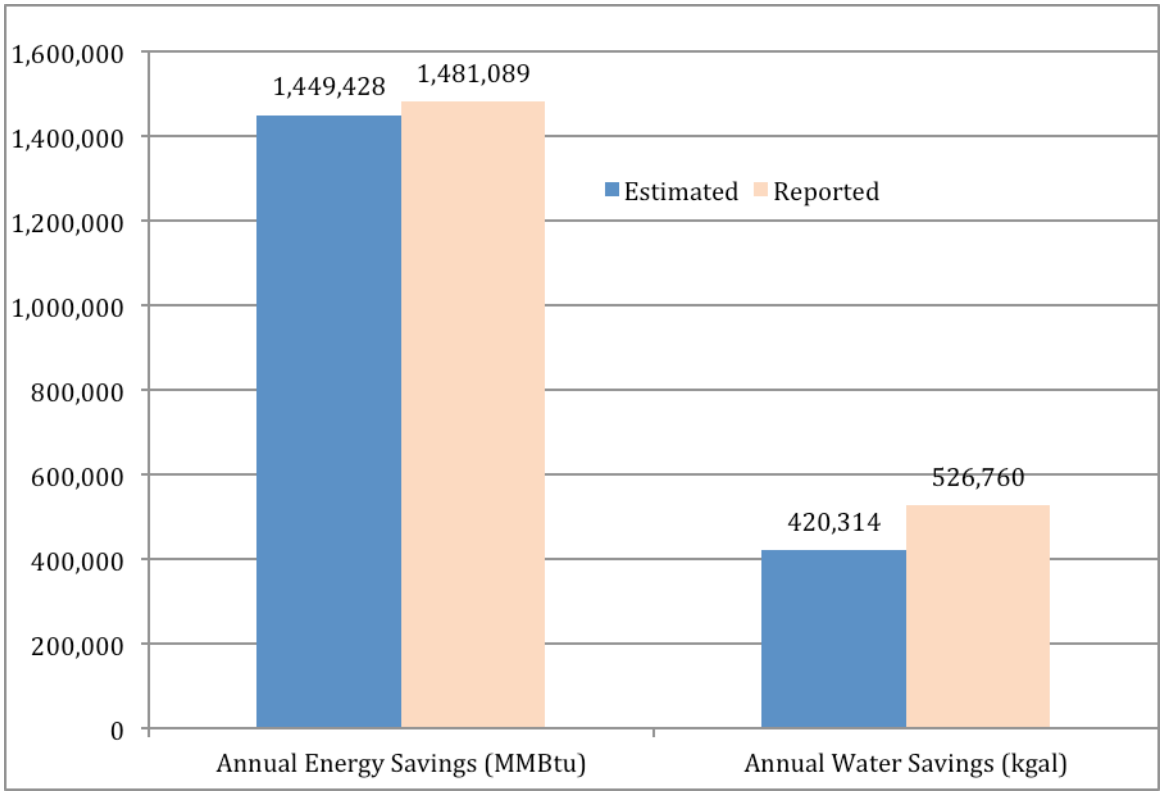

Figure 2: Comparing estimated and reported utility savings from ESPC projects.

[1] The realization rates for individual measures (ECMs) vary significantly as some over-perform while others have shortfalls. In almost all cases, though, the whole project is meeting or exceeding the guaranteed performance. The guarantee for an ESPC project is for the entire (multiple ECM) project and not at the individual ECM level (unless of course the project has only one ECM, which is rare).

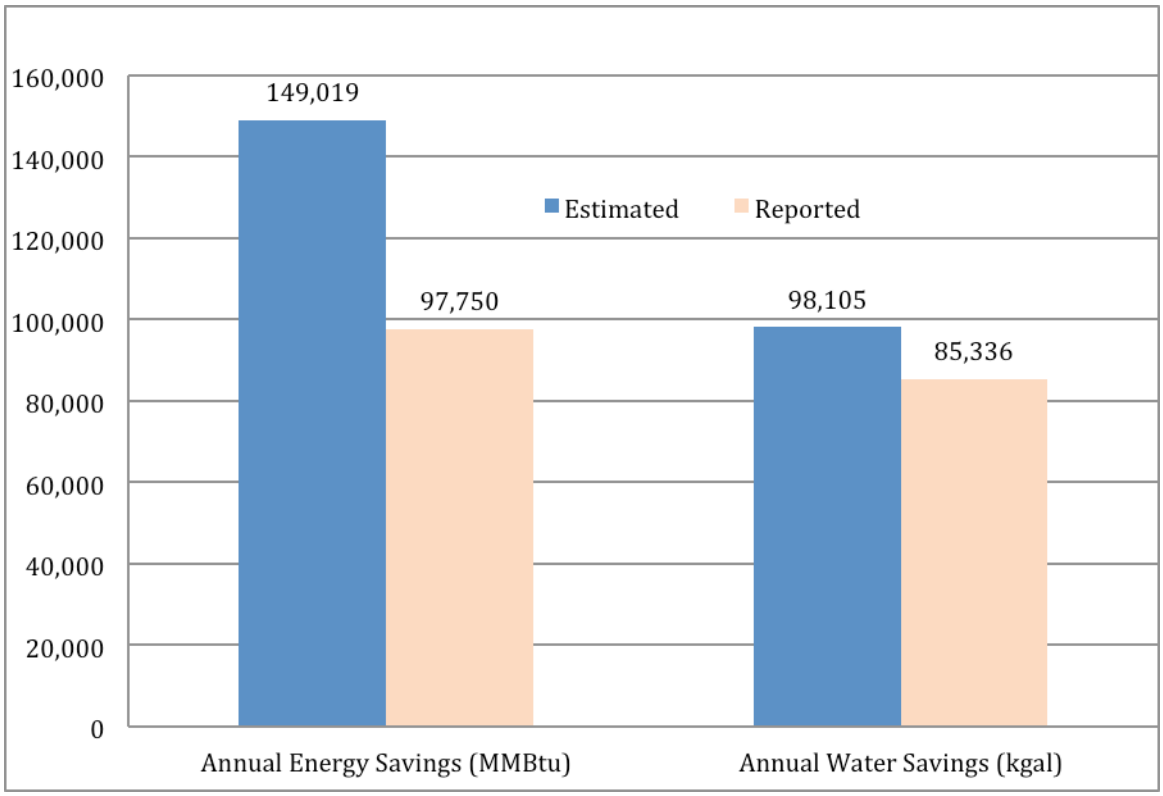

Figure 3: Comparing estimated and reported utility savings from non-ESPC projects.

Non-ESPC projects. Savings were also assessed for the 30 non-ESPC projects that were documented in CTS. The total savings from the non-ESPC project sample are an order of magnitude smaller than the ESPC sample, with the total estimated energy savings for these projects was roughly 149,000 MMBtu. The savings as documented through annual M&V and project follow-up were reported to be 97,750 MMBtu, for a realization rate of 67%. The realization rates for individual non-ESPC projects (as with the ESPCs) vary substantially. The realization rate for water measures was 87%, with a reported savings of approximately 85,000 kgal compared to an estimated performance of about 98,000 kgal.

While the M&V options used for the non-ESPC projects is reported in CTS, the case for the ESPC projects is trickier, as results for ESPCs are sometimes reported in the aggregate in CTS (and do not capture the ECM-by-ECM methods used for M&V). However, the distribution of M&V methods for the non-ESPC projects (70% Option A, 20% Option B, 7% Option C, and 3% Option D) closely resembles the approximate M&V mix in federal ESPC projects overall.

Analysis and Conclusion

That there was a difference between the savings realization rates of the ESPC and non-ESPC projects that favored ESPC was not a big surprise to the authors, but the magnitude (102% vs. 67%) very much was. It is important to note that the authors found a few data inconsistencies and, where these surfaced, actual ESPC contract document data (e.g., from annual M&V reports) always took precedence over the CTS; had we not made these corrections, the overall realization rate for the ESPCs would have been significantly *higher*, however. This level of quality control was not conducted for the non-ESPC projects as there is no alternate data source to validate the

savings numbers.

The results presented in this paper are based on the relatively small sample of data that is currently available in CTS. There are numerous other caveats to these findings:

- the CTS database is new (2012);
- the M&V performers were not consistent across the two types of projects;
- the volume of savings represented for the two types of projects was very uneven (the ESPC data represent roughly ten times the total savings of the non-ESPC set); and
- the types of measures that prevail in ESPC versus conventional projects may differ (e.g., perhaps ESCOs hew to more reliable ECMs because they have to guarantee savings) – though we are doubtful about this prospect, we did not investigate it and rule it out.

Nonetheless, these findings are still eye-catching. They clearly beg for further study and increased scientific rigor to try to control for the variables that may be distorting results. For instance, once additional data are added to the database, it will likely be possible to perform savings comparisons of similar ECMs, both in type and scale, in ESPC vs. non-ESPC projects. If the reported savings difference between ECMs within and outside of ESPC continues to be revealed, it is also possible that FEMP or another federal agency might support a study in which ECM measurements of savings from the two types of projects were assessed by a third party. If ESPCs do produce higher savings realization – as their adherents have long attested and their detractors long denied – it will provide a substantial argument in support of their broader use. At this point we cannot make that contention.

Another related extension to this study would be to compare the whole-building benchmarking (ENERGY STAR Portfolio Manager) performance reported in CTS of buildings that were retrofitted using ESPC with buildings that underwent energy improvement efforts using non-ESPCs. While this type of study, in its simplest form, would be blind to adjustments for changes in the buildings unrelated to the ECMs at issue (e.g., occupancy or use changes, and even other energy conservation work), these changes would presumably not differ across the two data sets with large enough sample sizes. This IPMVP "Option C" approach would speak to the respective realization rates of the two project sets and also shed light on the equally important issue of savings *persistence* between ESPC and non-ESPC ECMs. ESPC adherents have long trumpeted superior persistence as another plus to these projects.

References

ARRA (American Recovery and Reinvestment Act of 2009). 2009. Public Law 111-5, 123 Stat. 115.

EVO (Efficiency Valuation Organization). 2012. *International Performance Measurement and Verification Protocol (IPMVP)*: *Concepts and Options for Determining Energy and Water Savings* (Vol. 1). Washington, DC: Efficiency Valuation Organization. www.evo-world.org.

FEMAC (Federal Energy Management Advisory Committee). 2004. "Federal Spending by Funding Source to Meet Conservation Goals, 1999-2003." Report to the U.S. Department of Energy's Federal Energy Management Program.

Hansen, S. J. 1993. *Performance Contracting for Energy and Environmental Systems*. Lilburn, GA: Fairmont Press.

Lally, B. 2008. "Air Force ESPC Program." Presentation to NAESCO Federal Market Workshop (March 10, 2008), Washington, DC.

Shonder, J., P. Hughes, and E. Atkin. 2006. "Follow-Up on ESPC and Appropriations ─ Comparing Life-Cycle Costs." Oak Ridge National Laboratory: Oak Ridge TN.

Stuart, E., P.H. Larsen, C.A. Goldman, and D. Gilligan. 2013. "Current Size and Remaining Market Potential of the U.S. Energy Service Company Industry." Berkeley, CA: Lawrence Berkeley National Laboratory.

Thumann, A. and R. Hoshide. 1994. *Energy Management Guide for Government Buildings*. Lilburn GA: Fairmont Press.

Unruh, T. 2012. "Federal Facilities: Investment in Energy Efficient Projects." Graph shown in presentation to Federal Utilities Partnership Working Group, Jekyll Island, GA (4/11/12).

USDOE (U.S. Department of Energy). 2012. *Guidance for the Implementation and Follow-up of Identified Energy and Water Efficiency Measures in Covered Facilities (per 42 U.S.C. 8253(f), Use of Energy and Water Efficiency Measures in Federal Buildings)*. Washington, DC: US DOE. www1.eere.energy.gov/femp/pdfs/eisa_project_guidance.pdf.