ESCOs for residential buildings: market situation in the European Union and policy recommendations

Wolfgang Irrek
Hochschule Ruhr West University of Applied Sciences
Bottrop
Germany
Wolfgang.Irrek@hs-ruhrwest.de

Paolo Bertoldi
European Commission
Joint Research Centre
Institute for Energy and Transport
Via E. Fermi, 2749
IT-21027 Ispra (VA)
Italy
Paolo.Bertoldi@ec.europa.eu

Nicola Labanca
European Commission
Joint Research Centre
Institute for Energy and Transport
Via E. Fermi, 2749
IT-21027 Ispra (VA)
Italy
Nicola.Labanca@ec.europa.eu

Felix Suerkemper
Wuppertal Institute for Climate, Environment and Energy
Döppersberg 19
42103 Wuppertal
Germany
felix.suerkemper@wupperinst.org

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Abstract

Despite the large economic energy saving potential in the EU the energy service companies (ESCOs) market for residential buildings is much less developed than in other demand sectors (e.g. the industry or public/service sectors). Given the existing situation, energy policy experts and researchers appear generally quite sceptic about the possibility of a real and significant development in the near future. Besides sector cross-cutting barriers (e.g. low level of energy prices, lack of information and awareness, lack of appropriate forms of finance) there are indeed specific barriers which make a large scale application of the ESCO model for residential buildings particularly difficult. However encouraging development trends are being registered in specific market segments where the possibility of aggregating the demand or exploiting good relationships with customers have created interesting investment opportunities for ESCOs.

This paper aims to analyse the present situation for the development of the ESCO market in the residential sector in Europe. Specific market barriers and some existing energy policies affecting this market are also described together with a series of interesting case studies highlighting promising development trends. Finally some recommendations for policy makers on how these trends could be further stimulated are formulated.

Introduction

The main references for an analysis of the European ESCO market are represented by the reports produced by the European Commission Joint Research Centre (JRC) (e.g. Bertoldi et al. (2005; 2006b; 2007) and Marino et al. (2010)), although a specific overview dedicated to the development status of the ESCO market for the residential sector in the European countries is not covered in detail in these documents partly due to the limited development of the ESCO industry in this sector. For this reason analyses and considerations included in this paper have been only partly based on information available in the above documents and supplemented with surveys, interviews of acknowledged experts on ESCOs and estimates performed in the framework of recently concluded European projects, in particular the Changebest[1] project. After a brief clarification about the terminology adopted, the paper describes the existing barriers hindering the full development of the ESCO market and the ESCO market situation in the EU Member States. Existing energy efficiency policies affecting the ESCO market development are illustrated. Two possible development models (i.e. a so-called community model and a household model) for the ESCO market in the residential sector are analysed and a series of promising case studies reflecting these development models are briefly described. The paper concludes with some brief recommendations about energy policies that could be implemented at the European and the national level in order to stimulate the ESCO market growth in the residential sector.

1. See www.changebest.eu for further information on this project.

Terminology

The European standard on Energy Efficiency Services (CEN, 2010) defines Energy Efficiency Services (EES) as an agreed task or tasks, designed to lead to an energy efficiency improvement and other agreed performance criteria. The standard also requires that EESs include an energy audit as well as identification, selection and implementation of actions and verification. Moreover, a documented description of the proposed or agreed framework for the actions and the follow-up procedure has to be provided. Finally, the improvement of energy efficiency has to be measured and verified over a contractually defined period of time through contractually agreed methods. The energy efficiency improvement (EEI) can be of a technical nature (i.e. replacing or improvement of energy systems), organisational nature (better use of technology) or behavioural nature (changing daily energy use).

An Energy Service Company (ESCO) is a company delivering EES or partial services connected to EES, accepting some degree of financial risk[2] in doing so and being wholly or partially paid for EES delivery based on the achievement of EEIs and/or on the meeting of other performance criteria. Energy Performance Contracting (EPC) is a form of 'creative financing' for capital improvement, which allows funding energy efficiency upgrades from cost reductions. The approach is based on the transfer of technical risks from the client to the ESCO based on performance guarantees given by the ESCO. Regarding EPC, ESCO remuneration is based on demonstrated performance; a measure of performance is the level of energy or cost savings or the level of energy service. EPC is a means to deliver infrastructure improvements to facilities that lack energy engineering skills, manpower or management time, capital funding, understanding of risk, or technology information (Bertoldi 2005).

Finally, an Energy Service Provider (ESP) is defined in this paper as any entity that delivers EES, without necessarily taking a financial risk link to the delivery of the agreed energy savings. Therefore ESCOs, energy companies or any kind of company (e.g. equipment suppliers, electrical and mechanical contractors, etc.) will be referred to as ESP in so far as they deliver EES.

In this paper residential sector is intended as the ensemble of residential buildings, comprising both multi-family building as well as single family houses. It also includes a combination of occupiers' own buildings (apartment and houses) and well as rented apartments (including social housing). Through the paper the authors highlight the specific barriers, solution and ESCO models for the different types of ESCO buildings.

Barriers for ESCO projects in the residential sector and possible solutions

Despite the large economic energy saving potential[3], the ESCO market in the residential sector is much less developed compared to the industry, tertiary and public sectors in the European Union, as indicated in the JRC ESCO reports. Given the existing market conditions and barriers, market experts contacted in the frame of the Changebest project appear generally quite sceptic about the possibility of a real and significant development of the ESCO market for residential buildings in the near future. Besides sector cross-cutting barriers (e.g. low level of energy prices in some countries, long investment payback periods, lack of information and awareness, lack of appropriate forms of finance, lack of trust on the ESCO model, lack of monitoring and verification protocols) there are indeed specific barriers which make a large scale application of the ESCO concept in the residential sector on pure commercial basis (i.e. without incentives or other kinds of public/private subsidies) particularly difficult. These barriers typically are:

1. The particularly high transaction costs (Dahlman, 1979) for ESCOs relative to the small amount of energy costs and thus potential cost savings per single EES supplied. In this respect, initiatives aiming at creating district community groups and pooling together a number of buildings to implement EEI measures are highly beneficial, as e.g. shown by the results of the pooling of buildings for ESCO projects in the city of Berlin (Bertoldi 2007).
2. The high fragmentation of this mass-market making standardised EES necessary. Moreover in many of the EU-10 countries that have joined the EU in 2004 (e.g. Slovakia, Latvia, Hungary, etc.) the huge amount of existing prefabricated multifamily buildings constructed between 1960 and 1990 and currently in need of refurbishment represents a very interesting opportunity of providing highly standardised ESCO projects on a large scale.
3. The so-called landlord/tenant dilemma, where the tenant has an interest to achieve energy savings through EEI actions, while the landlord typically receives no benefits from these investments or can hardly pass on investment costs to the tenant[4]. In some Member States legal requirements hinder that the landlord of a multifamily building to pass on EEI action investment costs to the rent.
4. Decision making processes existing in multi-apartment buildings (which usually represent the most interesting investments for ESCOs) where only the general assembly of apartment owners can take decisions about building investments including possible EES implementation. Typically at least one half (but some times all) of the apartment owners must agree on this implementation in order to take any legally binding decision (Tigchelaar et al., 2011).
5. The fact that the energy consumption in the residential sector is much more correlated to individual needs and

2. By financial risk is meant the risk of not being fully paid for their provision of services if the contractually agreed energy savings and performances criteria are not met.

3. Based on energy saving potential evaluations performed by Fraunhofer-Institute et al. (2010), Duplessis et al. (2010) estimate an annual additional potential market volume of €2,440 M available for ESCOs operating in the residential sector of the EU-27 up to 2020. This estimated annual market volume would be additional compared to a business as usual scenario and refer only to EEI actions related to space and water heating in existing buildings. It would consist of about €190 M generated by investments with payback time (PBT) below 3 years, of about €1,640 M due to investments with PBT below 8 years and of about €800 M generated by investments with PBT over 8 years.

4. It may be interesting to notice that whereas a problem of split incentives for building renters and owners arises, EES providers could act as a broker and allow meeting the interests of all parties while realising the saving measures.

behaviours than in other sectors[5]. This can make it particularly difficult to define a consumption baseline and induces high risks when setting energy saving guarantees. Moreover, individual energy consumption meters for heat and hot water are often not present in multi apartment buildings impeding EE investment decisions by single households.

6. Difficulty for residential customers to understand the ESCO model and the EPC financing and contract and lack of information on the availability of ESCO services. Terms like energy services are sometimes used for services without the clear aim of improving energy efficiency. As already indicated there is now a European standardisation (CEN 2010); it remains to be seen how this will shape the understanding of terms and ultimately influence the market. Also standard financing and contracting options are being developed in several countries, but customers' understanding of these options remains low. In this respect market actors should be clearly guided to use correctly and fairly the terms and avoid misleading information to customers.
7. The lack of credibility of ESCOs also partially due to an often lacking legal framework for the accreditation of ESCOs. In addition, because of some bad experiences (poor quality services), in some Member States households are partly sceptical regarding ESCOs and their offers. In this respect a credible certification system for ESCOs would be very helpful. The recent CEN standard is a first step in this direction.
8. The fear to become too much dependent on the ESCO, especially if the contract also includes the supply of energy, and that the service offered would be more expensive than if the EEI were realised with a traditional contractor.
9. The present economic crisis and related economic and political uncertainties.
10. The lack or difficult accessibility to financial solutions dedicated to energy efficiency in commercial banks, and the scarce public subsidies or incentives for EEI.

The development status of the ESCO market in the residential sector in the countries of the European Union

The development status of the EES market in the residential sector for the most typical ESP (i.e. ESCOs and energy companies) has been analysed by Labanca et al. (2010). Different development stages have been defined and attributed to the EES markets existing in the 18 EU countries covered based on surveys and interviews to national experts performed by the ChangeBest project consortium.

From the analysis performed by the ChangeBest project in the surveyed countries or regions where the EES market in the residential sector has been described as well developed (i.e. Germany, Denmark, Flanders, France) the ESP are mostly energy companies. In Germany, energy companies (very often heating oil companies in competition with gas companies) offer EES mainly addressing EEI actions concerning space and water heating, including heat supply services for single households (house owners). The ESCO and EPC concepts are well developed in specific region or cities (e.g. Berlin). Moreover, the German government-owned development bank KfW is particularly active in promoting energy efficiency in residential buildings

In the UK, Denmark, Flanders and France energy companies address basically the same technologies and fields of application as in Germany, although in these countries and regions there is an energy saving obligation in place for energy companies, which stimulates these companies to supply EES to their customers. In France the white certificate scheme in conjunction with a tax deduction scheme seemed so far particularly effective in fostering the supply of EES related to the installation of individual and collective condensing boilers, high energy performance boilers, heat pumps and insulations measures (Giraudet et al. 2012, Duplessis et al., 2012). In Denmark most of the EES relate to the installation of efficient boilers and efficient ventilation and heating systems in general (Ea Energianalyse, 2008), whereas in Flanders the most common actions include super-insulated glazing, condensing and high-efficiency boilers, roof insulation in existing buildings (Bertoldi et al., 2010). In the UK the most common measure under the Energy Efficiency Commitment (EEC) and The Carbon Emission Reduction Target (CERT) was the loft insulation and the cavity wall insulation, followed by condensing boilers (Bertoldi, 2010). In the UK most of EEI were delivered by contractors (under contract with the energy suppliers). In Italy there is also a white certificates scheme, which has developed the local ESCO and ESP market, though the majority of projects implemented in the residential sector have been on CFLs and efficient appliances.

The JRC ESCO market survey (Marino et al., 2010) indicates that the ESCO market in residential sector is especially emerging in Hungary, Romania and UK and this is also supported by more recent reports as described later in the paper. In Hungary the complex refurbishment of residential block houses (involving heating, insulation, window replacement) has become a fast emerging market area for ESCOs mainly due to state and municipal grants available for panel blockhouse refurbishment. In Romania thermo-rehabilitation of existing buildings has been increasingly performed as of 2005 mainly thanks to the availability of a public funding programme covering up to 80 % of building rehabilitation costs. Similar developments are also taking place in Bulgaria where the ESCO industry for the residential sector is emerging. It is also interesting to note that a thermo-rehabilitation fund (subsidies) is available in Poland but this has not resulted in a creation of an ESCO industry. Concerning UK, the ESCO activities have mostly concentrated on the commercial and industrial sector so far. As already described existing CERT contributes to the provision of EES in the residential sector in this country. Nevertheless, this market remains dominated by a few ESP belonging to or working under contract for large energy suppliers, with a number of man-

5. Large scale installation of smart meters may partially contribute to overcome this barrier. For example in Italy almost all households are now equipped with electricity meters endowed of remote reading capabilities. The issue is how to make all this information readily available also to energy end-users and EES providers for verification of the energy savings.

aging agents aggregating small energy efficiency projects and selling the package to obliged suppliers. Typically an ESCO in the UK residential sector builds, operates and maintains the community or district energy scheme, sells energy to the end customers and provides customer care services. However, within this scheme, ESCOs demonstrate many different commercial structures and can encompass a broad range of services. A further opportunity for ESCOs should arise with the introduction of the Green Deal.[6]

Countries with a well-developed ESCO industry such as Czech Republic, Spain and Austria, have a less developed market in the residential sector. Interesting examples of ESCO implementation in the residential sector are emerging in Latvia, the Netherlands. The ESCO market is generally less developed in Greece, Ireland, Portugal, the Baltic countries, Belgium and therefore also ESCO projects in the residential sector.

Information and awareness raising activities are very important especially for the residential sector. These activities are rarely carried out by the ESCOs themselves, therefore it may be performed by energy agencies, including local one as in Portugal, Germany, Austria. They can be interesting partners for ESCOs, both in the stage of information and awareness-raising, and in the saving measurement and verification stage as they increase the credibility and transparency of the EES provided. In some countries (e.g. Austria) banks are active in providing information and advice on EES, which represents part of their marketing activity related to the credit lines they offer for EES. The provision of energy supply in combination with EES by energy companies seems to be a common practice in countries where a well-developed EES market exists (e.g. in France, Denmark, Germany, Flanders). In countries where the ESCO market is still in a preliminary development stage (e.g. Slovakia, Poland, Lithuania) this service combination is rare, though it is the first type of energy service provided, especially for managing existing district heating systems.

Financing of ESCO projects in the residential sector

Concerning EES financing and contracting, successful pure ESCO business models in the residential sector are rare in Europe. Whereas a good level of market activity for the provision on EES to the residential sector has been identified, e.g. in Germany, Denmark, Flanders and France, and more recently in Italy, this activity is typically supported by energy efficiency policy measures like energy saving obligations, tax deductions, tax credit schemes or subsidies. It is quite unlikely that EES activities for the residential sector would continue to exist on a pure commercial basis without any form of economic support provided through these policy measures. In addition, ESCO activities related to project financing is often limited to the identification of third parties available to finance investments for energy end-users (under share saving[7] or guaranteed saving models[8]).

Third Party Financing (TPF) is typically more common for the largest investments (e.g. in case of EES implemented by housing associations or real estate companies) or in those countries where banks have developed sufficient expertise and confidence in the EES business (e.g. Austria), or where international agencies have activated credit facilities to finance energy efficiency projects (e.g. the European Bank for Reconstruction and Development in Bulgaria and Romania). In general commercial financing for small residential projects is not existent or based on traditional asset based guarantees; only for a few larger projects in the residential sector project financing guaranteed by the future cash flows generated by the energy savings is available.

EES are often provided in combination with energy supply or contracts for operation and maintenance of energy systems at the energy end-user sites; this is very common in Germany, France and Italy. Additional contract types stipulated in the ESCO business in several countries analysed are leasing[9], Build-Own-Operate-Transfer (BOOT) contracts[10], chauffage[11]. energy performance contracts (EPCs) are still very rare. Some examples of EPCs stipulated in the residential sector have been identified in Sweden (Lindgren, 2009), Flanders (Coolen, 2010), Latvia (Rochas, 2010), Italy and Germany.

Moreover, the provision of energy saving measurement and verification (M&V) by ESCOs is a consequence of the stipulation of Energy Performance Contracts (EPCs) or the need to achieve some mandatory and measurable energy saving target (e.g. in Denmark, France, Flanders, Italy). M&V is increasing the transaction costs, and the more accurate is the more expensive is. Under suppliers obligations inexpensive (and less accurate) M&V methods have been developed such as the "deemed" savings.

6. The 'Green Deal' is a new initiative by the UK government designed to facilitate the retrofitting of energy saving measures to residential buildings across the UK. The scheme enables private firms to offer consumers energy efficiency improvements for their building, and to recoup payments through a charge of instalments on the electricity bill. The finance will be tied to the energy meter rather than the building owner, meaning that credit ratings will not be an issue when it comes to qualifying. The UK government plan to subsidise the loan interest rate charged to homeowners, as the current commercial rates would not be attractive to end-user.

7. Under a shared savings the ESCO assumes both performance and credit risk. The ESCO repays the loan and takes over the credit risk, The ESCO therefore assumes both performance and the underlying customer credit risk.

8. Under a guaranteed savings contract, the ESCO assumes the entire design, installation and savings performance risks, but does not assume credit risk of repayment by the customer.. The projects are financed by the customers who can also obtain financing from banks, from other financing agency, or a TPF entity.

9. Leasing can be an attractive alternative to borrowing because the lease payments tend to be lower than the loan payments; it is commonly used for industrial equipment. The client (lessee) makes payments of principal and interest; the frequency of payments depends on the contract. The stream of income from the cost savings covers the lease payment.

10. These contracts (Build-Own-Operate-Transfer) may set up a special purpose vehicles to design, build, finance, own, and operae the EE equipment for a defined period of time and then transferring its ownership to the client. These are long-term supply contracts where the service charges include capital and operating costs recovery as well as project profit.

11. The EES provider takes over complete responsibility for the provision of an agreed set of energy services. This arrangement is an extreme form of energy management outsourcing. Where the EES market is competitive, the EES provider also takes over responsibility for fuel/electricity purchasing. The fee paid by the client is calculated on the basis of its existing energy bill minus a percentage saving so that the client is guaranteed immediate savings. The more efficient the EES provider, the greater its earnings. If well designed chauffage contracts give strong incentives to EES providers to supply effective and efficient services.

Future EES market development in the residential sector: "community model" and "household model"

Although the residential sector is considered a market segment very difficult to be approached by ESCOs, the high energy saving potential and examples of some European countries indicate that interesting investment opportunities for ESCOs exist in this sector. Therefore, some of the most promising existing opportunities are highlighted in the following based on best practices identified in some European countries.

Two main distinct potentially interesting markets for ESCOs can be generally identified in the residential sector (Bertoldi et al. 2006a). The first type is assumed to reproduce a so-called "community" model, where decisions are taken by or on behalf of a group of customers in the same location (for example, but not exclusively, a community heating scheme in new build and social housing). The second type reproduces instead the "household" model, where energy suppliers, contractors or equipment suppliers to existing residential customers propose single or several elements of an ESCO service to the owner of a building. The community model gives the chance to realize economies of scale by installing energy efficiency solutions in several homes or in large multi family buildings in one go; in particular it can be applied in district/community heating, including renewable energies. Key sectors like local government or social housing can e.g. take the lead in stimulating the diffusion of this model in such a way that, in case of buildings retrofit or in case of new build developments, all energy related infrastructure on a site can be contracted out e.g. to an ESCO that could be in charge of energy efficient measure design, implementation, operation, maintenance and energy billing. Moreover, the ESCO could play the role of facilitator since energy efficiency investment decisions require the agreement of a large part of the community or building members. In the new EU-10 countries in Central and Eastern Europe, the ESCO market development has started with the refurbishment of existing district heating networks, and includes in some examples also pure end-use efficiency such as heating control equipment in dwellings. On the other hand, difficulties that may arise due to a need for co-ordination between ESCOs and housing association, to consumers' preference for individual rather than communal solutions, to high investment upfront costs and complex decision making rules should not be underestimated for this market segment.

Instead, the household model can represent an interesting opportunity especially for energy suppliers, who typically need to differentiate their offerings in liberalised energy markets in order to attract new customers and to increase customers' loyalty. Moreover, it should not be neglected that energy saving obligations for energy suppliers implemented or being implemented in some EU countries (e.g. Italy, France, UK, Denmark, Flemish region of Belgium, Poland) could bring additional cash flow to ESCOs projects and could increase the confidence of finance institutions in energy efficiency projects. Also small firms providing maintenance, breakdown repairs, equipment supply (e.g. boilers or solar heaters) for residential buildings can contribute to the diffusion of household models, as they are particularly sensitive to maintaining good customer relations and do not have to provide saving guarantees to convince customers of their capabilities. In this case the ongoing client/small contractor relationship for other services could be the foundation for an "ESCO-type" sale of incremental energy efficiency products and services, without the overhead of building a new relationship with a new ESCO. However, the risks due to high transactions costs involved, the need for a strategic and structured marketing approach, the difficulties linked to the identification of potential customers, and the lack of confidence in EES providers represent important barriers that should not be underestimated in this model.

A series of case studies and best practices going in these directions are described in the next section of this paper as they represent very useful examples and lessons learnt about how profitable business cases can be developed. However, it should be borne in mind that the conditions for the development of an actual market are typically context and country dependent and that the best practices described are not generally replicable in all EU countries. Concerning case studies reproducing a community model, the main and most interesting studies and best practices are those developed for local communities, social housing and multi-family buildings in general.

In case of social housing substantially different ESCO model approaches can in principle be identified depending on tenure (e.g. social houses provided for rent, for sale or shared ownership as in UK), providers (e.g. public authorities, non-profit or limited profit associations and companies, private for profit companies, etc.), beneficiaries (e.g. most vulnerable households, low-income households, all citizens), funding arrangements (e.g. social housing financed by public money, by a regulated or deregulated private rental market, etc.). The social housing operator (SHO) typically contracts an ESCO (by applying public procurement rules in case it is a public entity or an entity with a mission of public interest) and pays for the EES, whereas tenants pay the SHO a fixed rate including energy consumption costs for the contract duration. This rate usually does not exceed the average amount paid for energy consumption before ESCO project implementation and covers part of the EES supply costs. The support by a third party financing part of ESCO or SHO investments is often needed. Considering that social housing represents 35 million homes across Europe and accounts for about 18% of European green house gas emissions (Bullier, 2010), and given the size of the housing stock typically managed by social housing operators, the potential of this market segment is surely worth of being considered. An interesting example of ESCO implementation in this market segment is illustrated in the next section of the paper describing a case of EPC implementation for social houses in France.

Concerning ESCOs for privately owned multi-apartment buildings, they may represent a promising market segment for the same reasons that can be identified in case of ESCOs for social housing (i.e. possibility of realising economies of scale, higher investments that can be realized, lower transaction costs involved compared to EES supplied for single houses). The main differences with approaches developed for social housing concern procedures that can be adopted to select the ESCO (as public procurement rules do not have to be applied) and contracts that can be stipulated with EES beneficiaries, as in case of multi-apartment buildings these beneficiaries are not necessarily low-income or vulnerable households. However, especially in case of comprehensive renovation of buildings, a

certain level of subsidy is generally needed in order to implement EES most often complemented by a direct financial contribution by the flat owners. Moreover, transparency and the capability of inspiring trust to flat owners in order to stimulate collective action are highly needed together with the capability of co-ordinating all professional partners typically involved in the ESCO project and the capability of establishing a good co-operation with the local building managers. Contracts need to be explained in very detail showing profit margins and economic simulations, especially in case of EPC. Interesting examples of ESCO projects for multi-apartment buildings have been identified in Latvia and Hungary and have been briefly described in the next section.

Finally, as mentioned above, a further type of potential ESCO market can be identified for market actors like contractors or equipment suppliers that may decide to exploit the good relationships established with their customers to start providing some element of an ESCO contract or may decide to use EES offered to increase customer loyalty or attract new customers. Compared to a community model, this household model[12] is usually characterized by higher transaction costs, concerns the implementation of much smaller projects and is adopted by market actors whose core business is not EES provision. The market segment addressed is generally characterized by more standardised products/contracts and a better knowledge of customers' needs and priorities that is needed to design marketing concepts fitting to the target groups. Several examples of application of this model are nowadays available in Europe. Some particularly interesting cases are summarised in the final part of the paper.

Promising examples of ESCO projects in the residential sector

EXAMPLES PROJECTS OF "COMMUNITY MODELS" IN EUROPE

Energy Performance Contract (EPC) for social housing in France

The first EPC with third party investment in social housing in France was stipulated in 2011 for 64 social dwellings in Strasbourg suburb of Schiltigheim (Bullier & Lefevre, 2011). The EPC between the SHO (a private limited company) and the ESCO guarantees a primary energy consumption reduction of 47 % (from 239.5 to 126.1 KWh/year*m^2) for 19 years over the 6,781 m^2 of gross area covered by the 64 dwelling units concerned. Renovation activities planned consist of classic refurbishment works related to common areas comfort upgrading as well as to deep energy renovation of building shells and electric heat and ventilation systems. Annual adjustments of the guaranteed energy saving targets are envisaged based on possible variations observed in the estimated degree days, indoor maximum temperature, number of dwellings' occupants and DHW volumes consumed per occupant. Buildings energy performance are measured based on a measurement and verification plan and metering devices installed to record the electricity consumption for heating and ventilation, the amount of hot water consumed and the indoor temperature. The total investment for the EPC amounts to about 4,050,000 Euro, but only about 60 % of this will serve to cover EEI measure costs. Funding for total investments will be provided by grants (20 %), loans (9 %), ESCO equity (12 %) and third party financing (59 %). Besides local authorities' contribution (4 %) and private companies' contribution (1 %), the grants to be received will consist of a rebate on property tax and VAT reductions (7 %) envisaged in France for investments on energy conservation and of the amounts received by the sale of the white certificates that will be awarded under the French white certificate scheme for the energy saving measures implemented (8 %). Rents for building tenants will not be raised because of energy efficiency investments. The only revenue generated by these investments will be obtained through the energy bills paid to the SHO for 15 years after energy efficiency measures implementation. Economic savings generated by these measures during this period are estimated to be in total around 22,400 Euro/year and will be shared at 50 % between the tenants and the SHO. The decision to implement the project could not be taken without the approval of the majority of tenants who voted for it once the ESCO responsible for project implementation had been selected by applying the public procurement rules established in France for companies having a mission of public interest (as it is the case for social housing companies). This selection was based on a competitive dialogue leaving participant ESCOs the freedom to choose the most suitable technical options to achieve pre-established energy performances. The EPC establishes that the ESCO has to pay financial penalties in case the total consumption of the 64 dwellings exceeds the expected overall target and these penalties are supposed to be apportioned among all tenants. Each tenant pays for the amount of energy consumed and the less energy he consumes the higher the amount he receives in case of ESCO penalization. All risks of default on ESCO payments are taken by the SHO.

Energy Performance Contract (EPC) for multi-apartment buildings in Latvia

In 2009 an EPC has been stipulated for the EEI actions implemented in a multi-apartment building in Valmiera, Latvia (Rochas & Žogla, 2010). Since 1980 a district heating system supplies thermal energy for space and water heating to 36 apartments distributed over the 9 floors of the building, covering a heated area of about 1,914 m^2 and consuming on average 214 kWh/m^2/year (162 kWh due to space heating) between 2006 and 2008. EEI actions implemented are related to insulation of outer walls, insulation of attic and basement ceiling, repair of windows openings, improved insulation of heat distribution pipes, modernization of the heat substation, improvement of the DHW distribution system. A monitoring system measuring temperature (outdoor, in the attic, in the basement and in all flats) and energy consumption for space and water heating has been installed and allows the remote reading of monitored data as collected by a central data logger. Additional measures to improve visual and aesthetic aspects and solve operational and maintenance issues (e.g. refurbishment of the building entrance and staircase, etc.) have been also implemented. Data monitored during the first months of 2010 indicated that energy savings achieved were already

12. Although in the household model we have in mind smaller contractors or equipment suppliers serving a single household, in principle contractors, equipment suppliers and energy companies could also deliver their service under a "community" type model.

around 50 % of ex-ante consumption. Services included in the EPC were supplied by a network of companies with an ESCO responsible for supervision and quality control taking financing and technical risks. The EPC guarantees that no extra costs will be borne by apartment owners because of the measures implemented. During the whole contract period (20 years) they will pay the same amount for energy consumption as paid before building renovation. Total project implementation costs amounted to around 144,000 Euro, part of which were covered by subsidies. The building manager pays the ESCO for the service supplied (including heating) whereas flat owners do not keep any relation with the ESCO and continue paying their building manager for building maintenance and energy services.

ESCO project implementation for multi apartment buildings in Hungary stimulated by government

In 2001 the Hungarian Government launched a program called "Panel Program" providing support in the form of grants for the renovation of prefabricated buildings (Grosser Lagos, 2010). Government, municipalities and homeowners were supposed to contribute to the energy efficient renewal of prefabricated buildings by roughly providing one third of total investment costs each. ESCOs performing building renovations stipulated an EPC whereby energy savings to be achieved were guaranteed with the housing co-operatives representing apartment owners. The housing co-operatives typically took a loan to finance energy efficiency investments on behalf of apartment owners. A loan agreement involving the financing institution, the apartment owners, the ESCO and the local government was stipulated based on apartment owners' bank guarantee and ESCOs guarantee. Loans were or are typically repaid in a period between 65 and 105 months by apartment owners. About 380,000 flats were partly or totally renovated thanks to this initiative between 2001 and 2009. Their total energy consumption was in some cases reduced by up to 40–50 %. Total investment needed per apartment oscillated between 6,000 Euros (in case of comprehensive renovation) and 2,000 Euros (in case of partial renovation). Energy savings achieved were in some cases less than expected due to the fact that apartment owners sometimes preferred to install low-cost solutions. Moreover the financial crisis caused a credit slowdown and a contraction of ESCO investment in this initiative starting from 2009.

EXAMPLES PROJECTS OF "HOUSEHOLD MODEL" IN EUROPE

In *Germany* a municipal utility supplying electricity and gas has started offering to their customers the replacement of old and inefficient circulation pumps with efficient models saving up to 80 % of electricity. All customers are supposed to pay via their electricity bill a same amount of about 300 Euro for each circulator installed over a period of four years. Customers can easily understand how much they are paying and saving. Their electricity bills may be reduced by up to 10 % in the long term thanks to the efficient solution installed. Economic margins for the utility are low but higher customer retention can be achieved thanks to this EES.

A similar EES is supplied also by an energy company in *Slovakia*, which besides circulator replacement provides also an energy audit of the house.

In *Germany* an energy supply company started to install gas condensing boilers controlled by ambient temperature at single and multiple family houses under full service contracts for heat supply. The company carries out hydraulic adjustments of the heating systems, informs its clients about the functioning of the new system and maintains boilers ownership until the end of the contracts (i.e. for 10 years). An important demand for this EES seems to exist in Germany, but the contracts have to be simple and transparent, otherwise customers are not available to sign them.

In *Denmark* an energy supply and distribution company engaged in a strategic dialogue with its customers and organised a series of campaigns whereby the implementation of EES is stimulated by offering infra-red photography, mini energy audits, devices to reduce standby consumption, EE circulators, LEDs and complete building refurbishment within an EPC. 800 customers took part in the first campaign organised. Each of them achieved average energy savings around 650 kWh/year.

In *France* an ESCO provides a service consisting in assessing whether an energy efficiency project fits into the conditions for getting white certificates that can be sold to energy suppliers having to comply with an energy saving obligation. Customers implementing EE projects pay the ESCO a fixed amount or a pre-established percentage of the certificate market price for this specific service.

In *Italy* benefits from the combined installation of EE solutions and renewable energy sources are exploited by an ESCO offering free of charge PV panels combined with heat pump installation. This EES may allow ESCO clients to achieve zero energy bills and benefits from a feed-in tariff incentive mechanism in place in Italy for PV panel installation.

More information on the examples reproducing household EES models here reported is available in Renner et al. (2012).

Conclusions

Policy experts remain sceptical about a possible significant ESCO market development in the near future because of the specific barriers existing in the residential sector. These barriers mainly include the high transaction costs relative to the amount of energy costs, the high fragmentation of this mass market, the existing situations of split incentives, the rules regulating the decision processes in many multi-family buildings, the costs that can be included in rents, the highly subsidised energy prices in some Member States (MSs), the lack of incentives for improving efficiency in DH systems, and the lack of standardised procedures for measurement and verification of energy savings.

Nevertheless, the analyses illustrated in this paper have highlighted some main directions of improvement and provided elements of policy recommendations to stimulate the ESCO market in the residential sector. All in all, the case studies described in this paper and the many other cases for which information start to be available in the literature indicate that an ESCO market in the residential sector can in principle develop in most of the European countries.

Given the significant heterogeneity of national situations, it is obviously not possible to recommend a common EU policy approach to kick-start the market for ESCOs in the residential sector. However the newly adopted Energy Efficiency Directive

(EED) contains a range of measures that MSs have to implement to foster the provision of energy services, to develop an ESCO market, and to help financing energy efficiency. Article 18 contains a list of measures that Member States shall adopt in order to promote energy services market, including the ESCO market. It is important to notice that the EED Article 19 asks MSs to adopt measures to remove the split incentive barrier. Moreover, an important support could be provided at the EU level in helping to overcome existing financing barriers by specifically addressing banks and/or by arranging guarantee funds for EES (e.g. through the European Investment Bank or the recently established European Energy Efficiency Fund), as recently reinforced by Article 20 of the EED. In addition Article 8 requires MSs to promote to all final users high quality energy services.

In particular EU policy and national policies can increase trust into ESCOs by supporting information, qualification, certification and accreditation and training programmes, particularly in promoting and supporting harmonisation of such programmes among MSs, e.g., in terms of requirements and quality, and by supporting respective platforms and networks for exchange of experiences, standardised EES contracts and measurement and verification procedures.

At the MS level, national policies hindering the implementation of ESCO projects (e.g. the recently revised, but only partly improved tenant law in Germany) or being a barrier towards the development of a level playing field (e.g. policies and support programmes that do allow energy companies to monopolise the specific EES) should be revised or removed. Moreover, a mechanism allowing financing energy efficiency improvement actions and offering EES in the residential sector should be implemented in every MS (e.g. an energy efficiency fund and/or an energy efficiency obligation scheme like the ones already implemented in some countries for energy suppliers or distributors). The EED Article 7 will require MSs to set up energy companies' obligation or equivalent measures, although it would be also important to shift from the provision of EES under an obligation or support scheme to an independent and profitable ESCO market when suitable market conditions are created.

In general policy packages stimulating both demand and supply of ESCO services for the residential sector simultaneously would be highly beneficial. Policies stimulating supply of EES are especially rare at the moment. Finally, financial subsidies for soft loans or guarantee schemes to boost the EES market could be implemented by MSs. National governments or local administrations could collaborate with banks to offer EES at low interest rates, to offer financial guarantees that reduce investment decision risks, to create revolving funds to finance projects carried out by EES providers, as done in Germany through the KfW or in the UK with the recently launched Green Deal.

Although the provision of financial subsidies and/or incentives for EES is needed in the early phase of the market development, and this can generally allow generating more energy savings, it is important that these policy measures should be considered as temporary policy measures to be implemented only during EES market initial development stages. Albeit quite difficult to implement for ESCOs in the residential sector, policy measures facilitating the creation of competitive EES business models should instead have the priority.

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