

Energy Service Performance Contracting in Construction: A Review of the Literature

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Building-related energy consumption accounts for about 40% of total energy consumption in the United States. Thus, energy efficiency of the building sector plays a vital role in reducing energy consumption. To aid in the process of energy efficiency improvement, a large private sector energy efficiency service industry has developed in the United States, over the last two decades. The most commonly used contracting method adopted by these companies is Energy Service Performance Contracting. Analysis of the market trend of energy performance contracting reveals that this type of contracting is not commonly employed in the private sector, despite its growing success in the public sector and escalating energy consumption in private building sector. This paper reviews available literature to identify and summarize the major barriers preventing wide spread use of energy performance contracting in the private building sector. The barriers have been classified under four categories: market, institutional, financial, and technology barriers. Finally, this paper concludes that barriers in the private building sector are mainly market and financial barriers.

Keywords: Energy service companies, energy performance contracting, energy improvements

Introduction

Figures released by the Energy Information Administration show that the total energy consumption of the United States was in excess of 100 Quadrillion BTU in 2007; out of which a majority was consumed by the industrial sector (excess of 32 Quadrillion BTU) followed by transportation, residential and commercial sector (EIA 2008). 'Building Sector' which commonly refers to the combination of the residential and the commercial sector accounts for 40% (the actual figures are in excess of 40 Quadrillion BTU) of the total energy consumption. Coupled with this, the energy consumed by the transportation and industrial sector towards transportation and manufacturing of building materials augment the actual 'energy consumed by the building sector' even more. Architecture 2030 assessed this more realistically and concluded that buildings account for almost half of the total energy consumption in the United States (Architecture2030 2008). Considering that certain decisions among numerous others such as building form, envelope, orientation, and systems determine the performance of a particular building throughout its lifecycle, new construction or renovations provide the best opportunity to influence those decisions and seek energy efficient solutions (Sorrell 2003). To assist in the process of energy efficiency improvement, a large private sector energy efficiency service industry has developed in the United States over the last two decades (Osborn et al. 2002). This private sector energy service provider which was conceptualized in Europe more than a century ago is called Energy Service Company (henceforth referred to as ESCO) (Bertoldi et al. 2006). In the United States, ESCO came into existence in the 1970s, and presently there are eighty eight such companies operating in this country (DOE 2009).

The concept of ESCO has spread with varying success to most of the developed as well as developing countries. In spite of the contribution of ESCO in reducing energy consumption and their importance to policy makers to promote similar models elsewhere, very little empirical information exist on their performance (Goldman et al. 2005). This paper is based on a general review of literature concerning ESCO focusing on various models of the preferred contracting tool – Energy Service Performance Contracting (henceforth referred to as ESPC). This contracting method used by ESCO, which in essence is a turnkey approach provides the owner with a comprehensive energy audit and identifies improvements that will save energy. From its earlier stage of inception, ESPC has been popular in the 'MUSH' market which includes municipal and state governments, universities and colleges, schools, and healthcare facilities. Recent years have witnessed an upsurge of federal projects in the portfolios of ESCO in which performance contracting strategy have been utilized heavily. Surprisingly this contracting strategy is not very

popular in the private building sector. To investigate the factors that prevent the wide spread acceptance of ESPC in the private building sector, this paper attempts to summarize the barriers based on review of available literatures.

Concept of ESCO

Definitions of ESCO vary from country to country and thus present a wide gamut of definitions in existing literatures. In the report published by Lawrence Berkeley National Laboratory (LBNL), Hopper et al. (2005) defined ESCO as a company that offers services related to energy efficiency and other value added services. In conjunction with previous studies (Goldman et al. 2002 ; Hopper et al. 2005), this paper defines ESCO as a business that provides a broad range of energy services for projects which are designed to improve energy efficiency. Traditionally the compensation of an ESCO is a percentage of the energy saved by the project. However, the payment may also be dependent on one or multiple acceptable performance measures.

The typical services offered by ESCO include developing, designing and arranging finances for energy efficiency projects, installation and maintenance of energy efficiency equipments involved, measuring and verifying the projects energy savings. The contractual agreement of an ESCO with the owner, forces it to identify and evaluate energy savings opportunities and then recommend a package of improvement. The savings in energy cost that result due to the implementation of energy efficiency improvements is used to pay back the capital cost (for the energy efficiency measures) of the projects. In addition to the services mentioned above, ESCO sometimes assumes risk associated with the expected energy savings (NAESCO 2009). The risk is in the form of guarantee offered by the ESCO to the owner regarding the savings in energy cost to meet or exceed annual payment to cover all project costs (Vine et al. 1999). As mentioned before, these contracts are referred as ESPC and their term agreement vary between five to ten years(Vine 2005). A survey conducted in 2007 by LBNL (Hopper et al. 2007) suggests that majority of the industry activities of ESCO is based on ESPC (69%) followed by design-build/EPCS (25%), as shown in Figure 1.

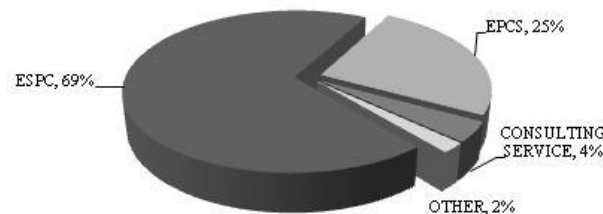


Figure 1. ESCO's revenue by contract type in 2006 (Source: (Hopper et al. 2007))

Development of Energy Performance Contracting

ESPC is a contracting method comparable with design-build construction contracting, in which the ESCO provides the owner (or contracting agency) with a comprehensive energy audit and identifies improvements that will save energy at the facility. Like the design-build approach, ESPC replaces the cumbersome collection of solicitation and contracts with a single request for proposal covering all aspects of the project and one contract with the selected proposer (Harding and Kaya 1998). According to the contract, ESCO designs and constructs the project in such a way that it meets the guaranteed energy savings and also arranges financing to pay for it. Most of the ESPC projects are financed with long term debt, though some owners are able to pay a portion of the improvement cost with capital budget allocation. In earlier days of ESPC, ESCO typically provided both technical services and project financing, because financial institutions (henceforth referred to as FI) lacked knowledge of ESPC and were unwilling to extend financial assistance. But with the increasing popularity of ESPC, a robust and competitive market place comprising of major FIs providing project financing has emerged (NAESCO 2007).

The ESCO guarantees that the savings realized by the project will be sufficient to pay back the capital investment over a fixed period of time. Thus ESPC is the contracting method that allows owner to accomplish energy savings in their projects without upfront capital cost (NAESCO 2007). The total savings resulting from improvements during the life of the contract is shared by the owner and the financing company. These savings include reductions in energy costs, operation and maintenance costs, and repair and replacement costs directly related to the energy efficiency improvements. In addition to direct costs for the improvement, other costs that savings should cover include monitoring services, and company-provided maintenance. After the contract gets over, the savings go to the owner (Figure 2).

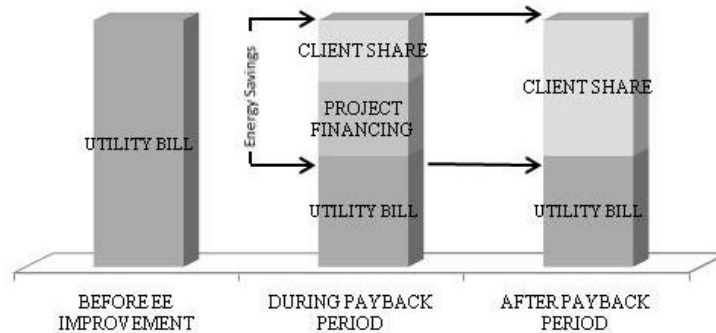


Figure 2. Distribution of savings achieved from energy efficient improvements (Source: Smith (2008))

Background and Benefit of Energy Performance Contracting

The emergence of ESCO can be traced back to late 1970s as a response to the Middle East Oil embargo (Bullock and Caraghiaur 2000). As a result of federal and state regulation following the oil embargo in late 1970s and early 1980s, utility companies were mandated to provide energy conservation services (NAESCO 2007). ESCO during this early stage was generally very small and relatively unsupported by the parent company. Initially, ESCO tried to sell energy-efficient products. Later ESCOs ventured into performance contracting, in the form of ESPC. ESCOs also began selling shared savings by using ESPC which was much more profitable than selling products alone (Bullock and Caraghiaur 2000).

ESPC contracting has the benefit of energy savings and reduced utility cost along with other advantages related to environmental benefits with installation of newer and cleaner technologies. However, to realize the complete benefit of ESPC, regular supervision is needed to protect the interest of the owner. Proper utilization of monitoring and verification protocol along with the implementation of energy efficiency improvements help in the elimination of environmental hazards, reduction of air pollution and improvement of indoor air quality. In addition to environmental benefits, ESPC financed projects also allow the owner to replace aging infrastructure without the burden of upfront capital investment. Even when upfront funds are not available, the most expensive option is to keep the inefficient equipments remain operational. This result in wastage of energy as well as repeated maintenance and repair costs. Furthermore, in case of federal projects where upfront funds are available, the time consumed in paperwork does not allow starting the project right away. In comparison, the approval procedure of ESPC is much faster (GAO 2005). ESPC funded projects also ensure an improved level of monitoring and verification in comparison to traditional projects where energy savings from equipments reduce over time (GAO 2005; Hopper et al. 2005). On a broader sense, ESPC provide the owner with excellent return on investment with a lower level of risk. However, the risks assumed by the various stakeholders in ESPC vary widely in different models of performance contracting.

Energy Performance Contracting Models

The payment provisions and risk allocation among ESCO, owner and financial institution (FI) under the umbrella of ESPC can be categorized into various models. This section discusses the two most common contracting models and briefly overviews less commonly used models. Guaranteed Savings Model (GSM) and the Shared Savings Model

(SSM) are the two most commonly used models of performance contracting. Under the GSM contract, ESCO assumes the responsibility of design, installation and savings performance, but does not assume the credit risk of repayment by the owner (Figure 3). Thus the owner who prefers this contracting model is capable of obtaining financing from other FI. At the same time, the FI works directly with the owner assessing and handling the credit risk as in any financing agreement. This enables the FI to work within their usual area of expertise and thus offer lowest financing cost. In this model, the owner gets into direct contract with the FI and assumes the investment repayment risk. However, if the savings from the energy improvements are not meeting the guaranteed amount to repay the loan amount, then the ESCO has to cover the difference. Usually, the contract contains a condition that the amount of energy savings guaranteed by the ESCO to meet the owner's debt obligation holds good, provided the price of energy does not go below a stipulated level (Bertoldi and Rezessy 2005). On the other hand, if the savings exceed the guaranteed amount, then the owner pays an agreed upon percentage to the ESCO. A variation of the GSM is the pay from savings contract, where the payment is based on a mutually decided percentage of the savings (WEEA 1999). The GSM functions properly in countries that have established banking structure and familiarity with energy efficiency projects within the banking sector. This model of the ESPC is difficult to use while introducing the ESCO in developing market as it forces the customer to assume investment repayment risk. On the contrary, novice ESCO with minimal credit history and limited resources can enter the market using this model by guaranteeing the savings and the owner securing the financing on its own. The main advantages of this model is the reduced financing cost as well as fostering the growth of smaller ESCO and FI in their respective industries. The public sector prefers the GSM to maximize the amount of infrastructure investment made in its facilities from an ESPC.

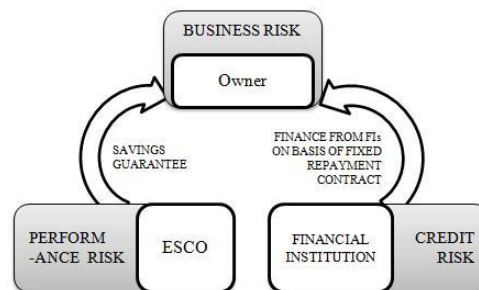


Figure 3. Guaranteed Savings Model of ESPC

In the United States, GSM evolved from the SSM as the owners are willing to assume more risk in lieu of significantly reduced financing charges. The increased knowledge about energy improvements among the owners in the United States provided motivation for them to realize the benefits of using SSM. In a typical SSM setup, ESCO assume both the performance and credit risk (Figure 4). Any SSM is more likely to be linked with third party financing or ESCO financing. The financing can also be of mixed nature coming from the owner and ESCO, where the ESCO repays the loan and assumes the credit risk. This way the ESCO assumes both the performance and the owner credit risk (WEEA 1999). This model of contracting leads to huge capital requirement on the part of ESCO and at some point of time FI can refuse lending to an ESCO due to high indebtedness. In this model, ESCO has to collateralize the loan with anticipated payments from the owner based on the savings from energy improvements. An adverse scenario may occur when the actual savings exceed the estimated amount and the owner accuses ESCO of deliberately lowering the estimated savings. As this situation is not uncommon in the SSM and keeping in mind the standard practice of ESCO to secure itself for guaranteed performance with some buffer, there should be a condition in the SSM contract to handle the excess savings above the estimated savings (Poole and Stoner 2003). Unlike GSM, the shared savings concept is a good introductory model in developing markets as owners are relieved of any financial risk. However this model is not so beneficial for the smaller ESCOs as they become highly leveraged very soon and could not obtain further financing for subsequent projects (Poole and Stoner 2003). This underlying disadvantage of SSM works against the long term growth of ESCO and FI in their respective industries. SSM focuses attention on projects with short payback period as most of the smaller ESCO do not have the resources to get into bigger projects having longer payback period (Dreessen 2003).

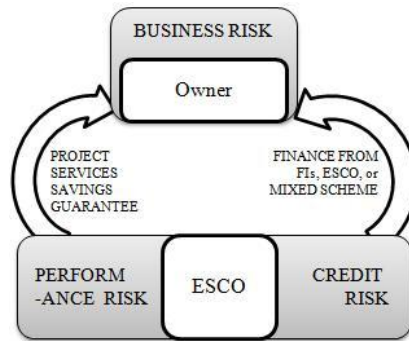


Figure 4. Shared Savings Model of ESPC

There are numerous other ways to structure ESPC, among which *Chauffage* is one where ESCO takes the complete responsibility of a set of energy services such as space heating, lighting, etc. This is an extreme form of energy management outsourcing where the ESCO takes over the full responsibility of purchasing fuel/electricity. Within the *Chauffage* model, the owner is guaranteed an immediate saving relative to its current energy bill by a percentage saving. The ESCO takes up the initiative to provide energy improvements for reduced bill. As the profit of ESCO is directly related to the amount of savings, this model presents a strong incentive for the ESCO to work in the most efficient manner. *Chauffage* contracts are typically very long (20-30 years) and the ESCO provides all the associated maintenance and operations during the contract period (WEEA 1999). Another model of the ESPC is the First Out approach, in which the service cost of the ESCO is paid first. The contract period is dependent on the level of savings achieved and decreases with the increase of savings (ECS 2003). The Build-Own-Operate-Transfer (BOOT) model involves an ESCO designing, constructing, financing, owning, and operating the equipment for a defined period of time and then transferring the ownership to the client. This model is being increasingly used in Europe for the combined heat and power projects where the clients enter into long term supply contracts with the BOOT operator and pay for capital cost, operating cost and project profit. Another alternative model is leasing and a lot of clients opt for this option as the lease payment is lower than the loan payments. This model is commonly used for the industrial equipments where the lessee (in this case the client) pays the principle and the interest. Within this model, there are two variations – capital lease and operating lease. While in a capital lease, the client owns and depreciates the equipment and gain tax benefits; in an operating lease, the ESCO owns the equipment and leases it to the client for a fixed monthly rent. In an operating lease, the risk of owning the equipment shifts from the client to the ESCO.

Market Trend of ESPC

According to the most recent survey of the United States ESCO industry, conducted by LBNL (Hopper et al. 2007), the revenue of the ESCO industry in 2006 was about \$3.6 billion. The majority (58%) of the revenue in 2006 came from the ‘MUSH’ market. The other source of revenue for the ESCO in 2006 was from the federal government (22%). The rest of the revenue came from public housing, residential, commercial and industrial sectors. Comparing the trend of revenue earned in 2006 with that of 2000 (Goldman et al. 2002), it is found that the amount of revenue earned in 2006 from federal projects has taken a huge leap from that in 2000 (6% only).

The steady increase of popularity of ESPC and the rising investment by federal government for energy efficiency improvement has not urged the private sector to embrace the same. On the contrary, data shows a downward trend in investment for energy efficiency improvement by the private sector in 2006 than that in 2000. According to the most recent data, only 14% of the ESCO industry revenue is attributed to the private sector.

Barriers of Implementing ESPC in Private Sector

Despite the success in the 'MUSH' market and with federal projects, ESCO has not been able to capitalize on the private market. While ESCO has been operational for more than two decades as self financing mechanisms to pay for energy efficiency improvements, the complexity of the ESPC has always acted as a barrier for their wide use in the private market. Coupled with that, the comparatively longer timeline for implementation have also impeded the acceptance of ESPC in the private market. The major barriers for the acceptance of ESPC in the private market can be categorized under four major groups: market barrier, institutional barrier, financial barrier, and technology barrier.

Market Barrier

Low market awareness of ESPC and insufficient information has hindered ESCO activities in the private sector. Many owners are not conscious about the energy efficiency potential of performance contracting primarily due to information gap, managerial disinclination and lack of interest. Potential clients are little interested in ESPC as they are more busy deliberating their attention on the core business or main mission and energy constitutes a small part of their expenses. This also gives rise to lack of confidence on ESCO services. Owners are suspicious of the 'win-win' solution and do not believe in the success of the energy savings measures. Inability of ESCO in providing comprehensive and quality service also contribute to increase the adversity of private sector owners towards energy performance contracting (Da-li 2009).

Credit risk, coupled with high perceived technical risk and risk by the owners, is a standing obstacle that has not changed in the private sector. Lack of involvement of the owners in energy performance contracting unlike traditional contracting strategies leads to distrust on the energy efficiency commitments. There is a mutual suspicion between the owner and ESCO regarding the realization of estimated energy savings and sharing of benefits according to the terms of ESPC. Situations worsen when owners do not accept energy savings and come out of the contract (Da-li 2009). It is quite common among the private sector owner to show reluctance in asking for external financing from FI or ESCO for energy efficiency and would rather use their own fund for the project. Due to this outlook combined with increased competition for scarce capital, there is diminishing interest about energy performance contracting in the private sector (Vorsatz et al. 2007).

In the United States, ESCO is sometime hired to submit proposal but then the owner implements the improvement and services proposed by the ESCO on its own without any compensation for the ESCO, since the owner has sufficient funds and knowledge for the required investments (Goldman et al. 2005). Similar occurrences reduce the mutual faith between ESCO and the owner, and act as deterrent to widespread use of ESCO in private sector. Furthermore absence of GSM of performance contracting in this sector also act as a barrier (DeGroot 2006).

Institutional Barrier

Despite reduced paperwork requirements, yet administrative hurdles and complicated approval process of ESPC act as a deterrent toward acceptance in the private sector. It also involves increased upfront legal costs and transaction costs while developing and implementing performance contracts. Most of customers in the private sector are not willing to spend this extra amount of money upfront to realize benefits in the future. Also, chances of savings through energy improvement for a single project (which is often small in private sector) are usually small compared to the transaction cost. The risk of 'non-contract' and the excessively long negotiation period also act as barrier to the implementation of ESPC in private sector (Vorsatz et al. 2007). In many developing countries, Governmental initiative to subsidize energy prices actually gives rise to owner's indifference towards energy performance contracting. Low energy prices due to political reasons cannot incentivize the owner to look for savings through energy improvements and thus hire ESCO (Vorsatz et al. 2007).

Financial Barrier

It is crucial for ESCO to survive in the competitive market of the private sector. A major financial inhibitor for ESCO is the long duration of the energy efficiency projects and lack of short term financial incentive. It is required

that the ESCO has large amount of fund for working capital as the long duration of the projects denies benefit in short term (Da-li 2009). Moreover, when the owner uses external financing, it limits the company's investment ability. The loans for ESPC which are normally long term, works negatively in the balance sheet of the owner and lower the ability to borrow money from FI (Vorsatz et al. 2007). The volatile nature of the private sector is also not supportive of the acceptance of ESPC due to uncertainty of payment based on energy savings. In addition, rent control limits the return on energy investment. Lastly the size of contract which often varies widely in the private sector act as a barrier for the implementation of ESPC as ESCO does not prefer to deal with small sized contracts.

ESCO themselves consider it more risky to invest in private than in the public sector because private project/site may be moved to another location or the owner can go bankrupt before the end of the energy performance contract. Another reason for lower acceptance rate of ESCO in the private sector is the inability to control the user behavior regarding usage of energy which reduces the effectiveness of the energy efficiency improvements. This is due to the fact that the financial benefit of the energy savings is consumed by the owner and not shared with the user. This lack of financial incentive on the part of the user, sometimes render the energy efficient improvements ineffective. Above all, the conservative lending practices of FI, lack of loan category suitable for energy performance contracting projects, and lack of appraisal ability to evaluate risks of ESPC projects highlight the barriers on the way of ESCO in private sector (Vorsatz et al. 2007).

Technology Barrier

Absence of standardized procedures for energy audit and energy conservation measurement and verification makes it difficult to evaluate the effects of the energy efficiency projects. The lack of standardized procedure that is enforceable to conduct an energy audit before implementing ESCO project leads to disputes between the owner and ESCO regarding the procedures to perform energy audit. This renders distrust in the relationship of the owner and ESCO (Da-li 2009). Moreover the lack of technical knowledge of the employees of the responsible for sanctioning loan for energy performance projects also fail to realize the estimated savings of the energy efficient improvements.

In summary, major barriers for the widespread involvement of ESCO in the private sector are: the relatively high transaction costs, low level of information and awareness about ESPC among owner and FI, and lack of long term commitment of the owner to realize full benefit of the contracting strategy.

Conclusion

Adoption of ESPC within the United States private-sector construction industry would potentially yield considerable improvements in energy efficiency. ESCO in the United States work mainly within the public sector and have seen rapid growth over the past few years. Adoption in the private sector has lagged, due to several barriers that include market, finance, institutional, technology barriers. These barriers must be addressed, by the use of systematic interventions, in order for the ESCO industry to flourish in the private sector. This paper summarizes the common barriers faced by the ESCO in the private building sector, through a review of the available literature. Further exploration of the barriers is required to improve our understanding.

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