IEA DSM TASK XVI

Competitive Energy Services
(Energy Contracting, ESCo Services)

Integrated Energy Contracting (IEC)
A New Energy Service Business Model to Combine Energy Efficiency and (Renewable) Supply

Bundesministerium für Verkehr, Innovation und Technologie

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Synopsis:

In this publication we introduce a new, market-based energy service business model to combine energy efficiency and energy supply (from renewables), which we call Integrated Energy Contracting (IEC). IEC builds on the Energy Supply Contracting model but extends the scope of service to the whole facility and promotes simplified measurement and verification procedures.

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1 Abstract

There is an urgent need to increase market penetration of energy-efficiency measures in buildings and production plants. Here we present for discussion a new business model, Integrated Energy Contracting (IEC), as an innovative "delivery mechanism" for energy-efficiency and renewable-energy projects. IEC is intended not as a replacement for existing business models, but as an additional product approach to help spread energy-efficiency and renewables initiatives into new market sectors and smaller projects.

Here are the three core ideas of IEC:

1. Combination of energy-efficiency measures at any point in the facility (building and/or production plant) with energy supply in one service package, following the "energy efficiency first" paradigm.
2. A flexible, pragmatic and case-by-case approach to measurement and verification (M&V) of energy-efficiency measures.
3. Avoidance of any incentive for the ESCo to deliver more energy.

We developed the IEC model out of the context of experience with the existing Energy Contracting (EC) business models, Energy Performance Contracting (EPC) and Energy Supply Contracting (ESC). Both of these models have their strengths. EPC is a well-established and effective framework for driving comprehensive energy savings in large facilities, especially where the utilization of these facilities is relatively constant over time. ESC has been successful in penetrating a variety of markets and improving energy efficiency on the supply side.

On the other hand, these two models also have limitations. ESC has, in practice, hardly moved out of the boiler room to include energy-efficiency improvements that reduce demand, and indeed it does not strictly exclude incentives for the ESCo to sell more energy. EPC uses relatively costly M&V methods, which are only affordable in rather large projects. IEC proposes ways to overcome these limitations.

Compared to ESC, IEC expands its scope to include energy efficiency measures in the entire facility in the areas of building technologies (e.g. controls, HVAC, lighting), building envelope, and the behavior of the users. Compared to EPC, IEC promotes different and less costly type of M&V regimes and a different remuneration of the ESCo. Energy supply is charged at the profit-neutral marginal price, so that there is no incentive to supply more energy. The energy-efficiency measures are accounted for separately, instead of being included in the total consumption bill. Their contributions to energy savings are estimated using specific quality assurance instruments (QAIs), and the results of these estimates are used to generate flat-rate charges for the operational costs of energy supply and the energy-efficiency measures.

With these features, IEC should provide a framework for market-driven energy-efficiency projects in a variety of market segments, and especially for finding economically viable solutions for smaller project volumes. We present experiences from some pilot projects which confirm that IEC can work in practice.

2 Introduction and Motivation

Any (renewable) supply should first of all focus on energy conservation by evaluating all possible demand-reduction opportunities. Only afterwards is the remaining demand supplied as efficiently as possible – preferably from renewables. Otherwise, climate-protection goals are not achievable.

A good example of this "energy efficiency-first" guiding principle[1] is the reduction of all electrical and thermal cooling loads, including solar shading options, before assessing and implementing an air conditioning unit (solar driven). Or, to take an example from industry: before installing a new air compressor, the necessary pressure level should be reviewed, distribution leakages sealed, all compressed-air consumers checked and possibly replaced by electric tools, and the air-intake temperature reduced.

The literature provides many pieces of supporting evidence for this approach. To quote one prominent source, the International Energy Agency (IEA): "At the point of use, the largest contributor to avoided CO_2 emissions is improved end-use efficiency, accounting for nearly two-thirds of total savings. Increased use of renewables in power generation and of bio-fuels in transport account for 12% in comparison to the reference scenario" [IEA 2006]. Another prominent example are the CO_2-abatement cost curves published by McKinsey, which report negative abatement cost for a variety of energy conservation measures such as thermal insulation, lighting, climatisation or electric drives [McKinsey 2007].

Thus we can say that comprehensive energy conservation measures are hugely important. Without them, climate-protection goals are not achievable; and in many cases, energy conservation generates positive cash flows in terms of project-cycle or life-cycle costs.

However, the take-up rate of these measures is still much lower than it should be. The consumption of final energy is still increasing. While the PRIMES 2009 energy-efficiency scenario does show a break in the trend towards ever-increasing energy demand, the reduction in consumption relative to previous projections will still be only about 9% in 2020. If the EU is to reach its 20% target, it must double its efforts on energy efficiency. [EC 2011] Therefore, we urgently need new "delivery mechanisms" that speed up the adoption of energy-saving measures in the built environment.

Due to the scattered nature[2] of the savings potentials, which are spread across all consumption sectors (in contrast to centralized supply systems), it is true that only concerted actions of all stakeholders and a mix of instruments will deliver. Legislative regulations and standards, information and labeling campaigns, financial incentives and subsidy programs, and voluntary agreements between associations

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[1] Also labeled as "Trias Energetica" in the Netherlands.

[2] By example of the housing sector: Out of 21.1 million occupied rental apartments in Germany, 23 % are single or double family houses, an additional 30 % is located in three to six apartment houses [Eikmeier et al. 2009, p. 114]

and political leadership are all relevant and useful. However, in addition to all these government-led mechanisms, we also need market-based instruments – concepts and tools that unlock commercial incentives for energy conservation.

In recent years, market-based mechanisms have climbed high on political agendas – and have even reached the headlines of European energy-efficiency legislation [2006/32/EC][3] – under the name of Energy Services (ES, also known as Energy Efficiency Services[4]). One special group of ES products, known as Energy Contracting (EC[5]), has been shown in practice to overcome a number of obstacles. The performance-based, interdisciplinary EC approach opens up solutions that are not achievable through a standard, disintegrated implementation process. EC involves life-cycle cost optimization across investment and operation budgets, integrated planning across technical disciplines, and performance guarantees over the entire project cycle.

Our discussions with stakeholders have led us to believe that the limitations, the realistic potentials but also the added values of "real", performance-based energy (efficiency) services are not always understood well enough. This publication aims to explore the range of possible ESCo models as delivery mechanisms for renewables and energy-efficiency projects, and thus to promote a better understanding of the options. We hope to provide input for consideration of make-or-buy decisions (i.e. pros and cons of ESCo products compared to in-house implementation).

We will review the strengths, and also the limitations, of the two main existing ESCo delivery mechanisms. One of these, Energy Performance Contracting (EPC), is a (theoretically) convincing concept, but its practical dissemination is mostly limited to the public sector and large projects. The other main model in use, Energy Supply Contracting (ESC), has been adopted in a wider spectrum of end-use sectors; among other advantages, it promotes the use of simpler measurement and verification (M&V) methods where these are sufficient. However, because the scope of ESC is generally limited to the conversion of final into useful energy, large efficiency potentials remain untapped.

From this analysis, we conclude that there is indeed room for a new, market-based energy service business model for energy efficiency and supply (from renewables), and we propose a model which we call **Integrated Energy Contracting** (IEC).

In outlining the IEC concept, we will focus especially on two issues:

1. How to combine energy conservation and (renewable) energy supply into an integrated delivery model,
2. How to promote simplified M&V methods where they are appropriate.

To avoid possible misunderstandings: our IEC model is not intended as a replacement for the EPC model, but as an additional contracting approach, one that

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[3] A recast of this directive is currently under negotiation between the European Commission, Parliament and Council.

[4] A list of abbreviations is provided at the end of this discussion paper.

[5] For a precise definition of Energy Contracting (EC) as we use the term in this discussion paper, please see Section 4.1.

is designed to facilitate the spread of energy-efficiency measures into market segments where their penetration is lagging behind their potential and the policy targets. To do this, IEC builds on the existing ESCo product ESC. It encourages clients and ESCOs to work out pragmatic packages of measures that gather scattered savings potentials into a feasible whole.

Besides presenting the IEC concept, we will also show that it has already been applied successfully in the real world, in eight public-sector buildings managed by the Landesimmobilien-Gesellschaft mbH (LIG; the real-estate holding and management agency of the regional government of Styria, Austria).

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A number of Graz Energy Agency cooperation partners from ESCo industry, energy agencies and others have peer-reviewed this paper and have given helpful comments. In particular, the author would like to thank Ing. Alfred Scharl, Landesimmobilien-Gesellschaft mbH, Styria (LIG) for his commitment and support in implementing the first Integrated Energy Contracting projects together. We also wish to thank Dr. Benjamin Hemmens for support in the form of language editing.

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As practical experience has so far been limited to Austria, the results of this publication should be seen as "work in progress". Questions or ideas for further co-operation are highly welcome.

3 Strengths and Weaknesses of Standard ESCo Products and Their Markets

3.1 Definition and Concept

Here we will focus on some key features, assuming that the reader has a basic knowledge of the Energy Contracting (EC)[6] concept and building energy efficiency.

A variety of definitions of EC are in use. Many of them fail to specify some features that are characteristic of "real" EC services, such as: outsourcing of commercial and technical risks to the ESCo; guarantees for results and "all-inclusive" cost of the measures implemented; and optimization in terms of project-cycle cost (cf. [2006/32/EC], [Bertholdi et.al. 2007], [EN 15900], [DIN 8930-5], [GEFMA 540], [Satchwell et.al. 2010], [UZ 50], [VDMA 24198]; this list is not exhaustive). Since these features can constitute an added value compared to standard in-house implementation, we consider them an important part of EC.

Therefore, in this paper we will use the following definition:

> *Energy Contracting – also called ESCo or Energy Efficiency Service – is a comprehensive energy service concept for executing energy-efficiency and renewables projects in buildings or production facilities according to minimized project-cycle cost.*
>
> *An Energy Service Company (ESCo) acts as a general contractor and implements a customized energy service package (consisting of e.g. design, building, operation & maintenance, optimization, fuel purchase, (co-)financing, user motivation …).*
>
> *As a key feature, the ESCo's remuneration is performance-based. The ESCo guarantees the outcome and all-inclusive cost of the services and bears the commercial as well as the technical implementation and operation risks for the duration of the project.* (after [Bleyl+Schinnerl 2008])

The EC service concept shifts the focus away from selling units of final energy (like fuel oil, gas or electricity) towards the desired benefits and results derived from the use of the energy carrier (e.g. the lowest cost of keeping a room warm, air-conditioned or lit). In other words: the ESCo's remuneration depends on the output of the services provided and not the inputs (like fuels or person-hours) consumed, thus introducing an intrinsic interest for the ESCo to increase efficiency and to reduce final-energy demand.

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[6] Energy Contracting (EC) is also known as ESCo or Energy Efficiency Service. For further basics on Energy Contracting you may refer to e.g. www.grazer-ea.at, www.contracting-portal.at, [Bemmann et.al 2000], [BEA 2012], [Hessen 2012], [Hessenenergie 2012] [dena 2008], [dena 2010], [EA.NRW 2007], [EA.NRW 2012], [energiekonsens 2012], [KEA 2012], [Bleyl+Schinnerl 2008 u. 2008a], [Eikmeier et.al. 2009] (this list is not exhaustive).

EC services are not about any particular technology or energy carrier. Instead, EC is a flexible and modular "efficiency tool" for implementation of energy-efficiency projects, according to the goals of the facility owner. It is an instrument for minimizing life-cycle or project-cycle cost, including the operational phase of the building.

The ESCo serves as a general contractor and is responsible for coordination and management of the individual components and interfaces of the service package for the customer. It has to deliver the commissioned energy service (Megawatthours of useful energy or energy savings ("Negawatthours")) to the customer at "all-inclusive" prices, as shown in Figure 1.

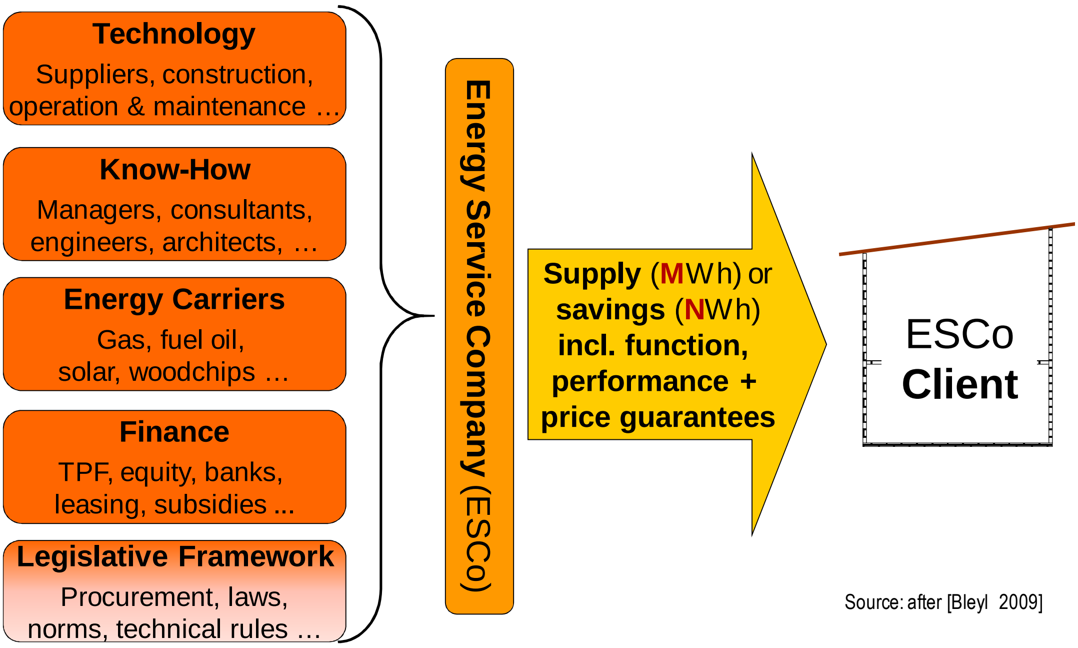

Figure 1 Energy Contracting: components of service package and outsourcing of interfaces and guarantees to an ESCo

Two basic ESCo business models are currently in use:

- Energy Supply Contracting (ESC), which provides useful energy, and
- Energy Performance Contracting (EPC), which provides energy savings,

as outputs to the end user.

Both business models are performance-based and result in a reduction of final-energy demand. They both achieve environmental benefits due to the associated energy and emissions savings as well as non-energetic benefits such as an increase in comfort or an enhancement of corporate image.

In ESC, efficient supply of useful energy such as heat, steam or compressed air is contracted and measured in megawatt hours (MWh) delivered. The model often includes purchasing of final energy (fuels) and is comparable to district heating and cogeneration supply contracts.[7] The scope of energy-efficiency measures is usually limited to the energy supply side, i.e. the boiler room or power plant (cf. Section 3.2).[8]

In EPC, the focus is on reducing final-energy consumption through demand-side energy-efficiency measures, including for example upgrades of the technology used in distribution systems and energy end-use appliances throughout the building (e.g. HVAC, lighting, compressed-air tools), and improvement of user behavior. The business model is based on delivering savings (also called "Negawatthours" (NWh)) compared to an *ex ante* baseline.

3.2 Scope of Service and Efficiency Potentials

Standard ESC models (including solar ESC) are limited to improving the performance and added-value chain of the supply of useful energy to a facility (a building and/or production plant). The scope is typically confined by the walls of the boiler room, as shown in Figure 2. Through new installations such as condensing boilers and frequency-controlled high-efficiency pumps, and regular operation & maintenance procedures, typical efficiency gains of up to 20% can be achieved. The associated CO_2 reductions may be higher, if low-carbon or renewable fuels or innovative technologies (e.g. solar, combined heat and power (CHP)) are applied.

Figure 2 illustrates the typical scope of services of standard ESC and EPC business models and the IEC model, to be introduced in the next section.

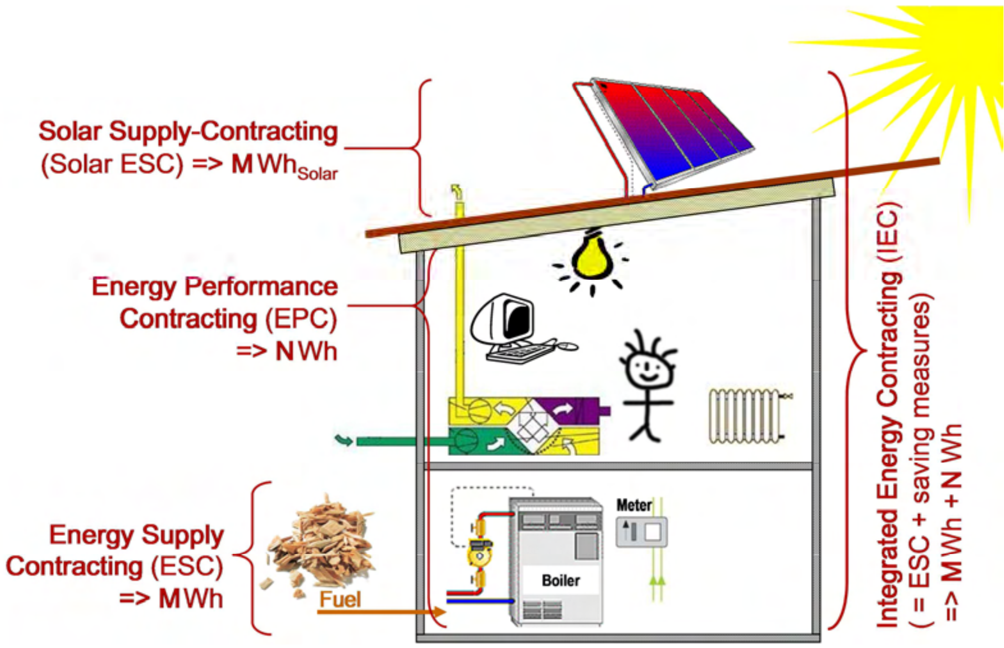

Figure 2 Scope of services of different ESCo business models

[7] The French "contrat chauffage" is structured in 4 different basic elements (P1-P4), but generally remuneration is not based on output performance.

[8] Also with ESC, the savings achieved can still be calculated by comparing to an *ex ante* energy baseline.

Even with only small investments, the efficiency of existing installations can often be improved by up to around 10%, for example through a recommissioning process that brings the systems under an EC regime, due to the inherent incentives of the EC model to reduce final-energy consumption [Eikmeier et.al. 2009].

With the EPC business model, the scope is extended to the entire building including measures such as technical building equipment (e.g. HVAC), “re-lighting” or user behavior as indicated in Figure 2. Consequently, somewhat higher efficiency potentials can be unlocked. The “Energiesparpartnerschaft” in Berlin and the “Federal Contracting Campaign” in Austria both report savings between 20 and 25 % in their large public pools of buildings [ESP Berlin 2009] [Bundescontracting 2009]. Typical measures are energy management and controls, HVAC technologies (such as hydraulic adjustment of distribution networks and air-conditioning systems), lighting, and also user-motivation measures designed to influence the behavior of the building occupants.

In special-purpose buildings such as hospitals or swimming pools, considerably higher savings are reported: “Pool 12 Berliner Bäder Betriebe” has achieved 33.5% [ESP Berlin 2009], two swimming facilities in Vienna report 50% savings in heat and 60-76% savings in water consumption [Siemens 2009].

EPC packages sometimes include simple building shell measures such as insulation of the upper-floor ceiling or a window retrofit, but this is not common practice.

As a further stage, the scope of the energy service can be extended to a comprehensive refurbishment of the building (deep retrofit) including the complete building shell (e.g. insulation, replacement of windows or passive solar shading through selective window films). The endpoint of such refurbishments can be equivalent to new low-energy buildings, but there are hardly any reports on projects of this type being implemented as part of an ESCo contracting arrangement (see [GEA 2009] [Bleyl+Schinnerl 2008a]).

3.3 Market Shares, End-use Markets and Minimum Project Sizes

Market data on national or European ESCo markets are rather scarce, sometimes not very reliable and sometimes not publicly available. Nevertheless, there is sufficient evidence that ESC projects dominate the market. The “Verband für Wärmelieferung” (one of Germany’s two ESCo associations) reports an 85% market share for the ESC model, based on the 2011 survey of its members. [VfW 2011]. This number agrees with the results of a recent comprehensive market survey by Prognos AG: “Almost two-thirds of the respondents reported doing more than 80% of their turnover with energy supply contracting, including the replacement of existing installations” [Prognos 2009].

ESC is applied in a variety of end-use sectors such as housing, commerce, industry or public buildings, though we do not know the exact numbers of projects or the market share. For the housing sector, specifications of minimum project sizes exist: based on transaction cost calculations and empirical results from a market survey, [Eikmeier et.al. 2009] specify a thermal load of 100 kW as a lower threshold. This corresponds to annual energy costs of roughly € 20,000. There is no upper limit to the project size, and there are some large industrial installations of 10 MW or more using this model to supply heat, steam, (back-up) electricity and compressed air.

Note on the ESCo market in the USA: A recent study of the USA ESCo industry reported an increasing ESCo revenue share (currently 14%) for renewable energy and onsite generation technologies bundled with energy-efficiency improvements. However, the study does not specify the business models in detail, and seems to exclude the category that would be most similar to ESC ("companies that only provide onsite generation or renewable energy systems") [Satchwell et al 2010].

The market share of EPC projects is estimated at 10-15%. The "Verband für Wärmelieferung" reports a market share of 8% [VfW 2009]. In the Prognos market survey, only 6% of the respondents reported doing 20-40% of their turnover with EPC products, while the rest were below this value or did not answer [Prognos 2009]. Section 0 gives more information on project sizes.

At least in Europe, EPC is largely limited to the public sector[9]. The public market consists of institutions at national, regional and local levels including special-purpose buildings such as universities, hospitals and leisure facilities. In Germany and Austria the geographical distribution of projects is very uneven. "EPC hotspots" are noticeable wherever the owners of public buildings are using independent market facilitators such as energy agencies to prepare specific projects for tender to ESCos.

Note on the USA: Market data from the USA show a similar picture: 84% of the ESCos' revenues come from EPC projects in public institutions, consisting of federal buildings and so called "MUSH" markets (municipal and state governments, universities and colleges, K-12 schools and hospitals) [Satchwell et al 2010].

From the market dominance of ESC versus EPC projects and the greater market diffusion in different end-use sectors, we conclude that marketable ESCo product innovations will be easier to implement if they are based on the ESC model.

3.4 Measurement and Verification

The EPC business model (cf. Section 3.1) is based on delivering energy savings in comparison to a historical (or calculated) cost baseline. Three features of this method can, under certain circumstances, become problematic:

1. Generally, savings ("Negawatthours") can only be measured indirectly as the difference between consumption before and after implementation of the energy-efficiency measures (relative measurement: savings = baseline – ex-post or reporting-period consumption) [IPMVP_2012]. This leads to two major difficulties:

[9] Three possible reasons for this are: Besides budgetary imperatives of public institutions to procure third-party financing, the existing high savings potentials due to backlogs in retrofitting and modernization of buildings facilitate a win-win situation between building owners and ESCos. Of course, a variety of regulations and statutory provisions on different policy levels also mandate energy policy goals for public entities.

- The baseline itself may be difficult to determine (with sufficient accuracy) due to a lack of availability of historical data (e.g. from bills or meters)
- The determined energy cost baseline is not a constant. Several relevant factors can change between the baseline and the reporting period. These include climatic conditions (e.g. ambient temperatures, solar radiation …), energy prices, and changes in utilization of the building or production process (e.g. variable loads, operation hours, user behavior or architectural modifications). Especially the changes in utilization may cause considerable difficulties, cost and insecurity for ESCo and facility owner in adjusting the baseline.

In addition to the resources necessary (high transaction and operation costs), the baseline determination and adjustment may cause a considerable degree of insecurity and monetary risk for the (prospective) project partners.

2. M&V of the savings may cause high expenses in relation to the savings potentials. This is amplified by the often highly scattered nature of savings potentials. Unlike investment costs, a proportion of M&V costs are current expenses and decrease the potential of future savings to refinance energy-efficiency investments.[10] This means there is a need to balance precision against costs of M&V, especially for smaller EPC projects.
3. The ESCo is likely to factor in safety surcharges in order to hedge the risks arising from the EPC savings guarantee. For example, the ESCo has to absorb possible increases in energy consumption, e.g. from user behavior or inaccuracies in savings calculations and data. This can be a source of significant additional cost for the client.

As a consequence, the transaction and M&V costs of EPC projects are particularly high. This means that the model is only suitable for larger projects (minimum energy cost baselines of € 200,000/year, but typically an order of magnitude higher). For example: the 24 building pools of the Berlin "Energy Saving Partnership" are one of the most successful EPC campaigns in Europe and have an average energy cost baseline of € 1.88 million/year [ESP Berlin 2009].

The problems discussed above, and the potentially high efforts of creating and maintaining the baseline over the contract period, have also led some potential clients and ESCos to become generally skeptical about the EPC model.

[10] As a rule of thumb, cost for M&V should not exceed 5 % of the savings (Source: Pierre Langlois, Econoler at ESCo Europe 2010)

3.5 Conclusions for the Further Development of Energy-Contracting Business Models

Based on the findings of the previous sections, the following table summarizes typical market properties of ESC and EPC products:

	ESC	**EPC**
End-use markets	Public institutions, residential, commerce, industry	Public institutions (including universities, hospitals, leisure facilities)
Project size: Minimum energy cost baseline	**> € 20,000**/year (=> smaller projects)	**> € 200,000**/year (Ø ESP Berlin: € 1.88 million /year)
Efficiency potentials	**15-20**% (=> limited scope of service)	**20-25**% (up to 30-50%)
Shares in ESCo market	**85-90**%	**10-15**%
Outputs	**Useful energy** (MWh**)** (=> final-energy savings)	**Energy savings** (**N**Wh)
M&V	**Direct**: Energy meters	**Indirect**: savings = Baseline– actual consumption (=> High transaction cost => Baseline risks)

Figure 3 ESC vs. EPC: summary of typical market properties

The key features of **Energy Supply Contracting** (ESC) are:

- Heat-supply projects dominate the ESCo market and are common in several end-use consumption sectors such as housing, commerce and industry, public buildings and the tertiary sector.
- ESC projects have also proven their value for the implementation of renewables supply projects or innovative technologies such as CHP.
- The minimum energy cost baseline of heat supply projects of circa € 20,000 per year are at least one order of magnitude below those of EPC projects.
- M&V: The ESC business model is more robust and more flexible with regard to changes in energy consumption and baselines, due to the direct measurement and billing of the useful energy supplied.
- The savings achieved can be calculated relative to a historical final-energy baseline, if desired.

However, large demand-side energy-efficiency potentials remain untapped, because the scope of services is limited to the provision of useful energy (or in other words to the energy supply equipment in the plant room).

By comparison, the key features of **Energy Performance Contracting** (EPC) are:

- The EPC model provides a more comprehensive approach and includes energy savings in the whole facility (building and/or production plant).
- With an ESCo market share of about 10%, EPC has a significantly lower market acceptance than ESC, and is more or less limited to the public sector and special-purpose buildings such as hospitals, swimming facilities or universities.
- In practice, some aspects of the EPC business model tend to limit the range of projects in which it is used. These are mainly in the areas of baseline determination and adjustment, the appraisal of risks, and the cost of the savings guarantee (cf. Sections 3.3 and 0).
- The latter result in expenses which are more easily supported in large projects than in small ones: The minimum energy cost baseline is € 200,000/year, but typically an order of magnitude higher.
- In practice, only very few EPC projects include building-envelope measures such as facades, windows or upper-floor insulations, although these measures constitute a substantial share of the savings potential. This empirical observation prompts the question of whether the EPC model is a suitable instrument for comprehensive refurbishment projects.

Another question for discussion is: does the immaterial nature of energy savings (NWh) make it more difficult to make EPC products tangible and marketable? Could the fact that "nobody has ever seen or touched a Negawatt hour" be a hindrance to the market penetration of EPC? What can be done to visualize savings better?

Last but not least, the widespread expectation that EPC projects must be completely refinanced from future energy cost savings, or should even create immediate budget relief, is only realistic for projects with large savings potentials. This severely limits the application of EPC as an energy-efficiency tool. If more realistic targets were communicated and applied; more specifically, if the refinancing contribution from future energy cost savings was allowed to be less than 100% over the project term, comprehensive refurbishment projects would become feasible (cf. [Bleyl+Schinnerl 2008]).

For the **development of future innovative ESCo products,** we conclude:

1. Marketable ESCo product innovations will be easier to achieve on the basis of the more widely spread ESC model.
2. The scope of services of the ESC model should be extended to the complete facility (building and/or production plant) in order to access higher savings potentials.
3. The key to making performance-based ESCo services attractive for smaller projects lies in finding ways to lower the transaction and M&V costs relative to the EPC model. Simpler and cheaper M&V methods need to be considered.

4. New delivery mechanisms should try to incorporate the features that have made the ESC model more successful in spreading into a diversity of market segments.
5. The simpler and more robust ESC model should be chosen wherever energy flows can be measured directly with acceptable effort. Practical applications may be electricity or heat supplied from renewables; CHP; and also MWh saved through energy-efficiency technologies such as heat-recovery installations[11].

The objectives should be to unite energy conservation and supply (from renewable sources) into an integrated product and to achieve higher savings potentials than with standard ESC.

Once again: we do not want to question the validity of the EPC model in the markets where its suitability is well-established. Instead, we propose an additional ESCo approach for energy-efficiency and renewables projects, applicable to all energy carriers and water.[12]

[11] Hita 2009 illustrates the complexity of an indirect measurement (baseline- ex post consumption) for an EPC model for a heat recovery system.

[12] For further remarks on opportunities and limitations of EC models in comparison to in-house implementation please refer to [Eikmeier et al. 2009, p. 30f. and 93f.]

4 The Integrated Energy Contracting Model

4.1 Objectives and Customized Scope of Services

The IEC model follows the "energy efficiency first" paradigm and combines two objectives:

1. **Reduction of energy demand** through the implementation of energy-efficiency measures in the fields of building technology (HVAC, lighting), building shell and user motivation;
2. **Efficient supply of the remaining useful-energy demand**, preferably from renewable energy sources.

In contrast to standard ESC, the range of services and thus the scope of savings potentials to be utilized is extended to the overall building or commercial enterprise (cf. Section 3.2 and Figure 2). Instead of limiting the service to the supply of heat energy, the model is intended to be used for all energy carriers and media such as heat, electricity, water or compressed air.

The results to be achieved by the energy-efficiency service package may include modernization of the technical systems, lower consumption and maintenance costs, and improvement of energy performance indicators (e.g. the EPBD building certificate). The project goals may also include non-energy benefits such as emissions reductions or increase in comfort and image.

The building owner draws up a customized energy service package and demands guarantees for the results of the measures taken by the ESCo (cf. definition of Energy Contracting in Section 3.1).[13] Contracts are usually awarded by way of a combined competition of solutions and prices based on a functional description of the energy services.

Most energy-efficiency projects differ in their contents and general conditions. Therefore, it has proved to be necessary and sensible to adapt the scope of services specifically to the individual project. This also implies that the building owner can – depending on their own resources – define which components of the energy service will be outsourced and which components they carry out themselves (e.g. ongoing on-site maintenance provided by a caretaker, or financing[14, 15]).

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[13] In principle, implementation can also be done in-house within an "Intracting model" [Intracting 1998, Picolight 2005], provided the building owner has the appropriate resources and controlling instruments to monitor and verify the results.

[14] Contrary to widespread opinions, the ESCo service package does not automatically need to include financing. Financing can be provided by the building owner, the ESCo or a third financing partner, depending on who can offer the better conditions. In any case, the ESCo can be used as a vehicle and facilitator for financing. This topic has been elaborated in more detail in [Bleyl+Suer 2006] or [Bleyl+Schinnerl 2008a].

[15] This view is also reflected in the English-speaking EPC markets, where two basic EPC models are differentiated, mainly with regard to who finances the investment: "Guaranteed Savings" refers to a

The essential components of energy (efficiency) projects are summarized in Figure 4, in an integrated energy service package including guarantees for the output of the service to the client.

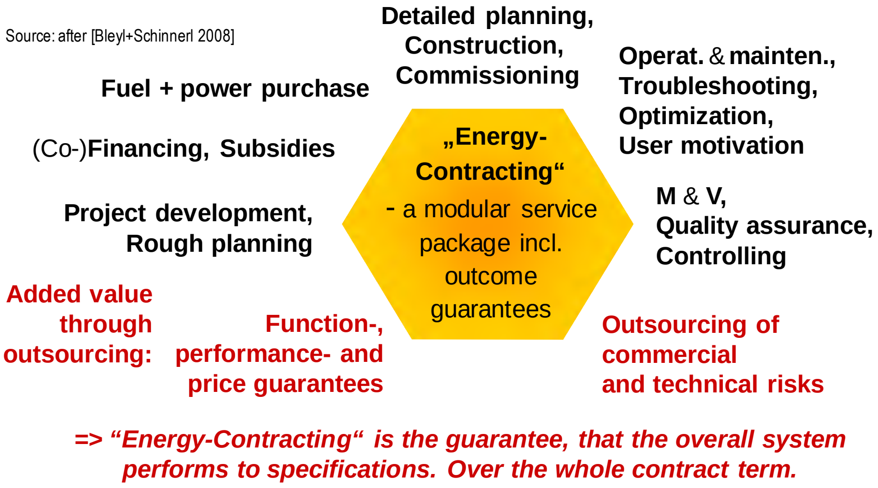

Figure 4 Energy Contracting: a modular energy service package with guaranteed results for the client

All the tasks shown in Figure 4, such as planning, construction and financing, as well as all the ongoing components of the service, such as operation and maintenance, optimization, purchasing of fuel, quality assurance and M&V, have to be done either by the building owner or the ESCo throughout the contract period.[16]

The IEC model basically adheres to a PDCA (plan, do, check, act) management cycle.

In case of outsourcing, the functional, performance and price guarantees provided by the ESCo and the assumption of technical and economic risks by the ESCo may constitute an added value for the client.

4.2 IEC Business Model

The IEC business model is based upon the relatively widespread and robust ESC model.[17] Its scope of service is extended to the savings potentials in the entire facility (building and/or production plant) as shown in Figure 2. To verify correct implementation and performance of the energy-efficiency measures, IEC prefers to use quality-assurance instruments (QAIs) for the individual measures (see Section 4.3 for details).

service model without ESCo finance, whereas “Shared Savings” include financing in the ESCo’s service package.

[16] In principle the service package can also be subdivided into two parts, “useful-energy supply” and “energy-efficiency measures and management”, and assigned separately, if appropriate.

[17] The price structure of the ESC model is comparable to that of standard district heating.

The ESCo takes over implementation and operation of the energy service package at its own expense and risk according to the project-specific requirements set by the contract. In return, the ESCo is remunerated for the useful energy delivered, depending on the actual consumption as well as a flat-rate energy-efficiency and service fee for operation & maintenance including quality assurance. A stipulation of bonuses and penalties for over- or underachievement of the efficiency measures can be added. Financing is a modular component of the service package, as mentioned earlier (cf. footnote 14).

The business model is depicted in Figure 6.

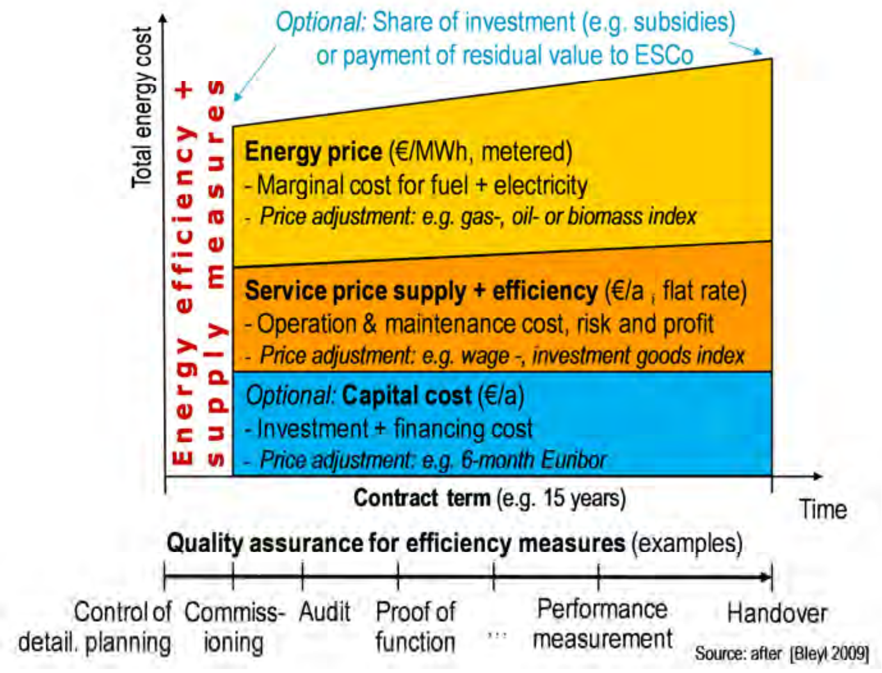

Figure 5 Integrated Energy-Contracting business model with QAIs for energy-efficiency measures

The ESCo's remuneration consists of the following three price components[18]:

- **Energy price** (per MWh of useful energy metered): This covers only the "consumption-related", marginal cost of useful energy supplied, i.e. the costs of generating an additional MWh.[19] The price is deliberately set at this level to avoid creating a consumption-related profit margin, so that the ESCo has no incentive to sell more energy. It also reduces the ESCo's risk in case of demand reductions, e.g. from thermal refurbishment.
  To account for market fluctuations in fuel prices, the ESCo's contract contains an index-linking clause pegging the energy price to suitable statistical price indices for the fuels used (e.g. gas or biomass index). In this way, the risk of changes in the final-energy price remains with the client.

[18] For a definition of consumption and operation related cost, refer to [VDI 2067]

[19] Alternatively, fuel can also be purchased by the client in case of better purchasing conditions and cleared with the energy price.

- **Service** (or basic) **fee** for **Energy Supply** (flat rate): This rate covers all operations-related costs – the costs of operation & maintenance of the energy supply infrastructure (including staff, insurance, management etc.), and also entrepreneurial risk.
  The prices are adjusted over the course of the contract period (typically every year retrospectively) by linking to statistical indices such as wage or investment-goods indices.
  Service fee for **Energy Efficiency** (flat rate[20]): This rate covers the operational costs of the energy-efficiency measures. As shown in Figure 5, the two flat-rate fees can be combined.
- **Capital cost** of energy-efficiency and supply investments may or may not be part of the service package.[14] If (co-) financed by the ESCo, the ESCo is remunerated for its capital cost minus subsidies and building cost allowances.
  During the contract period, the capital cost may be adjusted by using statistical indices such as the "6-month Euribor".

In the above-mentioned price components, all the ESCo's expenditure items for the defined scope of services throughout the contractual period must be included ("all-inclusive prices"). In this way, the IEC model is based on project or life-cycle costs (LCC), and on this basis the outsourced solution can be compared against an in-house implementation.

4.3 Simplified M&V Approaches

IEC is compatible with a wide spectrum of M&V methods. However, since the intention is to make the model attractive for smaller projects, we will emphasize the simplified M&V measures which are affordable on smaller budgets. Of course, if the project is large enough to support a bigger M&V budget, more comprehensive approaches (e.g. adhering to IPMVP) can be used.

With IEC, M&V simplifications are achieved in two areas: on the one hand through the direct measurement of the supply share of the energy service package and on the other hand by using (simplified) energy savings calculations in combination with QAIs for the energy conservation measures.

For the energy supply part of the energy service package, megawatt-hours delivered from boilers, solar systems or heat-recovery installations are metered directly. This avoids efforts and risks arising from indirect measurement of savings, such as the determination of energy cost baselines or their adjustment for changes in utilization of a facility. Since the supply of useful energy typically constitutes a significant share of the project volume, this can lead to a significant reduction of M&V costs compared to the EPC model.

To verify the energy conservation part of the energy service package, the basic idea is to devise QAIs for the energy-efficiency measures in combination with (simplified) savings calculations. Each QAI is designed to verify that a specific energy-efficiency measure has been correctly implemented and that it is effective,

[20] Possibly supplemented with a bonus/penalty system

without however attempting the kind of continuous monitoring used in the baseline-based M&V methods.

Here are two examples to illustrate typical QAIs in combination with saving calculations:

1. Contract partners may agree to quantify the savings of a thermal insulation measure through a heat-demand calculation before and after the measure and to verify its implementation quality using a blower-door-test, and a thermographic analysis of the building after the modification.
2. For a street or indoor re-lighting project, the power consumption by the system is measured in short once-off tests before and after the retrofit to verify the power savings. If the reduction in power consumption is multiplied by previously measured or deemed operating hours, a figure for the energy savings over time can be calculated, and factored into a flat-rate remuneration. Additionally compliance with the illuminance specifications is measured.

More QAI examples are listed in Sections 4.3.1 and 4.3.2.

The concept of M&V based on QAIs is illustrated in Figure 7 (based on the business model in Figure 5).

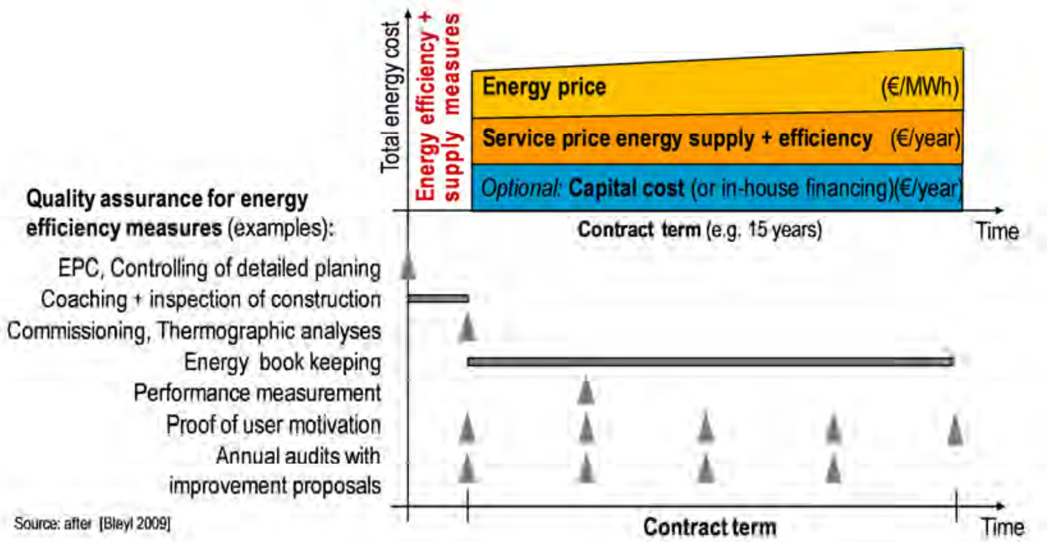

Figure 6 IEC business model: sample QAIs as a substitute for savings measurements

An important issue is the discussion of individual and practicable QAIs. QAIs can either be specified by the client or suggested by the ESCo as part of the competition of solutions during the procurement process or the detailed project design. The selection of QAIs as well as their exact design will depend on the specific requirements of the project scope and the parties involved.

As can be seen in Figure 7, the once-off QAIs (on commissioning of the energy-efficiency measures) are supplemented by a number of periodic QAIs. The function of the latter is to ensure the ESCo has an incentive to maintain performance levels throughout the entire contract period.

A number of possible QAIs are outlined in the following two sections. [21]

4.3.1 QAIs Performed by the Client (examples)

Possible QAIs for individual energy-efficiency measures (which can be provided by the client or by third parties on behalf of the client) include:

1. (Functional) specifications to communicate and document energy-related objectives and requirements (e.g. quality standards, maximum energy indicators, request of renewable energy sources with proof of origin …)
2. Support of detailed planning by an (independent) energy consultant;
3. Third-party construction supervision by an (independent) energy consultant;
4. Commissioning ("acceptance") after the construction phase in order to verify compliance with functional specifications, involving e.g. thermography, blower-door tests, proof of function …;
5. Energy book-keeping – comparison of target and actual values (could also be provided by the ESCo);
6. Survey by an (independent) energy consultant (2nd opinion report);
7. Building certification (like EPBD or Green Building; could also be provided by the ESCo)
8. …

This list and the following list are intended as a basis for discussion, and do not claim to be complete.

4.3.2 QAIs Performed by the ESCo (examples)

Examples of QAIs for energy-efficiency measures that can be provided by the ESCo are:

1. Reports: detailed analysis (DPR, IGA …) of the planned measures as a verification of a preliminary analysis;
2. Proof of function: e.g. through commissioning, parameter and operating records …;
3. Once-off verifications, e.g. performance tests and measurements, thermography analysis, blower-door tests, commissioning records …;
4. Periodic verifications, e.g. proof of user motivation, efficiency measurements, control of emission values, return temperature limitations, compliance with heating curves, parameter and operating records …;

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[21] [IPMVP_2012]: Some more advice and guidance on M&V can be obtained from http://www.evo-world.org/index.php

5. Obligatory annual reporting (auditing): energy balances, comparison of target and actual values or benchmarks, suggestions for saving measures …;
6. Computational savings verifications, e.g. nominal power savings times operating hours …;
7. Maintenance records …;
8. **…**

Backing up these measures is the fact that the ESCo takes on the technical and economic risks of construction and operation of the energy-efficiency measures at its own expense (for the scope of services defined in the contract) for the duration of the contract period, and therefore has a strong interest in ensuring that they are well implemented.

5 Integrated Energy Contracting in Practice

Of course, the idea of combining energy supply with demand-side energy-saving measures is not entirely new. For example, the following projects with at least some demand-side efficiency measures are documented in the dena guideline Energy Supply Contracting [dena 2010]:

- Jugendausbildungszentrum (Youth Training Centre) Berlin-Zehlendorf (10 buildings with a heated area of 12,744 m^2): In addition to the erection of a small-scale CHP plant, a new heat-distribution network was built in order to reduce losses, and a metering and billing system for electricity and heat was introduced as part of the ESC project.
- Heide-Grundschule (Primary School) Berlin Adlershof (school with a sports hall and three additional buildings supplied by a local heating network with a total useful area of 8,900 m^2): In addition to the new gas boiler plant, the classrooms were equipped with thermostatic valves. Also, consumption measurement, remote control and parameterization of the facilities were implemented.

This type of integration of demand-side saving measures into ESC projects has been more the exception than the rule up to now. However, there is no compelling reason why the scope of such projects must be confined to the boiler room (as shown in Figure 4). We will now turn to some real-world examples of projects where this scope was expanded, in a conscious effort to implement and test the IEC model.

5.1 Landesimmobilien-Gesellschaft mbH, Styria

(State-owned real-estate company)

The Landesimmobilien-Gesellschaft mbH (LIG), the real-estate holding and management agency of the regional government of Styria, Austria manages more than 420 buildings in Styria; about 200 of these, with an overall area of more than 600,000 m² are owned by LIG. LIG is owned 100% by the regional government of Styria [LIG 2009]. As far as we know, LIG is the first institutional building owner that has systematically applied the concept of Integrated Energy Contracting. Recently, LIG's was awarded the Energy Globe Styria 2009 in recognition of these activities.

The original motivation of LIG was to substitute renewable energy sources for heating oil as far as possible. In the course of project development, LIG extended and detailed the tender as follows:

1. Implementing demand-side saving measures with pay-back times of no more than 15 years in the fields of building technology, building shell and user motivation and improving the energy-efficiency indicators of the buildings;
2. Elimination of all oil-fired heating plants;

3. Reducing CO_2 emissions (which implies a change of energy carriers) and minimizing the overall energy costs.

In 2007/08, the first European-wide IEC call for tenders was executed for five buildings with a net floor area of approx. 11,000 m^2. In 2009 the package for Pool 2, which consisted of three sites with a net floor area of 20,000 m^2, was procured and implemented. In 2012 a third pool of buildings has been put out to tender and will be implemented subsequently.

The call for tenders was designed as a competition of prices and solutions, based on functional specifications. The tendering process used a negotiated procedure as defined in public procurement law. To evaluate the ESCo proposals, the following criteria were applied: 1. The lowest project-cycle cost for energy supply; 2. The lowest CO_2 emissions and 3. The highest energy cost savings through demand-side saving measures proposed by the ESCo.

For all short- to medium-term energy-efficiency measures with a pay-back period of less than 15 years, the bidders were invited to make proposals that stated investment costs, energy cost savings and proposals for QAIs. These quotations were assessed by a commission appointed by the client.

So far, two pools of buildings have been tendered for, resulting in competitive energy prices for heat supply, almost exclusively from renewable sources. In Pool 2, the negotiated procurement procedures resulted in the following energy savings:

- Thermal energy: 16.8-30.8% compared to baseline
- Thermal power: 0-27.6% compared to baseline
- Electric energy: 4.8-11.8% compared to baseline
- Water: 0-20% compared to baseline
- CO_2: 92% (primarily due to switching the energy source to geothermal and biomass)
- Value of future savings cash flows: € –15,000 to –250,000, including all costs of the energy-efficiency measures. The negative values represent net savings over the project period.
- QAIs (selection): review of detailed planning, commissioning after construction phase, computational savings verifications, adjustment records, thermography recordings, measurement of solar thermal output, …

Upon completion of the construction works, the ESCo has to verify that they comply with quality standards defined in the functional specifications and with the QAI for the energy-efficiency measures implemented, as part of the “acceptance” procedure. The annual audits performed have mostly confirmed the savings.

The ESCo will control and operate the building technology primarily in a web-based manner, also allowing access for the building owner to view the operating status of the installations, possible malfunctions and consumption data. Furthermore, the ESCo will take over operation, maintenance and replacement of the installations specified in the contract.

One noticeable aspect of this project is the relatively low rates of electricity savings. This suggests that there might be a need for better preliminary work in preparing the tender specifications, and generally more focus on electricity end-use efficiency.

From the upper limit of thermal savings of approx. 30% achieved, it is quite obvious that comprehensive thermal upgrading of the building shell within the specified pay-back period of 15 years (the contract period) cannot be implemented without additional subsidies or co-financing (out of the negative cash flow from energy savings). LIG is considering extending this period in future projects, so as to cover the investment costs of a complete thermal shell upgrade.

5.2 "Good Practice" Example

Now we can look at one specific building complex managed by LIG. The Retzhof is a conference and seminar venue based around a 16th-century manor house, with two modern buildings added in 1960 and 2009. The overall useful area of approx. 4,000 m^2 is used for meetings or seminars and accommodation.

Figure 7 Schloss Retzhof, a 16th century manor house; along with two modern buildings, it is now used as a seminar center.

The initial situation before refurbishment and the new building in 2009 can be summarized as follows: high energy costs, an inefficient natural gas boiler, and no insulation of the old manor house (a protected historic monument). The consumption indicator amounted to approx. 185 kWh/m^2/year. The project was triggered by the plan to build a new guest house, which in turn necessitated the demolition and relocation of the boiler house.

The owner had the following main goals in mind:

1. To replace the old boiler installation;
2. To outsource the energy supply and the financing of the investments;
3. To reduce the energy demand and costs, as well as CO_2 emissions, through demand-side saving measures.

The project was implemented with the support of Grazer Energieagentur GmbH using an IEC model. The central issues are: combination of energy-efficiency measures with supply of useful energy, and individual QAIs for specific energy-saving measures instead of an EPC savings guarantee. The ESCo contract was awarded in a combined competition of prices and solutions in the course of a two-phase negotiated procurement procedure. The business model is summarized in Figure 5 and Figure 6.

The most important contractual relationships and cash flows are summarized in Figure 9.

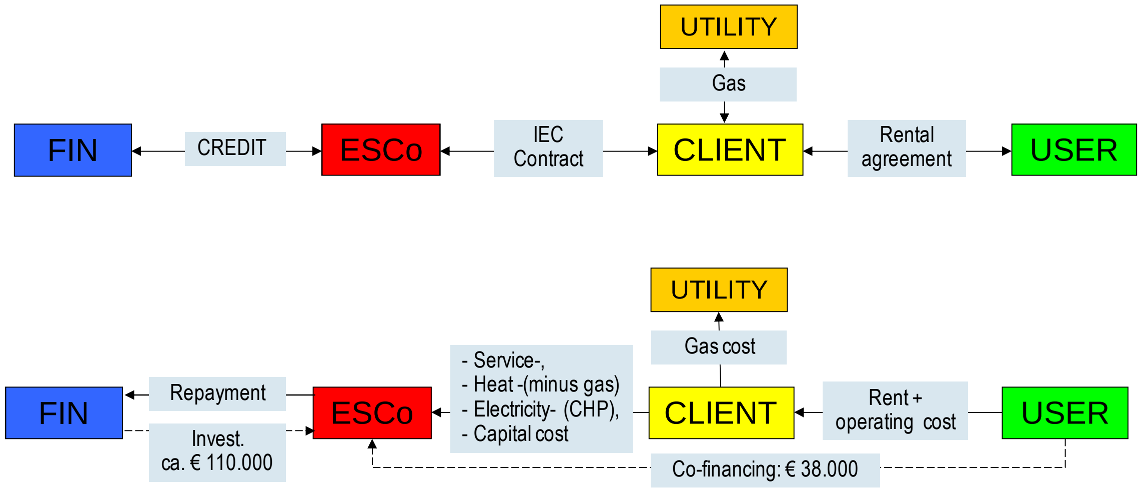

Figure 8 Retzhof: contractual relationships and cash flows (overview)

From the building owner's perspective, some important experiences and innovative approaches of the project can be summarized as follows:

1. The combination of energy efficiency and supply of useful energy within the IEC model basically works.
2. The building owner still retains coordinating and monitoring functions, even with an ESCo acting as a general contractor. This is especially the case if the ESCo activities need to be coordinated with other in-house projects (in this case: building of the new guest house).
3. The development of comprehensive energy (efficiency) projects requires committed facilitators and perseverance.
4. As for the manor house, which is a protected historic building, only the insulation of the top floor was possible without problems. The solution adopted, blow-in cellulose insulation, is cheap and functional but is only feasible if the roof space is not in use.
5. Thanks to co-financing of the investments from a cash reserve which was made available by the user of the building, it was possible to reduce the ongoing capital costs by approx. 30%.

These results are subject to systematic monitoring and verification in the course of annual auditing of the buildings. It is likely that details of the package will be adjusted over time, as the partners gather experience from ongoing operation.

6 Summary, Discussion and Outlook

6.1 Summary

The Integrated Energy-Contracting (IEC) model offers an innovative delivery mechanism for combining energy savings and supply (preferably from renewable energy sources) in an integrated, performance-based approach, following the "energy efficiency first" paradigm.

The goal of IEC is not to replace existing ESCo business models, but to propose an additional energy service business model that might help to facilitate market diffusion of energy-efficiency services into sectors where their uptake is lagging behind targets, e.g. for smaller projects.

The IEC business model builds on the Energy Supply Contracting (ESC) model which is also more widely applied in different energy end-use sectors than EPC. IEC extends the scope of services of the ESC model, in order to access saving potentials not only in the conversion of final to useful energy, but in the entire facility in the fields of building technologies (e.g. controls, HVAC, lighting), building envelope, and user motivation. IEC can also include all kinds of energy and media such as electricity, water, pressurized air, etc. in addition to heat.

The specific project scope can be customized according to the existing saving potentials and the customer's requests and own resources. Projects are typically tendered in a negotiated procedure using a combined competition of prices and solutions. Prices are based on life-cycle costs. The price of energy supply is set at the marginal cost and index-linked to avoid any incentive for the ESCo to supply more energy.

IEC promotes simplified measurement and verification (M&V) options. One reason for this is to make performance-based ESCo services accessible to smaller projects. Simplification compared to baseline-based M&V approaches is achieved by direct measurement of the useful energy supplied, combined with the quantification of energy savings using quality assurance instruments (QAI) for the individual energy-efficiency measures. QAIs are specific tests that verify the functionality and performance of individual energy-efficiency measures, but not necessarily their exact quantitative outcome over the entire project cycle. The simplified M&V approach reduces the ongoing expense of M&V. It also reduces the risks to the ESCo associated with baseline adjustment for factors beyond its control, thus reducing transaction costs. If appropriate to the project, however, IEC can accommodate any M&V system, up to full IPMVP compliance.

The IEC model has been tested in eight pilot projects procured by the building owner and manager Landesimmobilien-Gesellschaft mbH Steiermark, the real-estate holding and management agency of the regional government of Styria, Austria. The projects are considered successful by both the client and the ESCo and have generated substantial energy and CO_2 savings. Other stakeholders have expressed interest in starting similar projects.

6.2 Discussion and Outlook

The IEC concept is not intended as a readymade product, but rather as a framework for thinking out solutions that benefit all parties and save resources – for discovering routes to feasibility for energy conservation projects, especially in areas where their uptake has been weak. It needs to be filled with appropriate content for each project. Discussion of the issues is welcome and necessary. Here are some points for consideration.

Financial Aspects

How to structure the financial incentives in ESCo contracts is of course one of the central questions. ESC models are often criticized for their incentives to sell more energy. A simple but effective way to neutralize this effect is to set the energy price equal to the marginal generation cost of an additional MWh. An idea for discussion would be to take this even further, and set the energy price below marginal cost (e.g. by shifting 10% of the work costs to the basic price) in order to give the ESCo an even stronger saving incentive.

However, although financial mechanisms are important, it is important to bear in mind that monetary savings are often not the only trigger or driver of energy conservation projects. Non-energy benefits such as compliance with energy policies or regulations, public relations or increases in comfort may often be equally or even more decisive.

Measurement and Verification

A clear concept of the outcomes a project should achieve should come before the consideration of which M&V approaches are necessary and suitable. IEC is compatible with any kind of M&V options, including fully baseline-based IPMVP methods. But it is intended to promote use of simplified methods when these are adequate. Sometimes the cost-benefit ratio of M&V plans is burdened with disputable demands for precision. This tendency may be increased when M&V is promoted by actors with a technical background.

We suggest three kinds of reasons for considering simplified M&V methods. Firstly, the stronger the role of non-financial or non-energy benefits, the more appropriate they may be. Secondly, they become more relevant the smaller the project, because they save expense: and this may be an opportunity to integrate energy-efficiency resources into ESC and other projects (even non-EC projects). And finally, it is always a good exercise for energy service clients to consider how they would verify the same energy-saving measures if they were implementing them in-house. For example, defining a building standard and verifying it (such as Class B according to EPBD) might be sufficient. Is there really a good reason to demand a different type of verification from an ESCo?

The Pilot Projects

Experience collected in eight projects up to now has confirmed the practical feasibility of the IEC model. Both the building owner LIG as client and the ESCos concerned consider the pilot projects to be successful, and they are now preparing new IEC projects.

So far, the results of the annual project audits have predominantly verified the contractually agreed savings. It remains to be seen whether the QAIs agreed are sufficient to ensure the calculated energy and CO_2 savings in the long term. It will be important for the building owner to actively watch over fulfillment of targets, and it might be advisable to introduce penalties for missed targets.

The fact that an upper limit of thermal savings of approx. 30% is achieved makes it quite obvious that a comprehensive refurbishment of the building shell within the specified pay-back period of 15 years cannot be implemented without subsidies or co-financing by the building owner. Co-financing can also be realized through cross-subsidizing from savings cash flows of other efficiency measures. The savings potentials for electricity have not yet been fully exploited and will need additional measures.

The projects have attracted interest from other organizations, including DECA (the umbrella organization of the Austrian ESCos), ESCo Europe (the European conference of the ESCo industry) and the European Energy Service Initiative (EESI). In 2010, LIG was awarded the Energy Globe Styria 2009 for their IEC projects.

Future Prospects

There is an urgent need to expand the numbers and market penetration of energy-efficiency projects. Opening up energy savings potentials remains one of the most important and, at the same time, most difficult energy policy tasks. It requires concerted efforts by energy policy makers, energy-efficiency industries, market and project facilitators as promoters and intermediaries between (potential) customers and the suppliers, and not least the facility owners and end-users of energy themselves. One point of strategic importance will be for advocates of renewables and energy efficiency to join forces.

Whether projects are implemented in-house or outsourced to an ESCo can be seen as a strategic "make-or-buy decision". What is most important in both cases is to make these decisions on a rational and well-informed basis: to optimize investments based on project costs, or even better, on life-cycle costs and to verify the performance of the energy-efficiency and renewables measures on a long-term basis.

We believe there is a reasonable prospect that the IEC approach to bundling energy efficiency with renewable energy supply can boost the market diffusion of both. If we can spread the news that M&V of energy savings can be made affordable without sacrificing appropriate rigor or effectiveness, this may help the overall project of establishing energy efficiency as a resource.

IEC is not a ready-made solution, but a framework that needs to be filled with appropriate content for each project. Therefore, engaging independent energy consultants as facilitators is often an investment that pays off; in IEC no less than in the other ESCo business models.

We particularly recommend applying the simpler and more robust IEC model wherever energy flows can be measured with acceptable effort. For example, this is the case for electricity or heat supplied from CHP or renewable energy systems but also MWh saved through energy-efficiency technologies like heat recovery units. And we recommend to combine energy supply with as many energy conservation measures as possible by first assessing saving potentials and implementing energy conservation measures.

In the end, though, no ESCo or energy service business model will be able to solve all obstacles in the way of energy efficiency. Independent of the choice of an implementation model, the voluntary or regulatory driven decision and ability of the facility owner to tap into (long-term) energy efficiency and renewable resources (based on life or project cycle cost calculations) remains a basic requirement.

Abbreviations

CHP	Combined heat and power
DECA	"Dachverband Energie Contracting Austria", umbrella organization of the Austrian ESCos
DPR	Detailed project report
EC	Energy Contracting (for definition see Section 4.1)
EESI	European Energy Services Initiative
EPBD	Energy Performance of Buildings Directive, 2002/91/EC
EPC	Energy Performance Contracting
ES	Energy Services
ESC	Energy Supply Contracting
IEC	Integrated Energy Supply Contracting
IGA	Investment grade audit
IPMVP	International Performance Measurement and Verification Protocol
LIG	Landesimmobilien-Gesellschaft mbH (LIG), the real-estate holding and management agency of the regional government of Styria, Austria
M&V	Measurement and verification
QAI	Quality-assurance instrument

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