Wuppertal Institute

Energy Efficiency Services

Market development

Energy and energy service companies

Task 2.4: Economic incentives and barriers for EES and the relation between Energy companies and ESCOs

Wuppertal Institut
für Klima, Umwelt, Energie
GmbH

Intelligent Energy Europe

Change Best: Promoting the development of an energy efficiency service (EES) market – Good practice examples of changes in energy service business, strategies, and supportive policies and measures in the course of the implementation of Directive 2006/32/EC on Energy End-Use Efficiency and Energy Services.

A project supported by the Intelligent Energy Europe Programme of the European Commission (IEE/08/434/SI2.528383).

A main objective of the Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) is to stimulate the market for energy services and for the delivery of other energy efficiency improvement measures to final consumers. In order to achieve this objective, the ESD gives a special role to energy distributors, distribution system operators and retail energy sales companies. On the other hand, there are different types of "pure" energy service companies (ESCOs) in the market ready to expand their business in the field of energy efficiency services (EES).

Against this background, it is important to know, how and to which extent the EES market could be further developed, what are appropriate business strategies and promising services not only for “advanced” companies but also for “beginners”, what is a policy framework suitable to stimulate market development and to overcome existing barriers, and which role energy companies developing towards sustainable ESCOs could play.

Objectives
The main objectives of ChangeBest are:

- to assist energy companies and ESCOs in entering the B2B and B2C market for EES,
- to contribute to the development of the EES market as part of the implementation of the ESD,
- to demonstrate good practice in implementing the ESD.

Tasks
In order to achieve the objectives specified, the project work will consist of:

- empirical analysis of the EES market and the respective economic and policy framework in the course of the implementation of the ESD,
- exchange of experiences, national workshops and a European conference,
- a large bundle of promising EES business cases and strategies implemented in “field tests”,
- communication and dissemination activities, and
- induced further action and networking by energy (service) companies.

The analysis of economic incentives and barriers for EES and the relation between energy companies and ESCOs is the main objective of this report.

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SEVEn	Czech Republic
ESB - Energy Saving Bureau	Estonia
ARMINES	France
EDF – Electricity of France	France
ASEW -	Germany
ULUND - Lund University	Sweden
HELESCO S.A.	Greece
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Ekodoma	Latvia
ISR – University of Coimbra	Portugal
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Executive summary

The provision of energy efficiency services (EES) can be a win-win situation for EES providers and their clients. However, the economic situation is different for different types of EES providers (e.g., energy companies or ESCOs). Moreover, significant barriers exist in practice that hinder energy companies and ESCOs to enter the EES market. This paper analyses the existing economic incentives and the importance of several economic market barriers.

An overview of the EES markets in 18 countries, respective country reports analysing national EES markets and a report on policy instruments hindering or fostering market development have been published in other ChangeBest project reports (cf. www.changebest.eu), a report on the substantial EES economic potentials in the EU-27 will be published in autumn 2010.

Different types of providers of EES and of partial services connected to EES operate in the market. In order to stimulate the market for energy services and for the delivery of other energy efficiency improvement measures to final consumers, the Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) gives a special role to energy distributors, distribution system operators and retail energy sales companies. On the other hand, different types of "pure" energy service companies (ESCOs) in the market are ready to expand their business in the field of energy efficiency services (EES). The role and position of energy companies and ESCOs in the EES market, however, varies although both types of companies are appropriate actors to deliver EES. Characteristics and competitive advantages of each type of company in the EES market are identified and compared with each other in this report. In addition, the opportunities of strategic partnerships between ESCOs and energy companies are pointed out. They can help to remove a number of drawbacks that exist for independent ESCOs and energy companies offering EES.

	Energy companies	**Pure ESCOs**
Customer contacts and infrastructure facilities	+	-
Marketing synergies to energy retailing	+	-
Financial basis	+	-
Technical knowledge and capacities for EES	-	+
Competences for EES	+	+
Relevance of lost revenues	-	+
Strategic partnerships	+	+

(+) competitive advantage regarding the provision of EES

(-) competitive disadvantage regarding the provision of EES

The most important driver for energy companies and ESCOs in liberalised electricity markets is to increase their profits. Therefore, economic incentives and barriers for energy services are analysed by studying the impacts of providing EES on the company's profits or contribution margin. The net effect for an energy company that offers energy services is in principle determined as follows:

	Avoided Costs
+	Additional revenues (for example from payments for EES)
+	Cost recovery (if respective policy instruments exist)
./.	Energy efficiency service costs
./.	Net lost revenue (if savings will not be realised anyway)
=	Net effect.

In comparison to energy companies offering EES, the calculation of the net effect for pure ESCOs is less complex as the interactions between energy sales and saved energy are not relevant. Consequently, the cost-effectiveness of EES that are offered by pure ESCOs depends mainly on the EES costs and revenues which vary greatly by project type.

Included into this report are several sample calculations that illustrate the cost-effectiveness of hypothetical EES for several types of EES provider (a retail energy supplier as well as an unbundled energy distribution company acting as overall service providers and a pure ESCO). One of the exemplary calculations shows that the retail supply company is economically better-off by providing EES since the avoided costs and the contracting revenue clearly outweigh the EES investment costs and the lost revenue. Moreover, make-or-buy considerations point out that the retail supply company is significantly better-off if it acts as an overall EES provider than to leave the EES business to other energy service providers. For the cost-effectiveness analysis from the perspective of an unbundled energy distributor data was provided by an Italian gas distributor that is obliged by the Italian white certificate scheme. The specific gas distribution company meets its saving obligations by implementing gas and electricity saving projects. The comparison of the economic effect of the gas and electricity saving projects shows that the electricity saving activities are profitable for the gas distribution company in contrast to the gas saving activities.

An evaluation is also carried out from the customer perspective, since customers will unlikely demand an EES, if their benefits are lower than the costs. A high benefit-cost ratio is, consequently, an indicator of high demand for specific EES. The exemplary calculation presented in this report illustrates that industry as well as trade, commerce and service customer are much better-off by demanding EES since avoided energy bills outweigh the contracting rate paid to the EES provider.

Energy efficiency projects inevitably involve some degree of risk and uncertainty. These risk and uncertainty factors are in some cases a major barrier for EES provider to initiate energy efficiency projects. Risk and uncertainty factors that are especially important for EES provider including bankruptcy of the client, refusal of the

client to pay, risk of miscalculation, operational and behavioural risk, length of the contract period, operation and maintenance risk, degree of EES product standardisation, investment cost risk and financial risk are discussed in this publication.

Energy efficiency programmes can have a direct or indirect impact on the evolution of the EES market by addressing market barriers, reducing transaction costs, establishing standardisation and achieving market transformation. In this context, the report closes by analysing the relation between EES and energy efficiency programmes and discussing the main objectives of different kinds of programmes such as dissemination of information, standardisation, certification and providing financial support.

1 Introduction

The analysis of economic incentives and barriers for (potential) EES providers offering energy efficiency services (EES) and the relation between energy companies and energy service companies (ESCOs) is the main objective of this report.

Particular attention will be dedicated to existing market barriers, economic and political framework conditions under which energy companies and/or ESCOs enter this market, how they interact, compete or cooperate. This analysis will be conducted for energy companies and ESCOs acting as EES providers and typical market environments. Moreover, cost reduction potentials of standardisation of EES will be analysed as well as transaction costs. Finally, the relation between EES and energy efficiency programmes will be analysed.

The report is structured as follows: In chapter 2, different types of EES providers as well as barriers and incentives to enter the EES market are described. Afterwards, their relation to each other is discussed, and their role and position in the EES market compared.

In Chapter 3 economic incentives and barriers for EES are analysed by studying the decisive impacts of providing EES on the company's profits.

Following the information and conclusions from the previous chapters, the net economic effect is calculated in chapter 4 by using a quantitative cost-benefit analysis. Thereby, the economic impact of EES for a retail supply company, a pure ESCO and an unbundled energy distribution company providing hypothetical contracting projects is illustrated. In this context, also risk and uncertainty factors that are particular important for EES providers are discussed.

Finally, the relation between EES and energy efficiency programmes is analysed in chapter 5. The importance of energy efficiency programmes for a successful EES market development is pointed out and limitations for EES market activities are shown.

2 Types of energy efficiency service providers

Different types of energy companies and ESCOs acting as EES providers as well as barriers and incentives to enter the EES market are described in the following chapter. The relation of energy companies and ESCOs to each other will be discussed afterwards, and their role and position in the EES markets will be compared.

Despite energy companies and ESCOs, other types of EES providers are active on the market like energy agencies as well as engineering and consultancy companies. This report, however, discusses the special role of energy companies and ESCOs in providing EES. The impact of policy instruments on the development of the EES market is not extensively analysed in this report, but in detail in Task 2.3 of the ChangeBest project.

2.1 Energy service companies

The Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) defines ESCOs as being *"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. The payment for the services delivered is based (either wholly or in part) on the achievement of energy efficiency improvements and/or on meeting other agreed performance criteria."*

According to the Directive, sufficient incentives, equal competition and level playing fields should be provided by Member States for other market actors that are not energy companies offering and implementing energy efficiency services such as "pure" energy service companies (ESCOs).

For the purpose of the ChangeBest project Energy efficiency services (EES) are defined as an agreed task or tasks designed to lead to an energy efficiency improvement and maybe other agreed performance criteria, which have proven in "normal circumstances" to lead to verifiable and measurable or estimable energy efficiency improvement and/or primary energy savings.[1] EES may include energy audits, energy management, the supply of energy and equipment and the provision of services such as space heating (Bertoldi and Rezessy, 2005). Despite other companies offering energy services, ESCOs often offer EES that guarantee the savings or the delivery of the same level of energy service at a lower cost. Their remuneration is often directly linked to the energy savings achieved by the implementation of the project. Usually ESCOs provide or arrange the financing of the energy efficiency project. Typical tasks of ESCOs are:

[1] This defintion is similar to CEN/CLC/TF 189 No. 096 of Sept 24, 2009, but not demanding that an EES should consist of an audit + implementation + measurement and verification, i.e. ChangeBest has a broader understanding of EES.

- Developing, designing, financing and individuating third parties willing to finance energy efficiency projects;
- Installing the energy efficient equipment and providing the O&M;
- Measuring and monitoring the energy consumption and verifying the energy savings of the project during the contract lifetime.

Due to the uncertainty of the expected savings, ESCOs accept some degree of financial and technical risk (Bertoldi et al, 2006).

Even if from a theoretical point of view the concept of ESCOs seems to be a win-win situation for ESCOs and their clients, significant barriers exists that hinder ESCOs to enter the market. An overview of important barriers for ESCOs is presented below[2].

- **Level of energy prices**

  Low energy prices, which reduce the share of energy expenditures in total income, decrease the incentives for customers to implement energy efficiency improvement measure. Lower prices of electricity in some European countries partly brought by the market liberalisation in the last years for some customer groups made electricity savings less profitable, but on the other hand created room for easier implementation of policy measures that increase the overall energy prices. Such policy measures are for example emission trading schemes or carbon taxes to internalise external environmental costs or the removal of energy price subsidies. However, there are countries like Poland where a part of the society is still relatively poor and the household income fraction spent for the energy bill is relatively high despite the energy prices are kept low. In such situations policy measures that raise the energy prices would not be socially acceptable.

- **Lack of information and awareness**

  Potential customers and financial institutions may have insufficient information about existing energy efficiency improvement measures and are often unfamiliar with the principles of the ESCO business. Information and demonstration programmes, training of financial facilities and model contracts provided, for example by energy agencies, can reduce this barrier for ESCOs to enter the market. However, the end-user's lack of knowledge of the existing energy saving potential is often also a motivation for end-users to demand EES and, thus, an opportunity for ESCOs. Consequently, a lack of knowledge can also be a supportive factor for the ESCO market development. Moreover, the introduction of smart metering and billing in buildings improves the access to information about the energy use of specific buildings. This would raise the awareness of consumers about their energy consumption and consequently their interest in energy services (World Energy Council / ADEME, 2007). A further barrier from the customer point of view is the difficulty to find the

[2] The list of barriers that hinder ESCOs to enter the market is not exhaustive. Further barriers are, for example, analysed in (World Energy Council / ADEME, 2007).

appropriate EES provider since product types are often not easily described for most of the customers and some EES are offered by different types of EES providers, e.g. ESCOs, energy suppliers, energy agencies, consulting companies, NGOs. In this case, at least at first sight, the same EES-type is often offered within a wide range of costs depending on the type of EES provider while information of differences in quality are missing.

- **Transaction costs**

  ESCOs are usually not interested in implementing small scale projects that are characterised by transaction costs that are relatively high compared to the expected cost and energy saving potentials. This barrier is a main reason why only few energy services are offered to the residential sector. Bleyl-Androschin et al. (2009) concluded from an analysis conducted for Germany that the energy contracting market potential is restricted in the residential sector to projects that exceed 100 kW_{th}.The problem of low profitable and risky projects can be reduced with guaranteed funds, pooling of multiple projects (for example the same type of EES for several buildings) and support schemes provided by the state.

- **Principal/agent problem**

  The implementation of energy efficiency projects is often difficult for ESCOs if a cost partition between the owner of a building and the tenant exists (split incentives). On the one hand, the tenant must be informed and approve the measure. Moreover, the costs of the energy efficiency improvement measure can only be imposed on the tenant if this is defined in the contract. On the other hand, the building owner itself has no incentive to pay for energy efficiency improvements because the tenant is responsible for paying his energy bill. Split incentives may also exist in the public sector if decreasing energy costs will also reduce the available budget of public authorities. In this case public authorities have no incentive to use less energy and, therefore, to cooperate with ESCOs.

- **The level of energy intensity**

  The interest of non-energy intensive industries to implement energy efficiency improvement measures is in general low due to the small share of energy expenditures compared to their total expenditures. The success of ESCOs in countries with a high share of energy intensive sectors, such as in China, can at least partly be explained by this factor. However, successful ESCO industries in countries with low energy intensities show that this factor alone is not decisive.

- **Payback-Periods**

  Many customers, especially in the industrial sector, require short payback-periods for many ESCO projects. As many energy efficiency projects can have payback periods of several years, the lack of taking lifecycle costs into account creates large disincentives for ESCOs to implement capital intensive

projects. However, if ESCOs can manage to provide off-balance financing with longer payback-periods this barrier can also become an opportunity for them.

- **Lack of appropriate forms of finance**

  For ESCOs and their customers financing of EES has become increasingly burdensome due to Basel II, international accounting guidelines and since balance sheets are burdened by credit liabilities and market partners reach their credit lines (Bleyl and Schinnerl, 2008). A lack of appropriate forms of finance represents a potential barrier for EES provider. Bleyl and Schinnerl (2008) discuss innovative forms of financing like operate, finance lease or “pure” forfeiting options and compare them to classical credit financing. A further important barrier for EES providers is the unavailability of credit insurances. This barrier is especially important for large projects with one big customer due to the high risks in case of insolvency. However, if the risk is distributed among several smaller projects like it is the case in the housing industry (EES projects in several buildings) this barrier is of less importance.

- **Perceived risk of the industrial sector**

  Potential industrial clients of ESCOs may perceive technical and business risks due to the implementation of energy efficiency improvement measures. Companies fear, for example, that the implementation of saving measures leads to interruptions in the production process. Furthermore, companies may not allow ESCOs to check their industrial processes in detail because they fear about trade secrets. As a result, many ESCOs concentrate in the industrial sector by implementing standard applications instead of improving specific processes. In some cases the industrial sector also fears to become dependent on the contractor (EES provider) and to loose own competences.

- **Public sector barriers**

  The work of ESCOs in the public sector can be hindered by legal conditions, for example due to municipal and budgetary law. In order to reduce this barrier, an essential point is to establish a neutral approach on how remuneration from energy savings should be accounted for within the municipal budget (Hansen, 2009). Moreover, public contracts related to energy efficiency improvement measures are often awarded to the bidder with the lowest up-front investment costs instead of awarding to the bidder that offers the project with lowest overall life-cycle costs. Thus, energy savings during the whole project life-cycle should be considered when awarding public contracts (Hansen, 2009). Unclear and low-quality tender specifications, complex tendering procedures as well as due to the small size of tenders and long and costly acquisition processes are also a reason why EES provider are often reluctant to bid for contracting projects in the public sector (Hansen, 2009). More barriers that hinder the work of ESCOs in the public sector are, amongst others, complex decision processes, high effort needed to prepare a tender, bureaucracy, split budgets and missing support of the local politicians.

2.2 Energy distributors, distribution system operators and retail energy sales companies

The restructuring of the European energy market with both the unbundling of the generation, transmission, distribution and supply of energy and the competition in retail supply has generally induced more disincentives for energy companies to deliver energy services and demand-side energy efficiency programmes. Furthermore, most of the demand-side barriers to reduce energy consumption are still existent.

However, there are several reasons why energy companies are important actors in offering and implementing energy end-use efficiency activities which are recognised in Directive 2006/32/EC on energy end-use efficiency and energy services (ESD). In particular, energy distributors, distribution system operators and/or retail energy sales companies are mentioned in Article 6 of the Directive as important actors to achieve the energy saving targets of the Member States (MS).

An energy distributor is defined according to the Directive as *"a natural or legal person responsible for transporting energy with a view to its delivery to final customers and to distribution stations that sell energy to final customers."* Electricity distribution system operators are excluded in this definition. They are defined separately as *"a natural or legal person responsible for operating, ensuring the maintenance of and, if necessary, developing the distribution system of electricity or natural gas in a given area and, where applicable, its interconnections with other systems, and for ensuring the long term ability of the system to meet reasonable demands for the distribution of electricity or natural gas."* A retail energy sales company is *"a natural or legal person that sells energy to final customers"*.

Arguments why it is desirable that energy companies offer and implement energy services are:

- Energy companies are better off if they gain additional revenues by carrying out EES than if they leave the EES business to other ESCOs because the lost revenue due to the energy savings will be realised anyway;
- By providing energy services, small and medium sized energy companies can at least partly counterbalance profits and revenues that are lost in liberalised energy markets due to the impossibility to win the competition on the cheapest energy price;
- In the course of strengthened climate change mitigation policies and measures EES can be a promising business opportunity for energy companies that are threatened by increasing costs and losses in revenues and profits;
- Energy companies already have customer information like billing data, infrastructure such as customer information centres and valuable experiences as well as competences that can be beneficial when expanding the EES business to new customers;

- The delivery of EES leads to long-term contracts with customers and improves customer relations;
- Energy companies delivering EES show a higher social responsibility which ameliorates their public image. This factor is a competitive advantage in gaining new customers and when selling own shares;
- Provided that a supportive policy framework exists, the profit maximisation of energy companies may change from selling as much energy as possible to each customer to selling energy services to as many customers as possible. If such incentives for energy companies to deliver energy efficiency improvement measures to final consumers exist, the EES market will increase and cost-effective investments in energy efficiency will be facilitated.

2.3 Relation between ESCOs and energy companies – Comparison of their role and position in the EES market

Both, ESCOs and energy companies are appropriate actors to deliver EES.[3] However, their role and position in the EES market varies. Characteristics of each type of company in the EES market and differences between them are explained below.

The situation of energy companies

- Due to their core business of selling or distributing energy, energy companies have often already established customer contacts to all kinds of customer groups they can use for acquiring energy efficiency projects. Furthermore, infrastructure facilities like support and information centres exist. Using these customer contacts and infrastructure facilities when establishing the EES business allows energy companies to keep initial investment costs as low as possible. Consequently, energy companies have competitive advantages compared to pure ESCOs in this respect.
- Marketing synergies exist for energy companies that extend their core business of energy retailing to the provision of EES. The customer loyalty increases, for example, by longer contract periods as a result of contracting projects. A decline in revenue due to lost customers in the liberalised market can therefore be avoided. Furthermore, acting as an overall energy service provider usually increases the customer satisfaction and customer relationship. Finally, the energy company can stand out from its main competitors by a brand positioning that aims at a green and sustainable corporate image resulting in an increasing market share.

[3] In practice, sometimes no clear separation between ESCOs and energy companies exists, for example, if an independent functioning ESCO is a subsidiary of an energy company.

- In most European countries energy companies have a sound financial basis. This allows them to finance energy efficiency projects at least partly with internal funds. Moreover, energy companies with reasonable capital resources usually meet the creditworthiness criteria of banks which enable them to finance energy efficiency projects with external funds from the financial market (third party financing with energy company borrowing).
- Not all energy companies have sufficient competences to provide EES from the beginning. In the past, they often fully concentrated on their core business of energy retailing. Therefore, the development of competences in the field of energy efficiency could have been disregarded. Furthermore, a lack of capacities to extend the major business area to other fields may prevent energy companies from providing EES.
- Local government codes could prohibit municipal energy companies to provide EES. This is, for example, the case in Germany (especially in North-Rhine Westphalia, Baden-Württemberg and Bavaria) where municipal energy companies are prohibited by specific local government codes to offer EES if the same kind of EES is provided by private suppliers or if the potential customers are beyond the ruled area (VKU, ASEW, 2009).
- In comparison to pure ESCOs, lost revenues (i.e. distribution or retail supplier revenue) are at least partly relevant for energy companies offering EES because of less energy sales to own customers due to energy efficiency activities. However, in liberalised energy markets with supportive policies for energy efficiency activities, where it is attractive for ESCOs to support the energy company's customer to realise energy savings the revenue is lost anyway. Thus, lost revenue is not relevant if the energy efficiency activities are carried out also without an involvement of the energy company.[4]

The situation of ESCOs

- The financial basis of pure ESCOs often is relatively small compared to larger energy companies. This could make the financing of large energy efficiency projects from internal funds difficult. Third party financing where credits are provided to ESCOs by financial institutions can be problematic if ESCOs are small, new on the market or under-capitalised and, therefore, cannot meet the credit-worthiness of banks. As a result, banks may not lend sufficient credits to ESCOs or demand high interest rates which could result in unprofitable energy efficiency projects (Bertoldi and Rezessy 2005).
- The business concept of ESCOs is often not known by potential customers. Therefore, ESCOs mostly focus on larger customers that have access to information about their energy saving potential.

[4] The importance of lost revenues is explained in more detail in Chapter 3.6 of this report.

- ESCOs are often engineering firms with well-trained technical specialists in energy-related equipment. As a consequence, ESCOs are very suitable to implement energy savings measures that require specific knowledge in energy efficiency technologies.
- In practice, sometimes no clear separation between ESCOs and energy companies exists, for example, if an independent functioning ESCO is a subsidiary of an energy company. Such relations can help to remove a number of drawbacks that are described for independent ESCOs and energy companies offering EES. The formation of strategic partnerships between ESCOs and energy companies may, for example, bring together the strengths of both types of companies. Typically, the energy company provides capital as well as customer contacts and the ESCO engineering services. Such strategic partnerships are an important opportunity for energy companies that do not have own competences or capacities to implement energy efficiency improvement measures but are obliged to achieve energy savings, for example, in countries with white certificate schemes.

Table 2-1: Comparison of the role and position of energy companies and pure ESCOs in the EES market

	Energy companies	Pure ESCOs
Customer contacts and infrastructure facilities	+	-
Marketing synergies to energy retailing	+	-
Financial basis	+	-
Technical knowledge and capacities for EES	-	+
Competences for EES	+	+
Relevance of lost revenues	-	+
Strategic partnerships	+	+

(+) competitive advantage regarding the provision of EES
(-) competitive disadvantage regarding the provision of EES

3 Economic incentives and barriers for energy companies to provide energy efficiency services

3.1 General approach

The most important driver for energy companies operating in liberalised electricity markets is to increase their profits. Therefore, economic incentives and barriers for energy efficiency services should be analysed by studying the impacts of providing EES on the company's profits or contribution margin.

The net effect for an energy company that offers energy services is in principle determined as follows:

	Avoided Costs (section 3.2)
+	**Additional revenues** (for example from payments for EES) (section 3.3)
+	**Cost recovery** (if respective policy instruments exist) (section 3.4)
./.	**Energy efficiency service costs** (section 3.5)
./.	**Lost revenue** (if savings will not be realised anyway) (section 3.6)
=	**Net effect**.

Impacts that are difficult to evaluate in monetary terms like a higher customer loyalty are neglected in this rough calculation scheme, even if they represent often a central motive for implementing energy efficiency activities. The meaning of each of these impacts is explained in more detail in the subsequent section.

In comparison to energy companies offering EES the determination of the net effect for pure ESCOs is less complex as the interactions between energy sales and saved energy can be omitted. For pure ESCOs, the cost-effectiveness depends mainly on the EES costs and revenues which vary greatly by project type due to the individual characteristics of each EES.

3.2 Avoided costs

- **Avoided power purchase costs**

  The cost of buying power from the wholesale market is reduced due to the implementation of energy efficiency activities for unbundled retail supply companies.

- **Avoided distribution capacity and operation costs and losses**

  Energy efficiency activities which reduce peak demand in capacity constraint systems may enable distribution system operators to avoid or defer investment costs associated with expanding existing distribution capacity.

Distribution line losses as well as ongoing operation costs are also reduced with respect to the reduced transportation of energy due to less consumption. Consequently, the avoided costs and losses constitute a benefit for energy distribution companies and distribution system operators.

- **Avoided penalties or buyout prices**

  In countries with energy saving obligations for energy companies, penalties or buyout prices are avoided by the obliged actors provided that they fulfil their saving obligations. Consequently, obliged actors should take avoided penalties or buyout prices into consideration when they decide about offering and implementing energy efficiency activities. In Europe, saving obligations are either imposed on distribution companies, for example in the white certificate scheme in Italy or on energy retail supply companies, for example in the white certificate scheme in France and in the Carbon Emission Reduction Target (CERT) scheme in the UK.

3.3 Additional revenue

- **Service revenue of retail supplier or energy distribution companies**

  Retail supplier or distribution companies that act as overall energy service provider receive payments from EES which are paid from existing or new customers who directly benefit from these services. Paid EES comprise, for example, energy performance contracting, energy analysis, or load management.

- **Additional energy sales revenue**

  The delivery of EES leads to long-term contracts with customers and improves customer relations because the contacts of the service provider to the customer are more intensive. Consequently, retail supply companies offering EES may retain existing customers and gain new customers due to the offer of these value-added services. Revenues from energy sales to customers who were retained or won as new customers due to the offer of EES should, thus, be considered in cost-effectiveness analysis as a benefit for the overall energy service provider.

- **Revenues from selling white certificates**

  In countries with tradable white certificate schemes energy companies that implement energy efficiency activities and sell the corresponding certificates on the market generate additional revenue.

- **Improved system reliability**

  In general, end-use energy efficiency activities improve the reliability of the supply system. Demand savings in peak times could for example avoid costs of supply disruptions, blackouts and damage and control costs of customers and industries. A more reliable system can, therefore, be considered as a

benefit from the perspective of an energy company. However, the improved system reliability is difficult to evaluate in monetary terms.

- **Public image**

  The public perception of an overall energy service provider is in general higher compared to a pure retail supply company and results in a positive recognition, especially if environmental benefits are promoted.

3.4 Cost recovery

- **Distribution tariff changes to recover energy efficiency service costs**

  EES investment costs, which are borne by energy distributors that act as overall energy service provider could in principle be recovered within distribution tariffs. The wire charge could be used to pay the costs a distribution company incurs to implement EES. However, the distribution tariffs are controlled by a regulatory authority to avoid monopoly prices. This means for the recovery of programme costs, that the price regulation system must explicitly allow to consider the energy efficiency service investment costs in its ratemaking mechanism. Under certain regulatory regimes, energy efficiency service investment costs cannot be recovered by increased tariffs, which creates large disincentives for distribution companies to implement EES. If a cost-recovery mechanism exists, it is considered as a benefit from the perspective of the energy service provider.

- **Distribution tariff changes to recover net lost distribution revenues**

  The net lost distribution revenue due to reduced energy sales because of energy efficiency activities could be recovered within distribution tariffs. However, the regulatory authority controls the prices of the monopoly segments. A recovery is only possible if a ratemaking mechanism exists that allows a price increase. The incentive for energy distribution companies to invest in energy efficiency can be increased, if a ratemaking mechanism exists that makes the profit of the energy distributor insensitive to lost revenues and therefore to the amount of kWh distributed. Such a cost-recovery mechanism is considered as a benefit from the perspective of energy distribution companies.

- **Distribution tariff changes to receive a share in net cost savings to society**

  The incentives for distribution companies to act as overall energy service provider increase, if regulatory authorities allow to adjust distribution tariffs to receive a share in net cost savings to society. The revenues from the share in net cost savings to society are considered as a benefit from the perspective of energy distribution companies.

- **Supply price changes to recover energy efficiency service costs**

  EES costs, which are borne by retail suppliers that act as overall energy service provider, could in principle be recovered within supply prices. In this case supply prices would be increased to pay the costs a retail supply company incurs to implement EES. Retail supply companies are free to charge their customers for the EES investment costs because their tariffs are usually not regulated. The potential to recover EES costs with an increase in the supply price depends on the level of price competition a retail supplier faces. In an energy market where all energy end-users are eligible customers who have access to competitive energy suppliers, a recovery of EES investment costs is unlikely. In contrast, a recovery of programme costs by an increase in the supply price would be possible in an energy market with only partial retail competition where franchise monopolies are responsible for the supply of non-eligible customers. Cost recovery will also be possible if all competing suppliers have the same level of obligation to save energy, such as in the white certificate schemes. If a cost-recovery mechanism exists, it constitutes a benefit from the perspective of the energy service provider.

- **Energy efficiency service costs recovered from government or government funds**

  Overall energy service provider may also recover EES costs from the government or from funds initiated by the government. The aim of such government funds is to stimulate investments in energy efficiency projects. Usually the fund is raised through a public benefit charge applied on certain energy sectors. The additional revenues generated from the funds are considered as a benefit from the perspective of the EES provider.

3.5 Energy efficiency service costs

The profitability of EES depends strongly on the costs of EES products. Fixed costs mainly comprise the start-up costs of EES which are necessary to develop own know-how and capacities for energy efficiency activities. Variable costs include the costs that emerge from product development and marketing. Furthermore, the first phase of an energy efficiency project comprises considerable expenditures for the planning and design of the energy-efficient solution. These variable costs arise mainly due to the expenditures for labour. Capital costs include the investment into the energy efficient technology. In addition, installation costs of the equipment and cost for its energy-efficient operation as well as maintenance emerge. Despite these direct economic costs, transaction costs are of importance (see below). In general, the following **cost items** have to be considered:

- **Costs of energy-efficient technology** may be relevant in case EES include the supply of energy-efficient technologies such as HVAC equipment, CHP plant, transformer, etc.; purchasing prices will be different for the different types of EES providers and for different size of batches purchased.

- **Other material costs** such as costs of cable, pipes, valves, etc. are in general relevant.
- **Energy costs** are relevant if supply of energy is included within EES, e.g., supply of district heat for the supply of cold with the help of an energy-efficient absorption chiller.
- Overall EES costs include a large share of **personnel costs** due to fixed-term or permanent employment contracts for different staff categories. Qualification, competences, capacities, team culture, and transparent and clear incentive systems of staff are most important for the success of an EEI action, i.e. for its benefits to the customer and for an efficient implementation. However, qualified personnel causes high personnel costs, and thus should be allocated and organised efficiently.
- **Costs of external partners** are relevant if the provision of EES includes external partners due to their qualification, capacity constraints, costs, customer contact or strategic considerations. Make-or-buy decisions and management of co-operation are helpful in order to determine if an inclusion of external partners is of advantage.
- **Insurance costs**: usually, there is no insurance that cover the risk of insolvency of the client. However, there can be costs of insuring equipment.
- **Taxation** can strongly influence the profitability of an EES product (cf., e.g., the German country report in WP2.1 of the ChangeBest project for the influence of energy tax regulation on viability of EPC in Germany).
- The **imputed interest rate (costs of capital)** depends on the type of EES provider and company strategy.
- **Overhead costs** such as rent of building, office equipment, metering equipment, management and accounting, etc. are relevant: for the provision of EES in the B2B market, there is no need for renting costly buildings in the city centre. However, for the provision of EES in the B2C market, central selling points might be needed. An appropriate provision of office and metering equipment and effective and transparent information and communication technology contribute to the success of the EES business.
- **Transaction costs** are according to Williamson (1985) costs of determination, allocation, change, transfer, use and safeguard of property rights. With respect to EES products, transaction costs may include: costs of information and search for energy-efficient technology options and prices offered by different suppliers of this technology and of further materials; costs of information and search with regard to the degree of solvency of the customer; costs of bargaining and drawing up a contract; costs of co-ordinating the implementation of the EES; energy saving measurement and verification costs; billing costs; costs of evaluating the success of the EES provided. Transaction costs are predominantly independent of the EES size (but dependent on the number of EES implemented). Transaction costs

related to market development in general are fixed costs that are predominantly independent of the activity level, but depend, e.g., on the level of trust between market actors, existing norms, standards and certificates of qualification, etc.

EES provider should aim to reduce the transaction costs in order to increase the profitability of their EES products. Typical ways to reduce transaction costs are: using existing distribution and procurement channels; focus on cross-sectional technologies (meaning a higher market potential than sector-specific technologies); focus on "big" customers; standardisation of EEI action and EES processes; implementation of simple remuneration procedures (not dependent on measurement of energy savings but on credible calculation and/or other elements). Moreover, policy can contribute to reducing transaction costs by setting transparent, clear and supportive framework conditions, certification of EES providers, standardisation of EES processes, by providing well-developed model contracts, further tools for EES providers and measurement and verification standards as well as general support and social marketing of EEI actions which increases trust in their usefulness.[5]

- **Cost degression potentials**

EES costs may decrease over time and / or EES quality may increase due to learning and experience effects (Irrek, 2004). **Economies of scale** with increased number of EES can be expected in the procurement process of products like equipment, materials and energy that are required for the implementation and operation of the energy efficient solution. A higher volume ordered of energy-efficient technology and materials or large-sized energy efficient technologies usually decrease the average EES costs. **Economies of scope** can be realized by EES providers that offer an overall service package and not only individual EES solutions. These synergies of multiple EES activities help to reduce the advertising expenditures for each single EES that is offered and are beneficial for hedging risks. Typical examples are a joint marketing of different EES product types or an eased access to the customer if EES has been already offered in the past. Cost degression potentials can also be achieved by the **standardisation** of project procedures with increased number of EES provided. Important examples of standardisation potentials are the preparation of standardised sample contracts or the standardisation of the measurement and verification of energy savings in contracting projects.[6] In addition, EES costs decrease if fixed costs such as product development costs of EES are allocated to a larger number of EES. Finally, cost degression and quality intensification potentials and efficiency increases can be expected due to **learning mechanisms** over time. Learning effects increase, for example, the labour productivity of employees

[5] Text of cost items is based on WP 3.1 of the ChangeBest project.

[6] Proposals for standardisation of M&V in contracting projects can be found in International Performance Measurement and Verification Protocol (EVO, 2007).

by an increase in competence, through a higher efficiency of organisational procedures and achieve improvements in social processes in and between project teams (Irrek, 2004). Moreover, technology improvements occur due to research and development (learning by searching) and in the course of the product manufacturing process (learning by doing) (Weiss et al., 2007).

The effects that lead to the outlined cost degression potentials of EES can be quantified by the experience curve approach that analyses the development of historical and future costs of products and services. The experience curve approach has been applied for various kinds of energy efficient demand technologies for example by Weiss et al. (2007) as well as Jakob and Madlener (2003). Since the estimation of future cost developments solely with the application of experience curves captures a considerable degree of uncertainty, the approach is often complemented with bottom-up evaluations of cost reductions and expert assessments of long-term cost development paths (see for example Neij, 2006).

3.6 Lost revenue

- **Net lost distribution revenue**

  A reduced transport of energy through the network due to less energy consumption associated with energy efficiency activities may reduce the revenue of energy distribution companies. However, in liberalised energy markets with supportive policies for energy efficiency activities (in some cases also without), it is attractive for ESCOs to support customers of the energy company to realise energy savings. Consequently, lost distribution revenue should not be considered in cost effectiveness analysis if the energy efficiency activities are carried out also without an involvement of the distribution energy company and the revenue is lost anyway. Moreover, distribution network tariffs are usually regulated. An effective regulatory scheme ensures that reduced transport of energy through the network will not reduce profits and net revenues by allowing to increase the network tariffs if the costs of the distribution company are not reduced due to the lower transport of energy.

- **Net lost retail supplier revenue**

  Fewer energy sales to own customers due to energy efficiency activities reduce the revenue of retail supply companies. In liberalised energy markets with retail supply competition, the disincentive for energy efficiency activities becomes even more apparent, as the price competition prevents retail suppliers to recover the net lost revenues by an increase in the supply price. Nevertheless, lost retail supplier revenue is not considered in cost-effectiveness analysis if the energy efficiency activities are carried out also without an involvement of the retail supplier and consequently the revenue is lost anyway. This situation especially becomes important in liberalised energy markets with supportive policies for energy efficiency activities, where it is

attractive for suppliers of energy efficiency programmes and services to support the energy company's costumer to realise energy savings.

3.7 Summary

Economic evaluations of energy efficiency activities need to be applied from the perspective of the actor that provides the EES (energy distribution company, retail supply company or pure ESCO). For each type of EES provider different kind of cost and benefit factors are relevant that finally determine the incentives for the provider to offer EES. Table 3-1 classifies the most common cost and benefit components relevant for EES implemented in the European energy market and is intended to provide guidance. However, the list of impacts is not exhaustive. Which of the different impacts are relevant, depends on the specific service, service context, and specific EES provider.

Table 3-1: Classification of possible relevant cost and benefit components relevant for different types of energy service provider

Perspective	Benefits	Costs and Lost Revenues
Energy Distribution Company	Avoided Distribution Capacity and Operation Costs and Losses Avoided Penalties or Buyout Prices Energy Distribution Company Service Revenue Additional Energy Sales Revenue Revenues from Selling White Certificates Distribution Tariff Changes to Recover Energy Efficiency Service Costs Distribution Tariff Changes to Recover Net Lost Distribution Revenue Distribution Tariff Changes to Receive a Share in Net Cost Savings to Society Energy Efficiency Service Costs recovered from Government or Government Funds Improved System Reliability (*) Public Image (*)	Energy Efficiency Service Costs Net Lost Distribution Revenue
Retail Supply Company	Avoided Power Purchase Costs Avoided Penalties or Buyout Prices Retail Supplier Service Revenue Additional Energy Sales Revenue Revenues from Selling White Certificates Supply Price Changes to Recover Energy Efficiency Service Costs Energy Efficiency Service Costs recovered from Government or Government Funds Public Image (*)	Energy Efficiency Service Costs Net Lost Retail Supplier Revenue
Pure ESCO	Revenue of Energy Services Revenues from Selling White Certificates Energy Efficiency Service Costs recovered from Government or Government Funds	Energy Efficiency Service Costs
Impacts marked with a (*) indicate that they should be used in the cost-effectiveness analysis if they are translated into monetary equivalents. Otherwise, they can be considered qualitatively. These impacts can be critical in decision-making with respect to the implementation of energy efficiency activities.		

4 Cost-effectiveness evaluation of energy efficiency services

4.1 Three perspectives

When evaluating the cost-effectiveness of EES several perspectives can be considered as the involved stakeholders are affected by different kinds of costs and benefits. Three perspectives are of particular relevance for the evaluation of EES:

- the EES provider
- the final customer demanding EES
- the society

Relevant cost and benefit components from each perspective and the interpretation of the results are presented in this chapter. Exemplary calculations are provided for different types of EES provider and from the perspective of the customer. The intention of these exemplary calculations is to illustrate typical factors to be taken into account when assessing the cost-effectiveness of energy efficiency activities for the stakeholders mentioned above. The numbers and the calculation results shown in this section represent real and specific cases. However, the calculation results cannot be transferred to any other kind of EES that ESCOs or energy companies might decide to offer.

4.2 The economic effect of hypothetical energy efficiency activities from the perspective of different types of energy efficiency service providers

In this section the economic impact of providing a hypothetical EES to reduce electricity consumption is evaluated. The net economic effect is calculated by using a quantitative cost-benefit analysis that illustrates the impact of a hypothetical contracting project for an unbundled energy distribution as well as a retail energy supply company acting as overall service providers and for a pure ESCO.

The calculations for the retail supplier and the pure ESCO are based on former projects of the Wuppertal Institute (for example Stadtwerke Hannover AG, 1998). The data on costs and revenues of the contracting project are derived from case studies analysed by Irrek (2004), Irrek/Thomas (2006) and Solar&Saving contracting projects in schools that are evaluated by the Wuppertal Institute (see table 4-1). It is assumed that a contracting project is only offered if the ESCO expects to make a profit by implementing the project. This explains why the contracting revenue is equal to the EES investment costs plus a profit component that depends on the amount of savings achieved at the customer's site and is established according to a shared-savings approach. Moreover, levelized costs of conserved energy are calculated using a real discount rate of 8% for energy companies, a lifetime of the energy efficiency improvement measures of 12 years and a contract lifetime of 6 years.

Table 4-1: Cost and revenue data relevant for the analysis from the perspective of the retail supply company, pure ESCO and customer

Variable	Unit	Short-term	Source / Explanation
Contracting revenue (calculated over lifetime)	Ct/kWh	6,0 + 30% * net advantages small customers 4,5 + 30% * net advantages medium customers 3,0 + 30% * net advantages large customers	Based on real contracting projects: shared savings-approach over contract lifetime
Effects of customer loyalty	Ct/kWh	Neglected in this study, effects are not quantifiable	Irrek (2004)
Avoided costs - Power purchase costs (weighted wholesale prices) - Transmission tariffs - **Sum**	Ct/kWh	 6,43 0,60 **7,03**	EEX average values of Phelix Futures 2008 (BNetzA 2008: Monitoring report), weighted with 64% baseload and 36% peakload; source of grid tariffs see below
Contractor EES investment costs (calculated over lifetime)	Ct/kWh	6,0 small customers 4,5 medium customers 3,0 large customers	According to Irrek/Thomas (2006); capitalisation over contracting lifetime
Customer avoided energy bills - Industry - Trade, commerce and services - Private households	Ct/kWh	 9,30 21,06 20,56	Prices industry according to Eurostat 2008/s01 (average value from categories Id/Ie, without VAT); prices trade, commerce and services, private households: average prices of a project evaluated by Wuppertal Institute (2008)
Lost marginal revenue (less distribution network tariffs) - Business customers - medium voltage - Commercial- and business customers - low voltage - Private households	Ct/kWh	 7,30 9,00 7,15	Marginal revenue industry according to Eurostat 2008/s01 without taxes; Marginal revenue trade, commerce and services as well as private households are customer prices minus taxes and other duties (BNetzA 2008); distribution network tariffs are subtracted of marginal revenues
Network tariffs - Transmission - Distribution industry - Distribution trade, commerce and services - Distribution private households	Ct/kWh	 0,60 0,86 4,48 5,28	Distribution network tariffs according to BNetzA 2008; transmission network tariffs according to statements of transmission network companies

The economic impact of a hypothetical contracting project for a**n unbundled retail supply company** is explained below. Due to the fact that contracting is for private households usually not cost-effective because of high transaction costs compared to the possible energy savings, only the sectors industry as well as trade, commerce and services are considered. In order to simplify the interpretation of the results, avoided buyout prices or penalties for energy companies that are obliged to deliver energy savings and effects of customer loyalty are not taken into consideration. The net economic effect of providing this exemplary contracting project is for the analysed sectors significant positive, as table 4-2 as well as figure 4-1 show.

Table 4-2: Exemplary calculation of the net economic effect of a contracting project for an unbundled retail supply company that delivers electricity to an industrial or trade, commerce and service customer

Revenues and Costs	Cent / saved kWh	
	Industry	**Trade, commerce and services**
Contracting revenue (Contracting-rate; shared savings-approach: project costs + 30% * net advantages customers)	4,89	9,47
Effects of customer loyalty	Not quantifiable	
Avoided costs: Weighted wholesale price + avoided transmission tariffs (avoided penalty payments not considered here)	+ 7,03	+ 7,03
Contractor EES investment costs	- 3,00	- 4,50
Lost marginal revenue (if savings are not achieved anyway)	- 7,30	- 9,00
Net effect	**= 1,62**	**= 3,00**

Figure 4-1: Net economic effect of a contracting project for an unbundled retail supply company that delivers electricity to an industrial customer as well as a trade, commerce and service customer

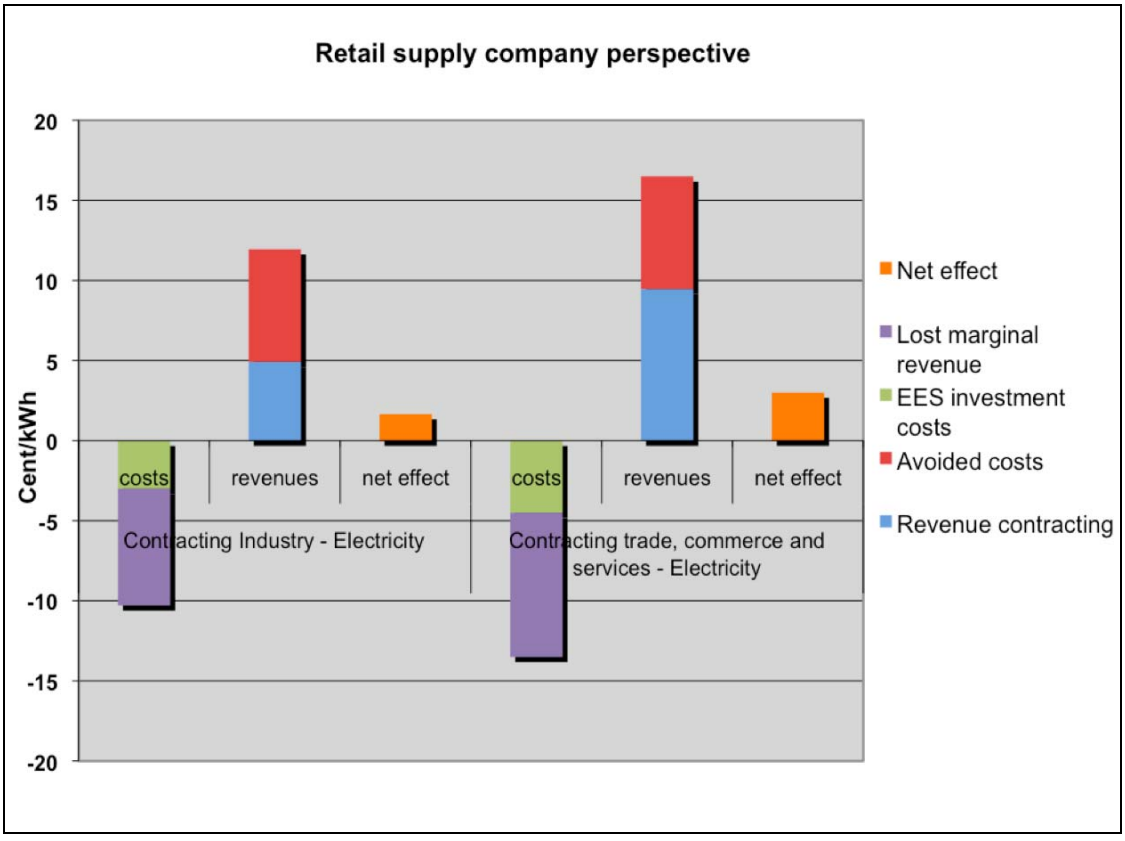
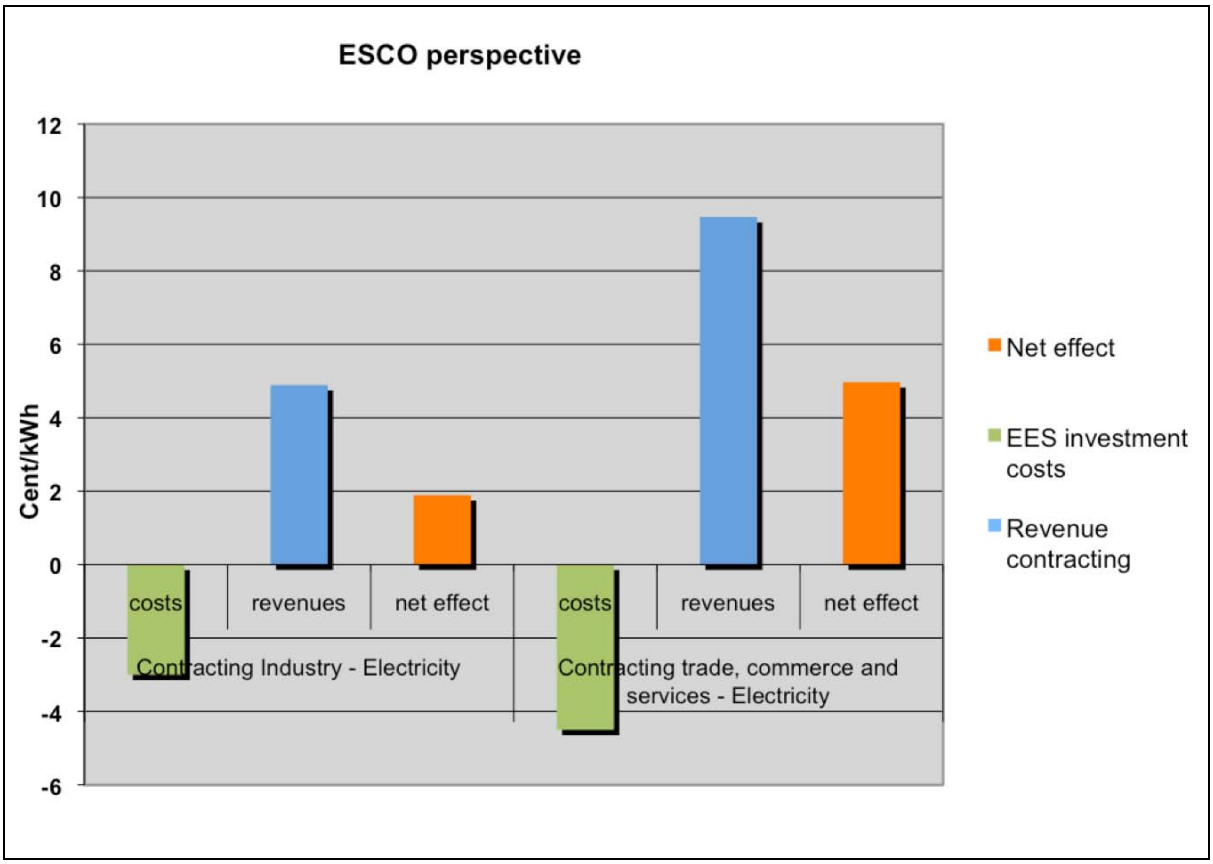


Table 4-3 and figure 4-2 demonstrate the net economic effect of the contracting project from **the perspective of a pure ESCO**. The calculation is less complex as avoided costs of the energy supply system and lost marginal revenue are not relevant for a pure ESCO.

Table 4-3: Exemplary calculation of the net economic impact of a contracting project for a pure ESCO that delivers electricity to an industrial or trade, commerce and service customer

Revenues and Costs	Cent / saved kWh	
	Industry	**Trade, commerce and services**
Contracting revenue (Contracting-rate; shared savings- approach: project costs + 30% * net advantages customers)	4,89	9,47
Contractor EES investment costs	- 3,00	- 4,50
Net effect	**= 1,89**	**= 4,97**

Figure 4-2: Net economic effect of a contracting project for a pure ESCO that delivers electricity to an industry as well as trade, commerce and service customer



Regarding the economic impact of providing EES from the perspective of **an unbundled energy distribution company** an Italian gas distributor was contacted that is obliged by the Italian white certificate scheme to acquire energy saving certificates. The specific gas distribution company meets its saving obligations by implementing gas as well as electricity saving projects. Table 4-4 shows the data reported by this gas distributor for 2008 and further data used in the evaluation.

Table 4-4: Cost and revenue data relevant for the analysis from the perspective of the Italian gas distribution company

Variable	Unit (primary energy)	Short-term	Source / Explanation
Distribution company EES revenue (contracting rate paid by the customer)	Ct/kWh	0	According to the Italian gas distributor no contracts regarding EES payments have been stipulated with the customers for most of the EES offered (contracting rate = 0).
Avoided penalties or buyout prices (due to the obligations of the WC scheme)	Ct/kWh	Not relevant	According to the Italian gas distributor there is no reason to incur into penalties because a plenty of certificates are available on the market at a price that is below the cost recovery rate paid to obliged actors by the scheme regulator.
Recovery of EES costs or lost distribution revenue (in case of electricity savings)	Ct/kWh	0,86	Based on the cost recovery rate of the white certificate scheme in Italy (100€/toe of primary energy saved until 2008)
Recovery of EES costs or lost distribution revenue (in case of gas savings)	Ct/kWh	0,86	Based on the cost recovery rate of the white certificate scheme in Italy (100€/toe of primary energy saved until 2008)
Average price of white certificates sold on the Italian market in 2008 of primary energy saved for type I certificates (i.e. certificates related to electricity savings)	Ct/kWh	0,39	Based on market data of the white certificate scheme in Italy
Average price of white certificates sold on the Italian market in 2008 of primary energy saved for type II certificates (i.e. certificates related to gas savings)	Ct/kWh	0,66	Based on market data of the white certificate scheme in Italy
Avoided distribution O&M costs and losses	Ct/kWh	Not relevant	According to the Italian gas distributor O&M costs did not change because of the energy saving obligation. Data concerning losses are not available due to the difficulty to match input and output gas data.
EES costs (= 2008 total investment costs/(2008 electricity+gas savings))	Ct/kWh	0,23	Based on data reported by an Italian gas distributor
Lost gas distribution revenue	Ct/kWh	0,69	

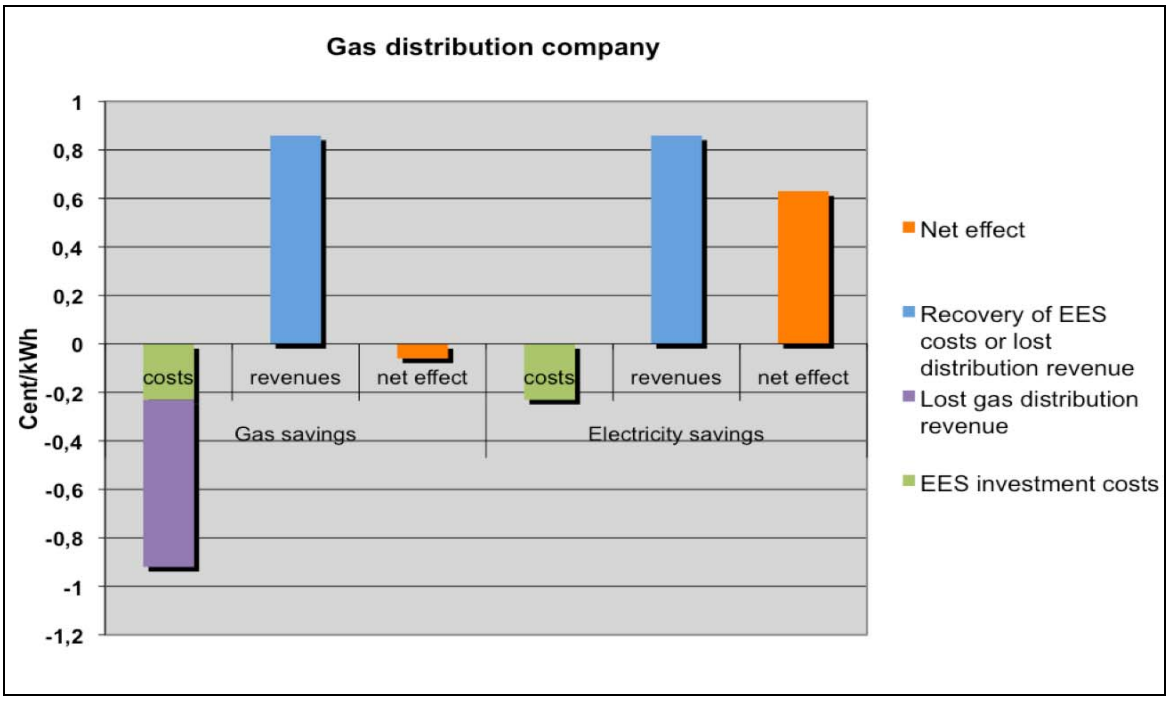
Concerning the data reported in table 4-4, the only economic benefit for the gas distribution company is the cost recovery rate established by the white certificate scheme regulator. No contracts have been stipulated by this gas distributor (as it is common practice of the great majority of the Italian obliged distributors) with the customers for the provision of most of the EES for which the white certificates are received. Consequently, no EES revenue from the customers for this provision has been obtained (contracting rate paid by the customer =0). The costs borne by the obliged gas distributor are represented by EES investment costs and lost distribution revenues.[7] As the gas distributor only provided total EES investment costs and no separate values for electricity and gas savings, the net economic impact calculations in terms of Ct/kWh (of final energy saved or distributed) assume that EES costs for gas and electricity saving projects are similar.

Table 4-5: Exemplary calculation of the net economic effect of gas and electricity saving projects for an Italian gas distributor obliged by the white certificate scheme

Revenues and costs	Cent / saved kWh	
	Gas savings	**Electricity savings**
Distribution company EES revenue	0	0
Recovery of EES costs or lost distribution revenue	0,86	0,86
EES investment costs	- 0,23	- 0,23
Lost gas distribution revenue	- 0,69	0
Net effect	**= - 0,06**	**= 0,63**

[7] The amount of 0,69 Ct/kWh corresponds to the average gas distribution tariff of the Italian distributor considered in the analysis. As this distributor may comply with its energy saving obligation by realising energy savings at other distributors' customers, the amount reported corresponds to the actual lost revenues only in the case that the amount of energy savings realised by this distributor at other obliged distributors' customers equals the amount of energy savings that the other obliged distributors realise at the customers of the specific distributor considered in this analysis.

Figure 4-3: Net economic effect of gas and electricity saving projects for an Italian gas distributor obliged by the white certificate scheme



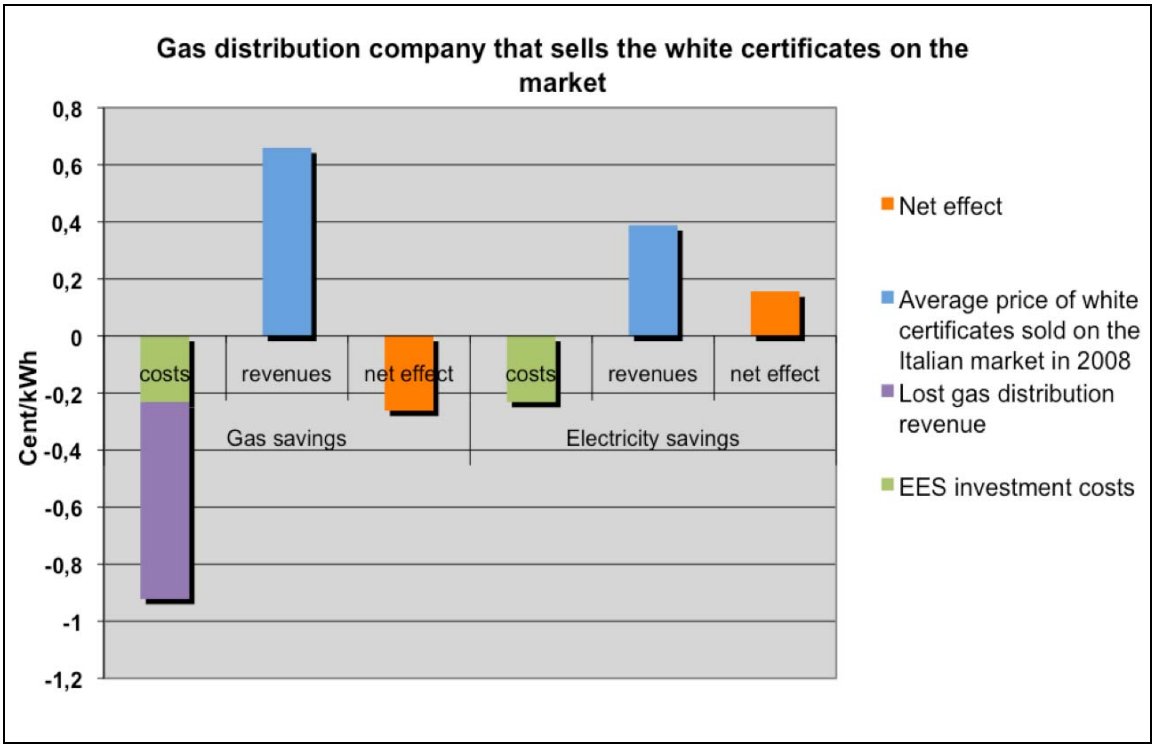
If the economic effect of the gas and electricity saving projects is compared to each other, it becomes apparent that the electricity saving activities are profitable for the gas distribution company in contrast to the gas saving activities. The reason for this result is that for a pure gas distribution company only lost gas revenues are relevant. As a result, lost revenues can be omitted with respect to the evaluation of the electricity saving activities implemented by the gas distributor. Nevertheless, it should again be pointed out that the calculation assumes that the EES investment costs do not differ between gas and electricity saving activities.

Concerning the net economic impact estimates, the obliged actor may also decide to sell the white certificates, issued by the scheme regulator for the EES provided, on the market. In this case, the obliged actor is no more eligible to recover the 100 €/toe through energy tariffs and the economic benefit for the EES provision is just represented by the price paid by the white certificate buyer. Some indications of the net economic impact regarding the case that the obliged actor sells the white certificates, obtained for the implementation of a given EES, on the market are given in table 4-6 and figure 4-4. However, these results should be interpreted with care since the fluctuation of the white certificate market price was very large during 2008 and the calculations assume that the white certificates were sold for the average white certificate price on the Italian market in 2008. In this scenario, the electricity saving activities are again profitable for the gas distribution company in contrast to the gas saving activities.

Table 4-6: Exemplary calculation of the net economic effect of gas and electricity saving projects for an Italian gas distributor obliged by the white certificate scheme that sells the white certificates on the market

Revenues and costs	Cent / saved kWh	
	Gas savings	Electricity savings
Distribution company EES revenue	0	0
Recovery of EES costs or lost distribution revenue	0	0
Average price of white certificates sold on the Italian market in 2008	0,66	0,39
EES investment costs	- 0,23	- 0,23
Lost gas distribution revenue	- 0,69	0
Net effect	**= - 0,26**	**= 0,16**

Figure 4-4: Net economic impact of gas and electricity saving projects for an Italian gas distributor obliged by the white certificate scheme that sells the white certificates on the market



When comparing both scenarios, to use the white certificates to be eligible to recover the 100 €/toe of primary energy saved through energy tariffs or to sell the white certificates on the market, the former option turns out to be more advantageous. However, the result of the scenario comparison depends in this analysis solely on the

relative price level of the white certificates compared to the level of recovery rate of EES costs and lost distribution revenue since all other factors remain constant in the two scenarios. Moreover, the net effect estimates above reported are not very representative due to the very significant fluctuations of the white certificate price in 2008. Thus, the Italian gas distributor considered in this analysis might have sold the white certificates when their market price was markedly different from the average values observed for 2008.

4.3 Energy efficiency services and the to-make-or-not-to-make dilemma for energy companies

The economic impact for the retail supply company is analysed for two additional cases in this section:

1. The retail supply company itself does not offer energy efficiency activities. However, third parties realise the energy savings at the customers of the specific retail supply company because the contracting projects are profitable for them (figure 4-2 illustrates the profitability for the case that the third parties are pure ESCOs). Consequently, the retail supply company looses anyway the revenue even without being active on the EES market due to the realised energy savings from the third parties. The avoided costs remain to be considered as a benefit for the retail supplier. Table 4-7 illustrates the calculation of the net economic effect for this case.

Table 4-7: Exemplary calculation of the net economic effect for an unbundled retail supply company of a contracting project that is implemented by third parties

Revenues and Costs	Cent / saved kWh	
	Industry	**Trade, commerce and services**
Avoided costs: Weighted wholesale price + avoided transmission tariffs	+ 7,03	+ 7,03
Lost marginal revenue	- 7,30	- 9,00
Net effect	**= - 0,27**	**= - 1,97**

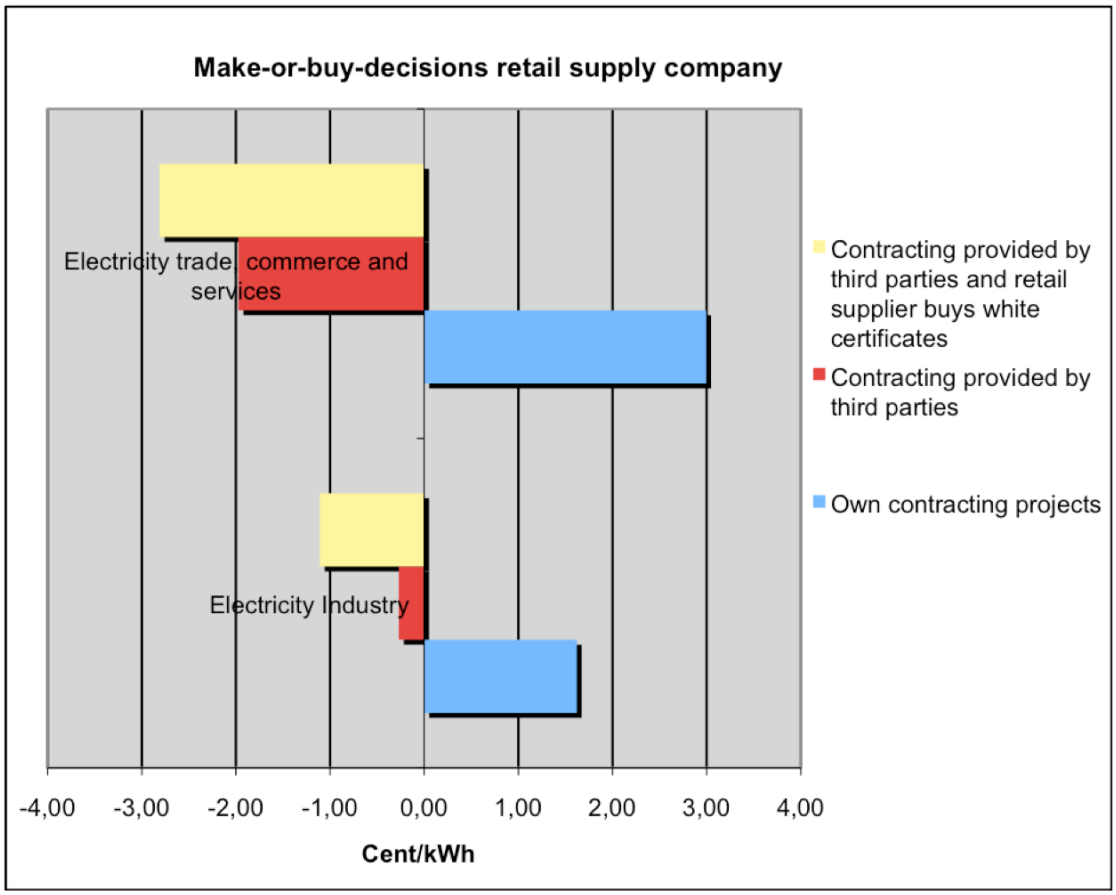
2. The retail supplier itself does not offer energy efficiency activities and third parties provide again the contracting projects. Thus, the retail supplier looses as in the first case the revenue. However, the retail supplier buys energy savings from third parties because a policy scheme exists that imposes energy savings obligations on energy companies, such as a white certificate scheme. The factors included in the calculation are the same as in the first case apart from the price of white certificates that must be added as a cost component (the average price of white certificates related to electricity savings on the Italian market in 2008 is assumed in the calculations).

Table 4-8: Exemplary calculation of the net economic effect for an unbundled retail supply company of a contracting project that is implemented by third parties and the retail supplier buys white certificates

Revenues and Costs	Cent / saved kWh	
	Industry	**Trade, commerce and services**
Avoided costs: Weighted wholesale price + avoided transmission tariffs	+ 7,03	+ 7,03
Lost marginal revenue	- 7,30	- 9,00
Average price per kWh of final energy saved for type I white certificates (i.e. certificates related to electricity savings) on the Italian market in 2008	- 0,84	- 0,84
Net effect	**= - 1,11**	**= - 2,81**

Figure 4-5 compares the net economic effect of all three cases and shows that an energy company is in any case significantly better off if it acts as an overall EES provider and offers energy efficiency activities than to leave the EES business to other energy service providers.

Figure 4-5: Economic impacts of different options a retail supply company could face with respect to the provision of contracting services



4.4 The economic effect from the perspective of the customer

The cost-effectiveness from the perspective of the customer is determined by analysing if the cost savings realised by the customer over the expected lifetime of the end-use action outweigh the costs associated with demanding a specific EES. An evaluation from the customer perspective is essential, since customers will be unlikely to demand an EES, if their benefits are lower than the costs. Such costs include the customer payments to the EES provider for the specific service and possibly further costs associated with demanding the EES that are borne directly by the customer. Benefits are mainly the energy bill savings achieved with the more efficient technology over the expected lifetime. Incentive payments, for example, provided by the government (including tax credits) are also considered as a benefit for the customer as far as they exist. Comfort gains of the more efficient technology can also be an important motivation for customers (especially in the residential sector) to demand EES. However, an increasing level of comfort is difficult to monetize.

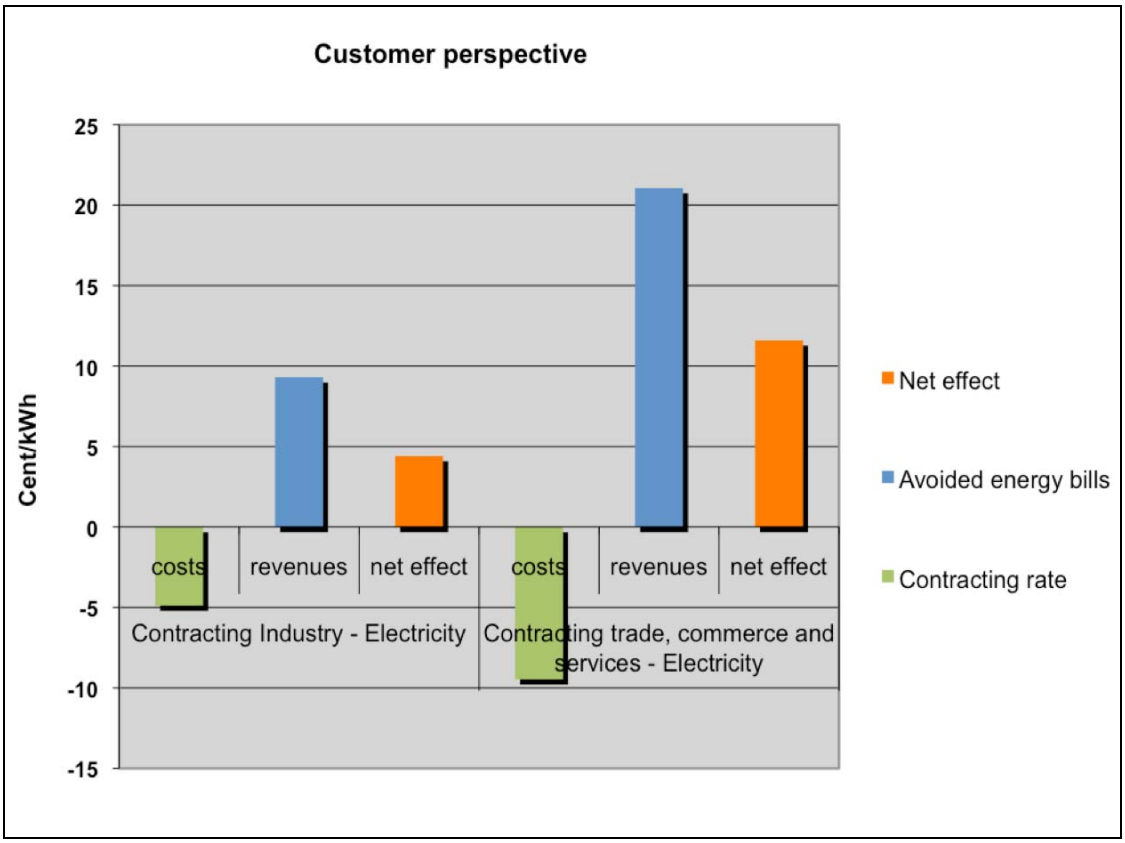
The economic effect from the customer perspective provides basic information that can be helpful in designing the level of EES rates. A high benefit-cost ratio / net effect indicates that individuals have a high incentive to participate. Consequently, a high adoption rate of the energy efficiency improvement measure can be expected. The result of the cost-effectiveness analysis helps in designing the appropriate level of service payments. Accordingly, the tariffication of too high or low service payments can be avoided.

Table 4-9 and figure 4-6 show the economic effect of the hypothetical contracting project that is already evaluated in chapter 4.1 for the unbundled retail supplier and pure ESCO. Industry as well as trade, commerce and service customer are much better-off by demanding EES and thus saving electricity since avoided energy bills clearly outweigh the contracting rate paid to the EES provider.

Table 4-9: Exemplary calculation of the net economic impact of a contracting project for an industrial as well as trade, commerce and service customer

Revenues and costs	Cent / saved kWh	
	Industry	Trade, commerce and services
Avoided energy bills	9,30	21,06
Contracting-rate (shared savings- approach: project costs + 30% * net advantages customers)	- 4,89	- 9,47
Net effect	**= 4,41**	**= 11,59**

Figure 4-6: Net economic impact of a contracting project for an industrial as well as trade, commerce and service customer



4.5 The economic effect from the perspective of the society

The economic impact on the entire society is measured by including all EES costs including the incremental costs for the more efficient technology, whether paid by the EES provider or partly by the state or customer. Benefits comprise mainly avoided energy supply system costs including avoided generation and in the long run capacity costs plus avoided transmission and distribution network costs and losses. Moreover, the avoided external costs of the energy supply system are incorporated. The external costs comprise all relevant costs currently not valued in market prices such as environmental costs that are not covered by emission allowances.

EES and incentive payments are not considered as they represent transfer payments which do not create added-value and are consequently not relevant from the perspective of the society. In contrast to the EES provider and customer perspective, a social discount rate is used in the calculations. A societal discount rate is lower than a market discount rate to avoid an undervaluation of the interests of future generations. The result of this analysis is especially relevant for energy policy as it indicates if the whole society is better off by implementing the energy efficiency improvement measure.

4.6 Risks and uncertainties

Energy efficiency projects inevitably involve some degree of risk and uncertainty which can be a major barrier for EES provider to initiate energy efficiency projects. EES providers have to be aware of risks and uncertainties before project implementation in order to identify potential consequences and the responsible party if the risk of a financial loss occurs.[8] The financial risk allocation between EES provider, customer and lender depends on the types of project financing and specific contractual procedures. The following risks and uncertainties are especially important for the EES provider:

- **Bankruptcy of the client**

  A crucial risk for the EES provider is bankruptcy of the client as the technical equipment installed at the facility of the client has in many cases only little value anywhere else and, consequently, cannot be sold for a reasonable price after bankruptcy (irreversibility of the EES technology). The risk of a client bankruptcy is especially important if the project lifetime is long and the customer's creditworthiness only insufficiently known. In the case of client's bankruptcy the EES provider is typically responsible for the repayment of the loan if the investment is financed from a third party and the capital borrowed by the EES service provider itself (third party financing with EES provider borrowing). If the investment is financed with internal funds the EES provider experiences a direct financial loss. An opportunity for the EES provider to avoid or reduce its financial loss is to sell the EES contract to the new owner if the commercial activity is continued in the existing facilities (Motiva, 2005).

- **Refusal of the client to pay**

  A theoretical risk for the EES provider is that the client is unwilling to pay according to the EES contract. This could be due to disagreements about the costs or performance of the energy efficiency technology. Regarding the unwillingness of the client to pay, according to the conditions agreed upon, the EES provider is the bearer of the risk (Motiva, 2005). As a result the EES provider would experience a direct financial loss compared to the conditions agreed on in the contract or this unwillingness would cause at least transaction costs for the EES provider, for example due to legal expenses.

- **Risk of miscalculation**

  An important risk for the EES provider is that the project investment costs are underestimated and/or the energy savings overestimated prior to project implementation. Consequently, the revenues from the EES project are less than expected. This risk of miscalculation is fully born by the EES provider. The uncertainty of the estimates can be reduced by improved measurement and verification (M&V) methods. However, a trade-off between evaluation

[8] Typical risk management approaches that are suitable for EES provider are explained in WP 3.1 of the ChangeBest project.

costs and accuracy of the saving calculation usually exist. To reduce the risk of a financial loss due to miscalculations it is common to include a reserve when setting the length of the monitoring period. For example, the specification of a 5 year monitoring period and a calculated pay-back time of 4 years would allow a 25% underestimation of project investment cost and a 25% overestimation of the expected savings (Motiva, 2005).

- **Operational and behavioural risk**

  The expected savings may erode after contract preparation due to operational conditions. Smaller savings than calculated can, for example, be the result of a reduction of the production volume of the client, the closing of a building, factory or production line, or the selling of the building or the company operating in it. In addition, end-users may change their behaviour after the energy efficiency improvement action is installed. Due to the technical improvements or cost savings as a result of the energy efficiency improvement actions customers often increase, for example, their level of comfort leading to fewer saving than expected (rebound effect). To avoid financial losses for the EES provider the operational and behavioural conditions should be specified in the EES contract as exactly as possible and verified continuously. However, the operational and behavioural risks cannot be considered completely in the EES contract. Creeping modifications like an increasing endowment with office equipment are, for example, not fully predictable and traceable (Irrek, 2003). The operational risk is influenced by the M&V method used for the determination of the energy savings. Only a small operational risk is born by the EES provider if the savings are measured only once at the beginning of the monitoring period and used for the payments of the client for the whole project lifetime. However, if the savings are measured continuously the operational risk is born by the EES provider (Motiva, 2005).

- **Contract period**

  Since specific customer and project developments cannot be fully anticipated over a long time period, long contract durations inevitably involve a certain degree of risk. Thus, the length of the contract should be evaluated as a risk criterion, for example, by including the contract length into the calculation of contracting rates.

- **Operation and maintenance risk**

  If the EES provider operates and maintains the energy efficient system installed the operation and maintenance costs represent a major risk source since the technical function of the EEI actions implemented must be warranted. However, the operation and maintenance can in many cases be partly transferred to the supplier of the technical systems.

- **Degree of EES product standardisation**

  Since individual EEI solutions require specific expertise, planning and implementation effort, specific purchase of material, specific co-operation with external partners, a specific contract, etc. more standardised EES products are associated with a lower degree of risk. Moreover, the economical and technical recyclability of the energy-efficient equipment installed is reduced with a higher degree of individualisation.

- **Investment cost risk**

  Unexpected investment cost increases of the energy efficiency improvement action should be considered as a potential risk factor. The investment cost risk increases with a higher investment volume of the plant. Precise evaluations of the status quo are very costly and, therefore, often limited. As a result, EES provider should be aware of the potential need of additional resources compared to the previous offer.

- **Financial risk**

  Financial risks that have to be considered by EES providers are changing energy prices and interest rates. In traditional shared saving schemes a decreasing energy price during the project lifetime leads to smaller cost savings for the EES provider than calculated. To eliminate this risk, Poole and Stoner (2003) propose to stipulate a constant energy price in the contract from the beginning on. As a result neither the customer nor the EES provider gain from energy price changes. For example, a lower actual price than the stipulated floor value leads to a windfall profit for the customer that compensates the lower project return. In contrast to that, if the actual price is higher than the floor value, the project return is higher than projected, but the consumer pays no more for the project. Thereby, the project performance is set in physical terms with fixed energy prices.

  Capital costs of energy efficiency projects are determined by the current interest rates which depend on the equity and debt financing opportunities of the specific EES provider. Increasing interest rates during the lifetime of the project lead to higher capital costs for the EES provider and, therefore, lower project returns. However, the risk of interest rate fluctuations can be hedged by the EES provider using suitable financial derivative instruments like forward rate agreements or interest rate futures.

5 Relation between energy efficiency services and energy efficiency programmes

Energy efficiency programmes are activities like targeted information, free energy audits, rebates for energy-efficient equipment, direct installation of efficient equipment etc. implemented by energy companies, ESCOs or state authorities that focus on end-users or market agents with the aim to increase end-use energy efficiency.[9] In contrast to EES, energy efficiency programmes are not directly paid for by the end-users or market agents that directly benefit from the programme. Customers pay in most cases collectively for the bill reduction they receive in future through a financing scheme for the energy efficiency programme (Wuppertal Institute et al., 2000).

Energy efficiency programmes can have a direct or indirect impact on the evolution of the EES market by addressing market barriers, reducing transaction costs and establishing standardisation. Moreover, market segments that are initially not profitable for EES can be stimulated by energy efficiency programmes with the aim to achieve market transformation.

The relation between EES and energy efficiency programmes is demonstrated by discussing the main objectives of different kinds of programmes. Further information on this topic can be found in the WP 2.3 report of the ChangeBest project.

- **Dissemination of information**

  Energy efficiency programmes that increase the public awareness of cost-effective energy savings potentials and disseminate specific information about energy efficiency projects, EES and financing possibilities reduce information barriers as well as scepticism of customers and result in a growing EES market. Information and motivation campaigns on energy efficiency are typically run by state authorities, energy agencies or energy companies and can be complemented with professional training courses and energy advices. The target sectors are not only potential customers like energy and facility managers but also financial institutions by providing information on energy performance contracting with the objective to reduce their risk perception of energy efficiency projects. The overcoming of these kinds of information barriers is decisive for a widespread expansion of the EES market.

- **Standardisation**

  Programmes that tend to establish standardisation can substantially reduce transaction costs for established EES provider as well as for potential competitors entering the EES market. Several cost reduction potentials of standardisation exist in the EES market. As the credibility of energy efficiency

[9] The wider term “energy efficiency demand side management programme” incorporates also load management and fuel switching that decrease primary energy consumption (Wuppertal Institute et al., 2000).

activities can only be determined by evaluating and verifying the energy savings achieved by specific projects the development of standardised monitoring, evaluation, verification and reporting concepts like the IPMVP - International Protocol of Monitoring and Verification (EVO, 2007) is crucial. Furthermore, concrete methods for the evaluation of single energy efficiency improvement (EEI) programmes, energy services and other EEI measures are developed in the EMEEES project that aims to design methods to evaluate the measures implemented to achieve the 9% energy savings target set out in the EU Directive (2006/32/EC) on energy end-use efficiency and energy services (ESD) (Wuppertal Institute, 2009). By the standardisation of evaluation methods, the performance of different kinds of energy efficiency projects become comparable and financial institutions as well as clients gain confidence in the return on investment of their project (Bertoldi and Rezessy, 2005).

Energy Performance Contracting is promoted by the provision of standard documents and performance contracts and contractual terms of reference for individual transactions, e.g. extension of HVAC maintenance contracts with rules to share the gains due to energy savings. Potential customers would benefit from standardised documents and procedures for selecting and contracting with EES providers like the provision of a guidebook that allows possible customers to assess EES contract offers and the risks or benefits of specific provisions in a contract (Wuppertal Institute et al., 2000). These standardisation procedures build in general trust in the EES business since these documents are usually produced by independent bodies like energy agencies, public authorities or NGOs.

- **Certification of energy efficiency service provider or energy efficiency services**

  Certification programmes for EES provider increase the confidence of potential customers and financial institutions. By ensuring minimum technical as well as financial qualifications of EES provider and thus, a provision of minimum quality standards and reliable EES, certification contributes to consumer protection. This is also proposed in Article 8 of the Directive on energy end-use efficiency and energy services which says that "*With a view to achieving a high level of technical competence, objectivity and reliability, Member States shall ensure, where they deem it necessary, the availability of appropriate qualification, accreditation and/or certification schemes for providers of energy services, energy audits and energy efficiency improvement measures as referred to in Article 6 (2)(a) (i) and (ii)*". An accreditation initiative for EES provider has already been implemented in the United States by the National Association of Energy Service Companies (NAESCO). Another possibility to increase consumer protection is to standardize or certify the product EES itself instead of certifying the provider of EES. This has been decided by the Sector Forum on Energy Management (SFEM) of CEN. A practical implementation of certification and

standardization initiatives in Europe would be desirable in order to strengthen the credibility of European EES providers.

- **Financial support programmes**

  EES can benefit from programmes that provide financial incentives to customers for energy investments that otherwise would not be profitable, such as in the residential sector. Due to high transaction and small project sizes energy efficiency investments are often unprofitable for EES providers in the residential sector. However, the saving potential combined with financial incentives from, for example, payments from public funds can make also these sectors interesting for EES provider. Examples are electricity saving advices in Germany that focus on households with a financial poor situation. In contrast, financial incentive programmes for investments in markets that are itself profitable for EES would be harmful for the development of the EES market. In all sectors, it would be useful to subsidise parts of the costs for the preparation of the tender for EES provider including the preliminary study. In the Czech Republic, for example, such support is successfully provided by the state program EFEKT. Such subsidies are especially effective in the public sector, where the EES cannot be realised without organising the public tender.

- **Limitations for EES market activities**

  The achievement of energy savings in the mass appliances market (for example in the residential sector through CFLs, LEDs, A-class refrigerators and freezers, technologies to reduce standby consumption) via EES activities is in general limited since the energy saving from one appliance is usually very small and transaction costs for EES too high. However, in this market synergies between energy efficiency programmes and legislation exist. Energy efficiency programmes provide financial incentives to end-users to buy efficient equipment and legislation sets minimum standards for appliances and establishes labels that enable customers to compare the energy efficiency of appliances. A problem of providing financial incentives to end-users that has mentioned by partners from practice, is, that some customer start to expect these financial incentives. As soon as the financial support is cancelled, some customers stop to buy the energy efficient equipment, even if it would be financially beneficial for them.

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