Energy Efficiency in the Residential Sector: Identification of Promising Policy Instruments and Private Initiatives among Selected European Countries

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Abstract
Improving residential energy efficiency is widely recognized as one of the best strategies for reducing energy demand, combating climate change and increasing security of energy supply. However, progress has been slow to date due to a number of market and behavioural barriers that have not been adequately addressed by energy efficiency policies and programmes. This study is based on updated findings of the European Futures for Energy Efficiency Project that responds to the EU Horizon 2020 Work Programme 2014-15 theme 'Secure, clean and efficient energy'. This article draws on five case studies from selected European countries - Finland, Italy, Hungary, Spain, and the UK - and evaluates recent energy efficiency developments in terms of indicators, private initiatives, and policy measures in the residential sector. Our analysis shows that the UK government has implemented a better range of policies, coupled with initiatives from the private sector, aimed at improving energy efficiency. However, its existing conditions appear to be more problematic than the other countries. On the other hand, the lack of effective and targeted policies in Finland resulted in increased energy consumption, while in Hungary, Spain and Italy some interesting initiatives, especially in terms of financial and fiscal incentives, have been found.

Keywords: energy efficiency policy, residential sector, European Union, NEEAPs, ESCOs

Introduction

Energy efficiency is widely considered as the most cost effective way to enhance security of energy supply, and to reduce emissions of greenhouse gases. In fact, the cheapest energy, the cleanest energy, the most secure energy is the energy that is not consumed at all (EC 2016a). Furthermore, energy efficiency improvements might have the potential to support economic growth and social development, to improve occupant health and well-being, and to enhance competitiveness and investment opportunities (IEA 2014a).

In the last years, the European Commission has acknowledged these benefits in a series of directives and long-term strategy documents - such as the Energy Performance of Buildings Directive 2010/31/EU, the Energy Efficiency Directive 2012/27/EU, the Energy Roadmap 2050, etc. - by establishing a set of measures for improving the existing policy framework of measures and promoting energy efficiency within EU. In addition, the new 30% binding energy efficiency target for 2030 recently proposed by the European Commission in the Winter package (EC 2016a) put the level of ambition of European energy efficiency policies into sharp focus. These regulations and policy documents have been mainly designed to meet the EU climate policy goals, i.e. an 80% reduction of CO2 emissions by 2050, but they are still not in line with the commitments under the Paris climate treaty which would require more efforts, so for the future stricter rather than relaxed regulations can be expected.

The residential sector is responsible for one of the largest share of energy consumption presenting the highest cost-efficient potential for mitigation, and it is consequently vital to meeting the EU objectives toward a low-carbon economy and energy system. Nevertheless, the move towards energy efficiency is happening too slowly and there continues to be a degree of inertia on a national level. Recent years' experience has shown that there are considerable barriers to full uptake of economically effective and technically feasible energy savings opportunities across the EU (EC 2016b).

In compliance with the Energy end-use efficiency and energy services Directive 2006/32/EC (ESD) and Energy Efficiency Directive 2012/27/EU (EED), Member States are required to translate the energy savings objectives into domestic and effective measures in their National Energy Efficiency Action Plans (NEEAPs). But there exists a wide disparity in terms of content, level of detail in describing, and the level of ambition about the energy efficiency instruments in place and planned for the next years between Member States. At the same time, the energy share of residential sector strongly varies among countries due to different energy infrastructure, climate conditions, energy resource availability, income, economic structure (IEA 2014b), dwelling characteristics, energy culture (Stephenson et al. 2010), household behaviour (Lopes et al. 2012; Frederiks et al. 2015), and other country-specific conditions.

Therefore, the type of policy instrument suitable for driving energy efficiency depends on many country and sector specifics, and the circumstances determine which policy instruments are more appropriate than others, depending e.g. on market and behavioural barriers, and target groups. However, the achievable impact of energy efficiency policies

depends more on the design of the instrument and the way in which it is implemented than on the type of instrument itself (Phylipsen 2010).
Although policy maker have a major role to play in impacting energy consumption in the residential sector, there are many other players that can stimulate energy efficiency improvements:

- Energy Service Companies (ESCOs), under an Energy Performance Contracting (EPC) arrangement, implement an energy efficiency project and use the stream of income from the cost savings to repay the costs of the project;
- Energy utilities provide advice and assistance to energy consumers, technology development, on-bill financing, etc.;
- Non-Governmental Organisations (NGOs) promote energy efficiency through an active participation of citizens and provide input to policies;
- National or regional banks develop specific packages for households to support energy efficiency improvements, renewable energy and broader green investments.

A comprehensive review of all energy efficiency policies and private initiatives in the residential sector of the European Union is beyond the scope of this paper, but several instruments seem particularly relevant to understanding the recent trends of energy efficiency, especially in terms of country-specific actions. This paper provides some overarching European data and insights, but mainly concentrates on five case countries - Finland, Hungary, Italy, Spain and the United Kingdom - by evaluating recent residential energy efficiency policies and private initiatives complementing public activities.

In order to make a robust assessment and provide an accurate picture of the European Union and the countries under investigation, we first build disaggregated indicators of energy efficiency suggested by the International Energy Agency (IEA 2014b; IEA 2014c). By doing so, we provide a strong basis for policy making evaluation and development of effective energy efficiency strategies. Then, we assess the residential energy efficiency policies in force, identifying best practice, instrument-specific success factors, and policy gaps. Moreover, we analyse the role of the private sector in stimulating the investments in energy efficiency and complementing European and national public policies. We conclude by discussing whether the policy instruments and private measures targeting energy efficiency in the residential sector are sufficient to contribute to reductions in energy use. In addition, we formulate policy recommendations in order to strengthen the existing policy packages.

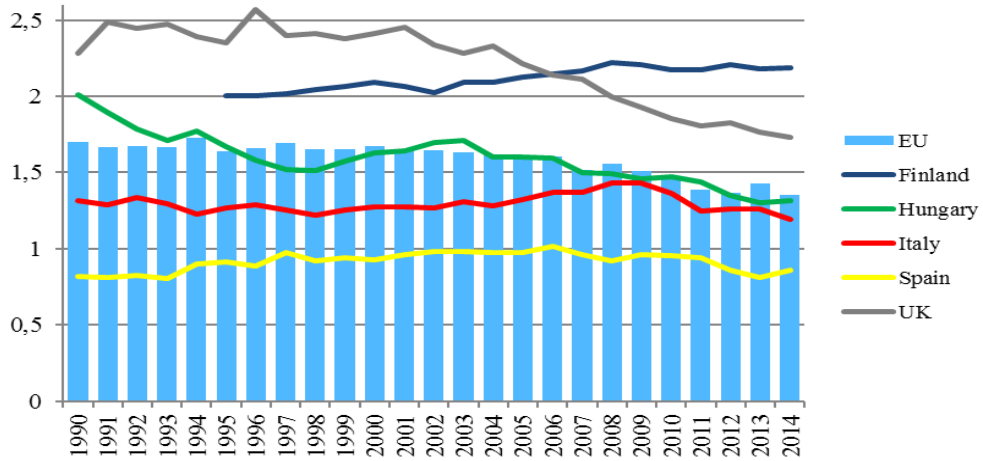
Most of the literature focuses on the analysis of the energy efficiency policies by the type of instrument (regulatory, economic, informational, etc.) without considering (i) the way they are implemented, (ii) synergies among policies, and (iii) the underlying determinants driving the design of a specific policy. In addition, to the best of the authors' knowledge, the role of the private sector across multiple actors in supporting the national government to stimulate energy efficiency investment in the residential sector has not been previously analysed.

The EU residential energy sector

The residential sector accounted for about a quarter of the total final energy consumption in Europe in 2013. This is only a global average of the European Union, and there exists a wide disparity of the share of the residential energy sector among countries due to climate condition, resource availability, energy infrastructure, economic structure and other country-specific conditions. For example, among the countries under investigation, in Spain the residential sector represented only 18.3% of the total energy consumption in 2013, while in Hungary and UK it was 32.5% and 30.6%, respectively; in Finland it represented 19.9%, while in Italy it was 25.3% (Odyssee database 2017).

At EU level the space heating consumption holds the largest portion of households energy use representing 68% in 2013, followed by the electricity consumption for electrical appliances and lighting (14%), water heating (13%) and cooking (5%). A similar composition of the energy consumption by end-use is found in Finland, Hungary, Italy, UK, but not in Spain where the portion of space heating is lower and electricity consumption is higher than the other European countries, respectively.

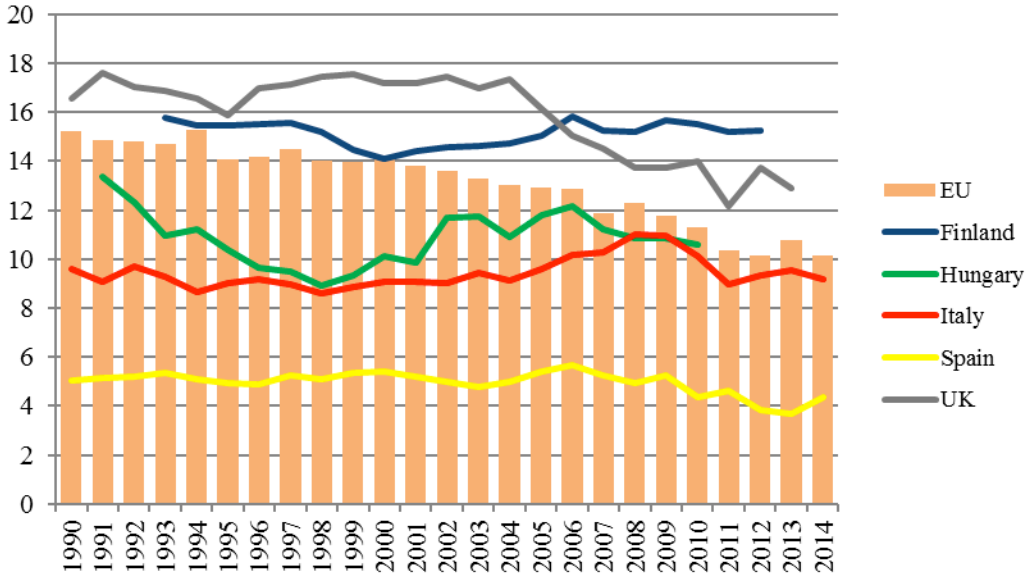
For each end-use, we selected the indicators of energy efficiency suggested by the International Energy Agency (IEA 2014b; IEA 2014c), namely the final residential energy consumption per stock of dwelling permanently occupied (at normal climate[1], figure 1), the final residential space heating consumption per floor area 1990-2014 (at normal climate, figure 2), and the final water heating, cooking, electrical appliances and lighting consumption per stock of dwelling permanently occupied (figure 3).



Source: Authors' elaboration based on Odyssee database (2017)

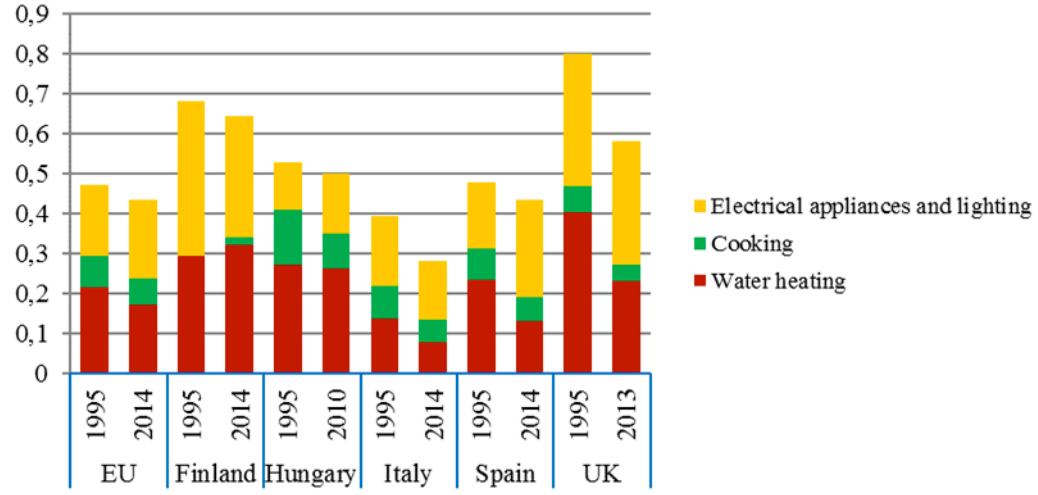
Figure 1. Final residential energy consumption per stock of dwelling permanently occupied 1990-2014 (at normal climate) for the European Union and selected countries (toe/dwellings)

[1] 'Normal climate' or 'climate correction' is an adjustment to space heating and cooling energy consumption to normalise the consumption pattern over time by removing the impact of year-to-year temperature variations (IEA 2014b; IEA 2014c).



Source: Authors' elaboration based on Odyssee database (2017)

Figure 2. Final residential space heating consumption per floor area 1990-2014 (at normal climate) for the European Union and selected countries (Kgoe/m2)



Source: Authors' elaboration based on Odyssee database (2017)

Figure 3. Final water heating, cooking, electrical appliances and lighting consumption per stock of dwelling permanently occupied in 1995 and 2014 for the European Union and selected countries (toe/dwellings)

While these detailed indicators do not fully explain what is driving the changes in observed energy consumption, they provide indications about recent trends, and combined with implemented European and national policy and private instruments aimed

at reducing energy consumption and CO2 emissions, they can provide some guidance on the efficiency improvements achieved in the residential sector.

Promising policy instruments

Improving the energy performance standards of new and existing buildings

Buildings standards ensure that the desirable energy performance of e.g. building components and (especially) heating equipment is achieved even when its purchaser does not show interest in obtaining more efficient products due to either credit constraints or lack of incentives (IEA 2011).

Reviews of the literature on energy efficiency policy shows that instruments such as energy efficiency standards have been one of the main drivers of innovation (Noailly 2012), and the preferred policy option in the European Union to address barriers to energy efficiency (Bleischwitz et al. 2009).

The 2010 recast Directive on Energy Performance of Buildings (recast EPBD) is the main legislative instrument affecting energy use and efficiency in the building sector in the EU. In a recent study commissioned by the DG Energy, the ICF Consulting Group analysed the national frameworks and systems put in place by Member States to help deliver and achieve compliance in relation to requirements of the Energy Performance of Buildings Directive (EPBD) concerning minimum energy performance and energy performance certificates (EC 2015b). Among the countries under investigation, Italy received an higher score in terms of compliance rate with the application of MEP requirements and production and use of EPCs placing fifth in the EU Member States' ranking, followed by the UK (seventh position), Finland (tenth position), Spain (thirteenth position), and Hungary (fifteenth position). Most of the Member States reported a high compliance rate for MEP requirements. Spain and Hungary failed to comply with the production of EPCs in rented buildings, while Italy and the UK have not produced EPCs for public buildings.

Financial facilities to encourage private capital investments

Financial incentives can take many forms – grants, subsidies, soft loan, etc. – and are commonly used to encourage energy efficiency improvements by lowering inhibitive up-front costs faced by households. According to the EED (preamble (52) and article 12 (2a)), Member States should make use, promote and facilitate innovative financing mechanisms that reduce the risks of energy efficiency projects and allow for cost-effective renovations among households.

In Hungary, the main financial instrument managed by the central government to promote investments aimed at furthering energy efficiency in households is a grant scheme called the 'Warmth of the Home Programme'. The Warmth of the Home Programme was launched in September 2014 and consisted of five sub-programmes providing co-financing up to a maximum of 40% or 50% of the total expenses incurred

by the households. Due to overwhelming interest on the part of households, the sub-programme funds have been sourced out fully after announcement, either within hours, or after a few days the latest (Slezák et al. 2015).
In Spain, the Royal Decree 233/2013 of 5 April 2013 of the Ministry of Development approved the State Housing Plan aimed at promoting the energy renovation of residential buildings. Measures eligible for subsidy include: improving the thermal envelope of buildings to reduce energy demand for heating and cooling; installing heating, cooling, domestic hot water and ventilation systems and common building facilities such as lifts and lighting. Up to 35% or 50% of the eligible costs of the action, with a maximum of up to €11,000 euros per house or 100 m2 of the premises useful surface could be claimed.

Fiscal incentives that indirectly reduce the cost of investments

Fiscal incentives for the energy efficiency in buildings include several measures to lower the taxes paid by consumers and are one of the instruments that can be used by Member States to promote and facilitate efficient use of energy among domestic costumers (EED, article 12 (2a)). In particular, measures include tax deductions on retrofitting investments and equipment, tax credits, tax reductions and rebates, accelerated depreciation allowances, tax or customs duty exemptions. They are widely used across the European Member States but not to the extent of financial instruments as grants. From a government perspective, fiscal incentives impact revenues, while grants require outlay of the public budget. Fiscal incentives are difficult to limit to a certain amount of revenue forgone and the amounts may only come to light at the end of the fiscal year, while costs for grants may be easier to track and control as they have a certain budget limit (Hilke and Ryan 2012). However, one advantage of fiscal incentives over grants, is that they are more likely to encourage greater scale of projects as they are usually granted over a longer time period and do not have a limited budget attached (Dyer et al. 2011).

Fiscal incentives have been traditionally common in Italy and Finland. Tax deductions for the energy upgrading of buildings were introduced in Italy by the Budget Law 2007 and are still in force. They consist of reductions of IRPEF (personal income tax) and IRES (corporate income tax) in respect of actions to improve the energy efficiency of existing buildings.

A tax deduction for the labour costs incurred in replacing, upgrading and repairing the heating and electricity systems of residential houses has been available in Finland since 2000. The maximum amount of household deduction varied according to the year it has been claimed. The house owner bears the first €100 of the labour costs and the deduction is available for the taxation of both spouses.

Promotion of small-scale renewable energy production systems

Most government policies start from the assumption that renewable energy and energy efficiency investments go hand in hand by creating a virtuous circle: one enhances the other. With greater energy efficiency, the total demand for energy drops, meaning that the same amount of renewable energy covers a larger share of demand. At the same time,

renewable energy technologies enhance efficiency, creating a symbiotic relationship (IRENA 2015). In addition, many applications of renewable energy, in particular renewable heating technologies, are more effective in an energy efficient home. Thus, the Italian and the UK governments implemented policies to promote the generation of renewable thermal energy in buildings as a way of contributing to the national energy efficiency target.

The Thermal Account, introduced by the Ministerial Decree of 28 December 2012 'Renewable Energy for Heating & Cooling Supporting Scheme', is the first nationwide and the youngest direct incentive scheme in Italy for projects of energy efficiency improvements and the generation of small-scale renewable thermal energy in buildings.

In order to support the deployment of renewable and low-carbon heating technologies in the residential sector, the UK government launched on 9 April 2014 the Domestic Renewable Heat Incentive (Domestic RHI). This scheme helps to bridge the gap between the cost of renewable heating systems and the conventional alternatives and it is open to home owners, private landlords, social landlords and self-builders.

Measures addressing vulnerable consumers and fuel poverty

The EED article 7 (7a) allows Member States to include requirements with social aims in their Energy Efficiency Obligation Schemes, as for example to prioritize households in energy poverty or social housing (EC 2012). However, most of the Member States have not translated this requirement into national legislation, if not through one-off measures.

The United Kingdom is one of the few EU Member States where this problem is both recognized and systematically addressed by means of household support policies and energy efficiency investments (Bouzarovski 2014). The Energy Companies Obligation (ECO), which started in 2013, is a government scheme for Great Britain that placed legal obligations on larger energy companies to deliver energy efficiency measures to domestic premises–targeted at low-income and vulnerable households, and homes in low income areas.

Measures addressing the landlord-tenant problem

According to the article 19 of the EED, Member States should take appropriate measures to overcome misaligned incentives between landlords and tenants. The landlord-tenant problem occurs when landlords have little incentive to invest in the energy efficiency of their properties, given that it is the tenant who benefits from lower energy bills (Allcott and Greenstone 2012). As a consequence, rental properties tend to be less energy efficient than owner occupied houses.

This split incentive between owners and renters is one of the greatest barriers hindering the development of sustainable renovation of residential buildings in Europe, but it has hardly been an objective of policy-making. In 2015, on average in the European Union, 69.5% of the dwellings were owner-occupied (own it outright and mortgagors), while the

remaining were privately or social rented. Significant differences exist among Member States: for example, in Hungary 86.3% of the dwellings, while in UK only 63.5%, were owner occupied in 2015. In particular, the private rented sector has been growing in recent years in UK, and is at its highest level since the early 1990s. In 2014-15, 19% (4,3 million) of households were renting privately, while 17% (3,9 million) of households lived in the social rented sector (EHS 2014-2015).

Increasing consumer information and promoting behavioural change

Consumers need relevant information and motivation for taking action, and to be able to make informed decisions and choices towards energy efficiency measures. While information is not sufficient to generate motivation or change behaviour, it is nonetheless a necessary (but not sufficient) condition for action.

With the aim of guiding consumers to be more concerned of energy efficiency in their purchasing decisions, governments and energy agencies have introduced in the last years a number of different mechanisms, ranging from energy labels and energy performance certificates to pure publication of information in brochures and mass media campaigns via internet or TV, respectively. Their effectiveness vary depending on the objective pursued, the obstacles present, and the way they are integrated with measures addressing routines, social norms and values, etc., and of course the technical feasibility.
The shift in consumer behaviour towards energy conservation measures can be also supported by the installation of smart meters and more accurate billing information (articles 9, 10 and 11 of the EED). By providing real time feedback, smart meters allow consumers to take control of the energy bill, and to become more aware of their actual energy consumption. The early actor of the smart meters roll out has been Italy (completed in 2011), followed by Finland and UK; in Spain the complete roll out of the smart meters is expected to be by the end of 2018, while in Hungary pilot projects are still on-going.

Private initiatives

Beyond public programs and policy instruments, energy efficiency improvements in the residential sector are supported by the private sector in a variety of ways:

- Initiating and implementing concrete actions, e.g. through providing loans, investment and implementing demonstration programs, alternative solutions to low-energy buildings;
- Organizing awareness raising and information exchange programs;
- Providing input to policies, analysing policies and initiating discussion.

Mobilising investments and actions from the private sector is therefore essential to complement public activities and to contribute meeting the energy efficiency and climate change goals. What motivates the private sector is the possibility for profit. Shareholders tend to request maximal dividends (institutional shareholders all the more), and reject ‘climate motivated’ actions. It is politics which must make sure that the environmentally

necessary is also the economically desirable – that is the justification for economic instruments and should be our yardstick for their efficacy.

Energy service companies (ESCOs)

The ESCO can be a natural or legal person that delivers energy services and/or other energy efficiency improvement measures in a user's facility or premises - such as project finance, engineering, project management, equipment maintenance, monitoring and evaluation - and accepts some degree of financial risk in so doing (EC 2006). Despite the large economic energy saving potential, 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 a recent JRC ESCO report (Bertoldi et al. 2014). Irrek et al. (2013) have traced the barriers preventing a large scale application of the ESCO concept in the residential sector on several sources: (i) the particularly high transaction costs for ESCOs relative to the small amount of energy costs and thus potential cost savings per single energy efficiency service supplied; (ii) the decision making processes existing in multi-apartment buildings, where typically at least one half of the apartment owners must agree on the energy efficiency investment; (iii) the perception of the ESCO as not a trustworthy organisation and the fear of households to become too much dependent on the ESCO, especially if the contract also includes the supply of energy; (iv) the difficulties for residential customers to understand the ESCO model and the EPC financing and contract and lack of information on the availability of ESCO services. The number of ESCOs, their market size and the type of services provided varies a lot among Member States. In Italy (that ranks second in terms of number of ESCOs in Europe after Germany) there were about 50-100 ESCOs in 2013, with a market size of €500 million.

Energy providers

The principal driver of the energy providers to deliver energy saving activities is induced by regulatory mechanisms created by the 'Energy Efficiency Obligation Scheme' (EEOS, article 7, EED) which calls on each Member State to ensure that energy providers achieve new savings each year from 1 January 2014 to 31 December 2020 of 1.5% of the annual energy sales to final customers of all energy distributors.

In the transposition of the EEOS into national law, the government of Finland decided to adopt the 'alternative approach', meaning that it opted to take other policy measures such as energy or CO2 taxes, financing schemes and fiscal incentives, voluntary agreements, etc., in order to achieve an equivalent energy saving target, while Hungary, Italy, Spain and the UK adopted a combination of both EEOS and alternative measures (Bertoldi et al. 2015).

Even though in almost all jurisdictions we find energy providers active in some form of demand-side management or other types of programmes, this energy efficiency activity seems to be only a window dressing or driven by legal requirements. On the other hand, in some cases energy suppliers seem to be genuinely attempting to develop and

implement new business models that incorporate energy efficiency, driven by a non-traditional profit motive and a belief that it is the right thing to do (Fawkes 2016).

Conclusion and implications for energy policy

This study builds on the EU Horizon 2020 project 'European Futures for Energy Efficiency' and provides unique insights from a large set of different perspectives bringing out ground-breaking elements for the European residential energy sector.

In this article we evaluated recent energy efficiency developments in terms of indicators, private initiatives and policies implemented in the residential sector over the last years in Finland, Hungary, Italy, Spain and the UK. Since it is not possible to show a causal relation between energy efficiency trends and differences on the basis of indicators alone, an assessment of implemented policies combined with private measures targeting energy efficiency in the residential sector can further improve the understanding of the country-specific conditions and actions. With the development of this framework that takes into account multiple actors and both quantitative and qualitative criteria in the evaluation process, we aim at contributing to a comprehensive and comparable analysis among case studies.

When compared to what has been done in the last years in Finland, Spain, Italy, and Hungary, the UK government seems to have implemented a better balanced set of energy efficiency policies targeted at the residential sector, with the participation of diverse private actors. In fact, a holistic policy package with a medium-term framework addressing many aspects of energy efficiency in the residential sector is also partially supported by a developed ESCO market and legal obligations placed on energy suppliers to deliver domestic energy efficiency programmes. But the UK residential energy sector appears to be more problematic than other countries. In particular, the prevalence of older dwellings in the national stock built to lower standards of energy efficiency combined with a high share of the private rented sector in the housing market leaves larger untapped potential for improvements than the other countries under investigation. In addition, a confusing number of only slightly different policy measures specifically address the same target (e.g. vulnerable consumers, energy poverty); increased flexibility, combined with a long-term perspective and continuous funding could help to optimise their impact.

It is currently unclear how Brexit will impact future energy efficiency policies in the UK. On the one hand, it is unlikely to change the orientation towards the Government's greenhouse gas target codified in the 2008 Climate Change Act. Consequently, the importance of energy efficiency improvements in the residential sector will prevail, as reducing household emissions is an important mean contributing to meeting the national emission reduction targets. On the other hand, after Brexit the UK will not be obliged to transpose the EU Winter Package into national legislation, in particular not the extension for the period 2021-2030 in article 7 of the proposed new Energy Efficiency Directive. This means that progress will slow unless a strong national energy efficiency strategy replaces the EU legislation as a driver of efficiency improvements.

With regard to Finland, improvements of energy efficiency in the residential sector seem not to be a priority for policymakers. Considering that Finland has one of the highest energy consumption per capita and space heating demand per dwelling in Europe, this result is quite surprising. Beyond a general tax reduction for any household services, no real economic incentives have been provided to stimulate energy efficiency investments in the last years. Also, issues like fuel poverty and the landlord-tenant problem have not been taken into account in the national energy efficiency strategy, and the private sector remains a marginal player. As a result, Finland is the only country that did not decrease its residential energy consumption per stock of dwelling permanently occupied within the period 1995-2014. However, the lack of political commitment in this regard can partially be explained by the policy makers' focus on the energy-intensive industries representing almost half of the energy consumed in the national energy sector.

Also in Spain the residential energy sector seems not to be at the top of the political agenda, while a major attention has been given to the transport sector representing about 40% of the energy consumption. But as opposed to Finland and the UK, in Spain the residential energy sector is one of the most efficient in Europe, mainly because of the modern building stock and the low level of space heating demand. In addition, with the State Housing Plan 2013-2016 and the PAREER-CRECE Programme, both the national and local governments have recently allocated a significant share of the budget for energy efficiency and saving projects in residential buildings.

Similarly, with the Warmth of the Home Programme, the Hungarian government provided financial incentives to households ranging from the replacement of inefficient appliances or obsolete facade doors and windows, to complex energetic refurbishment of blocks of flats. The success of this policy measure has been witnessed by the rapid end of funds allocated (the other side of the coin is that the program was underfunded as compared to demand). Also, in order to increase energy awareness, large-scale educational programmes targeted to specific groups, have been provided by both the government (ECARAP) and the energy providers E.ON and ELMÜ-ÉMÁSZ.

With regard to Italy, we have found some interesting policy initiatives, especially in terms of fiscal incentives and promotion of small-scale renewable energy sources that have kept the energy demand per dwelling stable. However, these measures have not been developed into a comprehensive policy package addressing all the aspects of the residential energy sector. The tax deduction scheme (implemented for the first time in 2007 and still in force) has proven to be very effective in attracting more investments than what it actually cost in terms of foregone fiscal revenue. In addition, the Thermal Account that entered into force for the first time in 2012 has provided substantial incentives for renewable energy and energy efficiency investments. Subsidies covering part of the expenses for renovation will be available until 2021. Benefits from these policy measures are also exploited by the ESCO market that has grown rapidly in the last years, becoming one of the largest in Europe.

Overall, an optimal policy strategy aiming at improving energy efficiency in the residential sector should seek to impact different barriers and target segments through a holistic approach pursuing multiple goals coherently, mutually supporting each other. Our study has provided some evidence on this. We could also confirm that an energy efficiency policy package is likely to be more effective if it is maintained over the long-term, while remaining flexible. In this latter regard, the Integrated National Energy and Climate Plans (EC 2016c) that will replace the National Energy Efficiency Action Plans (NEEAPs) and the National Renewable Energy Action Plans (NREAPs) and that will cover the ten-year period 2021-2030, will stimulate Member States to think up new energy efficiency policies with a longer perspective.

A long-term policy horizon could empower the confidence in the private sector that there is money to be made through efficiency. But getting private investments in energy efficiency in the residential sector is challenging. The cliché "the cheapest energy, the cleanest energy, the most secure energy is the energy that is not used at all" commonly used to highlight the advantages of energy efficiency, actually points its greatest weakness from a business point of view: there is, or appear to be, nothing to sell, and thus no profit (Fawkes 2016). Energy providers cannot easily decouple utility profits from energy volumes and ESCOs cannot benefit from economy of scale by selling energy efficiency solution to households.

Nevertheless, large reductions in household energy use are unlikely to be achieved from interventions designed to retrofit buildings alone. Studies on household energy use have found a large degree of variability in energy consumption across identical houses: this means that when it comes to energy consumption the role of the occupant behaviour can be as important as building physics (Santin et al. 2009). Also, the inclusion of sufficiency principles into the design of policy measures with a focus on what is really needed for a good quality of life could strengthen motivations for changing behaviours and contribute to reducing energy consumption. This does not undermine the importance of investments in efficiency solutions, but emphasizes energy saving and energy sufficiency measures as complementary approaches to energy efficiency which reduce the rebound effects and partially change the way we think of reductions in energy use from 'using less energy to provide the same service' to 'living well on less'.

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