BARRIERS AND ENABLERS TO ENERGY EFFICIENT RETROFITTING OF DWELLINGS IN IRELAND

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National government and EU policies and legislation have driven energy efficiency measures in Ireland's residential sector. The EU Energy Services Directive (ESD) 2006/32 set a 9% energy savings target by 2016. The National Energy Efficiency Action Plan (NEEAP), launched in May 2009, identified current and new measures to achieve the ESD target, with a further national target of 20% by 2020. An important feature in achieving these targets is the refurbishment of the current housing stock. There are a number of incentive schemes currently available to promote energy efficient retrofitting of domestic buildings. These schemes are operating with varied levels of success, despite the fact that full implementation is required to achieve the 2016 and 2020 targets. The market for efficiency retrofits is fragmented and undeveloped. It is difficult for individuals to determine the most beneficial and cost-effective way to increase efficiency, with credible information hard to decipher and quoted prices often unclear. The aims of this research it to assess overall success of these incentive schemes and identify the barriers to increased uptake. The proposed research methods include interviews with private homeowners from a broad demographic, and industry professionals. It will identify homeowner's awareness of their domestic energy use and knowledge of energy efficiency schemes available to them. It will establish the actions needed to incentivize homeowners to avail of these schemes. Further enhancement of the current schemes and making use of international experience by implementation of schemes such as 'Pay as you save' (PAYS) is required to engage homeowners. To achieve set targets the homeowner must be further educated and enthused into reducing their energy demand. Success must be consumer led rather than being dictated to from government through stronger legislation and penalties for non-compliance.

Keywords: energy efficiency, targets, residential sector, incentivization.

INTRODUCTION

Although the need to reduce Ireland's energy demand and mitigate greenhouse gas emissions has long since been established, the demand for energy across every sector of our economy has grown by 43% over the period 1990 – 2008 (SEI 2009a). This is a worrying trend, considering the European Union's statement of support for the Copenhagen Accord in January 2010, committing to implement an economy-wide carbon dioxide (CO_2) emissions reduction of 20%, compared to 1990 levels, by 2020 to 'further strengthen the emissions reductions initiated by the Kyoto Protocol' (Copenhagen Accord 2009).

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Sustainable Energy Ireland (SEI 2008a) states that Ireland's residential sector, numbering 1.5 million dwellings, is directly responsible for approximately 25% of all energy use in Ireland; a trend echoed across Europe. Therefore, to meet the requirements of Kyoto and the recent commitments in Copenhagen there is a clear need to address the issue of energy use in new and existing dwellings. Since Kyoto, a number of national government and EU policies and legislation have sought to drive energy efficiency measures in Ireland's residential sector. The EU Energy Performance of Buildings Directive (EPBD) 2002/91/EC was adopted by the Irish Government in December 2002 and transposed into Irish Legislation in 2006. The objective of this directive is to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. The EU Energy Efficiency and Energy Services Directive (ESD) Directive 2006/32/EC, obliges Member States to deliver energy savings of 9% by 2016 (European Parliment 2006). The National Energy Efficiency Action Plan 2009-2020 (NEEAP), published May 2009, established its target to achieve 20% energy efficiency savings across the economy by 2020. The plan identified two major energy efficiency challenges that must be met by Ireland's residential building sector in the period to 2020 (DECNR 2009):

1. Create a generation of buildings that meet expectations of comfort and functionality while significantly reducing energy usage and CO_2 emissions.
2. Address the legacy of older housing with poor energy and CO_2 performance.

The legacy of older housing is particularly pertinent as 50% of current residential buildings were built prior to 1979 when minimum insulation standards were introduced, whilst 80% of dwellings were built before 2000 (CSO 2007). These houses fall well below the requirements of the current building regulations and are energy inefficient. It is often postulated that up to 75% of the existing housing stock will exist in 2050 (Ravetz 2008 and SDC 2006), therefore, refurbishment of the existing and ageing housing stock presents substantial opportunities to create a cost effective energy efficient building to achieve energy targets. In addition refurbishment provides a healthier environment for the occupant through increased thermal comfort and increases the sale or rental value of the building.

Housing occupancy in Ireland falls into two broad categories, private and social. Approximately 10% of Ireland's 1.5 million dwellings are under the control of local authorities and social housing associations, while the vast majority are privately owned or rented, as shown in Table 1. Energy efficent upgrading of social housing is currently funded at national government level through a variety of social housing initiatives, which are not examined here. With the aging profile of the private housing stock it is imperative that homeowners are encouraged to undertake energy efficient upgrading of their homes to meet set energy targets.

Government and EU policies have been established and developed with clear goals to achieve the energy targets. However, the path to achieving these goals is far from clear. Many incentive schemes to promote energy efficient retrofitting of private domestic buildings are in place but these schemes are operating to various levels of success and unless fully implemented these targets will not be reached. The up-take rate of these schemes will make it difficult to meet the targets within the given timeframe. To fulfil the requirements of these policies and achieve the set targets it is

Table 1: Occupancy Nature of Irish Dwellings (CSO 2007: 83)

Dwelling Type	No. of Units
Privately owned	1,082,945
Rented from Local Authority/Social Housing	155,989
Rented from Private Landlord	145,317
Occupied free of Rent	21,701
Not Stated	47,344
Total	1,462,296

essential that a range of programmes are produced to incentivize homeowners on a large scale to undertake energy efficient upgrading of their homes. There is a lack of formal research identifying mechanisms to engage homeowners to carry out upgrading works. This paper addresses the first phase of this study.

BARRIERS TO UPGRADING

Research by Clinch and Healy (2000), found that there were a number of barriers to action regarding domestic energy conservation in Ireland including:

- Benefits unclear to homeowners – lack of knowledge about savings that can be made
- Lack of willingness on behalf of the government to support energy efficiency programmes
- Lack of disposable income following the 1980s recession resulted in homeowners reluctance to invest in retrofitting works
- Co-ordinated approach needed from government agencies as policy responsibility was spread across about 10 departments
- Irish energy policy has concentrated on supply side intervention and neglected demand side e.g. consumers/homeowners

In the past 10 years there has being significant changes which have addressed some of the issues raised by Clinch and Healy. There is now a large willingness and indeed a sense of urgency on behalf of the government to address the upgrading of dwellings. Sustainable Energy Ireland (SEI), established by the government in 2002, is a single agency responsible for implementing energy conservation techniques and renewable energy production in Ireland. A key SEI objective is the reduction of energy use and consequent CO_2 production from dwellings through energy efficient refurbishment. However, there is still reluctance on behalf of the consumer to invest in energy efficient upgrading of their dwellings. Recent research in the UK (Caird *et al*. 2008) suggests that even though well informed and 'environmentally-concerned' consumers may be interested in energy efficiency, but due to lack of information, high upfront costs and the hassle/disruption to their home, they are reluctant to undertake such measures. The market for energy efficient retrofitting in Ireland is fragmented with a large number of companies offering a variety of products from energy saving to renewable technologies. This is particularly evident since the downturn in the economy with construction professionals from different disciplines now getting involved in the energy sector. This leads to questions about the credibility and competence of the installer. This makes it difficult for individuals to choose between companies and technologies as there are often left unsure whether they are getting value for money.

CURRENT STATUS

As in the UK there is a large variability in Ireland's housing stock, including house type, construction type and age profile ranging from contemporary to pre- 1900 allowing for a large range of energy use and efficiency characteristics. With space heating accounting for the largest proportion of energy use in dwellings a key factor in determining the energy profile of housing stock is the period of construction (SEI 2008a). Since the introduction of minimum standards for buildings, in general the quality of dwellings has increased. Before 1979 there were no minimum insulation standards and little understanding of the benefits of insulation. This resulted in very little if any insulation being incorporated into the design and construction of dwellings. A greater understanding of how buildings function and use energy has allowed for the development of these standards, resulting in buildings that are more comfortable and healthy than in the past. Constant upgrading of minimum standards to reduce energy consumption and increase thermal comfort has led to new technologies and construction techniques being developed and adopted at an ever increasing pace. Energy performance requirements for new buildings have risen significantly in recent years. However, the energy performance of this existing stock is generally low, with a typical house built to 2007 standards having a 70% lower energy demand for space and water heating than its counterpart built 20 years ago (DECNR 2009).

Overall energy use in the Irish residential sector has increased by 32% between 1990 and 2006 but there has also been an observed ODEX decrease from 1997 to 2007 of 13% (SEI 2008a and SEI 2009b). This indicates though energy efficiency improvements have occurred, behavioural changes, such as increased use of space heating and appliances have cancelled any benefits. From a technological point of view, since space heating generally accounts for the largest energy end use a prudent strategy is to limit the requirement for space heating by the reduction of the conductive and ventilation leakiness of the building.

In an ideal world dwelling occupiers would recognize the potential benefits of upgrading their homes reaping the benefits of lower energy bills and increased comfort levels. However, there is always inertia on the part of people to spend money where a real return may not be realized for a long period of time. This has been recognized by the government who offer a series of incentives to upgrade their homes. These incentives are formulated, managed and funding distributed by Sustainable Energy Ireland on behalf of the government. To date most of the incentives have been in the form of grants which have worked to varying degrees. The main grants currently available are:

- Home Energy Savings (HES) scheme which provides grant assistance to homeowners who are interested in improving the energy efficiency of their home. It applies to all dwellings built before 2006, and measures included are roof/wall insulation, and heating system upgrades. The level of grant support available for each measure is outlined in Table 2 In the current market these grants broadly fund approximately 30% of the overall capital of the upgrading works.

Table 2: Home Energy Scheme Level of funding (SEI 2009c)

Measure	Category	Grant
Roof	Roof Insulation	€250
Wall	Cavity wall insulation	€400
	Internal wall dry-lining	€2500
	External wall insulation	€4000
Heating system upgrade	High efficiency gas or oil fired boiler with heating controls upgrade	€700 €500
BER Assessment	Heating controls upgrade Pre- and post- upgrade BER assessment	€200

Table 3: Greener Homes Scheme Level of funding (SEI 2008b)

Technology	Grant	Price Range €
Solar Thermal Space and/or Hot Water Heating (Evacuated Tube/Flat Plate) max of 6sqm	€300/sqm /tube €250/sqm/plate	Min €800/sqm to Max €1300/sqm
Heat Pump-Horizontal Ground Collector	€2,500	€13k to €15k
Heat Pump-Vertical Ground Collector	€3,500	€18k to €21k
Heat Pump- Water (well) to water	€2,500	€12k to €14k
Heat Pump- Air Source	€2,000	€12k to €13k
Wood Chip or Pellet Stove	€800	€2k to €5k
Wood Chip or Pellet Stove with integral boiler	€1,400	€4k to €8k
Wood Chip or Pellet Boiler	€2,500	€10k to €16k
Wood Gasification Boiler	€2,000	€10k to €16k

- Greener Homes Scheme provides grant assistance to homeowners who wish to install renewable energy technologies for existing homes. It was launched in March 2006 and provides grants to homeowners to install new renewable energy heating systems. The technologies supported by the scheme are Biomass, Heat Pump and Solar Thermal. The scheme aims to develop a sustainable market for domestic renewable energy technologies by increasing their uptake in the domestic market, thereby reducing greenhouse gas emissions in that sector, encouraging energy efficiency, contributing to security of supply objectives and facilitating greater consumer choice in the heating sector (DECNR 2009). Table 3 sets out the grants available and current cost estimates for each of the technologies.
- Warmer Homes Scheme (WHS) for homes occupied by low income households
- Awareness Campaign: Power of One – providing consumers with energy tips on how to reduce usage and costs.
- Low Carbon Homes Programme suspended in 2006, aimed to support the development of new low-carbon and energy efficient housing through providing capital grants to developers.

With the potential of upgrading in excess of 1 million homes Table 4 demonstrates that the take up of these grants and incentives are relatively low. It must however be noted that the HES was launch in March 2009. Each scheme requires upfront investment by the occupant which has been identified as a potential upgrading barrier.

Table 4: Take – up of various incentives (SEI 2010)

Scheme Implementation	Applications approved
Low Carbon Homes (solar/pv, turbines, biomass, heat pumps etc.	4,000 (suspended in 2006)
Greener Homes Scheme (Renewables as LCH)	26,352
Home Energy Savings Scheme – pre 2006 homes (Launched in 2009)	30,000 approx (Mar- Nov 2009)

INITIATIVES

There are a number of incentive schemes, mainly in the US and European markets which aim to eliminate 'upfront' costs for energy efficient measures. These schemes attempt to address some of the issues that hinder the upgrading of dwellings. These schemes are relatively new and the approaches have yet to be proven in practice.

- Pay As You Save (PAYS) – a repayment model, where the energy supplier pays for the upgrade works, and the cost of the improvements repaid over an agreed period, usually from 5 to 20 years.
- White Certificates – energy suppliers within some EU states, are obliged to invest in energy efficient upgrades, and are verified by issue of a White Cert.
- Property Assessed Clean Energy (PACE) – bonds are lent to commercial and residential property owners to pay for energy efficiency and renewable energy retrofits. The cost is repaid through an addition to the homeowner's property tax bill over a period of up to 20 years.

The UK Green Building Council (UKGBC 2009) summarizes the PAYS model as 'a low energy refurbishment provider uses finance, from a third party, to cover the upfront costs of the low energy work', as illustrated in Figure 1. This funding is repaid over an extended period through council or Energy Company billing. In the UK at present council billing is the preferred method of repayment as the funding is linked to the property rather than the individual consumer. As a result with a change in tenure the obligation of repayment is transferred to the new homeowner. A possible negative with this approach is that payments to the council are usually for the provision of municipal services, while PAYS is intuitively energy related. This may lead to confusion amongst consumers as logic would suggest paying through energy billing. To encourage mass take up a proportion of the upfront costs are subsidized. Colley (2009) called for the introduction of pay as you save, 'a repayment model which offers the potential of making significant energy upgrade investments achievable to the vast majority of Irish buildings'. However, unlike the UK, Irish households traditionally do not pay direct council tax. Psychologically, billing through the energy companies, both from a promotion and billing point of view may be more attractive for Irish homeowners. The Energy Saving Trust UK is currently conducting a pilot scheme to trial and assess elements of the PAYS concept and will run until April 2011.

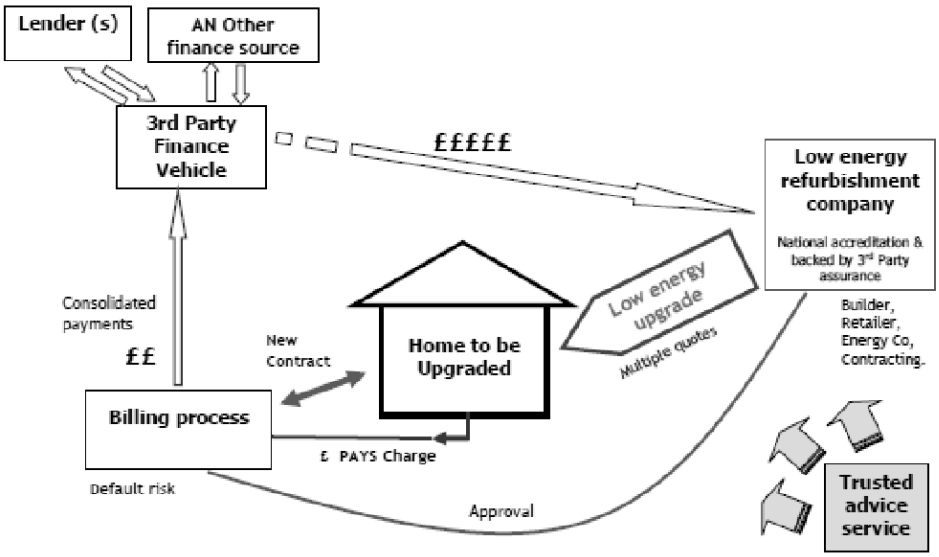

Figure 1: Overview of Pay As You Save (UKGBC 2009)

A number of Member States of the European Union (EU) have introduced obligations on some categories of energy market operators (in particular electricity and gas distributors or suppliers) to deliver energy savings. Specific targets are set for energy suppliers that must be completed within a specific timeframe (Oikonomou *et al.* 2007 and Bertoldi *et al.* 2010). Parties must promote technologies like high-efficiency appliances, condensing boilers and energy efficient lighting. Tradable White Certificates (WhC's) are issued to the energy companies upon independent verification as a means of guaranteeing the achievement of a claimed amount of energy saving. Though most suitable in an industrial setting, the UK, Italy and France have implemented schemes that function in a similar manner in the residential sector where projects are small and project transaction costs high (Bertoldi *et al.* 2010). Use of this type of certification in the Irish market, would require the introduction of strict regulation to ensure real energy savings achieved.

The PACE model named one of the 'Breakthrough Ideas for 2010' by Harvard Business Review (Hidary 2010) was devised in Berkley, California in 2007. To date PACE has been introduced in 15 States across the US. Similar to the PAYS model PACE removes the high upfront costs of retrofitting. Where adopted PACE Bonds are issued by the municipality through a specifically set up "PACE District". Homeowners apply for PACE funds to carry out energy efficiency measures and install renewable energy technologies. This funding is paid back over 20 years as an annual property tax surcharge.

PROPOSED RESEARCH

The overall aim of the on-going research is to 'identify the barriers to the take up of existing schemes and propose actions needed to incentivize homeowners to undertake energy efficient upgrading of their homes'. An initial study was carried out as a proof of concept. Semi-structured interviews were conducted with four experienced industry professionals to gain an insight to the retrofitting market in Ireland. Each of the interviewees expressed their opinions to why the retrofitting market in Ireland remains underdeveloped. A number of common issues emerged including:

A lack of understanding amongst homeowners about energy use in their homes. Homeowners know little about how much energy they use for the various activities

within the home such as space and water heating, lighting and appliances. As a result homeowners are unaware of the potential savings that can be made from as a result of energy efficient upgrading.

Lack of disposable income to cover the upfront costs of work is a significant problem. This is particularly evident where upgrading works have a relatively long pay back period, e.g. 5 – 7 years.

Homeowers are still unaware of the available grants schemes, and are unsure what 'real' benefits could be gained by making an initial capital investment.

The lack of a concerted marketing strategy was highlighted by all participants interviewed, and it was felt the construction industry in general, suffers from an inability, in getting its message delivered to consumers.

From the initial study and previous research (Clinch and Healy 2000 and Caird *et al*. 2008) it is clear there are a variety of reasons why private homeowners opt not to undertake upgrade works. Policies are in place to address many of the issues discussed but their implementation and success is at a rate not sufficient to meet energy targets. Therefore there is a need to identify mechanisms to incentive homeowners to carry out upgrading works. The proposed research aims to establish the effect that removing one of the barriers, 'upfront costs' will have on homeowner's attitudes to upgrading their homes. The research will seek to establish an effective mechanism for Ireland to allow these upfront costs can be removed.

The primary research will consist of carrying out in-depth structured interviews with a number of homeowners and industry professionals in Ireland. This reseach will concentrate on homeowners from a broad demographic occupying various dwelling types. In line with the Homes Energy Scheme, the study will apply to dwellings built prior to 2006. It will identify the homeowner's current level of understanding about energy use in their homes and their awareness of upgrading techniques and available grants. The interviews will identify the barriers to upgrading. It will propose a number of alternative incentive schemes such as PAYS to the homeowners to assess their willingness to consider and carry out upgrading works. Further interviews will be carried out with industry professionals to assess their awareness of energy usage and CO_2 emission reduction targets for 2016 and 2020. The interviews will establish the marketing strategies they employ. The research will propose the most suitable mechanism by which energy efficient works can be presented to the general public.

The underlying hypothesis to this research study is as follows:'The provision of innovative incentive schemes which remove upfront investment costs can significantly improve homeowner's uptake of energy efficient upgrading of their dwellings'.

EXPECTED OUTCOMES

Without large scale retrofitting of Ireland's existing housing stock specific energy saving targets identified for the residential sector, in the periods to 2016 and 2020, are unlikely to be delivered. It is clear that to be most effective, strategies must be developed to encourage consumer led upgrading of their homes rather than through legislation and penalties for non-compliance. This will occur by using innovative marketing techniques which engage and educated the homeowner about efficient building energy use and benefits of upgrading. An expected key outcome from the research will be to propose a framework of actions required to deal with the main barriers to energy efficient upgrading and implement innovative incentive schemes, such as PAYS, that are suitable for the Irish residential sector.

While the study will be carried out in Ireland, the results and the proposed framework should be useful to stakeholders in other countries to gain an insight into consumer requirements and adopt similar scheme. The results from this research may aid in the full implementation of the PAYS scheme in the UK which is currently in its trial phase.

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