AN OVERVIEW OF THE EUROPEAN ENERGY EFFICIENCY PROGRAMMES IN THE HOUSEHOLD SECTOR

Braulio Gonzalo, Marta [1]; Oloke, David [2]

[1] Universitat Jaume I, [2] University of Wolverhampton

The aim of the study is providing an overview of the main existing Energy Efficiency Programmes in the household sector around Europe. To tackle this, twelve countries have been selected, covering the five regions in Europe: Northern (Finland), Southern (Spain and Italy), Central (Germany, Denmark, France, Netherlands, Belgium and Poland), Western (United Kingdom and Ireland) and Easter countries (Hungary). For each country, it has been analyzed the working concept, identified the main stakeholders who take part in the programme, the package of measures provided and the economic instruments which make the measures come true. Once completed the analysis of the twelve programmes, it has been conducted a comparative study summarizing the main characteristics of each programme and making clear some findings related to the nature of the Energy Conservation Measures (ECM). Furthermore, it has been studied the implementation of the Energy Performance Certificates (EPC) in the different countries, due to their important role in most of the schemes. Finished the analysis, it is found out that seven of the selected countries have implemented more than 50% of the measures generally widespread in Europe, mixing passive measures (such as insulation or renovation of windows) with active measures (like renewable energies).

Keywords: *Energy performance certificate; Energy conservation measures; Policy instruments; Energy efficiency obligation; Building refurbishment*

VISIÓN GENERAL DE LOS PROGRAMAS DE EFICIENCIA ENERGÉTICA EUROPEOS EN EL SECTOR RESIDENCIAL

El objetivo del presente trabajo es proporcionar una revisión de los principales programas de eficiencia energética para el sector residencial en Europa. Para ello, han sido seleccionados doce países que abarcan las cinco regiones europeas: Norte (Finlandia), Sur (España e Italia), Centro (Alemania, Dinamarca, Francia, Países Bajos, Bélgica y Polonia), Oeste (Reino Unido e Irlanda) y Este (Hungría). Para cada uno de los países se analiza el esquema de funcionamiento, se identifican los actores que forman parte del proceso, el paquete de medidas de eficiencia energética y los instrumentos económicos que posibilitan la materialización de dichas medidas. Finalizado el análisis de los doce programas, se aporta un estudio comparativo que resume las principales características de cada programa y permite extraer conclusiones sobre las medidas de ahorro de energía utilizadas. Además, se estudia la implementación de los certificados de eficiencia energética en los diferentes países, dado su importante papel en la mayoría de los programas. Finalmente, se extrae que siete de los doce países han implementado más del 50% de las medidas de ahorro de energía identificadas en Europa, combinando las medidas pasivas (como el aislamiento térmico o la sustitución de ventanas) con las medidas activas (como las energías renovables).

Palabras clave: *Certificado de eficiencia energética; Medidas de ahorro de energía; Instrumentos normativos; Obligaciones de eficiencia energética; Rehabilitación de edificios*

Correspondencia: braulio@uji.es. Avda. de Vicent Sos Baynat, s/n. C.P. 12071. Castellón de la Plana (Spain)

1. Introduction and background

The European Union (EU) is leading the world in setting ambitious targets for reducing energy use, increasing energy efficiency and expanding the production of renewable energy in order to drastically cut Green House Gas (GHG) emissions, the most prominent of which is carbon dioxide (CO_2) (Power & Zulauf, 2011).

It is known that many European countries have launched some kind of programmes with the objective of promote energy improvements on existing buildings in order to decrease the energy consumption and CO_2 emissions, an example being the Green Deal, in United Kingdom (UK).

The priorities vary considerably among countries as each of them emphasizes different measures depending on the premises of the region and the context. For example to date, most of the obligations have focused on energy saving measures, which means that cogeneration, solar water heating and other renewable forms of heating have generally been included. Nevertheless, in some of the countries such as UK, there has been less promotion of renewable energy generation technologies.

Since the introduction of the European Directive on Energy Performance of Buildings (European Union, 2010), the application of a methodological framework for calculating energy performance of buildings had been required. For a long time now, many Member States have introduced energy performance certificates (EPC) – also known as white certificates, even for existing buildings. Some of the countries saw in this certificate the key to save energy in buildings and create a management system to pay for energy-saving home improvements. However, not every country has yet found the way to implement and spread it to achieve a high percentage of buildings with an EPC associated.

Hence, this study focuses on providing an overview of some of the existing and published energy efficiency programmes in the EU. This is with the aim of making a comparison between them and the UK Green Deal programme.

2. Identification of Energy Efficiency Programmes in the European Union

A research on the existing programmes in the European Union related to energy efficiency refurbishment of the existing building stock, was carried out. In order to tackle an overview of Europe, twelve available programmes in several countries have been identified, covering the central Europe (Germany, Denmark, France, Netherlands, Belgium and Poland), Northern Europe (Finland), Southern Europe (Italy and Spain), Eastern Europe (Hungary) and Western Europe (United Kingdom and Ireland).

The results with the name of each programme are summarized in the table 1:

Table 1: National building energy efficiency programmes in European Union

	Country	Programme
Western European countries	United Kingdom	Green Deal
		Feed-in tariffs (FITs)
		Renewable Heat Incentive (RHI)
	Ireland	The Better Energy Home
Central European countries	Germany	*CBRP* (German CO2-Building Rehabilitation)
	Denmark	Danish incentives
	France	*Grenelle de l'Environnement* (Environmental Round Table).
	Netherlands	*Meer Met Minder* (More with Less)
	Belgium	Belgium incentives
	Poland	Act on support for thermo-modernisation and renovations.
		Thermo-Modernisation Fund
Eastern European countries	Hungary	Green Investment scheme
Southern European countries	Italy	Tax reductions in energy efficiency measures
	Spain	*ESCO* (Energy Service Company)
		Empresa de Servicios Energeticos
Northern European countries	Finland	Energy Audit Programme

3. Analysis of some of the programmes

In order to know the operation of each programme, each country was analyzed according to an organized structure including: the working concept, the identification of the main stakeholders who take part in the programme, the package of measures provided and the economic instruments which facilitate the measures. Below, the analysis of 3 of the countries is shown.

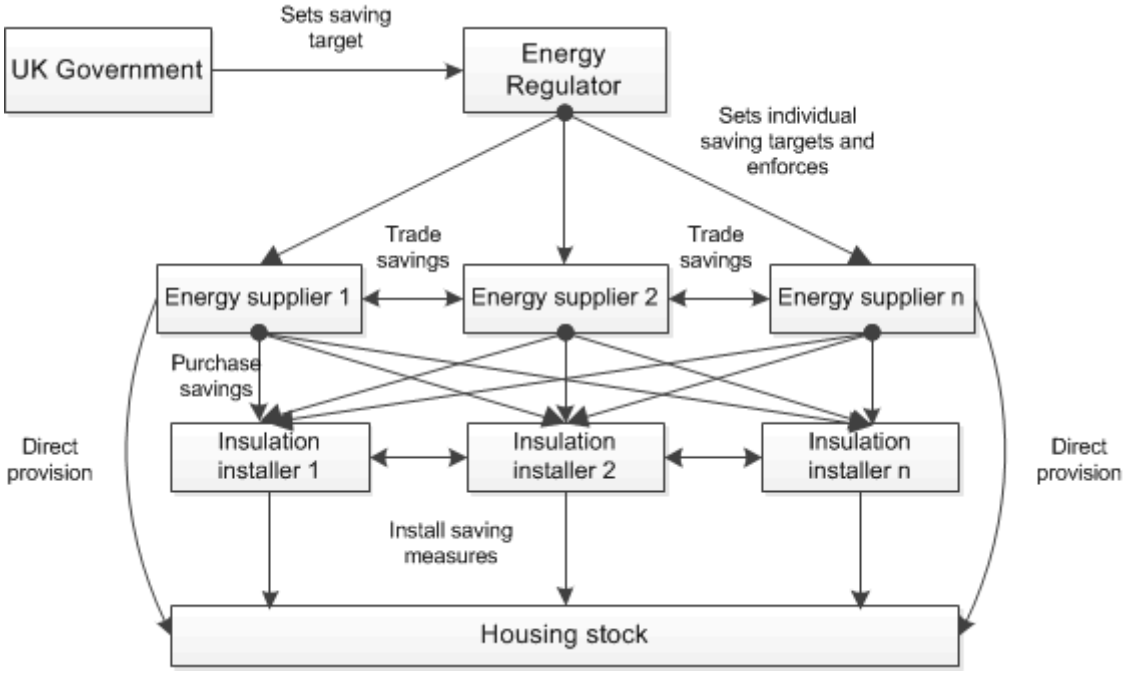
3.1 The Green Deal in the United Kingdom

The Green Deal (GD) is an innovative financing mechanism that lets people pay for energy-efficiency improvements through savings on their energy bills. Green Deal was launched in January 2013 and applies to both the domestic and non-domestic sector. It replaces current policies such as the Carbon Emissions Reduction Target (CERT) and the Community Energy Saving Programme (CESP). The government has appointed a Green Deal Registration and Oversight Body. Part of their role is to register the organisations that are approved to deliver the Green Deal – Advisors, Providers and Installers.

The main stakeholders who form the scheme of the Green Deal are the following ones: United Kingdom Government, user of the property (owner or tenant), Green Deal Provider, Green Deal advisor, Green Deal installer and energy supplier.

The programme concept of the GD Programme is based on the scheme drawn by the figure 1:

Figure 1: Operation of UK Green Deal



Source: based on (Rosenow, 2011)

The package of measures covered by the programme are the following; with most of them being focused on passive improvements in the envelope of the house, providing thermal insulation to avoid heat losses:

- Insulation (loft and cavity wall insulation)
- Heating
- Draught-proofing
- Double glazing
- Renewable energy technologies (solar panels, wind turbines, micro-generation)

So to finish defining the program, it is necessary to name the economic instruments used in the GD. The GD is a private way of financing the refurbishment of existing buildings, as a private company invests the money necessary to carry out the works. The return on investment is realized through the savings in the electricity bills, so that the customer (owner or renter of the house) continues paying the same for the use of energy, while the investor takes the savings to cover its previous investment.

It should be taken into account that the contract remains with the property, so the user of the house is paying back the investment to the provider, whether is owner or renter. Also the EPC, obtained during the energy audit by the Green Deal assessor, is linked to the house, so it should be transferred from one tenant to other.

3.2 "Meer Met Minder" (More with Less) in the Netherlands

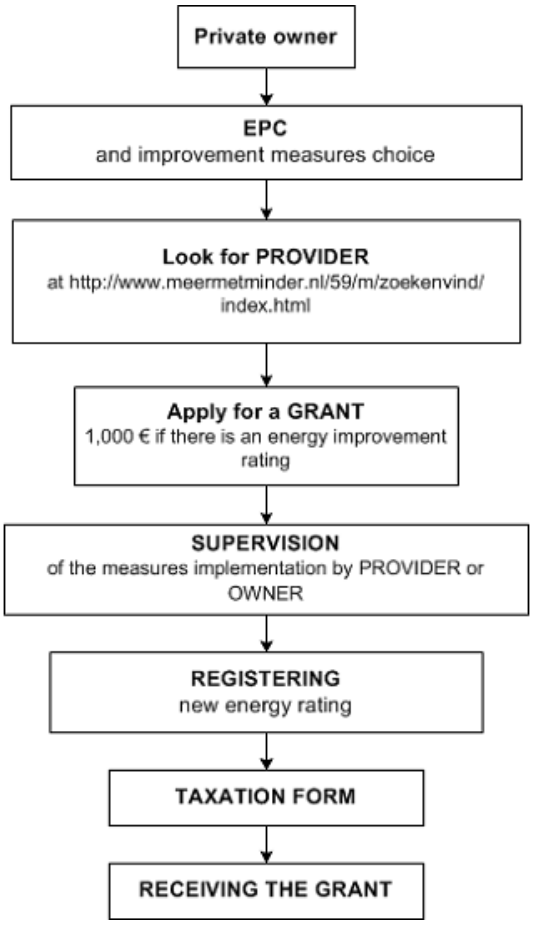
As part of the Meer met Minder (MMM), the government signed voluntary agreements with key players within the Dutch housing, energy and construction sector, to reduce energy consumption in existing buildings in 2020. Reducing barriers for owners of buildings must stimulate them to invest in energy saving measures, which should lead to over 200.000 buildings being refurbished annually. The programme uses the recently introduced energy performance certificates (EPC) for buildings (a result of the EPBD directive), to identify energy saving potential and monitor progress. The Energy Labelling for appliances has been introduced in 1996, and was originally combined with a national grant scheme. This led to a very high market share for A-label appliances (Netherlands Ministry for Housing, 2013).

The programme is available not only for individual households, but for: commercial buildings, public buildings (schools, hospitals, offices, etc.), private enterprises and institutions, municipalities or regions.

In the process of MMM take part several stakeholders with different functions and responsibilities under the programme, which are the following: private owner, providers (contractor, roofer, glazier, installation, renewable energy supplier, customer advisor, after insulation company), Ministry of Housing in Netherlands, custom advisor/assessor and a bank.

The process of carrying out the energy rehabilitation of existing buildings could vary depending on the region where it is implemented. However, the main process is reflected below according to the scheme shown in figure 2:

Figure 2: Steps in the MMM



Netherlands also provides transparency through a web page where the user (private owner) could obtain a previous assessment about the energy efficiency of his/her house, based on the EPC, and obtain information about what measures can be implemented.

The measures covered by the programme are the following:

- Sealing of joints* (windows and doors)
- Roof insulation*
- Wall and cavity wall insulation*
- Floor insulation* (from the bottom of the crawl space; soil and the walls of the crawl space)
- Pipe insulation
- Double glazing
- Heating (replace the boiler for a more efficient one; reflective film behind the radiator)
- Heat exchanger for the shower (to pre-heat the cold water with the shower waste hot water)
- PV Panels and Solar Water Heater

(*Recommending ventilation)

Attached to this program, there are many grants and funding arrangements that private owners can apply for. These are:

- Insulation (Programme completed in December 3 2010).
- MMM-Subsides: Provinces and municipalities regularly put their own subsidies so, depending on the region of the country, each Provincial Executive presents a kind of grant with different conditions. If the energy saving measures the customer takes, lead to an improvement of the Energy Index of at least 0.75 they can receive before a grant of 1,000 €. The different conditions could be consulted at (Energiesubsidiewijzer Netherlands, 2013)
- VAT reduction: From 21% to 6% for labor in the insulation work and the installation, renewal and maintenance of heating systems, solar water heaters and solar panels.
- Renewable heat (Programme completed in December 31 2010).
- Green Funds Scheme: In order to make it more attractive for people to join for green investments, loans with low interest exists approximately at 1.5%, although this depends on the bank or lender. It can be combined with a Groenprojecten Energy Credit, so it is possible to get a cheaper loan for solar cells (photovoltaic), solar collectors and heat pumps.
- Energy credit (Programme completed in December 31, 2011).
- Sustainability loan: It is possible to borrow cheaper for energy-saving measures using a number of municipalities in the Netherlands. In this case, the interest on the loan will be reduced by 3%. Private owners can get at least 2,500 € (borrowed) and a maximum of 15,000 €.

3.3 Energy Service Company (ESCO) in Spain

With the aim to satisfy the compromise of meeting the promotion of energy savings and energy efficiency, Spain has been conducting the initiative of creating a kind of company, which takes part of the refurbishment process: Energy Services Company (ESCO).

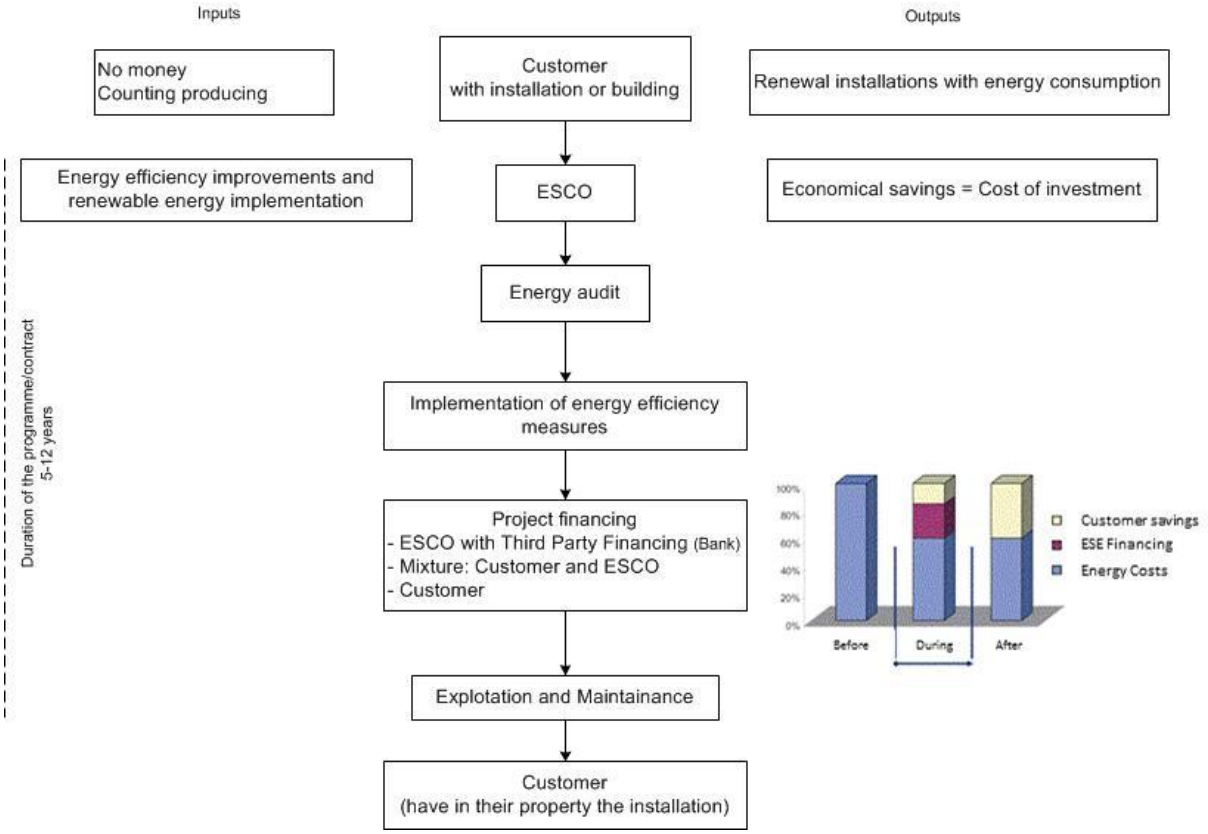
The common buildings where this system has been implemented, are big installations with significant energy consumption which enable the amortization, such as: hospitals, malls, schools and universities, sports buildings and office centres (Direccion General de Politica Energetica y Minas, 2013). However, this scheme could be applied in big existing residential buildings, such as home owners' association.

In the process of Energy Service Company (ESCO) take part several stakeholders with different functions and responsibilities under the programme, which are the following: customer or private owner, ESCO (assumes the figure of provider, makes the energy audit, assesses about what are the most accurate saving measures, and in the most of cases, provides financial backing with a Bank) and a bank.

The main process is reflected below according to the scheme shown in the figure 3:

Figure 3: ESCO Scheme

Created by the author based on (Garrigues Medio Ambiente, 2010)



Note that this kind of management system is not linked to the EPC, as it is applied to large buildings where it is necessary to conduct an energy audit to estimate the real consumption of the building and it savings potential. Probably, the reason is because in Spain the EPC for existing buildings has been implemented recently, from June 2013, and before the date it did not be mandatory.

The package of energy saving measures developed by an ESCO consists of the following options, where the customers can choose those ones which are more suitable for their interest, after the energy audit.

- Measures and energy efficiency measures:
  - Illumination/Lighting
  - Lighting control system
  - Electric engines
  - Thermal processes
- Energy production system based on renewable energies:
  - Solar energy
  - Wind energy
  - Geothermal energy
  - Biomass
- Pricing: Optimizing the electricity bill
- Saving quantification tools

The financing of the project can be carried out in three different ways. These include:

- “Third party financing”: this mode engages a third agent, the Bank, which will provide the investment through a contractual relationship with the ESCO.
- Mixed funding: this mode consists of the funding from both the ESCO and the customer. It drives to a reduction of the duration of the contract.
- Assumed by the customer: in this mode the customer is who makes the investment. This financing system is far from the specific model of ESCO, but works well whether the ESCO assumes the compromise of energy saving target.

Apart from this, there are other specific recent programmes and measures such as the “Grants Programme for Energy Rehabilitation of Existing Residential Buildings PAREER”, which allows to residential building owners apply for different types of grants:

- Façade: Improving the energy efficiency of the thermal envelope. 30% of the eligible costs in delivery money without consideration, and 60% in repayable loan (Euribor + 0.00% and installments of 12 years)
- Panels: Replacing conventional biomass energy in thermal installations. Grants are provided in the form of repayable loan.
- Boilers: Improving the energy efficiency of heating and lighting. Grants are provided in the form of repayable loan.
- Geothermal: Replacing conventional geothermal energy in thermal installations. Grants are provided in the form of repayable loan.

This grant program, with a total amount of € 125 million, is effective from October 1 2013 until October 30 2015 or until available funds are exhausted.

4. Comparative analysis

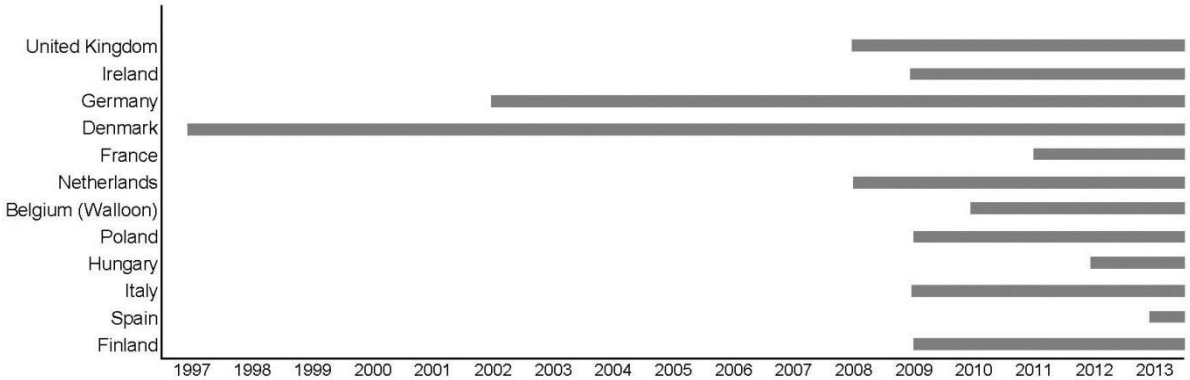
Once completed the review of the existing programmes in the European Union concerning Energy efficiency policies in the household sector, a comparative chart has been made (table 2), which summarizes the main characteristics of each program and made clear some findings.

Table 2: Comparative analysis of the energy efficiency measures implemented

	PACKAGE OF MEASURES													
COUNTRY	**Insulation**	**Windows/ double glazing**	**Draught-proofing**	**Heating distribution networks**	**Heating**	**Air conditioning**	**Lighting**	**Hot water**	**Ventilation**	**Appliances**	**Renewable energy**	**Audits/inspections**	**Promotional/ awareness campaigns**
United Kingdom	●	●	●		●			●			●		
Ireland	●				●		●	●			●		
Germany	●	●			●				●		●		●
Denmark		●		●	●	●		●	●				●
France	●	●			●	●	●	●	●		●		
Netherlands	●	●			●			●	●	●	●		
Belgium	●	●			●	●		●	●	●		●	●
Poland				●							●	●	
Hungary				●	●			●	●		●		
Italy	●	●			●		●	●	●	●	●		
Spain	●	●			●	●	●	●	●		●	●	
Finland	●	●		●	●		●		●	●	●	●	●

Furthermore, it is also interesting to note the entry into force of the EPC in time. Figure 4 presents the implementation of the EPC by each of the countries selected and evidences the significant differences among them. For instance, while Danish EPC were implemented in 1997 for the first time (including existing buildings), Spain did not until 2013.

Figure 4: Implementation in time of EPC in different countries



5. Results and discussion

It is worth highlighting that the most important difference of the Green Deal compared with most of the programmes of the European Union, is that this scheme is not based in a grant system provided by the Government, but it is a programme where the funds are provided by a private company (provider) supported in many cases by a bank, so that the recovery of the money is due to the energy savings in the bills of the house. This are called Energy Efficiency Obligations, and they are also implemented in other European countries: France, Italy, Belgium-Flanders and Denmark. In contrast, other countries are favouring public aid system.

Due to in these kinds of programmes, where the customers do not obtain any economic benefit (until the end of the period of the contract), it is very important the level of awareness to encourage them to participate in the scheme. Thus, they should be aware about the importance of the energy savings for the environment and the improvements in the comfort that they could achieve in their homes. For instance, countries such as Denmark, Germany and Belgium, promote dissemination and awareness campaigns and invest great amounts of money on it, as they consider it a distinguished measure to achieve targets on energy efficiency. Also noteworthy is the countries that promote training among stakeholders of industry sector (building workforce, contractors, etc.) involved in the scheme, as it is for example the case of Germany and the Netherlands.

Table 2 shows the specific energy efficiency measures implemented in each country. They are: insulation, windows, draught-proofing, heating distribution networks, heating and air conditioning systems, lighting, hot water systems, ventilation, appliances, renewable energies, audits and awareness campaigns.

While there are some instruments that target only the envelope or a specific technology, most of them support a mixture of measures, allowing for a more holistic approach. As it can be seen in the chart, seven countries have implemented more than 50% of the measures generally widespread in the European Union. These are: Finland (77%), Belgium and Spain (69%), Italy and France (62%), and Denmark and Netherlands (54%). These countries are covering a wide range package of measures, mixing passive measures (insulation, renovation of windows, etc.) with active measures (renewable energies).

Otherwise, the most implemented measure is the improvement of the heating system, as the 92% of the countries analyzed take into account in specific programmes. Following this, it is the renewable energies with 83% of implementation. Then, it is the insulation improvements and windows and doors action, hot water system and ventilation, with 75% of implementation. The measure with less level of implementation is the draught-proofing, with 8%, only in United Kingdom.

However it is worth pointing out that the Green Deal is basically focused on implementing passive measures for the improvement of the thermal envelope of the building (insulation, draught-proofing and double glazing). Thus, the active measures such as renewable energies to produce hot water and heating are relegated to second place. Nevertheless, there are some other programmes in the UK, like Feed-in tariffs (FITs) and Renewable Heat Incentive (RHI), which are specifically for these kinds of measures. Probably, both programmes should be integrated in the Green Deal in the future in order to make it more flexible and extend its range of coverage. UK has implemented 46% of the all measures analyzed.

On the other hand, one of the tools which could be strongly useful to encourage the renovation of existing buildings is the EPC (Energy Performance Certificate). EPCs can provide valuable information to all stakeholders in the building sector and property market, not least policy makers. Data gathered through EPCs can serve as an input into the

calculation of potential energy savings, building stock projections, compliance and policy design. It also can contribute to express the results of energy audits as well as in the homogenization of an energy rating scale around all European countries (Mudgal et al., 2013). At present, all countries analysed have already implemented the EPC, although the years of launching vary a lot, from 1997 (Denmark) to 2013 (Spain).

Concerning with the economic instruments to afford the different programmes, financial instruments are most frequently used rather than fiscal incentives. The form of grants/subsidies appears to be the most frequently chosen. However, increasingly, most Member States use a combination of financial and fiscal incentives. Commonly, grants and subsidies are combined with preferential loans and tax reduction with tax credit measures.

New strategies to secure financing for the deep renovation in European building stock are needed which ideally bring together private and public investment streams. Policy-makers and the relevant stakeholders in the building sector should elaborate the properly policy framework and this would not only create new investment opportunities for the private sector but would also reduce the burden on public budgets.

6. Conclusions

This research aimed to make a review of the existing programmes in the European Union concerning energy efficiency in the household sector and has selected twelve countries in attempting to achieve this.

The review of the programmes available in each country allowed the comparison with the Green Deal, the innovative energy efficiency programme being conducted by the United Kingdom Government. The main characteristics of each scheme according to an organized structure were identified and this led to the development of a comparative analysis chart for ease of reference.

The findings of the work can be used to establish more formal benchmarking standards and also serve as a precursor to countries intending to appraise or re-apraise existing programmes.

References

Direccion General de Politica Energetica y Minas (2013). Informe sobre el objetivo nacional de eficiencia energética 2020 - España. (pp. 1–31). Madrid. Ministerio de Industrial, Energía y Turismo.

Energiesubsidiewijzer Netherlands (2013). Meer Met Minder. Retrieved October 02, 2013, from http://www.energiesubsidiewijzer.nl/

European Union. Directive 2010/31/UE of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (2010). Official Journal of the European Union, pp. 15-35

Garrigues Medio Ambiente (2010). Guía sobre empresas de servicios energéticos (ESE). Madrid. Fundación de la energía de la Comunidad de Madrid.

Mudgal, S., Lorcan, L., Cohen, F., Bio Intelligence Service, Lyons, R., Oxford University, Ronan Lyons, Oxford University; Doreen Fedrigo-Fazio, IEEP (2013). Final Report: Energy performance certificates in buildings and their impact on transaction prices and rents in selected EU countries. Brussels. European Comission.

Netherlands Ministry for Housing (2013). Meer Met Minder. Retrieved October 02, 2013, from http://www.meermetminder.nl/

Power, A., Zulauf, M. (2011). Cutting Carbon Costs: Learning from Germany's Energy Saving Program. London. Building knowledge & sharing solutions for housing and urban policy

Rosenow, J. (2011, September). White Certificates: the British experience – can it also work in Germany?. Exclusive Workshop - Rethinking Policy on Market Based Financing Instruments for Energy Efficiency. Environmental Change Institute. University of Oxford, Berlin.