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Effectiveness of Energy Efficiency Certificates as Drivers for Industrial Energy Efficiency Projects

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ABSTRACT

The efficiency of policies in steering the implementation of energy efficiency (EE) projects has multiple implications including economic opportunity such as reduction of greenhouse gas emissions, security of supply, technological development opportunity for industry. One of the key new instruments foreseen to support EE improvements is the EE certificate (EEC). Focusing on the industrial business case, the purpose of this paper is two-fold. First the energy performance contact is analyzed and discussed, second this paper shows how EECs concur in supporting the viability of the investment. Specifically, results suggest including this instrument the payback time reduction would be around 20% below the baseline hypothesis.

Keywords: Energy Efficiency Certificates, Energy Efficiency, Energy Policy, Payback Time, Energy Performance Contract
JEL Classifications: H3, L52, Q48

1. INTRODUCTION

Interest in the energy and specifically in energy efficiency (EE) market has evolved significantly, both from the regulatory point of view and from the practical side. This sector is highly vulnerable to unanticipated and unpredictable occurrences – among others technological innovation and energy prices – that undermine the outcomes predictability of the energy policy initiatives and strategic decisions. It has been suggested that improving the EE of industry, in particular, is seen as essential for maintaining the viability of domestic manufacturing, especially in a world economy where production is shifting to low-cost, less regulated developing countries (Brown et al., 2014). Investments in this regard bring direct energy returns, and additional value streams to private owners and asset operators, as well as significant public benefits in terms of increased employment, lower emissions, increased energy security and reduced dependence on foreign energy imports and improvements to a country's fiscal balance (EEFIG, 2015). Previous research explain factors that are commonly claimed to inhibit investment in EE such as financial risk, imperfect information, hidden costs, access to capital, split incentives, bounded rationality, external and internal factors (Loures, 2014; Palmer et al., 2012; Pätäri and Sinkkonen, 2014; Sorrell et al., 2011). In theory, market forces would in time produce the most efficient outcome without interference. However, given the technical characteristics of the energy markets, there appears to be a need to promote and accompany such market induced change by improving EE more rapidly and thus reducing the demand for energy, a well-known form of promotion is the so-called EE certificates (EECs) system. Thus, to make the process to happen both energy policies and strategic decision shall coincide and evolve making accommodating EE investments. To complete the picture this paper highlights the implications of an established policy tool, i.e., EECs underscoring the investment enabling role. The theoretical framework which dominates viability of EE investments considers financial factors as the most important in explaining energy-efficiency investment decisions. The mainstream approach is contested by several authors whose works comprise a heterogeneous alternative energy literature (Cooremans, 2011). This paper presents a case of EE upgrading project regulated by an energy performance contract (EPC). The project corresponds to an EE action aimed at improving the efficiency of the cooling system of a data center. This is done under a payback time analysis framework since it provides an easy-to-apply and intuitive decision process and is common in practice. Results suggest that EECs positively influence the output by reducing the payback time by roughly 20%. The remainder of this paper is organized as follows: The first section corresponds to the background in which the rationale of the investments in EE are highlighted. This section also suggests how EE can drive organizations' competitiveness. After that the market section comes aiming at introduce the industry boundaries, specifically the energy service companies (ESCOs). This is followed by some clarifications on the financial mechanisms. The following section presents the analysis of the case including the risk analysis. Conclusions follow.

2. BACKGROUND

To appraisal the effectiveness of EE projects within the industrial sector it is necessary to consider the connection between such projects and sustainability goals. EE is measured using the EE indicators; the main of which consists in the ratio between the output and the input of energy. Given the useful energy output a, and energy input b, the index ŋ is ŋ = a/b. In addition to this there is an alternative approach that can be useful to define other types of indicators, which combine the resource used (input) with the service provided (output) in order to measure the amount of energy required to produce a unit of service. This is done by referring to the energy intensity. Being c the energy input and d the service output, then efficiency indicator becomes EI = c/d. Anyway, the measurement of EE is a process that requires the definition, evaluation and analysis of a set of indicators. Also, for a proper construction of such indicators a few adjustments must be done to make the flows of energy comparable and to avoid misunderstandings (Pérez-Lombard et al., 2012). A prominent organization when it comes to conduct EE measures or upgrading is the EPC that is a contract by which a service provider (ESCO) undertakes the completion of a series of services and integrated interventions aimed at upgrading and improving the efficiency of an energy system owned by another subject, i.e., the beneficiary. For this to happen both parties shall benefit, specifically the beneficiary of the intervention shall choose among different alternative; business as usual and the intervention. A model in which a subject chooses between two different alternatives effectively summarizes the economic foundations of EE (Sioshansi, 2013). In the first period, the subject chooses the good and pays for the investment of capital, while in the second period; the consumer uses the asset and is exposed to energy costs. The two different alternatives, one energy-inefficient and another efficient are denoted by 0 and 1 respectively, and have energy intensity e_0 and e_1, where $e_0 > e_1$. The incremental cost of capital is c and an incremental opportunity cost Ɛ. The price of energy is p and the discounted rate risk between the two periods is r. The variable m represents the way in which the subject uses the good. Within the variable m, there is an implicit function of energy prices, using m_i to indicate that it is an index that varies depending on the subjects. One would choose efficient alternative if the willingness to pay is greater than the incremental cost of capital. The parameter ỿ is a weight of the implicit energy cost saving in the decision of the subject. The subject chooses the energy efficient good if the willingness to pay is greater than the incremental cost. Therefore, the willingness to pay weighted on the weight of the subject's implicit energy cost saving $ỿpm_i$ is given by Equation (1).

$$ỿpm_i = \frac{(e_0 - e_1)}{(1+r)} Ɛ > c \quad (1)$$

In addition to such investments, there are social costs that are not internalized in energy prices and are denoted with Ψ. In the condition of social optimum, one adopts the energy efficient alternative if the willingness to pay, adding social costs not internalized in energy prices, is greater than the incremental cost as shown in Equation (2).

$$(p+\Psi)m_i \frac{(e_0 - e_1)}{(1+r)} - Ɛ > c \quad (2)$$

Choosing the most efficient alternative requires sufficient information in order to benchmark option (Di Foggia and Arrigo, 2015). As per the financial analysis, the literature on actual capital budgeting decision-making indicate that payback analysis is more frequently used than the standard net present value or internal rate of return analysis (Jackson, 2010). Similarly, it is important to stress the role of risk assessment as a recent paper suggests (Lee et al., 2013).

Provided that the EE continues to gain attention and to be considered a key resource for economic and social development, a deep understanding of its real value has become important. To understand this, it is important to analyze this issue by considering the multiple returns. In fact, investments in EE have a positive multiplier effect for economic systems because positive externalities, such as sustainability of energy system, reduction of energy dependence, reduction of greenhouse gases (GHGs) emissions, new jobs and technologies. At an industrial level, investments in EE can contribute positively in achieving the strategic priorities in many ways, for example: Reducing costs, increasing the added value, mitigating the risks (IEA, 2014). Defining and fie-tuning the concept of EE in industry is yet complex because the processes embed many steps in which different energy needs exist. Conversely, the advantages of an efficient energy management are recognized by many industries that are working to make production processes leaner and to implement new energy solutions. Some advantages are easy to quantify while others are not; hence, finding a way to assess them in the short and in the long-run can be helpful. Table 1 describes some of the potential benefits of EE measures.

Despite the undisputed multiple benefits, the projections show that, under the current policy, most cost-effective investments in EE will remain unrealized. Many barriers contribute to this problem: One of the main obstacles is the lack of attention to the opportunities for investment by public and private entities with respect to other options currently on the market.

3. INDUSTRY OVERVIEW

Main sectors in which most EE interventions happen are commonly recognized to be residential, tertiary and industrial. The structure of this market for simplicity of understanding is divided into three main stages. The first relates to the production and delivery of EE upgrading solutions, the second is the distribution that can be wholesale or retail and the last stage is the practical implementation

Table 1: Benefits and horizon

Impact	Short-term	Long-term
High	Increase in production, time reduction, performance improvement, cost reduction, process optimization, less raw materials	Reducing labor costs, reducing maintenance costs, more reliability, better productivity of the plants
Medium	Improvement of product quality, improving efficiency, improving product quality	Waste reduction, emissions reductions, environmental compliance cost reductions, CSR
Low	Improved working environment, improving air quality, less maintenance	Improvement of reputation, competitive advantage, customer satisfaction, benefits relating to health

Source: Adapted from (IEA, 2014). CSR: Corporate social responsibility

of the interventions of EE upgrading. The last phase is the most delicate and the one that requires more attention as it is the focal point around which the success of the savings objective. It also includes the step of the results assessment. Companies engaged in the three phases described above can be classified as follows: Original equipment manufacturers that engaged in the production and distribution of solutions for EE; wholesaler (W) which are companies that act as intermediaries and deal then mainly to trade and distribute the EE upgrading solutions; EE Service Provider (EESP) i.e., companies also called ESCO, which deal with the implementation of EE upgrading – they usually face the entire process: Initial analysis, implementation and monitoring of results; original equipment and EE manufacturers that as the EESP realize the interventions of EE upgrading but also produce and supply the technology. That all Sais one should remember that these operators act in the market interrelating in different ways. The EESP can in turn be divided into different types of businesses: Management of plants that generate or consume power, energy distribution and/or sale, technical-economic consultancy with regard to the solutions for EE and ESCOs that provide their customers with goods and services aimed at reducing energy needs.

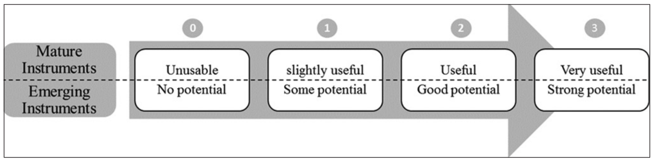
3.1. Business Organization

Long-term success depends on adopting and then being able to manage different strategies simultaneously. While business models provide a richer logic of the firm and the way it operates within an industry or economy, economic models provide an economic and mathematical rational specific to a firm (DaSilva and Trkman, 2013); the second interpretation fits to this paper. Under this framework, providers and beneficiaries put into practice contractual relationship when it comes to define an action. The contractual relationships fall into two types, first comes the selling and second comes the saving contract. In the first type, providers realize the action on behalf of the beneficiary against a defined remuneration, while in the second type such providers complete the action against a remuneration depending on the attainment of a certain level of savings. Included in this category fall the EPCs, as mentioned, the goal of the contract is the optimization of the energy system. The contract also contains a number of technical and economic information relating to the intervention of EE upgrading. There are two models of EPCs: One related to the shared-saving and the other the guaranteed-saving. In the shared savings model, the investment is reimbursed on account of an agreement to split the savings rate. As regards the guaranteed savings, the beneficiary funds the design and implementation of the efficiency measures, taking the contractual obligation of the payment and the risk of credit. Since it is well-known that the ESCOs are important players in the field of EE and influence the energy use (Fang et al., 2012), it becomes important to outline the business model. These firms offer a set of services that involve: Financial resources, implementation of energy audits, feasibility and design studies as well as measures of EE upgrades and maintenance. At the time of writing, tough services and technologies offered by ESCOs still face reluctance. In fact, he adoption process, in terms of the accumulated users using the services and technology over time, is S-shaped with a relatively slow uptake early in the period, a steep increase when the early majority and late majority start using it, and then a flattening as the last few (laggards) join in (Chiyangwa and Trish Alexander, 2016). Widely speaking, there are many business model characterize these companies, a digest as per the Italian market, i.e. industrial, tertiary-residential and ESCO full scope is provided in a recent report (ESG, 2015). The further development of the ESCO industry could greatly contribute to the implementation of many additional cost-effective projects, and can play an important role in bridging the gap between different actors on the energy and technology supply side and among energy consumers.

4. ECONOMIC AND FINANCIAL ASSESSMENT

Investors willing to finance EE project must cope with key factors that still remain uncertain, for example: Payback periods, the risk of investment, the bankability. It is clear that there are strong interdependencies between the three groups. In fact, organizations and investors require a robust regulatory framework under which to operate that provides certainly for their activities. Thus a framework of output stability is a necessary condition for sustainable investments that lead to economic growth, social and technological development. Proper roles for public and private sectors are required concur maximize the result. The financial industry is showing a growing interest in the green economy. However, there are reasons why there are still resistances in securing financing. Poor information and training on the most updated technologies (and their economic and financial impact on the rate of return from investment), together with a latent aversion to the risk associated with early adoption of new technologies, lead financial institutions to keep-on supporting outdated technology even when they are not the most efficient or offering the best return. Also important is the particular structure of the return of investments that are not always easily quantifiable and accurate. In addition, it is central the financial viability of the applicant. The one that is financed must be able to ensure that the mark-up coming the action exists and that it can be used to repay the loan. Another critical point is the technical evaluation of interventions required; in some cases, in fact, the technical contents related to

Figure 1: Evaluation grid



Source: Own elaboration

Table 2: Financial instruments: Usability and potential

Instruments	Type of business			
	Large energy intensive	Large non-energy intensive	Mid-cap	SMEs
Mature instruments				
EPC	3	3	3	2
Dedicated credit lines	2	2	3	3
Risk sharing facilities	2	2	2	2
Subordinated loan	2	2	2	2
Leasing	2	2	2	2
Covered bonds	1	1	1	0
Emerging instruments				
EE investment funds	3	3	2	2
Energy services agreements	2	2	2	2
Factoring fund for EPC	2	2	2	2
Green bonds	3	2	2	1
On-bill repayment	1	1	1	2
On-tax finance (PACE)	1	1	1	1

Source: EEFIG (2015). EPC: Energy performance contract, EE: Energy efficiency

EE measures, difficult to standardize, complicate the bankability analysis. Therefore, it may be necessary for the bank to get an assessment of the technical soundness of the measures to be supported by an independent third party. Among the problems, there is also the issue of guarantees; often, in fact, companies such as ESCOs struggle to provide necessary guarantees for access to credit. Of great importance is also the guarantee of ensuring the continuity of the activity to which the energy savings refers. The afore mentioned criticalities can be mitigated through selecting the right financial instrument. In this respect a recent document of the EE financing institutions Group demonstrated the potential of mature and emerging instruments in achieving desirable results. Experts in EE were asked to classify each financial instrument according to its usability to support the flow of investments in EE through a rating scale as shown in Figure 1.

The survey results on the usefulness and potential of some of the financial instruments are shown in Table 2. All businesses, whatever their size is, use all mature financial instruments except for covered bonds, a financial instrument that requires significant investments as collateral. Precisely these are bonds issued by a company and guaranteed by loans that, while still in the balance sheet of the issuing company, act as a guarantee to cover the cash flows related to the obligation. In case of default, the investor has a right to recourse against both the issuer and the collateral. Among other financial instruments there are also EPC and credit lines; while the first is a tool used by all types of companies, with greater success in large and medium-sized enterprises, the second is used mainly in medium-sized and small businesses. Risk sharing facilities and the leasing, indeed, are equally used in all companies; the first are guarantee funds that reduce the risk for banks, covering part of the risk of non-payment by a guarantee, thus increasing the possibility of obtaining a more significant bank loan. Among the emerging financial instruments, we find instead the EE and the Energy Services Investment Funds agreements, which are able to effectively contribute to the financing of EE projects for industrial upgrading. Even factoring funds resulted to be effective.

Besides the financial instruments it is worth noting the bankability of projects. Indeed, ESCOs, sometimes implement projects by mean of self-financing, nevertheless in most cases they rely on third-party financing arrangements (TPFA). At this point, we analyze in detail the main activities of each of the three actors listed. The ESCO, through a contract, propose to the beneficiary an action of energy optimization. It ensures the investment and assumes the risk of the result, receiving as compensation the energy saving achieved. The financial institution (lender) provides financial resources necessary for the realization of the project. In this case, the financing institution identifies the grade of bankability of the project. The beneficiary is the entity that get the service and a share of the energy savings achieved. Another option, in addition to third party financing, is the case of creation of a bilateral relationship where the ESCO itself act as a financier of the subject. In both cases, it is clear that the interest of the ESCO and the beneficiary match in wanting to maximize energy savings. The funding body, instead, pursuing economic interest aims at investment remuneration. The incentive mechanisms such as EECs can serve to boost bankability. The EECs have the aim of promoting the market uptake of innovative processes or systems that save energy since are securities that certify the achievement of energy savings in end-use energy through actions and EE upgrading projects. The system relies on ex ante savings, obviating the need for ex-post monitoring and verification. In addition, cultural barriers in connection with investments in EE play a remarkable role. Often interventions in EE require investments of small entities with quite long investment return periods. The lack of interest for smaller projects comes from the little savings generated that are not sufficient to cover the transaction costs of funding for the beneficiary and do not allow to adequately compensate the lenders. This takes the form of a reduced interest from operators for the interventions of this magnitude, which are struggling to find appropriate market instruments. Again, at and industrial level the beneficiaries can be divided into two parts: The energy-intensive companies and non-energy intensive companies. For the first management of the energy component is vital to be able to stay competitive, while in case of non-energy intensive companies the cost of energy is not critical, hence the attention that is paid is less than the attention paid to other spending that are quantitatively more onerous, such as raw materials, personnel or marketing. In such companies the barriers to EE are higher and more numerous (ENEA, 2015). A barrier to EE is defined as factor that inhibits a decision or behavior that appears to be both energy efficient and economically efficient and although a widely used concept, such barriers are classified in different ways. For example a recent study identifies barriers according to the organization' boundary: External – e.g., legal frameworks, incentives, governmental support for EPC, appropriate forms of finance due to conservative lending practices, confidence in ESCOs – or internal like heavy capital needs among ESCOs, a lack of technical skills, a lack of business skills to market and sell projects, a lack of accepted and standardized measurement and verification procedures for savings (Pätäri and Sinkkonen, 2014). From an economic point of view most of the factors that are commonly claimed to inhibit investment in EE can be so summarized (Sorrell et al., 2011): Financial risk, imperfect information, hidden costs, access to capital, split incentives, bounded rationality.

These factors explain why a technology that is both energy and economically efficient has not been adopted. In addition to them this paper defines the government support for EE though market based instruments as a tools to mitigate these barriers. In this category falls the innovative policy mechanisms

- Suppliers obligations and white certificates;
- Feed-in tariff for energy savings cap and invest schemes

In this regards it is anticipated that different tools interact one with each other including the traditional EE policies (Bertoldi, 2011):

- Energy taxation (at European union [EU] and national level);
- Incentives for investments in EE (national);
- Information campaigns (mainly national);
- Promotion of energy services (ESCOs) (weak EU measures);
- Minimum efficiency requirements (minimum energy performance standards) for end use equipment and equipment labelling;
- Buildings codes (standards) (at national level);
- Energy audits (at national level);
- Voluntary programs (mainly in industry at national level, but also for equipment and cars, these are at EU level);
- Demand-side management programs (not many, at national level or regional level)

5. FROM PANORAMA TO PRECISION: THE BUSINESS CASE

This section begins with the introduction of the analyzed provider's implementation process that is conceptually divided into three phases: Identification, evaluation and implementation. The first stage concerns the determination of the status of all relevant energy processes at both operational management and its organizational structure by means of a benchmark in the same industries. In the second stage, mainly to undertake evaluation, this provider conducts a comprehensive analysis of the site. From this stage, a specific assessment aimed at determining potential opportunities and related savings arises. In the last stage, solutions to save energy in systems are implemented with support of qualified experts in the assessment of the feasibility of the project and in the post-project monitoring. This is done while supporting the beneficiary throughout the entire process (Siemens, 2014). The advantages for beneficiaries do not limit to the reduction in energy costs but also include the provision of a value added service from a provider that offers both a consulting service and products and management skills needed to implement the best solutions. With the combination of ad-hoc services, the beneficiary gets more guarantees to transform the potential for improvement into real savings.

5.1. Statement and Delimitation

The case focuses on the achievement of EE improvements in a data center. The servers in the data center dissipate thermal power in the rooms, creating the need to have a cooling system to protect the electronic equipment. The purpose of the action is to generate improvements in EE. In this article, we calculate how much time is required for the return on investment. In the first phase of the contract, the provider performs a preliminary analysis together with the detailed analysis, analyzing the following aspects: Gas consumption 2011-2012, electricity consumption for 2011 and 2012, unit cost of energy, wiring and mechanical data diagrams, energy management system. Before the intervention, an index called EE ratio (EER) of the cooling system, for the year 2014 was calculated. This index allows measuring the EE of the data center, for the year 2014. Precisely, The EER is a parameter that measures the electrical efficiency of a cooling plant. Based on this index, the provider created an ad-hoc revamping project, with the aim to increase the efficiency of the plant. The project contains a future prediction according to which after the intervention; the EER would increase, using half the energy to cool the data center compared to the previous situation. Following this the contract was signed, as follows the key sections. The beneficiary relied on the provider for the design of the intervention of EE upgrading and the execution of all necessary actions for the implementation. The contract run from the date of its completion and lasts until the end of the guarantee of savings. The nominal value in connection with the execution in the project is estimated at €1.700 mn (excluding VAT). Included in the amount is all the work planned in the project documentation as well as anything else required for execution of the project. The provider shall offer an annual saving in terms of energy consumption. After having concluded the efficiency-drive measures, both parties shall sign the test report. The provider must then prepare a report, with any savings achieved in relation to the forecasts. To guarantee the savings a bank guarantee shall be opened. The provider shall declare that the production, marketing, supply, installation, and use of products and materials are exempt from infringement of third party rights, including industrial and intellectual property. The quality of supply and services must be guaranteed by the existence and implementation of a quality assurance system. The ISO 9000 (ISO 9001 or ISO 9002) can serve as references. At the end of the annual reference period for calculating the energy savings, the calculations of the amount of energy saved based on the data acquired in accordance with the plan for monitoring and verification are done. If case of failure to achieve the value of guaranteed energy savings, the provider must pay the difference between the value of estimated savings and the value of savings actually achieved.

5.2. The Process and EPC

EPC projects present a peculiar risk representation to the contracting parties as its principal focus is to deliver promised energy savings to beneficiaries. As already mentioned, there are two frameworks: Projects based on own financial resources against TPFA, The ESCO carries out the intervention and both contract parties define the savings sharing, and in case of TPFA how much of the savings achieved should serve to repay the investment, thus defining the repayment plan. The EPC is usually a medium to long-term contract with an average duration that varies from 3 to

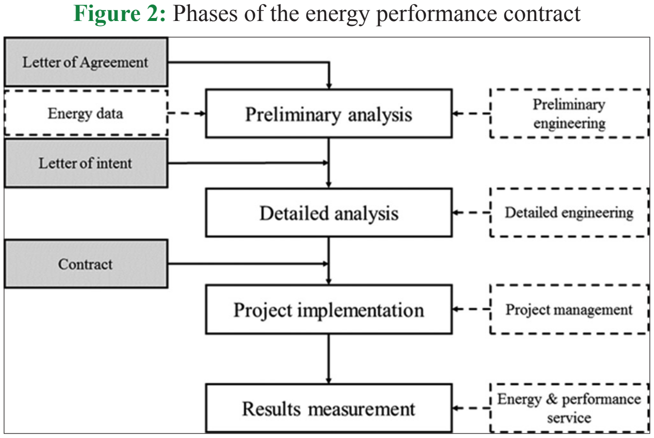
5 years and is a bankable contract. This means that as a guarantee of energy savings a bank guarantee is issued to cover the same savings. Figure 2 summarizes the steps that follow the process as from the EPC.

In the first phase the provider verifies the potential of energy saving and ends with the delivery of the energy analysis with an early indication of the savings and related investment required to achieve them. Based on the preliminary analysis, whether there were energy savings in line with expectations declared, the development of a detailed analysis through a letter of intent is proposed. After that phase two comes, in which the focus is on the analysis of all the sources and their energy pathways. In addition to the detailed analysis, one should try to identify aspects that reveal additional savings opportunities, allowing getting as much as estimated. If the detailed analysis confirms or improves the data of the preliminary analysis, then it is possible to proceed. Subsequently the contract is conducted; the contact contains the guarantee on savings and includes the fulfillment of energy services that including the execution and maintenance of energy saving measures and the monitoring and control. The following phase is the results measurement. Savings are presented in a report that highlights the savings achieved in relation to the provisions contained in the contract of performance. At the end of the measurement period, the provider calculates the amount of energy consumed/saved based on the acquired data. In the case study we present a detailed analysis concerning the payback period with and without the EEC. The four phases of the service characterizing the EPC described above appear in an EE-upgrading document.

5.3. Evidences

This section starts highlighting that the EEC influences the approval of a contract between a service provider and the beneficiary. Usually at the time of conclusion of the contract, the provider calculates how many EECs the project provides. In this case, the beneficiary has a unit responsible for managing the EEC. For a better understanding of the impact of EEC, in the next section we indicate the return on investment with and without taking into account the EEC. It is anticipated that the energy saving is measured in electricity kilowatt-hours (ekWh), which will then be converted into euros. The price of energy used to calculate the savings is considered constant throughout the investment period.

Figure 2: Phases of the energy performance contract



Source: Adapted from Siemens Building Technology, 2014

The framework of this analysis is the payback time as common in practice. Payback (PB) analysis provides an easy-to-apply and intuitive decision process where investment cost is divided by annual savings to show the number of years required for the investment to pay for itself. Payback analysis, however, suffers from many well-known deficiencies as an investment analysis tool with the most obvious being the inability to distinguish between short- and long-lived investments (Jackson, 2010). The following variable appears in the analysis. EEC is the electric energy cost (€/ekWh) and defines the fixed price of electricity that remains constant for the duration of the investment. TIC stands for total investment cost (€) which is the expense that the customer addresses for the project efficiency. PB is the payback energy saving and denotes the payback time excluding the EEC. PBE corresponds to the payback total saving, or the payback time including the EEC. AES are annual economic savings (€) and is meant to be the energy savings expressed in € without the EEC. AENS defines the annual energy savings (ekWh) i.e., the total savings in eKWh guaranteed. After that comes ATS annual total savings (€) or the total savings including the EEC. Specifically, we have the following data in €: The value of the EEC is €0.15/ekWh, the TIC: €1.7 mn, the total EEC, are €0.15 mn. We also have the following information; eKwh 3.619 mn. At this point, it is possible to calculate the cost savings and the total savings, including the amount of EEC. The AES stems from the product between AENS and the EEC as indicated in Equation (3) from which Equation (4) comes as per ATS.

$$AES = ekWh\ 3.616_{mn} \times €0.15_{eKWh} = €0.543_{mn} \quad (3)$$

$$ATS = €0.543_{mn} + €0.150_{mn} = €0.69_{mn} \quad (4)$$

At this point, provided the general payback time, Equation (5), we calculate the PB, Equation (6), and the PBE, Equation (7). Payback period is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows generated by the investment. The formula to calculate payback period is:

$$PB = \frac{\text{Intial investment}}{\text{Cash inflow per period}} \quad (5)$$

Other things being equal, the investment that is repaid in the shorter time period is considered the better choice. The shorter time period is preferred because: Investment or action costs are recovered sooner and are available again for further use and because shorter payback period is viewed as less risky.

$$PB = \frac{€1.7_{mn}}{€0.543_{mn/year}} = 3.13_{years} = 37.5_{months} \quad (6)$$

The influence of the EEC in terms of payback time emerges.

$$PBE = \frac{€1.7_{mn}}{€0.693_{mn/years}} = 2.45_{years} = 29.5_{months} \quad (7)$$

It is usually assumed that the longer the time required for covering funds, the more uncertain are the positive returns. For this reason, payback period is often viewed as a measure of risk, or a risk-related criterion that must be met before funds are spent. Provided that 3.13 years equals to 37.5 months and 2.45 years correspond to 25.5 as a result we have 8 months less (Graph 1).

From the comparison between the two results, it emerges that thanks to the EEC, the return on investment is about 8 months prior to the return time in the absence of the EEC. The EEC appears to be a useful tool to businesses to support EE upgrading projects. It is therefore necessary to consolidate this instrument and make it more effective. The steep decrease (by about 20%) in payback time confirm that, regardless the quantity of energy used, organizations shall commit more in this field. Nevertheless organizations are experiencing difficulty in finding people who are knowledgeable about and experienced in the evaluation of EE programs (Vine et al., 2012), no wonder that firms with revenue management professionals, outperform (Di Foggia and Lazzarotti, 2014).

5.4. Risk Management

Lack of a proper assessment method on performance risks in EPC projects is one of the reasons hindering the further development of the market (Lee et al., 2013). Thus, to ensure that action of EE upgrading was a successful action, it is important to warrant it by implementing a solid quality control system and related checks. The terms risk, refers to the likelihood that unwanted and unexpected events verify. Thus, organizations shall deeply analyze risks. Widely speaking there are different types of risks, for example: Economic risk such as increases in construction cost or interest rate, financial risk (if third party financing is required), project design risk is case of poor information on facility, Installation risk that can manifest as inappropriate design or installation delay, technology risk, operational risk, measurement and verification risk, again because of poor data (Lee et al., 2015) (Figure 3).

The first step brings out all the critical issues relating to the project. At this stage, it is appropriate to proceed with an analysis of risk through business intelligence tools, obtaining indices of financial viability. If the company is not solid, one should request collateral guarantees in order to prevent risky events. To determine the risk of a contract it is necessary to identify each type of risk that can appear along the process. Among the most common risks, there are the following: Energy risks, legal risks, technical risks and risks of context. The central step in the risk analysis covers the qualitative and quantitative assessment. The first can be conducted through the analysis of the indicator risk factor (RF) which is given by the product between the risk seriousness (RS) and the risk probability (RP), namely: RF = RS*RP. The severity of the risk is evaluated qualitatively as the effect on the timing, cost and quality of the project. The RS can take on, depending on how it is evaluated the severity of the risk, the values in an ordinal scale from the lowest (1) to the highest, for example (3). Similarly, tabulated is the risk probability (RP), also in this case with the values on an ordinal scale (1) = <20%, 2 if 20%< RP >50% and 3 if RP>50%. The quantitative evaluation, instead, aims to quantify the economic impact on the costs related to an EPC and of the possibility of risk. It is suggested to calculate the economic damage and the extra cost that the project would have in the case in which the risk occurred (Piselli, 2011). The latter value is the absolute impact of risk (RAI). The weighted impact (PRI) is the product between the absolute impact of risk (RAI) and the probability of it happening (RP), i.e., PRI = RAI*RP. The next step for the risk assessment is the determination, if necessary, of preventive actions that can avoid the whole or in part that the risk occurred. Such actions are the so-called mitigation actions that have a price. Below we summarize the relationship between benefits and costs. Given that the MAC is mitigation actions cost, NB stands for net benefit of the mitigation actions, RAI is he risk absolute impact, rPI defines the residual weighted impact and rRP encompasses the residual weighted risk after the MA, then rPI = RAI*rRP. From the above it is possible to obtain the net benefit: NB = [(MAC + rPI) − PI]. The mitigation action is undertaken if NB >0, otherwise it will be difficult to take any mitigation action. This in light of the fact that risks should be checked according to the schedule. In this step, it is suggested to make assumptions, based on which there will have a different result, which will affect costs.

Graph 1: Payback and payback energy

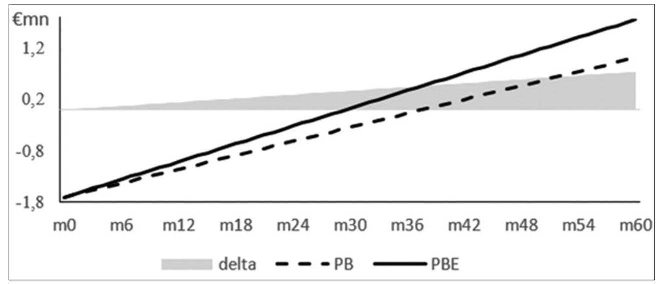
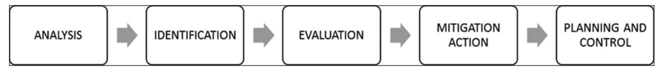


Figure 3: Risk analysis



Source: (Piselli, 2011)

6. CONCLUSION

Wiser energy use while fighting climate change is both a spur for new jobs and growth and an investment in sustainable future. Interest in the EE market is evolving significantly, both from the regulatory point of view and from the practical. This reasonably happens in response to a changing world in which emerges the concept of strong sustainability and efficiency. It is desirable that issues such as these become part of the way of working of private and public companies. Therefore, governments and relevant institutions should pay more attention to the issue and assess the potential of a market that increases the competitiveness of enterprises and more generally of economic systems also at a local level (Di Foggia and Lazzarotti, 2013).

EE satisfies the main foreseen objectives of energy policies today: Reduction of GHG emissions, security of supply, technological development opportunity for industry. Nevertheless, to ensure that EE projects are properly implemented and to meet their goals, they must be competitive in terms of return on investment. It is therefore necessary to consolidate the regulatory framework and strengthen the incentive systems in their practical use, raising awareness among all stakeholders, especially the beneficiaries.

This case demonstrates how the use of incentives such as the EEC could be a valuable support leading enterprises in the direction of investing in EE. In fact, the results of the business case suggest that the payback time is reduced by about 20%. From the point of view of financial instruments, it is important to streamline bureaucratic procedures for obtaining funding and motivate lenders to acquire the skills needed to evaluate the EE projects. This will encourage banks to develop programs tailored to the financing of projects for EE upgrading. Moreover, financial instruments other than bank loans shall be trusted. In this regard, a possible solution is to reinforce the role of ESCOs as lenders.

From an industrial policy geared to EE, we can have positive impacts in terms of technology leadership and business strategies for companies. In fact, these policies stimulate innovation and development of new products and services, produce positive effects on the environment, contribute to the reduction of operating costs in the different sectors and allow the creation of new specialized skills in the countries of origin. Industrial policies accommodating in this market have thus economic and social implications consistent with the energy-efficiency roadmap.

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