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# **The European market for energy efficiency services in the residential sector and the effects of existing energy efficiency policies on its development**

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## **Keywords**

Energy end-use efficiency, energy efficiency services, policies and measures, energy service companies, energy distributors, distribution system operators, retail energy sales companies, markets for energy efficiency services.

## **Abstract**

A main objective of the Energy Service Directive (ESD) is to stimulate the market for energy efficiency services (EES) and for the delivery of other energy efficiency improvement measures to final consumers. In order to achieve this objective, the ESD gives a special role to energy companies. On the other hand, there are energy service companies (ESCOs) and further actors ready to expand their business in the field of energy efficiency services. Against this background, it is important to know about the status and barriers of the markets of EES in Europe, how and to which extent existing energy efficiency policies foster or hinder EES market development, and how energy efficiency policies should be designed and implemented to stimulate this market. Since 2009 the IEE project ChangeBest is committed to assisting energy companies and ESCOs in entering the EES business, starting with an empirical analysis of the existing EES markets and the respective economic and policy frameworks.

The paper will discuss the effects of the existing energy efficiency policies on the provision of EES for the residential sector in the EU as analysed in the ChangeBest project and present the preliminary project conclusions and recommendations for the formulation and implementation of energy efficiency

policies that can stimulate EES provision in this sector. This will be done firstly by presenting an overview of the development status of the EES markets in the countries covered by the ChangeBest project and by discussing how existing national and EU policy measures positively or negatively influence the demand for, and supply of, EES for the residential sector in these countries. Then existing EES market potentials in the residential sector will be briefly discussed and the main preliminary ChangeBest project conclusions and recommendations on the formulation of policy measures which are most suitable for the exploitation of these potentials will be presented.

## Introduction

Since July 2009 the IEE<sup>1</sup> project “Promoting the development of an energy efficiency service market” (ChangeBest) is supporting the implementation of the Energy Service Directive (ESD) by assisting energy companies and ESCOs in entering the B2B and B2C market for EES, contributing to the development of the EES market and demonstrating good practice in implementing the ESD.

Among others things, ChangeBest project activities have so far produced a cross-country analysis [1] of the energy efficiency business in the 18 countries and regions participating in the ChangeBest project<sup>2</sup>, an analysis of the positive or negative effects of existing policy measures on the provision of EES [2] and an analysis of the potential market volume for EES in the EU [3].

This paper summarises the results and conclusions achieved by these analyses that can be referred to the residential sector.

The cross-country analysis performed has been based on the 18 country reports on the EES markets' development. They have been produced by the ChangeBest consortium in the countries by consultation of existing literature and conducting interviews with a number of national experts. One of the main objectives of this analysis has been highlighting similarities and differences in the national EES markets. This objective has been achieved first of all by making a qualitative comparison of the different national framework conditions (e.g. national legislations, status of the national economies, degree of energy market liberalisation, energy prices, etc.) and of the EES provider types existing in each country. Then the possible relationships that have or can be established among the EES market players acting in the various countries, the existing EES market offer for the various customer groups and the positioning of ESCOs and energy companies in the different demand sectors have been compared.

The effects of existing policy measures on EES markets have been studied by developing an analysis structure that describes in general how policy measures stimulate energy savings and how they can influence the demand for, and supply of, EES in EU countries.

The potential market volume for EES in the EU has been estimated based on existing studies that refer to the economic and technical potential of energy savings in the residential sector and on technical material collected by the project partners. The energy savings potentials have been priced with energy tariffs for energy end-users in order to provide an estimate of the market volume available for future possible activities in the field of EES.

In the following paper sections we firstly present an overview of the development status of the EES markets in the countries covered by the ChangeBest project. Then we discuss how existing national and EU policy measures positively or negatively influence the demand for, and supply of, EES for the residential sector in these countries. Finally we briefly discuss existing EES market potentials in the residential sector and present the main preliminary ChangeBest project conclusions and recommendations on the formulation of policy measures which are most suitable for the exploitation of these potentials.

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<sup>1</sup> Programme Intelligent Energy Europe of the European Commission: [http://ec.europa.eu/energy/intelligent/index\\_en.html](http://ec.europa.eu/energy/intelligent/index_en.html) (Grant Agreement No. IEE/08/434/SI2.528383),

<sup>2</sup> Germany, Denmark, Flanders, Sweden, The Netherlands, Austria, France, Italy, Czech Republic, Portugal, Estonia, Latvia, Slovakia, Slovenia, Estonia, Bulgaria, Greece, Poland

## Terminology

The European standard on Energy Efficiency Services [4] defines 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 EES 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). This is the definition of EES also adopted in the framework of ChangeBest and in the present paper.

A distinction is made as to EES activity types that are also indicated as EES value chain stages or partial services connected to EES.

In particular the following types of activities (or EES value chain stages, or partial services connected to EES) are distinguished: (1) awareness raising, (2) information and advice, (3) identification of measures, (4) technical planning, (5) financing and subsidies, (6) implementation (operation and or supervision), (7) optimization of technical operation, and (8) measurement and verification of savings.

As to providers of EES, an EES provider will be defined as any entity that delivers EES. Therefore ESCOs, energy companies or any kind of company (either independent or subsidiary of other companies, either focusing its business on EES or not) will be referred as EES providers in so far as they deliver EES.

## Overview of the development status of the EES markets for the residential sector and their market players in 18 EU countries

Despite the high economic energy saving potential of the residential sector (partly having a reasonable investment payback time)<sup>3</sup>, the development stage of the EES market in this sector in the countries analysed is on average ranked at the lowest level with respect to the other sectors. Given the existing market conditions and barriers, experts interviewed appear generally quite sceptic about the possibility of a real and significant development of the EES market in the residential sector in the near future. According to the experts and researchers participating in the ChangeBest project, besides sector cross-cutting barriers to the development of an EES market (e.g. level of energy prices, long investment payback periods, lack of information and awareness, lack of appropriate forms of finance) there are indeed specific barriers which make a large scale application of the EES concept in the residential sector on commercial bases much more difficult than e.g. in the industry or public/service sectors. These barriers are:

1. The particularly high transaction costs for EES providers relative to the small amount of energy costs and thus potential costs savings per single EES supplied. In this respect, initiatives aiming at creating district community groups and pooling together a number of buildings to implement energy efficiency improvement measures could be highly beneficial.
2. The high fragmentation of the mass market making standardised EES necessary. A standardised inspection and advice, as part of the energy labelling of dwellings to be sold or rented is often seen as a potentially effective way to partially solve the issue. Moreover in some countries analysed (e.g. Bulgaria, Slovakia, Latvia) the huge amount of existing prefabricated multifamily buildings constructed between 1960 and 1990 and in need of refurbishment represents a very interesting opportunity given the possibility of providing highly standardised EES on a large scale.
3. The so-called landlord/tenant dilemma due to the fact that, although the tenant basically has an interest to reach energy savings through EEI actions, the landlord typically receives no benefits from these investments or can hardly pass on investment costs to the tenant. In this respect the legal requirement that the landlord of a multifamily building is allowed to pass on EEI action investment costs to tenants only if all tenants agree on this investment is an important barrier to EES market development in some countries.

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<sup>3</sup> See the paper section dedicated to EES market potentials

4. The decision processes existing in multi-apartment buildings (which usually represent the most interesting investments for EES suppliers and financiers) where only the general assembly of apartment owners can take decisions about building management including possible EES implementation. Typically at least one half of the apartment owners directly or indirectly affected by EES implementation must agree on this implementation in order to take any legally binding decision.
5. The fact that the energy consumption in the residential sector is much more correlated to individual needs and behaviours than in other sectors<sup>4</sup>. 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 are often lacking in multi apartment buildings impeding EE investment decisions by single households.
6. Difficulty for potential EES customers to get oriented among existing EES offers also partially due to the difficulty in understanding the ESCO model and the EES financing and contract as well as to the lack of information on the availability of these services. Terms like energy services and EES are sometimes used for services without the clear aim of improving energy efficiency. A European standardisation process has been initiated and it remains to be seen how this will shape the understanding of the 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 on EES providers also partially due to the often lacking legal framework for the accreditation of EES providers. In addition, because of some bad experiences (poor quality services), households are partly sceptical regarding the EES providers and their offers. In this respect a credible certification system for ESCOs would be very helpful.
8. The fear to become too much dependent on the EES contractor and that the service offered would be more expensive than if the energy efficiency improvement were realised autonomously.
9. The present economic crisis and related economic and political uncertainties.
10. The scarce or difficult accessibility of public subsidies or incentives for EES implementation.

A summary about the development status of the EES markets in the residential sector for ESCOs and energy companies operating in the countries analysed is given in the table 1 below.

**Table 1: EES market development status in the residential sector by EES provider in the countries considered**

Legenda: 1=very well developed; 2=well developed; 3=emerging; 4=not well developed; 5=not existent; empty=unknown

ES = ESCOs; EC = Energy Companies

DE	DK	BE	SE	NL	AT	FR	IT	CZ	PT	ES	LV	SK	SL	EE	BG	EL	PL
ES <sup>1</sup> EC	ES <sup>1</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC	ES <sup>2</sup> EC
4	2	2	5	2	4-5	4-5	3	5	4	3	3-4	1	3	3	5	5	5

<sup>1</sup> Not including totally public EES providers like public energy agencies or NGOs

<sup>2</sup> Focus on EPC-contracts

As also showed by table 1, the analysis performed indicates that, in general, the EES market for ESCOs is less developed than the energy company EES market. Whereas the EES market for ESCOs appears in general as more developed than the EES market generated by energy companies in other demand sectors, the typically smaller projects implemented in the residential sector are

<sup>4</sup> 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 ESCOs for verification of the energy savings.

offered especially by retail energy sale companies or energy distributors, often to increase customers' loyalty or to comply with a possible energy saving obligation in place in the country where they operate.

In the surveyed countries or regions where the EES market in the residential sector has been depicted as well developed (i.e. Germany, Denmark, Flanders, France) the EES providers are mostly energy companies. In Germany, energy companies offer EES mainly addressing EEI actions concerning space and water heating, insulation and air conditioning. Such full EES are mostly offered to the housing industry, where a number of apartments or even houses can be covered<sup>5</sup>. In addition, there are heat supply services for single households (house owners) that include energy efficiency improvements of the heating system. Moreover there are some governmental programmes supporting energy agencies, some NGOs and other market actors in making EES related to building refurbishment or to electricity saving measures in low-income households financially viable.

In 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 mainly stimulates these companies to supply EES to their customers. The white certificate scheme in place in France has 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. In Denmark most of the EES relate to the installation of efficient boilers and efficient ventilation and heating systems in general [5], whereas in Flanders the most common actions include super-insulated glazing, condensing and high-efficiency boilers, roof insulation in existing buildings [6].

In the four countries mentioned above, and in general, the target group of single households is however often reached by energy companies only through partial services connected to EES, like information, energy audits, etc., aiming to increase customer loyalty.

Clearly also actors different from ESCOs and energy companies are typically active in the EES market, especially in countries with a long tradition of public subsidies in the housing sector (e.g. Austria). Social housing corporations, project developers, architects, investors, building companies and installers of energy using systems in the construction sector are other important EES market actors. Moreover energy consultants, auditors and engineers play an important role in the EES market, especially in those countries where this market relies on regulations related to building energy certification and/or energy audits.

However, whereas some of these company types may offer integrated services and cover the whole EES value chain, most of them may decide to focus on specific value chain stages. The cross-country analysis performed in the framework of the ChangeBest project shows that ESCOs rarely concentrate on information and awareness raising on EES in the countries where they operate. Additionally, their activity related to EES financing is often just limited to the identification of third parties available to finance EES investments (i.e. they typically do not finance EES investments with internal funds). Moreover, the provision of energy saving measurement and verification by ESCOs and energy companies is often a consequence of the stipulation of EPCs or the need to achieve some mandatory and measurable energy saving target (e.g. in Denmark, France, Flanders, Italy).

Information and awareness raising activities may be performed by energy agencies (like e.g. in Portugal) which could be interesting partners for EES providers, both in the stage of information and awareness-raising, and in the saving measurement and verification stage, by introducing more credibility and transparency in the EES provided. In some countries (e.g. Austria) banks are active on information and advice on EES which represent 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 Denmark, Germany, Flanders), whereas in the countries where the EES market is still in a preliminary development stage (e.g. Slovakia, Poland) this service combination is rare or not provided at all.

The analysis performed also considered technologies and fields of application for EES offered to the various possible customer groups in the countries covered. This survey addressed the main sector cross-cutting technologies and fields of applications in the sectors of industry, residential, commercial, public/service and agriculture.

Table 2 below summarises the results of the survey performed for those cross-cutting technologies and fields of applications constituting the EES market which may relate to the residential sector. This

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<sup>5</sup> However, such EES have become more difficult in recent years due to a legal decision that house owners are not allowed to transfer payment of the EES contract to the tenant. Existing political proposals to overcome this barrier by changes in tenant law have not been implemented yet.

table shows that energy efficiency improvement measures addressing building envelope insulation and heating systems are the sector cross-cutting technologies and fields of application mostly indicated in the country reports as typically addressed for the provision of EES<sup>6</sup>.

**Table 2 : Main sector cross-cutting technologies and fields of application for the EES provided in the countries analysed (“XXX” = *much more frequently preferred*, “XX” = *more frequently preferred*, “X” = *less frequently preferred technologies*)<sup>7</sup>**

Country	Cross cutting technologies							
	Building envelope insulation	heating system (incl. DH), hot water system	air conditioning	Ventilation	water saving	building automation and control systems	user behaviour training	Pumps
DE	xx	xx	xx	xx				x
DK	x	xxx	xx	xx				x
BE	x	x					x	
SE	x	xx		xx	x	xx	xx	
NL	x					x		xx
AT	xx	xx					xx	
FR	xx	xxx	x	x		x	x	xx
IT	x	xx	xx		x	x		
CZ	xx	xx						
PT		xx	x	x				
ES		x	x	x		x	x	
LV	x	xx				x		
SK	x	x						
SL	x	x				x	x	
EE	x	x	x	x				
BG	x	x					x	x
EL	x	x	x					
PL	xx	xx	x	x		xx	x	

Concerning EES financing and contracting, successful pure business models addressing EES supply in the residential sector are very rare in the countries analysed. Probably for this reason EES financing and contract types adopted in these countries are also not very evolved. Whereas a good level of market activity has been identified (e.g. in Germany, Denmark, Flanders, France) this activity is typically supported by energy efficiency policy measures like energy saving obligation, tax deduction, tax credit schemes or subsidies. It is often quite unlikely that this activity could continue to exist on a pure commercial basis without any form of economic support provided through these policy measures.

<sup>6</sup> Notice however that the information related to the different preference degrees for the various technologies and field of applications registered in the various countries refers to all possible sectors and could hence not actually indicate the actual variation in the preferences existing in the residential sector

<sup>7</sup> The three different preference degrees possibly reported in this table serve to highlight the possible differences *in a same country* and do *not* reflect the different preference degree for a given technology or field of application in *different* countries.

As already mentioned energy companies decide in some case to provide these services for commercial reasons in order to increase customers' loyalty or to acquire competitive advantage over existing competitors. 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).

EES are often provided in combination with energy supply or contracts for operation and maintenance of energy systems at the energy end-users sites. Contract types stipulated in the EES business in several countries analysed are leasing, Build-Own-Operate-Transfer (BOOT) contracts<sup>8</sup>, chauffage<sup>9</sup>. Energy performance contracts (EPCs) are very rare. Some examples of EPCs stipulated in the residential sector have been identified in Sweden [7], Flanders [8], Latvia [9].

## **Existing energy efficiency policies affecting EES market development in the residential sector**

As already mentioned, a specific analysis structure that describes in general how policy measures can influence the demand for and the supply of EES has been developed in the framework of ChangeBest [2] and has been used to analyse the policy measures of countries. Policy measures affecting the EES market have been categorised as:

- (1) specifically targeting EES providers,
- (2) creating or supporting general mechanisms for an EES-market,
- (3) stimulating one or more EES activities,
- (4) stimulating energy savings and thereby EES activities indirectly,
- (5) restricting the (commercial) market for EES.

Concerning policy measures specifically targeting EES providers, a distinction can be made among (a) measures for accreditation/certification of ESCOs or offered EES, (b) measures for the creation of platforms for ESCOs with common interests, (c) measures providing specific support for ESCOs (e.g. financial) and (d) legal arrangements often regarding the removal of barriers for ESCOs.

Clearly the potential for EES market development in a country cannot be directly correlated to the number of measures targeting EES providers in place. However, the overview performed highlighted that only a few countries have no measures specifically devoted to directly improve EES providers position (i.e. Bulgaria, Latvia, the Netherlands), whereas few countries have implemented more than two of the above mentioned policy measure types (i.e. Italy, Poland, Spain). Support is given in various ways, sometimes by extra subsidies for ESCO projects, a few times as preferred partner (Czech Republic) in energy saving projects. Financing of investments by ESCOs is generally part of policy on TPF, which however is not always related to projects implemented by ESCOs. This support can be positive but in principle can restrict the activities of other commercial EES providers and it can be debated whether this actually stimulates a commercial EES market.

Concerning policies creating a general mechanism for EES, like WCS (white certificate schemes), EPC (energy performance contracting), TPF (third party financing) or comparable schemes, these measures can in principle create ample opportunities for EES providers. Policy measures stimulating EPC and TPF are mentioned for 7-8 countries, although EPC are rarely adopted in the residential sector.

The above mentioned mechanisms create opportunities but they do not lead by definition to a thriving EES market because of the market barriers existing especially in the residential sector or the absence of a level playing field for EES providers. For example WCS can bring additional cash flow for EES providers and shorten payback times for the actors involved in EES implementation. Moreover WCS

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<sup>8</sup> These contracts (Build-Own-Operate-Transfer) may involve an EES provider designing, building, financing, owning, and operating 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.

<sup>9</sup> 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 is the EES provider, the greater its earnings. If well designed chauffage contracts give strong incentives to EES providers to supply effective and efficient services.



create an institutional and independent back-up to EES (energy savings are certified by a public authority) and can create harmonised and recognised procedures for measurement and verification of energy savings. Nevertheless, EES providers different from energy companies are not always eligible to get and trade certificates under the existing schemes. Furthermore, EEI actions so far mostly implemented could hardly be part of a self-sustaining long term EES market because they typically are the easiest and cheapest to implement (e.g. they relate to CFLs or low flow showerheads installation)<sup>10</sup>.

Concerning policy measures that stimulate one or more EES activities in the value chain (such as raising awareness, providing information, advice on saving measures, technical planning and monitoring of results) many types of EES activities are stimulated by such policy measures in place in the countries analysed. However, there are only single policy measures in place, and hence, there is a need for a complete set of policy measures ('policy packages') that stimulates *all* EES activities that are necessary in order to realise energy savings.

Concerning policy measures stimulating energy savings and thereby EES activities indirectly, all countries surveyed deploy policy measures to stimulate savings of the following types: energy performance standards for new dwellings/buildings, minimum efficiency standards for appliances, labelling of buildings and appliances, subsidies or favourable loans or tax-deductions, voluntary agreements, taxes on energy or on CO<sub>2</sub> emissions and emission trading scheme. Whether these policy measures stimulate the demand for EES depends on the complexity of solutions. Stimulation of simple solutions, such as efficient refrigerators, does not lead to more demand for various EES activities. Stimulation of complex solutions, such as renovation of buildings or installation of CHP, does provide opportunities for EES providers. Further on, some stimulating policy only creates a temporary market for EES, such as for very efficient new dwellings that will become common building practice in time.

Finally, concerning policies restricting the EES market a distinction can be made between legislation that restricts EES companies in their operation and policy measures that restrict the commercial market for EES. Legislations restricting EES providers activity relates for example to the prohibition of external funding of energy equipment in "chauffage contracts" in France, the requirement that all tenants of multifamily buildings must agree on investments by ESCOs (e.g. in Germany and Slovenia), the low and regulated heat prices not leaving room for ESCOs investments in Poland, the restricted transfer of district heat costs to the consumers in the Netherlands. Most of the legislative problems are not related to energy savings but regard arrangements between parties in general. In a number of countries policy measures have been formulated to lift the legislative barriers, as demanded in the ESD. However, the observed problems show that in many countries this demand has not yet been met. Policy measures stimulating public supply of EES which competes with commercial offers can actually restrict the commercial EES market. Examples are free energy checks/advice by energy agencies, government supported/erected ESCO's, support for training of energy experts and attractive subsidies only for energy users. Whether the public offering of EES restricts the commercial EES market or not also depends on the targeted end-users<sup>11</sup>, the type of EES activity (awareness raising is generally a public EES activity), the terms for public EES offering and the EES market development status in the residential sector. In particular public offering of, or public economic support for EES in the residential sector can in principle serve to stimulate the commercial market for EES whereas this market is in an initial development stage, this being case in practically all the countries analysed.

Also EU policy (ESD, EPBD, CHP, Ecodesign Directive, Labelling and ETS) transposed into national policy measures can be dealt with in the analysis of national policy measures. EU policy affecting European actors hardly influences the EES market. Although EU policy, as highlighted in the ESD, has a large indirect effect on the EES market, the direct effect of EU policy measures is very limited.

In general all the policy measures above described can be categorised as mostly indirectly, but partly also directly positively or negatively influencing the EES market via the supply side or via the demand for EES. Most policy measures directly targeting EES providers or EES activities are supply-oriented, e.g. policy measures that increase the quality of offered EES. Overall, far more policy measures

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<sup>10</sup> However the situation might change in the next years because more costly EEI actions could be implemented by obliged actors to achieve their saving targets because the so called "low hanging fruits" will have been harvested and because the new saving targets will generally be much higher than in the past.

<sup>11</sup> For example public EES offering may be necessary for single dwellings, which are typically very difficult to achieve by EES providers, whereas this offer might in principle restrict the commercial EES market for multifamily buildings.

influence the EES market via the demand side, and mostly only indirectly. However, influence via the supply side could be more focused and therefore more effective than indirect influence through the demand side.

## Existing EES market potentials in the residential sector

The potential market volume which can be generated by future promising EES in the residential sector has been estimated in the framework of ChangeBest [3]. This estimate has been mainly derived from assessments of the economic and technical energy saving potentials in 2020 as available in [10]. The market volume available for future activities in the field of EES has been indeed derived by pricing these potentials with the corresponding final end-users' energy tariffs<sup>12</sup>, as reported in the EUROSTAT database. Energy saving potentials considered in the ChangeBest analysis refer only and exclusively to EEI actions related to *space and water heating in existing residential buildings*.

Following the approach adopted in [10] estimates have been first performed by indicating a range of variability for the potential economic energy savings which have been assessed by considering a baseline scenario, a low policy intensity scenario (LPI) and a high policy intensity scenario (HPI). Whereas the baseline scenario extrapolates past autonomous energy efficiency improvement rates, including the impact of early energy savings (adopted through 2006), the LPI scenario assumes high barriers to energy efficiency, an increase in the policy effort to overcome these barriers compared to current policies and considers the implementation of EEI actions which are cost-effective for the whole country. The HPI scenario assumes a removal of the barriers to energy efficiency achieved by a high policy effort and considers actions whose implementation is cost-effective for the consumer<sup>13</sup> (see [10] for further information and details). The overall economic energy saving potentials in EU-27 by 2020 have resulted of 140 TWh final energy under the LPI scenario and of 379 TWh final energy under the HPI scenario, of which are 125 TWh fuel savings and 15 TWh electricity savings in the LPI scenario and 358 TWh fuel savings and 21 TWh electricity savings in the HPI scenario. The annual economic energy saving potentials (estimated for each EEI action considered in each of the EU-27 countries) have been multiplied by the corresponding country specific end-users' energy tariffs and have resulted in an annual additional EU-27 potential market volume of 527 M€ under the LPI scenario and of 1438 M€ under the HPI scenario.

The huge difference registered between electricity and fuels potential additional savings comes mainly from the fact that future electricity savings deriving from the installation of most of the energy efficient domestic electrical appliances are not considered (because these EEI actions could very hardly be part of EES), the fact that the energy performances of installed electric heating systems are assumed as hardly improvable, the fact that heat pumps, which are responsible for a significant amount of the estimated energy savings, are assumed to be mostly installed in substitution of existing oil or gas fuelled heating systems. The big variation between the economic energy saving potential estimated under the LPI and HPI scenarios derives instead mainly from the marked improvement of building envelopes energy performances assumed under the HPI with respect to the LPI scenario.

Although it could be roughly assumed that the actual EU-27 economic energy saving potential that will be exploited by 2020 through the implementation of EES lies somewhere between the potentials estimated respectively under the LPI and HPI scenarios, it should be also considered that these potentials include the possible implementation of EEI actions with a long investment payback time that could be hardly considered for the stipulation of EES contracts. For this reason the energy saving potential that might be in principle exploited by EES has been also estimated by adopting the following approach as an alternative to the one just described above: instead of assuming that this potential is made by those additional EEI actions which would be implemented under the LPI or the HPI scenarios, it has been assumed that this potential is made by those additional EEI actions having reasonably short payback times that could be implemented according to what foreseen by the technical scenario (TECH) considered in [10]<sup>14</sup>. The technical energy saving potential due to EEI

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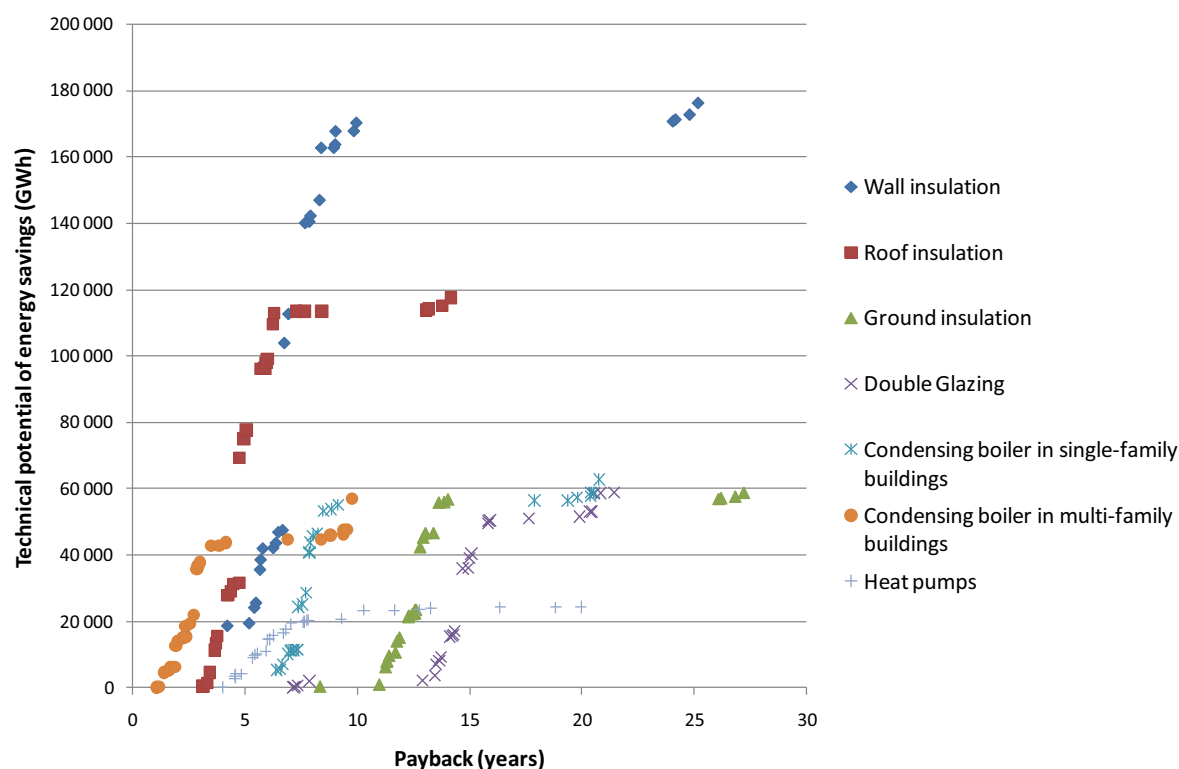
<sup>12</sup> All energy prices considered are prices before taxation and are expressed in 2007 € values

<sup>13</sup> Cost-effectiveness has been calculated in [10] from the sum of annualised investment costs, annual operation and maintenance costs minus the annual financial savings from lower energy bills. Capital costs have been annualised over the technical lifetime of the actions with a discount rate of 8% under the LPI scenario, and a discount rate of 4% under the HPI scenario. Energy prices are energy price after taxation and are expressed in 2005 € values.

<sup>14</sup> This scenario implements EEI actions to a level that is assumed to be technically achievable and takes into account also measures that are not cost-effective and whose related investment payback time is hence longer than measures' lifetime, although it does not include extremely costly measures (see [10] for more information).

actions related to space and water heating systems in the existing residential buildings of the countries of the EU-27 has been then analysed with respect to the payback times<sup>15</sup> of these actions (which may be, and actually are, different in each of these countries) [3].

Figure 1 reports the cumulated technical energy saving potentials estimated for the various EEI actions considered in each of the EU-27 countries vs. the average payback times of the related investments as estimated for each of these countries. These national technical potentials have been sorted by rising payback time and cumulated in order to represent the EU-27 “offer curve” of technical energy savings.



**Figure 1: cumulated technical energy saving potential estimated for the various EEI actions considered in each of the EU-27 countries vs. payback times of the related investments as estimated for each of these countries [3].**

Figure 1 indicates that the largest potential could come from wall and roof insulation. Both EEI actions can be implemented with short investment payback times in the countries with moderate or warm climates. This potential is less exploitable in colder climates because of the better quality of existing insulation solutions.

Boiler replacement has on average a short payback time and represents hence a very open EES market potential, mostly in multi-family buildings for which payback times are very short (less than 5 years for most of the countries). Heat pumps have also short payback times but their energy saving potential is smaller.

Finally, double glazing<sup>16</sup> and ground insulation represent a non negligible potential but their payback times seem to be too long to be considered as a potential open to EES (more than ten years).

The overall technical energy saving potential of the EEI actions considered for the residential sector and represented in Figure 1 corresponds to around 555 TWh in 2020 whatever the payback time. If we translate these figures in terms of yearly market, the yearly potential additional market volume open to EES results around 2 440 M€. But that would imply that investment payback times of some EEI actions would be longer than 25 years and EES contracts stipulated for their implementation would probably have to last at least for as much time, which seems fairly unrealistic. If we order these

<sup>15</sup> Payback times are estimated by assuming a zero discount rate

<sup>16</sup> Thermal performances of windows frames have not been taken into account and estimated energy savings derive hence only from glazing improvement.

technical potentials by their corresponding payback times it results that the yearly additional potential market open to EES could reach 194 M€ if the investment payback times (and hence the corresponding EES contract durations) were limited to 3 years. This analysis has also shown how a much higher potential could be exploited if EES could be offered on a longer period thanks to suitable policy measures or by providing new types of EES (in particularly long-term contracting types). With less than 8 years contracting, the annual additional EES potential market open to EES rises indeed to 1 644 M€, whereas a less accessible market potential of 795 M€ is made of investments with payback times over 8 years (see table 3 below).

**Table 3: Potential of the market open to EES for the residential sector in EU-27 – Summary [3]**

<b>Additional market for EES according to their accessibility (yearly market in M€ up to 2020)</b>		
<b>Very accessible (PBT &lt; 3 years)</b>	<b>Accessible (3 years &lt;PBT&lt; 8 years)</b>	<b>Less accessible (PBT&gt; 8 years)</b>
194	1 450	795

## Conclusions and recommendations on the formulation of policy measures

The country analyses performed in the framework of the ChangeBest project indicate that the development status of the EES markets in the residential sector is typically ranked at lowest level with respect to EES markets in other demand segments. Despite the estimated existing potential for an additional annual market volume in the EU-27 of about 190 M€ and made of investments with payback times below 3 years (or of about 1640 M€ made of investments with payback times below 8 years), experts are sceptical about a possible significant EES market development in the near future because of the specific barriers existing in this sector (notably 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-apartment buildings, the lack of standardised procedures for measurement and verification of energy savings).

Nevertheless the analysis of existing policy measures affecting this market segment has highlighted some main directions of improvement for stimulating its development. This has allowed the ChangeBest project consortium to produce a series of preliminary recommendations for policy makers that may be briefly summarised as follows.

Given the significant heterogeneity of national situations, it is obviously not possible to recommend a common EU policy approach to kick-start a market for EES in the residential sector. However 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 EIB). In addition in most EU Member States (MS) there is need for a more effective integrated and centrally co-ordinated approach to EES implementation because of the presence of the many intermediate actors typically involved (e.g. agencies, housing corporations, installers and manufacturers of efficient systems, etc.)<sup>17</sup> and there is need for a common understanding of what should be meant by EES, EPC, etc. when designing EU<sup>18</sup> and MS policies (see for example the EN 15900).

At the MS level, national policies hindering the implementation of EES (e.g. the tenant law in Germany) or being a barrier towards the development of a level playing field (e.g. policies and support programmes that do not allow energy companies to offer specific EES) should be revised or removed. Moreover a mechanism allowing financing energy efficiency improvement actions and offering EES in the domestic sector should probably be implemented in every MS (e.g. an energy efficiency fund and/or an energy saving obligation scheme like the ones presently implemented in some countries for energy suppliers or distributors), although it would be also important to envisage how to shift from the provision of EES due to an obligation or support scheme to an independent and profitable EES market when suitable market conditions are created.

<sup>17</sup> 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.

<sup>18</sup> In particular EU policy, but also national policies, can increase trust into EES and EES providers by supporting information, qualification, certification and accreditation and training programmes, particularly in promoting and supporting harmonisation of such programmes between Member States, 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.

Unwanted competition to the commercial provision of EES at the national level should also be avoided. For example it should be considered to replace possible free audit schemes of energy agencies by subsidies of energy audits valid for all EES providers.

In general policy packages stimulating both demand and supply of EES simultaneously would be highly beneficial especially because policies stimulating supply of EES are rare at the moment. Finally financial subsidies for soft loans or guarantee schemes to boost the EES market could be implemented by MSs (e.g. 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).

Overall the provision of financial subsidies and/or incentives for EES should always be considered as temporary policy measures to be implemented only during EES market initial development stages, whereas policy measures facilitating the creation of competitive EES business models should always have the priority, although the creation of these models seems to be particularly difficult for EES supplied in the residential sector.

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