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Barriers to the Use of ESPC in the Private Building Sector: Perception of the A/E/C Commune

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Analysis of market trend for energy service performance contracting (ESPC) reveals that ESPC is not commonly utilized in the private building sector, despite its growing success in the public sector. Previous study by the authors has identified the major barriers preventing widespread use of ESPC in the private building sector. Subsequently, the present study rank ordered the barriers according to their criticality as perceived by the A/E/C commune. To accomplish the main objectives of the study, survey was employed as main method of data collection. The survey instrument was developed by the authors based on the previously identified barriers and was distributed among the attendees of an international conference of construction education and research held in 2010, as also among the faculty of construction program and staff of facility management department of two universities in the US. Results showed that respondents were fairly familiar with the concept of ESPC and identified the following as some of the most critical barriers: low awareness about ESPC among the private building owners, followed by the lack of transparency between the owner and energy service company regarding estimated savings. The rank order of the barriers presented in this study has serious implications while formulating intervention methods as recognizing the critical barriers will ensure higher effectiveness of the intervention.

Key Words: Energy service companies, energy performance contracting, energy improvements, barriers

Introduction

Energy service companies (ESCOs) are gaining recognition every day for their role in enhancing sustainable use of energy and related energy services. The energy efficiency service industry that was originally conceptualized in Europe a century ago, has established a strong foothold in the US market, (Bertoldi et al. 2006) in the last two decades. Currently the number of ESCOs operating in the United States is close to ninety (DOE 2009b). These companies provide a broad range of energy services for projects that are designed to improve energy efficiency. The contracting strategy adopted by the ESCOs is known as energy service performance contracting (ESPC) which is analogous to the design-build construction contracting strategy. According to the contract, ESCO provides the owner with a comprehensive energy audit and identifies improvements that will save energy at the facility. In the next phase, 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. Earlier ESCOs typically provided both technical services and project financing as financial institutions lacked knowledge of ESPC and were unwilling to extend financial assistance. But with the increasing use of ESPC, a robust and competitive market place comprising of major financial institutions providing project financing has emerged (NAESCO 2007).

ESPC has earned favor of the owners due to its ability to replace the cumbersome traditional contracts with a single request for proposal covering all aspects of the project. However, the comparatively higher transaction costs in ESPC has made it more affordable by the larger owners (Hopper et al. 2005). This is evident due to the significantly increasing use of ESPC among the Municipal Governments, Universities, Schools, and Hospitals (MUSH) of the United States. Lately, Federal Government has also started using ESPC to their benefit. Since 1998, Federal Government has invested more than $1 billion for energy efficiency improvements using ESPC. On the contrary, ESPC is not being widely used in the private building sector. The complexity of ESPC and the lack of awareness among the private building owners have acted as deterrent to the widespread acceptance of ESPC in the private building sector. A study conducted by Bhattacharjee et al. (2010) identified the barriers for the implementation of ESPC in the private building sector. The barriers were classified under four categories: market, institutional,

financial, and technology barriers. As a logical next step, the authors have tried to rank order the barriers to identify the critical barriers that are impeding the use of ESPC in the private building sector. A survey conducted among the members of A/E/C academic community, as well as industry, revealed that market barriers and financial barriers play instrumental roles in this regard. The identification of the critical barriers is significant, as it will present opportunity to the researchers and ESCOs to plan intervention strategies for overcoming the barriers. The responses of the participants and the analyses of the survey results have been presented in this paper.

Market Trend for ESPC

Historically ESCOs have been primarily involved with energy efficiency improvements in existing buildings and the contracting vehicle they have been using is ESPC. ESPCs have been more active in the public and institutional market. This includes Federal, State and the MUSH market. Though relatively much lower, the use of ESPC in the residential market has been targeted towards larger multi-family and public housing facilities. Surprisingly, ESPCs do not have much success in commercial and industrial markets (NAESCO 2007).

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 approximately $3.6 billion. The majority of the total revenue (58%) in 2006 came from the MUSH market. The other mentionable source of revenue for the ESCOs in 2006 was from Federal projects (22%). The rest of the revenue came from public housing, residential, commercial and industrial sector as shown in Figure 1. A major change in the market trend of the ESCO in 2006 from that of 2000 has been the significant rise in the share of revenue earned from Federal projects. In 2000, 6% of the total revenue earned by ESCOs was from Federal projects (Goldman et al. 2002), which increased to 22% in the year 2006 (Hopper et al. 2007).

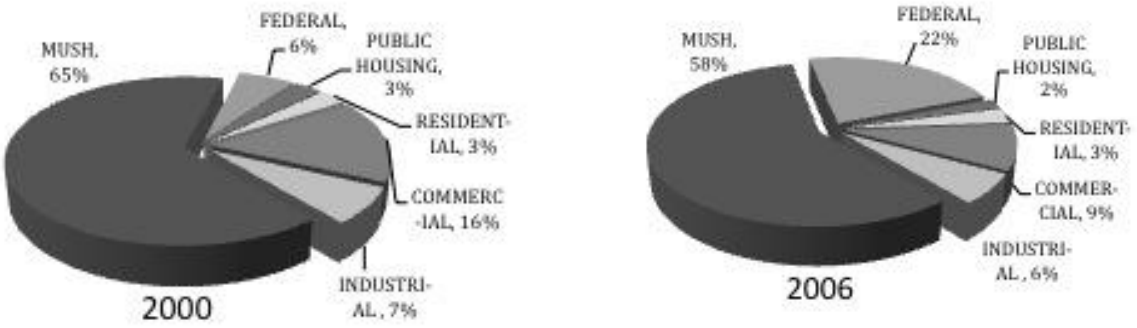

Figure 1: ESCOs revenues by market segment in 2000 and 2006
Source: Goldman et al. (2002), Hooper et al. (2007)

The change in market trend of 2006 from that of 2000 points to the growing interest of Federal Government in using ESPC in their projects. The growing interest has resulted in increasing investment in energy efficiency improvement using ESPC over the last decade. Based on the data compiled by Department of Energy (DOE), since 1998 the Federal Government has invested $ 1.23 billion for energy efficiency improvement of about 200 projects using ESPC (Figure 2). These improvements resulted in savings of about $3.03 billion (DOE 2009a). The decrease in investment during 2003-2004 was alleged due to the fall of Enron. Having overcome the crisis, ESPC regained popularity from 2005 onwards. Despite the success of ESPC in the MUSH market and Federal projects, several factors have worked against their widespread use in the private building sector.

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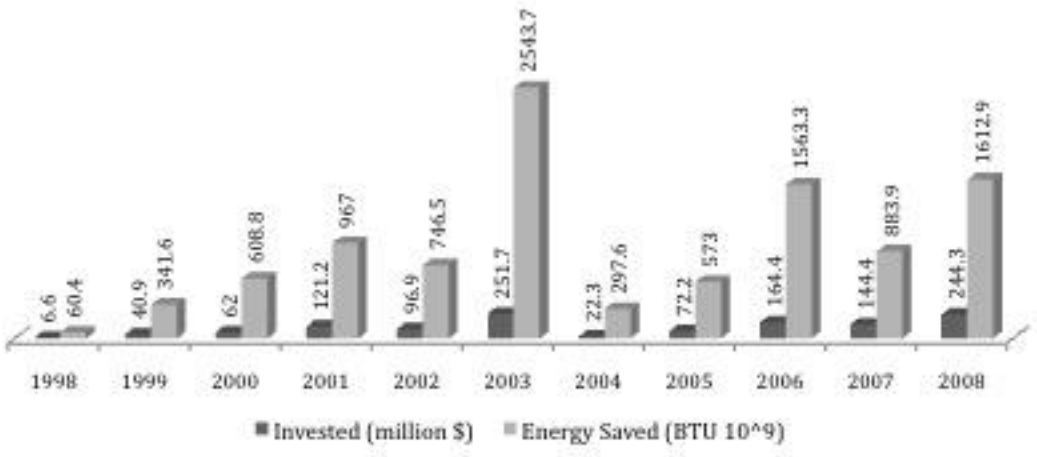

Figure 2: Annual investment and energy saved on Federal projects using ESPC
Source: Department of Energy (2009a)

Barriers

Bhattacharjee et al. (2010) identified the barriers that are impeding the implementation of ESPC in the private building sector using systematic literature review. The review of literature was focused on journal articles, conference proceedings, and reports published by renowned National Laboratories. A total of twenty-one barriers were identified in the study, which were classified into four categories as listed in Table 1 below. This paper attempts to rank order the barriers according to their importance, based on the perceptions of the A/E/C commune.

Table 1

List of barriers

Market Barriers (MB)	
MB # 1	Low awareness among owner/ insufficient information about ESPC
MB # 2	Inability of ESCO to provide comprehensive service
MB # 3	Limited involvement of the owner
MB # 4	Ambiguity between owner and ESCO regarding realization of estimated saving
MB # 5	Owner walking out of the contract
MB # 6	Owner reluctant to ask for external funding
MB # 7	Owners themselves implementing improvement according to ESCO's proposal
Institutional Barriers (IB)	
IB # 1	Administrative hurdle/ complicated approval process
IB # 2	Increased upfront legal cost
IB # 3	Risk of 'non-contract' and long negotiation period

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IB # 4	Government initiative to subsidize energy price
Financial Barriers (FB)	
FB # 1	Long duration of project requiring higher working capital
FB # 2	Lack of short term financial incentive
FB # 3	Reducing owner's credit capacity
FB # 4	Uncertainty of payments based on energy savings
FB # 5	Rent control limits the return on energy investment
FB # 6	Small size of contract
FB # 7	Inability to control user behavior regarding usage of energy
FB # 8	Conservative lending practice of financial institution
Technology Barriers (TB)	
TB # 1	Lack of standardized procedure for energy audit, conservation measurement, and verification
TB # 2	Lack of technical knowledge among financial institution

Note: The numbers in the left column do not refer to any ranking of the barriers. Those are solely used for identification purpose

Study Objectives

The main objectives of this study were to:

1. Identify the level of familiarity about ESCO and ESPC among the A/E/C commune.
2. Identify the barriers which are most instrumental in preventing the wide spread acceptance of ESPC among the private building sector.
3. Identify any other barrier that is not listed in Table 1.

Methodology

Survey research was the main method used to accomplish the study objectives. The following section discusses the survey instrument, population, and procedures followed. The survey instrument was composed of four categories:

1. Understand the professional affiliation of each respondent. Names or contact information of the respondents were not asked in the survey.
2. Understand the level of knowledge about ESCO and ESPC among the respondents.
3. Examine the level of agreement among the respondent with the definition of ESCO provided in the study conducted by Bhattacharjee et al. (2010).
4. Identify the importance of each barrier listed in Table 1.
5. Recognize other barrier that was not listed.

The survey questions were mainly of two types: five-point, Likert-type scale questions and open-ended questions. The instrument was distributed in hard copy format as also distributed via email as interactive portable document format (PDF) file. To protect the rights and ensure the safety of human subjects participating in the research, this study obtained approval from Virginia Tech Institutional Review Board (VT-IRB).

The authors selected a convenience sample from attendees of an international conference of construction education and research held in 2010. As this particular conference is always attended by leading A/E/C academician as well as graduate students, the authors considered the attendees to be knowledgeable about ESCO and ESPC. Upon approval from the conference committee, subjects were selected using random sampling, and one hundred hard-copied survey questionnaires were distributed. The response rate was below expectation. In order to increase the number of responses, the authors utilized convenience sampling. Same survey questionnaire was distributed among the faculty

members (of Construction Program) and staffs (of Facility Management Department) of two universities in the US. The detailed information of the total number of samples and response rate are provided in Table 2.

Table 2

Samples and response rate

	Faculty Member	Graduate Student	Staff of Facility Management	Total Respondents
Number	18	12	3	33
Percentage	54.5	36.4	9.1	100

Findings and Interpretation

From the survey results it was evident that the area of expertise of the respondents within the field of A/E/C was very diverse: construction management, heavy civil construction, project delivery and contracting strategy, sustainability, building information modeling, safety, construction innovation, information technology in construction, facilities management and utilities, etc. All of the respondents were affiliated to organizations located in the United States.

Level of Knowledge about ESCO and ESPC

Level of knowledge about ESCO was measured by the mean score of a five point Likert-type scale question: "What is your level of knowledge about ESCO?" The responses indicated the level of knowledge about ESCO from 1 (minimum) to 5 (maximum) with mean of 3.242 and standard deviation of 1.226. The mean score of a five Point Likert-type scale for a similar question measured the level of knowledge about ESPC among the respondents. The level of knowledge about ESPC had mean of 2.818 and standard deviation of 1.074. The level of knowledge about ESCO and ESPC among different groups of respondents are shown in Table 3.

Table 3

Familiarity regarding ESCO and ESPC among respondents

	Faculty Member		Graduate Student		Staff of Facility Management		Total Respondents	
	ESCO	ESPC	ESCO	ESPC	ESCO	ESPC	ESCO	ESPC
Mean Score	3.333	2.778	2.917	2.667	4.333	3.667	3.242	2.818
SD	1.328	1.114	1.084	1.073	0.577	0.577	1.226	1.074

The result clearly shows that awareness about ESCO and ESPC was more among the staffs of the Facilities Management Department, than that of the faculty members. However due to the disproportionate number of faculties and stuffs among the pool of respondents, the result could not be generalized. Still the result provided an overview about the awareness about ESCO and ESPC among various groups related to A/E/C.

Agreement with the Definition of ESCO

Definitions of ESCO vary from country to country and thus present a wide gamut of definitions in existing literatures. In their previous study, Bhattacharjee et al. (2010) provided a definition of ESCO adapted from previous studies of Goldman et al. (2002) and Hopper et al. (2005). Level of agreement among the respondents with the definition was measured by the mean score of a five point Likert-type scale question, "What is your level of agreement with the following definition of ESCO: *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 level of agreement was indicated from 2 (minimum) to 5 (maximum) with mean of 3.515 and standard deviation of 0.87. Though the result indicated a fairly high agreement with the existing definition, yet a lot of respondents presented their input in this regard. Based on the inputs of the respondents, this study modifies the earlier definition of ESCO as follows:

A business that develops, designs, constructs, manages, and arranges finances for energy efficiency projects, installs and maintains energy efficiency equipment, measures and verifies the project energy savings. Traditionally the compensation of an ESCO is a negotiated value that is connected to the amount of risk and reward to the parties involved and the potential for energy saving with the owner receiving the upside of potential once the ESCO has achieved its profit targets.

Rank Order the Barriers

To rank order the barriers according to their importance, the respondents were asked to indicate the importance of each barrier (listed in Table 1) with the help of a five point Likert-type scale question, "Below is a list of barriers for the adoption of ESPC in the private building sector. Please indicate the importance of each barrier according to you". Based on the mean score of the responses, Table 4 shows that respondents identified 'MB # 1: Low awareness among owner/ insufficient information about ESPC' as the most critical barrier preventing the wide spread acceptance of ESPC in the private building sector.

Table 4

Rank order of barriers according to survey response

Rank		Barrier	Mean Score	SD
1	MB # 1	Low awareness among owner/ insufficient information about ESPC	4.31	0.90
2	MB # 4	Ambiguity between owner and ESCO regarding realization of estimated saving	4.07	0.78
3	FB # 2	Lack of short term financial incentive	3.86	0.79
4	FB # 4	Uncertainty of payments based on energy savings	3.74	1.09
5	MB # 3	Limited involvement of the owner	3.73	0.91
5	IB # 1	Administrative hurdle/ complicated approval process	3.73	0.98
6	TB # 1	Lack of standardized procedure for energy audit, conservation measurement, and verification	3.71	1.08
7	FB # 1	Long duration of project requiring higher working capital	3.65	0.88
8	IB # 3	Risk of 'non-contract' and long negotiation period	3.48	1.09
9	FB # 8	Conservative lending practice of financial institution	3.31	0.79
10	TB # 2	Lack of technical knowledge among financial institution	3.19	0.98
11	IB # 2	Increased upfront legal cost	3.16	1.34
12	FB # 3	Reducing owner's credit capacity	3.13	0.87
13	FB # 5	Rent control limits the return on energy investment	3.07	0.90
13	FB # 7	Inability to control user behavior regarding usage of energy	3.07	1.03
14	MB # 6	Owner reluctant to ask for external funding	3.03	0.84
15	FB # 6	Small size of contract	3.00	1.22
16	IB # 4	Government initiative to subsidize energy price	2.96	0.92
17	MB # 7	Owner themselves implementing improvement according to ESCO's proposal	2.77	0.80
18	MB # 2	Inability of ESCO to provide comprehensive service	2.56	0.97
19	MB # 5	Owner walking out of the contract	2.37	1.13

Though Table 4 identifies the perception of all the respondents, yet the perspectives of different groups of respondents showed variations. The one commonality among all three groups of respondents was that they had identified 'MB # 1' as the most critical barrier. However, according to the faculty members 'FB # 1' and 'MB # 4' were the other barriers that played major inhibiting roles. Expectedly, the viewpoint of the staffs resonated closely with that of the faculty members. The staffs identified 'MB # 4', 'IB # 1', and 'FB # 1' as the major barriers. However the students' perspective showed much deviation from the above two. This group of respondents thought 'FB # 4' and 'IB # 1' were other major barriers following 'MB # 1'. To summarize the individual perspective of each group of respondents, Table 5 lists the first five barriers selected by each group.

Table 5

Comparison of responses of different groups

Rank	Faculty Perspective	Student Perspective	Staff Perspective
1	MB # 1	MB # 1	MB # 1
2	FB # 1	FB # 4	MB # 3
3	MB # 4	IB # 1	MB # 4
4	FB # 3	IB # 2	IB # 1
5	FB # 8	TB # 1	FB # 1

New Barriers

To know about other barriers not identified by Bhattacharjee et al. (2010), the survey asked the respondents to list other barriers with the help of open ended question, "Please mention other barriers" that are preventing the widespread use of ESPC in the private building sector. In response, participants mentioned the "Lack of experienced personnel in position of decision" as one of the major barriers. Deficiency of experienced personnel is a major drawback for the owner, ESCO and also the financial institutions. Due to lack of technical knowledge the owners of private building sector are skeptical of using ESPC, which is aggravated by the fact that low technical knowledge among financial institutions has lead to inefficient appraisal ability to evaluate risks of ESPC projects (Vorsatz et al. 2007). The blemish of not having enough experienced personnel is also applicable to the ESCO, as that result to "Lack of ability to demonstrate financial benefits to adopters in a succinct, reliable manner up front" (quoted from survey response).

The essentially unreliable and complex nature of the construction industry also has its share of responsibility for the present situation. Respondents were of the opinion that "Incremental cost control" of energy efficiency improvements in the private building sector was another barrier inhibiting the widespread use of ESPC. As the owners are constantly changing their requirement, it changes the budget of the project. One change begets another until a time arises when cost of the project is beyond capacity of the owner, and is deemed not worth the financial investment. Other barrier identified by the respondents was related to the basic consumer attitude. Energy efficiency improvement through ESCO is still "seen as new" in the private building sector and therefore resisted. The lack of knowledge and awareness is probably adding on to the declining attitude of the owners.

Conclusion

Based on the analyses so far, three distinct conclusions could be reached from the result of the survey. Results revealed respondents had a relatively high level of familiarity about ESCO and ESPC. Though the awareness of the staffs of the Facility Management department was higher than that of the faculty members, but the sample size of this study did not provide the scope for generalizing the conclusion in this regard. However, it could be deduced without hesitation that ESCO and ESPC were familiar terms among the A/E/C academic commune.

The most critical barrier identified by the respondents was the lack of awareness about ESPC among the private building owners. Coupled with that, insufficient information about ESPC is adding to the apprehension about ESPC among the owners. Owners are not conscious about the energy efficiency potential of ESPC primarily due to information gap, managerial disinclination and lack of interest. Due to lack of definite information and directive,

estimated savings from energy efficiency improvements is often wrapped in ambiguity. Moreover due to lack of short-term financial incentive, it is difficult to allure the private building owners. Often due to the inherent long-term nature of ESPC, owners stay away from the same as it involves large amount of working capital. Even though owners are convinced and get into ESPC, uncertainty of payments based on energy savings jeopardizes the project. The perspective of the respondents on the other barriers was also valuable and helped to accomplish the major objective of this study.

The feedback of the respondents related to identifying new barriers added another dimension to this study. The first step towards designing intervention methods is identifying the barriers. Nonetheless, identifying as many barriers is essential to complete the first step before proceeding to the next. The next step will be to formulate systematic intervention methodology to address these barriers. The rank order of the barriers presented in this study has serious implications while formulating intervention methods. Recognizing which barrier is most critical will ensure higher effectiveness of the intervention. However to guarantee wide spread acceptance of ESPC in the private building sector all the barriers need to be addressed.

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