LBNL-54952

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August 2004

http://eetd.lbl.gov/ea/EMS/EMS_pubs.html

In the Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings.

The work described in this paper was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Federal Energy Management Program, Rebuild America, and the Office of Electricity Transmission and Distribution, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

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ABSTRACT

The federal market has been a source of strong energy service company (ESCO) industry growth over the last decade as traditional "MUSH" markets – municipal/state governments, universities, schools and hospitals – have matured. Federal alternative financing programs – Utility Energy Services Contracts (UESC) and Department of Energy (DOE) Super, Army and Air Force Energy Savings Performance Contracts (ESPC) – have enabled this growth, but recent events threaten the ESPC programs. We compare the federal and MUSH markets by analyzing ~1550 completed projects and interviewing ESCO representatives. Federal ESPC market activity is estimated at ~$1.6 billion (B) over 10-15 years; activity in 2002 was ~$230 million (M). MUSH markets have produced ~ $12-16B in projects over 20 years, and ~$0.8-1.0B in 2002. Federal sector projects have longer average contract terms than MUSH (14 vs. 9.5 years respectively). Federal projects are larger (median costs are $1.85M vs. $0.98M for MUSH), but costs per square foot are lower (median costs are $2.08/ft^2 vs. $2.93/ft^2 for MUSH), and annual energy savings are higher (18 vs. 14 kBtu/ft^2). Non-energy savings are more often counted in federal projects (58% vs. 35% of MUSH projects) but when counted represent a higher proportion of savings in MUSH projects. Median payback times in the federal market are shorter than MUSH (7.7 vs. 8.8 years) and calculated net economic benefits of 214 federal projects amount to ~$550M, compared to ~$1.2B for 965 MUSH projects.

Introduction

The federal market has been a key source of ESCO industry growth over the last decade as the traditional "MUSH" markets – municipal agencies (state/local government), universities, schools and hospitals – have matured. Federal facilities share many common characteristics with these markets – they are often large, ageing and lack capital budgets for improvements – yet there are marked differences in policy, procurement and the role of ESCOs as well. The 1992 Energy Policy Act established a target-based federal energy-efficiency mandate and authorized several alternative-financing mechanisms that promote ESCO projects – Utility Energy Services Contracts (UESC), Army and Air Force Energy Savings Performance Contracts (ESPC) and, most recently, the Department of Energy (DOE)'s Super ESPC program.[1]

Despite a successful and growing program of private sector investment in federal energy efficiency, sunset provisions in the ESPC legislation came into effect October 1, 2003, stalling the program, and the Bush administration has been unable to pass an Energy Bill that would reinstate it (FEMP 2004).

In light of these developments, it is clear that detailed information on the actual performance of the federal ESPC market is needed if the program is to be continued. How does the federal market (and ESPC in particular) compare to other comparable markets in which

[1] The term "alternative financing" refers to utilizing private sector investment to finance projects as an alternative to paying for projects up-front from congressional appropriations.

ESCOs are active? Are concerns about cost-effectiveness validated? Are common perceptions – for example, that federal projects are costly – borne out by project data?

This research begins to answer these questions by comparing trends in the federal and other institutional markets using a large database of completed projects and by exploring industry perceptions about these markets through in-depth interviews with ESCOs. We begin with a high-level comparison of MUSH and federal ESPC markets, emphasizing legislation, market facilitation, and market drivers and barriers. We then move on to a bottom-up comparison of federal and MUSH projects, focusing on project strategies, size, costs, energy savings, and economics. Finally, we discuss our findings in light of the sunset of the ESPC authorizing legislation.

Approach

This paper presents results drawn from two complementary information sources: a database of completed ESCO projects[2] and interviews with ESCOs active in federal and MUSH markets.

Our database was developed for the National Association of Energy Services Companies (NAESCO) to track industry trends using a bottom-up approach (Goldman et al. 2002). Since Goldman et al (2002) was published, we have updated ~150 already existing projects with new information and added 505 new projects provided by ESCOs applying for NAESCO accreditation. We have also received ~170 new projects from state energy offices and other sources. Finally, FEMP has provided copies of executed Delivery Order contracts for all 127 Super ESPC projects, which we have included in the NAESCO database.[3] In all, the database now contains 2174 projects and captures recent trends – most of the newly added projects were completed between 2000 and 2004.[4]

Our interviews were developed to provide interpretive context for project data results by asking ESCOs to compare their experience working in federal and MUSH markets. With the help of NAESCO, we identified contacts in charge of federal market operations at nine ESCOs active in the federal and MUSH markets, and were able to schedule interviews with eight of them. The hour-long telephone interviews were administered in January and February of 2004.

Overview of Federal ESPC and MUSH markets

In many ways, ESCOs operate in the federal market as they do in MUSH markets: they install energy-efficient equipment at customers' sites and assume a share of the associated performance risk, engaging in long-term contractual agreements in which energy (and/or operational) savings pay for the initial investment over the lifetime of the equipment. However, many aspects of ESCO industry practices and performance differ between the federal and MUSH markets. These differences, which are largely customer driven, are explored in this paper.

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[2] The majority of projects are completed. However several Super ESPC projects provided to us by FEMP have been awarded but construction is not yet completed.

[3] The number of Super ESPC projects differs slightly from FEMP's tracking, because we have treated modifications to Delivery Orders which involve add-on phases as separate projects in our database.

[4] Because the focus of this study is on the US federal government and counterpart MUSH markets (the mainstay of US ESCO activity) we limit our analysis to public/institutional market segments, leaving private sector projects out. We also exclude all non-US projects, except for a few completed on US military bases overseas.

Both the MUSH and federal markets can be divided into several "submarkets", each with their own idiosyncrasies: state/local government, universities/colleges, K-12 schools, and health/hospital for MUSH, and the ESPC and UESC alternative financing mechanisms for the federal market. In Goldman et al. (2002) we explored and characterized differences between individual MUSH market segments, and in Hopper et al. (2004) we compare ESPC and UESC projects. In this paper, we focus mainly on higher-level differences in performance between the federal market and other markets in which ESCOs have traditionally been active. This allows us to make broad comparisons, but necessarily avoids some of the details.[5] Further, we largely focus on the ESPC side of the federal market. The reasons for this are twofold: our sample of projects is heavily biased toward ESPC (see Approach, above) and, due to the sunset of the Super ESPC program, there is a need for timely information that can address concerns about cost-effectiveness and program performance.

Characteristic features of the two markets are compared in Table 1. Activity in both markets can be attributed to strong enabling legislation, support from facilitating agencies, and standardized procurement and contractual mechanisms. However, as the table shows, there are differences in how these market attributes are achieved, and the resulting market barriers, drivers and typical projects undertaken by customers also differ. The following sections compare these two models in more detail.

Table 1. Characteristics of Federal ESPC and MUSH Markets

Attribute	Federal ESPC Market	MUSH Markets
Enabling Legislation	1992 Energy Policy Act 10 CFR-436 10 USC 2865 / 2866	State performance contracting laws
Procurement Mechanisms	Site-specific ESPC Army ESPC Air Force ESPC DOE Super ESPC	RFPs issued by customer agencies
Facilitating Agencies	Army Corps of Engineers (Huntsville) Air Force Civil Engineer Support Agency FEMP	State energy agencies or energy offices
Market Drivers	Compliance with legislation, need for new capital equipment	Need for new capital equipment
Market Barriers	Sales cycle time, customer preference for appropriations over ESPC, financing, bureaucracy	Lacking or limited enabling legislation in some states, sales cycle time, need to educate customers

Policies, Programs and Practices

The federal ESPC market is relatively young, with most activity occurring in the last 10 years. As Table 1 indicates, it consists of four "flavors" of the ESPC procurement mechanism. The first ESPCs were "site-specific" contracts that were initially approved in the 1986 amendments to the National Energy Conservation Policy Act of 1978 (FEMP 2004). They were negotiated individually by customer agencies, and most were contracted between 1988 and 1999, though a small number of customers still use this mechanism. The Energy Policy Act of 1992 introduced a mandate directing all federal agencies to reduce their energy consumption per square foot by 35% over a 1985 baseline by 2010. This Act and 10 CFR-436 "Federal Energy

[5] However, where observed, we note large distinctions between submarkets.

Management and Planning Program" also expanded the authorization for ESPC to allow the development of the DOE Super ESPC program (referred to hereafter as "Super ESPC"). The Army Corps of Engineers and the Air Force took advantage of this legislation to develop their own ESPC programs. The military programs received further authorization under 10 USC 2865 and 2866, which govern energy savings and water conservation at military installations (FEMP 2004).

The Super ESPC program is open to all federal agencies, as is the Army program; use of the latter by civilian agencies is limited. The Air Force program is used solely by the Air Force.

The agency-sponsored programs are designed to facilitate and expand the market compared to the site-specific mechanism by: (1) developing standardized contractual mechanisms and best practices, (2) establishing facilitating agencies to provide technical assistance and promote the ESPC mechanism to customer agencies, and (3) setting up "Indefinite Delivery, Indefinite Quantity" (IDIQ) contracts which pre-qualify ESCOs to enter into ESPC contracts after an initial selection process. The facilitating agency for the Army program is the Army Corps of Engineers at Huntsville; the Air Force Civil Engineer Support Agency (AFCESA) serves this function for the Air Force program and the Federal Energy Management Program (FEMP) within DOE is responsible for facilitating the Super ESPC program. The Super ESPC program awards IDIQ contracts to four to six ESCOs in each of six regions.[6] The Army Corps of Engineers awards contracts covering pre-defined regions of 4 or 46 states. The Air Force program awards region-wide contracts to a single ESCO – thus competition is effectively eliminated for the winner, so long as the contract is not re-qualified (AFCESA 2004). However, in interviews, ESCOs pointed out that competition still exists between the different financing mechanisms. Nonetheless, they all rated competition from other ESCOs in the federal market lower than in MUSH markets, citing the IDIQ contracts as the primary reason.[7]

In contrast to the centralized framework characteristic of the federal market, MUSH projects are enabled and administered at the state level. The implication is that the existence and quality of enabling legislation and administrative support varies considerably across the US. Nonetheless, the basic means for enabling and supporting projects are similar. Enabling legislation for ESCO projects entails state performance contracting laws, typically encompassing state/local government agencies, K-12 school boards or universities/colleges, that alter procurement regulations allowing these agencies to enter into multi-year contracts with ESCOs and often to engage in municipal leasing to finance projects. Most states specify maximum allowable contract terms that range, depending on the state, from less than 10 years to 20 years or more. Market facilitation in the form of promotion of performance contracting, interpretation of enabling legislation and technical assistance for customers is typically undertaken by state energy offices or agencies responsible for state facilities – here too, the quality of the assistance varies by state. State agencies or school districts typically issue RFPs for projects and ESCOs enter into a competitive bidding process. In some states, agency-wide RFQs may be issued to pre-select ESCOs to work on, for example, all projects in schools in an area or state. Because the bidding process is open to anyone, ESCOs told us in interviews, the degree of competition from other ESCOs as well as non-ESCO energy-efficiency contractors is typically very high in these markets.

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[6] The DOE program also runs several "technology specific" ESPC contracts (e.g., geothermal heat pumps, wind power) for which there are separate qualifications lists.

[7] All of the ESCOs we interviewed are IDIQ contract holders.

Major Market Drivers and Barriers

Based on our interviews with ESCO representatives, significant differences exist between federal and MUSH markets in their drivers – the motivations for customers to enter into ESCO contracts – and market barriers – factors limiting growth in ESCO activity or preventing cost-effective potential from being captured.

The federal market appears to be largely compliance driven. Because of the targeted energy-reduction goals mandated by the 1992 Energy Policy Act, federal agencies are required to pursue cost-effective measures to reduce energy consumption. By contrast, in MUSH markets, the primary driver is, as several interviewees put it, "to get new stuff". MUSH customers often suffer from inadequate capital budgets to replace old and failing infrastructure, and performance contracts are a way to finance new equipment. While this is also a factor in the federal market (one interviewee actually felt it was *more* important in the federal than MUSH markets), it competes for importance with agency compliance objectives.

Many of the interviewees cited common barriers across both market segments, but most emphasized that their magnitude was greater in the federal market. The most often-cited barrier, particularly for the federal government, is the time to develop projects. When asked, in their experience, how long it takes to move a project from initial customer contact to award, all but one ESCO indicated at least 12 months, two of them saying a typical project takes as long as 2 years. For MUSH markets, all ESCOs answered between 3 months to a year, with most indicating 6-9 months. Reasons given for the long federal project cycle time mostly involve bureaucracy – the number of layers of approval required to award a project and the complexity of the contract requirements.

Another often-cited barrier in the federal market is customer preference for congressional appropriations to fund projects over performance contracting, even if the funds take several years to be approved. Not only does this seriously limit ESCO industry growth, but it potentially results in significant lost savings opportunities for agencies (Hughes et al. 2003).

In MUSH markets, the primary barrier mentioned is the lack of well-designed and/or supported enabling legislation in certain states. Limited contract terms were especially noted as an impediment to fully capturing the opportunities available. Other barriers cited include an aversion to off-balance sheet financing, especially in the wake of the Enron scandal, the lack of a centralized effort across states, a history of bad projects "poisoning the market" in some states, the need to educate customers, and a feeling that "the low-hanging fruit is already picked".

Finally, it is worth noting that the ESPC sunset was mentioned by virtually all ESCOs as a critical barrier to federal market growth going forward.

Market Size and Potential

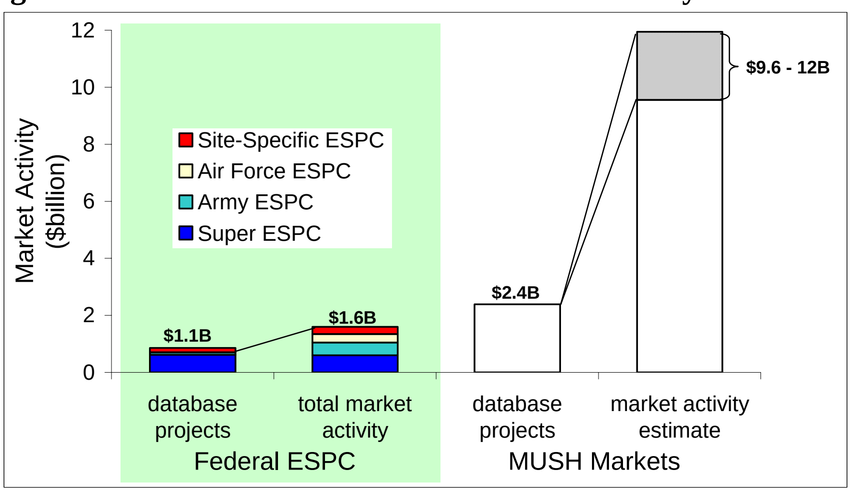
Market Activity. Historical activity in the federal ESPC market is relatively well known due to project tracking and reporting efforts by various agencies (FEMP, Air Force, Huntsville). For the 127 Super ESPC projects (all of which are included in our database) total project costs amount to ~$600 million. As of September 2003, the Army ESPC program had awarded 91 projects with a total investment of ~$450 million (Branch & Skumanich 2003). The site-specific ESPC mechanism has produced about ~$300 million in investment, and the Air Force ESPC program had awarded ~40 projects totaling ~$250 million as of 2002 (FEMP 2002). Adding these estimates, the federal ESPC market has produced at least 340 projects and ~$1.6 billion in project investment over 10-15 years (see Figure 1).

ESPC activity has been growing over the past decade. Combining project activity for the various ESPC programs, total activity in 2002 (the latest year for which complete data is available) was about $230 million (Branch & Skumanich 2003, FEMP 2002). Activity in 2003 was higher due to a large number of projects awarded just prior to the ESPC sunset deadline.

For MUSH market activity we assume, based on past research, that our database represents about 15-20% of total historical ESCO industry activity (Goldman et al. 2002). Hence, from the 1263 MUSH projects in our database, representing $2.45 billion, we extrapolate that the total industry activity in these market segments has been approximately $12.3-16.3 billion over the 20+ years that this market has been active. For the 1990-2002 time period shown in Figure 1, MUSH activity was approximately $9.6-12.0 billion.

For 2002, we take a more conservative approach, estimating that our database represents about 20-25% of MUSH activity.[8] This results in an estimate of approximately $0.8-1.0 billion in MUSH market activity in that year.

Figure 1. Federal ESPC and MUSH Market Activity: ~1990-2002



Sources: Branch & Skumanich (2003) (Federal ESPC market activity); LBNL database projection (MUSH market activity estimate)

Remaining Market Potential. Estimating the potential left to be captured in the federal and other institutional markets is challenging for several reasons. First, one must distinguish between *technical* potential – the opportunities for cost-effective energy savings, which depend on the size and characteristics of the building stock and equipment as well as other factors such as energy price regimes – and *achievable* potential – the subset of technical potential which is administratively possible to achieve, given the barriers to project development discussed above. Second, one must consider that technical potential, at least in the long term, is far from static – while opportunities are captured by projects already completed, advances in energy-efficient technologies along with ever aging equipment create new opportunities, even where retrofits

[8] We believe that ESCO industry growth has slowed since the estimate in Goldman et al. (2002), which was based on industry revenues up to the year 2000. Since that time, there has been substantial industry consolidation, several utilities have closed their ESCO operations, and fallout from the Enron scandal has impacted industry revenues.

have already been installed. Thus, technical potential is an ever-shifting target. Third, the influence of external events and policies may increase or decrease the technical or achievable potential. For example, military base privatization may reduce substantially the building stock covered by the federal energy reduction mandate, thus reducing technical potential. The ESPC sunset dramatically reduces achievable potential. Actual or forecasted increases in electricity and gas prices may serve to increase the cost-effective technical and achievable market potential.

In our interviews with ESCOs, we asked respondents for their best estimate of the degree of market penetration, in percentage terms, already achieved by the ESCO industry in federal and MUSH markets. Six out of eight rated market penetration higher in MUSH markets than the federal market; most estimated federal market penetration in the range of 20-40%, and MUSH markets at around 30-50%. Four of the ESCOs noted the difference between technical and achievable potential (though the question was not worded with this distinction), and rated market penetration based on technical potential much lower for the federal market (2-30%). Those that made this distinction felt that the gap between technical and achievable potential was wider for the federal market than MUSH markets, due to the barriers discussed above.

A detailed quantitative analysis of federal or MUSH market potential is beyond the scope of this paper, but is addressed in Hopper et al. (2004).

Project Trends and Characteristics: Federal ESPC vs. MUSH

Having compared and contrasted common practices in the federal ESPC and MUSH markets from a high-level perspective, we now present comparisons in key aspects of project performance from our database.

In interpreting the following results, it is important to understand the mix of federal projects in our database. As mentioned already, it contains 100% of awarded Super ESPC projects, as well as a mix of UESC and other ESPC projects (site-specific, Air Force and Army ESPC) received from ESCOs. These latter projects represent a smaller fraction of these markets. Altogether, our sample of 258 federal projects consists of 50% Super ESPC projects, 15% other ESPC, 24% UESC, and 11% are of unknown program type.[9] Thus, the results presented below reflect a heavy dominance of ESPC projects, which tend to be larger, more comprehensive and cover longer terms than UESC contracts (Hopper et al. 2004).

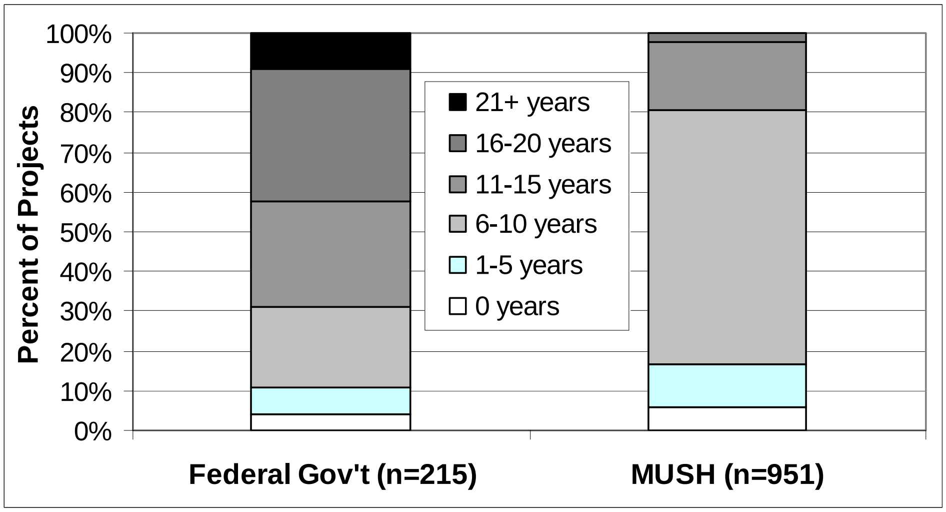
Project Strategies

Contract Term. In interviews, ESCOs consistently told us that contract terms are longer in the federal market, citing typical terms of 10-20 years, versus 10-12 years for MUSH projects, although many noted exceptions to this rule. Most cited state performance contracting laws that limit MUSH market contract terms to 10 years or less as the primary reason for this difference. Other factors include availability of financing (interest rates are higher for longer term projects) and less complex ECMs with shorter paybacks installed in MUSH market projects.

[9] ESCOs submitting federal projects for NAESCO accreditation were not asked which alternative financing mechanism was used. We coded projects using a delphi approach, asking ESPC and UESC program managers to identify projects based on the site and year. Projects that were unidentified through this process fall into an "unknown" category – however, we know that they are not Super ESPC projects as we have the complete list of these projects from FEMP.

As Figure 2 shows, our project data confirm our interview results. Federal contracts range in length from 0 to 25 years, with an average of 14 years, while MUSH market contracts range from 0 to 26 years and are 9.5 years on average. The zero-term projects usually correspond to *Design/build* type arrangements.[10] In the federal market, this practice is limited to the UESC market – all ESPC projects have multi-year commitments.

Figure 2. Contract Terms of Federal vs. MUSH Projects



Installed Measures. Based on our interviews with ESCOs, we expected to find significant differences in the types of measures installed in federal and MUSH market projects. Several interviewees expressed the view that MUSH customers tend to install simpler, less comprehensive "lighting and HVAC" projects, whereas federal customers are more likely to include "pet projects" that include innovative technologies. Reasons given for this view included differences in customer "sophistication", limitations due to maximum allowable terms set by state performance contracting laws in MUSH markets, and a greater focus on energy (rather than economic) savings in the federal market.

However, we don't find large differences in the types of measures installed in federal versus MUSH market projects in our database. Table 2 demonstrates that the penetration of most measure categories is quite similar in the two markets.[11] The most marked differences are: a higher incidence of lighting retrofits and non-energy improvements (such as new roofs, asbestos abatement) in MUSH than federal markets, and greater penetration of power supply (generation, cogeneration) and water conservation measures (plumbing products category) in the federal market. These results confirm the general trends expressed in interviews, but the differences are modest, nonetheless.

To examine project trends, we define four "retrofit strategies" to characterize the types of measures included in individual projects (see Table 3). *Lighting Only* projects installed only lighting equipment or controls. These projects, often characterized as "low hanging fruit", are by definition not comprehensive because they only target one end use. *HVAC & Lighting* projects include non-central plant HVAC measures, and may also include lighting or motors/drives – this

[10] Occasionally, ESCOs also report zero-length contracts for performance contracts in which the customer has opted not to pay for measurement and verification (M&V), agreeing instead to stipulate all savings.

[11] The individual measures included in these categories are presented in Goldman et al. (2002).

characterizes more comprehensive projects that still fall within the traditional end uses captured by ESCOs (a common example is a project targeting lighting and HVAC controls). As Table 3 shows, these two strategies are slightly more common in the MUSH markets. Our third strategy, *Central Plant/DG*, includes all projects that installed centralized capital-intensive equipment – distributed generation (DG), cogeneration, or central plant HVAC equipment (boilers, chillers and cooling towers). We grouped these strategies together because they tend to be highly capital intensive, may be motivated in part by reliability and/or capital stock replacement needs, and are recognized as an increasingly important strategy in the ESCO industry. However, such measures are usually bundled with more traditional energy-efficiency retrofits, partly to leverage the cost of the equipment; virtually all *Central Plant/DG* projects in our database also include other energy-efficiency measures. This strategy is somewhat more common in federal projects (see Table 3), which are also more likely to involve DG than MUSH projects (22% of federal *Central Plant/DG* projects include DG versus 8% for MUSH). Finally, our fourth, *Other*, strategy includes all other types of retrofits. These projects include measures such as water heating or conservation, installation of energy-efficient equipment such as vending machines, laundry or office equipment, high-efficiency refrigeration, industrial process improvements, strategies such as staff training or utility tariff negotiation, or non-energy improvements.

Table 2. Saturation of Measure Categories

ECM Category	Federal Government (N=252)		MUSH Markets (N=1250)	
	No. of projects	% of projects	No. of projects	% of projects
Lighting	200	79%	1098	88%
Comfort Conditioning	198	79%	1002	80%
Motors/drives	83	33%	333	27%
Water Heaters	21	8%	118	9%
Non-Energy Improvements	10	4%	84	7%
Power Supply	39	15%	75	6%
Refrigeration	3	1%	8	1%
Misc. Equipment/Systems	20	8%	80	6%
Industrial Process Improvements	10	4%	7	1%
Other Measures/Strategies	61	24%	336	27%
Plumbing Products & Fittings	68	27%	143	11%

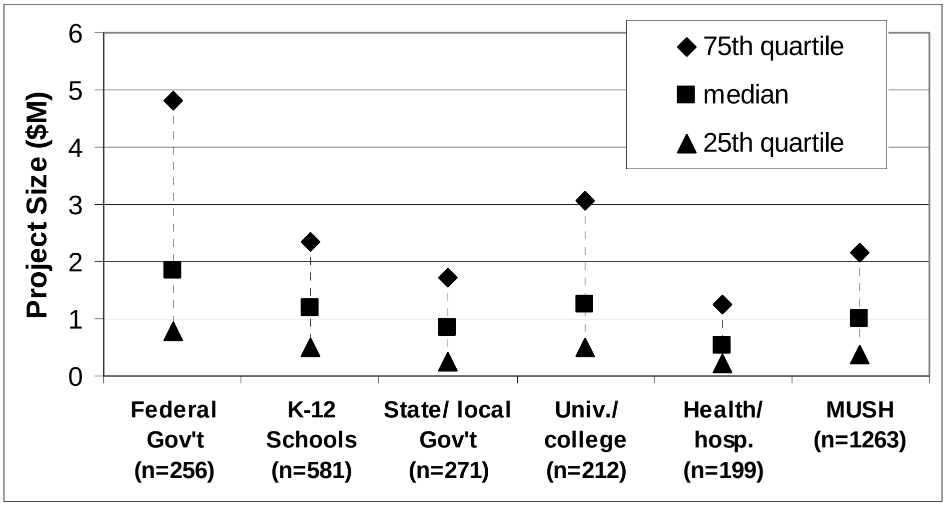
Table 3. Retrofit Strategies of Federal and MUSH Projects

Retrofit Strategy	Percent of Projects	
	Federal Government (N=252)	MUSH Markets (N=1250)
Lighting Only	13%	16%
HVAC & Lighting	16%	20%
Central Plant/DG	49%	43%
Other	23%	21%

Project Size and Costs

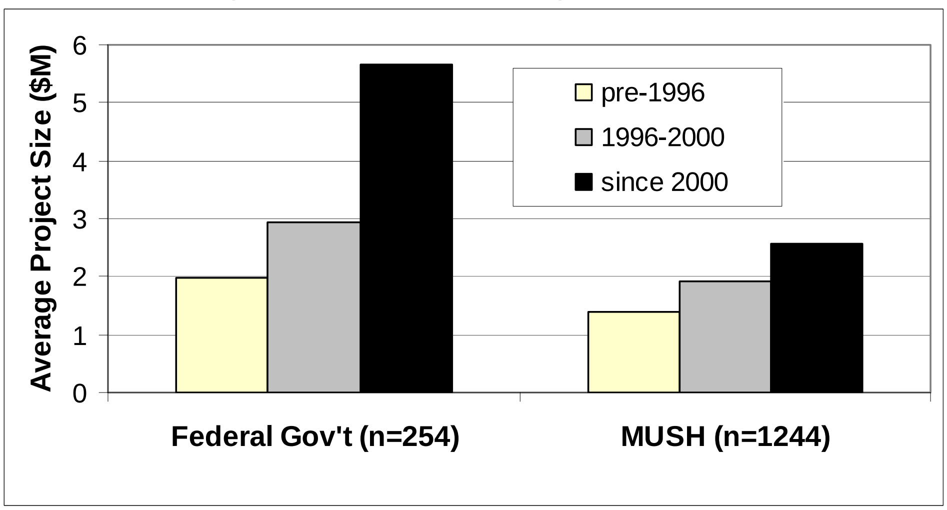
In interviews, ESCO representatives consistently told us that federal projects are larger than MUSH market projects, and the evidence in our database supports this. Figure 3 shows the distribution of projects by cost for federal and MUSH market segments, as well as the MUSH market as a whole[12]. Median costs for federal projects are almost twice as high as for MUSH projects ($1.85 million versus $0.98 million). Average costs are $4.4 million for federal projects, which suggests that a few very large projects dominate; this is true to a lesser extent for MUSH projects, with average costs of $1.9million.

Figure 3. Project Size by Market Segment



We also examined changes in project size over time, and we find that in both markets, average project size is increasing (see Figure 4). This trend appears more prominent in the federal market, though this probably reflects the heavy representation by Super ESPC projects in our database, most of which were implemented since 2000.

Figure 4. Trends in Average Project Size

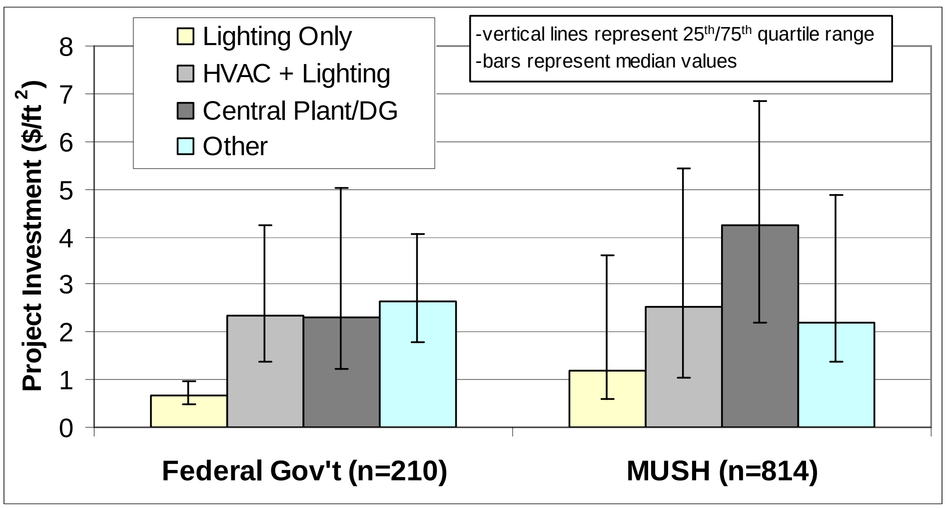


To compare the installed *cost* of projects (rather than size), we normalize project costs by the retrofitted floor space and examine trends across different retrofit strategies. On this basis, we

[12]All financial terms in this paper are nominal. For a treatment using inflation-adjusted dollars, see Hopper et al. (2004).

find that, overall, *federal projects cost less per square foot* than MUSH market projects. Median costs in the federal market are $2.08/ft^2, versus $2.93/ft^2 for MUSH projects. This does not appear to be explained by the types of installed measures – as noted earlier, federal projects adopt similar strategies to their MUSH market counterparts. Examining Figure 5, it seems that certain retrofit strategies actually cost more in the MUSH market – this is particularly so for *Central Plant/DG* projects, but also appears to be so for *Lighting Only* projects. It may be that federal market projects reap economies of scale from installing large projects in large facilities that are not achieved by smaller MUSH customers. It should be noted, however, that financing costs are not included in this analysis. While we find here that the *installed* cost of federal projects is lower, federal projects tend to have higher interest rates for long-term financing, thus the up-front savings relative to MUSH markets may be negated by debt service. This issue is explored in greater detail in Hopper et al. (2004).

Figure 5. Project Costs by Retrofit Strategy: Federal vs. MUSH



Energy Savings

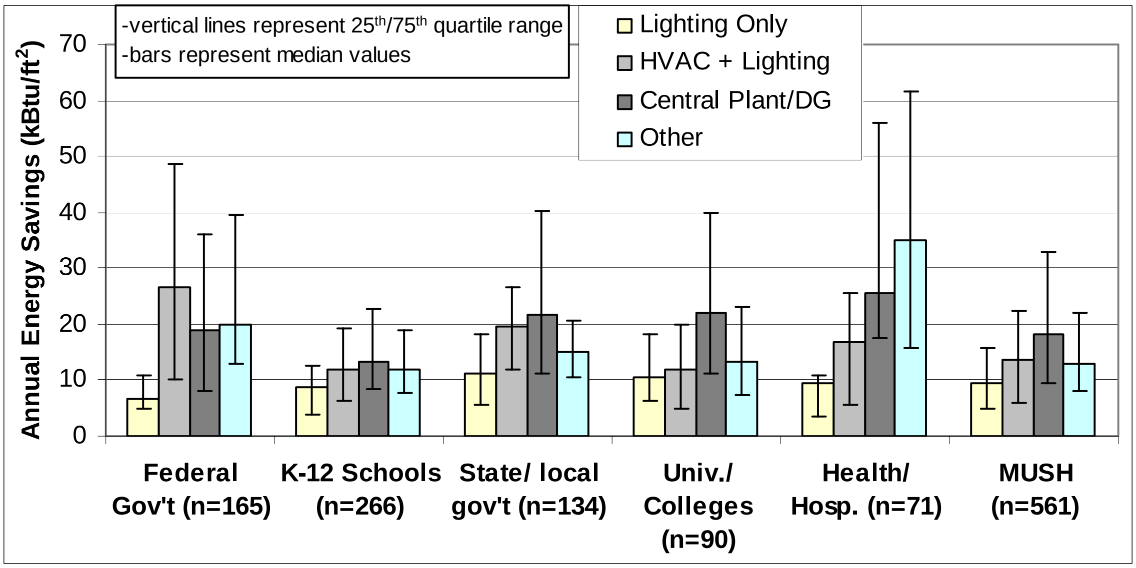
Annual energy savings are shown by market segment and retrofit strategy, for each market individually and the MUSH market as a whole, in Figure 6. The annual energy savings achieved by federal market projects are about 30% higher on a per-square-foot basis[13] than for MUSH market projects: federal median annual energy savings are 18 kBtu/ft^2, versus 14 kBtu/ft^2 for MUSH projects.[14] The only MUSH market segment that outperforms the federal projects is health/hospitals, with median annual savings of 19 kBtu/ft^2 – this is probably due to retrofit strategies unique to this market segment, as noted by the unusually high savings in the *Other* category. K-12 schools have the lowest savings of any market segment – as discussed in Goldman et al. (2002) this is attributable to leveraging of energy savings to pay for non-energy

[13] As with project costs, we normalized energy savings by floor space to account for differences in project scale.

[14] These results are based on averaged actual yearly savings data, where available, and engineering estimates of projected savings where not. For most Super ESPC projects, only projected savings were available. We combined and converted various fuel and electricity units to kBtu, assuming site energy conversion for electricity (1 kWh = 3412 Btu).

improvements and valuation of indirect benefits as well as typically lower energy use than other similar facilities due to operational practices (e.g., reduced use during school vacation).[15] Federal market energy savings are highest for the *HVAC & Lighting* strategy; it appears that opportunities for energy savings within this strategy are high in the federal market compared to other market segments.

Figure 6. Annual Energy Savings by Market Segment and Retrofit Strategy



Project Economics

Our analysis of project economics follows the same basic methodology and assumptions developed in Goldman et al. (2002), with the exception that we included the impact of incentives from utility or public purpose energy-efficiency programs in reducing project costs, assuming that 100% of technology rebates were seen by the customer, and 50% of DSM Bidding and Standard Performance Contract program incentives were passed through to the customer.[16] We employ a 7% nominal discount rate in calculating net benefits. We also calculate the value of energy savings by combining reported fuel and electricity savings with fuel and electricity price data and escalation rates available from the Energy Information Administration (EIA), rather than relying on ESCOs' estimates.

Importance of Non-Energy Savings. Non-energy savings, which include operations and maintenance (O&M) savings resulting from installed equipment along with other economic benefits not directly tied to energy savings (such as capital cost avoidance or reductions in personnel costs), are often included in ESCO savings guarantees. Including non-energy savings can mean the difference in justifying a project, or can allow the inclusion of ECMs that would

[15] Indirect benefits are difficult-to-quantify benefits that may be valued by the customer but which cannot be easily monetized. Examples include increased comfort (e.g., from better lighting or space conditioning), increased productivity (closely related to comfort), replacement of ageing equipment, and environmental improvements.

[16] In Goldman et al. (2002), incentives were ignored in the base-case economic analysis, but were tested using the same assumptions outlined here in a sensitivity analysis of simple payback time.

not be cost effective from energy savings alone. Our interviews with ESCOs revealed a common perception that non-energy savings are more often counted in MUSH markets than the federal market. However, our analysis of project data reveals a different story. As Table 4 shows, well over half of the federal market projects in our sample reported non-energy savings, versus only 35% of MUSH market projects. Thus, based on our sample of projects, federal customers are about 65% more likely to leverage projects with operational savings.

For those projects that reported non-energy savings, we can compare the relative magnitude of these savings among federal and MUSH projects. We find that MUSH projects, while reporting non-energy savings less frequently, tend to rely more heavily on these savings when they are included. On average, the share of projects' annual dollar savings from non-energy sources reported for MUSH projects is 32%, versus 22% for federal projects.

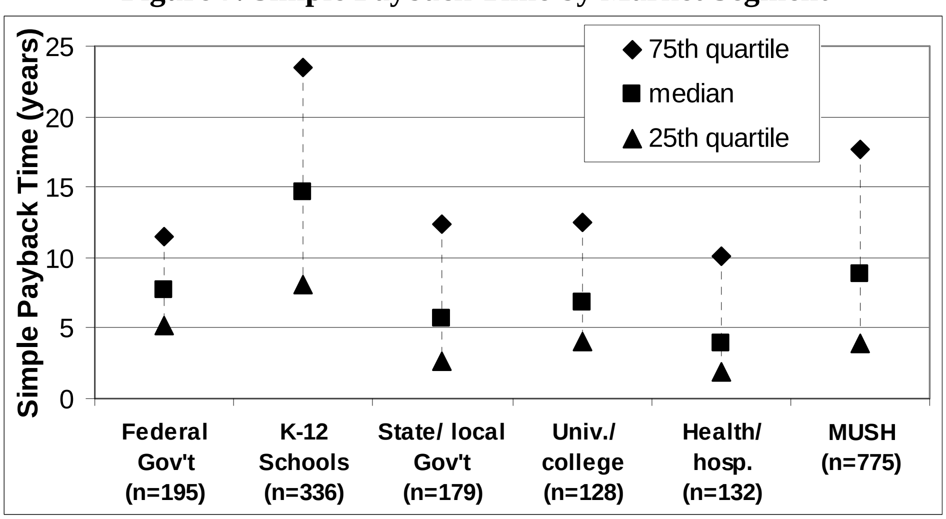
Table 4. Importance of Non-Energy Savings

Market Segment	**N**	**Percent of projects reporting…**		
		O&M Savings	**Other Non-Energy Savings**	**Any Non-Energy Savings***
Federal Government	223	55%	12%	58%
MUSH Markets	1059	31%	7%	35%

*includes projects that reported O&M, other non-energy savings, or both

Simple Payback Time. Simple payback time (SPT), defined as project costs divided by annual savings, is a common, easily computed measure of the cost-effectiveness of an investment, though it does not take into account the time value of money nor the lifetime of the savings. The median payback time calculated for federal projects is 7.7 years; this is shorter than the 8.8 years computed for MUSH projects overall. However, as Figure 7 shows, there is great variation between the individual MUSH market segments. K-12 schools tend to have relatively long payback times because of the factors mentioned already. Hospitals tend to have shorter paybacks because restructuring and cost cutting in the industry have led to private sector style decision-making in this market segment. Overall, federal market performance according to this metric can be said to be modestly comparable to similar markets.

Figure 7. Simple Payback Time by Market Segment



As with project costs, retrofit strategies don't appear to drive the economics of federal market projects because the proportional representation of strategies is similar in federal and MUSH markets, and because similar strategies show different paybacks in different market segments (e.g., all four strategies have significantly longer paybacks in K-12 schools than other market segments). Nonetheless, there are differences in payback time across retrofit strategies that are worth noting. *Lighting Only* projects have median payback times of 3.5 years when computed across all market segments; this is much lower than for other retrofit strategies (8.4 years for *HVAC & Lighting*, 11.2 years for *Central Plant/DG* and 9.6 years for *Other*).

Net Economic Benefits. A final question of particular importance given the controversy around the ESPC sunset is that of net economic benefits – the time-discounted value of the investments made through ESCO contracts. We computed this metric using the methodology developed in Goldman et al. (2002), using a 7% discount rate and extending benefits into the future according to established measure lifetimes for the ECMs reported in the project. The results are presented in Table 5. We find that the 214 federal projects in our database produced net benefits of ~$550 million. This is proportionally about twice the ~$1.2 billion produced by 965 MUSH market projects, though as noted with regard to payback time, there are significant differences in project value among MUSH market segments. Nonetheless, this metric shows federal projects outperforming the MUSH market by a larger margin than did the SPT analysis – this is probably due to differences in the lifetime of the investments.

Table 5. Net Economic Benefits of Federal and MUSH Projects

Market Segment	**N**	**Net Economic Benefits assuming 7% discount rate ($ million)**
K-12 Schools	*462*	*87*
State/Local Government	*206*	*323*
Universities/Colleges	*149*	*578*
Health/Hospitals	*148*	*232*
MUSH markets combined	965	1221
Federal Government	214	549

Conclusions

The federal market for ESCO services, while relatively young compared to the MUSH markets in which ESCOs have traditionally operated, has been an important source of growth to the ESCO industry over the last decade. Through the ESPC mechanisms, large investments in energy efficiency have been made by federal agencies, providing significant energy and economic savings to the US federal government. Our analysis of project data shows that project development and installation costs are typically lower and energy savings higher than found in other institutional markets, and our economic analysis shows that projects are cost effective, producing greater lifetime economic benefits than projects in most MUSH market segments. As one ESCO representative put it, "it's still a good market: despite the long cycle time, the rewards are high and the projects are sexy – they are not just lighting and controls".

The ESPC sunset has certainly hampered the market for alternatively financed energy-efficiency investments in federal facilities in the near term and until this legislative issue is resolved, the future of the program will remain uncertain. Should the sunset not be repealed, ESCO activity in the federal market will continue, at a much-reduced level, through the UESC contracting mechanism. Unless increased congressional appropriations are authorized to make up for lost ESPC activity, achieving the federal energy reduction goals mandated by the 1992 Energy Policy Act will become much more difficult.

Acknowledgements

The work described in this paper was funded by the Assistant Secretary of Energy Efficiency and Renewable Energy, Federal Energy Management Program, Rebuild America, and the Office of Electricity Transmission and Distribution, of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098. We would like to thank the following individuals and organizations that contributed valuable information on energy-efficiency projects and ESCO industry activity: Tatiana Strajnic (FEMP), Teresa Nealon (NREL), Kate McMordie (PNNL), Kristi Branch (PNNL), Marina Skumanich (PNNL), Doug Dahle (NREL), Mary Colvin (NREL), Jim Snook (US Air Force), FEMP ESPC Project Facilitators, Terry Singer (NAESCO), Nina Lockhart (NAESCO), NAESCO member companies and state energy offices.

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