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Real Option Application in Energy Performance Contracts

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Abstract

Energy Performance Contracts (EPCs) are mainly designed to facilitate energy saving and greenhouse gas emission reduction. Despite their numerous benefits, EPCs have not been utilized to their full potential. A variety of factors hinder the adoption of EPCs including long time investment, uncertain market, technology and credit and performance risks. These barriers discourage stakeholders and parties to invest in energy sector. Owners and Energy Service Companies (ESCOs) can overcome the barriers to adoption of EPC by making adjustments to current EPC schemes. Flexible design of the contract enables managers and parties of the EPCs to adapt project to circumstances that develop. Improvement on EPC schemes is essential to achieve the success in implementing EPC contracts. Research is needed in order to identify and evaluate various approaches to improve current EPC schemes. This study proposes the incorporation of real options in order to enhance the flexibility in EPCs and thus, encourage ESCOs and investors to participate in energy efficiency and saving endeavors. The real options approach incorporates a learning model, such that management makes better and more informed strategic decisions when some levels of uncertainty are resolved through the passage of time. This study focuses on two conventional types of EPCs, Guaranteed Saving (GS) and Shared Saving (SS). As part of this study, option to expand that can be incorporated in EPCs is identified. In addition, the opportunity to embed this option in two main contract types is explored. Various scenarios are considered, and the challenges and benefits of incorporating each option are evaluated. The findings of this study enhance the understanding about the possibility of incorporating real options into EPC contracts in order to increase the investment value for various projects stakeholders.

Keywords: Sustainability, Real option, Energy Performance Contract (EPC), Flexibility, Energy Efficiency

1. Introduction

Advancing energy efficiency can lead to more efficient use of final energy or useful energy in industry, services, agriculture, households, transportation, and other areas. It provides the greatest potential for moderating the energy demand. This is critical since, in many situations, it is more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply to satisfy demand for energy services. Efficiency improvement can also have a positive effect on energy security, local and regional air pollution abatement, and employment[1, 2] Therefore, energy efficiency is considered a critical aspect of efforts to achieve the ambitious goal of realizing sustainable development. Nevertheless, there are several barriers to enhance energy efficiency including the issues concerning institutional and legal frameworks, financial and economic incentives, and information, knowledge and technology gaps (International Development Finance Club Promoting Energy Efficiency 2013).

Energy Performance Contracts (EPCs) can provide a cost-effective route to overcome barriers to energy efficiency. Energy Performance Contracts, provided by Energy Service Companies (ESCOs), are novel market mechanisms to finance capital improvement that allow funding energy upgrades from cost reductions. Under an EPC arrangement an external organization (ESCO) implements a project to deliver energy efficiency. The stream of income from the cost savings repays the costs of the project, including the costs of the investment.

Performance-based contracts have been essential to the growth of the energy efficiency industry[3]. In fact, EPCs have become the most important mode for developing the energy service industry [4]. However, evidence suggests that EPCs have not been used to their full potential[5]. A significant barrier to the application of EPCs is the uncertainty associated with these contracts. Credit and performance risks often impact the outcome of energy efficiency investments. [6]. The development of the ESCO industry to its full potential is also inhibited by the difficulties of negotiation a balanced contract between the owner and ESCO[7]. Appropriate contract schemes are required in order to promote investment in the field of energy performance contracting.

To maximize the value of EPCs, parties to these contracts must devise plans to strategically manage uncertainty. EPCs must be enhanced in order to facilitate appropriate allocation of risks among the involved parties and allow them to deal with various situations as various uncertainties evolve. Owners and ESCOs can incorporate proactive flexibility in the form of real options into their investment decisions, and enhance opportunities to optimize the performance of their investment. This can result in well-structured EPCs that enable fair sharing of benefits and risks, offer a win-win situation for owners and ESCOs, encourage adoption of energy efficiency measures [8].

The objective of this paper is to explore the opportunity for embedding real options, option to expand only, into EPCs and thus, add more flexibility to these contracts. To achieve this objective, the working mechanism of expansion option is characterized and the opportunities to embed it in EPCs are evaluated. The remainder of this paper is organized as follows. Section 2 provides an introduction to EPCs and the risk allocation to the ESCOs and owners. Section 3 presents an introduction of the basic principle of the real options theory. Section 4, explains the methodology used in this study for evaluation and implementation of options in EPCs. Section 5, identifies option to expand the project that can be incorporate in EPCs. The applicability of this option type and the type of EPCs that best fit a given option type are also discussed in this section. Section 6 concludes the paper presenting the main findings and some perspective for further research.

2. EPCs and risk allocation

Energy Performance Contracts (EPCs) are alternatives to the conventional Energy Efficiency (EE) contracts implemented by energy service companies (ESCOs). The existing EPC models differ in the way that risks are hedged by involved parties including the owner, ESCO and lender [9]. Generally, there are two types of risks in EPCs: credit risks and performance risks[10]. Credit risks are related to the financing of the project and the party in charge of financing bears this risk accordingly. On the other hand, the performance risks are very diverse; from the uncertainty in energy price to energy audit quality and people factors.[6] Performance contracting is essentially a mechanism to transfer energy efficiency performance risks from the owner to the ESCO[6]. Therefore, the ESCO always bears the performance risks.[11]

EPCs are divided into two major contractual forms: Shared Saving models and Guaranteed Saving models. In a shared savings contract, the ESCO shares the value of energy savings resulted from the implementation of the proposed Energy Conservation Measures (ECMs) with the project owner under a pre-determined arrangement that is dependent on project-specific factors. In a shared saving contract, the ESCO typically secures financing from a third-party entity. Consequently both parties bear some degree of credit and performance risk.[12, 13]

In a guaranteed saving contract, the ESCO guarantees the owner a certain level of energy savings resulted from the implementation of the proposed ECM. In case the actual energy savings are less than the guaranteed level, the ESCO would compensate the owner for the difference. The owner is usually responsible for providing required funds from its own internal resources or a third party e.g. a bank or financial institution [10] This contractual form has a significantly different risk profile compared to shared savings. It removes the burden of financial risks from the ESCO. Nevertheless, the performance guarantee must be designed in a way that ensure the recovery of various costs including debt service, Measurement and Verification (M&V) fees to the ESCO, maintenance obligations or other incremental costs stipulated by the contract [14].

When using any of the above-mentioned EPC models, owners and ESCOs are often exposed to substantial downside risks. Incorporating mechanisms that can enhance the flexibility to reduce exposure to downside risks and match the schedule of project savings cash flows can provide potentially great strategic benefits and enhance the value EPCs for owners and ESCOs. Flexibility allows investors to perform more effectively in a world of substantial price and demand uncertainty, and product variety.[15] Real options can be utilized in order to optimally manage the creation and use of flexibility as a device to exploit uncertainty.

3. Basic Principle of Real Options Theory

The term “real options” was coined by Stewart Myers in 1977. He argued that the value of a firm includes the real assets in place plus the present value of options to make further investments in the future. These future investment opportunities are undertaken at the discretion of the firm, just as options on trade are exercised only when it is profitable to do so[15].

Real options are inspired by the financial option that is the right but not the obligation, to take an action in the future. In finance, according to Black and Scholes, "An option is a security giving the right to buy or sell an asset"[16]. When options ideas are used in business and real projects rather than stocks and financial markets, they are called real options. Application of real options analysis is numerous. For instance, a financial assessment under uncertainty may be required in order to determine whether and when the investment should be implemented. Real Options Analysis properly meets this objective[17].

4. Research Methodology

Since the determination of significant potential benefits precedes the effort to fully explore and quantify the value of contracts and options, this study reflects an exploratory effort to characterize the potential benefits of real options in EPCs. The two basic forms of financial options are *"call"* and *"put"* options: A *call* option gives the holder the right but not the obligation to buy an asset at a specified "*strike*" price, within a given timescale. [18]. A *put* option gives the holder the right but not the obligation to sell an asset at a specified "*strike*" price, within a given timescale. [18]. The opportunity to invest can be seen as a call option, involving the right to acquire an asset for a specified price (investment outlay) at some future time.[19] The abandonment option resembles a put option on stock. It gives the option owner the right to leave the project if the project does not meet the expectation in profitability.[19]

The scope of this research includes the characterization of real options applicable to EPCs. Five main steps were followed in the study: 1) Analysis of available literature on EPCs and ESCOs, their mechanism, uncertainty inherent in energy sector and the risk pattern parties confront in different types of EPCs; 2) Analysis of available literature on Real Options and their capability for enhancing managerial flexibility; 3) Analysis of literature on the application of real options in energy investments; 4) Identification of options that have the potential to be embedded in EPCs; 5) Evaluation of the identified options, in this paper only option to expand the project is analyzed, to determine their applicability in dominant types of EPCs. The focus of this article will be the contract terms level including only a quality-based analysis of potential real options in EPCs. The outcomes of this research are as follows:

1. Identify the risk bearer in Shared Saving and Guaranteed Savings Contracts.
2. Develop a framework for potential options to be embedded in different types of EPCs.
3. Define the proposed time for exercising the options
4. Investigate alternative scenarios for option holder (ESCO or Client)

5. Real Options and EPCs

Here the project is built with capacity in excess of the required level so the owner can expand the project when intended [18]. Management then has the right but not the obligation to expand – i.e. exercise the option – should conditions turn out to be favorable. A project with the option to expand will cost more to establish, the excess being the option premium, but may worth more than the same without the possibility of expansion. This is equivalent to a call option.[18]

In guaranteed saving EPCs, where the client is responsible for financing, whether himself or by a third-party, it is rational that the client holds the option instead of the ESCO. One should consider since one of the major risk of guaranteed saving contracts is the level of guaranteed energy for ESCO, it should be considered in the option's terms to set a new level of guaranteed energy in case of exercising the option.

In this situation, it is important to consider the ways that the ESCO can be incentivized by the owner to accept this option and its associated burden. As mentioned before, this option is worth to exercise only when the profit is higher than expectations. This cannot be achieved unless the saved energy passes the guaranteed level. On the other hand, it is one of the key terms of the guaranteed saving contracts to share the excess saved energy profits among ESCO and owner. That means in the case of exercising the option, the ESCO can have its own share from excess energy saving. ESCO can accept the risk of reaching to the new guaranteed level of energy saved amount again after exercising. Thus, there are two possible solutions for incentivizing ESCO: 1) Higher option premium paid by the owner to the ESCO. 2) Increasing the amount of share of ESCO or setting a fixed payment in case of exceeding the new guaranteed level.

There are barriers to utilizing the option to expand in the guaranteed saving contracts. Suppose that the ESCO has the option to expand. Since the credit risk and financing should be done by the owner, whenever the ESCO decide to exercise the option the owner is obliged to finance the project whether is willing or there may be better opportunity in other fields. What comes to mind is an alternative that is inspired by the variable contract term. There can be a shift in the type of financing as the ESCO decide to exercise the option and instead the share of saving will be increased. There is no such option in the typical contracts but it can be implemented as the parties agree on the option.

In Shared Saving EPCs, the ESCO bears both performance and credit risk. Since the ESCO is responsible for financing the project, it is more rational to own the option to expand. The case of exercising is similar to the guaranteed saving.

As it was illustrated in the case of guaranteed saving contracts, the party that bears the credit risk is more likely to be interested in holding the option to expand the project. In the shared saving contracts, the ESCO bears the credit risk. Therefore, the scenario in which the owner holds the option is unlikely. However, in these situations similar to the guaranteed saving contracts, appropriate mechanism can be devised to incentivize the opposite party to become and stay involved in the project.

For shared saving contracts in which energy price is the main factor of profitability of a project, a boundary or threshold for energy prices, which spans the investment horizon, can be identified. (For a detailed discussion on the way to identify the exercise boundary for an option please refer to Kashani et al(2015)[20])

In Figure.1 the cumulative energy saved pattern is shown. At the early stages, the energy saved will raise faster as at the end of the project this increase will happen in a lower rate due to a variety of factors that degrade the performance of a system. [17]

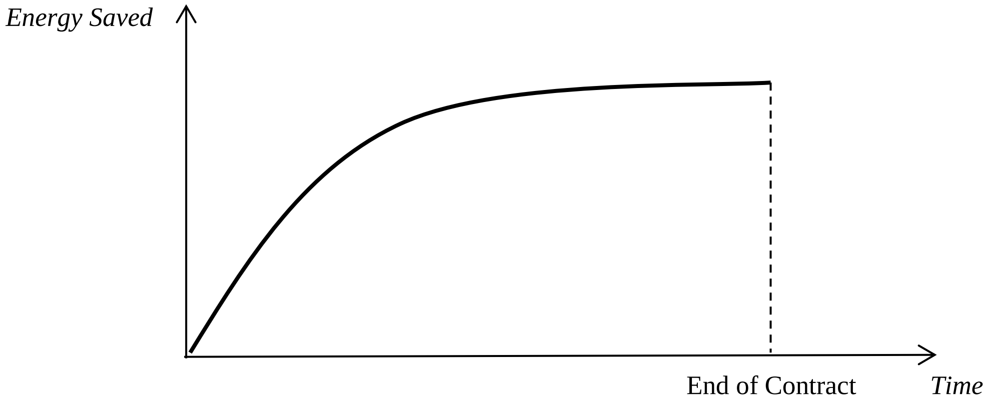

Figure.1- The Energy Saved Pattern

The expansion of the project is justified if higher profits and better prospects are expected as a result of the investment. This is possible when, considering the abovementioned energy saved pattern, the energy price increases over time and, as a result, the amount of saving (Energy saved * Energy price) increase. The boundary identifies the minimum prices at given point of time over the investment horizon at which the value of exercising the option is higher than the value of delaying it exercise. This exercise boundary is shown schematically in Figure.2

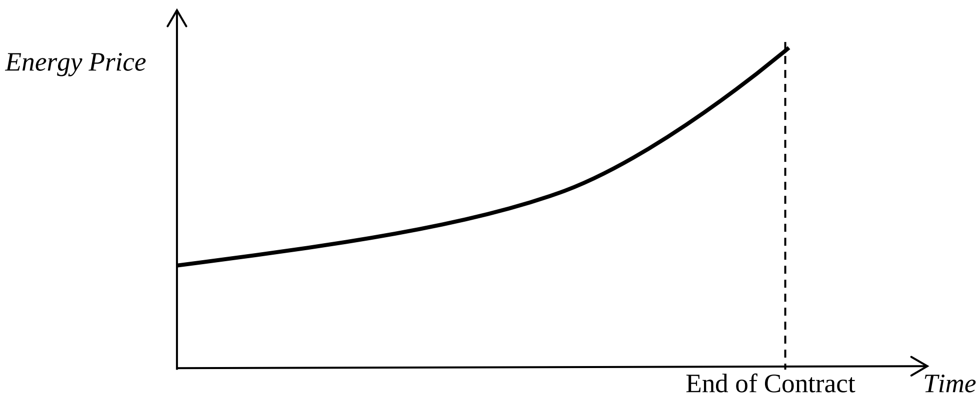

Figure2. - Minimum energy price threshold for option to expand the project

Unlike shared savings contracts, in the guaranteed saving contracts, the level of guaranteed energy saved is stipulated in the contract as the main defining characteristic of the contract. Therefore, for this type of contracts, a threshold for the level of guaranteed energy saved in going to be shaped as shown in Figure.3. As it can be seen, at the end of the contract higher level is expected since the time for recovering the investment is less than before. It is obvious that the level of guaranteed saved energy must be higher than the initial level of the contract at each point since it is the logic of the option to expand.

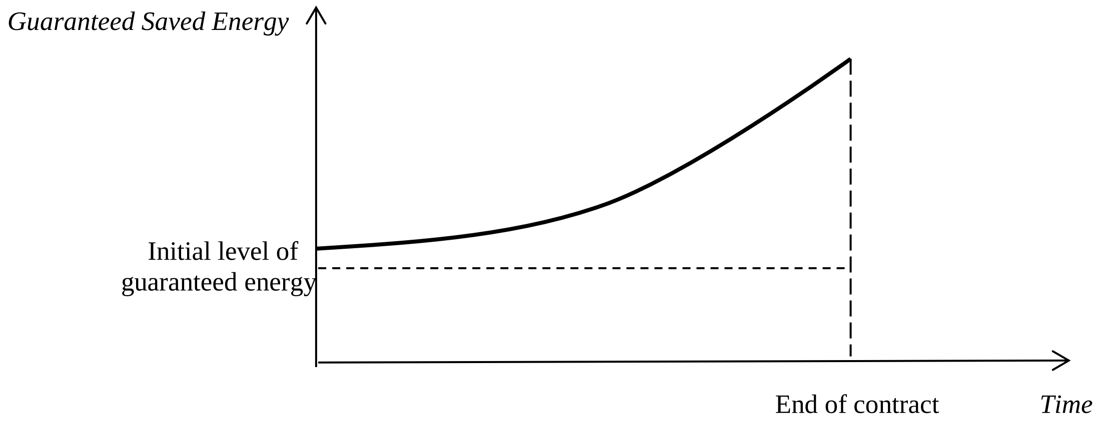

Figure.3- Minimum energy guaranteed level in GS for option to expand the project

Conclusion and future work

Incorporating flexibility in the EPC contracts can lead to more adoption of these contracts and facilitate energy saving approaches. Given the increasing scale of investments in sustainable retrofitting, it is of great importance to put additional terms in EPCs in order to make them more flexible for parties and thus encourage them to use these contracts. The energy based projects due to their high initial costs, high financial and performance risks and uncertainties, caused by their natural source variability, discourage investors to participate in these projects. Embedding real options in EPCs can work as a support mechanism to enhance the value of energy efficiency investments. In this paper, after discussing the risks of EPCs, the option to expand and the opportunities for embedding this option in contract terms were analyzed. The option holder and scenarios for exercising the option was analyzed and at the end the boundary and threshold for energy price and level of guaranteed energy saved was proposed.

A number of extensions to the present work are recommended. A method for evaluation of real options performance and the use of proposed methods such as ROV can be studied in future works. The authors are currently conducting a risk analysis and evaluation method including conventional and real option theory to develop a framework for EPCs.

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