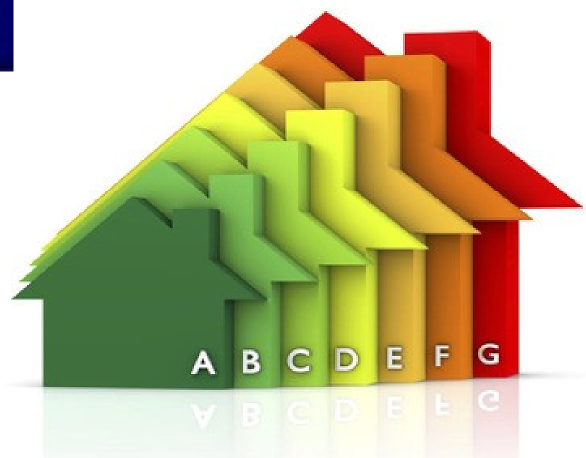
THE DEVELOPED ENERGY SERVICE COMPANY MARKETS IN THE EUROPEAN UNION

WHAT LESSONS CAN BE DRAWN FOR THE DEVELOPMENT OF THE DUTCH ESCO MARKET?



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Summary

There is a global urgency towards low-carbon economies, since the use of fossil resources is causing vast problems to the economy and society. In the Netherlands about 30% of the total fossil primary energy is consumed in buildings, and the biggest energy savings potential of the Netherlands can be realised in that sector. Despite the fact that so much energy consumption can be reduced in the real estate sector, refurbishment and retrofits are rarely executed in the existing building stock. In the contrast to the Netherlands, in Germany, France and Austria a lot of buildings are being refurbished with applying energy saving measures thanks to projects executed by energy service companies (ESCO's). An ESCO is 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 doing so. These new kinds of businesses are seen as effective business models to overcome some of the barriers of energy efficiency and are successful in implementing energy saving measures in buildings.

Taking into account the effectiveness of ESCO businesses and the urgency to increase energy efficiency in buildings it can be concluded that the absence of a well-developed ESCO market is a problem for the Netherlands. In order to learn from the successful experiences of the well-developed ESCO market the following research question is set: ***What are the success factors of the developed ESCO markets in Germany, France and the Austria and what can be learned from this in order to develop the Dutch ESCO market successfully?***

The success factors which has been effective for the development of each investigated ESCO market are the establishment of an ESCO association and ESCO accreditation system, standardization of contacts and M & V procedures, a suitable regulatory and policy framework and supporting measures by national or local energy agencies. In all the three countries the ESCO's have united themselves by establishing an ESCO association. In general, these associations provide information to its members and are engaged in political lobbying in order to improve the conditions for ESCO businesses. Furthermore, they keep members up-to-date on key policies and issues affecting the ESCO market and some ESCO associations even made an accreditations scheme which provides the competent ESCO with quality labels. Standardization of contracts and procedures and an ESCO accreditation system has proved to be crucial for trust in the ESCO business in the market. The Austrian and German local energy agencies also organized successful demonstration projects by bundling of the public buildings. Another important success factor in the French market is the national savings obligation schemes in place. The French government has set strict policy objectives concerning the energy efficiency of buildings in the action plan called 'Grenelle l'Environnement'. In Germany the substantial rise in energy prices due to taxing is also a very important one, and by some German ESCO's even considered as the most important factor of all.

Despite these successful experiences, the Dutch ESCO market is still immature and lagging behind. All of the common success factors investigated, which are the most essential for an ESCO markets developed, are not put in place in The Netherlands. It is an imperative to implement these according to the roadmap made by Bertoldi et al. in 2006.

Preface

This graduate research is written for the research master program Sustainable Development – Energy & Resources track of the University of Utrecht. Besides the university, I have also conducted this graduate research for the interest of my internship provider, the Dutch utility company Eneco.

The process of formatting and writing this master thesis was a process of ups and downs. During the process of writing the thesis it had to be adjusted several times. I was also confronted with a lack of cooperation by people I liked to have interviewed and a comparative research of different markets proved to be recalcitrant. Luckily, whenever I was in a difficult phase I could count on my two supervisors. Therefore, first I would like to thank my internship supervisor mister Michiel Houwing for his support and consult. Also my thanks go to my supervisor of the Utrecht university mister Ernst Worrell for his good feedback and advice. Finally, I would like to thank all the persons I've interviewed for their co-operation and making time for it.

It was a long way of writing this thesis but I am satisfied with the end result. I hope that it will be read by a lot of people, especially by the stakeholders of the Dutch ESCO market and people how are in a position of influence on the development of the market. I hope that my research can give new insights for them and that my findings ultimately contribute to the development and maturation of the Dutch ESCO market.

Roel Vreeken. Utrecht, October 2012

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1. Introduction

1.1 Background information

According to estimates done by the International Energy Agency in 2008 the world's primary energy demand will grow by 45 per cent between 2006 and 2030, requiring approximately 26 trillion U.S. dollar for investments in supply infrastructure. Unfortunately, fossil fuels are expected to remain the dominant source of primary energy for the coming decades, accounting for about 80 per cent of the overall increase to 2030 (International Energy Agency, 2008). This causes the world in facing a set of complex energy challenges: security of energy supply, access to affordable energy for all, and countering climate change (International Energy Agency, 2007).

In addressing these challenges, energy efficiency plays an indispensable role. Energy efficiency leads to more energy services (such as production, transport and heat) per unit of energy used (i.e. coal, gas, electricity). Therefore, energy efficiency is increasingly regarded as a low-cost, clean alternative to building electricity (and gas) supply, transmission and distribution capacity (Hopper & Goldman, 2007). It is rapidly becoming one of the most critical policy tools to help meet the sustainable growth in energy demand. By all accounts, energy efficiency programs have always represented a win-win-win option by providing positive returns to the government, energy consumers and the environment. The most important benefits of such programs are that they conserve natural resources, reduce environmental pollution and carbon footprint on the energy sector, reduce a countries dependence on fossil fuels, ease infrastructural bottlenecks and the impact of temporal power shortfalls, and improve industrial and commercial competiveness through reduced operating costs (Singh, et al., 2010).

For the sake of promoting energy efficiency in all kinds of sectors, energy service companies (ESCO's) are seen as an important vehicle to overcome some of the barrier (Vine, 2005). An energy service company is 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 doing that. 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 (Marino, Bertoldi, & Rezessy, 2010).

Energy service companies are primarily active in enhancing the energy efficiency in the existing building stock, which is of particular importance since the biggest absolute amount of energy savings can be realised in the buildings. In the Netherlands the energy use in buildings is 30% of the total fossil energy use in the Netherlands (Rooijers, Leguijt, & Groot, 2010), and the existing buildings uses approximately 25% more energy than new buildings (De Boer, 2011).

The ESCO concept arose in the 1970's in the United States (Goldman & Dayton, 1996) and in Europe in the late 80's. The majority of ESCO projects in Europe have been undertaken in the public sector, primarily because the public sector is perceived as having 'safer' clients that do not normally go out of business, but in some cases also as a result of national or local authorities and energy agencies taking the lead with retrofitting public sector buildings (Bertoldi, Rezessy, & Vine, 2006). These national policies concerning energy efficiency in buildings results from the EU policy directives, namely the Energy Performance of Buildings Directive and the European Energy Efficiency Directive. These are the most important directives which shape the national policies concerning ESCO markets. The 2007 Status Report of the European Commission's Joint Research Centre confirmed Germany as the largest and most advanced market, followed by a number other Western European countries like France and Austria. The development of the Austrian ESCO market is primarily interesting due to the successful start-up phase which is an example for every undeveloped ESCO market. In France, there is a long tradition of outsourcing energy service contracting and thereby the ESCO market is the biggest in Europe. The ESCO market in the Netherlands is not significant and is far behind this leading ESCO market (Bertoli, Bozza-Kiss, & Rezessy, 2007).

1.2 Problem definition, research aim & research questions

Problem definition

Concerning the EU directives 'Energy Performance of Buildings Directives' and the 'Energy efficiency directive' developed by the European Commission, there is an urgency to make buildings in EU Member State countries more energy efficient. Although Member States have promoted a number of policy initiatives to foster the energy service company industry major difference exists in the development of the ESCO markets among the various countries. ESCO's have found a lucrative way in some western countries like in Germany, France and the Austria.

In contrast with those countries, in The Netherlands the ESCO market is still very small and undeveloped (Bertoldi, Rezessy, & Vine, 2006). Therefore, nowadays the Netherlands misses the chance of deploying a new kind of industry which is very effective in implementing energy saving measures by its self-financing business model. Regarding the growing urgency for energy efficiency in buildings, the potential of the industry and its employment opportunities and the proven effectiveness and successful experiences of ESCO's in Germany, France and the Austria, it can be concluded that this is a problem for the Netherlands.

Aim

The aim of this research is to investigate what factors made the German, French and Austrian ESCO markets successful. After that, these 'investigated lessons' will be translated into recommendations for the Dutch government and the Dutch ESCO industry in order to successfully develop and enlarge the Dutch ESCO market. Finally, also recommendations will be given for the ESCO of the Dutch utility Eneco specifically.

Research Question

What are the success factors of the developed ESCO markets in Germany, France and Austria and what can be learned from this in order to develop the Dutch ESCO market successfully?

In order to ensure a complete answer to the main research question, this research deals with the following sub questions:

1. *What are the success factors of the ESCO market in Germany?*
2. *What are the success factors of the ESCO market in France?*
3. *What are the success factors of the ESCO market in Austria?*
4. *What should the Dutch Government and the Dutch ESCO industry do after knowing the critical success factors from the experiences of the three countries?*

1.4 Research scope

Since the Netherlands is an EU Member State and therefore subject to EU energy efficiency policy, the well-developed ESCO markets of the EU Member States are of interest in this research since they are subjected with the same EU EE policy. In order to learn the most from these ESCO markets, to verify the success factors, and to investigate for similarities in success factors, three different types of ESCO markets will be investigated. The European Union as a whole has (by now) a very heterogeneous ESCO market. While the former EU-15 countries in Western Europe have the most mature markets and are often referred to as success stories, ESCO markets in Central and Eastern Europe have continued growing but remain in a period of transition (Lamers, Kuhn, & Krechting, 2008). This research will focus on the western EU ESCO markets of Germany, France and Austria. Because there is no determined, clear limit when being a developed or undeveloped ESCO market, e.g. in terms of number of ESCO's or in market size, the choice for ESCO market in the EU is based on the statements about developed EU ESCO markets in the international scientific literature.
First of all, the ESCO market of Germany will be researched since it is generally referred to as most well-developed and advanced ESCO-market in the EU by several scientists (Vine, 2005) (Bertoli, Bozza-Kiss, & Rezessy, 2007) (Seefeldt, 2003). The annual turnover per year is one of the biggest of all the EU Member State countries (see appendix C). Close followers of the German ESCO market is the EU Member State France. This ESCO market is also often described by the same researchers as a developed one. However, the number of ESCO's in France is little, especially compared to the German ESCO market, the annual turnover in the ESCO market is the biggest of all (see appendix C).
Finally, the Austrian ESCO market will be analyzed since it is generally recognized as the fastest growing ESCO market in the EU, and is characterized by its fast take-up (Seefeldt, 2003) (Bertoli, Bozza-Kiss, & Rezessy, 2007) (Marino, Bertoldi, & Rezessy, 2010). Starting from a level around zero in 1998, 500 to 600 buildings have been undergoing a thermal-energetic optimisation by ESCO's till the end of 2002 (Seefeldt, 2003). This is unique among the western EU countries and therefore, the Austrian ESCO market development and its success factors are an example for the development for the take of phase of every infant ESCO market.

1.5 Relevance

Scientific relevance

Despite the fact that a lot of research already has been conducted of ESCO's and ESCO markets, a comparative research about three well-developed ESCO markets together with one undeveloped, lagging ESCO market (namely the Dutch) have not been conducted yet. An analysis primarily about the success factors which made the three ESCO markets big and mature followed by an application of these 'lessons learned ' to an undeveloped ESCO markets, like the Dutch market, is unique and has never been done by other scientists yet. An intensive review about the experiences of the successful development of developed ESCO markets can give new insights for the development of the infant, undeveloped Dutch ESCO market.

Social relevance

As stated in the introduction, ESCO's are generally seen as effective business model to decrease energy demand and mitigate climate and transform the efficiency gap into a viable business model. This is because ESCO's are very effective companies which can increase the energy efficiency of buildings, by applying energy savings measures in a cost effective way. Energy efficiency is important for society for a number of reasons. First of all, in 2007 the International Energy Agency has calculated that every euro spent on more efficient energy use avoids two euro investment in energy supply. Secondly, as stated in the introduction, the IEA has estimated in 2008 that the world primary energy demand will grow by 45 per cent between 2006 and 2030. In order to meet this rising energy demand in the most cost-effective way is to increase the energy efficiency.

Another argument for the increase in energy efficiency is that energy efficiency contributes to sustainable society, namely in the following aspects (Steinberger, van Niel, & Bourg, 2009):

- Social: Universal and equitable access to essential energy services;
- Environmental: Reducing harmful emissions to environmentally tolerable levels;
- Economic: Increasing and share economic prosperity

2. Methodology

In this chapter the methodology of this research will be explained. Methodology refers to a process where the design of the research and choices of particular methods, and their justification in relation to the research project, are made evident (DiCicco-Bloom & Crabtree, 2006). This research is a qualitative descriptive research. It is a qualitative research because it entirely based on qualitative data gathering, namely literature reviewing and conducting interviews. It is descriptive because the researches is about describing and inventory the characteristics of the research units in terms of quality and not in term of quantity (Baarda, De Goede, & Teunissen, 2005). In the first paragraph the two research methods used are explained as well as their importance. In the second paragraph the manner in which these two research methods are applied will be discussed.

2.1 Research methods

Literature review

The main part of the research consists of a comprehensive literature review. A literature review is a critical and evaluative account of what has been published on a chosen research topic. The purpose of a literature review is to (University of Leicester, 2012):

- Situate your research focus within the context of the wider academic community in your field
- Report your critical review of the relevant literature
- Identify a gap within that literature that your research will attempt to address

A substantial amount of literature is written about the energy services companies internationally, like international scientific journals, reports, books and websites of relevant and reliable organizations. Research institutes like Lawrence Berkeley National Laboratory, the Joint Research Centre of the European Commission and the energy agencies of Berlin and Graz have published a lot of scientific literature. Along with other ESCO institutes, the Berlin and Grazer Energy agencies are united in the EU's European Energy Service Initiative which has also published substantial amount of reports of EPC markets.

Furthermore, former master students Sanne de Boer and Joost van Barneveld have both conducted comprehensive graduate research reports about the status of the Dutch ESCO industry and its barriers for a successful market development. Sanne de Boer has researched the Dutch ESCO market intensively, and Joost van Barneveld made a comparative research between the US and the Dutch ESCO market. In particular the results of De Boer’s research are intensively used in chapter 9. Reviewing and analysing the articles and journals of these researchers will be of relevance in answering the research question.

During the analysis of the literature, an understanding and knowledge will be developed which can be used in preparing the interviews.

Individual Qualitative in-depth semi-structured Research Interviews

Besides a comprehensive literature review, research interviews will be conducted with relevant persons for this research. These persons are experts of ESCO markets which have a lot of experience and knowledge with ESCO's and ESCO markets. These persons are mainly employees of ESCO's, consultancy firms or energy agencies. Also interviews will be conducted with experts at Dutch utilities in the Netherlands. In the first place these will be interviews with experts of the utility Eneco, but possibly also with experts of other Dutch utilities.

After these interviews have been conducted, the drivers and barriers for utilities in The Netherlands for offering EPC's can be concluded. The data gathered with the interviews is processed in all chapters. In appendix D the interview lists can be found and the conducted interviews are written out.

3. European Union Energy Efficiency Policy Context

In this chapter the most influential EU policy is reviewed considering energy efficiency of buildings. EU policy determines target and directives which have an effect on the national energy efficiency policies of all EU Member States and therefore determines the context in which ESCO in the EU Member States have to operate. At first, the main drivers that shape the European Union Energy Efficiency policy in which ESCO's in the EU have to operate are mentioned. Secondly, the main set targets and directive by the EU are discussed which result from the drivers, followed by an outline of the policy instrument which are most important to achieve these targets and the policy context and has an effect on the policy context ESCO's have to operate in.

3.1 Drivers of EU energy efficiency policy

Energy efficiency is considered to be a key component of European energy policy. There are two major drivers that shape the European Union energy efficiency policy in which ESCO's operate (Bertoldi, Rezessy, & Vine, 2006):

- Restructuring and liberalization of electricity and gas markets, and;
- Measures to combat climate change.

An important EU energy policy drive is the restructuring of the electricity and gas markets. The effect of the market liberalization on energy efficiency is under discussion and is very dependent upon an abundance of factors. Due to the liberalization the energy prices are falling and volatile and they are expected to have a negative impact on ESCO projects and short-term oriented suppliers maximizing turnover which may be detrimental to actions of improving energy efficiency. On the other hand, at the same time improved efficiency at the demand side may be fostered by distribution companies trying to retain consumers and attract new ones by offering energy services as 'added value' to another homogenous commodity such as electricity and gas. This second beneficial effect for ESCO's is long term and especially the case for utilities that see their business fall due to the rising competition by the liberalisation of the energy market (Bertoldi, Rezessy, & Vine, 2006). The second driver of the European energy efficiency policy is the aim of combating climate change. In order to combat climate change the EU has ratified the Kyoto protocol.

3.2 EU policy targets

EU 2020 strategy – 20% efficiency in 2020

In 2008 the EU Member States committed themselves to become a highly energy-efficient, low carbon economy, and were enacted through the climate and energy package, the 'EU Climate Action and Energy Package'. In this package these targets, known as the 20-20-20 targets, set three key objectives for 2020 (European Commision, 2012a):

- A 20% reduction of EU greenhouse gas emissions in the EU from 1990 levels
- Raising the share of EU energy consumption produced from renewable resources to 20%
- A 20% improvement in the EU's energy efficiency

The EU 20-20-20 targets represent an integrated approach to climate and energy policy that aims to combat climate change, increase the EU's energy security and strengthen its competiveness. Resulting from this directive for the year 2020, also other directives are made which contribute for reaching this target (European Commision, 2012a).

The ones, who are important for ESCO's in the EU, are the 'Energy Performance of Buildings Directive' and the 'Energy Efficiency Directive'. These two directives will be discussed in the following sections.

Energy Performance of Buildings Directive

In the European Union, buildings are responsible for 40% of the energy consumption and 36% of the European CO2 emissions on average. Therefore energy performance of buildings is of key importance to achieve the objectives set by the EU. Because of this fact, the European Parliament adopted Directive 2002/91/EC on the Energy Performance of Buildings Directive (EPBD). The Energy Performance of Buildings Directive (EPBD) lays down an EU wide regulatory framework that should help get the energy performance of buildings on the agenda (European Union, 2010).

This directive is the main legislative instrument at EU level to achieve energy performance in buildings. The directive states that EU Member States must apply minimum requirements regarding the energy performance of new and existing buildings and ensure the certification of their energy performance (European Commission, 2010b). When existing buildings undergo a refurbishment, the energy performance should be upgraded in order to meet the minimum energy performance requirements. However, Member States shall not be required to set minimum energy performance requirements which are not cost-effective over the estimated economic lifetime (European Union, 2010).

Moreover, the directive requires Member States to ensure that by 31 December 2020 all new buildings are so-called 'nearly zero-energy buildings'. And after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings. Member States shall draw up national plans for increasing the number of nearly zero-energy buildings. These national plans may include targets differentiated according to the category of buildings. Furthermore, following the leading example of the public sector, Member States shall take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into nearly zero-buildings (European Union, 2010).

EU Energy Efficiency directive 2011

According to the European Commission, with the policies and measures in place in 2011, the EU was on track to achieve only about half of its 20% energy efficiency measure in place. Or to explain it in numbers, policies to deliver an additional 202 million tons of oil equivalent (Mtoe) of energy savings were needed. To close the gap, the Commission proposed a new energy efficiency directive, which would contribute about 150 Mtoe (European Commission, 2012b). On 11 September 2012 the European Parliament voted in favour on the Energy Efficiency Directive.

The directive brings forward legally binding measures for every Member State to use energy more efficient at all stage of the energy chain; from the transformation of energy and its distribution to its final consumption. Measures include the legal obligation to establish energy efficiency obligations schemes or policy measure in all member state. These energy efficiency improvements will have to take place in household, industries and the transportation sectors. Other measures of the Energy Efficiency Directive include an exemplary role to be played by the public sector and a right for consumers to know how much energy they consume (European Commission, 2012b).

3.3 Policy instrument

White Certificates

White Certificates (WhiteCert), also referred to as Energy Efficiency Titles, are an energy policy tool to stimulate energy efficiency using market-based mechanisms in a cost effective manner. A white certificate is an instrument issued by an authority or an authorized body providing a guarantee that a certain amount of energy has been saved as compared to a reference scenario (Bertoldi, Rezessy, & Vine, 2006).

The basic principal of a WhiteCert Scheme is that a regulatory authority imposes energy efficiency obligations on certain parties, mostly energy suppliers and/or grid operators. The obliged parties can decide whether to implement energy efficiency measures themselves or to buy certificates, depending on their marginal costs. White certificates become available and are generated where energy savings are realized and certified. The underlying key rational of this system is the combination of the guaranteed results of setting obligations with the economic efficiency of market-based mechanisms (Pavan, 2002).

Among the many policy instruments introduced in the European Union to support energy efficiency, the United Kingdom, France, Italy, Denmark and the Flemish part of Belgium have introduced obligations on some categories of energy market operators (in particular electricity and gas distributors or suppliers) to deliver a certain amount of energy savings. Energy saving obligations imposed on energy companies includes an energy saving-target. This target can be defined in absolute terms based on energy market shares, as a percentage of annual sales, or for simplicity in the residential sectors, in terms of customer numbers.

The introduction of certification or project-based savings and the possibility to trade certificates is an additional policy option related to the implementation of energy-saving obligations. The savings related to the implementation of energy saving projects must be verified by an independent party and certified by means of white certificates. However, in the EU Italy and France are the only countries where the policy portfolio includes energy saving obligations in combination with fully tradable white certificates (Marino, Bertoldi, & Rezessy, 2010). A tradable certificate for energy savings portfolio involves 4 key elements (Bertoldi & Rezessy, 2006):

- The creation and framing of the demand, by an obligation to save energy imposed on some market actors in the energy sector
- The tradable instrument (certificate) certifying the obtained savings and the rules for trading
- Institutional infrastructure to support the scheme and the market
- Cost recovery mechanism (in some cases)

Link between EPC & White certificates:
In short, white certificates are means to force suppliers that don't have a special interest yet to think about energy efficiency. While the white certificates and EPC have quite different goals they are linked. EPC is an opportunity for consumers that would like to lower their costs, but they don't have the means to invest. White certificates are an obligation for suppliers, but EPC could be their mechanism to fulfil their obligation, making them also more acceptable because of the profitability of such projects. Therefore, by putting a white certificates scheme in place the obliged parties will become supporters for ESCO projects (Geissler & Waldmann, 2006).

4. Energy Service Companies

4.1 Energy Service Companies (ESCO's)

Definitions for ESCO's vary from country to country. Energy service companies are usually differentiated from other firms that offer energy efficiency improvement or energy services (such as consulting firms and equipment contractors) by the concept of performance-based contracting. This means that the ESCO's payment is directly linked to the amount of energy saved (Ürge-Vorsatz, et al., 2007). ESCO's offer the same services as energy service providing companies do. The difference is that ESCO's guarantee the savings and their remuneration is linked to the project's performance.

In this research the definition of ESCO's is according to the definition made by the researchers Marino, Bertoldi & Rezessy in 2010 of the Berlin Energy Agency:
An energy service company is 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 doing that. 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.

ESCO's are diverse and come in all shapes and sizes. They differ in terms of ownership, target markets, technology focus/expertise, in-house capabilities, geographical preferences, project financing, etcetera. Thus, there is no real 'prototypical ESCO' (Vine, Nakagami, & Morakoshi, 1999). ESCO's can be grouped into four ownership categories (Goldman, Hopper, & Osborn, 2005):

- Companies that are owned by building equipment or control manufactures
- Companies that provide engineering services and are 'independent' in the sense that they are not owned by utilities or equipment/controls manufactures
- Companies that are subsidiaries of utilities or utilities itself
- Companies that are owned by other types of energy companies such as gas producers and pipelines

ESCO's work project wise, i.e. they identify savings potentials, install the necessary equipment, operate the system, purchase fuel and electricity and provide financing of the project. In short, all ESCO's have the following key characteristics (Bertoldi, Rezessy, & Vine, 2006):

- They guarantee the energy savings and/or provision of the same level of energy service at a lower cost by implementing an energy efficiency project;
- The remunerations are directly linked to the energy savings achieved (which in turn is significantly dependent on the energy market prices);
- ESCO's typically finance, or assist in arranging financing, for the installation of an energy project they implement by providing a savings guarantee;
- ESCO's retain an on-going operational role in measuring and verifying the savings over the financing term.

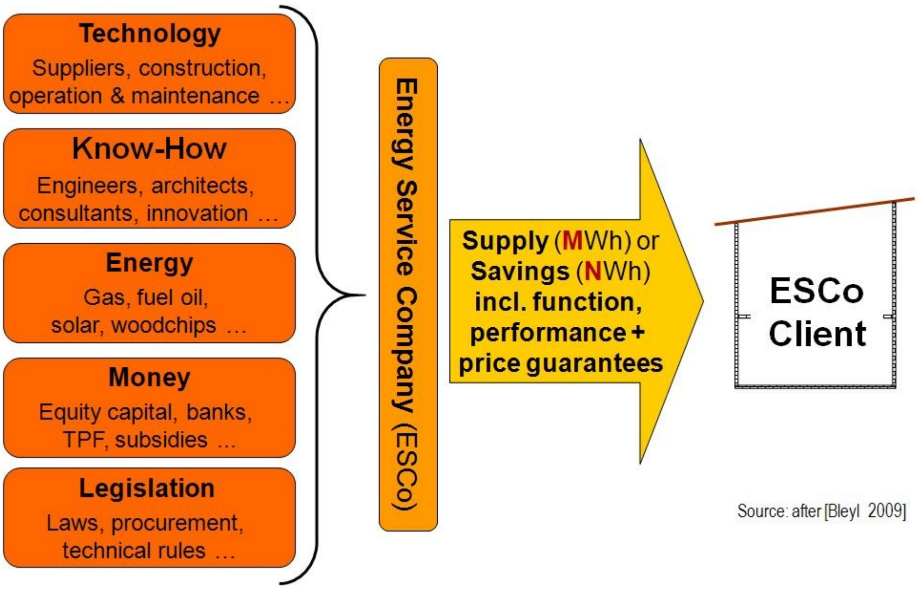

Figure 1: The expert domains of an ESCO business (Bleyl-Androschin, 2010)

4.2 Benefits & downsides of ESCO's

Therefore energy service companies (ESCO's) are seen an important vehicle for promoting energy efficiency in all kinds of sectors, since they overcome several key market barriers and failures to energy efficiency. Energy service companies create the focus needed to implement economically sound energy efficiency ideas. Their experience is valuable to facility owners who (Bertoldi, Hinnels, & Rezessy, 2006):

- Do not understand their energy bills
- Do not believe they have any wastage
- Do not understand their energy use and where saving opportunities may lie or how to design retrofits
- Do not know how to raise finance without debt
- Do not recognize the role of operational monitoring in controlling energy costs

By offering energy performance contract ESCO's attempt to mitigate customer's real and perceived risks associated with energy-efficiency projects (Vine, 2005). These include the project's technical risk (the probability that installed energy-efficiency measures will produce estimated savings in practice) and performance risks associated with the ESCO (the ESCO ability to design, manage, and implement a high-quality, complex project in a timely fashion).

The benefits of ESCO's

Direct benefits

ESCO projects can provide a variety of benefits to customers, both direct and indirect. The directly quantifiable benefits include energy costs savings and decreased O & M costs. By offering and EPC contract to the client, an ESCO enables the organization to (Lamers, Kuhn, & Krechting, 2008):

- Reduce the financial risks associated with energy consumption
- Utilize ESCO design, implementation and finance resource to improve the energy efficiency of buildings
- Conduct a detailed energy audit to identify where and how much energy demand can be reduced
- Get a guarantee in cost savings. Energy savings are guaranteed by the ESCO. In the unlikely event the agreed savings not being deliver, the ESCO makes up the difference. Usually, any additional saving above that guaranteed is left to the customer to keep shared savings model as described in the diagram below can also be employed

Critically seen, collaboration with an ESCO is without risk to the customer. Working with an experienced ESCO ensures that savings are measured, verified and guaranteed. The guarantee transfers all technical and operational risk to the ESCO. Added to that, working with an ESCO provides organizations access to additional and skilled resources to implement energy efficiency solutions. ESCO expert can help plan and budget for capital improvements by taking a whole facility approach (Lamers, Kuhn, & Krechting, 2008).

Indirect, less tangible benefits

The indirect, less tangible, benefits can include increased productivity, replacement of aging equipment, improved amenity and comfort levels and environmental improvements. These effects are difficult to quantify. For many customers, these indirect benefits may be as, or even more, important than the direct cost-saving benefits of ESCO projects. It is important to recognize that these indirect benefits can be key driver of customer's participation and satisfaction (Goldman, Hopper, & Osborn, 2005).

Downsides of ESCO's

ESCO's are profit oriented businesses and should not be expected to intervene in areas that are too risky or do not offer a profit. Performance contracting represents a niche product in the larger market for energy-efficiency services. ESCO offerings of EPC's tend to be focused on the larger institutional customers.

Surveys show that only one of the eight small commercial customers in the US receives offers for energy-efficient products or services within a two year period, while 64% of large customers (>2MW) receives such offers. Secondly, industrial customers, despite their size, have also proven elusive to US ESCO's. This is due to the high costs of developing projects, the highly customized nature of process improvement and need for industry specific expertise, limited access to decision-makers within industrial firms, and difficulty in evaluating the success of projects (Goldman, Hopper, & Osborn, 2005).

Therefore, it can be concluded that the ESCO business model is not the one and only solution to overcome market barriers among all customer classes. Encouraging ESCO industry development is a partial solution to the broader problem of achieving socially optimal levels of energy-efficiency and should be viewed as one component in a package of policy and private sector tools to achieve this goal (Goldman, Hopper, & Osborn, 2005).

4.3 ESCO's energy saving measures

When offering an ESCO contract to the energy consumer or host facility the ESCO provides a range of services related to the adoption of energy efficient products, technologies and equipment. ESCO's implement energy saving measures to achieve either energy savings or to supply useful energy. An overview of the most implemented energy saving measures is given in table 1.

Table 1: Most implemented energy saving measures (Lamers, Kuhn, & Krechting, 2008)

Lighting	• Energy efficient lighting • Daylight sensors • Adjustment lighting time clocks
HVAC (Heat, ventilation, air conditioning)	• Boilers • Chillers • Distribution / ventilation • Heat recovery
Refurbishment	• Insulation • Energy saving glass
Building management control systems	• PC shutdown software • Advanced thermostats • Other
RES & advanced heating	• Solar thermal • Geothermal Heat Plants (GHP) • Combined Heat and Power (CHP) • District Heating (DH) • Solar PV

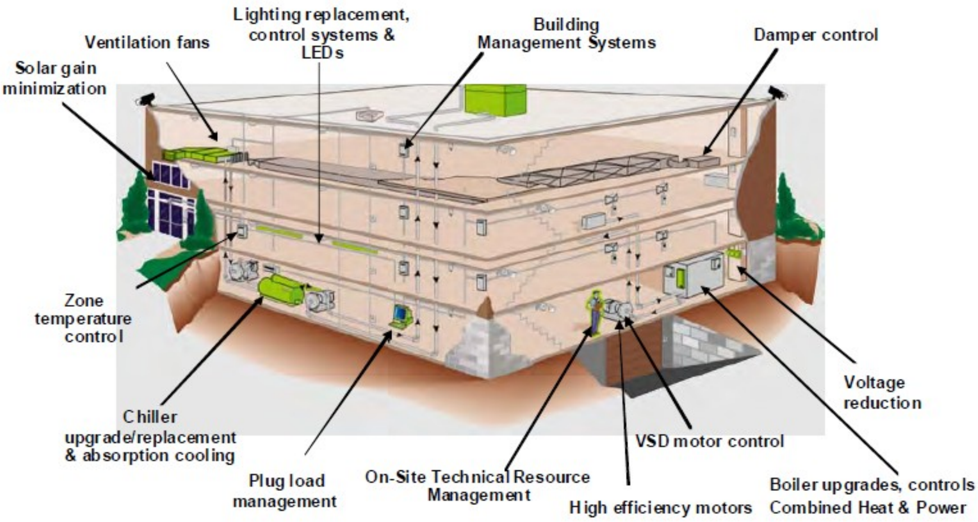

Figure 2: An ESCO's total facility approach accessing over 250 different energy conservation measures (European Association of Energy Service Companies, 2011)

4.4 Sectors targeted by ESCO's

In the table beneath an overview of the targeted sectors by ESCO's is given. Logically, these sectors might vary from country to country. But is provides a general perspective of the sectors targeted by ESCO's.

Table 2: Sectors targeted by ESCO's (Berliner Energieagentur GmbH, 2008)

Sector	Services	EPC activity
Institutional	Heat and power supply and distribution systems for educational institutions (schools, universities), federal/local government buildings, sports facilities (swimming pools, gyms, etc.), public housing, (street) lighting	Main target area for most ESCO's: some are specialized on specific services e.g. lightning
Hospitals and Health	Lighting, heat and power supply including distribution systems, and specific supply contracting (e.g. cooling) with saving guarantees	Services offered by the majority of ESCO's
Residential	Lighting, heat and power supply including distribution systems	Very dependent on legislative framework
Private housing	Lighting, heat and power supply including distribution systems, plus specific contracting (cooling or cold storage) with saving guarantees or renewable energy sources (e.g. PV)	Services offered by the majority of ESCO's
Retail and commerce	In case of buildings: see 'retail and commercial sector'. In case of production systems: very specific contracting models for heat/steam/cooling or pressure supply	Few ESCOs: high technological specification needed

5. Energy Service Contracting Models

5.1 Energy performance contracting

An energy performance contract is a contractual arrangement between the beneficiary and the provider of the energy efficiency improvement measures, where investments for these measures are paid in relation to a contractual agreed level of energy efficiency improvement (Marino, Bertoldi, & Rezessy, 2010). The approach is based on the transfer of technical risks from the client to the ESCO based on performance guarantees given by the ESCO. EPC payment is based on performance; a measure of performance is the level of energy savings (Bertoldi, Rezessy, & Vine, 2006). An EPC comprises the operation and management of (the technical equipment of) the building and may even include the training and motivation of the building users (Seefeldt, 2003).

> We will leave a steam engine free of charge to you. We will install these and will take over for five years the customer service. We guarantee you that the coal for the machine costs less, than you must spend at present at fodder (energy) on the horses, which do the same work. And everything that we require of you, is that you give us a third of the money, which you save." [James Watt, 1736-1819]

Figure 3: One of the first examples of Energy Performance Contracting in history (Bleyl-Androschin & Ungerböck, 2009)

The concept of energy performance contracting was born in the industrial revolution. While motivation changed over time, the search for suitable business models for the implementation of innovative technologies is ongoing.

Economic Parameters for EPC Contracts

There are basically four economically parameters defining an EPC contract (Seefeldt, 2003):

- Energy savings;
- Energy efficiency investment;
- Participation of the building owner;
- Contract duration.

In the figure below, the relations between the basic economic parameters are outlined. The total project volume is defined by performance guarantee and contract duration. The total revenues cover both the share of the building owner and the contractor's rate.

The revenue of the ESCO has to cover (Seefeldt, 2003):

- The investment (including capital service and interest rates)

- The initial service (project transfer costs, conceptual design, engineering, implementation)
- Operational services (project administration, optimization, maintenance, education of the technical staff, information and motivation of the building users)

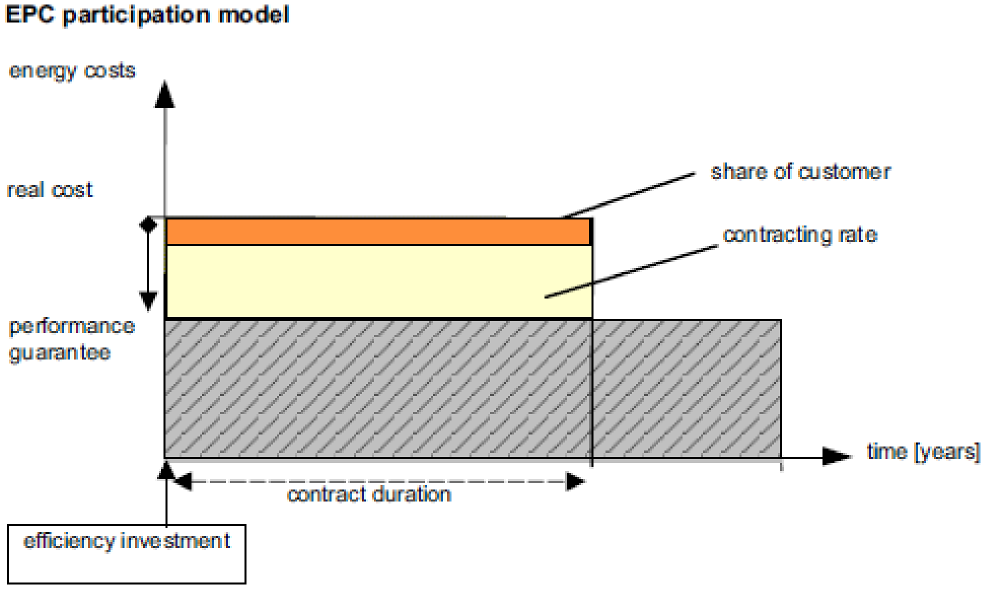

Figure 3: Basic parameters of an energy performance contract (Seefeldt, 2003)

Energy services are usually designed and implemented by the most efficient packages (payback period: 0, 5 -2) at first and, followed by medium efficient measures (PBP: 2-7 years) and low efficient measures like retrofitting boilers and piping (8-15 years). The longer the payback period of energy saving measures applied the longer the required contract duration (Seefeldt, 2003).

Key Performance indicators

By using key performance indicators (KPI's) the remuneration of ESCO's is measured. KPI's are variable that measure the achievements of the ESCO's implementation of energy services. For an energy performance contract the most important KPI is of course the level of energy savings. Other KPI's which are used are linked to the comfort in buildings, for instance temperature and humidity. The client and the ESCO define these specific agreements into an energy performance contract. If the ESCO does not meet these agreed levels, due to a technical failure of the implemented energy savings measures for instance, the ESCO will not receive full remuneration because the target of the KPI is not met (De Boer, 2011).

5.2 Other energy service contracting models

Other types of EPC contracts: First Out and Boot

First out is a contract type in which the ESCO is paid 100% of the energy savings until the project costs, including a pre-defined amount of ECSO profit, are fully paid. The exact duration of the contract thus depends on the level of achieved savings; the greater the savings, the short the contract. After the contract had ended, the customer benefits from the achieved energy savings (Marino, Bertoldi, & Rezessy, 2010). Boot contract, Build-Own-Operate-Transfer (BOOT) contract, is a funding model which involves an organisation/consortium in designing, building, funding, owning and operating the scheme for a defined period of time and then transferring this ownership to agreed party (Marino, Bertoldi, & Rezessy, 2010).

Delivery contracting

In contrast to EPC, and ESCO could also be focused on the supply of a set of energy services mainly via outsourcing the energy supply. Delivery contracting is also known as energy supply contracting or contract energy management (Marino, Bertoldi, & Rezessy, 2010).

Energy Supply Contracting (ESP)/Contract Energy Management (CEM)

With energy supply contracting (ESC) 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, e.g. boiler room. It can also be applied to energy supply from renewable, like solar photovoltaic or solar thermal energy. ESC contracting is also known as contract energy management (CEM). (Bleyl-Androschin & Ungerböck, What is energy contracting (ESCO services)? Concept, definition, two basic business model., 2009).

Chauffage

Chauffage is also a form of delivery contracting and is a most common contract in France. Chauffage is a contract type where an ESCO takes over the complete responsibility for the provision of an agreed set of energy services. The concept offers for instance, conditioned space at a specified price per energy unit to be consumed or per some measurable criteria through a supply and demand contract offered by the ESCO. The ESCO manages all supply and demand efficiencies. The remuneration of the ESCO is normally based on the client’s existing energy bill minus a certain percentage of the savings. Thus, the client is guaranteed and immediate saving compared to its current bill and the profit of the ESCO is directly depending on the level of savings they achieve. This is a reason why chauffage give a strong incentive to provide services in an efficient manner. The ESCO may also take over the purchase of fuel and electricity (International Finance Corporation, 2011)

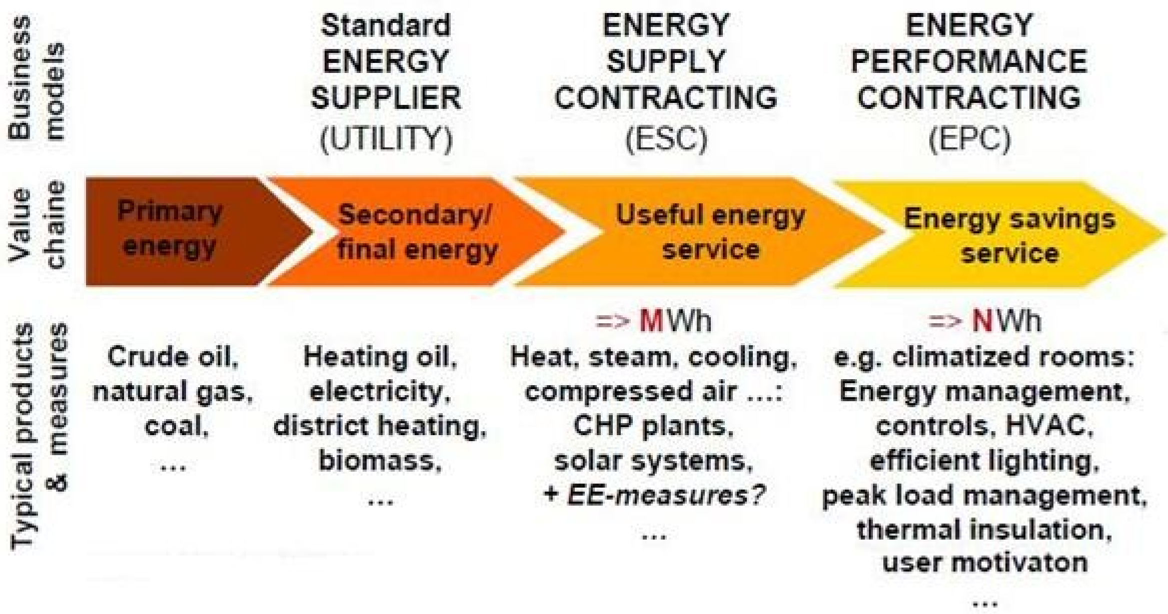

Figure 4: Examples of energy services by EPC and ESC (Bleyl-Androschin & Ungerböck, 2009)

EPC versus ESC

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 (Bleyl-Androschin & Ungerböck, 2009). To make the differences clear, when using an EPC the focus is on reducing the final energy consumption through applying demand-side energy efficiency measures. The biggest disadvantage of EPC is that in advance a cost or energy baseline has to be determined, and during the real-time energy savings have to be measured and verified. Consequently, the overhead costs of EPC projects are relatively high (Bleyl-Androschin, 2010). When applying an energy supply contract (ESC), the ESCO focuses on the efficient supply of useful energy such as heat, steam, or compressed air and the performance is measured in megawatt hours delivered. Usually, the model includes the purchasing of fuels and is comparable to district heating or cogeneration supply contracts. So, the focus of ESC is limited to the energy supply-side, and the focus of an EPC is on the energy demand-side (Bleyl-Androschin, 2010).

5.3 Ways of Financing Energy Services

Practical experience has shown that financing by a third party often plays a decisive role when using an EPC. However, it has to be taken into account that EPC does not necessarily need third party financing. EPC also work when the client takes over financing and the ESCO carries out the design, implementation, and operation of the energy efficiency investment. Financing is often offered as an additional motivation for the client. For this purpose, ESCO co-operate intensively with a banking partner and/or national investment banks (Seefeldt, 2003).

In general three broad financing options for financing energy efficiency improvements can be distinguished (Bertoldi, Rezessy, & Vine, 2006):

Customer Financing/energy- user

Energy-user/customer financing usually involves financing with internal funds of the user/customer backed by an energy savings guarantee provided by the ESCO. Energy-user/customer financing may also be associated with borrowing in the case when the energy-user/customer as a direct borrower has to provide a guarantee to the finance institution. Such an arrangement is no longer related to EPC because the key element of an EPC, namely the provision of a performance guarantee, is missing (Bertoldi, Rezessy, & Vine, 2006).

ESCO financing

This type of financing refers to financing with internal funds of the ESCO and may involve own capital or equipment lease (Bertoldi, Rezessy, & Vine, 2006). The factors that determine how ESCO's will provide financing are (Hansen, Langlois, & Bertoldi, 2009):

- Local practices
- The inability of customers to meet financiers' creditworthiness criteria
- Costs of equity financing

Small and/or under-capitalized ESCO's that cannot borrow significant amounts of money from the financial markets believe that their role is not to finance energy efficiency investment.

Third Party Financing

This third type of financing refers solely to debt financing. Third party financing (TPF) is a contractual arrangement involving a third party (in addition to the ESCO and the beneficiary of the energy saving measures that provides the capital for the measures, and charges the beneficiary a fee equivalent to a part of the energy savings achieved as a result of the energy efficiency improvement measure (Marino, Bertoldi, & Rezessy, 2010).

There are two conceptual different TPF arrangements, whereby the key difference between them is the party who borrows the money, the ESCO or the client:

- Shared Savings: In this arrangement an ESCO may borrow the financial sources necessary for project implementation.
- Guaranteed Savings: In the second arrangement the customer takes a loan from a financial institution back by an energy savings guarantee agreement with the ESCO. The purpose of the savings guarantee is to demonstrate to the bank that the ESCO project will generate a positive cash flow, so that the savings achieved will certainly cover the debt repayment.

  In a guaranteed savings contract, ESCO's assume financial responsibility for the project's technical risk, which allow customers and financiers to enter into agreements for which risks would otherwise be deemed too great or (Goldman, Hopper, & Osborn, 2005).

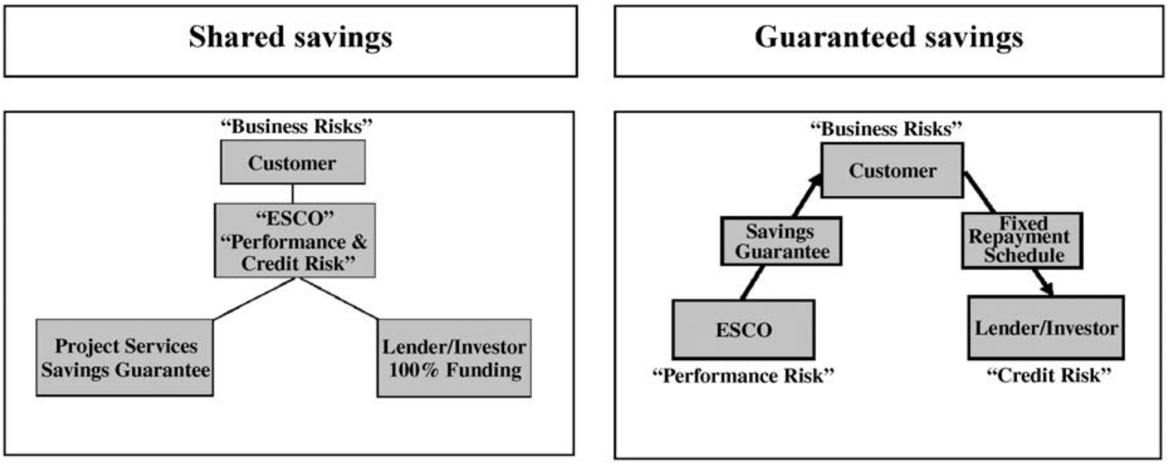

Figure 5: Guaranteed savings and shared saving model (Dreessen, 2003)

An important advantage of TPF is that in effect the ESCO client is safeguarded from financial risks related to the project technical performance because the guarantee given to the financial institution either comes from the project value itself or is on the balance sheet of the ESCO (Climate Technology Initiative, 2003). Large ESCO's with deep pockets and hence high credit ratings start to prefer TPF to own financing because the costs of equity financing and long-term financing are too high: the weighed capital cost for internal funds are often much greater than what can be accessed on the financial markets. When an ESCO arranges third party financing for the customer, then its own risk decreases. This allows the ESCO a lower cost of money and hence higher size of the investment (Hansen, Langlois, & Bertoldi, 2009). The general rule states that the larger the borrower, and the longer its credit history, the cheaper borrowing money from a financial institution become (Bertoldi, Rezessy, & Vine, 2006).

Because under a guaranteed savings contract the ESCO takes over het entire performance risk; it is unlikely to be willing to further assume credit risk; consequently TPF rarely goes along with guaranteed savings contract. The customers are financed directly by the banks or by a financing agency. Therefore the customer repays the loan and the credit risk stays with the lender (Dreessen, 2003). This scheme is likely to function properly only in countries with a well-established banking structure with a high degree of familiarity of project financing and sufficient technological expertise, so energy efficiency projects are understand well (Bertoldi, Rezessy, & Vine, 2006).

6. The German ESCO market

This chapter will begin with a description of the ESCO market in Germany. Herein a brief overview of the history of the German ESCO market will be given, followed by the most important characteristics of the market, e.g. markets size, type of ESCO's, targeted sectors, energy service contracts used, etc. After this is mentioned, the reader has obtained a basic understanding of the ESCO market. Thereafter the success factors can be given. These success factors are categorized into three different groups: government regulation, stimulation measures and ESCO sector initiates. Conclusions about the development of the ESCO market will be given in the final section.

6.1 Description of the German ESCO market

In the beginning and middle of the 1990's, only very few ESCO projects were initiated by a few selected ESCO's, mostly through 'informal' EPC contracting. In that times only a limited number of ESCO projects were initiated, no standard documents were available, and doubt about the trustworthiness of ESCO's, their reliability and the correct value of contracts hindered the sector in Germany (Seefeldt, 2003). There was a young and growing market of heat supply contracting, meaning a simpler case of energy services, focussing on heat supply (combined with electricity supply in case of micro CHP). Despite, energy supply contracting was already a common activity, building owners where hesitating to approach the EPC offers made by few existing contractors for EPC in the market. They did not know whether offers where trustworthy, whether submitted contracts where legally reliable. Transparency, procedural and contractual security and the economic evaluation of EPC offers where the main barriers for the EPC market (Seefeldt, 2003)

In 1995 the establishment of the Energy Saving Partnership (ESP) in Berlin is considered an important step in establishing the energy efficiency market in the public sector in Germany (Geissler & Waldmann, 2006). Under the ESP scheme buildings are bundled into pools in order to decrease transaction costs and reducing risk for ESCO's. By 2006, 21 pools had been contracted by ESCO's encompassing over 1300 buildings altogether (Berliner Energieagentur GmbH, 2008)

ESCO market size & type of energy service contracting

The German ESCO market is the most established energy service industry in Europe (Seefeldt, 2003). For 2005, the overall number of ESCO's and ESCO-like companies is still estimated to be around 500 (Brand & Geissler, 2003), (Bertoldi, Rezessy, & Vine, 2006). The majority of these companies offer energy supply contracting (particularly heat delivery services) and operations contracting.

The number of companies offering services through Energy Performance Contracting is only a fraction of the total figure, around 50, and ESCO's with more than one reference EPC project are in the range of 20. In 2008, around 750 million euro has been invested in EPC projects.

The background of ESCO is fairly diverse, ranging from subsidiaries of large utilities and former municipal utilities to equipment suppliers, contraction companies, and engineering and consulting firms (Bertoli, Bozza-Kiss, & Rezessy, 2007). Many ESCO's in Germany focus on heating improvements, i.e. 85% of all ESCO's contracts mainly deal with heating improvements (Ürge-Vorsatz, et al., 2007). Therefore, most projects are carried out through ESC, where ESC is among others used as a supplementary service in facility management. Guaranteed savings, where the ESCO guarantee the savings and the clients take the financial risk is predominately used. Guaranteed saving contract are thereafter the most commonly used contractual types. BOOT contracts with and without guarantee elements are also less commonly used (Marino, Bertoldi, & Rezessy, 2010).

German ESCO industry

Small and large local companies, including former municipal utilities and multinational companies, are active on the market. Furthermore, the four largest energy companies all have daughter companies carrying out various contracting activities, of which one is particularly active in the energy performance business (Bertoli, Bozza-Kiss, & Rezessy, 2007). EPC is a core product of several companies or an expedient supplement to their service portfolio. The market shares of different ESCO's are approximately as follows in 2010 (Marino, Bertoldi, & Rezessy, 2010):

- Energy suppliers 66% market share (regional and association suppliers 17%, municipal energy suppliers 19% and other energy suppliers 30%)
- Building equipment and control manufactures 26 % market share
- Energy agencies 4% market share
- Other 4% market shares are metering companies, providing metering and billing of energy consumption in the residential housing sector. They are also involved in ESCO projects

Sectors Targeted by ESCO's

The sectors targeted by ESCO's in the German market are the following (Vine, 2005):

Municipal sector: 30 %
Industrial sector: 35 %
Commercial sector: 25%
Residential sector: 10%

Regional project hot-spots can be found in the German areas of Baden-Württemberg, Bavaria, Berlin and Hessen. These hot-spots have a role model effect on its surrounding regions in Germany (Berliner Energieagentur GmbH, 2008).

Table 3: Overview of the German ESCO market key characteristics in 2010 (Marino, Bertoldi, & Rezessy, 2010)

Number of ESCO's	250- 500 (100 smaller actors)
Size of the market (turnover)	1,7 – 2,4 billion €/year
ESCO contracts used	ESC (85%), EPC (15%)
ESCO Association	Association of Heat Supply, (Verband für Wärmelieferung) ESCO Forum
Type of ESCO's	Energy suppliers & manufacturers of building automation and control systems
Targeted sectors and most common measures	Public and private non residential building projects Cogeneration, district heating and renewable energy

6.2 Success factors

Government regulation

Energy taxes

Since 1999 the German government has increased energy prices by taxation substantially and accounted in 2006 for instance approximately 35% of the total industrial electricity price. This, combined with the rising oil and gas prices, is an important incentive for companies to care about the energy efficiency and thus engage in ESCO services. The steady rise in energy taxes has improved the payback time of energy efficiency investments and increased the importance of energy efficiency in cost competition. Some ESCO's even consider the energy taxes as the most important political support measure of all (Ürge-Vorsatz, et al., 2007).

Supportive measures

Public-Private-Partnership

For the public sector the model of Public-Private-Partnership (PPP) is considered to be one of the most effective tools to enhance the energy efficiency in the public building sector. It helps to accelerate the upgrade of public buildings. Crucial point for the market uptake of this model is the creation of demand in the public sector. This is including the political acceptance of private sector involvement in prior duties, trust from the private sector in doing business with the regional and local level in the new member states, trust form the financial institutions in the model, the contracting partners and the applied risk mitigation measures (Geissler & Waldmann, 2006).

Successful demonstration projects & bundling of public buildings

The energy Saving Partnership (ESP) in Berlin was a very positive and visible starting signal for the ESCO industry, since it created a demand for energy performance contracting from the public sector (Seefeldt, 2003). The ESP was developed by the Berlin Energy Agency and the Berlin State during the 1990's. The model offers effective refurbishment of public and private buildings with the pivotal advantage to release the building owner of any investment costs. An accredited ESCO (accredited by the BEA), which is determined by tendering, finances and implement appropriate energy saving investments to achieve pre-defined energy and costs reductions. In their bids, ESCO put together their investments targeted at delivering specified energy savings and respective CO2-reductions (Lamers, Kuhn, & Krechting, 2008). The bundling of about 100 buildings in the capital turned out to be helpful in minimizing transaction costs, thereby reducing the risk for the ESCO. Bundling also reduces the incentives for cherry-picking because also the less attractive buildings for energy efficiency investment can be included.

In 2003, in the city of Berlin alone, 1500 public buildings had been contracted by ESCO's. Since 1995, these involve 11 EPC contracts and annual total guaranteed savings of about 6 million euro. The Berlin best practice examples disseminated the positive result, mainly to the tertiary sectors: university, hospitals, swimming pools, hospitals, hotels, to residential buildings. This significantly increased the demand for ESCO's projects (Seefeldt, 2003).

A follow-up scheme of the ESP, called Energy Saving Partnership Plus is being set up. This scheme is to embrace building and construction measures, including for instance heat insulation, and window replacement. The scheme is based on the existing one and expands its application by also including work on the building shell, instead of the typical focus on energy system improvements.

Standard procedures and documents

A vital step for the evolution of the ESCO industry was the establishment of standard procedures and documents such as models contracts, an energy performance retrofitting model and a standard procurement procedure as well as contracting guidelines by the federal states of Hessen and Berlin. In the contract models, the following agreements have been implemented:

- Guaranteed performance
- Functional description of the service programme
- Definition of service and comfort levels
- Remuneration model (participation model, payments)

Experience has shown the acceptance of an EPC scheme is much higher when standards are available. Standard contract terms can help both end users and the financial community better understand performance contracting (Vine, 2005). However, this does not necessarily mean that the negotiated contacts are all looking the same. An existing model contract can be adapted to the requirements of the building owner, for instance technical interfaces, co-operation model, risk sharing model (Seefeldt, 2003). There are approximately 7 different model contracts in Germany. Although many ESCOs prefer not to be bound to such standard contracts, they are very important for customers in order to increase trust (Ürge-Vorsatz, et al., 2007).

Energy Agencies

The energy agencies in Germany at national, regional and local levels (such as the Berlin Energy Agency) are acting as a neutral market actor and play an important role as mediator between ESCO's and clients, especially for the public sector. They are acting as a neutral market actor. The energy agencies carry-out energy efficiency checks, help contract negotiations or provide model contracts. They also provide consultancy, practical support and a broad technical background to buildings owners. The provide guidelines for gathering baseline information. They support during the procurement process and in the commissioning and post implementation phases (Singh, et al., 2010). They are key actors for the dissemination of positive result and lessons learned by ESCO's in Germany (Seefeldt, 2003).

The German national energy agency supports public institutions in implementing EPC through the elaboration of guidelines, advices and project advertisement. The agency also established an electronic platform where public institutions tender and come in contact with ESCO's (Ürge-Vorsatz, et al., 2007).

The Berlin energy agency has been among the front-runners in Germany to promote a growth of the local ESCO market in Berlin. The agency is a private ESCO established in 1992 on the initiative of the House of Representatives to open up energy savings potential and the use of renewable energies. Equal shareholders are the State of Berlin, Vattenfall Warme AG, GASAG Berliner (Gaswerkte Aktien Gesellschaft) and KfW banking group. As part of our three business divisions Consulting, Contracting and International Know-how Transfer the BEA develop and realize innovative projects that reduce high energy costs as well as CO_2 emissions (Berliner Energieagentur, 2012). Good examples of this is the development and implementation of the Energy Savings Partnership in Berlin, which is guided by the BEA and has become a national and international role model for the realisation of ambitious objectives for climate protection and energy cost reduction under tight budgetary restrictions (Lamers, Kuhn, & Krechting, 2008). Additionally, all municipal institutions are allowed to address the experts of the Berlin Energy Agency to get their EPC projects defined and to get assistance for the procurement. The negotiation and final recommendations as well as the assignment of the contract are carried out by the experts of the BEA. Besides these activities, the BEA also performs an accreditation for ESCO's by using quality labelling. This ensures trust for the ESCO clients in the German market (Seefeldt, 2003).

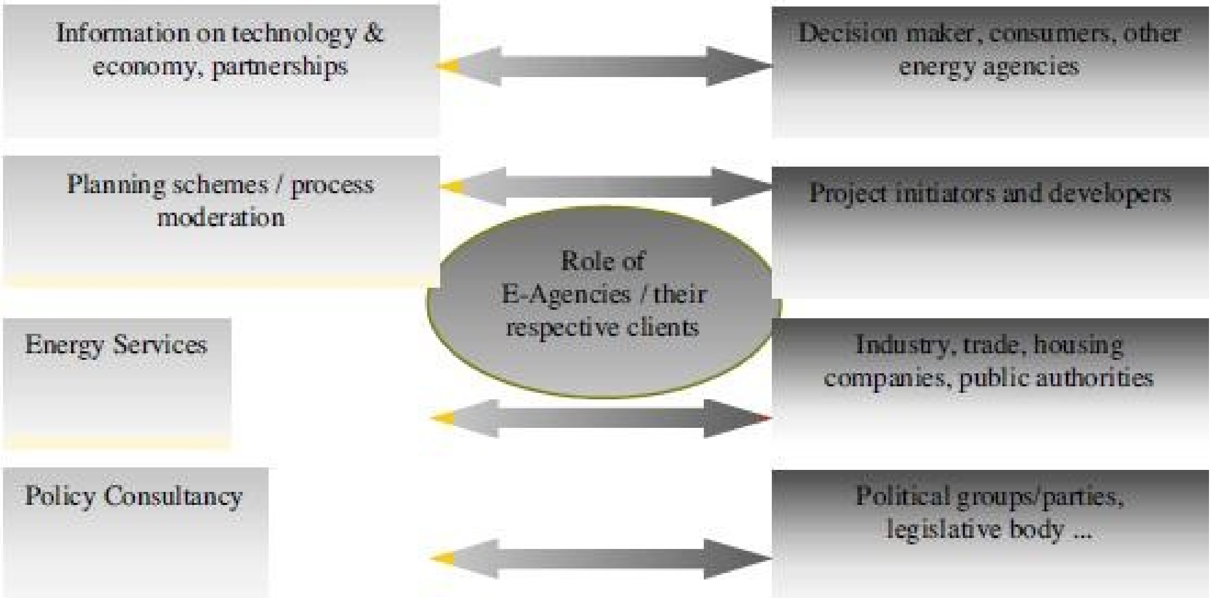

Figure 6: The role of energy agencies in Germany (Seefeldt, 2003)

Government's funding and the ease of third party financing

The choice of source for financing of ESCO projects depends on the project type. All government's funding is managed by the Kreditanstalt für Wiederaufbau (KfW) banking group (in English: Credit Institute for Reconstruction). KfW is a non-profit banking group owned by the government (80%) and the states (federal subdivisions) of Germany (20%). The KfW raises funds from the financial markets and transfers this capital, via commercial banks, to program applicants in the form of lower interest loans. The funding programs target around 95% of existing buildings in Germany. It does not accord loans or any sort of financial product directly to the investor (some public applicants are exception), but to credit institutes (Marino, Bertoldi, & Rezessy, 2010).

A second main determinant of ESCO financing is the ease of arranging third party financing by ESCO's and its clients. Third party financing is widely used in Germany, because of the high investment volume and the favourable banking system in place (Ürge-Vorsatz, et al., 2007).

ESCO Sector initiatives

ESCO Associations

In Germany there are two associations of ESCO's helping the ESCO sector via a range of activities, namely the ESCO Forum and 'Verband fur Warmelieferung (Vfw) (in English: Association for heat suppliers).

The ESCO Forum represents the larger ESCO's. Among these are subsidiaries of Germany's multinational energy companies, big heating and building control equipment retailers and also some big public service companies (Bunse, et al., 2010). These ESCO's focus mainly on commercial and industrial clients in the the private sector. At 2009 the association had 26 members. ESCO Forum provides information to its members and is engaged in political lobbying in order to improve the conditions for ESCO's in Germany (Ürge-Vorsatz, et al., 2007).

The second association is the Association for Heat Supply (Verband für Wärmelieferung), an association for the smaller heat delivery service suppliers. Among the members of the VfW are mostly installers/suppliers of heating systems, public service companies and building control equipment retailers. This association had in 2009 255 members, of which 80 conduct energy supply contacting project that in principle can include energy efficiency measures (Bunse, et al., 2010). The VfW association provides its members with information, technical support, political lobbying, and education through seminars and suchlike (Ürge-Vorsatz, et al., 2007).

6.3 Conclusion

The relative success of the ESCO industry in Germany is due to several factors, but owes primarily to political decisions (Ürge-Vorsatz, et al., 2007) and supportive measures by the government. The German government have made a lot of regulation which is beneficial for the German ESCO industry. The most obvious and also the simplest one is the increase of energy prices since 1999 by increasing the energy taxes. This regulation has made energy efficiency projects of ESCO much more economically sound. Some ESCO even consider this regulation has the most effective one of all.

Besides regulation, the German government has contributed to a clear and visible start signal of the ESCO industry. The Energy Savings Partnership project in Berlin became this visible starting signal and created an attractive demand for ESCO's by bundling about a hundred public buildings, which could be perceived in the whole federal republic (Seefeldt, 2003). The implementation of a large number of municipal projects along with public-private partnerships also had a strong demonstration effect by introducing the ESCO en EPC concepts on the market. It was important that this signal was sent out by the demand side: the ESCO's should 'smell' projects with a comparably high potential. The success of the German ESCO industry has shown that demonstration projects in the public sector, such as the Berlin Energy Savings Partnership, bundling of buildings can be crucial to raise awareness and increase trust in EPC among potential customers. The Berlin Energy agency also established standardization by model contract and measurement and verification procedures. The German government makes financing easier by its public banking group called ‘Kreditanstalt für Wiederaufbau’. The KfW raises funds from the financial markets and transfers this capital, via commercial banks, to program applicants in the form of lower interest loans. The funding programs target around 95% of existing buildings in Germany.

The German ESCO sectors itself also created an important success factor by establishing ESCO associations. The two existing ESCO associations provide information to its member and technical support. But also is engaged in political lobbying and provides education and information about ESCO business and services to potential ESCO clients. The German successful development of the market might also be the result of the existence of a large number of competing energy service providers on the market, such as municipal utilities (Stadtwerke), manufacturers of building automation & control systems and independent players as energy agencies. (Bertoli, Bozza-Kiss, & Rezessy, 2007)

7. The French ESCO market

This chapter will begin with a description of the ESCO market in France. Herein a brief overview of the history of the French ESCO market will be given, followed by the most important characteristics of the market, e.g. markets size, type of markets players and customers groups, energy contracts used, etc. After the reader has obtained a basic understanding of the ESCO market the success factors can be given, whereby they can be seen in the right context. These success factors are categorized into three different groups: government regulation, stimulation measures and ESCO sector initiates. Conclusions about the development of the ESCO market are given in the final section.

7.1 Description of the French ESCO Market

Energy services in the form of outsourcing public services in France dates back into the 19th century. The success of these and other 'delegated management' services financially strengthened the private companies involved in these businesses, thus creating the basis of the oldest French ESCO model. Traditionally, 'the contract of operation' model dominates the French ESCO market. The French ESCO market cannot be fully associated with the definitions usually applied elsewhere. Originally it was based on the combined operation and maintenance contract of HVAC systems (Hansen, Langlois, & Bertoldi, 2009).

Clients in the private sector applied the above contract type, but also become more flexible. The first formalized contact including third party financing was signed in 1983. This was primarily for financing energy saving investments and to overcome client's aversion to the high perceived risk of improvements that in reality were cost-effective, but not acknowledge as such by the clients. This model did not particularly spread in France due to the strength of the traditional 'contract of operation' mode.

Due to the historical developments described above, traditionally clients of ESCO's where derived from the tertiary sector, and later from the industry sector. Experts increasingly focus on industrial and residential projects In recent years, while the public sector is still the primary client of facility management contracts.

French ESCO industry

The ESCO's in the French market is characterized by a strong concentration of large companies, subsidiaries of national and international companies, having energy services as their core business or as a supplementary business. The following eight companies are the active actors on the market, and are able to offer complex solutions (Marino, Bertoldi, & Rezessy, 2010):

- facility management and operation companies (Dalkia and Cofely)
- Building controls and equipment manufacturers (Siemens, Honeywell, Schneider Electric and Johnson Controls)
- Utility companies (EDF and GDF-Suez)

New actors on the market are big installers providing financing in addition to traditional HVAC services (Hansen, Langlois, & Bertoldi, 2009).

ESCO contracts used

The French ESCO market cannot be fully associated with the ESCO definitions usually applied in other markets in the EU. Originally energy services were based on the combined operation and maintenance contract of HVAC systems. This type of contract is typically defined as 'chauffage' or 'contract energy management'. This contract includes operation without explicitly committing to carrying out energy efficiency investments. Under a chauffage contract, the contractor ensures optimal operation of an already existing system and must provide an agreed comfort level at a lower cost for the client. The contractor can increase its profits by investing in more energy saving equipment or by procuring cheaper fuel, thus reducing the costs. These types of contracts in France are usually long-term and include the obligation to diagnose problems and identify needs for improvement in the system, and a stimulus to carry out the investment, due to their dual nature (Hansen, Langlois, & Bertoldi, 2009)

The most frequent ESCO contracts are still the first generation of chauffage contracts, based on operations contracting, with extensions. Operating contract involve heating and air conditioning installations for which the service provider has a firm commitment; undertaking a temperature level to be guaranteed for the heating of premises. The services provider is responsible for supplying the resources, which he considers necessary in order to achieve a specific result. The four different contracts differ in the share of the investment assumed by the ESCO and the duration of the contract, which in turn depends on the value of the guaranteed energy savings. The contractual agreements are (Hansen, Langlois, & Bertoldi, 2009):

1. Supply of energy, without explicit incentives.
2. Control and routine maintenance of installations delivered with a full guarantee.
3. Major maintenance and renewal of equipment. The building owner pays a fixed annual fee depending on the age and condition of the installations in exchange for the operator replacing all or part of any defective equipment during the term of the contract.
4. New equipment funding and investment depreciation.

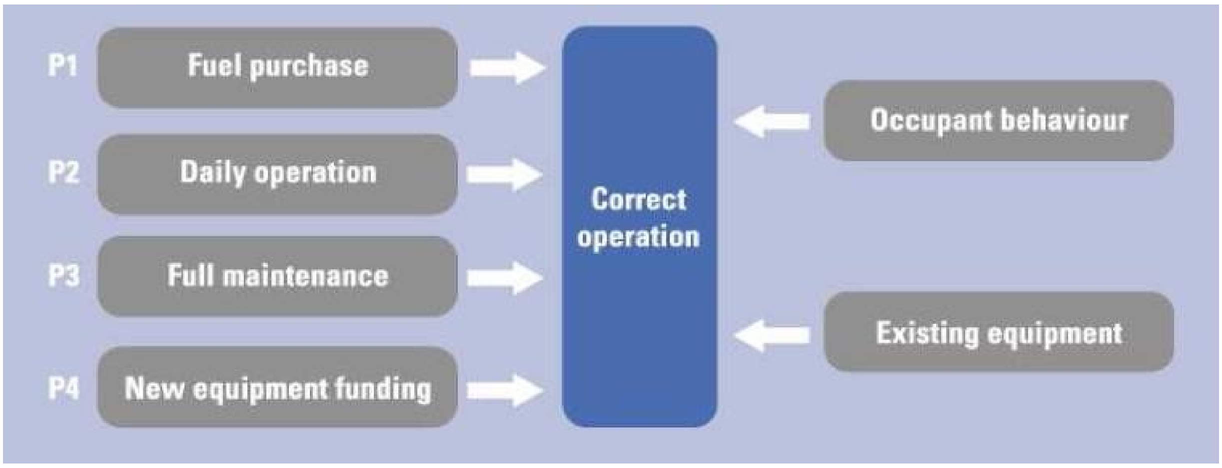

Figure 7: French contract of operations model (Berliner Energieagentur, 2008)

New types of contracts are now being used, like EPC. Guaranteed saving contracts are increasingly popular since the year 2008 (Marino, Bertoldi, & Rezessy, 2010). A second developing contractual arrangement is the Public-Private-Partnerships (PPP), which contains a specific award procedure. PPPs allow performance targets to be introduced into the letter of tender such as the level of energy consumption (Hansen, Langlois, & Bertoldi, 2009).

Targeted sectors

The public sector remains the primary client for energy service contracts. However, in recent year an increasing activity has been seen in the industrial and residential sectors. It is expected that the private sector becomes more interesting because of the white certificates scheme that is implemented (Hansen, Langlois, & Bertoldi, 2009).

Table 4: Overview of the French ESCO market key characteristics in 2010 (Marino, Bertoldi, & Rezessy, 2010)

Number of ESCO's	10 (big actors) (100 smaller actors)
Size of the market (turnover)	4-5 billion €
ESCO contracts used	Chauffage, EPC
ESCO Association	Association of Energy Efficiency Service Companies (Club des Services d'Efficacité Energétique, CS2E)
Type of ESCO's	Facility management and operation companies, manufacturers of building automation & control systems
Targeted ESCO sectors	Public buildings and private non-residential buildings

7.2 Critical Success factors

Government regulation

White Certificates

In France there is a white certificate scheme in place since July 2006. For each period of 3 years, French public authorities define a certain amount of savings to be generated. It places an obligation on suppliers of electricity, gas, domestic fuel (but not for transport), LPG, cooling and heat to save energy in the residential and commercial markets. White certificates where a key part of the French EE policy to reduce energy intensity by 2% per year until 2015 and then by 2.5% until 2030. It particularly was designed to focus on the more diffuse potentials of energy savings in the residential and tertiary sectors and was intended to provide a new means of financing energy efficiency projects in these sectors (Ürge-Vorsatz, et al., 2007). The French White Certificates are intended to encourage the efficient use of energy in a liberalized market. Additionally, it hopes to encourage the development of the energy service approach (Marino, Bertoldi, & Rezessy, 2010).

In the first obligation period obliged actors have received targets based on a combination of their physical energy and value of sales in the residential and commercial sectors. They were based on turnover (75%) and market shares of energy sales (25%) in the residential and tertiary sectors. For instance, the utility company Electricity de France (EDF) accounted for approximately 55% of the obligation and Gas de France SUEZ (GDF SUEZ) for 26 %. In principle, the apportionment of the total

target is done on annual basis to take into account new market players and variation in sales volumes/customer market shares (Marino, Bertoldi, & Rezessy, 2010).
Despite the existence of a white certificates scheme in France, white certificates are of no advantage to ESCO's. This is because they don't have the right to claim the certificates produced within their projects, and therefore there is no additional source of revenue for them (Intelligent Energy Europe, 2011)

Law concerning financing energy efficiency projects

The French law enforces the banks to finance EE project by spending a part of the money saved by people in 'sustainable development' saving accounts. These saving account are particularly attractive for people because rates are guaranteed and interesting whereas money remains available. As the amounts earned are largely higher than the retribution they have to give back to people, banks are obliged to finance energy efficiency projects (Adnot, et al., 2010).

CO2 TAX

The CO2 tax (Contribution Climat Energie) results in increasing costs of fuels which thus improve the cost-efficiency of some energy efficiency investments in any sector not already covered by the EU ETS (Adnot, et al., 2010).

Building code (Réglementation Thermique)

The building code, called 'Réglementation Thermique', sets minimal energy efficiency requirement standards in case of a construction, extension or refurbishment of a building. The policy is revised every 5 years and simulates the demand of EE equipment and services (Adnot, et al., 2010).

Action plan 'Grenelle de l'Environnement'

Action plan 'Grenelle de l'Environnement' is developed in 2007 through a discussion with business, local communities, unions, and associations organized by the French government. The action plan includes policy objectives, information campaigns and financial instruments (Marino, Bertoldi, & Rezessy, 2010). The name 'Grennelle' comes from the first conference bringing all these players together which took place in May 1968 in the Rue de Grennelle (Ministère de l'Ecologie, du Développement durable et de l'Energie, 2012)
The action plan contains a number of policy objectives concerning the residential sector have been introduced, including buildings consumption of existing buildings by reduced 38% by 2020 in comparison to 2008, refurbishing 250 million m2 of residential buildings by 2018 achieving a reduction of 40% of the energy consumption and 50% of the GHG emissions and limiting the primary energy consumption of new buildings and 50% of the GHG emissions. Also the action plan set a lit to the primary energy consumption for new buildings to 50 kWh m2/year. The French Governments action plan 'Grenelle de l'Environnement' (Environment Round Table) is recognised as one the strongest driving factors for the ESCO market (Marino, Bertoldi, & Rezessy, 2010).

Supportive measures

Public-Private-Partnership (PPP)

The French government introduced the concept of public-private-partnership (PPP). PPP is a contractual arrangement and it is being used in the public sector. It is changing the investment funding context since PPPs allow performance targets to be introduced into the letter of tender such as the level of energy consumption to be attained. The public establishment involves a third party in the funding, design, production, conversion, operation or maintenance of public equipment, or with the funding and management of services (Hansen, Langlois, & Bertoldi, 2009). The PPP is for many public authorities an ideal way to contract for savings in the public sector, since in energy contracting the ESCO identifies and develops energy efficiency projects in energy consuming sites, finance them, operates and maintains (Singh, et al., 2010).

Funding by Governments support

FOGIME (Fonds de Garantie des Investissements de Maîtrise de l'Energie) is a crediting guarantee fund for investments in sustainable energy and renewable energy sources in the private sector. The crediting system is cooperation between ADEME and the French development bank (Bertoli, Bozza-Kiss, & Rezessy, 2007). FIDEME (Fonds d'Intervention pour l'Environnement et la Maitrise de l'Energie) is an investment fund to support private investors in environment and energy efficiency investments (Marino, Bertoldi, & Rezessy, 2010).

French Energy Agency

ADEME, the French Environment and energy management agency, is the national energy agency in France. The agency supports (with subsidies) energy diagnoses or audits. These diagnoses compete with ESCO diagnoses in theory, since both of them provide the customer with a lot of information on its equipments, their energy consumption and the possible EE improvements to apply. But the benefit is that, on the basis of an energy audit, the French energy agency can assist the customer in writing the call for tenders and selecting the best ESCO to implement the energy efficiency improvements in the client's building (Adnot, et al., 2010).

Furthermore, ADEME uses certification for new building and buildings which are for sale with energy and CO_2 rating. Through the program, called 'Espace Info-Energie' ADEME promotes energy advices, supported by association and/or local authorities, committing themselves to give free information to the general public about energy efficiency and renewable energy and to be independent towards energy suppliers (Marino, Bertoldi, & Rezessy, 2010).

ESCO Sector initiatives

ESCO Association

An important element in the development of the French ESCO market in the last couple of years is the establishment of the French ESCO association called Energy Efficiency Services Club (Club S2E) (Club des Services d'Efficacité Energétique), which was founded in November 2005 by 5 main professional associations in the ESCO market with the support of the French energy agency ADEME (Berliner Energieagentur GmbH, 2008). Club S2E aims at promoting good practice in the field of energy efficiency services (Club S2E, 2012).

Club S2E was established as the place where the different actors of EPC can work together on federal subjects, such as models of procedure for tendering process, definition of common methodology for measuring and evaluating the energy guarantees of EPC, all this will contribute to securing the contracts and so the developing further EPC market in France. Club 2SE is working on standardised M & V methodologies (Berliner Energieagentur GmbH, 2008) and involved in the development of models of Energy Performance Contracting (EPC) (Club S2E, 2012). Club S2E consists of member of the following professional associations with co-founded Club S2E (Berliner Energieagentur GmbH, 2008):

- FG3E, the French Federation of firms offering services dealing with equipment, energy and environment
- GIMELEC, a group of firms manufacturing electric equipment, control and related services
- SERCE, the Union of Companies dealing with electrical engineering
- UCF, the union of companies dealing with environmental engineering, as a part of the French federation of building
- UFE, the French Union of Electricity, professional association of the electric sector

7.3 Conclusion

The French ESCO market has a long history with energy service contracting, namely by chauffage contracting. EPC was known much later, in the 1990's. During the last years, the French situation has evolved and could be more favourable for EPC development in the future.

The French government maintains strict regulation concerning energy efficiency in buildings. In the Grenelle de l'Environnement action plan, one of the strongest driving factors for the market growth, ambitious policy objectives concerning energy efficiency in buildings are set for the coming decade. Other governmental regulation striving to increase energy efficiency such as the white certificates have had a lower impact on the market, since the framework conditions of the scheme are not favourable for ESCO businesses. Furthermore, the French law enforces banks to financing energy efficiency projects, the buildings code 'Réglementation Thermique' sets minimal energy efficiency requirement standards in case of a construction, extension or refurbishment of a building and the CO2 tax increases the price of fuels which makes ESCO projects more economically attractive for clients.
Supportive measures have been set by either the French energy agency ADEME as well as the French ESCO association club S2E. Thanks to the work of the national energy agency (ADEME) with the Grenelle programme, a recent progress has been noticed in the public sector by creating a market in the public sector with PPPs and private investments. ADEME also supports building owners by conducting energy audits for them and writing the call for tenders and selecting the best ESCO to implement the energy efficiency improvements in the client's building. The main initiative of the French ESCO sector is the establishment of a national ESCO association called 'Club S2E'. The association standardizes M & V methodologies (Berliner Energieagentur GmbH, 2008) and is involved in the development of models for Energy Performance Contracting (EPC)

8. The Austrian ESCO market

This chapter will begin with a description of the ESCO market in Austria. Herein a brief overview of the history of the Austrian ESCO market will be given, followed by the most important characteristics of the market, e.g. markets size, type of markets players and customers groups, energy contracts used, etc. After this is mentioned, the reader has obtained a basic understanding of the ESCO market. Thereafter the success factors can be given, whereby they can be seen in the right context. These success factors are categorized into three different groups: government regulation, supportive measures and ESCO sector initiates. Conclusions about the development of the ESCO market are given in the final section.

8.1 Austrian ESCO market description

Austria is another success story of the ESCO industry in Europe Union, particularly the fast uptake is an exemplary case for the rest of Europe. The ESCO market in Austria saw a rather late commencement. The level of the ESCO market was nearly zero in 1998, while for instance the German and French ESCO market has already developed significantly. With a quick take-off in less than a decade, Austria has obtained a developed ESCO market and its take-off phase is an example for every undeveloped ESCO market (Geissler & Waldmann, 2006).

Austrian ESCO Industry

As of 2009, about 10 local and multinational ESCOs are operating on the Austrian market. Most companies are utilities or building technology companies, where the ESCO division counts 10-15 persons. The typical company works in an area where the know-how and reputation in the core business can be used when offering energy performance contracting. According to Austrian association of ESCO's DECA, 3 market actors are building technology companies while 4 are part or subsidiary of a utility company (Marino, Bertoldi, & Rezessy, 2010).

The ESCO's that are active on the Austrian ESCO market have developed from the different starting positions (Seefeldt, 2003):

1. Some international companies from the building techniques industry;
2. A few civil engineers, that cover the energy planning and management aspect of the business and engage subcontractors from the operational work;
3. A limited number of utilities has developed towards the energy service concept and is offering ESCO services.

Targeted Sectors

The great majority of the EPC contracts until now have been concluded in the public sector, namely in federal and municipal buildings whereas the private sector is lagging behind. Between 1997 and 2005 over 1000 public buildings were optimized with the EPC tool. In 2004-2005 another huge federal program started with about 800 buildings (Bertoli, Bozza-Kiss, & Rezessy, 2007). On average, ESCOs have been able to guarantee almost 20 % savings for 10 years in these contracts (Grim, 2006).

Improvements have been achieved on heating and cooling systems, lighting, and water management. Street lighting has been renovated widely to. ESCOs estimate there is a ca. 500 million EUR investment opportunity in economically feasible projects for the rationalization of energy use (Bertoli, Bozza-Kiss, & Rezessy, 2007).

Contracts used & project financing.

Most companies offer EPC although energy supply, leasing, and operational contracts are also common. Guaranteed savings appears to be the preferred contractual model while shared savings contracts are used to a lesser extent. EPC mainly target public buildings while supply contracting is more common in the residential sector and for public infrastructure (such as street-lighting). Supply contracting involves a range of project types, from small-scale biomass heat supply (mainly to the residential sector) to larger CHP generation and district heating supply (Marino, Bertoldi, & Rezessy, 2010). Project financing is done via bank loans to the ESCO or to the client, ESCOs' and clients' internal funds, and state funds (Marino, Bertoldi, & Rezessy, 2010)

Table 5: Overview of the Austrian ESCO market key characteristics in 2010 (Marino, Bertoldi, & Rezessy, 2010)

Begin year ESCO market	1998
Number of ESCO's	5-14
Size of the market	€10 - €15 M
ESCO association	Association of EPC-Companies Austria (Dachverband Energie-Contracting Austria) (DECA)
Type of ESCO's	Energy service and supply companies and consulting/engineering firms

8.2 Success factors

<u>Government's regulation</u>

'Omnibus' Directive

At the middle of the nineties the so-called 'Omnibus-Directive' put some pressure on public authorities to think about energy efficiency in public building stock. This was the starting point for a big- and therefore visible- pilot project in the federal building stock (Seefeldt, 2003).

<u>Stimulation measures</u>

Energy agencies

Several energy agencies - at the national, regional and local level – have become important carriers of EPC-related know-how. The energy agencies played a crucial role in convincing potential customers of the feasibility and advantages of the EPC model, because they are seen as neutral advisors (Seefeldt, 2003). Experience in Austria has shown that the availability of ESCO-independent neutral advice through energy agencies reduces the entrance barrier of building owners considerably. Mainly in the start-up phase of an ESCO market they seem to play an important role (Seefeldt, 2003). Energy agencies are successful mediator in the ESCO market.

The Graz Energy Agency supports building owners during the implementation of actual projects. Services include data collection, preliminary analysis, project development, bidding procedures, contract negotiations, documentation and control. The Graz Energy agency also certifies ESCO companies and issues the labels (Graz Energy Agency, 2003).

Pilot projects in public building sector

Municipalities and, most importantly, the federal state created a steady demand for EPC through energy performance contracting tenders for their own building stock and for street lighting. This has created a significant market push (Marino, Bertoldi, & Rezessy, 2010). Starting with public buildings has proven to be a successful approach. Public buildings represent a volume big enough to arouse interest of ESCO's. However, there is a need to have a visible starting point, i.e. an attractive pilot project, which gives an incentive to the supply side to build up capacities (Seefeldt, 2003). Bundling of similar projects following the example of the Berlin 'Energy Savings Partnership' has proven to be an important success factor.

Model contracts, quality standards and data basis

Several quality labels have been set up for ESCOs and their services. The Thermoprofit quality label was introduced to guarantee reliable high quality proposals by ESCO's and their projects using the label. The label is issued by Graz Energy Agency and an independent commission that assesses the ESCO companies in regular frequencies to confirm that comply with the pre-set standards (Lamers, Kuhn, & Krechting, 2008).

The certification takes place every two years. In order for an enterprise to be certified as a Thermoprofit partner, or to keep its certification, it must fulfil certain conditions and observe certain quality standards in project handling. The certification as Thermoprofit partner authorises the partner a company to use the trade name Thermoprofit. The idea behind Thermoprofit is to create a brand in order to boost energy services via the creation of a network of competent suppliers, the development of quality standards of the energy services provided, the support from the Graz Energy Agency and some marketing activities (Intelligent Energy Europe, 2011). This example has spread to other regions as well. The so called eco-label, on the other hand, denotes the quality of ESCO services and the compliance with standards (Lamers, Kuhn, & Krechting, 2008).

Companies who commit themselves to obey the Thermoprofit criteria and are able to proof their ability to an evaluated reference project can apply for the Thermoprofit certification. If no reference project is available the required qualifications can be obtained through seminars. Subsequently, the projects should be implemented according to the Thermoprofit quality criteria. In the figure beneath, the process become a Thermoprofit partner is visualised.

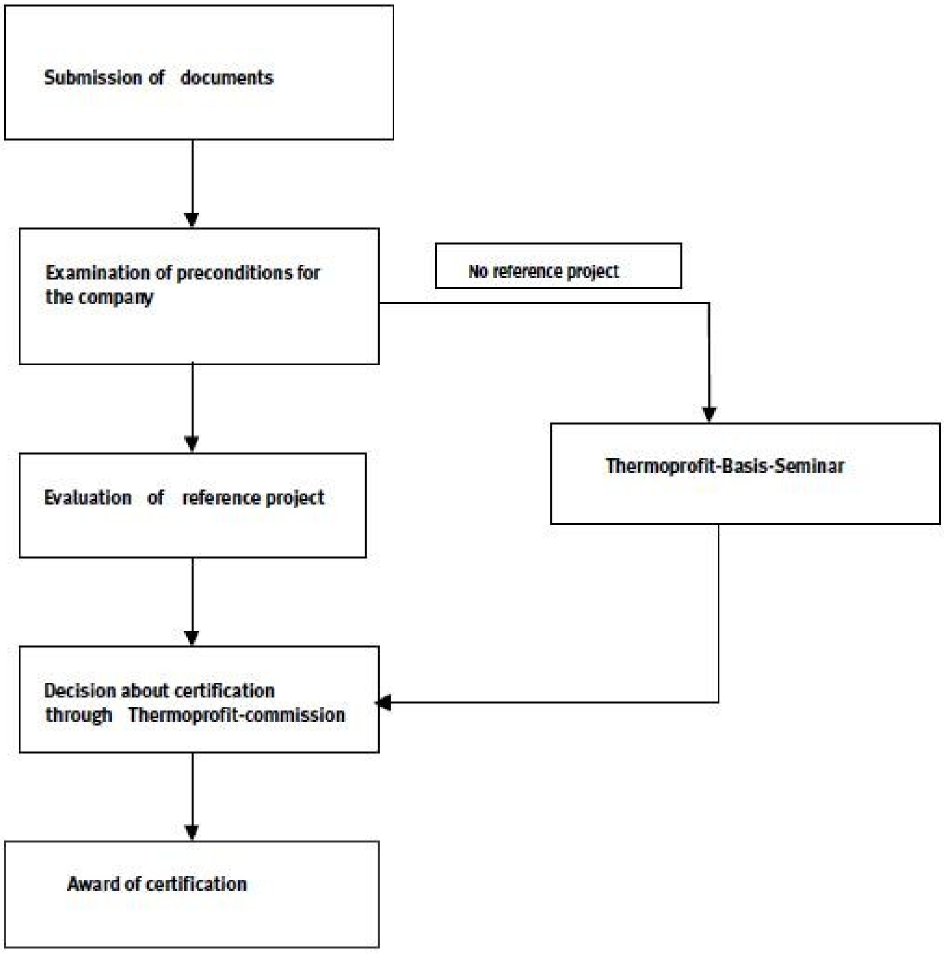

Figure 8: Procedure to become a Thermoprofit partner (Berliner Energieagentur, FIRE, n.a.)

Supportive measures by Austrian government

There is a variety of policy instruments which support the energy services market, such as information and energy advice for private residential and non-residential buildings, public subsidies, negotiated agreements with the main utility associations, information and awareness programmes, and the Federal EPC programme for public buildings. "Mustersanierungsoffensive" is a campaign especially directed to support best practice refurbishment in hotels and hospitality buildings. In non-residential buildings the federal subsidy "Umweltförderung im Inland" (UFI) can be combined with EPC. In the autumn of 2009, utility associations committed to achieve agreed saving targets. The companies represented by the association contribute to the achievement of these targets but do not have any formal obligation (Marino, Bertoldi, & Rezessy, 2010).

ESCO Sector initiatives

ESCO association

The ESCO's Austria have their own association called DECA, established in 2005. DECA is an abbreviation for 'Dachverband Energie Contracting Austria' which means umbrella organisation for energy contracting in Austria. The DECA sees itself as a precursor for innovative energy contracting solutions. Its goals are to develop services suiting the needs of customers, to form the political and financial framework for energy services and to inform potential customers about function, limits and advantages of energy services (Ungerböck, 2010). The most important activities for the ESCO market developed by DECA is the lobbying for the interest of ESCO in Austria and dissemination of information among its members, by organising workshop, seminars and suchlike (DECA, 2010).

8.3 Conclusion

Of every ESCO market in the European Union, the start-up phase of the Austrian ESCO market is mostly likely the biggest success story of all. The fast uptake is an exemplary case for the rest of Europe. The ESCO market in Austria clearly shows that promotion of ESCO businesses needs actions at the local level in strong public sector market. Intermediate organisations like energy agencies play a vital role in developing the market. This important role of energy agencies especially counts for the start-up and development. Just like the kick-off of the German ESCO market, the energy agencies in Austria took the demonstration projects of the Berlin Energy Saving Partnership as clear example and have taken a lead with pilot projects (thereby creating demand), disseminating information and acting as an independent advisor.

To improve the trust in the market, quality standards and certification (or labelling are helpful in assuring quality (Marino, Bertoldi, & Rezessy, 2010). Also the Government has played a significant role in the sharp development of the ESCO industry in Austria. A number of incentives made are available for investments for the rational use of energy, like subsidies, soft loans and tax credits for residential buildings. Although obligations have not been typical, in a few regions the Austrian government obligated certification in public buildings. In Austria standard documents (such as contract models) have been made available and standardized project development has been introduced. These measures guarantee and increase the quality of ESCO projects which is a priority to obtain trust by the ESCO's clients (Bertoli, Bozza-Kiss, & Rezessy, 2007).

The ESCO industry (sector) itself is also responsible for an important success factor, namely the establishment of an ESCO association. It is engaged in political lobbying for better circumstances for ESCO's and provides its members information.

9. The Dutch ESCO Market and its barriers

In this chapter first the main elements of the Dutch ESCO industry will be discussed as well as the different sectors which are attractive or unattractive for ESCO's. In the second section, the main barriers and therefore the reasons why the ESCO industry is undeveloped will be mentioned. This part of this chapter is based on the findings of the research conducted by former student De Boer. Finally, conclusions are drawn in section 9.3.

9.1 Description of the Dutch ESCO market

Despite the fact that the Netherlands has traditionally been among the leaders in energy efficiency policies, until 2005 there was hardly any ESCO activity on the Dutch market. Provisions for mandatory demand-side management requiring utilities to implement energy efficiency projects together with numerous projects implement by the national energy agency left little space for commercial ESCO in this period (Bertoldi & Rezessy, 2005).

In 2009 researchers Boonekamp and Vethman of the Energy Research Centre of the Netherlands (ECN) shows that around 25 independent companies and 25 subsidiaries of larger organizations deliver energy services as their business with a background in construction or engineering. Energy efficiency comes along with the general energy services provided and is part of operation and maintenance of installations for companies offering CEM contracts. The providers offer project management (design, build finance) or service (operation, maintenance) and a combination of renewable and energy efficiency technologies (Marino, Bertoldi, & Rezessy, 2010).

The largest customer groups of ESCO's in the Netherlands are in the commercial and the public sector. Projects in the public sector are mainly developed in the public administration and health care sector. The projects mainly incorporate the construction of new (large) non-residential buildings developed by focusing on energy efficient architectural design and equipment. CHP, heat and cold storage, heat pumps, insulation, operation and maintenance are targeted in the public sector. Renewable energy sources are also common for contracts with municipalities and the public administration. Energy saving technologies receive less attention mainly limited to efficiency lighting projects developed in the public administration (Marino, Bertoldi, & Rezessy, 2010).

In the industrial sector the implementation of internally developed energy efficiency investment is supported by voluntary agreements, financial and technical means and in-house capacity. In the industrial sector, projects developed focus mainly on supporting utilities, such as compressed air systems or installations in buildings or offices. Energy efficiency improvements in the residential sector where supported by other means than ESCO's, including grants and soft loans (Bertoli, Bozza-Kiss, & Rezessy, 2007). Dwellings are less common clients in the Netherlands. Insulation, energy efficiency of small installations, renewable energy (solar heating systems, solar panels, heat pumps) project are nevertheless being developed in the private residential sector, mainly be new services provided by utilities (Marino, Bertoldi, & Rezessy, 2010).

In general, energy intensive real estate is of interest to ESCO's because they represent large saving potentials. Offices and schools are most likely to offer ESCO's the best business opportunities together with municipal real estate, hospitals and swimming pools. These sectors offer great energy savings potentials and benefit most from other features offered by ESCO's, like removing the split-incentive barrier and prefinancing the investment need in advance. Retail is a difficult sector because of the lack of individual meter cupboards. Other real estate sectors, like convention centres and warehouses, are not that interesting to the ESCO industry because of low energy saving potentials or difficulties to identify energy savings. Public real estate which is managed by the state buildings service (Rijksgebouwendienst (RGD)) is very interesting to ESCOs but the RGD is not interested in cooperating with ESCOs. Players active in the Dutch ESCO market also state that dwellings are not interesting because of the low energy consumptions levels (De Boer, 2011)

Table 6: Overview of the Dutch ESCO market key characteristics (Marino, Bertoldi, & Rezessy, 2010):

Number of ESCO's	50
Size of the market	N/A
ESCO association	No
Type of ESCO's	Energy services, construction and engineering companies
Market Development	Growing
Sector ESCO projects & main EE measures	Middle and large non-residential new building projects addressing energy systems.

9.2 Barriers

Because there are plenty of opportunities and drivers for the ESCO market to develop and grow, there must be good reasons for the fact it does not. In this section the main barriers which inhibits the development of the Dutch ESCO market will be mentioned by category.

Financial barriers

The first and most fundamental barriers are the financial ones concerning ESCO businesses (Institute for Building Efficiency, 2010). Financial issues can be barriers at three sites in the ESCO market: at the client-side, the ESCO-side or the financial institution-side.

At the client-side, due to the insufficient rate of returns and/or long payback periods problems arise concerning the proposed ESCO activities. In the ESCO industry payback periods of 5 to 15 years are often the standards in the ESCO industry, but this is much longer than the three years which is common in industry, and hence energy saving investments often do not comply with company's investments rules. Secondly, the strong competition between energy saving investments and core business related investments is a major client-side barrier. A euro can be only spend one time, and mostly the choice is made to invest the expansion of the core business rather to put capital into energy efficiency investments (Institute for Building Efficiency, 2010). A third common, client-side barrier is a situation where capital goods do not reach the end of their economic life time and therefore the company does not choose to invest in energy saving activities. In general, customers only look at initial investment costs instead of looking at the so-called 'total costs of ownership'. This argument holds for both the private and the public sector. When the public sector is concerned, this

lack of integrated perspective might be the most distinctive impediment to an increasing demand for the ESCO industry (Marino, Bertoldi, & Rezessy, 2010)(Schneider, et al., 2011).
An ESCO-side barriers is concerned with the fact that most of the ESCO projects in the Netherlands are customer financed until present. In contrast with that financing model, ESCO takes care of the initial investment costs since this is an effective marketing tool to attract new customers. In theory, an ESCO can fund an infinite amount of projects but in practice it cannot. If the amount of ESCO activity related assets becomes the major part on the balance sheet, this can influence the credit rating of a company. It also has the consequence for the ESCO to make a choice on how to spend its available capital; either investing it in its core business or in ESCO activities. As most of the Dutch ESCO's are in fact new subsidiaries of an older existing mother company like utilities, technical service companies or in financing ESCO activities, they will want not lose sight of their main activities (De Boer, 2011).
From the financial institution side, also a lot of barriers exist in the Netherlands. Despite the importance of TPF with ESCO projects, banks are responsible for significant barriers for the Dutch markets developed due to limited knowledge and experience in financing EPC projects. These barriers are primarily caused by the fact that ESCO businesses are relatively new phenomena in the Netherlands. Therefore, a lot of ESCO's in the Netherlands which are active in energy performance contracting have obtained no track record, or at least not a significant one, and therefore financial institutions are less willing to participate in an EPC project. Due to this unfamiliarity, the risks and the returns attached to projects are unknown. Furthermore, financial institutions want to have the prove that an EPC works and that the energy savings are indeed sufficient to pay off the initial investment costs, interest and profit margin for the ESCO. It is a prerequisite that the market monitors and registers the progress of the projects and the achieved energy savings for the ESCO funding taking off and a large scale. Furthermore, because EPC projects are relatively new phenomena, to assess ESCO projects a lot of knowledge to be acquired. Project risks have to be investigated by the financial institutions which cannot be copied easily since there are no standard EPC contracts in use yet. This leads to high project development and transaction costs. Another barrier for third party financing is the volatility of energy prices. Fluctuating energy prices are a disadvantage for TPF, because the party providing the upfront investment costs cannot make clear forecasts about the size of the future cash flow extracted from the achieved energy savings even though the ESCO is giving a guarantee for the amount of energy that will be saved. The final barrier of the market side, is that the creditworthiness of ESCO's is in some cases too little. Especially the smaller ESCO's are often not able to attract sufficient amounts of funding but only the large and financially sound ESCO's who are a subsidiary of a large mother companies (e.g. a utility) are in the position to attract third-party funding (European Commission DG Joint Research Centre, 2010).

Behavioural barriers

Several behavioural barriers exist by the building or facility managers, concerning the collaboration with an ESCO. First of all, the facility manager could have already implemented the most economically profitable energy saving measures in the building. Buildings where the low-hanging fruit has already been picked often do not qualify anymore for an EPC project. Secondly, facility managers often see ESCO's more as threat instead of a chance. An external company, which an ESCO is, can be seen as questioning their competences or as stealing their jobs. Furthermore, organisations are in general reluctant to outsource their energy since the facility manger or top management does not like to give the control over their installation away (De Boer, 2011).

Legislative barriers

Another group of barriers in the Netherlands is concerning the Dutch legislative framework. In the Dutch ESCO market exists a low level of confidence due to the absence of a specific legal framework for energy performance contracting. What also hampered the markets development is the chance of accounting rules (De Boer, 2011).

Human barriers

A very important group of barriers are human barriers, like informational barriers and a lack of knowledge. A low awareness and a low priority of energy saving needs are due to a lack of knowledge and understanding of energy in general and the ESCO market in particular. Especially at decision making level this is important. The high level management, e.g. board of directors, are often not obliged and concerned with cutting back the energy consumption because energy is not a core business of the company. Secondly, most often mistrust prevails among the customers towards the business model of the ESCO and its profit margins. Other potential customers have unrealistic views of energy savings potentials and are unsatisfied and disappointed when the ESCO cannot meet these expectations (Marino, Bertoldi, & Rezessy, 2010). The final barrier is that customers often have a high perception of the technical and business risk of energy saving measures which prevent them from entering in an EPC project (De Boer, 2011).

9.3 Conclusion

In the Netherlands there was hardly any ESCO activity present until 2005. Since that year, the Dutch ESCO market has grown in size, but when comparing it with other ESCO markets for instance German one, the stage of development is still to be classified as immature nowadays. The largest customer groups of ESCO’s in the Netherlands are in the commercial and the public sector. These sectors offer the most opportunities. Strict energy efficiency directives from the EU, environmental concerns and changing public procurement rules drive the demand for ESCO activities. Despite these drivers, major barriers are still in place which have to be tackled for the sake of establishing a mature Dutch ESCO market. These barriers are financial, legislative, behavioural and informational barriers.

10. Lessons learned from the developed ESCO markets

Now that the developed ESCO markets and the factors which caused the successful development of Germany, France and Austria have been analysed, an overview of the main success factors will be mentioned in the table below.

Table 7: Overview of the success factors of the German, French and Austrian ESCO markets

Success factor	Germany	France	Austria
Regulation by government			
❖ Energy taxing	X		
❖ EE policy targets set in building sector		X	
❖ Beneficial regulation to access financing	X	X	X
Supportive measures by an energy agency or an ESCO association			
❖ Project bundling / demonstration projects	X		X
❖ Standardisation of contracts and procedures	X	X	X
❖ Quality labels ESCO's and its services			X
❖ Energy agencies support	X	X	X
ESCO sector initiatives			
❖ Establishing an ESCO association	X	X	X

The table shows that there are a lot of similarities in the success factors of the three different countries. Only in Germany the increase in energy prices due to taxation has only been of significance, and project bundling and demonstration project has not been the case in France as it was in Germany and Austria. In France a strict policy objective for building energy efficiency in the coming decade is set, while it hasn't in Austria and Germany. For the rest, only similarities can be observed which underlines the importance of these specific factors in the development of an ESCO market, and therefore also for the Dutch ESCO market.

In the next sections of this chapter recommendations will be given for three kinds of actors in the Dutch ESCO market:

- Dutch government
- Dutch ESCO industry

But beforehand, first a basic 'roadmap' of five crucial steps for the development of an ESCO market is given, based on the statements in the journal of researchers Bertoldi, Rezessy and Vine in 2006. The roadmap lays out the sequence in which the success factors should be undertaken.

1. *Increase dissemination of ESCO services and projects*
   The first action to be done is to increase information about energy-efficiency project, financing opportunities and services offered by ESCO's.
2. *Launch an accreditation system for ESCO's*

A lot of companies are eager to call themselves ESCO's with having proper qualifications, therefore an accreditation system must be in place to ensure that ESCO's provide a qualified and reliable service.

3. *Develop financing sources*
   ESCO's need working capital and therefore sources of debt and equity financing need to be located. Several possible financing sources should be investigated, such as private banks and lending institutions, equity funds, strategic partnership etcetera. A revolving fund to financing energy-efficiency measures could also be set up.
4. *Standardize contracts and M & V*
   The fourth action to take for the market development is to standardize the contracts of ESCO's and measurement and verification (M & V) procedures. Hereby, the owners of buildings and the financial community are helped to better understand the contract of an ESCO like the EPC.
5. *Ensure that governments take the lead with measures in public buildings*
   Promoting ESCO services in national and local government buildings is the fifth action to undertake. This practice has resulted in a noteworthy success in Austria and Germany. Hereby it is crucial to have public procurement procedures that take into account the specifics of energy service provisions and are supportive to the 'one-stop-shop' concept which ESCO are based. A more hospitable environment is to review regulations and remove institutional impediments.

These steps must be made by either the governments of the country or by the ESCO sector itself. In the next sections, at first the actions to undertake by the Dutch national and regional governments will be discussed. As the experiences of the German, French and Austrian ESCO market developments have shown, the government is a very important actor which can make a substantial contribution to the market development. After that, in section 10.2 recommendations will be given concerning the initiatives of the Dutch ESCO industry.

10.1 Recommendations for the Dutch Government

After having analyzed the success factors of the German and French and Austrian ESCO markets it can be concluded that the role of those government was crucial. Therefore, if the Dutch government decides to stimulate the ESCO industry because this industry can contribute to achieving Dutch and European environmental and energy targets, recommendations for the Dutch government can certainly be given.

Government Regulation

Dutch governmental favourable policy for ESCO's: White Certificates Scheme

Another major success factor for ESCO in the Netherlands would be if the government decides to implement a white certificates scheme. However, as the effects of the scheme in France have shown, it should be well tuned on ESCO's. The WhiteCert scheme should have the following criteria (Intelligent Energy Europe, 2011):

1. The ESCO should have the right to claim the certificated produced within their projects. Therefore, extra certificates should be awarded to standard eligible measures implemented in the frame of EPC contracts.
2. Award certificates to EPC projects including non-standard measures based on the level of additional guaranteed energy savings

The ESCO is one of the actors who can be the architect or the partner of an energy savings project: to implement a project the customer will choose the best actor to minimize the costs, the complexity and the risks. The whiteCert mechanisms bring changes in the level of costs, complexity and risks for each scenario for implementing a project. Depending of the scenarios and the rules of the whiteCert mechanisms, the ESCO will have less or more opportunities to develop their EPC business (Berliner Energieagentur GmbH, 2008)

Increasing energy taxes

This success factor is probably the simplest one to execute. Despite the disadvantageous of high energy prices, rising energy prices result in major stimulants for ESCO services. The experiences in the German ESCO market had shown the big effect on the ESCO businesses. Some German ESCO's even consider the energy taxes as the most important political support measure. Because of it high effectiveness, it is recommended for the Dutch government to increase the energy taxes to stimulate the Dutch ESCO market.

EE policy targets set in building sector

Another effective government's regulation is simply setting targets for the level of the energy efficiency in buildings for a certain year in the near future. The case of the French ESCO market has shown that, by setting strict policy objectives in the action plain 'Grennelle de l'Environnement', which has the support by all the stakeholder holder parties in the ESCO market, is an important stimulant for the development of the market. By setting these targets the urgency to do something about the energy waste in the building environment is enlarged as well as the necessity for the national and local governments for greening the public buildings.

Government's supporting measures

Government should take on the 'launching customer role'.

To improve the ESCO activity in the public building sector, the Dutch government should take the lead with measures in public buildings (Bertoldi, Rezessy, & Vine, 2006). Therefore the policy of the Dutch government building service (Rijksgebouwendienst) should be changed, so that the buildings of the national government can be retrofitted by means of ESCO's. The buildings service should change from a suspicious and negative stand towards a positive and co-operative one. This government institution is a very important player in the Dutch ESCO market, since government-owned property is a major energy user and can represent a significant portion of the potential ESCO market. Furthermore, ESCO's can provide government organization with valuable expertise and private sector investment capital (Vine, 2005).

Project bundling

The experience of the Energy Savings Partnership in Berlin has shown that bundling of buildings entails important benefits. First of all, bundling reduces the transaction costs for ESCO's, which is a major barrier for EPC projects. It also avoids cherry picking by ESCO's and thereby also the less attractive buildings, with a lower energy savings potential, are taken into account. Bundling is also important since ESCO's and banks do not accept projects below a certain value (Ürge-Vorsatz, et al., 2007).

Demonstration projects

Demonstration projects in, or organized by, the public sector may be essential in order to increase awareness about EPC as well as trust in ESCO among other potential clients. Early success is very important for a positive development of the ESCO industry. In order to increase the chance of the success, demonstration projects should be done in cooperation with experienced and accredited ESCO's or energy agencies. If possible, local ESCO's are the best to contract since these increases the employment opportunities in the region (Ürge-Vorsatz, et al., 2007).

Dutch energy agency support

As in Germany, in Austria and to a lesser extent in France, the national and regional energy agencies in the Netherlands should become more active in developing the Dutch ESCO Industry. As the case of Austria clearly shows, energy agencies have a key role in taking a lead with pilot projects, creating demand and acting as an independent advisor.

The Dutch Energy Agency 'Agentschap NL' should act as a know-how carrier and through actions in public buildings it should draw attention of businesses to the end-use energy efficiency market niche. This does not mean that public money should be allocated to ESCO projects. Instead, public money should be used for information and marketing activities and for advice to potential ESCO customers. An energy agency is the ideal institution of disseminating information about ESCO's and promotes the ESCO industry.

The Dutch Energy Agency should play an important role of a mediator between ESCO and their customers, especially in the public but also in the residential sector. Like in Germany and Austria, energy agencies can support the ESCO market through the elaboration of guidelines, advices and project advertisement. Like the Berlin Energy Agency, the agency should establish an electronic platform where public institutions tender and come in contact with ESCO's (Ürge-Vorsatz, et al., 2007). Finally, an energy agency is the right public institution to launch an accreditation system for ESCO's. This is important because a number of companies are eager to call themselves ESCO's in the Netherlands, without having proper qualifications. Secondly, it is important to ensure that ESCO's provide a qualified and reliable service.
Besides national, the Dutch local and regional governments can also set up their own energy agencies, like the state government of Berlin has done with the Berlin Energy Agency by, which itself can act as an ESCO.

Standardization of contracts and Measurement & Verification procedures

By standardizing ESCO's contracts or key contractual provisions, end-users and the financial community's concerns about the reliability of ESCO can be answered. Standardization also improves time and cost effectiveness as well as competition and transparency. Such a step is made by the Berlin Energy Agency and proved to be very important for the success of the German ESCO industry during the 90's, especially in the public sector (Seefeldt, 2003).
Standardized contracts also increase the trust of customers, especially in the public sector as in Germany, Austria and France. Furthermore they simplify and accelerate the negotiation process. However, ESCO's themselves often prefer not be bound to fixed standard contracts but want to elaborate their own unique contract approaches instead. For this reason, standardisation of key contractual provisions is often more helpful than complete standardized contracts.
Furthermore, standardization of measurement and verification, for instance through the International Protocol for Measurement and Verification (IPMVP) (see attachment D), can be helpful in increasing trust of customers and banks in ESCO activities (Vine, 2005).

Certification and quality labels

In order to acquire broad customer confidence in ESCO's, the ESCO's and its services need to demonstrate a constant good quality. Generally, this can be achieved via the certification of providers of energy services or via the establishment of quality standards for the services provided. Like in Austria and Germany some successful certification procedures already exist. For instance, the Thermoprofit quality label which is linked to a series of standards to be met by the ESCO's and its services. According to most of the participants, the certification of ESCO's is quite desirable from the point of view of clients. It can build confidence, ease the procurement process (particularly in the public sector) and it can even be a great marketing tool for ESCO's. An important issue to certification of ESCO's and their services is the fact that any certification scheme should be backed by independent organizations, e.g. an energy agency, and that the feedback of customers and ESCO's should be taken into account into consideration. Implementation of an ESCO certification scheme avoids a complex bureaucratic effort and very high transaction costs. As the market of energy services is still a very young one high implementation costs could constrain the development of the Dutch ESCO market (Berliner Energieagentur, FIRE, n.a.)

Government's financial support

Like in all the three reviewed developed ESCO markets, government's support in financing of EPC projects can be a major success factor. Especially in the take-off phase of an ESCO market since EPC project are unknown phenomena.

Like in Germany for instance, a non-profit banking group (owned by the government) should raise funds from the financial market and transfers this capital to the ESCO project applicant in the form of lower interest loan. The funding program should target the most buildings in the Netherlands as possible. Public subsidies and investment and crediting funds are also beneficial for the development of the Dutch ESCO market.

10.2 Recommendation for the Dutch ESCO Sector

ESCO Association

This research has shown that a very important step in the development of the Dutch ESCO markets is the establishment of an ESCO association. The main function of an ESCO association is to provide technical, legal and other support to their member companies (Ürge-Vorsatz, et al., 2007). The creation of ESCO association enables a market establishment with important activities, such as standardization and quality control efforts, dissemination of information and capacity building lobbying. An ESCO association can act as a reference point for ESCO customers and suppliers and, by grouping and concentration of ESCO professionals, can represent the point of view of the industry with a unified voice (Marino, Bertoldi, & Rezessy, 2010).

In addition, the establishment of an association or a similar platform or forum could concentrate resources in information dissemination and capacity building. The association can create a support network for potential customers with capacity building, give direct advice, and access to information. The association could also organize workshops and knowledge sharing events with ESCOs, potential clients (municipal representatives, facility managers, etc) and financial institutions in order to increase the knowledge of how ESCOs engage in projects and what benefits can ESCOs bring to project management from a risk reduction, financial and environmental perspective. Furthermore, an ESCO association would be a useful reference point for collaboration opportunities between ESCOs, like strengthening the political lobbying of ESCO's. The establishment of independent market experts can provide confidence in the market and performs the function of a reference point for all stakeholders such as ESCOs, clients and decision makers (Marino, Bertoldi, & Rezessy, 2010). Beside collaboration between ESCO's, an ESCO association is the perfect institution to represent the Dutch ESCO industry for collaboration with an energy agency. This is because the representative of the association can speak for the entire industry (or at least a large part), which makes it easier for the energy agency to collaborate with the industry.

ESCO's entrepreneurship

Dutch ESCO should build up a sound business case, not only focusing on the technical aspects of energy efficiency measures but also especially on the financial aspects. Especially in a relatively new ESCO market like the Dutch one, client's investors and financial institutions have to be convinced that the uncertainties and the risks involved in ESCO projects are manageable. Secondly, ESCO's should build up a track record as quickly as possible. For ESCO customers it is important to know what projects the ESCO has undertaken in the past and how the contractor performed previously. An ESCO's track record is a very useful tool for clients to assess the competence of the ESCO.

11. Discussion

The research has investigated success factors which are common for the three mature ESCO markets Germany, France and Austria. The existence of these factors in every developed market proves its necessity, and is therefore essential for every ESCO market to develop. However, the first and most important discussion point in this research is the inevitable fact that there's no 'magic formula' to develop an infant ESCO market. A mixture of success factors might work for the benefits of ESCO's in one country while the same mixture might not have a start-up value for ESCO's in another country. Therefore, strategies to develop the ESCO markets must consider the local and/or national circumstances and combine interventions most appropriate there. In addition to that, the most careful market development strategy might fail for unknown or unexpected reasons (Bertoli, Bozza-Kiss, & Rezessy, 2007).

The second discussion point in this research is that a comparison of ESCO markets in constrained by the fact that the notion of 'Energy Service Company' is understood differently from one country to another, and sometimes used differently by experts even in the same country. Despite a clear definition of an ESCO is set in the beginning of this research, due to the different definitions the reliability is affected concerning a comparison of ESCO's markets.

The third discussion point is the lack of means to elaborate more thoroughly on the success factors of the different, researched ESCO markets. First of all, the available time for this research was limited to 30 week. By looking afterwards to the research process, this time period proved to be too short to analyse all the success factors of the three developed ESCO markets and 1 undeveloped ESCO market in-depth. I had to stick with the main success factors while there are of course a lot more elements which drive the development. Another used mean which had a limited effect on the research was the date of the literature. While this seems weird since there is a substantial amount of literature written about EU ESCO markets, most literature is older than 2 years. This resulted in the disadvantageous effect that statistics and other kinds of data are outdated since ESCO market can evolve quickly. Also, in contrast with the substantial amount of literature about the Germany (since it is generally recognised as the most successful and maturated ESCO market in Europe), there was relatively little literature available of the two smaller ESCO markets France and Austria.

For further research, several recommendations can be made. More research should be conducted concerning the French and Austrian ESCO markets (and presumably also other new start-up ESCO markets). Thereby, new scientific research should be conducted which can provide up-to-date statistics and characteristics of the rapidly changing ESCO markets in the EU.

Secondly, this research is about the main factors which caused the ESCO markets of Germany, Austria and France to develop. There are enormous amounts of other less obvious factors, which had a positive effect on the ESCO markets development, either direct or indirect. In order to obtain a more complete overview of the success factors of the three developed ESCO markets a wider-ranging research is necessary.

12. Conclusion

Now the developed ESCO markets of the European Union; Germany, Austria and France have been analyzed as well as the Dutch ESCO market and its barriers for its market development, all the sub questions are answered. Now an answer can be given to the main research question: *What are the critical success factors of the developed ESCO markets in Germany and France and the Austria and what can be learned from this in order to develop the Dutch ESCO market successfully?*

First of all, this research has investigated that the governments of these three countries have established beneficial regulations for ESCO businesses. In Germany an important one is the increase of the energy prices since the year 2000 due to rising energy taxes. Despite the economic downsides, this regulation makes energy saving measure more economically attractive and therefore improves the success of ESCO businesses. In France, the action plan 'Grennelle l'Environment' is being set up, which contains ambitious policy targets for energy efficiency in the building sector. Setting these targets creates a necessity for the French government to combat energy waste in the public buildings which is a major stimulant for the French ESCO's. Besides that, in all three analyzed countries the government regulation is beneficial concerning the access for financing ESCO businesses. In Germany a public bank issues lower interest rates for ESCO's, in France there are several funds installed and the French law enforces banks to financing EE projects in buildings and in Austria subsidies can be used for increasing energy efficiency of buildings.

Besides regulation, the energy agencies of Germany, Austria and France have established important supportive measures which have a major positive effect on the development of its markets. First of all, the local energy agencies of Germany and Austria, the Berlin energy agency and the Grazer energy agency, have established a standardization of ESCO contracts and M & V procedures and an accreditation system. By standardization and certification, trust is created by clients in ESCO services. In France, this is done by its national ESCO association. Trust in the ESCO's is crucial since it is a relatively new business concept in these countries, the contracts have a long duration and there is a lot of skepticism towards the business. Secondly, the local energy agencies in Germany and Austria have used project bundling of buildings. Bundling buildings has the benefits of decreasing transaction costs, increasing the amount of energy savings and it prevented cherry-picking of the most attractive buildings. Furthermore, it proved to be successful demonstration projects and is seen as a visible kick-off of these ESCO markets. Energy agencies can also be successful mediators on the ESCO market. They can provide consultancy and practical support and a broad technical background to buildings owners, thus acting as a neutral advisor. In Austria the Grazer energy agency has also made an accreditation system, in which ESCO can get a Thermoprofit label if its services meet the set quality requirements. This ESCO labeling also improves the trust by clients in the ESCO markets. In general, energy agencies play a decisive role especially in the start-up phase.

The final main success factors of the three ESCO markets, and an initiative of the ESCO industries themselves, is the establishment of an ESCO association. An ESCO association acts as a reference point for ESCO's, customers and suppliers. By grouping and concentrating ESCO professionals, the association can represent the point of view of the industry with a unified voice, thereby enforcing the political lobbying power of the ESCO’s substantially. Lobbying power is important since it enforce policy makers to establish beneficial circumstance for ESCO’s. Furthermore, an association of the ESCO markets provides its member with information, technical support and education through seminars and suchlike.

The biggest lesson learned from the analyzes of the three development of the three mature ESCO markets for the development of the Dutch ESCO market is the active role the Dutch government should undertake, especially in the start-up phase. The government should create an attractive demand for ESCO by bundling its public buildings into pools and making it successful demonstration projects, which gives the development of the market a boost. Another lessons learned, is the key role the Dutch energy agency (Agentschap NL) has got and must use in the development. The agency is eminently the independent organisation that can increase the trust in the market by establishing an accreditation system (or ESCO labelling/certifying system) and developing standards for contract models and procedures. Experiences in countries like Germany, France and Austria shows that the availability of an ESCO-independent neutral advice by energy agencies reduces the entrance barrier of building owners considerably. The final main action the government of the Netherlands must take it to facilitate the financing of EPC projects, mainly for the smaller ESCO crucial. Since ESCO businesses are relatively unknown in the Netherlands TPF is hard to acquire for most ESCO’s. Solutions to this problem could be investment and crediting guarantee funds and the establishment of a non-profit public bank aimed at financing energy efficiency projects.

The final lesson learned is that the Dutch ESCO industry should establish an association. An association is important for the market’s development since it unifies the ESCO’s, thereby enabling the enforcement of political lobbying, decrease the unfamiliarity of ESCO businesses by the building owners in the Netherlands and provide its member with information and technical support.

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List of Acronyms

ADEME	French Environment and Energy Management Agency (Agence de l'Environnement et de la Maîtrise de l' Energie)
BEA	Berlin Energy Agency (Berliner Energieagentur GmbH)
Club S2E	Energy Efficiency Services Club (Club des Services d'Efficacité Energétique)
DECA	Umbrella Association Energy contracting Austria (Dachverband Energie Contracting Austria)
EE	Energy Efficiency
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contract
ESC	Energy Supply Contract
ESP	Energy Saving Partnership
ETS	Emission Trading System
ESD	Energy Saving Directive
ESCO	Energy Service Company
ESM	Energy Saving Measures
EU	European Union
EVO	Efficiency Valuation Organisation
HVAC	Heating, Ventilation and Air-Conditioning
IEA	International Energy Agency
IPMVP	International Performance for Measurement and Verification Protocol
KfW	Credit Institute for Reconstruction (Kreditanstalt für Wiederaufbau)
KPI	Key Performance Index
M & V	Measurement (monitoring) & Verification
PPP	Public-Private-Partnership
PV	Photovoltaic
RES	Renewable Energy Sources
TPF	Third Party Financing
VfW	Association for heat supply (Verband für Wärmelieferung)
WhiteCert	White Certificates

Appendices

A. The efficiency gap

The Efficiency gap is the difference between the actual level of energy efficiency and the higher level that would be cost-effective form the individual's or firm's point of view. Many studies have documented the existence of this gap (Blok, de Jager, & Hendriks, 2001) (Intergovernmental Panel on Climate Change, 2001). The existence of energy efficiency gap is a result of the presence of 'market failure' and 'market barriers' to energy efficiency (International Energy Agency, 2007). In the context of energy efficiency, the term market barrier refers to any market-related factor that inhibits energy efficiency improvements (Intergovernmental Panel on Climate Change, 2001)

Energy policy analysts commonly identify a subset of market barriers called market failures. These market failures include Principal-Agent Problems, insufficient information, and externalities. It is important to identify market failures because, according to neoclassical economics, only those barriers that are market failures lead to inefficient allocation of resources. Thus market failures occur when one or more of the conditions necessary for markets to operate efficiently are not met. According to neoclassical theory, markets operate efficiently when (International Energy Agency, 2007):

- There are sufficiently large number of firms so that each firm believes it has no effect on price
- All firms have perfect information
- There are no barriers to enter or exit the market place
- Firms are rational profit maximises
- Transactions are costless and instantaneous

When any of these ideal conditions are not met, there is a market failure, and markets are not achieving an optimal allocation of resources. In the context of energy efficiency, a market failure would imply that more energy is being consumed for the level of service than a rational allocation of resources would justify, in light of consumers and producers preferences. Market failures provided a minimum justification for government policy invention to improve efficiency. However, because market failures are pervasive, the mere existence of market failure is not sufficient to justify government intervention.
Market barriers to energy efficiency are very diverse and are classified in a variety of ways. The figure below provides one possible classification for market barriers and market failures. Keep in mind that the following figure provides only one possible classification for market barriers and market failure (International Energy Agency, 2007).

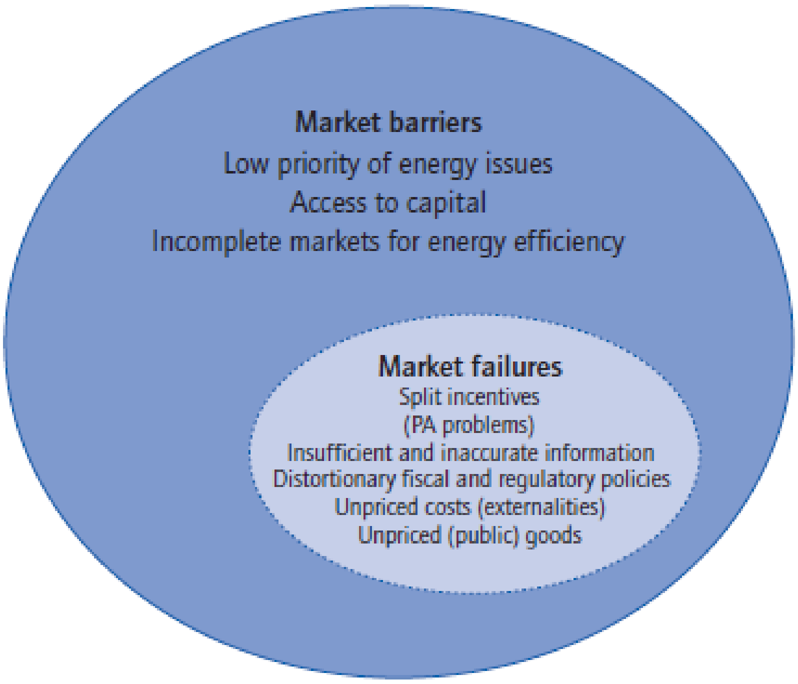

Figure 9: Market barriers and failures (International Energy Agency, 2007)

Market barriers

Incomplete markets for energy efficiency

Energy efficiency is often a secondary attribute bundled together with other product features. This is due to historically-low energy prices and a general lack of interest in energy efficiency features. With increasing energy prices, one might expect products to emerge with separate energy efficiency options. If this does not happen then governments may decide to intervene (International Energy Agency, 2007).

Low priority of energy issues

Energy efficiency is not a major concern for consumers or firms because energy costs are low relative to the cost of many other factors (such as labour costs). Consequently, there is little incentive to invest in energy efficiency improvements. Examples of this are well-documented. For instance, in the office space market in London, energy costs are equivalent to 1% - 2% of rental costs (International Energy Agency, 2007). Since energy costs are typically small relative to other costs, it is easy for consumers to ignore them. This may also mean that the benefits from energy savings to individuals may be outweighed by the transaction costs. Numerous studies demonstrate that consumer's investment in upgrades of their buildings, appliances, cars, and other equipment for safety, health, comfort, aesthetics, reliability, convenience and status reasons. Energy efficiency rarely is a high priority issues relative to these other factors. However, even though at an individual level energy costs may be insignificant, when summed over all individuals, energy can represent a significant cost to society (International Energy Agency, 2007).

Access to capital (capital rationing)

Access to capital in order to make invest in energy efficiency can be a barrier. For example, residential and small commercial energy users face much higher finance costs than large businesses and utilities. As a result it can be difficult for some energy users to access the capital necessary to make energy efficiency improvements. In addition, many energy efficiency projects do not qualify for traditional sources of financing or may not qualify under conventional lending criteria. A study undertaken by DeCanio (1993) showed that firms typically establish internal hurdles for energy efficiency investment that are higher than the costs of the capital to the firm. Furthermore, energy efficiency investments are often small scale and dispersed and it can be difficult to quantify all of the benefits from the investments. As a result, financial institutions that are unfamiliar with energy efficiency can be reluctant to lend for energy efficiency improvements (International Energy Agency, 2007).

Market failures

Split incentives

Split incentives occur when participant in an economic exchange have different goals or incentives. This can lead to les investments in energy efficiency than could be achieved if the participants had the same goals. A classic example in energy efficiency literature is the 'landlord-tenant problem', where the landlord provides the tenant with appliances, but the tenant is responsible for paying the energy bills. The problem is that landlords and tenants face different goals: the landlord typically wants to minimise the capital costs of the appliance and the tenant wants to maximise the energy efficiency of the appliance to save on energy costs (International Energy Agency, 2007).

Split incentive occur in the property ownership market, where many homeowners and businesses have limited incentive to invest in efficiency measures because they do not expect to stay in their building long enough to realise the payback form investments in energy efficiency. Split incentives also occur in the hotel industry, where the occupant seeks to maximise comfort and does not directly play for the room's energy use. The hotel owner, on the other hand, does face the energy costs (International Energy Agency, 2007).

Insufficient and inaccurate information

Imperfect (insufficient and/or incorrect) information can cause firms to make suboptimal investments in energy efficiency. Evidence that imperfect information affects investments in energy efficiency is widespread. DeCanio (1993) found that firms often lack the ability or time to process and evaluate the information they have, a situation sometimes referred to as bounded rationality A common example of imperfect information is the belief that energy-efficient products are more expensive than their less efficient counterpart (International Energy Agency, 2007).

Researches Sanstad & Howarth (1994) point out that there is a large body of research documenting that consumers are often poorly informed about technology characteristics and energy efficiency opportunities. Another study of 12 Dutch industrial firms found that the costs of collecting information on energy efficiency investment can be substantial, 2% to 6 % of the total cost of the efficiency investment (Hein & Blok, 1995). Similar transaction costs can be expected for the commercial sector, but are likely to be higher than for residential consumers (International Energy Agency, 2007).

The irreversible nature of energy efficiency investments

The majority of energy efficiency investments are highly illiquid and are therefore irreversible, which increases the riskiness. The investments are illiquid because the measures are very case-specific and cannot be retrieved from a building. Insulation, lightning and software are good examples of irreversible investments. Although they, in theory, they can be retrieved from a building and places in another one, but in practice this would be too expensive (Jackson, 2010).

Bounded rationality

Bounded rationality is the idea that in decision making, rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time available to make decisions. This concept can be used to explain the efficiency gap because energy and energy efficiency is often not the field of experience of the managers responsible for taking the investment decisions, so their information is far from complete (Jackson, 2010).

Energy Price uncertainty

Energy prices are volatile and therefore it adds another risk to energy efficiency investments. Risk causes a barrier to take make these investments (Jackson, 2010).

Common Impediments of ESCO's specifically

Technical barriers

For energy service companies the technical barriers are only little. Minor technical barriers are such as difficulties in putting the necessary solid data basis. It is indispensable that the building owner prepares the basic data on the building. In practice this is a time and money consuming process.

Human barriers

Persistent barriers inhibit many cost-effective energy efficiency projects and prevent the full development of the ESCO-industry internationally. The International Energy Association's Demand-Side Management Implementing Agreement's Task X identified some major barriers (Westling, 2003).

Low awareness and lack of information and understanding of the opportunities that energy efficiency offer;

The European ESCO Status Report 2005 emphasized this impediment as the most important barrier to the widespread use of the ESCO offer. The results of the analysis of the research in 2002-2007 indicate that this remains the most pressing obstacle to the ESCO market expansion across Europe. The most important barrier that hinder the evolution of ESCO's is believed to be that potential clients are not aware of this solution and/or are little interested because their attention is on their core business or main mission and energy constitutes a small part of their expenses. Furthermore, large energy users usually have in-house expertise. Thus increasing awareness and dissemination of information about ESCO's still need significant attention even in countries with highly developed ESCO markets such as Germany, especially in the building sector and in case of small and medium size enterprises (Bertoli, Bozza-Kiss, & Rezessy, 2007).

Lack of culture and trust for project financing;

Lack of trust, culture and scepticism on the client's side in the ESCO offer is another long standing obstacle that has not changed significantly in most countries. This is often the result of limited understanding of energy efficiency opportunities. Some clients are afraid that he guarantee would not function as expected (Bertoli, Bozza-Kiss, & Rezessy, 2007).

B. Global trends resulting in an increasing demand for energy efficiency

The ESCO industry in general has evolved significantly over the last decade (Vine, Nakagami, & Morakoshi, 1999). The next decade will engender more change. Although market conditions and opportunities vary widely across countries, several trends are evident in many of the largest countries, which tend to increase the demand for energy efficiency and ESCO's (Vine, 2005):

Subsidy removal
Many countries have in recent years decreased or removed energy subsidies. This makes the true cost of energy more apparent to the end user and increases the incentives for efficiency.

Privatization
Many countries are, or have been, privatizing formerly state-owned energy utilities and major industries. This typically increases pressure on companies to improve efficiency in all aspects of operation, including energy use. However, the consequences are contested: it led to a significant decrease of energy prices in the short run. Because of the increased competition the liberalization provided opportunity as well as necessity to utility companies to expand their business field beyond the traditional electricity and natural gas sales to energy services. Thus, those value-added energy services are becoming more important than simply selling the product of electricity and natural gas (Bertoldi & Rezessy, 2005). Many utility companies turned into energy service companies (Ürge-Vorsatz, et al., 2007).

International competition
Increasing global trade and competition forces companies to minimize input costs. As wages and the costs of local inputs rise with economic development, energy costs become relatively more important, providing further incentive for efficiency.

Constrained power supply
The demand for electricity is growing factor than the expansion of electricity supply, creating incentives and demand for energy efficient equipment and processes. In fact, some developing countries experience regular electricity shortfalls that threaten industrial expansion and economic growth.

Environmental concerns
Countries are under increasing pressure to clean up local pollution from industry and the power sector, and to limit growth in emissions of greenhouse gases that contribute. International climate agreements could become an important mechanism for promoting energy efficiency and the ESCO industry.

C. Overview key figures of ESCO markets in the European Union

Table 5: Key features of EU member states ESCO markets (Marino, Bertoldi, & Rezessy, 2010)

Country	Market size (€ turnover/year)	Number of ESCO's	Types of ESCO's	Measures mostly implemented	Contract types	Sectors
Germany	1,7 – 2,4 bln	250-500		Heating Insulation CHP	ESC (GS, SS) EPC (GS, SS) BOOT	Public Buildings Private buildings
France	4-5 bln	10 big and100 smaller actors	Facility management and operation companies, manufactures of building automation & control systems	HVAC Street lightning compressed air production systems	Chauffage	Public buildings Private non-residential buildings
UK	400 mln	20	Subsidiaries of large international manufactures of buildings automation & control systems, and Energy service and supply companies	Lighting HVAC Plant Replacement Decentralised boilers and controls CHP	EPC	Industry Commercial and public sector
Italy	387 million (in 2009)	50	Very diverse. Subsidiaries of large international companies and SME.	CHP Public lightning Control Renewable energy	Chauffage	Public sector Industry Residential sector
Spain	> 100 mln €	> 15	National and international large utilities, construction and multiservice companies	CHP CCHP Street lighting Solar-thermal Wind PV	SS BOOT Chauffage	Public sector Private non-residential buildings Industry
Austria	10-15 mln €	5-14	Energy service & supply companies & consultancy and engineering firms	Heating Cooling Lighting Water management	SS	Public buildings Private buildings
Belgium	N.A.	13- 17 ESCO's	Large international manufactures of building automations & Control systems (1 public, 7 large and 5-7 small ESCO's)	Insulation Lighting HVAC	Customer financing ESCO-based funding Leasing	Public sector Industry
Sweden	60 – 80 mln €	5-10	International medium sized, manufacturers of building automation & control systems	Improved control systems Ventilation Heat recovery	TPF Receivable Financing	Public buildings
Netherlands	n.a.	50	Energy services, Construction and engineering companies	Street lighting Large building renovations	Grants Preferential loans	Public sector Municipal

D. International performance measurement & verification protocol

The IPMVP is the widely reference framework for 'measuring' energy or water savings. Its protocol is particularly used in energy performance contracts where savings must be reported to a client and may form the basis of a payment to an ESCO. The IPMPV presents common terminology and defines full disclosure, to support rational discussion of often contentious M & V issues. It documents the state of the art. However, it does not specify project design since it is a high level framework. Therefore, an M & V engineer is still needed to apply IPMVP principles to the 'measurement' of signs for each energy efficiency project (Efficiency Valuation Organisation, 2012).

Programs that adhere to IPMVP guidance bring the following benefits for ESCO's (Efficiency Valuation Organisation, 2012):

- Substantiation of payment for performance. Where financial payment is based on demonstrated energy or water savings, adherence to IPMVP ensures that savings follow good practice. Energy service companies (ESCO's) whose invoices are supported by IPMVP-adherent savings reports, usually receive prompt payments.
- Lower transaction costs in an energy performance contract. Specifications of IPMVP as the basis for designing a project's M & V can simplify the negations for an energy performance contract.
- International credibility for energy savings reports, thereby increasing the value to a buyer of the associated energy savings.
- Enhanced rating under programs to encourage or label sustainability designed and/or operated facilities.

There are two main techniques to determine savings, depending whether the purpose of the customer is measuring Energy Conservation Measures (ECMs) or facility performance. In the first case, Options A and B represent the Retrofit Isolation technique which narrows the measurement boundary to focus only on the systems or equipment of a particular ECM. While under Option A we only measure the key parameters affecting energy use and estimate the rest, Option B requires measuring all parameters affecting consumption.

On the other hand, Options C and D represent the Whole Facility approach. In Option C the measurement is done at facility level while Option D allows the use of simulation techniques to determine the savings. The following chart summarizes all M&V Options considered in the IPMVP protocol (Efficiency Valuation Organisation, 2012).

The way of measuring and verifying the savings depend on the measures implemented by the ESCO. In table below, you can find an outline of which techniques have to be used for what approach.

Table 8: IPMVP Options (Efficiency Valuation Organisation, 2012)

IPMVP option	How savings are calculated	Typical applications
A. Retrofit isolation: key parameter measurement Savings are determined by field measurement of the key performance parameter(s) which define the energy use of the ECM's affected system(s) and/or the success of the project. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period. Parameters not selected for field measurement are estimated. Estimates can based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter is required. The plausible savings error arising from estimation rather than measurement is evaluated.	Engineering calculation of baseline and reporting period energy from: short-term or continuous measurements of key operating parameter(s); and estimated values. Routine and non-routine adjustments as required.	A lighting retrofit where power draw is the key performance parameter that is measured periodically. Estimate operating hours of the lights based on building schedules and occupant behaviour.
B. Retrofit Isolation: All Parameter Measurement Savings are determined by field measurement of the energy use of the ECM-affected system. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.	Short-term or continuous measurements of baseline and reporting period energy, and/or engineering computations using measurements of proxies of energy use. Routine and non-routine adjustments as required.	Application of a variable speed drive and controls to a motor to adjust pump flow. Measure electric power with a kW meter installed on the electrical supply to the motor, which reads the power every minute. In the baseline period this meter is in place for a week to verify constant loading. The meter is in place throughout the reporting period to track variations in power use.
C. Whole Facility Savings are determined by measuring energy use at the whole facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period.	Analysis of whole facility baseline and reporting period (utility) meter data. Routine adjustments as required, using techniques such as simple comparison or regression analysis. Non-routine adjustments as required.	Multifaceted energy management program affecting many systems in a facility. Measure energy use with the gas and electric utility meters for a twelve month baseline period and throughout the reporting period.
D. Calibrated Simulation Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility. Simulation routines are demonstrated to adequately model actual energy performance measured in the facility. This Option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data. (Energy end use metering may be used to help refine input data)	Multifaceted energy management program affecting many systems in a facility but where no meter existed in the baseline period. Energy use measurements, after installation of gas and electric meters, are used to calibrate a simulation. determined using the calibrated simulation, is compared to a simulation of reporting period energy use.

E. Example EPC project of the Berlin Energy Saving Partnership

The content in the table beneath illustrates the main economic data of one ESP-project in Berlin.

Table 9: Project example of the ESP Berlin: pool of public buildings (Lamers, Kuhn, & Krechting, 2008)

Project data sheet: ESP Pool 14, Berlin			
Customer type	Community, district of Friedrichshain-Kreuzberg, Berlin		
Building type	Schools, children day care, cultural buildings (22 buildings in total)		
Tender procedure	EU-level (functional tender, negotiation procedure)		
(Net) energy cost baseline	Heat (gas, oil, DH)	22.544 MWh	763.642 Euro
	Electricity	4.276 MWh	464.776 Euro
	Water	54.984 m³	295.548 Euro
		Sum	1.523.966 Euro
(Net) investments	1.492.200 Euro		
Project duration	10 years		
Technical focus	Renewal of the heating systems, optimisation of the heating and regulation control system, thermostat implementation, hydraulic adjustment, utilisation of DDC technique and building automatisation, implementation of water savings technique, optimisation of air-conditioning system, energy saving lighting		
Mandatory measures	Oil to natural gas switch in 4 buildings, boiler exchange in 5 buildings		
(Net) guaranteed savings	29,00% (421.400 Euro/a)		
Customer cost saving share	85.100 Euro/a		
CO_2 – reduction	2.543 t/a		
Contractor	ARGE Imtech Contracting GmbH & Co KG and dEDL Boysen GmbH		

F. Interview list

Table 10: Interview list

Person	Position	Organisation	Interview date (2012)
Michiel Houwing **Gijs postma** **Dick van Veen** **Paul Vijver** **Maarten Sessink**	Consultant EPC Financial consultant Manager EPC Real Estate Business Controller Consultant Regulatory affairs, energy efficiency	Eneco Eneco Eneco Eneco Eneco	2 - 8 26-6 27-6 22-6 22-6
Coen Janssen	Business development manager	Essent	29-5
Albert Hulsfhoff	Director Director	ESCOnetwerk.nl, AHB consulting	23-5
Frank Bakker	Consultant	Honeywell Building Solutions SES	4-5
Kees verspui	Business development manager energy solutions	Johnson Controls	25-4
Myra Glaser	director	Glaser & Partners	21-5
Lieven Vanstraelen	Chairman General director	BELESCO EnergInvest	23-5
Ger Kempen	Director product development	ESCO-Plan	5 - 6
Palle Yde Poulsen	Department Manager	Dong Energy	8-6