ENERGY SERVICE COMPANIES AND THE ENERGY PERFORMANCE CONTRACTING IN EUROPE

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1. Executive summary

Nowadays, there are different energy contracting models being offered by the Energy Service Companies (ESCOs). This paper tries to give some clarity to them and especially to the Energy Performance Contracting (EPC) model since it is considered a good solution to face the barriers of the development of the ESCOs market, like the financing, through for instance the sharing of savings. Moreover, it is going to analyze the path of this market and the policy and public supports in two different countries, Spain and Sweden, in order to see if each can learn something of the other. Besides, the barriers to the development of the ESCOs market will be studied and the possible solutions to a further development will be presented.

Hopefully, this paper can provide the reader an understanding on how the work in different countries and how this kind of projects are performed.

2. Introduction and purpose

Energy Service Companies (ESCOs) concept starts in Europe more than a hundred years ago, but it was after the implementation of this kind of firms in United States in the 1970s, due to the beginning of the oil crisis, when this concept came back to Europe with more strength, since until this time it has been implemented successfully only in a few countries like Germany [3].

In the last decade, the issue of the climate change especially in relation with the anthropogenic emissions of CO2, has had influence on decision-makers towards a more sustainable use of the energy sector.

In order to achieve a more efficient use of the energy, the ESCOs has an important role since they provide solutions to improve the energy efficient and promote the use of renewable energies.

It has been proved that the energy services carried out by the ESCOs are responsible of the reduction of the operation costs as well as environmental impact of buildings or facilities of the firms, in particular in relation to use energy and CO2 emissions, without the owners have to bear big risks [17]. Buildings are related with 40% of the global energy use and CO2 emissions, so the work of the ESCOs in public and private buildings is as important as in the industrial sector. In this paper, some projects are

going to be analyzed in order to understand how ESCOs work and see the real improvements that they achieved.

The energy efficiency in Europe was far from reached its maximum potential, since there are a lot of barriers such as low levels of awareness or confusion regarding its definitions.

The aim of this paper is to get an overview of the ESCOs in Europe through time, give some clarity to their definition and to the concepts related with the energy sector, understand how one project is carried out from the financing to the measurement and verification of the results taking into account the different models to develop a project, identify the barriers and challenges as well as the benefits and opportunities. Just as important to this literature review is the to see some real cases of the work of a ESCO. Therefore some real projects are going to be studied.

This paper is focused especially on Spanish and Swedish firms, trying to find out possible differences between them, and in the case that they exist, analyze how one country could learn from the other one.

3.Definitions

3.1. ESCOs

ESCOs are understood as business or companies that promote the improvement of the energy efficiency (European Commission, 2006. Energy service directive 2006/32/EC). Nevertheless huge differences exist in ESCOs' business between countries and different organizations, moreover bigger variations are seen in how their efficiency projects are developed and implemented. These variations are due to distinct local and national regulations, the type and size of the markets and variations in its definition and in related terms such as Energy performance contracting (EPC) which is an innovative form of contracting that is going to be explained later.

The different processes in which owners work with ESCOs to develop those projects are going to be analyzed later on in the chapter 8, Model project development and procurement process.

The central theme of this paragraph is the variations regarding the ESCOs' definitions and other terms related to the energy sector. There are no commonly accepted

definitions. Sometimes the variations between definitions are small, for instance in the case of Energy Supply Contracting (ESC) or Energy Services Agreements (ESAs), but on the other hand wide variations exist between jurisdictions and organizations regarding how ESCOs are understood, what can be expected from them and how EPC and projects are carried out [17]. An overview of the definitions used in the European Union is collected in Annex I, with the purpose to analyze the size of the variations and look for common elements between them.

The lack of a standard definition has been proved to be cause of confusion regarding what can be expected from the ESCOs. In addition it can create variations in the quality delivered of their services and it also makes it more difficult the comparison between different projects in relation to the energy efficiency improvements and reductions of greenhouse gas emissions achieved. By analyzing the several definitions and taking into account sources of income of this kind of companies, some key factors required to be an ESCOs have been found [17].

Nowadays ESCOs' industry is constituted by many companies with distinct structures offering a huge variety of services and products. It can be differentiated between two kinds of companies according to if they sell products and performance improvement services, or if they just sell services. The first sort of company is formed by many subsidiaries of large firms such as oil or gas companies, engineering firms, non-regulated energy suppliers or building equipment firms. In this group are also included regulated enterprises of public service of electricity and gas. In the other group can be found independent companies selling only services [11].

One of the characteristics that differentiates ESCOs from other energy supply companies is that both products and services have as aim to satisfy demands of energy efficiency rather than provide energy supply. Therefore the majority of their benefits come from the provided energy efficiency, followed by renewable energies supplied, and the distributed generation and/or cogeneration of heat and power. Some energy services or energy efficient improvements provided by ESCOs are: energy efficiency, water efficiency, operations and maintenance cost efficiency, renewable energy and/or distributed generation improvement measures [17].

Moreover from the definitions another crucial characteristic can be appreciated. This time regarding its business model, since generally it is based on the assumption of the risk derived energetic savings expected from the equipment installed or the services provided and continue with the measurement and verification of the outcomes of the project as a long-term guarantee to the customer. Hence, the benefits achieved by the ESCOs depend directly on the savings reached.

Usually ESCOs tasks in a project start with the energy analysis and audit, followed by the design in detail of the project and its implementation, the installation of the equipment required and its maintenance, and ends with the monitoring and measurement of the savings [17].

3.2. Energy Performance Contracting, EPC

Energy performance contracting (EPC) is a kind of arrangement between customers and ESCOs through which they design, implement and finance or arrange the financing of the project. But as it has been said, there is not a common definition accepted for this. Nevertheless through Annex I in the section 14.1.2, it can be seen that the ten definitions, which go from the 'i' definition to the 'x', agree in common characteristics for describing an EPC such as:

- EPC improves energy efficiency

- EPC reduces operating costs

- Investment needed for the EPC is recovered by cost savings.

- ESCOs take the performance risks which is related to the guarantee savings and shared savings.

In general, carry out a EPC implies that the ESCOs have to offer a "turnkey service" which means that they develop the project from the start and continue with measures and verification even when the project has finished. Moreover, the current concept of ESCOs about the guarantee saving is due to the EPC, since energy performance contracting was an innovative form of contracting that allowed to overcome one of the most important barriers for the implementation of energy efficient improvements. Most of the building or firm owners did not want to take the risk of not recover a minimum of the investment done to perform energy efficient improvement projects. So the main characteristic of the EPC and therefore of the ESCOs, is that ESCOs take the risk, and not the owner, assuring a minimum of cost savings and also basing its remuneration on demonstrated performance which makes reference to the levels of energy or/and operating cost savings. If the ESCOs do not fall short in the saving achieved in relation to the energy savings expected and which has been defined previously in the contract, they must pay to the owner for any shortfall [11].

Another advantage of this kind of arrangement is that owners do not need to have any knowledge about neither engineering, energies, technologies nor financing, so the market for the ESCOs through the EPC is bigger which implies a growth of the ESCOs.

The EPC projects can be financed by varied sources, can be carried out under different performance contracting models and can be performed according to different procurement processes. These different options will be analyzed in sections 7 and 8, as well as one of the key characteristic of this projects, the Measurement and Verification, which is going to be explained in section 9.

3.3. Energy Supply Contracting, ESC

Energy Supply Contracting (ESC) is used to provide useful energies in a efficient way, such as cooling, heating, electricity, stream, etc. It is important not to confuse ESC and EPC, since EPC is focused on achieving energy efficiency improvements rather than on supply energy as ESC does. Moreover in the ESC, investments are not recovered with the cost savings over time, as happened with the EPC. Another key difference between them is that through the ESC the companies do not take performance risks, in contrast to one of the main characteristic of the EPC [17].

Thus, despite in some European countries the market demand side attended by them has been considered the same, the ESC are related with the energy supply rather than carry out energy efficient improvements.

3.4. Power Purchase Agreements or Energy Services Agreements, PPAs or ESAs

The PPA includes all the commercial terms needed in the energy buying between the building owner and the ESCO or third party which owns the assets related with the production of electricity, cooling, heat, etc. The price per unit delivered is prefixed in the agreement and also the level of quality expected, as well as the penalties for underived service and the payment terms [11].

The assets are usually decentralized sources, generally of renewable energies, facilities for cogeneration and trigeneration or district heating. In the case of distributed generation, i.e. the generator responsible of producing the energy is inside the boundaries of the building, when the contract finishes the building owners has as a rule

the chance to buy the asset. This mechanism helps the financing of expensive assets like photovoltaic cells or microturbines [17].

As can be seen, this approach is different from the supply provided by large energy companies, whether they are public or private, which offers energy from large scale production from centralized sources.

4. Background and current situation

4.1. European overview

The concept of the ESCOs as companies offering energy services began in France during the 1800s and then it moved to other European countries and to United States where it emerged after the oil crisis in the 1970s due to the increasing energy prices and where actually boomed.

In the 1980s the concept of the ESCOs came back strongly to Europe, where ESCOs only had been developed successfully in a few countries. The increasing energy prices, the rise of the awareness of the climate change and some European measures helped to promote the develop of the ESCOs markets in the UE. These measures include European projects such as the Eurocontract which tries to create comfortable markets by constructing standardized contract models and which is going to be analyzed later. The European support also includes the European Efficiency Directive (2012/27/EU) and the Energy Efficiency Plan, which encourage the enforcement of efficiency energy measures and of which will be discussed later in more detail.

Besides, the different governments have taken both direct and indirect measures to back the growing of the market, like the develop of rules and guidelines such as mandatory audits or efficiency certificates, and have provided subsidies. In some cases they have also created public ESCOs or have carried out promotion campaigns.

The market of the ESCOs has not been developed equally in all the countries, as it can be seen comparing the Swedish and the Spanish markets, which are going to be studied in depth in the following paragraphs.

4.1.1 Policy

The European Union has set up 2020 targets in order to face the problem of the climate change. These objectives imply the reduction of the emissions of CO2 by 20% from the 1990 levels, a growth of 20% in the use of energies renewable as well as an increase by 20% of the energy efficiency. The energy efficiency target makes reference to savings of primary energy consumption compared to projections, but in contrast to the others, this targets is not legally binding [13].

Energy efficiency is at the heart of EU's Europe 2020 Strategy for smart, sustainable and inclusive growth and of the transition to a resource efficient economy. Energy efficiency is one of the most cost effective ways to enhance security of energy supply, and to reduce emissions of greenhouse gases and other pollutants. (Energy Efficiency Plan 2011).

In early 2011, despite it had been taken steps towards the accomplishment of the targets, the Commission considered that the EU was not going to be able to achieve them and needed act so as to obtain greater savings. Thus in 8 March 2011 the Energy Efficiency Plan is implemented [6].

Energy Efficiency Plan [6]

The Energy Efficiency Plan is part of the measures to arrive at EU's target of the 20% reduction in energy primary consumption and therefore of the 2020 Energy strategy. The plan takes into account potential savings in building, transport and industry, nevertheless the followings paragraphs are going to focus only on the buildings and the industry since these sectors are which have a major important influence in the ESCOs market.

Buildings are responsible of almost the 40% of the final energy consumption in Europe, and they are hence one of the biggest potential savings. The plan tries to promote the renovation of public and private buildings and moreover to improve their energy efficiency, by for instance speeding up refurbishments in public buildings in order to use them to give an exemplary behavior, and also giving financial support. Thus the Commission will present a binding measure under which the public authorities will must renovate at least the 3% of their buildings each year.

In the industry the energy efficiency is pursued through establishing energy efficiency requirements for the industrial equipment, by providing efficiency information to the companies, and in particular to the small and medium enterprises (SMEs) and also by establishing mandatory and regular energy audits in the large companies. The Commission encourages the Member States to develop appropriate incentives to the

SMEs to invest in energy efficiency and also in large companies to introduce energy management investment. Another important issue it the need of a scheme to improve the electricity and industrial production, through for instance the recovery of the heat losses. The Commission encourages the Member States to establish a system of national energy saving obligations for this sector, some of them have already established a mandatory percentage of savings of the final energy consumption with good results.

These initiatives have a great influence in the ESCOs market, since the best way to carry out them is through this companies, but in order to promote even more this market the plan proposes to the members that they should provide a market overview and a list of accredited ESCOs and model contracts. The plan also makes reference to the EPC model, and it encourages the use of this contract model especially in the refurbishment of buildings.

Besides the national plans to meet these targets and taking into account that the investment costs still represent a important financial barrier, the EU has promoted and is currently promoting the ESCOs market through:

- Cohesion Policy: it provided approximately €4.4 billion of funds to investments associated with energy efficiency, cogeneration and energy management for the period 2007-2013.

- The Intelligent Energy Europe Programme (2007-2013): it provided €730 million to back projects related to improvement of energy efficiency market.

- Intermediated finance: it makes reference to the use of banks and International Financial Institutions (IFI) as a source of finance.

- The European Economic Recovery Programme: it provides €1 billion to research methods and technologies to reduce the energy consumption of new and renovated buildings.

- The Frame work Programme for research, technological development and demonstration (2007-2013): it supported research in energy efficiency, and it led to hundreds of project financed with an EU contribution.

The Member States play a crucial role in establishing a proper framework for energy efficiency development and therefore the improvement of the ESCOs market. Thus the main task of the Commission is to provide support and tools to the Member States to establish their national energy efficiency targets and programs, as well as to monitor their implementation and assess the results. In the case that results may show that the

targets for 2020 are unlikely to be reached, then the Commission will propose legally binding national targets.

Nowadays, this national framework is defined by the National Energy Efficiency Action Plans (NEEAPs) introduced under the Energy Efficiency Directive.

Energy Efficiency Directive [10]

The directive establishes measures to promote the energy efficiency at all stages of the energy chain, the most of them should be applied by the Member Stages by 5 June 2014. The aim of this Directive is to ensure the accomplishment of the European Union's 2020 targets and to prepare the path to future energy efficiency improvements.

Under this Directive, all of the members will have to develop a plan, which must include measures and the methodology that each of them will use in detail, as well as the national energy efficiency targets for 2020. In the paragraph of Sweden and Spain it will be analyzed their targets and plans.

Starting the 30 April 2014 and every 3 years, the Member States must provide National Energy Efficiency Action Plans (NEEAPs) to the Commission which meanwhile provides a template and a guidance related with what the Members should include in the NEEAPs.

Some of the new measures included in this directive and which affect to the ESCOs market are:

- Mandatory energy audits for the large enterprises, at least one every four year, and the first one must be carried out as late the 5 December 2015. Incentives for the SMEs to encourage them to do audits too.

- The public sector must be an example to follow, thus the 3% of all buildings property of the government are going to be renewed starting the first of January 2014 taking into account the energy efficiency.

The NEEAPs of Sweden and Spain as it has been said, are going to be analyzed in the following sections.

4.2. Sweden

4.2.1. Swedish market

The ESCO concept had two upsurges in the Swedish market, the first one in the 1980s as a consequence of the oil crisis and the referendum to phase out the nuclear power in Sweden, but this first attempt failed because the expected savings were not reached. In the 1990 the concept of ESCO emerges again, but it neither succeeded due to the lack of experience, the legal ambiguities and especially to the distrust in the ESCOs and the EPC model because of the failure of the first attempt [13].

Despite this disastrous beginnings, in 2000 the ESCO concept and the EPC model emerged again in Sweden and they have achieved a strong development during the recent years. The main drivers of the success of this third attempt were the political incentives carried out by both the EU and the Swedish government, the growing climate concerns and the increasing electricity prices which are expected to continue growing since the electrical connectivity between the European countries is increasing too, thus raising Swedish prices on par with the other countries [13].

In early 2000, the Swedish market was composed only by two consultancy firms and one heating, ventilation and air conditioning (HVAC) company which provided energy services for small projects. The energy companies did not start to offer ESCO services until five years ago, and since then the market has gone from be composed only by 5 companies to more than 30 companies nowadays, showing an important growth trend [13]. The current ESCO market is compound by local market actors, control companies, building service companies and consultancy companies [18].

The main customer is the public sector which demand projects for refurbishment and modernization of public buildings involving more energy services (e.g. lighting and HVAC), complex refurbishments and fuel switch in oil-heated buildings [12].

The municipalities in Sweden usually have a good economy, and therefore they can finance the project and get better loans than any ESCO. So, most of the time the financing is carried out by the customer which can get more beneficial financing than any ESCO can provide [13]. Furthermore the TPF was not well established in banks and therefore it was not common. Nevertheless nowadays there is already a bank, Nordic Commercial Bank, providing this kind of financing [18].

Guaranteed savings is the most common contracting model since it implies less risks to the companies and it also is advisable to create long-term mature ECP markets [13]. There is vast use of the district heating in Sweden, being present in around 50% of all buildings, 82% of the residential apartments and 68 % for office space, commercial premises and public buildings (Energimyndighetenen 2010), it has a strong influence in the kind of the services provided by the ESCOs. Thus, ESCOs do not generally take over the demand side market, since it does it the district heating companies. Moreover,

the typical characteristic of the Swedish market is that ESCOs do not provide service and maintenance organization, since their main customer as it has been said is the public sector and these ones, most of the times have their own service and maintenance organization or have previous contracts with other companies. In addition, few ESCOs have the capacity to provide these services. If the ESCOs become more common in the private sector, then it will be more likely that ESCOs start to integrate the service and maintenance organization as a part of the EPC [13].

The use of the Chauffage model is growing between the municipal energy companies, but as these companies only can work in their own municipality its growth is limited [13].

The Swedish market is valued in 60€ to 80€ million a year and despite it is not mature market, it has a really great growth trend [12].

4.2.2. Policy and public support

The resurgence was consequence of a strategy composed by suitable activities, among which stand, market studies, pilot projects and guidelines for procurement and model contracts, large scale and effective information dissemination and personalized information to EPC buyers [18].

In order to promote more the EPC projects in Sweden, the Swedish Energy Agency (STEM) is pursuing a "portfolio of flexible mechanisms" which will include a ESCO network, a customer oriented network, guidelines for procurement process and model contract, EU-IEE projects and projects evaluation [12].

Pursuing the Article 3 of the Energy Efficiency Directive, each Member state has to establish indicative national energy efficiency target for 2020. The target defined by Sweden states that the energy use shall be 20% more efficient by 2020 compared with 2008 and it will achieve a 20% reduction in energy intensity between 2008 and 2020. Thus the absolute level of energy consumption has to decrease from 43.4 to 30.3 Mtoe by 2020 [9]. Moreover Sweden has been proposed to decrease its CO2 emissions by 40% to 2020 from the 1990 levels, furthermore the National program for energy efficiency and energy conserving building construction, forces that the consumption of energy per heated floor space must decrease by 20% to 2020 and by 40% to 2050 from the 1995 levels [13].

Besides the EU support to achieve the 2020 targets, as it has been said before, each Member State has to develop its own National Energy Efficiency Action Plans (NEEAPs). The Article 7 of the Energy Efficiency Directive states that each Member

States in order to achieve the energy savings expected has to either develop an energy efficiency obligation scheme or use other instruments. Sweden has decided to accomplish the savings through different instruments instead of develop an energy efficiency obligation scheme. Between all of instruments that are explained in the *Swedish NEEAP* [8], here they are going to be explained those which could influence in the ESCOs market:

- Support for energy efficiency in municipalities and county councils: the Swedish Energy Agency provides support to approximately 96% of the energy efficiency of the municipalities and county councils, and on the other hand, these ones must establish a set of targets to 2014 to 2020 and to develop an action plan describing how these targets are going to be achieved.

- Municipal and climate advice: The Swedish Energy Agency provides support both financially as informative, for example by informing the SMEs of the need of carry out energy audits and let them know that the government provides financial support.

-Energy audits checks: Since 2010 those companies who have an energy consumption in excess of 500 MWh and those related with the primary production of agricultural products which have at least 100 livestock units, are able to request to financial support to carry out audits up to 50% of the total cost, obtaining a grant of maximum 30.000 SEK.

The political framework as it can be seen, is being increasingly more aware of the need to promote energy efficiency and energy services and therefore they are climbing in the political agendas thus helping the development of the ESCOs market.

4.3. Spain

4.3.1. Spanish market

The ESCOs on the Spanish market are well established. They are very active, and have been one of the most developed in Europe due to a large support from the Government and initiatives and measures they have taken. Nevertheless the economic crisis which affects the country the last years, has stopped most of these measures, and it is actually one of the biggest barrier for the further development of the Spanish market.

There is not an official register of the ESCOs operating in Spain, but according to the European Institute for Environment and Sustainability (2010), there are 15 companies

working currently as ESCOs in the country. On the other hand the Institute of Energy Diversification and Savings (IDAE), which is a government agency reporting to the Ministry of Industry, Tourism and Commerce (MITyC) which manages overall energy policy, pointed that there are more than 653 companies offering energy services. Therefore, once again, it is demonstrated the need of a global standardized definition of the ESCOs [1].

Large companies are mainly dominating the market, since they have the financial capacity to assume big investments and the long-term recovery of them. There is also, a mix of large utilities, companies and multi services companies and small and medium sized companies, offering energy services, most of them as diversification of their activities. All these ESCOs generally carried out project of energy efficiency in public building, in private non-residential building and in industries involving cogeneration, audits, HVAC control systems and lighting [12].

Furthermore, in 2009, with the purpose of bringing together all the ESCOs, two associations were created, the Business Association of Facility Management Services and Energetic (AMI) which is composed by 15 large companies, and the Association of Energy Service Companies (ANESE) which gathers more than 200 small associates [12].

The EPC were not very common, so in order to promote them the IDEA developed an EPC template. Currently, the most common performance contracting models are the Chauffage and the Shared savings, which are going to be studied in the Section 7 [12].

The most common source of financing were the commercial banks, but due to the economic crisis of the last few years, the conditions of the credits have become harder. Therefore, some companies have began to use their own capital to finance the projects, but this financing way is not sustainable long term since the recovery of the investment needs too much time. Other ESCOs have made agreements with private funds to get the credits.

During the last decade, due largely to the construction crisis and the increasing energy prices it has been made a great promotion of the ESCOs in order to buoy construction companies which have diversified towards renovation projects and ESCO services. Moreover, some new companies have emerged offering fully-integrated energy management especially to public administrations and private companies [1].

This market was valued in 2007 at over 100 million Euros, but in 2010, private companies estimated the potential of this market at € 1.4-4 billion [12].

4.3.2. Policy and public support

Starting in 2004, in order to promote the demand of the energy services and therefore boost the growing of the market of the ESCOs, the Spanish government implemented some programs, between which they emphasize the Estrategia de ahorro y eficiencia energética E4 (National Efficiency Energy Strategy) and Plan 2000 ESCO. Both measures are especially focused in six sectors, building, industry, transport, agriculture, public services and appliances, and they are managed by the government of each Comunidad Autonoma (each region of the country) with the help of regional agencies. In particular, the E4 subsidizes the 75% of the cost of the energy audits, and depending on the solutions proposed in the audit report [1], the project could also be subsidized but in this case only up to 22% of the total cost of the financing [12].

Other measure driven by the national government to encourage the market is the National Building Code, since it forces the new and refurbished buildings to supply part of their energy needs through renewable energy sources [12]. This measure together with the Renewable Energy Programs which mainly consists in decreasing the feed-in tariffs, have been some of the main drivers which have influenced in the important growth that the solar and wind energy generation have experienced in the last years.

As in the case of Sweden besides the national policies there is some EU-based policies influencing the energy services market, and as it happened before, the most important in relation to the ESCOs is the Energy Efficiency Directive 2012/27/EU.

Each country is responsible to the application of the proper legislation in order to reach the objectives signaled in the mentioned Directive, as it has been pointed before. In the case of Spain, in addition to the measures which have been already mentioned, the national government developed the Sustainable Economy Law, Royal Decree Law 6/2010 which has an special section dedicated to measures to promote the market of the ESCOs and of course, the Spanish NEEAP.

Pursuing the Article 3 of the Energy Efficiency Directive, each Member state has to establish indicative national energy efficiency target for 2020. The target defined by Spain states that an energy savings of the 20% has to be achieved by 2020, thus the absolute level of energy consumption has to decrease from 121.6 to 82.9 Mtoe by 2020 [9].

Regarding the *Spanish NEEAP* [7], the Article 7 of the Energy Efficiency Directive states that each Member States in order to achieve the energy savings expected has to either develop an energy efficiency obligation scheme or use other instruments, and in contrast to the Swedish plan, Spain decided to adopt an energy efficiency obligation scheme.

This energy efficiency obligation scheme will be implemented based on a standardized scheme of negotiable energy saving certificates that are sufficiently flexible and simple such that there is no significant administrative burden for either the obligated parties in the scheme or for the managing authority, which is expected to be fully operational in 2015–2016. (Spanish NEEAP).

The obligated parties are the electricity, gas and oil product retailers including transport, and their annual savings obligations are expressed in terms of final energy (GWh). At the end of each annual period, the obligated parties must provide the certificates obtained that are necessary to fulfill their obligation, or, alternatively, provide an equivalent amount of compensation to the Energy Efficiency National Fund. The operation of the obligation scheme is summarized in graph below.

The obligated parties should provide to the managing authority (IDAE) the energy efficiency certificates which ensure that they have fulfilled the obligations which have been imposed by law, meanwhile the IDAE assume the task of supervise the accomplishment of these obligations. These energy efficiency certificates are emitted and registered by the IDAE, and the measures of energy efficiency as well as the expected savings derived from their enforcement and which will lead to the right to have these certificates are included in a catalogue.

Energy service companies and/or obligated parties must obtain explicit approval from the final consumer for the action of promoting, supporting and/or funding investments in energy saving and efficiency measures. These investments will be those that give energy service companies (as participating parties and/or obligated parties) the right to receive energy efficiency certificates for the savings arising from such investments.

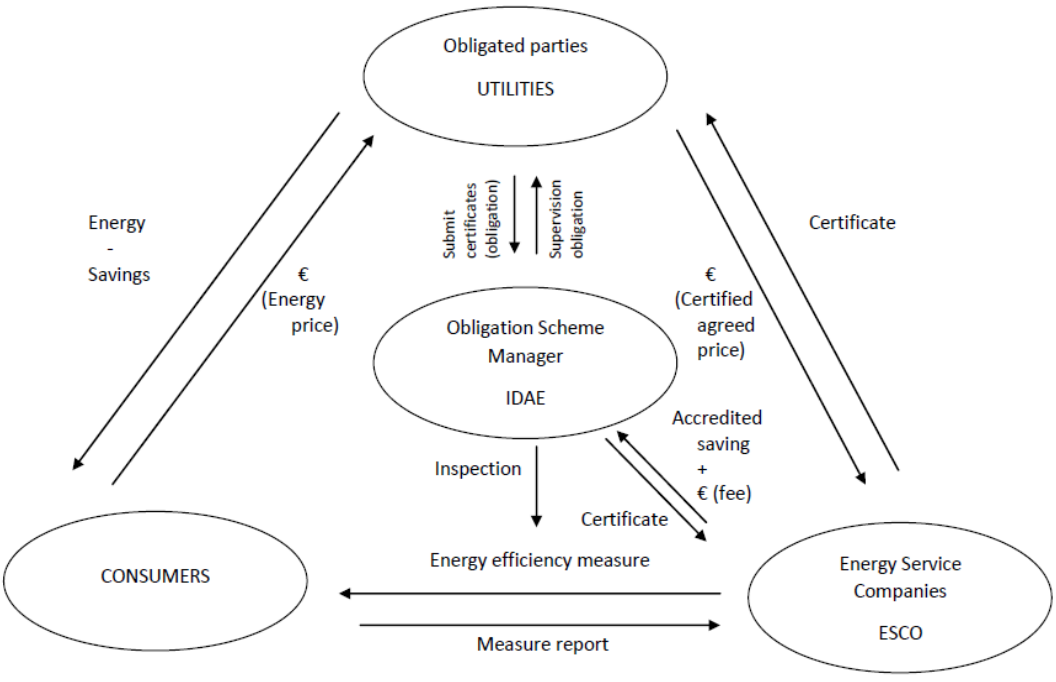

Figure 1. General diagram on the operation of the energy efficiency obligation scheme. (Spanish NEEAP)

In the Spanish NEEAP it is also include an alternative measure to achieve the 2020 target, the Law 15/2012 of 27 December on fiscal measures for energy sustainability which has introduced a tax reform with the aim of internalizing the environment costs derived of the production of electricity and the storage of radioactive waste, in order to encourage people and companies to improve their levels of energy efficiency.

Despite all the efforts made, according to different public and private identities they are insufficient to satisfy the recommendations pointed in the European directive.

The main cause of this negative framework to the development of the ESCOs market is the economic crisis which is responsible of great restrictions in the public budget. Since the legislative basis is going in the right direction, it is expected that the compliance of these measures could be sufficient with the end of this crisis.

5. Barriers to the ESCO industry

The theoretical concept of the ESCOs and the savings that they are able to reach is very attractive, moreover if we accept the fact which has been published widely in many times supporting that exists a cost-effective energy-efficiency potential in all countries then, ESCOs industry would have great market with an very high success. Nevertheless as it can be seen in the case of Sweden and Spain, the ESCOs market is present in each country in different ways, due to that there are barriers which impede the total success and the exploitation of the all potential of this industry.

Therefore, the barriers are different depending on the country, thus in this section it is going to be presented an overview of the main barriers to the development of the ESCOs market in Sweden and Spain [3].

5.1. Barriers in Sweden

Some of the barriers of the Swedish market are also presented in most of the other European countries, like problems with legal issues and inappropriate accounting rules, collaboration and commitment issues or the lack of standardization, however this last trouble is being faced since a few years ago for instance, through the development of standard model contracts. Besides, the low energy prices make that increase the pay-back times, nevertheless the increasing electrical connectivity between the European

countries is enhancing the price of the electricity at par to other countries with higher prices such as Germany [12].

The main barrier to carry out EPC projects in Sweden, is the risk perceived by customers, banks or the TPF in the case they are the financial source, thus causing the increase of the financial costs. One of the main characteristic of the Swedish customers is their lack of confidence due to the unsuccessful past of the ESCO projects in Sweden, since the ESCOs had two failed upsurges in the 80s and the 90s, in which they were not able to achieve neither the expected savings nor benefits. The lack of successful reference cases with a clear client focus also contribute to this mistrust. This lack of confidence together with the limited knowledge and experience on EPC make difficult that customers engage contract models [12].

It has to be taken into account that the Swedish market is a growing market and this implies the entrance of new ESCOs in the market and due to they are new, these companies are more likely to deliver projects not as good as the projects delivered by the already established companies, which could decrease even more the confidence in the EPC models [13].

Another typical Swedish barrier is the lack of qualified people with the right background, as consequence of not be a mature market. Taking a look to the people who are currently training in the energy field, it can be said that this is not only a short-term problem but also a long-term. Besides the low number of energy service companies, due to lack of qualified staff and a mature market, makes the competition between them is poor and small, which increases the costs of services [13].

The public procurement process are complex and costly, thus becomes a barrier for all the energy contracting models but specially to the EPC since it is one of the most complex contracting models. Besides this complexity, the restriction in tendering process cause the increase of the transaction costs. Finally, the last barrier is the "cultural unacceptance" of obtain monetary profits through the energy savings measures [12].

5.2. Barriers in Spain

Currently the main barrier to the development of the ESCOs market in Spain, is the incapacity of the government to fulfill the European and Spanish legislation due to the economic crisis.

Some administrative barriers are the inefficient decision-making structures of the local government, the long and inefficient public procurement processes as in Sweden and the lack of experience and preparation of the administrative accounting systems to carry out in an efficient way the energy cost savings. Moreover the changing of this current structures is very difficult [1].

There are also some technical barriers like the lack of standard and enforced measurement and verification protocols and the lack of TPF institutions. Regarding the financing, the ESCOs industry is facing a lot of barriers, such as the lack of suitable financing schemes to develop the ESCOs market and EPC models [1].

Moreover, before the crisis most of the ESCOs were able to finance their projects through the banks, nevertheless nowadays the conditions credit have become harder, thus a lot of ESCOs have started to finance the projects with their own capital, and this is unsustainable. So, it can be said that nowadays in Spain there is a lack of capital and mechanisms for EPC contracts [18].

As happened in Sweden, the energy prices are not high enough and make longer of the payback times thus causing the decrease the interest of the customers. However, it is expected that the prices will increase with the time as a consequence of the increasing electrical connectivity between European countries as it has been said before. The high transaction costs also decrease the interest of the customers and also of the ESCOs in the case of small projects [1].

In relation to the market, in Spain each autonomous community has is own legislation and hierarchy related to the energy generation and conservation, which become an obstacle to those ESCOs who would like to expand their boundaries to different regions. Finally, the lack of awareness of energy efficiency opportunities and technology, and the high perceived technological and financial risk perceived by the customer is an important barrier like in Sweden. In contrast to the Swedish case, now the main cause is again the economic situation since the customers see the energy costs irrelevant compared to other business costs [1].

6. Opportunities and possible improvements

With the purpose of overcome the barriers which have been described in the last section and achieve a higher growth of the ESCOs market and the EPC model contract, here it is proposed a comprehensive framework of improvements and opportunities.

Firstly they are going to be considered possible European measures, and then as the current situation and the background of the ESCOs in each country is different as it has seen, it is going to analyze what Sweden and Spain should do to promote even more, the energy efficient measures.

6.1. Improvements in the European framework

In Europe, as it has already seen, different measures are being taken as the Energy Efficiency Directive or the Energy Efficiency Plan 2011 in order to make an effort towards the creation of a clear framework, standard definitions, guidelines for EPC projects structure and stricter enforcement of the environmental and energy efficiency legislation, in order to increase the confidence in the energy efficiency market and therefore increasing the ESCOs market.

In order to overcome the barriers and exploit more the potential of this market, the following measures are suggested [3]:

- Energy price levels: increase the energy price could be an incentive to carry out energy efficiency measures. One way to do it could be through the liberalization of the energy market and with the introduction of CO2 taxes. The liberalization of the energy market is related with the increase of the competence between energy companies, which leads to a better and cheaper quality of the services delivered.

- Demonstration projects: as a method to increase the awareness and trust in the EPC projects, since the mistrust is still being one of the major barrier.

-Project bundling: project bundling in a pool makes reference to one project which implicates several buildings, in order to avoid the high transaction cost which is another of the bigger barriers of the EPC projects. This solution is most suitable for municipal and commercial sector.

-Information campaigns and training programs: in order to increase the awareness of the importance of the energy efficient measures and the measures to carry them out. This dissemination of information, the publicity of the ESCOs or advice on EPC can be done by an energy agency, housing associations or industrial associations. Moreover the financial institutions, should train their employers in order that they will be able to provide confidence and information required about the EPC projects.

-Standardization of Measurement and verification protocol: Besides the increase of the confidence through the assurance of the promised energy savings, the standardization

leads to the growth of the competition, the transparency and the increase of the cost effectiveness. The different governments should make policy reforms to establish an measurement and verification protocol mandatory, one option could be the implantation of the International Performance Measurement and Verification Protocol (IPMVP).

-Development of Accreditation system: it is another measure to increase the confidence and the trust of the customers, since in a lot of countries like Spain, there are too companies calling themselves ESCOs but actually they are not. An official certification is one solution to assure to the customers that they are working with real ESCOs.

6.2. Improvements in the Swedish framework

Sweden has a growing market, not mature yet, and therefore customers need to realize of the benefits that are related with carry out EPC projects from a point of view financing, environmental and risk reduction since it has to be remembered that through the EPC contract, the ESCO assumes some kind of risk instead of them. As it is a young market there is lack of staff qualified, it is need an education and training programs through certificate and degree programs offered at community and technical colleges and universities that would be directly related to occupations in the ESCOs market. Besides, in order to increase the customers awareness, the following measures could be carried out [12]:

- Workshops and knowledge sharing events with ESCOs, potential clients (municipal representation, facility managers..) and financial institutions.

- A support network for potential customers, giving them advice and personalized information, successful cases similar to their situation and showing them the importance of guaranteed and shared savings.

Moreover, in order to expand the bounds of the current ESCO market, the companies could:

- Incorporate the supply side in the EPC projects, and offer a larger responsibility in the service, maintenance and operations of the supply side since it could lead to the increase of the interest of the customers and the savings as it also grows the interest of the ESCOs towards the optimization the technical facilities [13].

- Introduce themselves in the private sector , since it has not been explored yet. The events mentioned before could be an option to capture customers of the private sectors.

The EPC projects in Sweden have had a more individualized approach in comparison with the projects in Spain. On the one hand it could lead to more suitable solution, nevertheless in the other hand a more standardized approach implies a faster and easier implementation, and also more standardized procurement procedures will lead to a lower transaction costs. This more standardized approach could lead to a growing implementation of EPC projects, which is a key objective in a growing market [13].

6.3. Improvements in the Spanish framework

In Spain the economic crisis is the main barrier which keeps the ESCO market off the fulfill the European and the Spanish legislation, therefore to overcome this crisis would be the principal driver of the development of the market.

In order to overcome the current lack of suitable financing sources, one option to finance the ESCO projects could be the cash-flow based financing through which the banks accept the stream of revenues directly from the energy savings as guarantee [2].

Besides the economic crisis, they exist other barriers like the administrative problem, since in Spain each community has its legislation and the provincial governments know better their local situation, these ones should be the main drivers to overcome the barriers, moreover they can be more agile as the national government has inefficient decision-making structures. It is necessary to change this administrative structure and their current contracting law, one possible and needed reform is shorten the length of the public procurement processes. The Spanish government should carry out a long term solution at a national level, in order to unify the legislation of the different autonomous communities, since in this way the ESCOs could expand their market bounds. These growth will lead to an increase of the competence which is related with a higher quality of the delivered services and a lower price, which implies a growth of the market [2].

One option to Spanish ESCOs could be to specialize their services having a specific customer profile (schools, hospitals, supermarkets, etc.) so they will be able to provide more suitable solutions and also it is a way to decrease the skepticism of the customers.

7. Financing projects options and performance contracting models

7.1 Sources of financing

There are three possible sources of financing energy efficiency projects [4]:

- ESCO: the ESCO provides the financial resources needed through their own capital, i.e. its internal funds. Equity financing is undesired by the ESCO since it implies tie up capital in one project, therefore it rarely is used.

The using of internal funds as financial resources of the project, makes the balance sheet of the company looks like to that of a bank, and it should be remembered that ESCOs are not a financial identity but a service company, so it is advisable use of the following two ways of financing instead of this one. As it is going to be seen, the ESCO can obtain the financial resources through debt or lease financing.

- Energy-users/customers: the customer uses their own funds to finance the project with the guarantee provided by the ESCO, assuring that a certain amount of energy savings is going to be reached.

-Third-party financing (TPF): the financing does not proceed from internal funds neither of the customer nor the company, in this case it is an external financing carried out by a third party, such as finance institution. It has to be take into account that it only makes reference to debt financing. There are two different types of arrangements according to who is requesting the loan, the energy-user/customer or the ESCO.

The client usually prefers that the ESCO be who takes the loan, and so he does not take any financial risks related to the technical performance of the project and thereby the debt appears in the balance sheet of the ESCO, rather than in the customer one. This is what is known as off-balance-sheet-financing, and it implies that the lease rates are seen as operating expenses in the income statements instead of appear in the balance sheet of the customer; which is very beneficial for that customers who are high leverage companies to preserve the company borrowing capacity and lower their borrowing rates.

7.2. EPC models

The different types of financing are associated with different performance contracting models. The three main EPC contract models are:

- Shared savings :

The ESCO provides the capital needed through either its internal funds or a TPF, and therefore if a loan is needed, as it has been said before, usually, it is off-balance of the sheet financing of the customer [5]. Assuming an external financing, the next graph represents the relations between the customer, the ESCO and the TPF, and if otherwise the ESCO uses its own capital, the relations are the same taking out the terms related with third party financier.

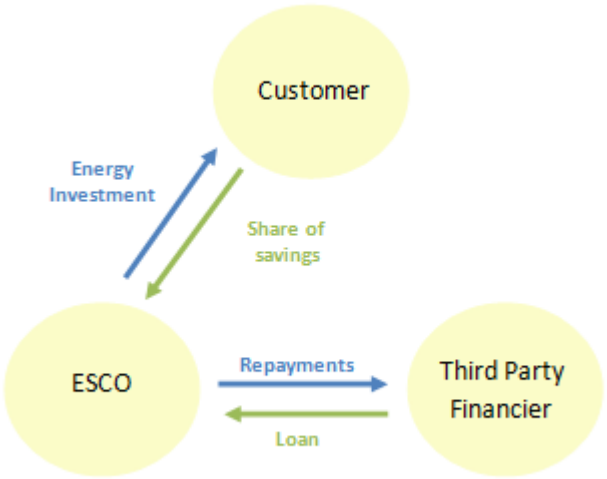

Figure 2. Cash Flow in Shared Savings Contract (based on: SEAI. A guide to energy performance contracts and guarantees)

Once the project has finished, the energy costs have to have been reduced and this reduction implies cost savings. These savings are shared between the customer and the ESCO according to the proportion previously established in the EPC, until the end of the contract which is agreed in the EPC too. As can be predicted the expected savings are bigger than the money needed to pay the loan, therefore the ESCO uses an amount of those savings to repay the loan to the TPF [5].

The ESCO takes the performance risks, related to the cost of energy saved, and the credit risks, as they are who must handle with the financing, what means that they depend on the customer, since if the customer goes out to the business, the ESCO will not be able to repay the loan or recover they investment, therefore the customer generally pays an anticipated savings payments as guarantee. In this way, the TPF takes the risks derived from the possibility that company may not be able to repay the loan, hence if the ESCO is a small enterprise the cost of the borrowing will increase. It exists another risk related to the price of the energy, since the payments to the ESCO linked to

the cost of energy saved depends on the energy price which can change, so the ESCO takes the energy price risk too [15].

From the customer perspective, this way of financing it is very useful to attract every kind of customers and open the market for the ESCO, since they do not take any financial risks and do not require to have the financial resources, but obviously they need to be creditworthy. On the other hand, this model fits better with large ESCOs, since small ESCOs may do not have neither the financial resources needed nor experience in loans required. The shared savings approach implies that ESCO takes out a lot of risks, which can make that small ESCOs become indebted and leveraged rapidly. Moreover, it is easy to use the shared savings model to introduce the ESCO concept in developing markets since it not requires financial risks by the customer [15].

ESCO prefers to share instead of guarantee savings as it assures that the customer will help to reduce the energy consumption [5].

Finally, due to the high financing costs, projects with short payback fits better with this financing model [15].

- Guaranteed savings:

In this case, is the customer who provides the financial resources through either its internal funds or a TPF backed by the energy savings guaranteed by the ESCO, so in this case the debt appears on the balance sheet of the customer [5]. Assuming a external financing, the next graph represents the relations between the customer, the ESCO and the TPF, and if otherwise the customer uses its own funds, the relations are the same taking out the terms related with third party financier.

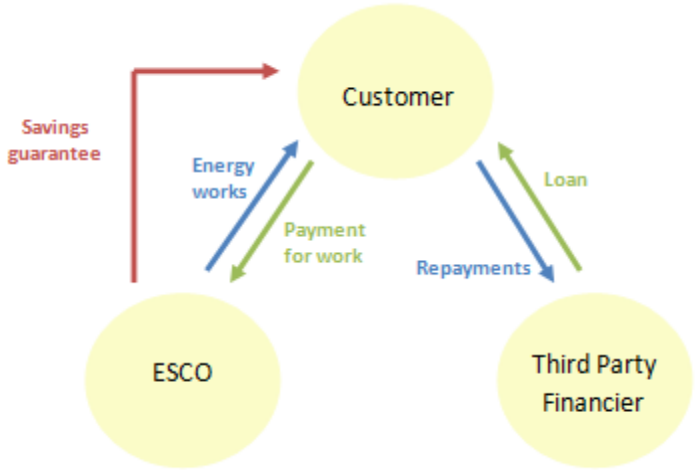

Figure 3. Cash Flow in Guaranteed Savings Contract (based on: SEAI. A guide to energy performance contracts and guarantees)

The customer, as it has been said before, obtains the financing usually through a loan and hires the services of the ESCO which carries out an efficiency energy project. Unlike to in the shared savings model, now the ESCO assures that they are going to achieve certain amount of energy savings, i.e. they assumes the performance risks. The customer will pay the ESCO for their work but he can retain some of the payment until the savings guaranteed have been verified, moreover, if the savings reached are smaller than the savings guaranteed and agreed in the EPC, the ESCO will have to pay to the customer the difference between them [5]. On the other hand, if reached savings are bigger than the guaranteed ones, the customer will paid to the ESCO an percentage of those savings exceeded, which has been previously agreed in the contract [15].

The main advantage of this financing model is that it leads to the lowest financial cost, since the risks taken by the financial institution are similar to those that they are accustomed to deal, as they just assess and handle with credit of customers [15].

The guarantee of savings it is a assurance not only for the customer but also for the bank, since in this way the bank can ensure that energy savings achieved will generate a positive cash flow able to cover the repayment of the debt, reducing the risks of the borrowing, i.e. reducing the risk perceived by the bank and therefore it will be more willing to give the loan. The cost of the loan depends on the risks of the project itself and on the financial and debt history of the customer [4].

In this case that it is the customer who takes the energy price risks and the credit risk, while the ESCO takes the performance risk in terms of the level of energy saved, and as happened before, if a loan has been needed, the financier takes risk associated to the possibility that the borrower may not return the money [15].

Now, due to the ESCO does not have to worry about getting the capital needed for the project, small companies can be taken into account [5]. Nevertheless, it is not an appropriate model to introduce the ESCO concept in developing market, since customers have to assume the financing and therefore with the financial risk.

Finally, now given that financing costs are not as higher as before, projects with a thorough scope can be carried out [15].

- Variable contract term:

This business contract model is similar to the Shared Savings model, but now the risks taken by the ESCO is less.

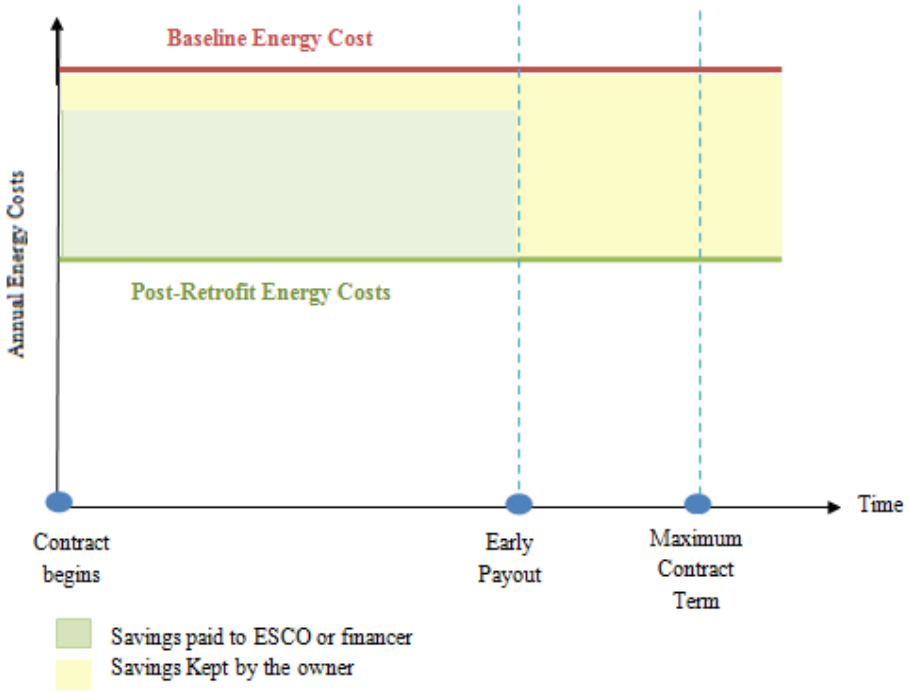

Figure 4. Cash flow & variable contract term (based on: SEAI. A guide to energy performance contracts and guarantees)

Previously, regardless the amount of savings, they were shared over the term of the contract, so that the ESCO took the risks of not to recover their investment if the savings are less than the expected. Nevertheless, now the proportion of the savings received by the ESCO is almost the total amount of them, allowing the ESCO recover their investment and plus an agreed amount more due to their services much earlier and, as it can be seen in the previous graph. The figure 4 shows an example where the ESCOs keep around the 90% of the savings, which are represented by the difference between the baseline energy cost and the post-retrofit energy cost, until they have got the amount of the money agreed with the customer. Once achieved this point in time, called Early payout, all the savings are kept by the owner [15].

When the proportion kept by the ESCO is the total amount of the savings, the contract model is known as 'First Out' , and it has as main benefit that the collaboration between the ESCO and the customers ends even earlier [5].

It has to be taken into account that normally, it exist a maximum contract term and once reached, even if the ESCO has not received the amount the payment expected, the

contract finishes and from there the customer keeps all the savings, as it can be seen in the following figure [15]:

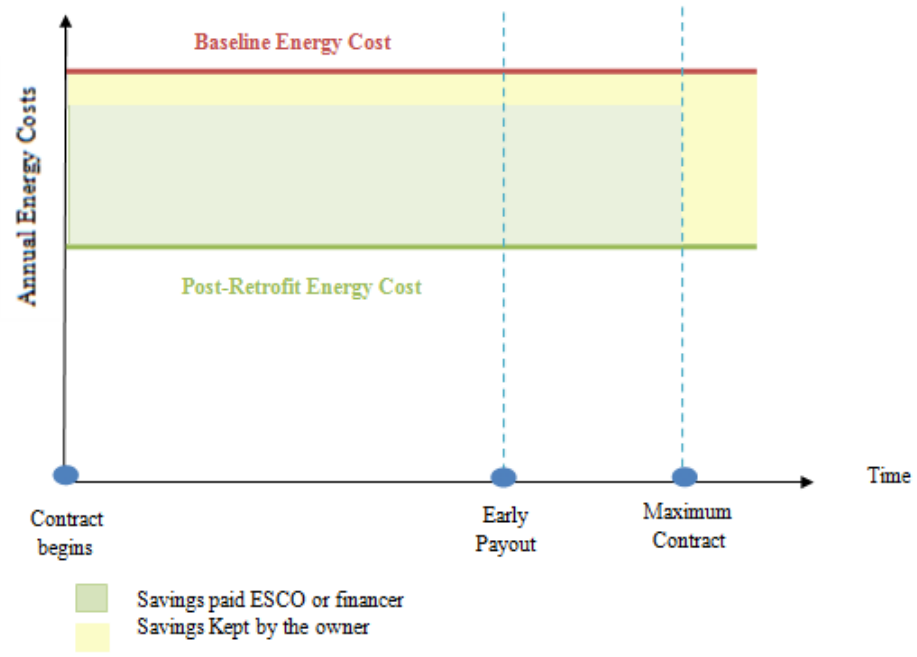

Figure 5. Cash flow & variable contract term (based on: SEAI. A guide to energy performance contracts and guarantees)

7.3. Other contracting models

Although these are the main ways to structure a contract, there are other contracting models which are also used. Here and to finalize, an overview of the '*Chauffage*', the BOOT and the leasing contracts is provided.

-'*Chauffage*':

This contract is a kind of supply contracting, since the ESCO is responsible to provide to the customer a set of energy services such as heating or lighting, therefore, they take care of the operation and maintenance of the facilities involved, so it can be said that the Chauffage is a form of energy management outsourcing [5].

It is a contract of long duration, usually from 20 to 30 years, during which ones, the ESCO pays all the accounts needed, like the maintenance, the operation or the improvement of the facilities, and the customer pays them based on its current bill minus a percentage related with the savings guaranteed by the ESCO, or on price per meter squared basis [5]. In this way, as much as efficiently the ESCO can provide the energy services, the higher will be their incomes.

This contract is used frequently when the customer wants the externalize some facilities or the investment needed to the improvement of one energy service.

To stimulate the cooperation of the customer to reduce the amount of energy, it exists a term of shared savings, according to which, below a certain amount of energy savings, these savings will serve to the ESCO the recover their investment, but above this amount the savings are shared between the ESCO and the customer. The savings usually comes from the operation and maintenance services.

- BOOT, Build-Own-Operate-Transfer.

Under this contract, the ESCO is responsible of design, build, financing and operating of an equipment during a agreed period of time, during which they are the owner of the facility, and after this period, the ESCO must transfer to the customer the ownership of the asset. It is a long contract duration, and it is used generally with large infrastructure such as boilers, energy centers, power systems (combined heat and power plants, CHP), power distributions systems (high voltage HV and low voltage LV) or refrigerators [5].

The customer pays the ESCO along the agreed period; this payment covers the capital needed to the equipment, the operations costs and also an interest.

-Leasing:

The leasing contract is an alternative to borrowing, which is used generally in industrial equipment. The main advantage versus the borrowing, is that the lease payments are usually lower than the loan payments. The costs savings should cover the lease payments and the customer, i.e. the lessee, pays to the lessor with interests with an agreed frequency [5].

There are two types of leasing: capital and operating leasing. Capital leasing is related with the purchase of equipment, when the lessee owns the asset and therefore it appears in their balance sheet, and moreover is who takes the risk. On the other hand, under the operating leasing, the ESCO is the owner of the asset, and the customer hires the equipment by paying a agreed monthly amount. Now, the asset does not appear in the customer balance sheet, and ESCO takes the risks, but on contrary it is more expensive to the customer.

8. Model project development and procurement processes

Since almost two decades ago, the EPC offers a solution to the financing of efficiency energy projects through the self-financing due to the cost savings, but its development and procurement process remained too complex and spent long times, because, among other reasons, the lack of a standardized energy services performance contracting model.

Several organizations, in an attempt to overcome the barriers which limited the market size, developed different project development models and procurement processes in order to make easier the issue of design the project and the bidding and selection of the proper ESCO. This standardized templates allows increase the market to those customer who are not energy experts, and also enables to reduce the time required [17].

Now, the diverse model processes developed by the different organizations are going to be analyzed, and then, it will be carried out a process comparison between the customer and ESCO perspective.

8.1. Building Owners and Managers Association and Clinton Climate Initiative model

The Building Owners and Managers Association (BOMA) together with Clinton Climate Initiative (CCI) developed in 2009 a project development process standard which can be summarized in seven steps contained in the following graph.

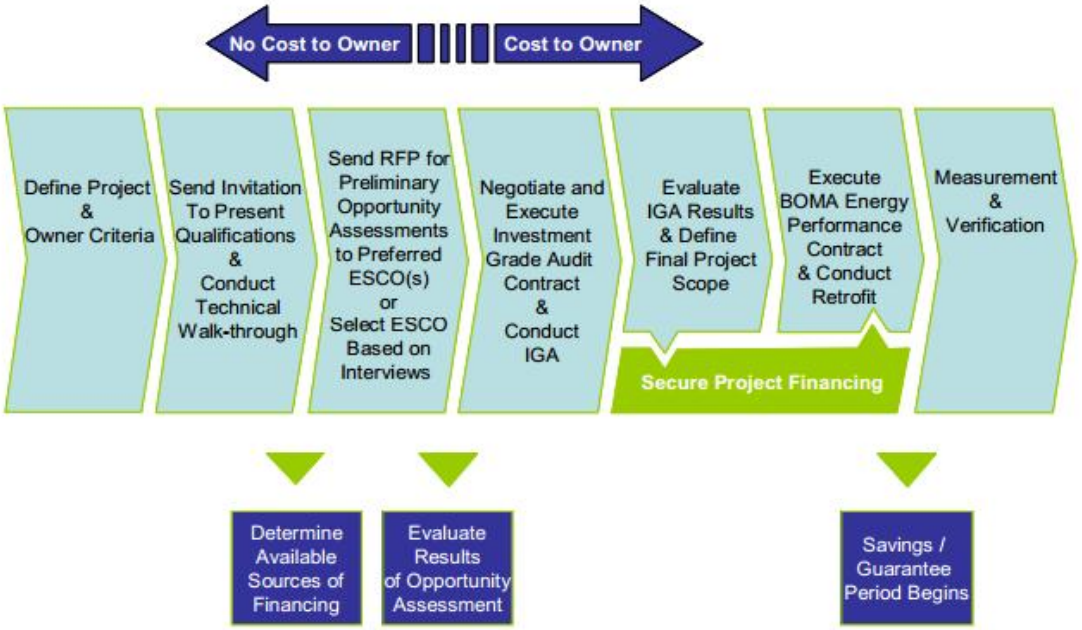

Figure 6. BOMA/CCI Project development process (BOMA and CCI, 2009. Building Energy Retrofit Program)

The first step in the BOMA Energy Performance Contract (BEPC), is performed by the building owner or customer, who must to define the project and the criteria which has to be followed throughout the project. In this first definition, the customer should include the desired outcomes, the economic return on investment (ROI) and the minimum Internal Rate of Return (IRR). And also at this point, it is advisable for the customer, start to look for and assess the potential sources of financing.

Then, different ESCOs are invited to present their qualifications and conduct a technical walk-through. To make this technical walk-through more productive, customer should provide to the ESCO what is called as "Property information summary" which must contain as minimum, the annual consumption, a copy of the energy bills of the last twelve months, as well as the information about the age and size of every system involved, and their current status, i.e. if they have been upgraded or not. This information allows the invited ESCOs analyze the viability of the project and assess if they are enough qualified to carry out the project or not.

The owner evaluate the capabilities of the different ESCOs and some of them are pre selected. After that, there are two options to select a single company between those preselected, ESCOs can be interviewed by the customer or they can be asked to send a more detailed proposal, what is known as Request for proposal (RFP) for preliminary opportunity assessment. It is advisable to carry out the RFP since it enables both, customer and company, have a more detailed assessment of the scope of the project and

cost and savings expected, since the RPF should include all the Energy Conservation Measures (ECM's) and the cost and savings related with each one of this measures.

Until now, the process does not imply any cost for the customer, but from now it is better if the project financing is assured since the next step could entail some costs as it will be seen.

Once the customer has assessed all RPFs, the most suitable company is selected, which has to carry out a Project Development Agreement (PDA). The most critical and costly part of the PGA is the Investment Grade Audit (IGA). The IGA provides additional measures and an more critical analysis, which includes all the methods and assumptions followed, the data utilized, as well as the costs, energy savings, the expected annual maintenance and life, the environmental impact and the recuperation period of the investment. The cost of the IGA is included in the total cost of the project in the case that the customer decides to continue with the project, nevertheless in the event that project proposed meets the requirements established by the customer, and this one determines not to continue with them, he will must to pay a "walk-away fee" which is agreed before starting the IGA. And finally, if the ESCO is not able to meet the requirements, then the customer does not have to pay any fee.

The results of the IGA are evaluated and the customer with ESCO, determine which measures are going to be included in the definitive project, in order to define the final scope.

The next step is the execution of the BEPC itself. The BEPC include the guaranteed savings term, which assures the customer that a agreed minimum of energy savings is going to be achieved and otherwise the ESCO will pay for any shortfall. It is also included a guaranteed maximum price (GMP) that implies that the whole project will cost at most that amount, and in the event that the final cost is smaller than the GMP, the savings will be shared between the customer and the company at an previously agreed percentage. Moreover the BEPC uses the transparent pricing methodology, which means that it includes every cost and savings which enables customers know and negotiate the cost structure before sign the contract.

Once the contract has been signed the work of the ESCO to implement the energy efficiency project starts. The savings/guarantee period begins when the execution of the project has been finished, in which ESCO has to carry out the measurement and verification of the cost savings, during the agreed period in the contract, which is usually from 10 to 20 years [21].

8.2. Eurocontract

The Eurocontract is an European project which began in 2005 and finished in 2007 achieving as a result the development of two different project development models: the Single-Stage model and the Two-Stage model [17].

Many organizations collaborate in its development, but its main partners were the Berlin Energy Agency and the Austrian Energy Agency.

8.2.1. Single-Stage project development

The use of this model is appropriate to simple and small buildings (e.g. a single building), which require shorter time, easier and therefore cheaper projects. The process begins with the project preparation (around 2-4 months), where the building owner/the customer has to prepare all the building data and determine an annual energy cost baseline, as well as carry out a rough analysis determining potential energy and cost savings, and moreover he must define the targets of the project such as the minimum savings guarantee.

Then, ESCOs are invited to present their offers and they have to prepare it basing only in the data and the analysis provided by the owner, and an rough analysis that they can carry out and allows them to validate the building data. After only this rough analysis, they have to do its offer which must contain the savings guarantee, the efficiency energy measures that they are planned to perform, as well as the estimated investment costs. From all the tenders that the customer receives, from 4 to 10 bidders get preselected and are called to present its bids. After these presentation, the number of potential bidders is reduced from 2 to 4. The remaining offers are analyzed in deep and the most economic one is finally selected with whom now the customer have to negotiate the contract. This process, from the request for tenders until one of them finally is selected and signs the contract, takes around 6-9 months.

The next step is the project implementation (around 7-15 years), which starts with the preparatory phase in which it is carried out a fine analysis, allowing the second validation of the building data as well as the accurate calculation of the potential energy savings of the planned measures. Once the fine analysis is done, it can start with the planning, design and implementation of the energy savings measures. When the project finishes the measurement and verification of the guaranteed energy cost savings will begin, and they will remain during the period agreed in the contract.

The main characteristics of this model is the high preparation and work required by the customer, and that the fine analysis is part of the project implementation once the contract is signed and not of the tender [17].

8.2.2. Two-Stage project development

Unlike the single-stage model, this model is appropriate to more complex and bigger buildings, e.g. an hospital, which supposes a longer period, a more difficult project and therefore more expensive.

As happened before, the owner/customer has to prepare all the building data required and a rough analysis determining the cost baseline and the targets of the project, and then, ESCOs are invited but this time, only from 3 to 10 companies are called to prepare an offer to perform the project. These tenders have the same structure than tenders of the single-stage model, but now he also has to plan costs for fine analysis, unlike the other model where the fine analysis was part of the project implementation once the contract had been signed.

After tender assessment, the most economic offer is selected, and from this point the model is similar to the BEPC: the ESCO carries out a fine analysis where they are done a validation of the rough analysis and detailed calculation of potential energy and cost savings of the measures planned. The result of this analysis is the confirmation of the guarantee savings and the planning of the project. The customer evaluates the results, and if they confirm the rough analysis, he can decide either to continue or cancel the project, but in the case that he determines not to proceed he will have to paid a "walk-away-fee" to the company as happen in the BECP which means that the ESCO takes a smaller risk than in the single-stage model. In the event that directly the project does not confirm the rough analysis it will be cancelled without a remuneration.

In the case that the project continues, the project implementation begins which is the same as the single-model stage unlike that now the fine analysis has already been done in the previous phase [17].

.Both models have been summarized in the following figure:

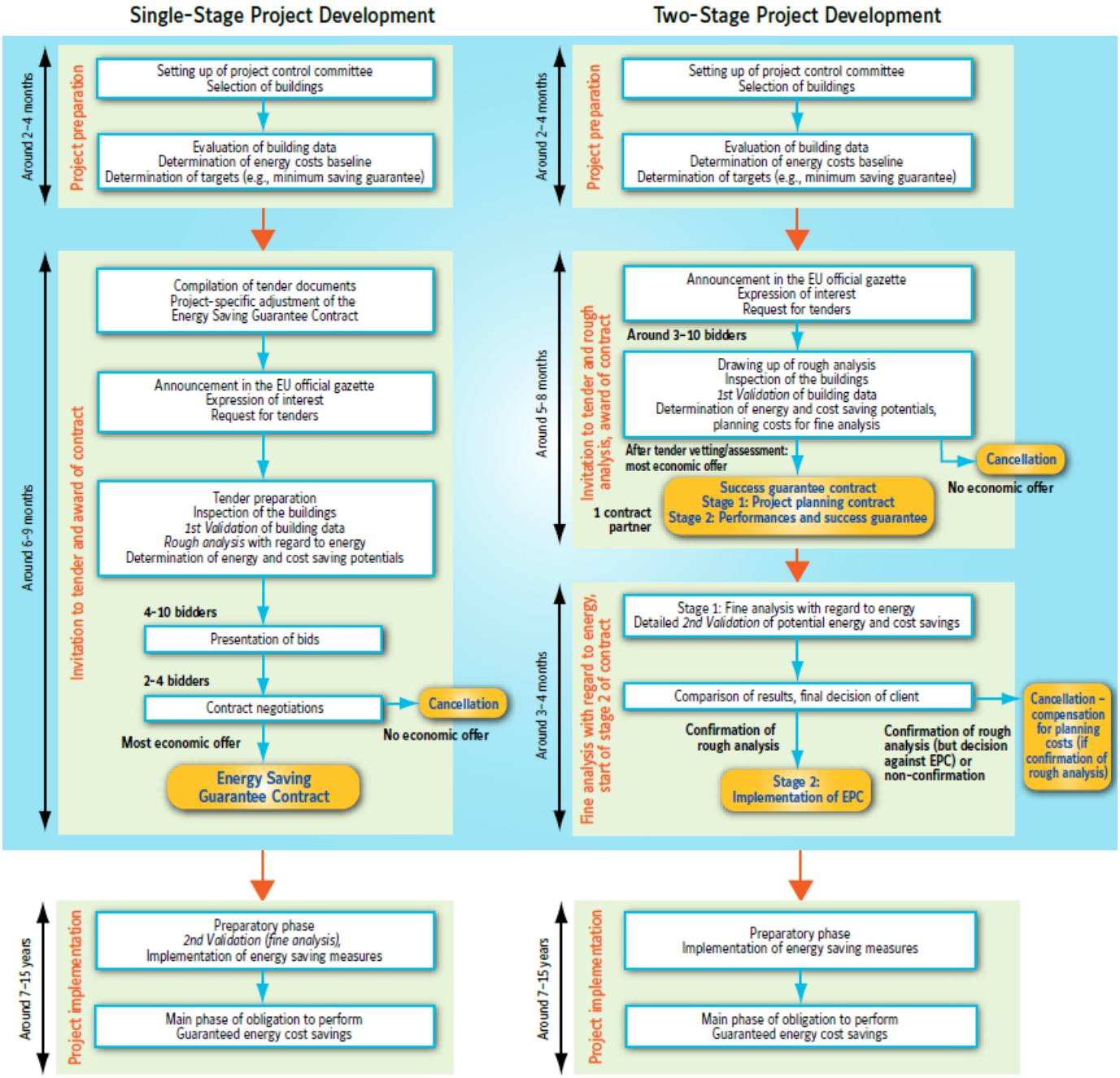

Figure 7. Eurocontract Project Development Models (Institute of building efficiency, 2010. Energy Performance contracting in Europe: creating common "model" definitions, processes and contracts).

8.3. Model contract comparison

Each model have some advantages and at the same time, disadvantages for the ESCO and the customer. Here, both perspectives, regarding to the three models, are going to be analyzed.

8.3.1. ESCO Perspective

On one hand, the BEPC model implies less risk to the ESCOs since the two Eurocontract models force the companies to present an offer basing only in the data provided by the customers and an rough analysis. That makes that the BEPC model will be able to carry out more aggressive measures to reduce energy costs and improve the efficiency energy, and therefore they are more likely to reach more savings and thus more benefits. On the other hand, Eurocontract models saves time to the ESCO, due to the customer is who provides the data needed and the first rough analysis, and moreover they do not have to present an Investment Grade Audit (IGA) to the customer, which implies a faster remuneration and hence a sooner improvement of the cash flows of the ESCO.

Between the two models of the Eurocontract, the single-stage project development is the more easier and faster, but nevertheless it is also the more risky. That risk is reduced in the BEPC and the two-stage models, where the fine analysis or the IGA are developed under an agreement, under which, if the customer decides to not proceed with the project and if they have fulfilled with the requisites of the customer, the remuneration is guaranteed. Moreover, the selection of a single company in these models happens sooner in the process, what means that ESCOs minimizes the cost risks related to the planning and the design of the project since they are carried out once they have been selected, i.e. under contract.

Furthermore, with the single-stage model, ESCOs have to promise some guarantees directly with the offer, which increase the risk even more, but to offset it and secure their incomes, they take into account security premiums in the calculations of bidders.

8.3.2. Customer Perspective

From the customer perspective the BEPC model is attractive due to the transparent pricing methodology which allows him to be aware of and negotiate the cost before signing the contract. Also, under this model the ESCO must provide the guaranteed maximum price (GPM) which fixed a maximum price of the project and any savings under this price will be shared between the customer and them.

On the other hand, the Eurocontract model it is more cheaper since it promotes a more competitive bidding process, nevertheless it implies a higher preparation and work by

the customer, and the measures taken are less deeper and therefore the cost savings are smaller.

9. Measurement and Verification

The energy measurement and verification is one of the key concepts of the EPC model contract and it implies the study, measurement y knowledge about the energy levels before and after the implementation of the energy efficient measures carried out according to the EPC project [16].

The book "Performance Contracting - Expanding Horizons" (Hansen, 2006, page 64) describes Measurement and verification as: "the set of methodologies that are employed to validate and value changes in energy and water consumption patterns over a specified period of time, which result from an identified intervention or set of energy conservation measures"

In other words, it is a tool used to measure the savings which have been achieved after the implementation of the EPC-measures with the purpose of verify that the expected and guaranteed savings remain throughout the period of time agreed between the customer and the ESCO. The energy level is not the only measure, it would also be measured and compared with the baseline the lighting level, the water usage, the emissions of CO2 ... [14]

In general, the Measurement and verification is carried out by the same ESCO which have implemented the project, but sometimes it is the customer himself or a third part who carries it out. Moreover, there are different methods and protocols which can be followed to carry out the measurement and verification. One of the most used standard protocol, is the International Performance Measurement and Verification Protocol (IPMVP) [14].

The savings cannot be directly measured, since it has to be taken into account that some savings can be a consequence of different factors such as the amount of production, the opening hours or the changes in the weather instead of be caused by the EPC-measures [16].

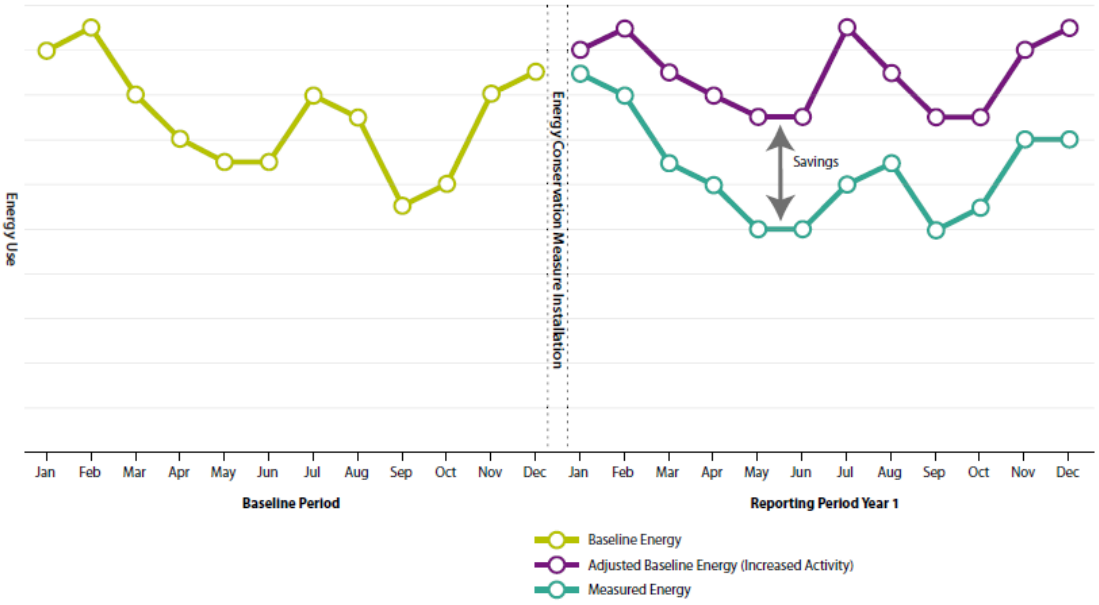

Figure 8. Measuring and Verifying Energy Savings as a result of an Energy Performance Contract (SEAI. A guide to Energy Performance Contracts and Guarantees)

Therefore the savings are calculated by comparing the measured energy use before and after the implementation of the measures with the adjustments required. The calculation can be summarized with the formula below:

$$Changed\ Re\ sourceUse = \sum\{Post\ Installation\ Usages\} \pm \sum Adjustments - \sum Baseline\ Usages$$

Where the *Baseline Usages* makes reference to the baseline prior to the implementation of the measures, the *Adjustments* makes reference to the changes which are not directly related with these measures as it has been said before, and finally the *Post Installation Usage* refers to the energy usage after the EPC-measures [14].

Before starting to gathering the data which will be part of the Baseline energy records, it must be taken into account some considerations. First of all, the Measurement Boundary has to be defined, which refers to the scope of the project, i.e. if savings are going to be calculated taking into account the whole facility or only for a part of it. Another important consideration which has to be determined is how are going to be measured the levels of energy to calculate the savings, since in most cases a instantaneous measure of the electricity (or gas or heat) load before and after the implantation of the project, is enough but other times it is not. When an instant measurement is not enough, it has to be carried out a logging of the energy use during a representative period of

time. If there is not an historical baseline data, then it can be done a simulation, but nevertheless, it requires both time and skills to do accurately [16].

Both the method of measurement, the Measurement Boundary, how the adjustment will be made and the records of the baseline energy among other rules, are included in the Measurement and Verification Plan which have to be defined before of the beginning of the measurement and verification of the savings. Furthermore, in general all these concepts follow some kind of standard protocol like for instance, the already aforementioned IPMVP [16].

10. Examples of good practice

10.1. Berriak Supermarkets (Spain)

Customer

Berriak Supermarkets is an leader enterprise in the food industry in the Basque Country (Spain) which is composed by four shops and whose aim is to offer good quality products and of close proximity, with a adjusted price and giving to their customers a professional treatment and friendly at the same time.

One of the main characteristic of their business plan is their sustainability vision, since they look for reduce the energetic consumption reducing by this way their environmental impact. In order to improve their energetic efficiency, they decided to rely on the services of one Energy Services Company, which finally was GESE Servicios Energetico [19].

Challenge and solution

The main challenge that GESE had to deal was to reduce the energy consumption without neither modify the conditions of comfort of the customer nor interfere in the instructions of the marketing sector.

They decided to monitor in real time the consumption of electricity, industrial cool and the lighting, and they did it through the software offered by DEXMA, the DEXCell Energy Manager. This tool carries out a lot of functions, from the monitoring in real time or the invoice management, to the optimization of the energetic consumption since it can detect the unnecessary consumptions. Moreover it allows to know the accumulated savings related to each measure taken [19].

Saving measures and results

The software showed that the subsystems which were consuming more energy were the industrial cool, the lighting and the baked of fresh products in the bakery, and therefore the measures that they had to carry out needed to be related to these subsystems.

The first measure taken was the *optimization of the management of vertical refrigerated shelves* reaching an annual savings of 2.450€, due to the reduction of 40% of its energy consumption, as it can be seen in the next graph [19].

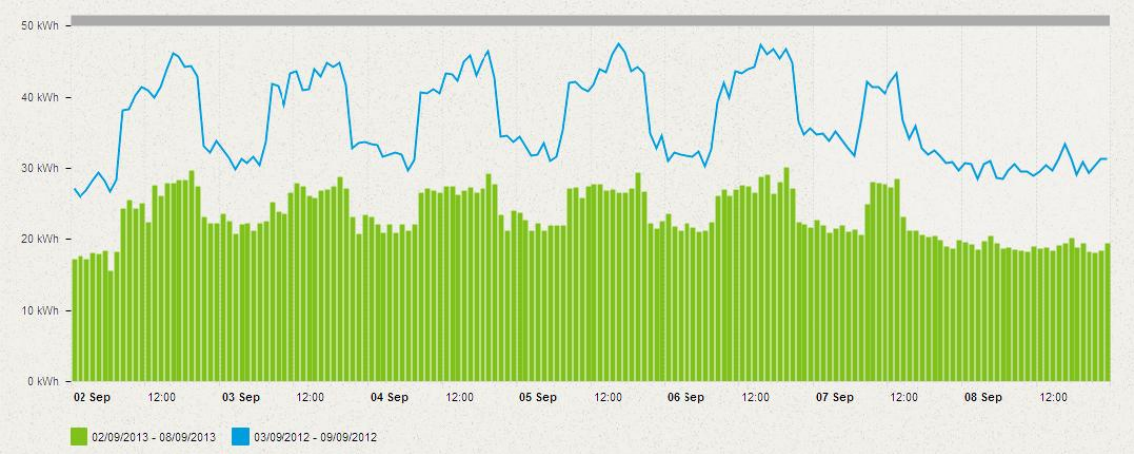

Figure 9. Consumption of energy related with the vertical refrigerated shelves (ANESE. Casos de éxito: Caso de estudio Berriak)

The reduction was achieved by fitting the temperature of the fridge while still ensuring the conditions needed for the food conservation, as well as by the installation of insulation panels which allow close the shelves in order to conserve the temperature and thus reducing the consumption. For the purpose of not affect to the comfort of the customer the panels are used only in the non-activity period.

Other measure taken was the optimization of the start times of the bakery ovens, which allows the annual saving of 3100€ due to a reduction of the consumption of the energy involved in the baked of the 30%, as it can be seen in the next graph [19].

The savings are due to the movement of the most of the baking period to the valley schedule, in which the electricity is almost a 60% cheaper than in the initial time slot.

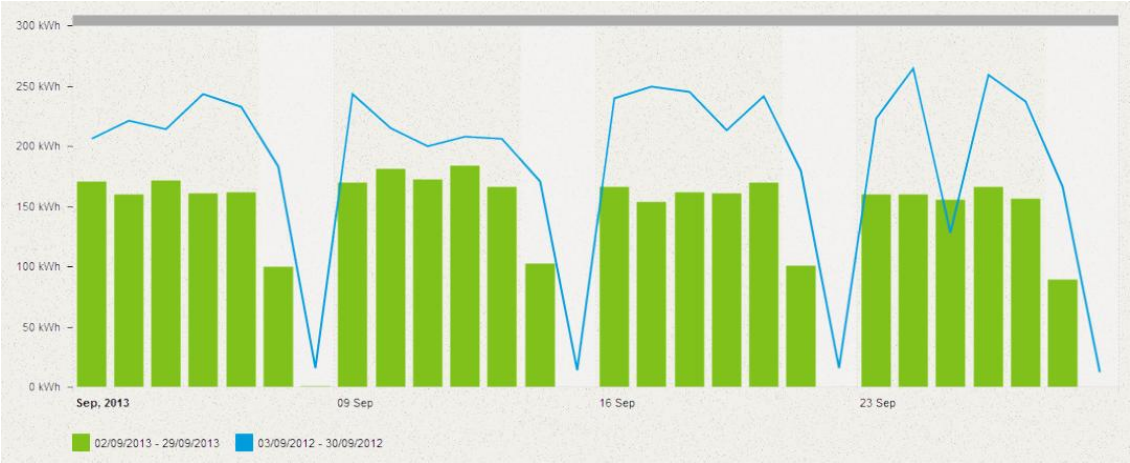

Figure 10. Consumption of energy related with the bakery ovens (ANESE. Casos de éxito: Caso de estudio Berriak)

To deal with the high consumption in lighting, the company decided to replace fluorescent tubes T8 by T5 tubes in the zones with bigger demand since they need less energy and moreover they improve the quality of the lighting thus improving the comfort of the customers. The energy savings in lighting is almost of 18% of the initial demand, reaching annual savings of 2800€ [19]. The reduction can be seen in the next graph:

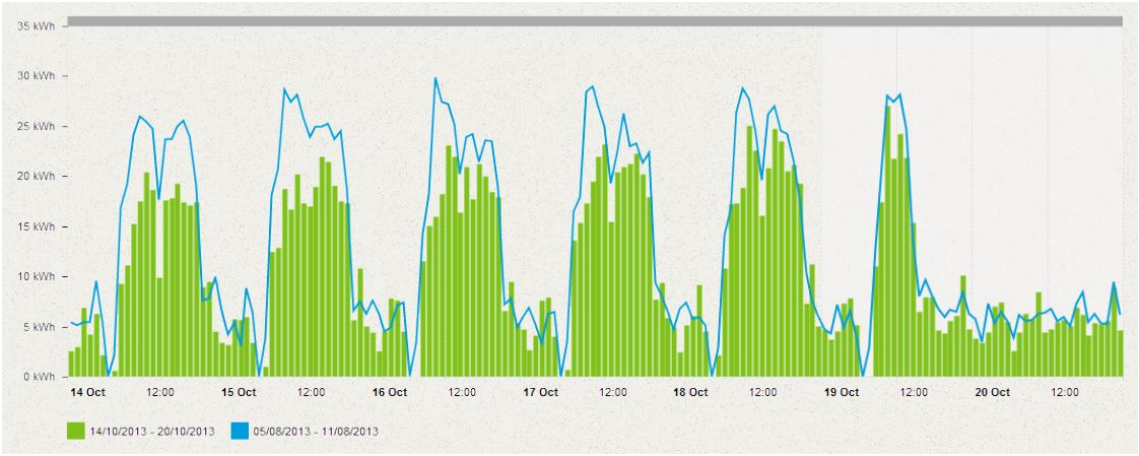

Figure 11. Consumption of energy related with the lighting (ANESE. Casos de éxito: Caso de estudio Berriak)

In addition to these measures, the company studied the contractual terms and they considered that, it would be advisable to increase the contracted potential from 60 to 74 kw since despite of the initial cost is higher, the cost of the power excesses which was an important amount of the total potential cost will decrease a lot, thus decreasing the total bill, as it can be seen in the graph [19].

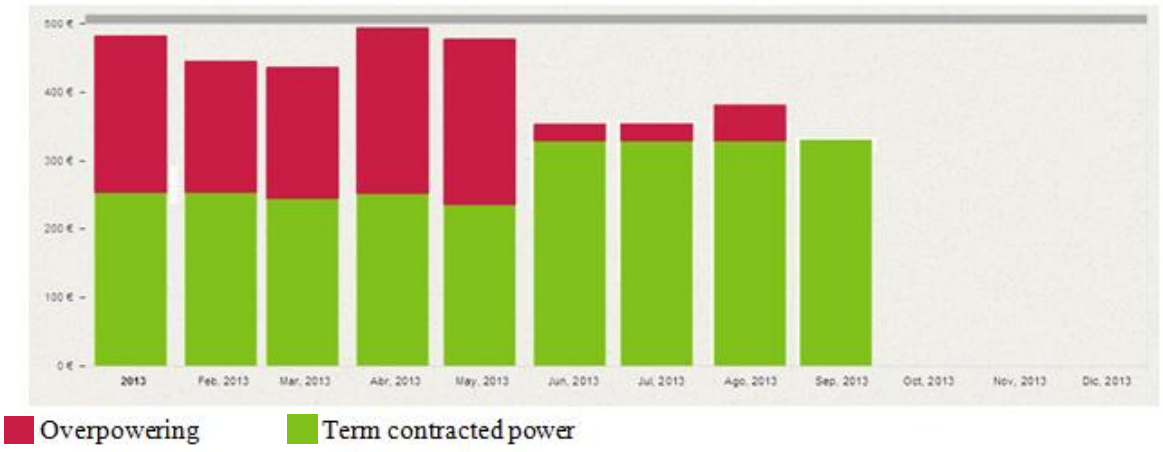

Figure 12. Price of the contracted power (ANESE. Casos de éxito: Caso de estudio Berriak)

Finally, GESE suggested that it will be cheaper to carry out the purchase of electricity directly at indexed price, since as it has been done, part of the production can be adapted to the proper time slots, those where the prices are smaller.

The global results were the a total energy reduction of 120000 kWh, annual savings of 20300€ and what it is more, the reduction of their CO_2 emissions of by 34.000 kg [19].

Thus return of the investment (ROI) [19] is:

20.300 € annual savings /12 months = 1.691'67 € monthly savings

10.000 € of investment / 1.691'67 € = 5'9 months.

The results show that the project was successful, and back the theory that ESCOs are profitable both for the environment as for the business.

10.2. National EPC project for non residential buildings (Sweden)

Customer

One of the most notable company operating in the EPC market in Sweden is Siemens*, and therefore it was the enterprise selected to carry out a national project in Sweden which affected to a total of 90 buildings (250.000 m2) involving hospitals, healthcare centers and folk high schools [20].

Challenge and solution

The sources of energy used before the implementation of the EPC-measures were mostly district heating and electricity, and the energy consumption ratio was approximately of 300 kWh/m2/year [20].

In most of the building the maintenance has been neglected for some time and the indoor climate and technical standards needed to be upgraded to the current standards. Moreover, the 90% of the building were care institutions, which implies that they accommodate ill people, therefore in this kind of building the standards for indoor climate are higher than normal, thus the temperature must be higher and furthermore there have to be back up systems for energy supply [20].

The building owner pointed goals that had to be fulfilled, among which the most important were the following ones [20]:

- The investment should be financed by the energy savings obtained through the energy efficiency measures applied according to the EPC project in at most 8 years.

- It must to perform upgrades in the technical equipment in the buildings.

- The indoor climate must to be improved

- It has to be carry out improvements of the Net Operating Income.

Saving measures and results

The EPC model carried out by Siemens, had the three common main phases of an EPC project. Firstly, they performed an analysis of the buildings where the baseline parameters were identified, and based on them, the company proposed measures and they also calculated potential savings and the pay-back time. Then, the customer assessed the outcome of the results of analysis, and after its approval the company started with the execution of the project.

The most common measures adopted were [20]:

- Operation optimization

- Measures for water economization

- Automatic control of lighting

- New automatic and regulation control systems

- Change to air ventilation with heat recovery

After the implementation of the measures it was mandatory to perform last phase, which consisted of the follow up and guaranteeing of the calculating savings.

In relation to the cash flows, as it is common for this kind of contracts, the first phase was paid only when the company showed the results of the analysis. Besides, during the execution phase they are done progress payments, and in the last phases as is a service and support agreement, the company is paid quarterly [20].

The total investment costs were: €3.050.00

The savings through energy efficiency measures were: € 370.000 per year

And finally as it was imposed by the customer, the repayment time was: 8 years

12. Discussion

This report has tried to show how, despite that the concepts of the ESCO and EPC have spread through the whole Europe, their background and the path that they have followed in each country have been different, and hence the successful achievement of each, as has been demonstrated by the examples from Sweden and Spain. Moreover, it also claims to provide a clear overview of some issues related to the EPC projects, like the possible sources of financing or the different methods to carry out a project.

ESCOs are more active depending on the sectors and the countries, but it has been proved that the public sector is one of the most important customer and hence one of the main drivers in the development of the ESCOs market.

Besides, although in theory the ESCOs seem to be the proper solution to take advantage from the huge potential of the cost-effective energy efficient options in all countries, as it has been said, the success is different among sectors and countries, which indicate that there are barriers preventing the full exploitation of their potential. Some of the factors which influence the success of the ESCOs market are the size and the openness of the banks to engage in EPC or the energy efficiency market structure. Furthermore the public procurement rules are a main problem in many countries when working with public sector, since often, these processes are too complex and a lot of time is needed to obtain larger and long-term projects. Besides, the public authorities, many times, pay

more attention to the more economic project instead of the more efficient ones. Thus they have to learn how to choose the proper project and also, the policy makers should work to make the public procurement rules to be easy and simple. The access to financing is a barrier in a lot of countries. It is not the case in Sweden but in Spain, where nowadays there is an economic crisis. Finally, the trust and awareness issue is a concern for most of the countries since it is essential to the market to be successful, the ESCOs need to prove that they are able to obtain the promised savings. It has to be remembered that the failure of ESCOs in Sweden in one of the previous upsurges was caused because the ESCOs were unable to reach the expected savings. Thus in Sweden the mistrust in the EPC has been bigger and therefore it took more time than in other countries like in Spain to achieve a strong position in the market. Nowadays, the increase of awareness in the model is the main reason of the growth of the market, since every day there are more cases which prove that the ESCOs meet the expectations. Nevertheless, when looking for good practices for this report, it was more easier to find examples of successful cases in Spain than in Sweden, and also Spanish cases were explained deeper than the Swedish ones. This proves of major maturity of the Spanish market despite being through a bad time.

While it is true that the energy contracting models have to stand on by themselves, it is needed that the right framework exists. For instance, in Stockholm 2010 there was an incident about the legal situation of the procurement which questioned the entire national EPC market. Nevertheless, as has been seen the energy efficiency is being increasingly an issue more important on the political agenda, mainly due to the targets defined by the European union. It can be said that the path that it is being marked by the current measures will hopefully lead to the best possible framework for energy contracting.

In Spain, during the last years, it has been made a lot of publicity about the ESCOs' projects due to the national decline of the construction market and the increasing energy costs. This publicity contributes to overcome the informational barrier, however, a deeper investigation is needed to solve the current financing problems and also a necessary change of the inefficient execution of government procedures is required. The increasing energy prices and the "free market" for selling electricity and natural gas ("regulated market" has almost disappeared) are also helping to promote the implementation of energy efficiency projects. Despite the good path of the ESCOs in Spain partly due to the large governmental programme, specific laws to regulate their implementation and promotion of ESCO from energy agencies and the constant decrease in state support for energy efficiency projects as a consequence of the crisis are the actual main barrier. If the government could simply carry out the measures which have already been established the adequate framework could exist.

The case of Sweden has seen a different path since despite the failure in its beginning it is an example of how a deliberated, well-designed dissemination of information and trustworthy documents and procedures is a key for the development. So, while in Spain, the ESCOs required less time to get a strong position in the market, now due the current economical situation its growth rate has decreased. On contrary in Sweden after having overcome the mistrust and the bad reputation, the ESCOs have experimented a good growth rate during last few years. The market structure is also different. Therefore the characteristics of the EPC projects are not the same. The main feature of the Swedish energy market is the high use of district heating, due to which, the EPC projects do not usually include neither service and maintenance nor supply side measures. The common projects are mainly of modernization and refurbishment of public buildings involving lighting, heating, ventilation and air conditioning (HVAC), complex refurbishments and fuel switch. On the other hand the projects in Spain include public buildings, private non residential buildings and industries involving cogeneration, audits, HVAC control system and lights. Once again, focusing on the most common projects that are performed, it can be seen that the Spanish market is more mature than the Swedish, therefore both Swedish policy makers and Swedish ESCOs should learn from the Spanish ones, especially how to reach the private sector.

Both countries, also has differences between the typical energy service providers. The Swedish market is composed mainly by international medium sized building and control manufactures and facility and operation companies with EPC as a side business, while in Spain the market consists of national and international large utilities, construction and multiservice companies, which once again, proves the major maturity of the ESCOs in Spain.

Sweden has experimented a great growth in the last few years, and a suitable way of continue in the good path and continue growing could be to enter in the private sector, to include the service and maintenance in the EPC projects or for instance, in cases where the supply facilities are installed (such as existing oil heat boilers), providing just the service and maintenance could be an option.

The energy service market is constantly changing, therefore the energy service providers should be dynamic and they should be able to adapt their services to the customer needs and develop new approaches capable to comply today's and tomorrow's challenges.

After this report, it seems that, although much remains to take advantage of the full potential of the energy efficiency services, the ESCOs and both European, national and regional policy makers are working in the correct way.

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14. Annexes

14.1 Annex I

14.1.1 ESCOs

i) European Commission (2006) "Energy Service Directive" (2006/32/EC)

"Energy service company' (ESCO): a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises, and accepts some degree of financial risk in so doing. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and on the meeting of the other agreed performance criteria. "

ii) Graz Energy Agency Ltd (2009)

"An Energy Service Company (ESCO) implements a customized energy service package (consisting of planning, building, operation & maintenance, optimization, fuel purchase, (co-)financing, user behavior …). The ESCO provides guarantees for all inclusive cost and results and takes over commercial and technical implementation and operation risks over the whole project term of typically 10 to 15 years. ESCo products provide either useful energy (Energy Supply Contracting - ESC) or energy savings (Energy Performance Contracting - EPC) to the end user. And they achieve environmental benefits due to the associated energy and emission savings as well as non-energetic benefits such as increase in comfort or image gains. "

iii) Lawrence Berkeley National Lab (2013)

"Firms that provide energy efficiency-related and other value-added services and for which performance contracting makes up a core part of its energy-efficiency services business. In a performance contract, the ESCO guarantees energy and/or dollar savings for the project and ESCO compensation is therefore linked in some fashion to the performance of the project."

iv) World Energy Council (2007)

"Energy service companies offer energy efficiency improvement or energy services , such as consulting firms and equipment contractors, by the concept of performance-based contracting, which means that the ESCO's payment is directly linked to the amount of energy saved (in physical or monetary terms). They usually offer the following services: they develop, design, and finance energy efficiency projects; install and maintain the energy efficient equipment involved; measure, monitor, and verify the project's energy savings; and assume the risk involved in the expected amount of energy savings. Therefore, they take financial, technical and other risks. "

v) Clinton climate initiative and American college & university presidents climate commitment (2009)

An ESCO, or Energy Service Company, is a business that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities over a seven to twenty year time period. ESCOs generally act as project developers for a wide range of tasks and assume the technical and performance risk associated with the project

14.1.2. EPC

i) Berliner Energieagentur GmbH (2011)

"EPC is comprehensive energy service (planning, implementation, operation and optimization of building installations) that aims to achieve guaranteed improvements. [EPC] is based on cooperative work and contracts. Necessary investments are refinanced through guaranteed cost saving over the contract's period "

ii) Berliner Energieagentur GmbH (2010)

"Energy Performance Contracting (EPC) is a proven and cost-efficient instrument for tapping existing energy saving potentials in the buildings sector. An Energy Service Company (ESCO) implements a customized energy service package, consisting of planning, building, operation & maintenance, optimization, fuel purchase, (co-) financing and user behavior. EPC deals with the optimization across the trades of automation installations in buildings and building operation by an ESCO in the form of a co-operation based on partnership. Performance components of the ESCOs services are financing, planning and installation of components for energy generation, distribution and usage as well as their operation and maintenance. Integration and training of the users are often part of EPC"

iii) Ecole des Mines de Paris (2002)

"EPCs are all types of Energy Performance Contracts. Energy performance contracting (EPC) is any mechanism, in which a third part opens opportunities for energy savings in conditions where it is not spontaneous. It ranges from a financing alternative to lower the financial burden for the facility owner to a full outsourcing to reduce the yearly operational costs for energy, for instance. The dominant model is a pure service where

the various components are unbundled (can be taken or not by the user) and the service company is judged (and paid) on each of the unbundled components : the economic efficiency in purchasing energy, the technical efficiency in continuous audit and maintenance, the financial efficiency in planning works on time, the technical and economic efficiency in proposing energy saving works repaid from benefits."

iv) European Commission (2006) "Energy Service Directive" (2006/32/EC)

" Energy performance contracting is a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where investments in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement. "

v) Graz Energy Agency (2009)

"Energy Performance Contracting (EPC), the focus is on reducing final energy consumption through demand side energy efficiency measures. The scope is extended to the entire building or enterprise including measures such as technical building equipment, user behavior or the building envelope insulation. "

vi) International Energy Agency Demand Side Management Programme (2013)

"Energy Performance Contracting (EPC), the focus is on reducing final energy consumption through demand side energy efficiency measures. The scope is extended to the entire building or enterprise including measures such as technical building equipment, user behavior or the building envelope insulation. "

vii) ICF International and National Association of Energy Services Companies (NAESCO) (2007)

"EPC is a turnkey service, sometimes compared to design/build construction contracting which provides customers with a comprehensive set of energy efficiency, renewable energy and distributed generation measures and often is accompanied with guarantees that the savings produced by a project will be sufficient to finance the full cost of the project. A typical EPC project is delivered by an Energy Service Company (ESCO) which provides all of the services required to design and implement a comprehensive project at the customer facility, from the initial energy audit through long-term Monitoring and Verification (M&V) of project savings. "

viii) Johnson Controls (2010)

"Energy performance contracting (EPC) is a proven and internationally-recognized procurement method for reducing the operating costs and environmental impacts of buildings at low risk to property owners. Under a performance contract, an Energy Services Company (ESCO) brings its technical know-how to provide complete turnkey responsibility for a comprehensive set of energy efficiency, water efficiency, operations and maintenance cost efficiency, renewable energy, and/or distributed generation improvement measures. The ESCO manages all aspects of the project from start to finish: building audits, detailed design and engineering, business case analysis, installation, commissioning, and ongoing performance measurement and verification. Importantly, the ESCO assumes performance risk for the project in the form of a long-term financial guarantee to ensure that the projected energy, water, and operational cost savings materialize and are preserved over time."

ix) London Development Agen cyRE:FIT Programme

"The reduction in energy bills and the carbon footprint of buildings is achieved by appointing an Energy Service Company (ESCo) to undertake energy efficiency measures in buildings. The ESCo guarantees a set level of energy savings, this offers a financial saving over the period of the arrangement. The risk associated with the delivery of energy savings is passed onto the ESCo rather than the owner of the building. This is known as Energy Performance Contracting (EPC). "

x) World Energy Council (2004)

"Energy Performance Contracting (EPC)56 is a contract on energy performance between a consumer and an Energy Service Company (ESCO) that uses cost savings from reduced energy consumption to repay the cost of implementing energy conservation measures. The ESCO, which is basically a supplier for building techniques, an engineering company or a utility, carries out a cluster of services and carries the risks of performance and operation. In this scheme, an energy agency can intervene to assist the public body in the collection of energy data, in the negotiations with ESCOs (tendering process) and in the follow-up of the project."

14.1.3. ESC

i) Graz Energy Agency (2009)

"Energy Supply Contracting (ESC) implies efficient supply of useful energy such as heat, steam or compressed air is contracted and measured in Megawatt hours (MWh) delivered. The business model usually includes purchasing of fuels and is comparable to district heating or cogeneration supply contracts. The scope of energy end-use efficiency measures is usually limited to the energy supply side of the building or enterprise, e.g. the boiler room. It can also be applied to energy supply from renewable sources, e.g. solar ESC. "

ii) Johnson Controls (2010)

"Energy supply contracting, as the name suggests, refers primarily to the supply side provision of heating, cooling, electricity, steam, compressed air, or other forms of useful energy in an efficient manner. In addition, ESC providers such as utilities generally do not assume the kind of project performance risk that is a central feature of EPC. Despite these demand versus supply side distinctions, the term "energy supply contracting" has been used in some European countries to describe a demand side service that is essentially identical to EPC. In most countries, however, energy supply contracting is commonly understood to apply primarily to efficient supply side energy provision rather than to demand side energy efficiency improvements."

15.1.4. Energy-Contracting EC

i) Graz Energy Agency Ltd (2008)

"The physical benefit, utility or good derived from a combination of energy with energy efficient technology and/or with action, which may include the operations, maintenance and control necessary to deliver the service, which is delivered on the basis of a contract and in normal circumstances has proven to lead to verifiable and measurable or estimable energy efficiency improvement and/or primary energy saving"

ii) Graz Energy Agency (2013)

"Energy Contracting - also labeled as ESCo or Energy Service - is a comprehensive energy service concept to execute energy efficiency projects in buildings or production facilities according to minimized project cycle cost. The Energy Contracting concept shifts the focus away from selling units of final energy (like fuel oil, gas or electricity)

towards the desired benefits and services derived from the use of the energy, e.g. the lowest cost of keeping a room warm, air-conditioned or lit."