Deep Retrofit Trends Analysis Report

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Contents

1.0 Introduction

This report, D2.1- Deep Retrofit Trends Analysis Report, is an overview of the key trends affecting the deep retrofit market in Ireland. The trends investigated arose from the main forces affecting the retrofit market, specifically, from political, industry, financial, market and social forces. Political forces include both national and international forces. The industry forces investigated aim to cover as many aspects of relevant industry as manageable. Investigation into financial forces focuses on possible financing options available in Ireland as well as options working elsewhere. The market trends research aims to evaluate positive market trends and highlight key market failures. Investigating social forces aims provide better insight into the societal trends affecting the uptake of deep retrofit.
The SuperHomes 2030 project aims to create better understanding of the retrofit market in Ireland in order to grow the capacity of Tipperary Energy Agency (TEA) in its SuperHomes offer. This report results from the work carried out in Task 2.1.1, Trends and Drivers for Deep Retrofit and Task 2.2 EU trends and future Market Opportunities and is part of Work Package 2 – Market Analysis and Brand Development. The research was carried out remotely using desk research with primary data collected through interviews and data from a focus group meeting facilitated out by TEA. Limerick Institute of Technology (LIT) worked closely with TEA in the research and compilation of this report.

2.0 Methodology

This report is made up of two elements; Firstly, a trends analysis undertaken by LIT, informed by both primary and secondary sources. This section of the study aims to understand the forces affecting the deep retrofit market in Ireland. The secondary data for this element has been gathered using desk research and it is underpinned by primary data gathered by interviews with experts in the field. Secondary research focuses on establishing a knowledge base on the retrofit market using broad searches in scientific paper databases. Relevant papers were reviewed to scope a broad overview of the market, opportunities, and challenges. Additional research focused on developing a comprehensive view of the trends of deep retrofit in Ireland, with reference to Industry, market, political, customer, external and financial trends. The study includes a review of the Tipperary Energy Agency's 'SuperHomes' offer, the agency being a major actor within the market. The SuperHomes review along with the analysis of key trends will help inform the future development of Tipperary Energy Agency's SuperHomes offer. Building on the comprehensive review of secondary sources, interviews were undertaken with experts and key stakeholders. These interviews aimed to capture two perceptions: firstly, general perception of the overall retrofit situation in Ireland, opportunities, and challenges, and secondly, the expert's perception of key barriers and opportunities for the market related to their specific areas of expertise.

This report is also informed by key findings from an internal TEA report (King, 2020) which provides insight into market segmentation and trigger points. TEA used a mixture of primary and secondary research to produce an internal report using application-form data, surveys, and desk research. These findings will be incorporated into the customer trends analysis of this report.

'Realist evaluation' has been employed as an over-arching paradigm; as we understand that the world does not always conform the way we expect it to and thus it is imperative to have these expert perceptions to give a better understanding of the data we gather in desktop research (Pawson and Tilley, 1997).

3.0 Deep Retrofit Trends in Ireland

3.1 Overview

Analysis of trends is used to assess whether a new product or service will be successful or not. In producing this report, expert interviews were carried out to gauge perception of the market and identification of key trends affecting it. These trends are likely to impact on the elements of the business ecosystem which are not under the control of the company. Understanding these trends is an important part of planning and futureproofing.

It is particularly useful to explore the trends affecting the uptake of deep retrofit in Ireland and across Europe including trends within industry actors, the market, the political agenda, environmental and sustainability commitments, the reality of finance and other external factors. This can help identify factors driving higher uptake and indeed barriers to uptake.

Interviews with experts identified key themes; technology is sufficiently well developed but problems arise around finance, human behaviour and to a lesser extent the complex nature of retrofitting individual homes. Whilst current government policy was viewed positively, implementing the current government policy was challenging.

3.2 Customer Trends

The upfront costs of deep retrofit are substantial, and income is therefore a key factor in identifying the future customer. In the absence of an attractive financing scheme, the capital investment needed for deep retrofit means that there will be an income threshold below which deep retrofit will become unaffordable.

The Central Statistics Office groups income levels by brackets (Central Statistics Office, 2016). This allows clear identification of income groups in Ireland. figure 1 illustrates the proportion of households by income bracket:

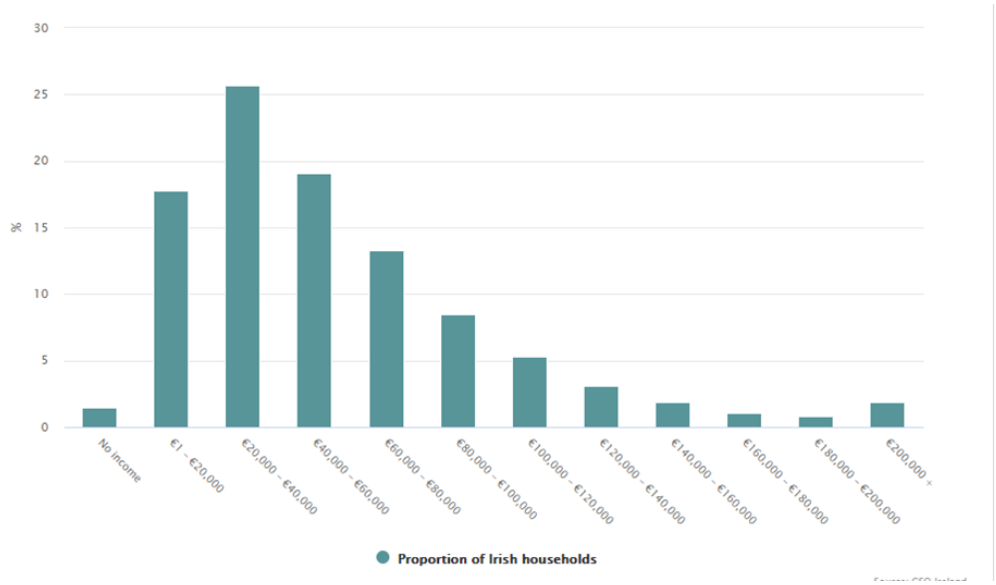

Figure 1 Proportion of Irish Households by Income Bracket

From Figure 1 we can see that;

- 1.5% of households with no income
- 17.8% of households with 1-20,000
- 25.7% of households with 20,000 – 40,000
- 19.1% of households with 40,000 – 60,000
- 13.3% of households with 60,000 – 80,000
- 8.5% of households with 80,000 – 100,000
- 14.1% of households with 100,000 +

It is important to note however that since this data was gathered in 2016, the Irish economy has been negatively affected because of the coronavirus pandemic. The pandemic will continue to impact employment and income. Employment and lift effects of COVID 19 (Central Statistics Office, 2020) states that 47% of people aged 15 years and over have had their employment status effected in some way by the pandemic., of which, 14% lost employment and 33% have been temporarily laid off. The Central Bank of Ireland had previously predicted overall GDP decline of 11% & 8.3% from their projections of Q2 & Q3 of 2020. However, in their most recent Quarterly Bulletin published in October 2020 the estimated decline is down to only 0.4% (Central Bank of Ireland, 2020). The more positive recent bulletin must be viewed with caution as unemployment remains high, the better-than-expected forecast is based on 'unexpectedly robust growth in exports' (Burke-Kennedy, 2020) exports which cover for other shrinking areas of the economy such as tourism, hospitality and retail. Certainly, for the next two or three years the outlook is still volatile, this no doubt will have an impact on the willingness and confidence of customers to commit to the substantial capital investment required for deep retrofit.

Despite the current economic climate, there is a potential opportunity for the retrofit market as one way of kick-starting the economy. With specific attention to deep retrofit, the "Renovate Europe" initiative has published the 'renovation wave' document calling for deep retrofit attention that can boost Europe's economy in a post-COVID era. It calls for the development of initiatives, policy, and investment to that end (Renovate Europe, 2020). The call underscores the opportunity to tie economic recovery to already existing commitments to energy renovation.

3.2.1 Trigger Points

A second key factor for identifying the future customers for SuperHomes is understanding the trigger points -where these customers interact with opportunities to take on deep retrofit.

The Sustainable Energy Authority of Ireland report on energy efficiency in the residential sector (2020) is particularly useful in understanding factors facilitating customers accessing deep retrofit. The report discusses 'enablers' to retrofit. This includes 'awareness & buy-in, 'decision factor and frequency', 'ability to finance' and 'investment behaviour and motivation'. These are not quite 'trigger points' but prerequisites to the trigger points. These enablers have been largely overlooked in academic research and in short, the SEAI report suggests the following enablers are key for engaging future customers.

- Awareness of the benefits of deep retrofit and buy into the motivations.
- Timing of arrival at the identified 'trigger points'. i.e. what stage of life & how frequently the trigger points may occur in their lives.

- Ability to finance through their own personal savings or having access to a financing mechanism that they are happy with.
- Motivation to do so, which may not just be for the financial benefits, but also environmental benefits or improved comfort levels might be motivating factors.
- The SEAI report draws some useful conclusions on the actual trigger points and useful channels of communication associated with these trigger points. The main trigger points discovered by the team are listed in figure 2.

Trigger point	Channel of communication
Anticipated home improvement	Architects, supply chain, contractors, banks, obligated energy suppliers
Buying a new house	Mortgage broker, BER assessor, estate agent
Retirement	Pension provider, employer
Illness or extending your family	Hospitals, community-based services

Figure 2 Main Trigger Points and Channels of Communication [SEAI]

As part of TEA Commercial Internal Report WP2.1.1, King (2020) identified the most common trigger points from literature review. The most common trigger points were; moments in the life of a building, home improvement, changes in personal circumstance, changes of ownership, health related concerns, energy led investment and finance led investment. In addition, analysis of the SuperHomes application data was undertaken. The following trigger points were found to be most common.

- Finance led investment, 31.1% of applicants.
- Home improvement, 27.1% of applicants.
- Energy led investment 22.6% of applicants.
- Health Impacts, 9.9% of applicants.
- 'Already renovating' 9.3%.

The investigation showed that the four top trigger points are related to personal preferences and social norms linked to individual decision-making criteria. Whereas the three trigger points that do not feature, 'moments in the life of a building', 'changes in personal circumstance' and 'changes in ownership' are more easily linked to economic and technological justification and are therefore labelled as 'already renovating'.

3.2.2 Trigger points, additional literature.

A study by Klockner & Nayum in 2016, which focused on the different stages of decision making for energy efficient renovations made several important points. Firstly, it suggests that simply creating a media campaign connected to a certain existing subsidy is enough to create a trigger point for some customers (Klöckner & Nayum, 2016).

A study of Dutch homeowners by Ebrahimigharehbaghi, et al. In 2019 also highlighted the need for different communication at different stages of the decision-making process and thus showing a variety of possible trigger points. The study showed; 'In the considering phase, the socioeconomic factors (e.g., education and income) are important when thinking and acquiring knowledge of renovations. In the planning phase, an awareness of the benefits can persuade

homeowners to renovate. In the planning and implementing phases, access to information regarding the methods and/or means in conducting the EERs is essential. After implementing and experiencing the EERs, the bad and/or good experiences are circulated through social networks and communication channels. The circulation of these feedback data also influences the next up-coming renovation processes for the users' (Ebrahimigharehbaghi, Qian, Meijer & Visscher, 2019).

An Irish study by Collins & Curtis discovered a seasonal trend exists for deciding to make energy renovations. This information was attained from a study looking at applications made for the residential grant scheme for energy efficient upgrades. The trend was that; 'applications made during autumn and winter much less likely to be made for more comprehensive retrofits' (Collins & Curtis, 2016).

Another interesting theory outlined by the SEAI Behavioural Economics Unit in 'Changing Energy Behaviour – What Works?' (2020) suggests that a trigger point could also be 'created' through free independent energy audits.

3.2.3 Market Segmentation

As part of understanding the potential customer profile, we must look at the housing stock as well as the occupiers. Different homes will have different need of retrofit with older homes usually needed deeper retrofit measures. Collecting data on house types is important in establishing where the SuperHomes package can be offered in the market. It is also useful at this stage to compare domestic housing data with housing data from European partners. There are potentially useful lessons in evaluating how the market acts in other European countries with a similar housing stock profile. This section of the report aims to review European housing stock and identify countries with similar profiles to Ireland with a view to analysing key factors and trends.

In 2015 Building Research Establishment carried out an investigation to investigate the quality of European housing stock.

EU Member State	Population	Number of dwellings	Persons per dwelling
Austria	8,700,471	4,441,000	1.96
Belgium	11,289,853	5,203,400	2.17
Bulgaria	7,153,784	3,918,200	1.83
Croatia	4,190,669	1,923,522	2.18
Cyprus	848,319	433,212	1.96
Czech Republic	10,553,843	4,101,635	2.57
Denmark	5,707,251	2,762,444	2.07
Estonia	1,315,944	649,700	2.03
Finland	5,487,308	2,906,000	1.89
France	66,661,621	28,077,000	2.37
Germany	82,162,000	40,545,300	2.03
Greece	10,793,526	6,384,000	1.70
Hungary	9,830,485	4,400,000	2.23
Ireland	4,658,530	2,019,000	2.31
Italy	60,665,551	28,863,000	2.10
Latvia	1,968,957	1,018,000	1.93
Lithuania	2,888,558	1,389,000	2.08
Luxembourg	576,249	208,000	2.77
Malta	434,403	223,900	1.94
Netherlands	16,979,120	7,200,000	2.36
Poland	37,967,209	13,853,000	2.74
Portugal	10,341,330	5,878,700	1.76
Romania	19,759,968	8,329,000	2.37
Slovakia	5,426,252	1,994,900	2.72
Slovenia	2,064,188	857,000	2.41
Spain	46,438,422	25,208,000	1.84
Sweden	9,851,017	4,633,678	2.13
UK	65,341,183	27,767,000	2.35
EU28	510,056,011	235,187,591	2.17

Figure 3 Housing, Population, and Persons per Dwelling Across all 28 EU Countries

From the data we can see that Ireland has 2,019,000 houses with 2.31 people per household. Countries with similar numbers of dwellings include Croatia (1,923,522), Denmark (2,762,444), Finland (2,906,000), Lithuania (1,389,000) and Slovakia (1,994,000). However, what is more significant in this data set is the number of people per dwelling. Similar countries with +/- 0.06 are the UK (2.35), Romania (2.37), Netherlands (2.36), France (2.37).

EU Member State	Pre 1946	1946-1980	1980-2000	Post 2000
Austria	25.5	40.1	22.7	11.7
Belgium	37.1	38.2	16.5	8.2
Bulgaria	10.5	55.4	25.5	8.6
Croatia	13.6	42.5	23.6	11.0
Cyprus	3.0	24.6	36.1	34.1
Czech Republic	19.0	37.1	20.5	7.7
Denmark	34.1	44.6	14.0	7.2
Estonia	17.0	47.0	22.8	9.4
Finland	9.6	48.7	29.7	10.7
France	28.7	37.0	23.9	10.4
Germany	24.3	46.5	23.1	6.1
Greece	7.6	47.8	29.1	15.5
Hungary	20.3	48.3	21.7	9.7
Ireland	13.3	22.9	20.7	22.0
Italy	20.7	51.4	19.8	7.9
Latvia	22.7	46.6	24.3	5.1
Lithuania	13.5	49.6	28.9	6.2
Luxembourg	21.8	31.5	21.6	14.0
Malta	13.0	23.2	23.4	8.7
Netherlands	18.9	41.9	26.4	9.5
Poland	19.1	43.0	22.7	11.4
Portugal	10.7	37.1	36.0	16.3
Romania	11.2	59.1	19.0	8.0
Slovakia	8.2	52.6	21.5	5.8
Slovenia	21.3	45.0	25.0	8.7
Spain	11.1	43.0	24.7	18.5
Sweden	24.3	47.7	12.3	4.6
UK	37.8	39.7	15.6	6.9
EU28	22.3	44.1	22.1	9.8

Figure 4 Housing by Age of Construction by EU Member States

The age of a building can be a significant factor in the energy performance of the building. Older buildings tend to have poorer quality windows, more leaky building envelopes and inefficient energy systems. Figure 4 outlines four bands of construction periods; pre-1946, 1946-1980, 1980-2000 & Post 2000. Ireland has relatively small numbers of houses built pre 1946 in comparison to other countries with 13.3%. Between 1946 – 1980, 22.9% houses built. 1980-2000, 20.7% of houses built and post 2000, 22% of houses were built. From this data we can see that Ireland has an even spread of construction from 1946 onwards (in relation to the bands used) with less built pre 1946. This may be potentially beneficial in relation to retrofit as there fewer very old buildings. This is in contrast with neighbouring countries UK, France and Denmark which have 37.8%, 28.7% and 34.1% pre 1946 build, respectively. Ireland however has one of the newest housing stocks in all of Europe with 22% built post 2000. The only country with a higher share of post 2000 houses is Cyprus with 34.1%. This is relatively modern housing stock in comparison to other countries. Furthermore, the age of the dwelling can be reliably linked to the overall energy performance.

	% of row						
	Energy Rating						
Period of Construction	A	B	C	D	E	F/G	Total
1700-1949	0	3	12	18	19	47	106,549
1950-1999	0	5	34	33	16	12	379,532
2000-2019	11	21	49	14	4	1	331,835
Total	4	11	37	24	11	12	817,916

Figure 5 Energy Rating by Construction Age;

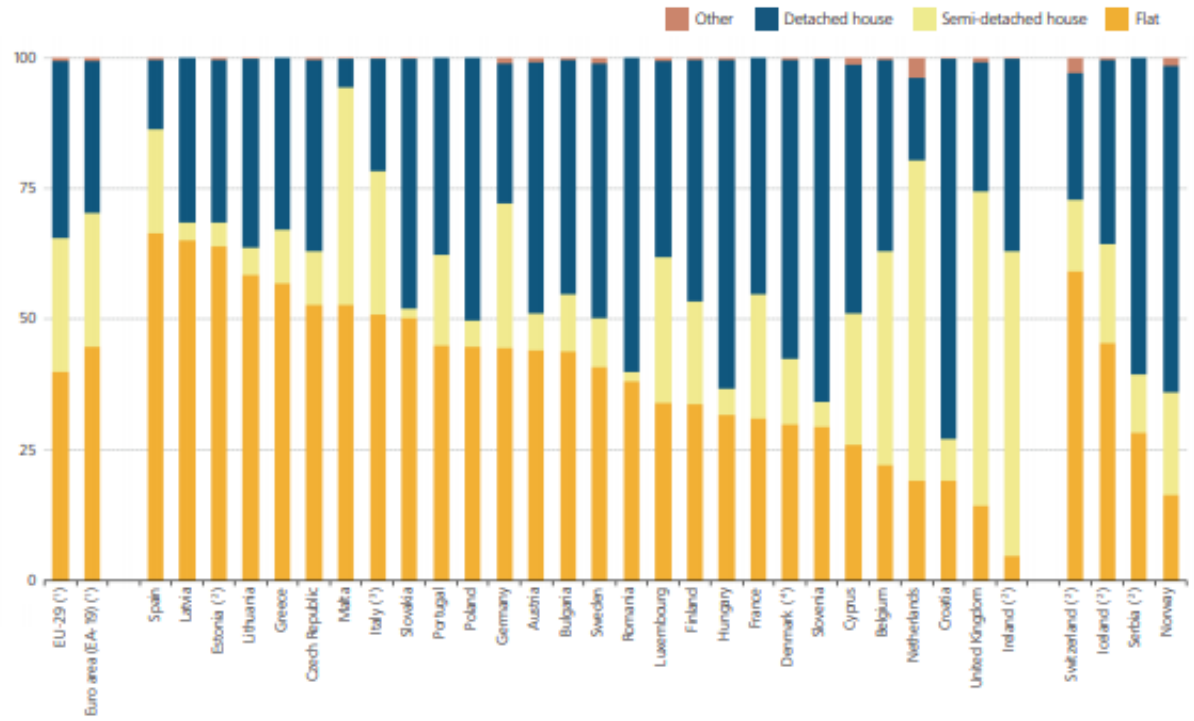

Figure 6 House Type by EU Member State

In addition to the age of the dwelling, understanding the makeup of the housing stock by dwelling type is essential to identify trends. Figure 6 clearly shows that Ireland has the lowest proportion of **flats** in its housing stock than any other EU country (The country with the next lowest share in flats is the United Kingdom). Ireland has a significant portion of its dwellings built as **semi-detached** houses – Similar to the United Kingdom, the Netherlands, and to a lesser extent Malta. Ireland has an average proportion of **Detached** houses similar to United Kingdom, Belgium, Cyprus, France, Luxembourg, Germany, Italy, Czech Republic, Greece, Lithuania, Estonia & Latvia. The two countries most like Ireland in all three dwelling types therefore are The Netherlands & The United Kingdom.

A Third factor in segmenting the housing stock is tenure, this is an important consideration and directly linked to uptake of deep retrofit. The private rented market is a particularly challenging

customer base for increasing deep retrofit due to the split incentive – the tenant and landlord would both benefit from a deep retrofit of the house, however challenges arise with financing the retrofit as the savings are often seen by the tenant on the energy bill but the construction work is a considerable expense for the landlord. The split-incentive is discussed further in market trends.

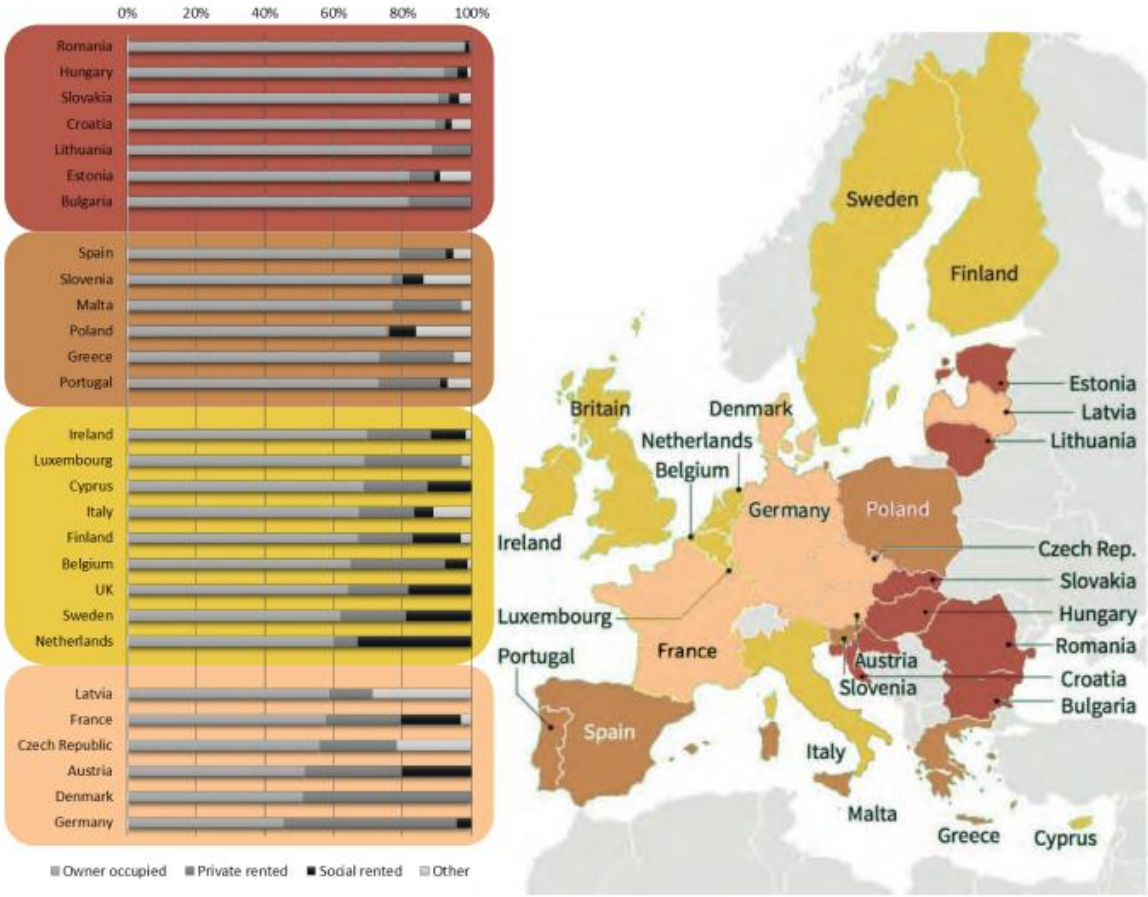

Figure 7 Variances in Tenure Across EU Member States

Looking at various EU countries owner-occupied dwellings are the most popular in all countries. Ireland has around 70% of housing owner occupied. Countries with the most similar tenure profiles are Luxembourg, Cyprus, Italy, Portugal, Greece & Poland. However, it is important to note that many other European countries have similar rates of owner-occupied dwellings. Ireland has 15% of housing stock that is privately rented, this is where the market failure 'split incentive' is most prevalent. Countries with similar rates of private rented dwellings would be Cyprus, Sweden, UK, Portugal, Bulgaria. Ireland has roughly 10% of housing socially rented and less than 5% categorised as 'other'. Comparing all countries in terms of share of tenure, Ireland is most similar to Cyprus and Finland.

Other demographic factors

Whilst it is true that some demographics such as income levels and tenure can help in identifying future customers. Other demographic factors may hold no scientific significance and can be ruled out. An Irish study from 2016 by Aravena et al, on the priorities and determinants of energy efficiency investments conclude that both age and gender have no significant effect

overall adoption of EEMs (Aravena, Riquelme & Denny, 2016). This was in line with previous studies by Zundel and Stiess 2001, and Kastner and Stern 2015. The study by Aravena did however find statistical significance in the composition of the household with a higher probability of adapting energy efficiency measures attributed to larger households, with 0.6% increase per additional adults and 0.8% increase per additional children.

The SuperHomes customers in the future will not be the houses with A & B ratings but rather the houses with ratings of C and below.

% of row

	Energy Rating													
Dwelling Type	A	B1	B2	B3	C1	C2	C3	D1	D2	E1	E2	F	G	Total
Apartment	5	2	6	9	11	11	10	11	11	7	5	5	8	164,415
Detached house	3	1	2	7	10	12	12	12	11	6	5	6	11	675,927
Semi-detached house	3	1	1	5	11	14	14	15	12	7	6	6	5	434,331
Terraced house	3	1	2	6	11	12	11	12	12	8	7	7	9	262,684
Total	3	1	2	7	11	12	13	13	11	7	6	6	9	1,537,358

Figure 8 House Type by Achieved BER

Key findings from Tipperary Energy Agency on Segmentation.

Further investigation by TEA aimed to identify more specific market segmentation of the deep retrofit market in Ireland. A literature review was initially carried out to identify methods used to segment the market. This review usefully identified a range of approaches which focused on sociodemographic data, behavioural psychology, technology & housing typologies as their underlying justification. TEA identified the most appropriate approach to segmentation, taking account of the aims and targets of SuperHomes. The 2030 SuperHomes program aims to realise 500 retrofits, locate the areas in Ireland with the highest demand and identify optimal locations for informational SuperHomes hubs.

The TEA approach to segmentation focused on private housing stock, splitting this segment into three cohorts; Cohort 1) People who cannot afford any form of Deep Retrofit (separate to social housing), Cohort 2) Those that can afford a small amount or smaller Willingness to Pay into Deep retrofit, Cohort 3) Those that have a high Willingness to Pay – bearing most of the cost of Deep Retrofit.

Cohort 3 was identified as the focus of the internal study into market segmentation. The rationale for this focus was that Cohort 3 are more likely to be participants in SuperHomes due to less financial constraint and heightened awareness. This Cohort were also considered the cohort the least challenging cohort due to less financial constraint and more willingness to pay. The study then sought to locate Cohort 3 across Ireland. In order to locate the cohort Michael King from TEA designed a spatial approach to market segmentation incorporating the Pobal HP deprivation Index, Central Statistics Office Census data and a framework previously proposed in Rogers (2010) - A framework (DOIT) for the characteristics of innovators and early adopters. This spatial approach was then used to locate Cohort 3 nationwide. Application of the framework enables better focus of communication strategies and the optimum locations for one-stop-shop hubs.

Subsequently, the results of the analysis concluded that the optimal location of hubs included greater Dublin & City, Limerick County & City, County Tipperary, Cork County & City. It is also pointed out that variance can be seen within these areas and spatial depiction of trends in

electoral districts or even ‘small areas’ can be more beneficial in planning targeted communication campaigns.

3.3 Industry Trends

Within the retrofit market, many different industry actors play a role in influencing the market; homeowners, tenants, designers, architects, insulation installers, contractors, building suppliers, surveyors, local authorities, non-profit organisations, and others. Trends are driven by industry actors at micro-level, national level, European level, and global level.

The energy efficiency obligation scheme.

The energy efficiency obligation scheme is a key driver. It is intended to foster support for energy efficiency improvements for consumers from the financial resources of their energy suppliers. Under the scheme large energy suppliers are obligated to support energy efficiency projects in businesses and/or homes across Ireland. The scheme is underpinned by the energy efficiency directive (2012/27/EU). The scheme in Ireland started in 2014 and is to run until at least 2020.

The companies who sell large amounts of energy are known as ‘obligated parties. To qualify as an obligated party, the energy supplier must supply 600GWh of energy in any relevant year, regardless of the sector.

Each obligated party in Ireland is allocated energy saving targets according to their proportion of energy sales within the market. Once the targets are set, the energy company has until 31st of March each year to make the necessary energy savings set for that year.

The obligated parties can offer supports to homes or businesses and every unit of energy saved will achieve energy credits towards their targets. The obligated parties are also permitted to exchange validated savings up to 30% of their total cumulative target. For any portion of the target not achieved by year end, a penalty will be imposed on the company.

The obligated parties can offer support in several different ways.

Financial supports:

- Direct monetary contribution
- Low interest loans
- Negotiating discounts on materials
- Reduced energy prices

Technical support:

- Energy audits
- Energy management system implementation
- Identify energy efficiency opportunities
- Measure & verify savings

Energy Service Companies

An ESCO is a business providing energy solutions such as design & implementation of energy saving projects. Modern versions of ESCOs are evolving to adapt to the trends of sustainability & are therefore offering a range of renewable technology plans with innovative finance methods. It is quite popular for modern ESCOs to offer customers payback through their energy bills. This is known as an energy performance contract which where the payback must come from either energy savings or energy supply.

EnerPower Is an ESCO founded in 2005 in Ireland. They offer energy savings solutions such as renewable energy technology installations, heating system upgrades, district heating systems. EnerPower offers solutions to public, commercial, industrial, and agricultural customers. On an ESCO basis, EnerPower offer both Biomass heating systems and wind turbines on a 'no upfront capital' basis. Meaning that companies can apply for the technology, pay nothing up front, but pay back through metered energy savings.

Clearpower is a renewable energy solutions company founded in 2002. The company operate in the commercial and industrial sectors and so it is an adjacent market to the residential retrofit market. Clear power offer installation of biomass boilers, heat pumps, solar photovoltaic, and other low carbon heating and electricity generating solutions. For financing solutions, they offer to build, own, and operate renewable energy installations selling the energy to the customer in an ESCO agreement.

Glas Éireann Solutions / GES energy solutions gained ESCO status in 2018, it was supported by the local enterprise office in Limerick & co-funded by the Irish Government & the European Regional development Fund. The company offer a three-step plan to costumers to achieve energy savings.

1. Audit, asses & plan
2. Contract & financing
3. Retrofit, Install & maintain

The result is up to 60% guaranteed energy cost savings, 100% of capital expenditure covered, off balance sheet financing structure, contract length management, amongst other benefits.

There are other ESCOs operating within the market. The European ESCO Market report of 2013 (Bertoldi, et al, 2013) listed the Irish ESCO market as having strong growth. The report highlighted 'fewer than 5' Large ESCOs & Fewer than 10 small ESCOs. The report mentioned that the typical ESCO projects at the time were mostly pilot projects, mostly in the public and private tertiary sectors.

Energy Efficiency Fund

Launched in 2013 by the Irish government the energy efficiency fund is to act as a catalyst to develop energy efficiency projects in the Irish market (IEEF, 2020). The fund will also enhance the level of finance available to support the clear cost saving opportunity that exists for public and commercial sector organisations. The fund was initially launched by the government with €35 Million seed capital. In 2014 Sustainable Development Capital Limited were selected to act as fund manager by the Department of the Environment, Climate and Communications. The

fund provides finance for two main types of energy efficiency project in public and commercial sectors.

1. Energy Performance Contracts where funding is loaned to an ESCO.
2. Direct lending to client's company.

Better Energy Warmer Home Scheme

The Better Energy Warmer Homes scheme set up by SEAI provides grant assistance for energy efficiency upgrades for eligible homes. The aim of the scheme is to make eligible homes warmer, healthier, and cheaper to run. The scheme is funded by Ireland's EU structural Funds Programme, co-founded by the Irish Government and the European Union. The scheme will provide a surveyor who will assess which upgrades can be committed to an eligible home, these could be attic insulation, cavity wall insulation, external wall insulation, internal wall insulation, other secondary measures such as lagging jackets, draught proofing & energy efficient lighting; and in some cases, heating upgrade and / or window replacement may also be recommended.

Eligibility for the scheme is based on a set of criteria for both the applicant and the home. For the applicant, Homeowner and occupier, principal residence, within the Republic of Ireland, built and occupied before 1st January 2006, be in receipt of a welfare payment such as fuel allowance or job seekers. Must not have received works from the scheme in the past. The home will be eligible upon the successful conclusion of a survey by SEAI.

Some companies involved in implementing the scheme are:

- Energy Action
- Bray Community Enterprises
- Longford Warmer Homes
- IRD Duhallow
- West Cork Development Partnership
- Midland Warmer Homes Co Ltd
- Home Comforts Better Energy Ltd
- Leitrim Warmer Homes CLG
- Tait House Community Enterprise
- Clár I.C.H. Ltd
- NCE Insulation
- Wexford Local Development Warm Project

Renovate Europe

Renovate Europe is a major industry force with significant influence on current trends. It is primarily a political communications campaign lead by EUROACE (the European alliance of companies for energy efficiency in buildings) with the explicit aim to reduce energy demand in the EU building stock by 80% by 2050. This will be achieved through legislation and ambitious renovation programmes and is supported by over 40 partners from industry and civil society and 15 national partners active at national level. The group also lobby support from MEPs, business leaders and community leaders. Renovate Europe has a very clear call: 'Reduce the energy demand of the building stock in the EU by 80% by 2050 to reach nearly zero energy building standard by mid-century.'

The Renovate Europe initiative has been able to perform many actions since it set out in 2011.

- Sign up ‘champions’ – Political figures past and present to help push the renovation ambition within the EU governing level.
- Regularly disseminating best practice – REday for example is an annual showcase of best practice cases of deep renovation for energy efficiency available to industry professionals, political persons and the wider public. Webinars also regular on their website.
- Publications – Renovate Europe has numerous useful publications aimed at the industry & policy makers.

Renovate Europe Publications:

1) Building renovation: kick starter for the EU recovery (A short study carried out by The BPIE at the request of the Renovate Europe Campaign. ‘The findings are encouraging, in the sense that much research has taken place at all levels – national level, European level and global level – and that the stimulus effect of investing in energy renovation is great. This makes this short Study a valuable contribution to the debate on how and where to spend the large funds that are being mobilised to help the EU and its Member States recover from the economic impact of tackling the COVID-19 pandemic).
2) Making the EU Renovation Wave a Success – A short article outlining 10 principles required to make the renovation wave successful in the sustainability and economic ambitions.
3) Renovation Fund for All Europeans – A proposal to tackle (arguably) the largest barrier to private deep renovation across Europe – financing. The call was initially supported by 39 of the initiatives regular supporters (actors within the industry) but within a very short space of time the number of supporters rose to 125.

Renovate Europe is an ongoing initiative with notable success in nurturing political support for deep renovation across Europe. The initiative has responded well to the current pandemic in that it has presented deep renovation as an unmissable opportunity for restarting the EU economy & working towards our climate targets at the same time. On their website they host regular webinars and are successful in the ambition to share this information effectively ("Renovate Europe", 2020).

European Projects

European projects led by research and academic institutions have long been significant drivers. Below is a non-exhaustive list of European projects based within the retrofit market, many collaborating with industry actors outside of academia.

One expert view from a key academic stakeholder identified a key issue as the ‘project vs programme conundrum’ (Seamus Hoyne, LIT). Retrofit projects and pilots have been well tested and developed over the years. The challenge is moving from project and pilot to the full roll out of programmes for actual large-scale change. In short, academia has played its part, now it’s time for industry and government.

Project	Description	Actions
Build Up Europe https://www.buildup.eu/en	Build Up is an initiative set up to support EU member states to implement their EPBD's. It is an online web portal. It is funded & managed by the Executive Agency for small & medium enterprises. The portal is intended to make use of the collective knowledge on energy reduction in buildings across the EU & available to all relevant audiences. It should bring together new practitioners and professional associations while motivating them to exchange better working practices & knowledge to transfer tools & resources. Target professions working in the building sector with an interest on the latest developments at technical or political level, policy legislation, financial issues, etc.	- The portal is set up and accessible. It provides news, events, case studies, best practices, learning tools, webinars with experts, relevant publications, country specific resource directory and skills initiative section. - The portal is operating with an ocean of information available that appears to be easily accessible. It is an on-going project & so the knowledge base is expected to grow.
Build Upon https://worldgbc.org/build-upon	A project to strengthen implementation of the renovation strategies required by EU law. Led by a group of green building councils in partnership with Climate Alliance and BPIE. The project is to help cities lead the charge toward net zero carbon by 2050 by developing strategies and solutions to scale up energy efficient building renovation.	- Develop & pilot 'multi-level renovation impact framework'. Containing milestones and measurable progress indicators for city renovation strategies including emission reductions, increased employment & improved health. By capturing data at a local level, the framework will link renovation to policy and decision making processed at a national level, driving greater investment in city

		regeneration programmes. - As a result of recent actions, an aim for the framework is to be used as a blueprint for the EPBDs implementation In the future.
PIMES https://www.emi.hu/EMI/web.nsf/Pub/research_pimes.html	PIMES is a project which demonstrates examples of innovative technologies that are ready for application. Use of RES for cities, EE measures, sustainable building, and district development. It is part of the EU Concerto initiative. 10million Euro funding from the EU commission and 8million funded from industry. Partners are industry actors, professional institutions, local authorities, and R & D institutions. Their mission is to research, demonstrate & disseminate technologies for the construction of houses that take into account the local climatic conditions while at the same time reducing the need for heating and cooling.	Delivered innovative, sustainable & solid demonstration projects. The Szentendre project contained almost 30 kinds of innovative architectural elements/ engineering solutions to include: • Hybrid solar cells • Heat pumps based on sewage water • Visible PC for shading & seasonal shading with textile or PV. • Double glazed climate face, tilted windows, green facades & roofs as different kinds of protection against summer overheating. • Heat recovery ventilation The Zaramaga project – façade s and roofs of the three housing blocks have been fully insulated and cladding applied, indoor common spaces renewed & elevators installed. The new Salburua building in the project included innovative features such as CHP, heat recovery ventilation, high insulation levels and an innovative

		design with integration of PV in façade. - The Salburua building was selected as one of the most sustainable building promotions in 2012 by the ENDESA awards.
RESSEEPE https://cordis.europa.eu/ project/id/609377	The project was focused on the study of new innovative technologies that include measures for: • Envelope retrofitting • Integration of RES • Energy storage systems • Nanotechnologies and smart materials • ICT Funded by the EU's seventh programme framework research and innovation programme of 8.8m / 13.7m total funding. A consortium of 25 partners from 10 EU countries including R&D, building/ district owners, public authorities, industrial partners & SMEs. The RESSEEPE project was launched with the aim of developing and demonstrating an easily replicable methodology for designing, constructing, and managing public building & district renovation projects, realising near net zero energy. The projects bring design and decision-making tools and innovative building fabric manufacturers together with a strong programme to demonstrate improvements in	The developed methods & tools were implemented at 3 test sites in UK, Sweden & Spain. Taken from the test sites: 'the result is a reduction of at least 60% in energy consumption compared to the values before renovation'.

	building performance through retrofitting.	
ENERFUND http://enerfund.eu/	ENERFUND is a tool that rates and scores deep renovation opportunities. The tool is based on parameters such as EPCs, number of certified installers, governmental schemes etc. The project was made up of a consortium of universities, energy agencies & professional institutes. The idea is that from the rating of deep renovation opportunities, energy service/products companies can identify customer segments based on their needs. The tool can be useful for environmental department heads for use when prioritising funding. The tool should also assist financial institutions to provide targeted loans to building owners.	The project has succeeded in building an online tool that allows you to look at deep renovation opportunities in 12 European countries. You can filter the results by region, municipality etc then compare energy ratings, building elements etc of each submitted building within that area. The tool building is ongoing, with more submitted data, more accurate analysis can be taken from the app.
Fit-to-nZeb http://www.fit-to-nzeb.com/	An international research project to increase the demand for training on energy efficiency in building & particularly on deep retrofit; increase number of qualified workers & specialist across the construction chain. Operated by European Agency for Small & Medium Enterprises & a consortium of research centres across Europe. To accelerate the energy renovation of Existing building stock & raise the quality of renovat3ed buildings. Increase the number of construction specialists at all levels. Provide	• Develop training programmes for all levels • Large scale communication campaign • Pilot courses on new programmes St Bricins in Dublin is a good example of a successful deep retrofit of a group of buildings after professional training from the project.

	accessible & quality educational programmes developed by the consortium.	
iBroad https://ibroad-project.eu/	Develop road maps for individual building renovations to support building owners in a step – by – step. The consortium of energy agencies, research centres and professional institutions. The goal is for a roadmap to be an evolution of the EPC & Audit system. Where the roadmap will serve as a tool outlining a customized renovation plan with a long-term horizon for deep step-by-step renovation of individual buildings.	Data collection – what is important information to provide to homeowners (technical advice & detailed building information). The design of the module is tailored for each pilot country to reflect the national conditions to enable implementation. As the project is still ongoing, the expected results are; • Study of pilot specific adoption of iBroad. • Assessment of feasibility of iBroad across Europe.
EeMAP https://eemap. energyefficientmortgages.eu/	EeMAP is an EU initiative that aims to create a standardised 'energy efficiency mortgage' – which incentivises building owners to improve energy efficiency or buying already energy efficient property by way of preferential financing conditions linked to the mortgage. Who? • EMF-ECBC – Voice of European Mortgage industry • University ca Foscari Venezia – Oldest business school in Italy	- Data collection led to a need for a pilot scheme to • test the framework in operation and • gather data on the performance of energy efficient mortgages 52 lending institutions so far signed up to the pilot scheme.

	• RICS – Royal institute of chartered surveyors • ERN – Network or green building councils • E.ON – A leading private energy supplier across Europe • SAFE – Research centre Frankfurt Their mission is a Market-led initiative focused on the design and delivery of an energy efficient mortgage which is intended to incentivise & channel private capital into energy efficient investments.	
INNOVATE https://energy-cities.eu/project/innovate-2/	Integrated solutions for ambitious energy refurbishment of private housing. Coordinated by Energie-Cities Association, France. To overcome market barriers to deep energy efficient retrofits by developing & rolling out integrated EE service packages. The scope is 11 targeted territories in 10 EU member states.	The integrated EE package to include: • Development of products adopted to consumer concerns • Marketing & communication • Independent advice & technical assistance • Tailor-made financial advice • Coordination of chain of suppliers / contractors • Ensuring high quality standards • Long term & affordable financing
LEMON http://www.lemon-project.eu/	The LEMON project is for providing technical assistance to public & private entities in the preparation of tenders for retrofitting 622 social housing units. It is focused on the Reggio Emilia & Parma regions of Italy. Lemon Project also supplements loans & incentives for energy efficiency	The project ran from Feb 2016 until May 2018 and was split into 4 phases Phase 1: preliminary research, energy audits, focus groups, etc

	improvements & also applies new contractual instruments to govern relations between tenants, residence owners, energy suppliers & ESCOs. The project is made up of the public Authorities of Parma & Reggio Emilia, AESS (non-profit organisation), ART-ER (research consortium). Their Mission • To experiment innovative financing models • To implement EE projects in 622 dwellings within the 'maximum impact' category segment of the housing stock. • To develop a new 'energy performance tenancy agreement'	Phase 2: EPC tender development & set up of financial instruments Phase 3: Publish the tenders & award/sign contracts with ESCO's Phase 4: Capacity building, evaluation & LEMON monitoring.
GuarantEE https://guarantee-project.eu/	GuarantEE is a project aimed at developing innovative business and financing models for performance based ESCO projects. The goal is to test solutions that share costs and benefits between users, building owners and ESCOs i.e. Triple-win approach. The project will test the innovative energy service models in pilot projects where the building owners will receive support from experienced EPC facilitators. The consortium is made up of 14 different members, mainly from energy agencies but also ESCO consultancy and public institutions. The project has several relevant publish deliverables	The report on the European EPC market was a market analysis based on a survey with 256 participants. The two main conclusions were; 1. It shows a huge potential for cost savings through EPC projects in Europe. 2. Half respondents indicated they prefer investing in energy efficiency measures on their own capital funds and their own technical risk instead of outsourcing them to an external energy service company.

	including D2.2 – report on the European EPC Market and D2.5 triple-win-solutions for the split-incentive-dilemma.	

3.4 Market Trends

To understand the trends that may affect the retrofit market we must not only look at the activities of industry players but also the wider market, social and political trends. Environmental and green issues are becoming more prominent both politically and socially, throughout the world and in Ireland. This prominence is evident in social media and popular culture, TrendWatching 2020 identified 'Green Pressure' as the most important trend of 2020. The trends report claims that consumers are moving from eco-status to eco-shame. These changing social attitudes will doubtlessly filter through to the retrofit market.

Energy Efficiency Market Report by IEA 2019.

The Annual Energy Efficiency market report from the International Energy Agency, outlines trends relevant to the retrofit market in Ireland. The report tracks the effects of energy efficiency improvements in the residential sector by trends in residential space heating intensity i.e. energy consumption per floor area. In the 2019 report, it highlights the trend of a significant decrease in most IEA countries. For example, France, Germany and the United Kingdom have experienced reductions of over 30% since 2000. The report has a section dedicated to key trends in each IEA member country. The data collected for the residential sector covers 2000 – 2017.

	Residential consumption (PJ)	Share of fossil fuels* in space heating (%)	Population (million)	Consumption per capita (GJ/pers)	Average dwelling surface (m²)	Average dwelling occupancy (pers/dw)
2000	104	95	4	27	107	3.1
2017	109	93	5	23	121	2.7

Figure 9 Key Markey Changes in Ireland 2000 to 2017

There are a number of obvious trends identified; overall residential consumption has increased slightly. This could be a result of an increase in population. Share of energy from fossil fuels for space heating has only reduced from 95% to 93%. The consumption per capita has also reduced quite significantly from 27GJ/ person to 23 GJ/person. The average dwelling size has increased from 107 to 121 m^2 and the average dwelling occupancy has decreased from 3.1 persons per dwelling to 2.7 persons per dwelling.

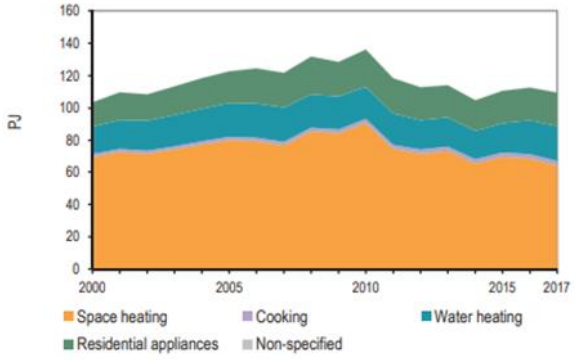

Figure 10 Shows the trend in Ireland was an overall increase in residential energy consumption up until 2010 and then it has been decreasing since then. This could be due to many factors, including, weather, policies & energy efficiency improvements amongst others.

Figure 10 residential energy consumption by end use

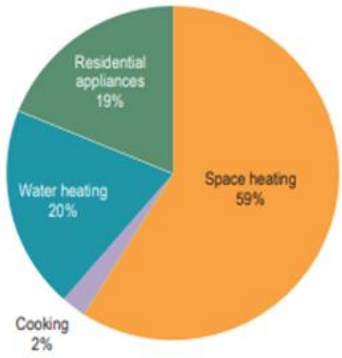

Figure 11 shows that by far the largest energy consuming activity in the residential sector is space heating with 59% of final energy consumption.

Figure 11 Residential Energy Consumption by End Use 2017

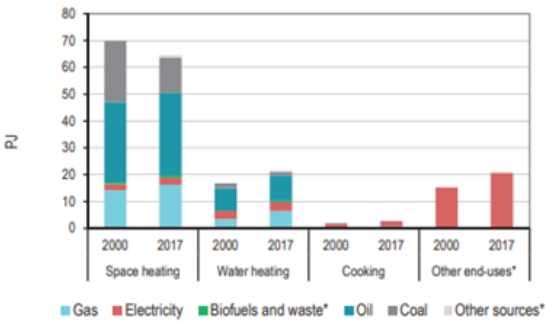

Figure 12 shows residential energy consumption by source and highlights three major changes:

1. A decrease in the use of coal for space heating.

2. An increase in the use of Gas for water heating.

3. An increase in the use of electricity for 'other end uses.

Figure 12 Residential Energy Consumption by Source

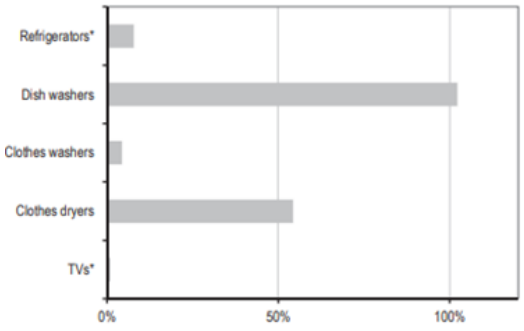

Figure 13 Shows the appliances per dwelling. A large change in adoption of dish washers and clothes dryers with a moderate – small increase in refrigerators and clothes washers.

Figure 13 Appliances per Dwelling, 2000-17 % change

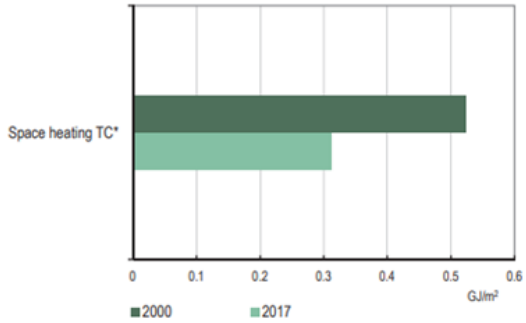

Figure 14 The energy intensities by end use per floor area shows large decrease in intensity for space heating from over 0.5 GJ/ m^2 to just over 0.3GJ/ m^2.

Figure 14 Energy Intensities by End Use per Floor Area

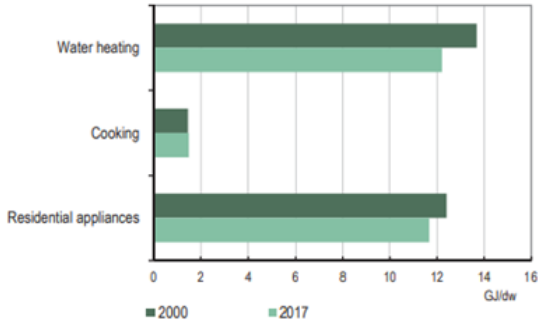

Figure 15 The energy intensities by end use per dwelling show no change in cooking and slight decreases in intensities for water heating and residential appliances.

Figure 15 Energy Intensities by End Use per Dwelling

Summary

There is a clear trend within the Irish market towards improving energy efficiency in the residential sector, the most significant impact on energy efficiency has been improvements in

space heating. It is significant that this improvement has taken place in the context of significant population growth, decreasing household size and larger average dwelling sizes.

Market Failures

The private rented sector remains a persistent area of market failure for deep retrofit. The split incentive remains a long-standing challenge for developing this market sector, both in Ireland and other European jurisdictions. Energy upgrades are clearly beneficial to tenants, but landlords have little incentive, either financial or legal to undertake deep retrofit. Whilst the private rental housing market is over heated and in the absence of financial incentives and/or regulatory imperative, this situation is unlikely to change. Innovative measures have been adapted in other jurisdictions to address this challenge including minimum energy efficiency standards for private rental properties and energy inclusive rents.

Finance is a major area of market failure for both private rented and owner occupiers. There is a high capital investment with retrofit projects. Even considering the payback from energy savings, the initial capital outlay is beyond the financial resources of many owner occupiers. This is specifically pertinent in Ireland where the legacy of lending has led to tighter restrictions on loans and higher interest rates (Brennan, 2019).

The erratic start/stop nature of government programmes was also identified as a factor in market failure by an expert stakeholder. The role of government programmes is to promote the expansion and increase the rate of retrofit market. Contractors must be able to expand their capacity and invest confidently in their growth. The short-term nature of government programmes (which are replaced after a couple of years) makes it extremely difficult for contractors to realistically plan a scale up of their operation. More market certainty over these government programmes is essential, many similar programmes examples in Europe of countries running 5+ year programmes, (see below political trends 3.5).

3.5 Political Trends

Political and financial intervention by government is essential for developing deep retrofit - Deep renovation is an expensive process. Costs must be set aside for a wide range of activities including improving the building envelope through insulation upgrades and eliminating drafts and air leakage. The Installation of renewable technology such as PV panels or Heat Pumps is also expensive. In addition, there is often a requirement to replace heating systems, radiators, piping & water storage. The average costs often range from 25,000 to 75,000 Euro depending on the level of works required ("What is Deep Retrofit? - Superhomes", 2020). Due to the expensive nature of the process, governmental financial intervention has been essential to the expansion of the market to date. Currently, costs can be offset by grants and subsidies offered by SEAI at the time of planning. The deep retrofit will see savings in energy bills of 50-70%. The grants and subsidies are essential in attracting customers and significantly reducing the payback periods.

Moving forward, Ireland along with other EU member states has committed to tackling climate change. The 2030 Climate & Energy Framework includes the targets and policy objectives for the EU28 between 2021 & 2030. The key targets are:

1. Reduce greenhouse gas emissions by at least 40% (from 1990 levels).

2. Have at least 32% of the energy share from renewable energy
3. Have at least 32.5% improvement in energy efficiency.

These key targets by the EU are good news for the SuperHomes offer as they will help to emphasise sustainability, environmental improvements and policies geared towards promoting initiatives such as SuperHomes.

Currently within Europe, buildings are responsible for 40% of all energy use and 36% of carbon emissions. We also spend 90% of our time in buildings ("New rules for greener and smarter buildings will increase quality of life for all Europeans", 2019). This is a significant portion of our energy use and carbon emissions and given that quite a large portion of our buildings are energy inefficient then it represents a great opportunity for improvement. The impact of renovation however does not stop at contributing to the climate commitments of the EU, renovation is also attributed to lower energy bills, improved health and comfort.

Energy Efficiency Directive

The energy efficiency directive is another key political driver, setting out measures to help the EU reach its goal of 20% energy efficiency by 2020. The directive is binding to all EU countries and requires them to act on improving their efficiency in energy use in all parts of the energy chain. In relation to the EED several important measures were adopted to help improve the energy efficiency in Europe including; reducing national energy sales by 1.5%, make energy efficiency renovation to at least 3% per year of governmental buildings, produce long-term renovation strategies for the building stock in each EU country, mandatory energy efficiency certificates, national energy efficiency action plans every three years, minimum energy efficiency standards and labelling, planned roll out of 200 million smart meters, obligation scheme to energy companies to achieve yearly savings of 1.5%, large companies obliged to conduct energy audits every 4 years, protecting the rights of consumers to receive easy and free access to data on real-time and historical consumption.

In 2018, as part of the ‘clean energy for all Europeans package’, the energy directive was amended to upgrade the policy framework or 2030 and beyond. The amended directive includes a new energy efficiency target or 2030 of at least 32.5% to be achieved collectively across the EU. The target takes account of the withdrawal of the UK from the EU. The amendment also includes a possible revision for more a more ambitious target if substantial cost reductions in economic or technological developments are achieved. It includes an extension to the energy obligation scheme, and it includes new energy savings for individual EU countries of 0.8% per year of final energy consumption for the 2021-2030 period. Malta and Cyprus are both exempt from the 0.8% target and instead have a 0.24% target.

The European Green Deal is the newest package the EU will roll out to combat climate change. It will have energy efficiency measures included which will certainly have more ambitious aims. The European Green Deal is discussed in more detail later in this report.

Long term renovation strategies

As part of the 2030 climate & energy framework, each member state must adopt national energy & climate plans and provide national long-term strategies. These must be consistently linked together. By reviewing these commitments, it is possible to identify trends within Europe.

This report has chosen specific countries in the EU who share similarities with Ireland either by demographics or housing profiles.

Ireland

Ireland has released its Long-Term Renovation Strategy (LTRS) for 2020 as of the 8th October 2020. The LTRS is the product of governments commitments to renovation set out in the programme for government, which is summarised below:

The programme for government acknowledges that the retrofitting programme is not only to improve the energy bills of its citizens but also reduce emissions and to deliver an economic stimulus to the economy. The National Retrofitting Plan is to be published as part of the National Economic Plan. It will commit to developing an area-based one-stop-shop approach to retrofitting with an eye on retrofitting 500,000 homes to B2 Energy rating by 2030. Homes will be grouped together to lower cost. Leverage smart finance, it mentions loan guarantee, European investment bank and strategic banking corporation of Ireland. As part of the plan, the government commits to developing an easy pay back mechanism such as through energy bills. It also commits to ensuring economies of scale and employment generation through combing homes in specific area-based schemes.

Actions taken to deliver the commitments include the designation of a National Retrofitting Delivery Body by the end of 2020.

- Use resources from the National Recovery Fund to finance local authority retrofit programmes & offer grants to private homeowners with immediate focus on the midlands where dependence on fossil fuels is greatest.
- As early as 2021 to commence pilot schemes to test the key elements of the national plan to roll out the full National Retrofitting Scheme.
- Commence a significant effort to upskill existing work force to meet the capacity needs of the retrofit programme & overhaul existing apprenticeships, traineeships, and education programmes in the short term.
- Develop funding options to deliver retrofitting with suitable retailers in conjunction with Strategic Banking Corporation of Ireland.
- Establish a loan guarantee scheme to support access to finance.
- Increase the targets of the Energy Obligation Scheme in order the boost the rate of retrofits specifically for domestic homes and those in energy poverty.
- Increase the number of homes and businesses with Building Energy Ratings and Display Energy Certificates.

The programme for government claims that the plan will grow the existing retrofit industry ten-fold, with many opportunities for the SME sector and provide confidence in the market for enterprises to scale up capacity.

A goal set out in the program is to make Ireland a leader in retrofitting using innovative ways to roll out the retrofitting programme. Including.

- Developing standard designs available for all property types.
- Automating and digitising construction through design tools and digital scanning of properties.
- Investing in research and development to improve products and materials.
- Centralising procurement and quality assurance.

- Using pre-assembled materials.

Other goals set out in the programme include,

- A target programme to install 600,000 heat pumps 2030
- Establish regularity environment for district heating.
- Actions to drive energy efficiency upgrades in rented properties and commercial building stock.
- Publish a new public sector decarbonisation strategy or 2030. With a public sector decarbonisation target of at least 50%.

The programme for governments' chapter on retrofitting is good news for SuperHomes, it aligns many of the goals of TEA into the programme and mentions measures to alleviate the primary barriers to scale up such as market certainty and upskilling.

Austria

In Austria there are generally two sets of subsidies available. One is provided by the provincial government and the other is a federal subsidy. The provincial subsidies all have many of the same prerequisites & conditions, but some provinces mention some nuanced differences. The common principles are for both new-build & renovation projects, 'sliding scale' subsidies based on energy indicators achieved through the works, innovative and climate friendly heating systems. All the provincial subsides lie between 15 and 30% of the overall cost of renovation.

Measure	Basic amount (€)	possible head (€)
Hot water heat pumps	300	600
Thermal solar system for hot water heating	700	1.100
Heating heat pumps (earth or water heat pump)	1.400	2.200
Heating heat pumps (air heat pumps)	1.400	2.200
Heating heat pumps (hybrid and bivalently operated heat pumps)	700	1.300
Thermal solar system for heating support	1.200	1.800
House central heating via biomass	1.400	2.200
Other systems to cover space heat requirements based on renewable energy	400	1.300
District heating connections	1.400	2.000
Comfort ventilation (mechanically controlled ventilation of the living room with heat recovery)	800	1.400
Rain or well water utilization systems	800	1.000
Measures to increase the efficiency of existing biomass plants	300	400

Figure 16 Subsidy/Grant offer in Austria

The Burgenland Residential Building Subsidies Act (for the province of Burgenland) has an additional precondition that ecological building materials must be used (this is not mentioned in other provinces' guidelines). The province offers free energy consultation to any citizen who wants it. There is also a specific separate grant for technology purpose, the amount in principle is 30% of the costs but Figure 16 gives a more detailed look at the subsidy offer.

The Carinthia Residential Building subsidies have on-site energy consultation as a precondition for the grant. The provincial scheme also pays out additional investment grans in bi-annual instalments (for 10 years) specifically for when renewable energy supply is included in the retrofit.

Lower Austria Residential Building Subsidy System. The system follows all the common pre-requisites and base their subsidy on heat energy demand, use of heating and hot water systems, use of renewable energy sources and use of ecological building materials. Between 2012 and 2016 the province carried out 30,000 renovations. The system offers free energy consultation, the province hires 80 fulltime consultants for this job. There is also a special 'interest subsidy' in relation to a bank loan taken out by a municipality or associated company when the works are related to 'infrastructural construction'.

Upper Austria offer three different payment methods of their subsidies; 1. Annuity Grans to a bank loan (15-25 years). 2. Annuity grants to mortgage (30 years). 3. One-off payment. The annuity grants have a sliding scale from 25% for a standard of 75 kWh/m^2 to 40% for 15 kWh/m^2. The one-off payment option is between 12% -24% of renovation cost.

Salzburg have a lower rate offered at 20% of overall renovation costs but they do offer an interest free loan. To achieve the maximum 20%, the renovation must over 25% of the building envelope.

Styria 'Deep energy renovation' is an initiate for the province of Styria. Styria already has more advanced energy related policies than the other provinces; There is already compulsory use of solar energy for supply of hot water, a ban on fossil fuels for heating purposes and a ban on the use of direct electrical heating. The upper limit prerequisite is 75kWh/ m^2 for surface to volume of 0.8 and 35kWh/m^2 for surface to volume of 0.2. The two options are either a 30% annuity subsidy for a bank loan on a 14-year term or a one-off payment of 15% up to a maximum of 30,000 Euros.

Both provinces have Tyrol and Voralberg have no distinctively different preconditions or offers.

Vienna offers between 25-160 Euro per m^2 depending on the indicators achieved with an additional 60 Euro per m^2 if passive house standard is achieved. It is limited to 30% of the renovation costs.

The Federal Government also offer a subsidy called the Federal Renovation Cheque. This federal bonus is up to 8,000 Euro as a one-off payment. The subsidy amount of 30% of the eligible costs with a maximum of 8,000 for a detached home and 3,000 for an apartment. There is also a 1,000 Euro bonus supplement for use of renewable raw materials.

United Kingdom

The United Kingdom has over 28 million homes of which a significant proportion are older buildings 19% built between 1945-1964, 16% built between 1919-1944 and 21% built before 1919. 20% of buildings were built between 1965-1980 which mean sonly 24% of buildings have been built since 1981. This makes the UK's building stock one of the oldest in Europe. We know then that the vast majority of the housing stock in the UK was built before the introduction of energy efficiency building standards and so we can safely assume that at majority of the housing stock is in need of energy efficiency renovation. Collectively the housing stock in the

UK is responsible for 29% of final energy consumption in the UK. The UK began large scale renovation projects in 2002 with the Energy Supplier Obligations which to date have delivered 7million loft insulation, 6 million cavity wall insulations, 300 thousand solid wall insulations and over 1 million boiler replacements per year with a required A rated boiler. This overhaul of the building stock has achieved an EPC rating of D or higher for 78% of the building stock compared with 30% before the Energy Supplier Obligations in 2001. The greatest energy improvements have been seen in housing association and local authority building stock.

The UK employ a wide range of policy measures to reach their renovation commitments.

The Public Sector Energy Efficiency Loans Scheme is an interest-free loan to support public sector bodies in England to carry out energy efficiency projects. Salix Finance Ltd oversee managing the scheme where the scheme is revolving i.e. the loan repayments are reinvested in further loans.

RE:Fit is a procurement initiative meant for public bodies wishing to implement either energy efficiency or energy generation measures. It is a framework that uses energy performance contracting. Use of the framework is growing across England and Wales so far 165 million Pounds of works have been procured through the initiative for more than 700 buildings.

The Products Policy is to ensure that energy using products meet minimum performance standards and provide information for consumers for more informed purchases. This is in accordance with the energy labelling directive and is mentioned as part of the UK's long-term renovation strategy.

The green government commitment is a set of targets for the UK government departments and agencies to reduce their emissions by at least 32% from 2010 level by 2020. The commitment also set outs for departments to improve sustainable procurement and report transparently on sustainability issues.

Climate Change Levy was introduced in 2001. Is levied on the supply of energy to business and public sector consumers. Each of the commodities has its own rate per unit of energy (Electricity, gas, coal and liquified petroleum gas). The intention is to change business behaviour to reduce energy consumption and ensure the UK fulfils its EU obligations under the Energy Tax Directive. The CCA or Climate Change Agreements were introduced alongside the CC. They have the aims of mitigating the impact of the CCL on energy intensive industry as well as delivering energy efficiency improvements at least equivalent to the savings that would have been saved had the sector was required to pay the full rates of the CCL. The CCAs are voluntary which give the eligible parties a discount on the rate of CCL in exchange for agreeing to energy efficiency targets.

The CRC energy efficiency scheme is designed to over the energy that is not already included in the climate change agreements or the EU emission trading system. Some public bodies are mandated participants to the scheme which include all UK central government departments and devolved administrations. The organisations affected must collect and report information about their energy supplies, buy and surrender allowances equivalent to the CO2 emissions generated, inform the environment agency about any organisational changes that may affect its registration of the CRC and also keep records about its energy supplies.

The Energy Savings Opportunity Scheme is a mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. It is administrated by the Environment Agency; obligated organisations must carry out assessments at least every 4 years. This include energy audits of the energy used by their buildings, industrial processes, and transport. The aim is to identify cost-effective energy saving measures.

The government put in place licence conditions requiring energy suppliers to take all reasonable steps to roll out smart meters to all domestic properties and smaller non-domestic premises in Great Britain by the end of 2020. Energy suppliers are required to provide energy saving advice as part of the installation. Energy networks will then have more information to manage and plan activities.

The Carbon Trust originally set up and funded by the UK government and now a self-financing private company promotes its own carbon trust standard to businesses. To obtain the carbon trust standard requires the measurement, reduction and management of energy use and emissions.

The energy company obligation came in January 2013 and replaced its predecessors, the Carbon Emission Reduction Target, and Community Energy Saving Programme. It requires domestic energy suppliers over a certain size to achieve carbon and notional bill savings by promoting and installing energy efficiency measures into domestic homes. As of the 2015 spending review, it was announced that ECO would be replace with a new cheaper scheme that aimed to deliver the government's commitment to insulate one million homes between 2015 and 2020 in support of its commitment to tackle fuel poverty.

Private rented sector regulations from 2018 are required to have a minimum energy performance rating of E on their EPC. Meaning it will be unlawful to rent a property which breaches the requirement of a minimum E rating.

The Netherlands

Netherlands cost effective approaches, policies & 'low-performing buildings' specific measures.

With a major renovation, the strategy makes a mandatory standard of insulation of envelope parts to be Rc = 2.5-3.5 m^2 K/W & HR++ glazing. As both measures are highlighted as cost effective. A renovation is considered major is 25% or more of the surface of the building envelope undergoes renovation. For 'non-major' renovation, requirements in place since 2015 say that measures that have a 'clear effect on energy performance' must be implemented. For example, if changing a window, a better performing window & frame must be chosen than the previous.

Netherlands has a lower VAT rate for labour costs of insulating floors, walls, and roofs that are more than 2 years old. This is 9%, down from 21%.

The 'Energy Saving Explorer' was set up. It is an online tool that allows homeowners to calculate costs & benefits of energy saving measures within their homes. The tool also provides access to advice about envelope improvements/ heating alternatives, etc. Additionally, a government website was created to show homeowners some examples of projects that will be carried out in the coming years.

An expansion of mortgage rules to allow people to borrow more for renovation investment. It is scaled so that better performing renovations get better conditions, i.e. 'sums left out of LTV equation.'

The 'renovation accelerator' is a fund set up for housing associations to help reach the demand for hybrid heat pumps, insulation & other measures. Between now & 2024, 130 million Euro will be made available for the scheme.

Tackling the worst performing buildings in the Netherlands can be divided into office buildings and dwellings. Offices must have the 'C' energy label as a minimum by 2023. Split incentives in the residential sector will be addressed by amending the laws on renting. To prevent market failures the Dutch government involves all stakeholders intensively in the transformation of buildings, by means of the district-oriented approach and well organised participation. Energy poverty will be combated by a housing cost-neutral approach to the transformation: after renovation tenants must not be worse off on balance than before, while for home owners the goal is for monthly costs of servicing the sustainability loan not to exceed the associated savings in energy costs.

As well as specific measures aimed at promoting investments by private homeowners and housing associations, the Government is also bringing various generic financial and tax instruments into play so as to promote the investment climate for sustainability improvements. These are partly aimed at businesses, partly at private homeowners and partly at all building owners. The most important measures are:

- Adaptation of energy tax on gas and electricity (all building owners)

  This is a change in energy taxation that basically means higher taxes on gas and lower taxes on electricity.

- Sustainable Energy Investment Subsidy (ISDE) (businesses and private individuals)

  Ear marked for the installation of heat pumps & also recently, insulation – the fund is worth 100 million euro per year until 2030.

- Own Home Energy Saving Subsidy (private individuals)

  To help owner-occupants in the short with making their homes sustainable, a total of €90 million is available for 2019 and 2020 through the Own Home Energy Saving Subsidy (SEEH)

- VAT refund and PV offset scheme (businesses and private individuals)

Refunding VAT on the acquisition of PV & making the supply of electricity attractive through and offset scheme.

- Reduced VAT rate (businesses and private individuals)

A reduced VAT rate applies to installing insulation material and (insulation) glazing. The VAT rate is reduced from 21% to 6%.

- Energy saving measures programme (private individuals)

With small measures such as better settings for the heating installation and the application of radiator foil, substantial savings on the energy bill can be made for very little outlay and CO2 emissions directly reduced. Therefore, a start has been made with the Energy Saving Measures Programme in cooperation with municipalities and market actors. For this €93 million is available.

- Exemption from energy tax for self-generated energy for energy cooperatives (private individuals)

Members of energy cooperatives (groups of private individuals) do not have to pay tax in the first bracket of the energy tax for the portion of the collectively generated renewable electricity allocated to them. We are also looking into whether a development facility can be set up with which energy cooperatives can finance development cost

Energy saving loans and sustainability loads are also available. A total of 600 million euro is made available (with interest and repayments going back into the fund) to be loaned out to private homeowners, apartments associations and schools. The loans a described as having favourable terms.

Cyprus

Cyprus has a relatively new housing stock with most buildings constructed after 1980. However, most homes are still low to medium performance rating as most were constructed before the introduction of policy measures to control efficiency standards. 91% of homes in Cyprus already have solar water heaters installed for water heating.

The Cypriot plan to stimulate cost effective deep renovations can be broken down into 4 methods. Legislative measures, incentives, training measures & information measures/

Legislative measures: As of January 1st, 2017, all buildings undergoing major renovation must be classified as energy efficiency class B (minimum level).

Cyprus's latest incentive programme is called 'save & upgrade'. The programme has a budget of 16.5 million Euros for households & is co-financed by the European union's cohesion fund. As opposed to grants being handed out to individual intervention measures, the grants are awarded based on the whole building upgrade to a minim energy efficiency level (B) with higher grants being awards to NZEBs. Vulnerable consumers may be granted higher aid and may also take advantage of aid for individual intervention measures if necessary.

Training measures are considered a fundamental measure to promote deep renovation in Cyprus. Training programmes are organised in Cyprus by a co-operation between the Cyprus energy agency, Frederick University, University of Cyprus, Cyprus Scientific and Technical Chamber. They are intended to help train architects, engineers, energy assessors, contractors, etc through workshops, courses, and laboratories. This is considering many of the current professionals did not receive any form of formal energy saving training whilst they were in study. Now, the ministry of energy in Cyprus is trying in partnership with the universities to introduce more training and courses for the future professionals in construction. Finally, the government also offer an apprenticeship programme that has apprentices trained with the skills for energy efficiency performance improvement specifically for the construction industry.

There has been an increase in the vernal awareness of energy savings measures across the general public of Cyprus through legislative measures and incentives, however it is still not the vast majority of people. The energy performance certificates are other ways of disseminating the information to the population however, these only are issued upon the sale, rental, or renovation of a property. The Cypriot government have started an energy performance information campaign to increase the availability of knowledge and promote the uptake of energy saving intervention measures.

Slovenia

Slovenia have produced a document in accordance with the requirements of article 4 of the energy efficiency directive named 'long term strategy for stimulating investment into energy renovation of buildings. The document is concerning both private and public buildings. The supplement document is published in English which includes a summary table for the directions for residential buildings.

Financial incentives for energy efficient renovation and sustainable construction of residential buildings (subsidies and grants, demonstration projects): Demonstration projects on comprehensive renovation of multi-apartment buildings according to the almost zero-energy renovation criteria, as planned in the OP ECP, with emphasis on the use of new technologies and by employing energy performance contracting, are placed on the list of priority tasks of the Ministry of Infrastructure. The basis is the revised interest of municipalities to implement demonstration projects on energy renovation of multi-apartment buildings (in accordance with sustainable town planning strategies of city municipalities

Assistance scheme for energy renovation for vulnerable population groups: It is proposed to upgrade the financing model and additional measures for energy renovation of buildings for socially weak residents. It is reasonable to assess the implementation of an additional model for differentiation of owners according to their household social and financial situation, and to assess the reasonableness of introducing an appropriate partial adjustment on the amount of co-financing. This measure is to remedy barriers of difficulties with renovation financing by those households that live on the poverty threshold but do not have the status as…

Advisory energy network for residents: - The ENSVET is to expand its activities towards better information accessibility of residents (one of the activities is to establish mobile information points to operate in larger shopping centres). - Within existing offices, the ENSVET is to expand its activities and upgrade its consultation services by offering new services (for example field inspection, communication with supervisors and project designers, etc.).

Financing instruments for renovation of buildings of many owners: Instruments: Business banks currently do not utilize the potential of projects on energy renovation of residential building because most are not aware of the opportunities of such projects. Considering the foreign market, a gap in the field of new products and financing solutions is noticeable. It is reasonable to include business banks in the process of creating together the financial products in accordance with the identified market needs. It is also necessary to provide adequate awareness and training. Current legal basis for decision-making process in multi-apartment buildings: The Action Plan for the Resolution on national housing programme plans measures for providing legal basis for decision-making process in multi-apartment buildings. The

ministries responsible for justice, finance and for carrying out projects on renovation of multi-apartment building.

Allocation of incentives between owners and renters in multi-apartment buildings: The problem of having an appropriate approach to determine non-profit rent is also stated in the Resolution on national apartment programme (2015) which plans for changing the rent model in the future.

Setting-up a guarantee scheme: The proposal is to establish a scheme (Chapter 3.1.1).

Finland

The finish housing stock can be split into house types: Single family & semi-detached home make up 1.2 million units of which only 6% are have 'low energy efficiency rating;'. Homes built in the 1960's have an average of 240kWh/ m^2 and by the 2010's the average has been improved to 85kWh/ m^2.

Terraces housing makes up 0.4 million united with only 4% having 'low energy efficiency rating.' The buildings constructed in the 1960's have an average rating of 195kWh/ m^2 and by 2010's it has improved to 100kWh/ m^2.

Blocks of Flats contain 1.4 million dwelling units of which 10% are considered to have 'low energy efficiency rating.' They were mostly bult in the 1970's. Flats built in the 1960's has an average of 190kWh/ m^2. The 2010's seen the average improve to 85 kWh/ m^2.

Finland are using a broad collection of actions and policies that make up their long-term renovation strategy.

- Binding legislation
- Energy efficiency agreements
- Energy & renovation subsidies
- Undergraduate education & further education
- Dissemination of information

The renovation cost effective measures highlighted by the finish government are:

- Structural energy efficiency in renovation projects
- Improving energy efficiency during the renovation of culturally & historically valuable buildings
- Functional renovation strategy in terms of humidity
- Adding thermal insulation to buildings
- Repairing windows & doors, guidelines for modification projects
- Exhaust air heat pumps in district heat systems
- Policies & Actions promoting the measures

Binding legislation:

- Renovation energy efficiency requirements - when a renovation is taking place certain standards on building envelope & technical systems must be followed.
- Mandatory energy performance certificates
- Limited liabilities housing companies Act 2009 obligates all companies to prepare a 5 year plan on future repairs

Enabling legislation:

- Tools made available for systematic property development. The responsibility on the owner to use the available tools and make the appropriate decisions.
- Suggestions for promoting far-sighted property management.
- Worst performing segments of the housing stock, specifically housing in categories F&G will be eligible for a subsidy to be made available between 2020 & 2022.

The strategy includes a section on the split incentive dilemma. The general rule in Finland is heating to be included in rent and invoicing of actual consumption of warm water. Tenants then generally pay their own electricity bills. The plan includes a 'green lease' & 'light green lease' template which is developed so that the investments costs in lighting systems & technology can be split fairly between landlord & tenant.

The renovation strategy contains a section on market failures. The strategy claims that typically renovation projects are funded by own financing or market-based loans in Finland. The main market failure in Finland is a lack of competent workforce 'design engineers' for energy efficiency renovation projects.

Political Trends in Ireland

Within democratic systems it is possible to see the trend of the public through the manifestos of their biggest political parties. A well-functioning party will mimic the wishes of their voters within their election manifesto. In the last election in Ireland in 2020 three standout parties shared the vote. The two stalwarts of Irish politics Fianna Fáil and Fine Gael both maintained large vote shares at 22.2% and 20.9% respectively and always on the fringe party Sinn Féin surprised many by winning the vote share with 24.5%. The 4th party on vote share was the Green Party with 7.1% of votes. This is significant as together these parties make up 74.7% of the vote share. Despite the parties diverging in many areas of their manifesto we can see trends related to 'green' issues that all parties share in similarities, and as so we can say that these similarities in green policy are mimicking the wishes of the vast majority of the Irish population. 'The climate policy agenda has tended to focus on energy, on which there has been an absence of significant differences.' (Ladrech & Little, 2019)

Political Trends in Europe

Climate change has been used as a political football since the 70's when activism around environmental issues became more popular and managed to seep into the political sphere. We can look abroad to the USA where opinions on climate change are deeply polarised with many republicans opting to promote climate change denial campaigns and many democrats opting to promote sustainability. This polarisation does also exist in Europe, albeit to a lesser extent. We see an ever-growing divide in Europe in terms of political agenda, two stark divides we see emerging are the divides between western and eastern nation and the divides between northern and southern nations. Despite having a history of being a world leader in climate policy, the European Union is seeing conflicting interests damaging the united front against climate change. Some states rely more heavily on coal than others, and industrial lobbies raise issues around global competitiveness and job retention. The rise of populism across Europe has also not aided, with populists often latching on to the counter argument of anything to gain attention or lay the groundwork for building political support. It is promising however that the European

Union is still seen to be prioritising the climate and is taking action to address the concerns of those set to lose out from the energy transition. The most recent battle cry of the European Union is the European Green Deal.

The European Green Deal launched by the new EU commissioner Ursula Von Der Leyen is an ambitious set of policy initiatives with the aim of making Europe the first climate neutral continent by 2050. The policy areas the green deal covers include clean energy, sustainable industry, building, renovation, agriculture, eliminating pollution, sustainable mobility, and biodiversity. The deal itself supersedes previous climate commitments due to its increased ambition and is in its nature a seismic shift of economic focus for the entire EU.

The full details of the plan are still being realised. So far, we have seen the overview presented on the 11th of December 2019. By the 14th of January 2020 we see the presentation of the European Green Deal investment plan and the Just transition Mechanism. The investment plan is designed to mobilise both public and private investments that are needed for the energy transition. To summarise the plan, it aims to mobilise 1 trillion euro of sustainable investments over the next 10 years, provide tools for investors by 'putting sustainable finance at the heart o the financial system', facilitate green investment from public authorities by encouraging green budgeting and procurement, practical support to public authorities and projects from planning, designing and executing sustainable projects.

The just transition mechanism is a key pillar of the European Green Deal. So that no one gets 'left behind', the JTM is a key tool to ensure the transition is fair to everyone. It aims to provide support to help raise at least 150 billion euros from 2021 to 2027 in the regions most effected by the transition. The money is available to the regions that are carbon intensive or have large sectors of the community working with fossil fuels. It will help individuals by facilitating new employment opportunities, re-skilling opportunities, improving energy efficient housing, facilitating access to clean and affordable energy, and addressing the issue of energy poverty. It will help companies by supporting transition to meet low carbon technology needs, creating attractive conditions for investors, providing easier access to loans, investing in new SMES/ start-ups and also investing in the research and innovation activities that drive the transition. It will help specific states/regions by supporting the transition to climate friendly activities, creating new jobs in the green economy, investing in public transport, providing technical assistance, investing in renewable energy sources, improving digital connectivity, providing loans and improving energy infrastructure.

The 4th of March 20202 seen a proposal for a European Climate Law. The aim of this is to turn the political commitment into legal obligation. Other individual elements of the deal have also been announced such as the European industrial strategy, circular economy action plan, farm to fork strategy, EU biodiversity strategy 2030, EU strategies for energy system integration and hydrogen and most recently the 2030 climate target plan.

The most relevant plan to come from the green deal to the retrofit market in Ireland is the 'renovation wave'. This plan aims to refurbish and improve European building stock for clean energy systems and decarbonised buildings. The commission launched the public consultation on the plan on 11th of June 2020 and is publish the strategy in October 2020. What we know about the plan so far is that it will address the current low rate of renovation (around 1% across Europe). The plan highlights renovation not only as an obligation to meet the ambitions of the climate plan but also as a major opportunity for economic growth as part of the shift towards a

green focused economy. So, we expect the plan to include measures to boost jobs in the construction sector and upskilling plans to grow the capacity of the sector. We know the 'renovation wave' will build on the previously agreed measures in the clean energy for all package – where countries were committed to publishing long-term renovation strategies.

3.6 Financing Trends

One of the greatest barriers to deep retrofit is finance. There is a clear need for government to support retrofit initiative through grants and subsidies to make the renovation affordable and attractive to customers. Funding retrofit programmes is consistent with government commitments under the energy efficiency direction and their climate targets.

Current grants and subsidies available in Ireland often fall short of making the deep renovation project an attractive option for the homeowner, particularly those on lower incomes. The option for homeowners of financing a deep retrofit through a bank loan exists but the conditions are unfavourable.

There is a need to develop innovative financing mechanisms to make deep renovation projects financially feasible for larger sections of the population. A number of innovative financing mechanisms are currently being piloted; these will potentially impact on trends in financing. Other factors are affecting trends such as the looming economic recession and the possibility of financial stimulus.

Financing in Ireland Today

Today in Ireland there are grants provided by SEAI and the shortfall in capital cost must be made up via personal savings or loans. Currently, there are few dedicated loan schemes for energy efficiency improvements. The best loan available is the 'An Post Green Hub.' The loan is available for amounts between 20,000-75,000 Euros. The loan term is 10 years with an APR 'as low as' 4.9%. Combined with the loan is a 'one-stop-shop' service. This is the pledge to 'manage' the home energy upgrade for customer. This management is actually is carried out by Airtricity whom are in partnership with An Post. There is an option however for the customer to manage the process themselves. For those opting for a loan with management support this includes; Assessment of needs, applications for grants, provision of loan, and includes a designated project manager to perform works and final assessment and to ensure works completed (An Post, 2020).

Within the mortgage market, several providers offer green mortgages. Whilst green mortgages are becoming more popular, they are more often used for new purchase homes or new build homes. Green mortgages offer a discount on interest rate on the standard mortgage with different banks offering slightly different terms to the deal. With Allied Irish Banks, Bank Of Ireland and Ulster Bank all offering variations of the mortgage (Weston, 2020).

Current Grants and Subsidies

SEAI – Sustainable Energy Authority Ireland are the organisation charged with distributing the grants to homeowners. They provide a comprehensive range of grants and subsidies across the spectrum to meet energy saving needs. The current grans and subsides available are;

1. Insulation grant – the insulation grant is given at different values to different types of insulation needed. Attic insulation, €400. Cavity wall insulation, €400. Internal insulation, Apartment, or mid-terrace house, €1,600. Semi-detached OR end of terrace €2,200. Detached house €2,400. External wall insulation, apartment, or mid-terrace house €2,750. Semi-detached OR end of terrace €4,500. Detached house €6,000. The insulation grant will also increase in value the more you commit to. 3 upgrades will result in an increase of €300 to the overall grant. And 4 upgrades will give an additional €400 euro to the overall grant. It is important to note that homeowners should be made aware that as of the newest building regulations part L from 1st November 2019, any alteration that covers 25% or more of the surface area of the home must achieve a minimum of B2 rating in the BER.

2. Heat pump system grant – Various forms of heat pumps are given grants. €3,500 is given to Air to Water, Ground Source to Water, Exhaust Air to Water, and Water to Water heat pump systems. Only Air to Air heat pump systems receive less at €600. Before applying for the heat pump, the homeowner must engage with an independent technical advisor registered with SEAI. This is because a requirement of the grant is to have your home 'heat pump ready' this means it must have a high standard of insulation and low fabric heat loss. This is so that the heat pump can operative effectively. There is an additional grant of €200 available for the technical assessment required of the home.

3. Heat zoning is a tried and tested effective measure to reduce energy bills. Splitting your home into heating zones and controlling them to be heated only when needed as well as being able to heat your water without having to turn on the space heating. Also being able to plan the heating use days in advance will help make efficient use of the heating system in the home. For this purpose, a €700 grant is available for the heating controls upgrade. This grant is also eligible for the 'do more, receive more' principle. As with the insulation grants, you may get additional grants for more upgrade actions. €300 additional for 3 upgrades and €400 additional for 4 upgrades.

4. Solar water heating grants – modern solar thermal systems are designed to meet 50-60% of hot water requirement throughout the year. This can greatly reduce your overall

energy use. For this a grant of €1200 is available for installing solar water heating if your home was built and occupied before 2011. The grant is also eligible for the 'do more, receive more' principle.

5. Solar electricity grants – Solar electricity grants are available for installation of solar PV systems, to be eligible the home must be built and occupied before 2011 and no previous grants have previously been provided for the address. Upon completion of the installation it is required that the homes BER is C or better. The grant amount is scalable depending on the installed kWp. The grant is €900 per kWp up to 2kWp, then it is €300 for each additional kWp up to 4kWp so long as you get an energy storage battery. The battery itself also has an additional €600 grant.

SEAI also offer free upgrades to eligible homes based on income support. The better energy warmer homes scheme exists for this and you are eligible If; you own and live in your own home, it was built before 2006, you receive welfare payments and you have not received works previously under the scheme.

SEAI now offer a community grant package. It is aimed towards groups of private households, housing associations and local authorities. the grant amount will depend on the type of homes that have applied. For groups of private homes, up to 35% of the funding amount may be covered. For housing associations, up to 50% of the funding amount may be covered. For local authority homes up to 35% of the funding amount may be covered. The maximum amount of grant is €750,000.

The criteria to be eligible are;

- A single county application,
- A companywide or finance provider district led application (applications submitted by a company or financial institution on behalf of their employees or members).
- The grant will support homes built and occupied before 2006.
- In the case of a heat pump installation, solar PV or solar water heating, the property must be built and occupied before 2011.

Review of International Examples of Innovative Financing Mechanism

United States of America

In the USA, the concept of 'Property Assessed Clean Energy Financing' has been used in the past where a municipality can offer bonds to investors. The capital is then invested into energy retrofits. The financing for the retrofit is then paid by a charge on the property tax bill. This major advantage is that the benefits and costs of the retrofit remains with the property and not the owner/tenant. This however does require participation of the local government (Bird & Hernández, 2012).

Apart from PACE, the USA also have 30 of 50 states offering an energy efficiency loans programme ("State Energy Financing Programs | NASEO", 2020) and in some states the gas and electricity companies are offering on-bill finance programmes where the company pay for the energy efficiency upgrade and the users pays back through the energy bill.

Belgium

Within the Flemish region of Belgium, they have several interesting financing mechanisms to make up the shortfall, green bonds are used to finance energy efficiency improvements along with other green and social upgrades. These bonds are due to mature on 21st November 2033 and 500 million Euro was raised through public issue from 61 lending institutions and 11 countries.

The Flemish Energy Loan is an interest free loan available to the target group, up to a value of 15,000 Euro with a 10-year term. Since 2015 21,000 loans have been granted to a total value of 175 million Euro. Up to 2019 some loans (2%) where given to non-priority group however since 2019 only people from the priority group have received the loans.

Fund for purchase in duress is a loan available for target groups who do not have sufficient financial resources. The interest free loan amount is up to 25,000 Euro and the payback is not necessary until either the dwelling is sold, or 20 years has passed.

Like the Flemish region, the Brussels region also uses innovative financing. The 'Prêt Vert Bruxellois' is a 0-2% green loan offered to residents whose annual income does not exceed specific thresholds. The loan is currently available from two different lenders. Firstly, from Crédal (the cooperative bank of Belgium) in the form of a personal loan and, secondly, as a mortgage provided by the Fonds du Logement (co-operative society housing fund). The loan is particularly attractive as it is variable based on the amount of works the resident wants to carry out but guarantees that the interest stays low.

The Netherlands

The Netherlands have been using several financing mechanisms, firstly, the heating fund is available as of February 2020 where 20 term loans are offered to owner-residents and 30 years offered to associations of associations of owners from 8 apartments and more. The interest rate offered as part of the heating fun will be like the rate of a mortgage loan with national mortgage guarantee. The heating fund is to be offered to all, even those who do not qualify for regular finance based on their income. The top cap of the loan for owner-residents is 25,000 Euro and the term of the financing account will be taken by the technical life of the installation.

The mortgage loan is a trusted form of financing for almost all homeowners. The financing mechanism works by increasing the amount of the mortgage loan that is already on the dwelling.

Building related finance is a concept where the lending is linked to the dwelling and not the occupier / owner. The provision is being laid out in the Civil Code as per the requirements of the climate agreement which enables all lenders to offer building related sustainability loans. This is advantageous to the growth of energy efficiency retrofit as it is another option to get past another barrier. It would mean that an occupier could get the work done with the knowledge that the repayments of the loan would be passed on to a new owner if they were to sell the property.

Finland

In Finland, the first port of call for financing is the repair loan granted by the banks. The repair loan amounts to a maximum of 50% of the buildings fair market price and in the case of a set of apartments, a maximum of 30% of the housing units in the building may be owned and rented out by the investors.

For further marked-based external funding, it is necessary to have reliable information on the site undergoing work and the benefits from the retrofit project. The energy subsidy programme for residential buildings runs from 2020 to 2022 and requires submission at the planning stage of a retrofit project. Payment is delayed until verification or the implementation of the plan and production of an updated energy performance certificate.

Finish energy service provides and banks re currently developing leasing-based funding solutions for projects where payment is in monthly instalments for any retrofit. Within this model, the bank supplies the funding and the energy service provider carrying out the planning, implementation and follow up. In this case, the energy service provider also provides the financial institution with a collateral security to verify financial feasibility to the renovation.

Some finish industries participated in EeMap – Energy efficient Mortgages Action Plan which is a Horizon 2020 project with a goal of promoting the development of green mortgages. Along with this, banks have been granting support to customers through the issue of green bonds and green loans.

3.7 External Factors

COVID-19

The global covid-19 pandemic will certainly impact the deep renovation market. As of 27th March 2020, Ireland went into full lockdown, effectively stopping all construction work including deep renovation. The construction sector was locked down from the 27th March until the 18th of May. The second lockdown which began on the 21st of October did not lockdown construction, the government is clearly intending to keep as many areas of the economy open as possible and as a relatively low risk area, construction has been allowed to continue. However, whilst construction has remained open there may be issues for deep retrofit contractors accessing owner occupied properties. The pandemic may also have a wider impact on the deep retrofit market through supply chain issues (although this may be more likely to be affected by Brexit). Also, customers may be unwilling to engage with the deep retrofit process given that deep retrofit requires contractors working in the home which may be perceived as unnecessary COVID risk exposure. Finally, potential customers are less likely to commit to capital expenditure due to the economic uncertainty and job insecurity. It has been suggested that the exit point from the COVID pandemic will be the development of an effective vaccine. However, questions remain as to the efficacy of any vaccine and the duration of protection provided. The consensus of medical opinion is that COVID will remain a challenge for the foreseeable future.

Brexit

The impact of Brexit in Ireland is likely to be mixed given Irelands level of exposure to the UK markets. The Economic and Social Research Institute predicted (October 2020) that the Irish economy would grow by 6.3% - even with the ongoing impact of COVID-19. This projection however assumes that Brexit negotiations reach a successful conclusion, and a free trade agreement is reached before the end of December 2020. In the absence of a UK-EU agreement, the ESRI forecast growth to be closer to 3%, this lower growth would potentially impact on jobs and income and clearly create additional financial barriers for the retrofit market. In addition, it is possible that a no-deal Brexit would bring with it supply chain issues as well as additional costs to any materials imported from the UK.

4.0 SuperHomes

SuperHomes is the one-stop-shop for deep retrofit offered by Tipperary Energy Agency. Deep retrofit has been carried out by TEA since 2015, initially just a handful projects were taken to completion, mainly people closely tied to Tipperary Energy Agency. TEA had very much been pioneering the deep retrofit one-stop-shop when the three year deep retrofit pilot scheme came about. This was a big help to TEA for stimulating demand. The market becomes more competitive as a result and TEA were already well positioned to compete in the market.

4.1 SuperHomes Ecosystem

For every business model, there is an ecosystem surrounding it. This ecosystem, like the ecosystems of nature is influential on the success of the business model. The ecosystem is made up of many different considerations that may affect the business model. It is imperative for a successful business to recognise these elements of its ecosystem and to be able to respond to changes. Within the retrofit business ecosystem, the most important elements to consider are labour, customer engagement, finance, technology, and processes. These are certainly everything influencing the business model of SuperHomes, but they are identified by experts as the most influential.

As part of the primary data collected, David Flannery, a long-standing member of TEA and expert on deep retrofit was interviewed for both his perceptions of the deep retrofit market and specifically for insights into the SuperHomes offer.

For each element of the business ecosystem the business model must be able to adapt. For this insight was needed from David.

The availability of labour is considered a key element within the business ecosystem effecting TEA. Larger contractors do not see the profit margins in retrofit to be as lucrative and so up to now most of the contractors carrying out retrofit as part of the SuperHomes offer have been 'man in a van' contractors. To reach the ambitions of the government retrofit plan, serious scale up of these labour operations are needed. This has been highlighted as a difficult situation as small contractors need market certainty to scale up their work force. Another factor is that retrofit must be carried out by trained specialists and so it is also a challenge for contractors to attain the correct accreditation for themselves and their employees.

The customer plays a vital role in the business ecosystem of SuperHomes. For retrofit to be carried out you need an engaged customer who sees the benefits of retrofit. Previous sections have described the trigger points, market segmentation and profile of the customers.

Technology & Processes is a key element of the business ecosystem to the SuperHomes offer. As emerging technology reaches the market, TEA must be ready to adopt and incorporate the cutting-edge tech into their offer in order to stay competitive. Similarly, operational processes may also benefit from continuous evaluation and improvement. When asked, David said regarding technology and processes that TEA have a tried and tested approach, they are always keeping an eye on the future.

4.2 Focus Group

As part of the primary data collection, a focus group meeting was held with participants who had gone through the SuperHomes process. The focus group was split into 4 sections. 1. Awareness & Diffusion. 2. Adoption. 3. Finance. 4. SuperHomes.

4.2.1 Awareness & Diffusion

Firstly, participants were asked two discussion questions:

Q1.1 What was your prior '***Awareness'*** (knowledge) of Deep Retrofit before engaging with your renovation project?

Q1.2 What is the likelihood that you would recommend a Deep Retrofit to others after your renovation?

Then Participants were asked to rank each statement from 1 to 5 with **1** = Strongly Disagree **2** = Disagree **3** = Neither Agree nor Disagree **4** = Agree **5** = Strongly Agree. The statements where:
Q1.3.1 I would classify myself as 'Risk Averse' (''I avoid Risk'')
Q1.3.2 'I had considered myself to be 'Fully Aware' of the benefits and needs of improving home energy efficiency measures **before** applying for a Deep Retrofit'
Q1.3.3 'I would consider myself a ***'Pioneer'*** within my community' (meaning – somewhat influential within you community / social circle – setting trends)

Finally the participants were asked a last discussion question:
Q1.4 Were you always going to Deep Retrofit your home, or were you influenced by your own value-based system (e.g. Sustainability Issues) or by the Influence of others' (e.g. people of policy)?

Results

Q1.1 What was your prior '***Awareness'*** (knowledge) of Deep Retrofit before engaging with your renovation project?

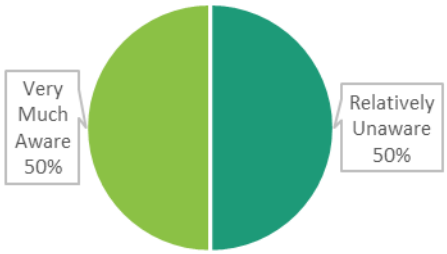

Figure 17 Results Q1.1

Very Much Aware:

- 'I was fairly familiar with it - I am a construction studies teacher'
- 'I am doing a Masters in Climate Change, so I am very much aware'
- 'Very much aware – I had installed insulation in a previous home'
- 'Quite aware – having previously installed works'

Relatively Unaware

- 'I thought all I had to do was buy a Heat Pump & stick to the side of my house and it'd all work'
- 'I had heard a small bit'
- 'Not that familiar'
- 'More aware of minor measures'

How did they then become aware'?

- Advertisements online
- Previously installed works
- A story shown on their Twitter feed
- Looked into buying a Heat Pump
- Attended a TEA information event
- Through visiting a neighbours retrofit home
- Enquiring about shallower measures such as Insulation
- Visiting Cloughjordan Eco Village

Key Findings

Most of those who considered themselves 'Very much aware' admitted to being very much unaware of the Deep Retrofit process – which they massively underestimated

Renovation works to previous and current dwellings appears to be an important factor within Deep Retrofit engagement

Many discuss that their 'awareness' was influenced by; Colleagues, Friends and Neighbours as well as Deep Retrofit Stakeholders such as; TEA Staff, Heat Pump Suppliers and Architects

Q1.2 What is the likelihood that you would recommend a Deep Retrofit to others after your renovation?

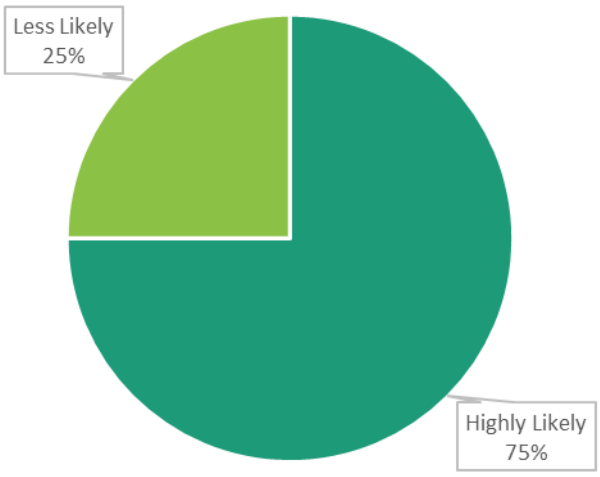

Figure 18 Results Q1.2

Key Finding - Every participant offered a proviso to their answers…. That their recommendation would highlight the **high cost, long installation time, upheaval** and mess created throughout the Installation Process.

Q1.3.1 I would classify myself as 'Risk Averse' (''I avoid Risk'')

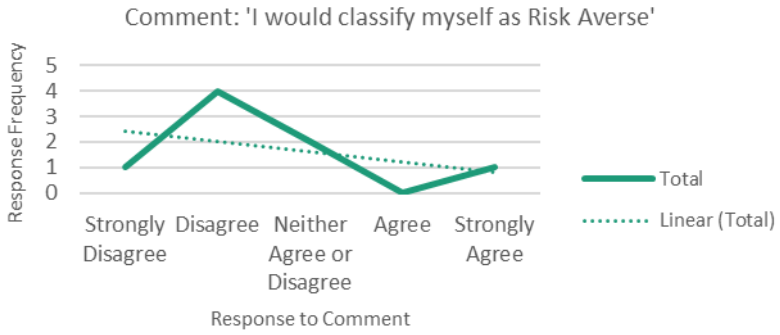

Figure 19 results Q1.3.1

Q1.3.2 'I had considered myself to be 'Fully Aware' of the benefits and needs of improving home energy efficiency measures **before** applying for a Deep Retrofit'

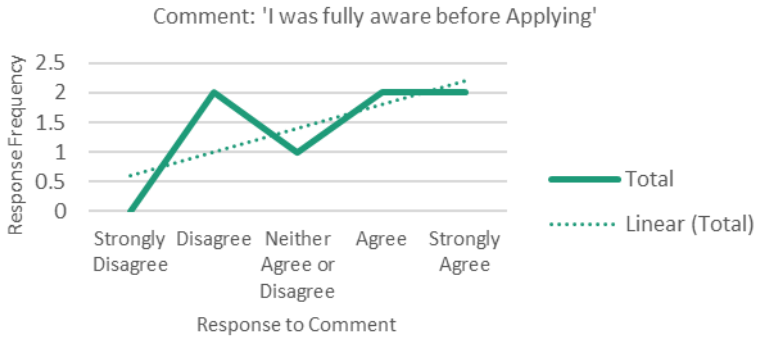

Figure 20 Results Q1.3.2

Key Finding - Although a small sample set – with the potential for typical focus group biases – Awareness ahead of each participants' project appears to be quite subjective – albeit trending towards agreement with being 'Fully Aware before applying'

Q1.3.3 'I would consider myself a 'Pioneer' within my community' (meaning – somewhat influential within you community / social circle – setting trends)

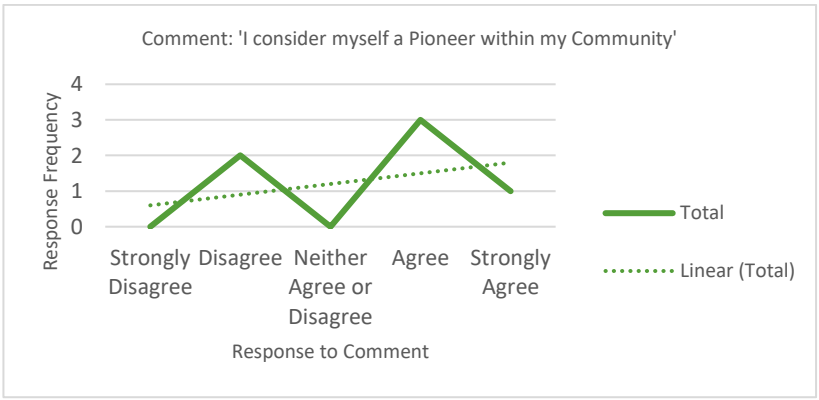

Figure 21 Results Q1.3.3

Key finding - Although responses trend towards agreeing with this statement – a common theme when justifying answers about post retrofit feedback from others suggested that participants became pioneers to their community through the actions based upon their own personal gain.

Q1.4 Were you always going to Deep Retrofit your home, or were you influenced by your own value-based system (e.g. Sustainability Issues) or by the Influence of others' (e.g. people of policy)?

Were you always going to Retrofit you home?

Findings…

- Most participants felt they had to Improve their home or invest in its future to some extent
- This was justified in most cases by certain building upgrades which were needed due to time or simply due to prosaic changes to the façade of their dwelling such as wanting to change windows.

Or were you influenced by your own Value-based System – for example: Sustainability Issues?

Findings…

- Three out of the eight participants were influenced by technological efficiencies delivered through improved insulation and the Heat Pump
- The same participants justified their decision through futureproofing their home by reducing emissions, reduction in reliance on fossil fuels and their price fluctuations and overall environmental awareness

Or by the influence of others – for example: People or Policy?

Findings…

- In nearly every response – the Grant availability (between 35% up to 50% in these cases) influenced a Deeper Retrofit project than what they had set out to do

Key answer

- 'I wanted to update my house in a way that was sustainable and futureproofed. The Grant is what incentivised me to go the extra mile a carry out a Deep Retrofit'

4.2.2 Adoption

Firstly, the participants were given a list of the top 5 decisional drivers in retrofitting a home. The participants when they asked to rank the drivers in order of importance starting with the highest to the lowest. The drivers were.

Q: 2.1.1 Please type in the order of importance – In the order that you believe is the most important decisional Driver (starting with Highest rating to lowest) (e.g. 4, 1, 5, 3, 2)

1. Financial Savings (Grant Aid, Long-Run Cost savings)
2. Thermal Comfort (Improved Warm Home – free of draughts)
3. Environmental Concerns (Doing your part – Driven by efficiency aims)

4. Health Impacts (Improving the home due to concern for improved health)
5. You were already renovating

Secondly, the participants were given a list of the top decisional barriers to retrofitting a home. The participants were then asked to rank the barriers in order of their perceived importance.

Q: 2.1.2 Please type in the order of importance– In the order that you believe is the most important decisional Barrier (starting with Highest rating to lowest) (e.g. 4, 1, 5, 3, 2)

1. Finance (High upfront Cost – financing decisions)
2. Imperfect Information (Unaware of all the Information needed to decide effectively)
3. Technical Issues (Highly technical elements of the build or decisions)
4. Distrust (Installers, Building Industry in general)
5. Lifestyle Disruption (Deep Retrofit measures cause mess and upheaval)

Then Participants where asked a question on previous engagement with energy efficiency measures.

Q: 2.2 Did you Install any other Energy Efficiency measures BEFORE applying for a Deep Retrofit?

Finally, participants were asked to say to what level they agree or disagree with the following statement. With **1** = Strongly Disagree **2** = Disagree **3** = Neither Agree nor Disagree **4** = Agree **5** = Strongly Agree.

Q: 2.3 'Not having the opportunity to 'Trial' A Deep Retrofit did not impact my decision'

Results

Q: 2.1.1 Please type in the order of importance– In the order that you believe is the most important decisional Barrier (starting with Highest rating to lowest) (e.g. 4, 1, 5, 3, 2)

Comparison between decisional DRIVERS into Retrofit between Previous TEA Research & the Focus Group

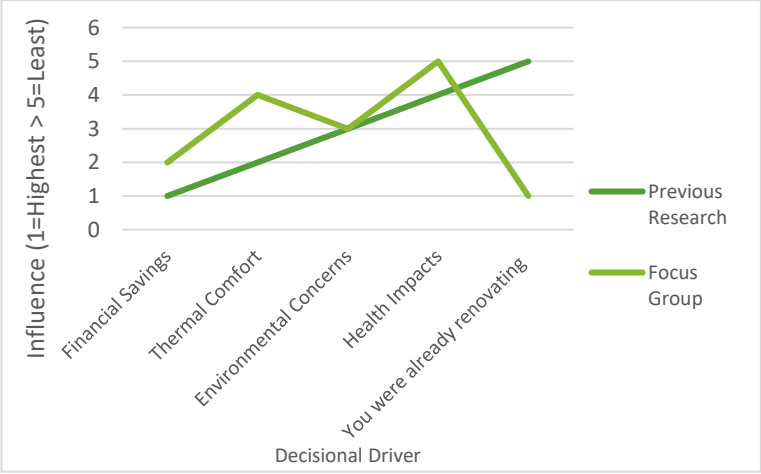

Figure 22 Results Q2.1.1

Key findings

The Focus Group responses mostly match the previous research with the exception that most Participants had been driven by their renovation project they were already planning to carry out.

Financial Savings through the Grant match in both instances as a significant Driver. Health Impacts less-so. Environmental Concerns appear as a significant decisional driver.

Q: 2.1.2 Please type in the order of importance– In the order that you believe is the most important decisional Barrier (starting with Highest rating to lowest) (e.g. 4, 1, 5, 3, 2)

Comparison between decisional BARRIERS into Retrofit between Previous TEA Research & the Focus Group

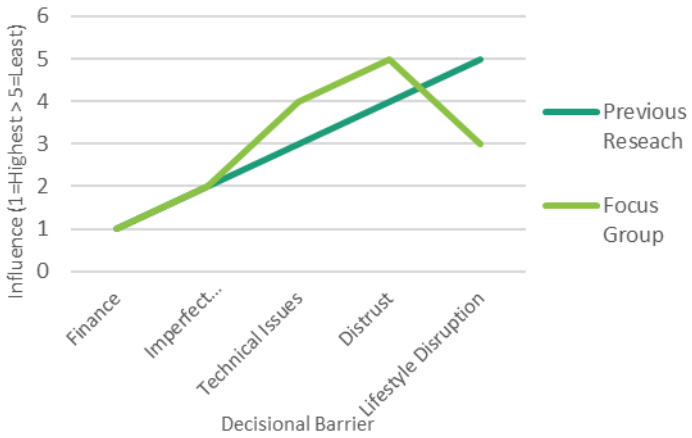

Figure 23 Results Q2.1.2

Key finding - Decisional Barriers between both Previous Research and the Focus Group both follow similar trends. Lifestyle Disruption receives higher Influence rating within the Focus Group. This reflects post project reflection and opinion changes.

Q: 2.2 Did you Install any other Energy Efficiency measures BEFORE applying for a Deep Retrofit?

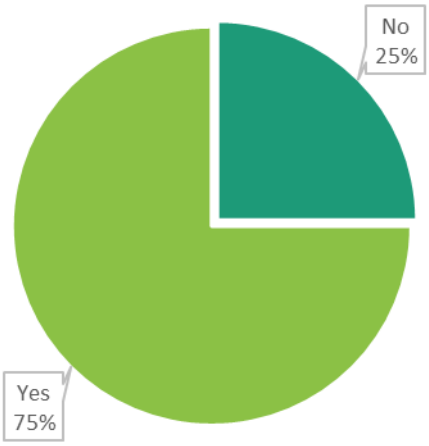

Figure 24 Results Q2.2

Measures previously installed by participants….

- Windows
- Doors
- Covered over Open Fireplace
- Installed Insert Stove
- Applied reflective radiator backing
- Pumped Cavity Walls
- Re-Insulated Attic
- Changed Heating System
- Installed Condensing Boiler

Q: 2.3 ‘Not having the opportunity to ‘Trial’ A Deep Retrofit did not impact my decision’

The Deep Retrofit decision involves large up-front personal expense with rewards only realised later in time in the form of greater levels of comfort and financial savings. We wanted to learn whether the inability to ‘Trial’ or ‘Feel’ a Deep Retrofit had impacted our participants’ decision to adopt.

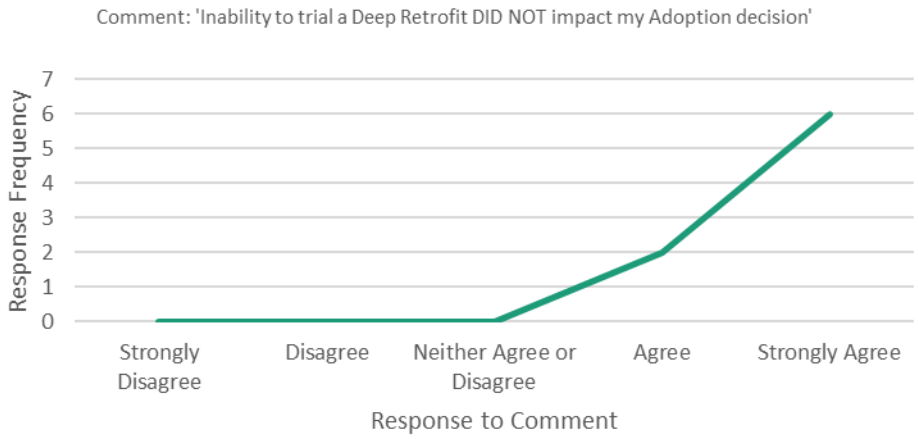

Figure 25 Results Q2.3

Key finding - Whilst every effort was made to make sure our participants were representative of a typical Deep Retrofit across varying ages, sexes and locations – in zero cases was the need to trial a Deep Retrofit a negative Influence on their decision into their project

Feedback…

- 'Probably seeing peers with a house that is very well insulated helps'
- 'I would have been down in Cloughjordan Eco Village and been in homes and they were always lovely'
- 'I also have a friend based up in the Wicklow mountains with a passive house and its just always warm year-round and its wonderful and that's the extent of a trial that I would have had'
- 'We visited an Open-House before this project'
- 'I Was going ahead with it anyway'

4.2.3 Finance

Firstly, participants were asked about the deep retrofit grant and their perception of it playing a role in their decision making.

Q: 3.1 How important was the Deep Retrofit grant in your decision to apply for a Deep Retrofit?

Secondly, participants were given a statement: 'The current Grant support available to SuperHomes clients is up to 35% of the Total Capital Investment. In a Deep Retrofit project costing a Total of €70,000 – this represents a government subsidy of €22,000 towards that project. You pay the remaining 65% (c.€48,000)' Then were asked about it.

Q: 3.2 Knowing what you know now – would you have gone ahead with your Deep Retrofit project at this level? If not, the why not?

Next participants were asked a question to find out if they would have still attempted the retrofit project if the grant was not available.

Q: 3.3 If the existing Grant Support was not available at the time, would you still have attempted to carry out a Deep Retrofit project – not necessarily with SuperHomes – paid by your own funds? If so, what would you have done differently?

Then, participants were given another statement: 'Future iterations of the SuperHomes program may include 'Green Loan' financing – which removes common risk aversion of applicants and bypasses the upfront investment required by each homeowner. The financing is offered at competitive interest rates – all of which providing a cost-effective alternative finance route to potential applicants. This would replace much of the grant funding that you availed-of….' They were then asked I they would have preferred this route.

Q: 3.4 If this alternative were available at the time – would you have preferred to have gone this route instead if the grant for a Deep Retrofit?

Results

Q: 3.1 How important was the Deep Retrofit grant in your decision to apply for a Deep Retrofit?

Key Answers:

- 'Wouldn't have done it unless the Grant was there'
- 'A Major Factor'
- 'We would not have done as much and therefore would not have carried out a true Deep Retrofit without-it'

Q: 3.2 Knowing what you know now – would you have gone ahead with your Deep Retrofit project at this level? If not, the why not?

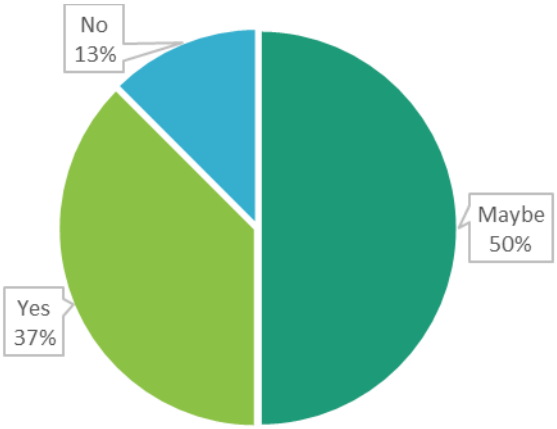

Figure 26 Results Q3.2

Free-Riding…

- Many participants availed of up 50% Grant towards total costs and this point may bias answers towards the opportunity afforded by a 35% Grant in question
- The three participants (37%) who answered YES to above suggest potentially some element of Free-Riding
- Also – those who responded with MAYBE may simply require more information

- Finally – most responses offer the Proviso that they are unsure whether they would receive as much 'niceties' as they have under the 50% Grant level… these responses may show evidence of loss aversion.

….'if was starting afresh and knew no different, the 35% represents still a full third of the project. Now, it's down to my budget after that but I wouldn't laugh at 35%'

Q: 3.3 If the existing Grant Support was not available at the time, would you still have attempted to carry out a Deep Retrofit project – not necessarily with SuperHomes – paid by your own funds? If so, what would you have done differently?

Key Answers:

- 'If we had to get low cost finance – I don't think we would have done it – we would have just gone ahead with shallower measures'
- 'I would have just bought more Kerosene'
- 'I think I would have just gone along with what I thought and had decided to do before I had made the decision to Deep Retrofit '

Q: 3.4 If this alternative were available at the time – would you have preferred to have gone this route instead if the grant for a Deep Retrofit?

Overall this alternative received positive Feedback.

Key findings:

Many efforts were made to make sure the Focus Group participants were representative of the broader Deep Retrofit catchment.

Unfortunately – most responses were given against the generous Grant level that most participants enjoyed within their respective projects….

Some participants enjoyed access to very generous savings – which may have swayed them towards support of the existing Grant structure.

Key Answers:

'You're not going to get much for investing your money now anyway! So, I'd go for the grant rather than a green loan'

'A grant (free money) will always seem more attractive than a loan to be repaid over time. Perhaps a blend of the two would be great. Considering Green Loans as an investment in the national housing stock rather than as a personal (temporary) bonus for the owner of the property''

'It would have to depend on the interest rate of the loan – some people say 4% is low for these type loans but I'd be thinking of closer to 0-1%'

Key finding - Focus Group moderators attempted to derive the feedback from participants without the help of savings – or simply to offer the scenario where cheap finance enabling them to therefore hold-onto their savings. The comments above highlighted some Behavioural Finance Biases future SuperHomes iterations may attempt to influence.

4.2.4 SuperHomes

The fourth section was to capture the opinions and perceptions of specifically, the SuperHomes Journey as offered by TEA. The first question put to participants was to understand what kept engaged to see the project through to the end.

Q: 4.1 Considering the many factors involved to get to the point of deciding to commit to a SuperHomes – once the works started – what kept you going until the end of the project?

Secondly, participants were asked to say whether they agreed or disagreed with the statement using the scale: 1 = Strongly Disagree 2 = Disagree 3 = Neither Agree nor Disagree 4 = Agree 5 = Strongly Agree.

Q: 4.2'I would have benefitted from improved communications into a Deep Retrofit through other channels such as my; Bank, Pension Provider or Real Estate Agent – when I was engaging and investigating a deep retrofit'

Finally, the participants were asked for their perception on the successfulness of a localised information hub if it were to be implemented by TEA.

Q: 4.3 If an informational hub was located in an area near your home – as opposed to the current situation – where the only base is in SuperHomes offices in Tipperary – would you think that would encourage many MORE people to apply for a Deep Retrofit?

Results

Q: 4.1 Considering the many factors involved to get to the point of deciding to commit to a SuperHomes – once the works started – what kept you going until the end of the project?

Common Issues during Retrofit

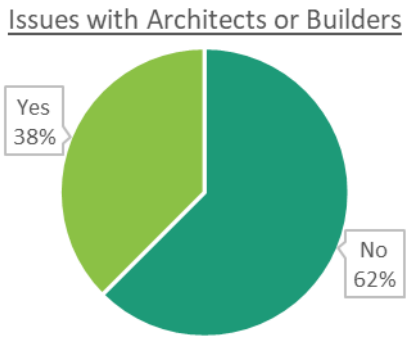

Figure 27 Results Q4.1 P1

Quotes - 'I found the architects to be very difficult and patronizing. I did not trust my builder'

- 'We had full-faith in our Builder – I know that I could trust him'

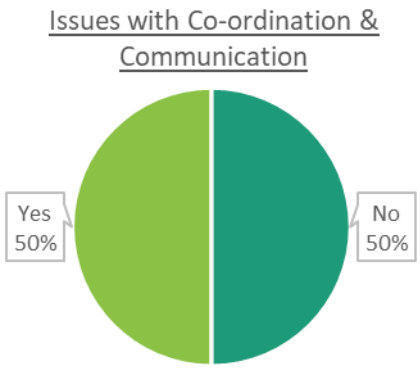

Figure 28 results Q4.1 P2

Quote - 'For Deep Retrofit with so many trades there needs better coordination of such due to the complexity of the job…. sometimes there was not adequate supervision so that they would leave the mess behind them'

'We had full-faith in our Builder – I know that I could trust him'

Key findings

The feedback here begins to highlight the service experience which are key to the SuperHomes package.

High stress and Upheaval are also mentioned but ABOVE highlights the most common themes…

It's not all bad news though – effective facilitation of skilled personal actually adds to the experience for some participants reflected in the quote below….

Q: 4.2'I would have benefitted from improved communications into a Deep Retrofit through other channels such as my; Bank, Pension Provider or Real Estate Agent – when I was engaging and investigating a deep retrofit'

The potential effectiveness of Strategic Partners – We attempted to gain feedback on whether advice or closer links to Deep Retrofit through stakeholders related to typical Trigger Points would have help participants during their investigation of Deep Retrofit…

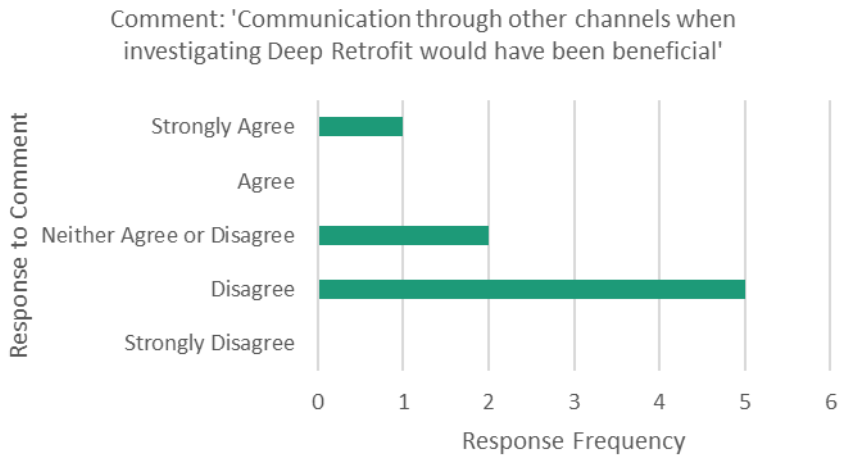

Figure 29 Results Q4.2

Key findings

Many of the participants were self-aware and deemed themselves unsuitable to this question.

Many self-funded and bypassed examples given such as; Banks, Pension providers and Estate Agents

Key Answers

'I can imagine that it would be useful for greater communications through the bank or pension provider for those who are less aware of the grants or supports available, though this is not applicable to me as I was already quite aware of the grants available and the work done by TEA and SuperHomes'

'I think so – I think face to face consultation always makes a difference'

Q: 4.3 If an informational hub was located in an area near your home – as opposed to the current situation – where the only base is in SuperHomes offices in Tipperary – would you think that would encourage many MORE people to apply for a Deep Retrofit?

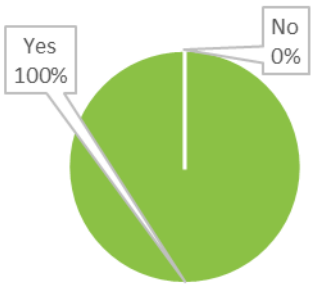

Figure 30 Results Q4.3

Feedback was unanimous

Key Answers:

'…there is so much interest and enthusiasm for what I have done and I spend a lot of time trying to explain… it would be amazing if I could say – well, there is a place up the road who can advise and inform you further'

'I'm a construction studies teacher. If we could bring our construction studies classes to a resource like that… I think it would be a massive benefit to society in general'

5.0 Interviews

Introduction

Interviews were conducted as part of the primary research for this report. These interviews aimed to identify perceptions from experts on the retrofit market. Three interviews in total were carried out, for each interview all participants were firstly asked some general questions about the retrofit market, secondly, they were asked some questions specific to their field of expertise.

The general questions put to all interviewees were;

1. What are the current challenges of the retrofit market?
2. How do you see these challenges overcome?
3. What future opportunities do you see for the retrofit market?

Seamus Hoyne is the manager of the Limerick Institute of Technology Development Unit, Chair of the board of directors of Tipperary Energy Agency and Secretary general of FEDARENE (European Federation of Agencies and Regions for Energy and the Environment). The specific questions for Seamus would aim to gain insight into political, regulatory, economic, and social factors effecting the retrofit market.

1. What is your perception of the current government strategy towards deep retrofit (as per programme of government)?
2. What industry forces are most effective in pushing the deep retrofit agenda? (European projects, politicians, financial institutions)
3. What industry actors need to do more?
4. What do you see as the main market failures of the deep retrofit market in Ireland?

Laura Heuston, a leading expert in the field of sustainable and green finance, she currently works with Sustainability Works. Also present at this interview was Jill Mahon who is an experienced consultant to the public and private sector on alternative and sustainable finance. The specific questions for Laura and Jill would be focused on financing deep retrofit.

1. What is your perception of the current grants, subsidies, and loan options for Irish customers to the retrofit market?
2. What is your perception of the 'shortfall' between the grant amount and the total cost of retrofit and how many people does barrier prevent from reaching the market?
3. In the future is there a need for a variety of financing mechanisms to bridge the 'shortfall' or is there one to fit all?
4. What innovative financing mechanisms are you most excited about?

David Flannery is highly experienced in the home retrofit process. He works for Tipperary Energy Agency as the point of contact for customer engagement. David's expertise lie in the

retrofit process and so specific questions for David would focus on the SuperHomes offer and its position in the Irish retrofit market.

1. Can you tell us a little bit about the beginning of SuperHomes and the journey up until now? 3. How has the SuperHomes offer changed from the start to what it is now?
2. How difficult was it to enter the retrofit market? / How competitive do you see the market?
3. Do you see the goal of 3000 homes per year being reached, if so, what is necessary for it to happen?
4. Thinking about the business Ecosystem how can the SuperHomes offer be adapted to meet changes in a) customer engagement, b) Labour capacity, c) technology/process innovation, d) innovative finance mechanisms

Results From General Questions

Question 1. What are the current challenges of the retrofit market?

For this question, all respondents had consensus that the main challenges for the retrofit market were; overcoming the financial barrier to deep retrofit, stimulating the demand for deep retrofit amongst the people and achieving market certainty to allow contractors to increase capacity. An interesting addition from David Flannery was that the deep retrofit process, from a contractor's perspective is a tricky job. He points out that this is an inbuilt challenge that will not easily be overcome as it is down to the variance in built dwellings and the individual needs of each deep retrofit design.

Question 2. How do you see these challenges overcome?

The main commonality identified from the answers to question 2 was the agreement that the political will is there (at least in Ireland) to overcome the challenges of the deep retrofit market. In addition to this it was common that the interviewees expressed a need for effective programmes overcoming these challenges to be rolled out.

Question 3. What future opportunities do you see for the retrofit market?

This question provided more varied answers. Laura initially pointed out the opportunities for contractors in gaining more work and expanding their operation and citizens in gaining healthier, cleaner energy homes and reduced energy bills. Jill Mahon then added that Ireland already has a large sector of unused housing, suggesting that a great opportunity would be to retrofit and sell these homes, this way avoiding in large the disturbance to peoples day to day lives that is usually caused by a retrofit.

David expressed the opportunity for the retrofit market to be a 'bounce back' for the economy and said that; (when trying to rebuild from the recent pandemic) 'Climate, carbon, energy and retrofit will all be part of the reimagined new vision.'

Seamus identified digitisation as a major opportunity for the deep retrofit market. Seamus identified key areas of the retrofit process that can be greatly improved with innovation digitisation, marketing, surveying, designing, management. Seamus also identified smart technology as major opportunities for the retrofit market, such as smart homes and the use of electric vehicles incorporated in the smart home system.

Results from Specific Questions on Industry, Market and Politics – Seamus Hoyne

1.What is your perception of the current government strategy towards deep retrofit (as per programme of government)?

Seamus, referring to the programme for government reflected that the proposal was hugely ambitious and over and above what is in the current climate action plan. Subsequently, the conclusion is that the political will is there. However, Seamus expressed scepticism over the capacity of the state institutions to deliver on that ambition, namely the various state departments, the SEAI and local authorities. Seamus Identified that the European Green Deal is becoming the 'only show in town' and so expect a lot more drive from a European level.

2.What industry forces are most effective in pushing the deep retrofit agenda? (European projects, politicians, financial institutions)
3. What industry actors need to do more?

Seamus points to his expression the 'project vs programme conundrum' meaning that the role of micro-projects has been fulfilled and now is it the time for money to be invested, construction industry to catch up and programmes to be effectively rolled out. When asked what industry actors need to do more, Seamus pointed to the Construction Industry Federation being insufficient in driving the retrofit agenda, in that the organisation is known to wait for government direction and not influence their members.

4.What do you see as the main market failures of the deep retrofit market in Ireland?

The stop/start nature of incentive programmes in Ireland was a major market failure as this causes market uncertainty. Seamus points out that the market certainty is essential for contractors to confidently grow their capacity to the level needed to carry out the quantity of retrofits planned.

Results from Specific Questions on Finance – Laura Heuston & Jill Mahon

1.What is your perception of the current grants, subsidies, and loan options for Irish customers to the retrofit market?

Laura stated that the current grant system is moving towards a bundled measure and that it is the grant system that is completely driving the market currently. However, Laura identifies the failings of the system is the picky administration and short windows of application that cause the uncertainty experienced by contractors. When speaking about loans, Laura and Jill both agreed that the current loans are as low as they can get in Ireland, with the best being offered by An Post at 4.9% with a 10 year term. Jill makes the point that many consumers expect lower loans at 1/2% but this is not a possibility with the legacy of books in Ireland.

2.What is your perception of the 'shortfall' between the grant amount and the total cost of retrofit and how many people does this barrier prevent from reaching the market?

Laura quotes the SEAI stats that '70% of people see finance as a barrier to deep retrofit'. Jill expresses a need for greater dissection of the housing stock to truly understand this shortfall.

3.In the future is there a need for a variety of financing mechanisms to bridge the 'shortfall' or is there one to fit all?

There is a common answer between both Jill and Laura for this question, simply put, there needs to be multiple financing mechanisms available and a big problem with this is that governments often do not consider parallel markets.

4.What innovative financing mechanisms are you most excited about?

Laura identifies green mortgages as being an exciting financing mechanism that doesn't currently go far enough, she identifies public credit enhancement mechanisms on a national or EU level as the most exciting innovative financing mechanisms that she has come across.

Results from Specific Questions on SuperHomes – David Flannery

1.Can you tell us a little bit about the beginning of SuperHomes and the journey up until now?
2. How has the SuperHomes offer changed from the start to what it is now?

'Retrofit has been in TEA since 2015, at the start it was just small scale, people closely related to TEA or within TEA and it was maybe 10 the first year and 17 the second. 2018 became more significant for the scheme. In 2017 when the retrofit scheme came in, it was a big leg up to TEA as TEA had been pioneering at this stage.

The initial learning process was learning what was technically required and how much things should cost. Grants were low at the start and people got used to the high costs. It gave the opportunity to build the business and gave the company the opportunity to hire and research. Therefore, the market became competitive but TEA were in a good position.

The technical offer hasn't changed much but it has been refined based on performance & costs.'

2.How difficult was it to enter the retrofit market? / How competitive do you see the market?

For this question, David points out that it is important to separate retrofit and deep retrofit. He states that retrofit is very prominent around the country but deep retrofit, the whole one-stop-shop is not as common. There is also an existing competition in that some people opt to go for single measure as opposed to the full package offered by TEA.

3.Do you see the goal of 3000 homes per year being reached, if so, what is necessary for it to happen?

David makes the point that the larger goal of 3000 homes per year is difficult to get your head around and perhaps it is better to look ahead to 100 or 500 homes for now and then perhaps look ahead from there. David says that stimulating the market is the number one necessary action if the goal is to be reached. It is also necessary to grow with the right finance partner and marketing team. In addition to these necessitates, David also states that a necessity for more specialisation within the roles is necessary to create a more efficient process.

4.Thinking about the business Ecosystem how can the SuperHomes offer be adapted to meet changes in a) customer engagement, b) Labour capacity, c) technology/process innovation, d) innovative finance mechanisms

For labour capacity David states that TEA can adopt clearer process and have more specialised roles within their organisation, an example he gives is taking admin off the engineers would free them up for more design. For technology and process innovation, David says that TEA do spend a lot of time thinking about the future, and are prepared to adapt, but also, they have a tried and tested approach currently. For customer engagement, David links this back to labour capacity, with engineers often busy with work they can easily lose touch with their duties for customer engagement, again leading to a need for more specialisation.

6.0 Conclusion

Using a realist approach to analysing the retrofit trends was effective. Secondary data was underpinned by primary data through the results of the interviews and the focus group. This led to some significant findings.

A Key element found was the importance of trigger points in managing the demand of retrofit. It was shown that trigger points exist and can be exploited with targeted communication, it was also shown that trigger points can be created. The customers who undertake the retrofit were found by the focus group to be aware of deep retrofit already which underpins the research into trigger points. The participants of the focus group also highlighted finance as the most significant barrier to deep retrofit.

The number and types of financing options available in Ireland were found to be limited compared to other countries, but these numbers are growing. SEAI administers most of the grants and subsidies available in Ireland for deep retrofit whilst the best retrofit loan on the market is offered by An Post. Other lenders were found to be entering this market, as this area of finance is seen to be growing. Other interesting financing mechanisms seen across the world were discussed but the perception of the financial expert interviewee was that Ireland would find success in financing with a blend of financing options.

The housing stock in Ireland was found to be the youngest in Europe, it is also mostly owner-occupied, C or D BER rated, mostly semi-detached, contains the least number of flats in Europe and has an average of 2.10 people per dwelling. This profile of the housing stock enabled the research to find trends with countries with similar profiles in the EU.

The analysis of the long-term renovation strategies based on similar housing stock profiles gave insight into the political trends within Europe. Austria, United Kingdom, Netherlands, Finland, Cyprus and Slovenia were found by the study to have the most similar housing stock profile to Ireland. All these countries shown similar trends to have some form of grant scheme. Countries varied in financing options, perhaps reflecting the difficulty of defining the most appropriate financing mechanism. All countries offered energy audits to possible retrofit recipients. Also, most countries mentioned a need to increase the labour availability in their country to meet the demand of an expanding retrofit market.

Other political trends found were encouraging for deep retrofit. It was shown that there is significant political will both in Ireland and the EU to move towards climate neutrality, with retrofit as a fundamental step to reaching climate targets.

Other key trends highlighted in Europe were the mechanisms included in the green deal, ‘just transition’ and ‘renovation wave’. Just transition is an essential part of the political strategy as it addresses the concerns of energy transition and how it may affect individuals and businesses. The renovation wave also highlighted a trend of states looking at the retrofit market as an opportunity for economic stimulus.

Political trends within Ireland were studied. It was significant that all major parties in the most recent election In Ireland has a ‘green agenda’ as a key part of their respective election campaigns. This was shown to reflect a key concern of the electorate.

External trends were discussed that have the potential to negatively affect the retrofit market in Ireland such as COVID-19 and Brexit. Both of which potentially affecting the supply chain and willingness to participate amongst homeowners.

Within industry, the research identified an increase in new innovative business models such as the ESCO business model. Another successful industry trend is the Energy Efficiency obligation Scheme which s commits energy suppliers to playing their part in financing energy efficiency. Also, the successful ‘better energy warmer home scheme’ which is addresses issues in Ireland with fuel poverty.

Trends analysis of the market has shown market failures such as the split incentive, legacy of lending in Ireland and stop-start nature of government programme’s making it extremely difficult for companies in the deep retrofit market to scale up. However, the effects of these market failures are reduced as generally the market is showing a shift to ‘greening’ and an overall growth in the Irish retrofit market. Finally, it should be noted that major influence on the retrofit market is coming from Europe, not only from the green deal but also from the many European projects in the retrofit market, some of which were discussed in the research. Also, the work of initiatives such as ‘Renovate Europe’ is pushing the retrofit agenda at the top level in the EU.

7.0 References

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