Future Trends Report & Superhomes Model EcoSystem Report

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Tipperary Energy Agency

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Contents

Introduction

This report is the amalgamation of two deliverables produced for the Horizon 2020 funded, SuperHomes 2030 project. Deliverable 2.3 is a future trends report, highlighting the future trends that industry actors should be aware of moving forward for the deep retrofit industry in Ireland. These trends are influenced by national, international, and regional forces. Although, many future trends from many fields of research can be identified, the most significant of these are trends in; technology, politics, finance, future business models, and future customers.
Deliverable 2.4 is the SuperHomes Model Ecosystem. This is presented as a node diagram, with Tipperary Energy Agency centred within the Ecosystem in which the business operates. The most relevant and important interactions are included in the diagram. The report then provides analysis on the key 'Mechanisms' to deep retrofit within the Business Model Ecosystem.

Methodology

Both sections of the report were written based largely on desk research. The primary sources for this research are expert interviews included in Annex 1. The secondary research was conducted using scientific papers, journals, reliable news sources and internet searches.
For D2.3 specifically, the section is produced to be supplementary to the previous deliverable D2.1 Market Trends analysis where an in-depth study of current retrofit trends in Ireland was conducted. Where D2.3 aims to looks ahead and analyse future trends.
For D2.4 specifically, both the previous deliverable D2.1 Market Trends Analysis and D2.3 Future Trends are used to help build the Business Eco System Model. Then, a Context- Mechanism- Outcome approach is applied to undertake programme evaluation of the SuperHomes offer. Through this, mechanism analysis is presented to highlight key considerations for SuperHomes in understanding the business ecosystem in which they operate.

D2.3 Future Trends

1. Future Technologies

Deep retrofit uses a range of technologies both innovative and traditional. The main features of a deep retrofit are improving the building envelope, incorporating renewable technologies, and ensuring the heating and water systems are highly efficient. The technology required to upgrade our homes to NZeb standard already exists and has been tried, tested, and proven. This assertion that current technology is not a key barrier to the development of retrofit in Ireland was highlighted by interviewee A (Annex 1). This is reflected in the fact that many homes in Ireland are currently undergoing deep retrofit to NZeb standard with reasonable payback periods. It can then be said that innovation in technology is not necessary if there is a suitable financing package for customers. However, as deep retrofit is an expensive process and current finance is limited, future innovation in technology should aim to reduce overall payback periods, improve system processes, or reduce capital costs.

1.1 Digitisation

Digitisation is the process of transforming physical data into digital data. The process of using this digital data to improve processes is known as digitalisation. Both Digitisation and Digitalisation are used today for many functions, but the application of digitisation and digitalisation for retrofit is still growing. There are many future trends that can be seen to use digitisation and digitalisation for the retrofit market. It is important for market actors to be aware of these future trends if they wish to stay competitive.

1.1.1 BIM

BIM stands for Building Information Modelling. BIM initially came as the next generation computer aided design software. The 3D modelling function of BIM software is certainly an upgrade to 2D design drawings traditionally used by architects, engineers, surveyors, and contractors. However, further benefits of BIM software have been realised. Specific to retrofit is the ability to laser scan existing structures and check for hidden building envelope details and accurate dimension data [1]. This is done by capturing millions of points of data in what is known as a 'point cloud' (digitisation) that can be transformed into an accurate 3D image of the surrounding features, structures, terrain, and items (Digitalisation). This 3D image can be used to simulate heat loss, effectiveness of heating and cooling systems, impact of appliances, water management. All of this gives designers the opportunity to make the deep retrofit much more efficient. A 2016 literature review of Sustainability and BIM specific to energy-driven deep energy retrofit, concluded that the BIM technology was immature for the use of energy renovation as several challenges exist such as, handling of uncertain data, data management and interpretation of data. For this, the paper recommends an adoption of legal and organisational frameworks to standardise the use of BIM for deep retrofit [2].

1.1.2 Smart Homes

Smart homes are certainly a future trend for industry actors to be aware of. As with new build customers, retrofit customers will also soon (if not already) be requesting smart home technology as part of the retrofit package. Also, some retrofit providers may already be recommending smart home technology as part of their retrofit package.
Smart home technology has many advances such as; users can control all their devices and appliances from one centralised controller, this could be as simple as an app on their smart phone which can dim lights, turn on the heat pump, set a timer for the washing machine to begin or change the channel on the television. This advantage is mainly convenience. However, this also enables the advantage of energy efficiency. With this increased level of control, it Is possible to precisely control the heating and cooling outputs and locations. Also, with a management interface that comes with smart home technology it is possible to visualise and keep track of energy use, water use and appliance use, giving the user a more accurate indication of what they need and what they are wasting [3].
Smart homes will be part of the 'smart-grid' which will be able to facilitate a flexibility service required for the grid operator to balance the renewable energy sources entering the grid. One key method the grid operator will use will be the incentivisation through smart home technology to use appliances at certain times of the day. Another key method the grid operator will use will be the use of electric cars as 'batteries.'

1.1.3 Electric Vehicles

Electric vehicles are a great opportunity for carbon cutting in general as transport makes up a large section of our energy use in Ireland. Electric cars are also clearly on the agenda in Ireland with the government announcing as part of the climate action plan, 936,000 electric cars on Irish roads by 2030. This would be the equivalent to one third of all cars on the road in Ireland [4]. Sustainable Energy Authority of Ireland currently offer up to 5000 Euro grant for electric vehicle purchases [5].
Electric vehicles offer a unique opportunity outside of the benefits of carbon reduction. Electric vehicles are an opportunity to provide flexibility to the grid operator. Electric vehicles can both 'charge' energy from the grid as well as feedback energy onto the grid. The greater abundance electric vehicles utilising this vehicle to grid technology the larger the flexibility capacity. This flexibility is much sought after by the grid operator, especially as more technology is electrified, and more renewables need balancing on the grid. Therefore, this opportunity may come with a financial benefit to the electric vehicle owner.
Therefore, it is essential that SuperHomes stay on top of the electric vehicle roll out. It is very probable that in the near future demand for house retrofit will include demand for electric vehicle charging equipment. So as part of the development of SuperHomes key issues around the electrical service

demands installation requirements of electrical charging points and electric car storage must be considered.

1.1.4 Employment

Another key benefit of digitisation for the deep retrofit as put by Renovate Europe is the opportunity to increase youth employment. As a way of tackling the rise in youth unemployment and an ageing construction sector, RE suggest EU member states invest in effective apprenticeship programmes and upskilling programmes for the digitisation in the retrofit market. Key advantages that digitisation has for the retrofit market as put by Renovate Europe include; A safer working environment as many manual tasks will now become digital, improved working conditions as digital techniques undertaken indoors are replacing techniques required outdoors, increased productivity as digital automations reduces costs and facilitates quicker delivery, enhanced collaboration facilitated by data exchange, more innovative quality jobs as low skill tasks are replaced with better paid and higher skilled jobs, a more inclusive labour market as the digitalization could bring in more youth and women to the construction workforce [6].

1.2 Other technologies

Other Technologies that we may see in our homes in the future are Ultra-efficient heat pumps, carbon fighting clothes dryer, magnetic fridges, window shading controllers, vacuum tube window, [7].
Heat pumps are a well-known technology on market with a key role to play in the future energy transition. As the popularity of heat pumps grows, so does the design quality. We now see Ultra-efficient heat pumps with Coefficient of Performance Ratings of up to 4.5 where they would be around 2-3 COP only 10 years ago. Further development of Heat Pumps using improvements in vapour compression cycle show that we may have heat pumps with COP up to 5.5 by 2030 [8].
The emergence of CO2 heat pumps is another future trend that can make a home more environmentally friendly. The technology uses CO2 as an alternative refrigerant to HFC and HFO. CO2 has a lower global warming effect than traditional refrigerants whilst the high operating temperature of CO2 heat pumps means they are well suited to matching requirements for domestic hot water production and higher temperature heating systems.
Heat pump tumble dryers are another neat innovation reaching the market. The tumble dryer utilises the heat pump cycle to dry clothes in place of traditional power from the mains electricity.
A new fridge is entering the market which utilises the magnetocaloric effect of temperature change upon exposure to the magnetic field. Cooltech claim their technology has the potential to reduce energy consumption of the fridge by up to 50% when compared to conventional compression gas systems [9].
Window shading controllers can optimise the sunlight entering the home at different hours of the day, thus giving the user more control over the heating of their home.
The window is often a key contributor to heat loss in a building. New vacuum tube windows are in development which would greatly improve the performance of the windows and reduce heat loss [10].Also to note, windows when used ‘smartly’ can be used for heat gains when needed. This may come in the form of automated smart blinds.

2. Future Business Models

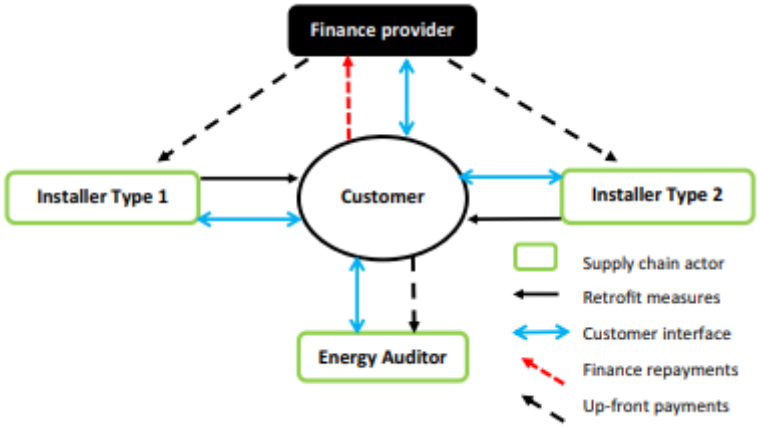
With a rapidly changing world is a rapidly changing set of circumstances under which business is conducted. Therefore, it is vital for industry actors to be aware of innovative business models and business model trends that may become necessary soon to stay competitive. SuperHomes already has a business model in place; however, it is important to see what competitors are doing and what beneficial examples from across the EU or the world can contribute to ideas.

2.1 Critical Review of Key Literature

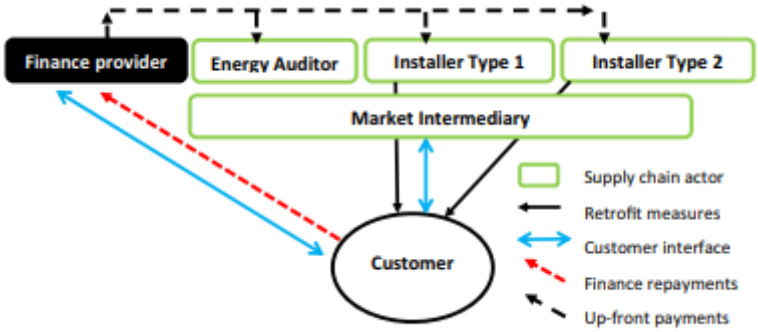
A research project by TNO highlighted a mismatch between supply and demand for deep retrofit. Where the Demand side find the energy interventions too expensive and the supply side are convinced that attractive and cheaper options would be available if the demand were greater. The project aimed to balance this mismatch by introducing a business that created value for the demand side to stimulate the supply chain. However, upon validation with industry actors they were not able to validate a business model despite their data highlighting a unified urgency expressed by industry actors for such a business [11]. The project tested four business models with varying degrees of involvement. The orientations of the business models were district level, housing association level, energy service level and product level. The data of the study highlighted that industry actors see the greatest need for the district level company for development of the deep retrofit sector. This finding is especially relevant to SuperHomes.

A critical assessment of 5 key archetypal business models for deep retrofit by Brown (2017) is a key piece of literature for insight into EU trends for these types of business models [12]. The paper identified 5 archetypal business model for deep retrofit used throughout the EU;

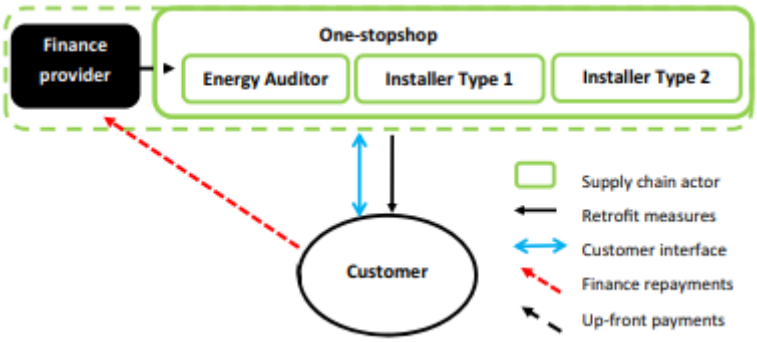
1. atomised market model – This is where the customer is the project manager, and it is a collection of individual energy interventions carried out by separate contractors. Financing and energy audits are also separated. It is probably the most common form of retrofit but does not lend well to the most comprehensive deep retrofits.



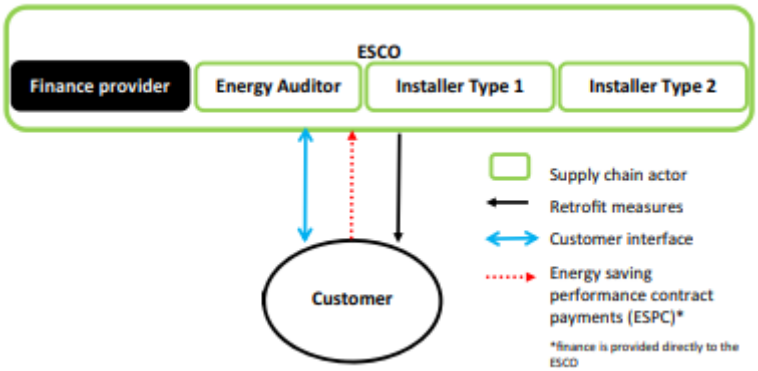
2. Market intermediation model – This is where an intermediary company offer to manage the supply chain and supply guidance and consultation on grants and financing. The aim of this model is to simply the customer experience and make the retrofit measures more accessible.



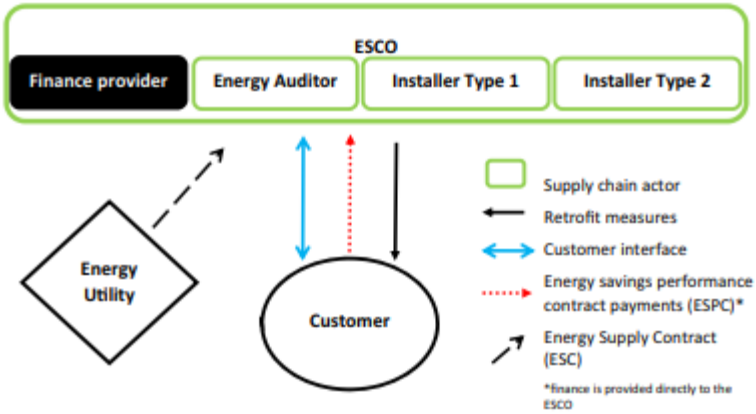
3. One-stop-shop – This is where the supply chain and customer interface are integrated so that there is a single point of contact for the customer. The supplier in this model offers a fully comprehensive 'package' retrofit. Thus, this model leads to more comprehensive retrofit packages.



4. Energy services agreement – This is where the building users are offered an energy performance guarantee for specific energy services. Therefore, users pay for the output they desire from the energy system and therefore it is in the interest of the supplier to make it more efficient at their own cost. This would mean that the comprehensive retrofit, paid for by the ESA company is almost a precondition for the ESA company to become profitable.



5. Managed energy services agreement – Similar to the ESA, only this model introduces the contracting organisation to take on the responsibility of the payment of the energy bill through an energy supply contract.



Tipperary Energy Agency describe their offer as a one-stop-shop and so analysis on this business model is particularly relevant. A further look at the SuperHomes OSS shows that it goes further than the one-stop-shop described in this analysis as SuperHomes also applies for and processes the grant payments for homeowners Where the study concludes that this integrated approach is critical for providing comprehensive residential retrofits.

The paper by McIlvaine et al (2013) [13] highlights two innovative approaches to business models for deep energy retrofit. The first is a an 'alliance' approach, which bring about an alliance of industry actors who work together to deliver deep retrofits. These industry actors may be contractors, assessors, or sub-contractors. The main element is that they maintain their own independent businesses. The main

challenge for this innovative business model is the competition amongst the industry actors as each will have their own ambitions. For the alliance to work these ambitions must align in a way that is advantageous to the customer. A lack of clear and transparent procurement processes could also lead to issues in accesses grant funding. There would also be quality assurance issues when organised by an alliance. Another challenge would be the integrity of the energy audit would be called into question with an alliance that includes the energy assessor, this may foster distrust from potential customer and so a checks and balances system would be necessary. Advantages of the alliance approach business model would be a high level of co-ordination within the design and implementation of the project. Especially if the experience of the alliance is considered if they are used to working with one another. Another major advantage of this approach is reach of promotion, in that each member of the alliance can carry out marketing that benefits the whole alliance.
The other approach put forward by the research is an 'expansion' approach. This approach is primarily aimed at the HVAC sub-contractor as a suggestion that they may be the subcontractor that benefits most from expanding their operation to include the whole house assessment and implement other improvements. The HVAC sub-contractor was chosen by the research as they are considered to have an advantage due to their current business model often incorporating service work after installation of HVAC in the form of window replacement, insulation, or boiler upgrades. A major advantage is that it opens new revenue streams for the HVAC installer, as a HVAC system is often a major part of a deep retrofit, they can offer the remaining measures to make the whole installation a 'deep retrofit.' The biggest barrier to this approach, is that it requires the HVAC installation company to take initiative to go out and get the correct qualifications and knowledge that gives confidence to customers that they can consult on energy efficiency measures outside of HVAC installation. Of course, the same logic could be applied to a heat pump installation company if it were to be the subject of the expansion business model. However, it is still worth noting to keep an eye on future competitors.

2.2 Energy Co-Operatives

Renewable Energy Cooperatives traditionally base themselves in becoming prosumers to the electricity market. Where a community combine their finances for renewable generation projects which they then use for their own consumption and sell the excess energy back to the grid. One innovative example of a cooperative showing potential to enter the retrofit market. Meerstad is a community in the north east of the Netherlands, their energy co-operative currently encompasses 2000 members (homes) and are seeking to expand to 6500 [14]. The aim of the co-operative is to sell either land or existing houses on the principle that will be sold as 'energy inclusive'. This would mean that if you were to buy a piece of land you would be obliged to build the home to a high standard on the contract of the co-operative membership but included in your purchase is your access to the renewable energy systems. More interestingly, this would affect the retrofit market, as if an individual were to purchase a home with a bad energy performance rating, then it would be within the co-operatives interest to retrofit the home to a high standard thus enabling use of community financing.

3. Future Political Trends

It is vital for industry actors to be aware of political trends that exist in Ireland, the EU and across the globe. This will allow actors such as SuperHomes to prepare for possible shifts in political and policy agenda. Regardless of the policy framework from Europe, deep retrofit cannot develop in Ireland without governmental financial intervention and political support. Current costs for deep retrofit between 21,000 and 39,000 Euro according to literature [15]. However, the experience of SuperHomes is that these costs are actually higher with a 2020 average of 58,019 and a 2019 average of 63,000 Euro, at least for the customers that SuperHomes have managed to reach so far. Costs can be significantly offset by funding from SEAI, but payback is also seen through energy bill savings. In the future, it is critical for government support to be consistent and for retrofit programmes to be

long term as the current stop start nature of government programmes is prohibitive for the necessary scale up of the industry This is strongly supported by both the expert interviews in Appendix 1 as well as feedback taken through the Construction Sector Deep Retrofit Opinion Base. In 2019 Building Regulations Part L was revised. This building regulation will drive the deep retrofit market in the coming years, the document is concerned with conservation of fuel and energy within dwellings and the revisions of 2019 have a particular focus on guidance to major renovation of buildings achieving NZEB status.

3.1 European Trends

Before addressing internal political and policy considerations in Ireland, it is important to explore how the political and policy context is framed by Europe. Ireland along with other EU member states has committed to tackling climate change. The 2030 Climate & Energy Framework is written up to include the targets and policy objectives for the EU28 between 2021 & 2030. The key targets include a reduction of greenhouse gas emissions by at least 40% from 1990 levels, 32% overall energy share from renewable energy and 32.5% improvement in overall energy efficiency. Arising from the 2030 climate & energy framework are the Long-Term Renovation Strategies (LTRS). These are key policy drivers for retrofit in Ireland; each member state must adopt national energy & climate plans and provide national long-term strategies. These strategies signal the future trends within Europe.
Favourable policy for deep retrofit relies on the political will of the politicians and the wants of the people who elect them. Therefore, the overall political climate is important to understand the future trends, as an 'environmentally aware' and 'transition willing' political climate will inevitably lead to positive policy agendas across Europe for deep retrofit. For this to occur, consensus is needed across most of the population on green issues. A major threat to this consensus is the recent rise in populism and climate change denial.

3.2 European green deal

The latest statement of intent regarding commitment to tackling climate change from the European Union is the European Green Deal. The deal was launched in 2020 by the new EU commissioner Ursula Von Der Leyen. The Green Deal is a set of policy commitments that ties the EU member states to becoming the first climate neutral union of countries by 2050. The main policy areas highlighted within the green deal are clean energy, sustainable industry, building renovation, agriculture, pollution, sustainable mobility, and biodiversity. The deal is an update to the already ambitious commitments agreed by the EU in the 2030 policy framework. Key elements of the deal include the investment plan, just transition mechanism and the circular economy, renovation wave and European climate law. The deal also strengthens the commitment from EU member to the Paris Agreement.

3.2.1 European Climate Law

The first key element of the European Green Deal is the European Climate Law. This is the proposal for the first climate law for Europe. This would enshrine the goal of the European Green Deal into law. Thus meaning, any successive administration of the EU commission must adhere to the goal of carbon neutrality by 2050. This is a long-term objective of the European Green Deal to ensure sustained effort in advancing its carbon neutrality goal. The law would not only bind the EU commission to the EU Green Deal goal but also the member states to be bound to the necessary measures to meet the target. The law will deal with broad necessary steps to reach climate neutrality and will also include monitoring and adjustment considerations so that approaches to reach targets can be modified based on progress. The law will give the commission powers to issue recommendations to member states who fall short of their targets. These member states will be obliged to provide explanation if they fail to take account of the recommendations.

3.2.2 Rising ambitions

Upon ratification, the European Green Deal aims to raise the bar in terms of the current climate targets. Most notably, a raise to 50-55% of carbon reduction compared with 1990 levels by 2030 from the 40% target previously set. A rise in the target of electricity generation from renewable energy and a higher carbon price are two other key improvements of the ambitions of the EU.
To justify these raised ambitions, protection has been promised to industry. Firstly, an EU carbon border tax has been proposed to protect European businesses from non-EU companies who are not in a jurisdiction which are pulling their weight on climate change. Secondly, the EU industrial strategy plans to improve cooperation in industry through digitalisation, build a more circular European economy and support industries in the move toward climate neutrality.

3.2.3 Implementation

To achieve carbon neutrality by 2050, drastic action must begin immediately. This means a particular emphasis has been put on implementation. For this reason, the priority for implementation is the National Energy and Climate Action Plans. The NECPS are developed by each member state to help reach their climate targets for 2030. There were introduced under the 'regulation on the governance of the energy union and climate action' (EU/2018/1999) and the final submission deadline was the end of 2019. The NECPs cover the particulars of how member states plan to address energy efficiency, GHG emission reductions, renewable energy, interconnections and research and innovation. The NECP requires high levels of coordination across governmental departments which brings complexity, for this reason, the member states are encouraged to learn from one another by way of using similar templates and coordination to make 'cross border energy savings.' It is the job of the EU commission to monitor the Member States implementation every 2 years upon submission of a progress report. After feedback on the draft NECPS, the final version was re-submitted by the 17th of September 2020. A final element of the NECPs to consider is the National Long-Term strategies that were also developed under the governance regulation, where EU member states are required to publish their plans to ensure the consistency across their NECPS.

3.2.4 Just transition

The just transition mechanism is one of the most exciting elements of the European Green Deal. Previous plans to tackle climate change have rarely committed enough effort to 'softening the blow' to the communities and industries most reliant on fossil fuels. The Just transition mechanism aims to address the main challenges faced by those asked to change the most.
"We must show solidarity with the most affected regions in Europe, such as coal mining regions and others, to make sure the Green Deal gets everyone's full support and has a chance to become a reality."
Frans Timmermans, Executive Vice-President of the European Commission
It marks a change in approach to one of co-operation and emphasises the need to get everyone on side. The beneficiaries of the JTM will be people, industries, sectors, regional and national governments.
The details of the JTM are that it is to mobilise 150 Billion over the period of 2021 – 2027 to address socio-economic impact of the energy transition. The JTM will focus on the regions, industries, and workers most affected using three pillars.

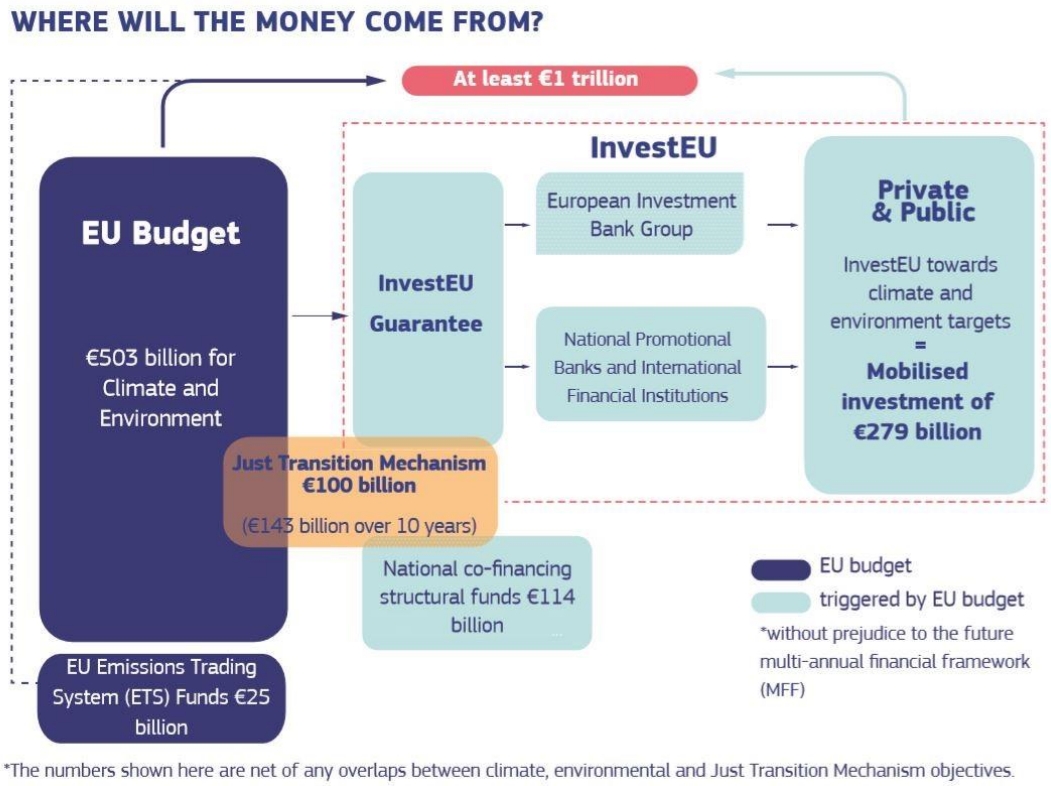
1. A new Just Transition Fund of 40 Billion ad generating 89-107 Billion of investments.
2. InvestEU "just Transition" Scheme to mobilise 30 Billion of investments
3. EIB public sector loan facility – 10 billion in loans, backed by 1.5 billion of the EU budgets and mobilising up to 30 Billion of investments.

The support will be accessed from the Just Transition Platform which will provide technical and advisory support to aide beneficiaries find and access the fund and opportunities they require. The commission will also communicate with specific territories in which the Just Transition Fund will be aimed toward.

3.2.5 The European Green Deal Investment Plan

Also known as the Sustainable Europe Investment Plan, this pillar of the green deal aims to stimulate over 1 Trillion Euro in sustainable investments between 2020 and 2030, create an investing framework for private sector investment and public sector facilitation of sustainable investments, it will also

provide public administrators and project promoters to assist in the execution of sustainable projects. The financing for the investment plan is laid out;



[16] European Green Deal Investment Plan

3.2.6 Circular economy

A key pillar of the European Green Deal is the Circular Economy Action Plan. The plan aims to have the EU revolutionise the economy to produce longer -lasting, repairable, and recyclable products. Today the EU's economy is mostly linear with only 12% of materials recycled into secondary use [17]. It is the aim of the Circular Economy Action Plan to drastically change this statistic and make Europe much less wasteful. The plan includes measures to make sustainable products which are designed specifically to last longer and are easy to recycle. Empower consumers to be informed on the products they buy. Focus on the sectors with most potential for circularity such as electronics, batteries, vehicles, packaging, plastics, textiles, construction, and food.

3.2.7 Renovation wave

Of all the elements of the European Green Deal, the most relevant to the deep retrofit sector in Ireland in the Renovation Wave. This is a plan to stimulate greater activity in the renovation sector that is currently decarbonising European building stock. The strategy was published in October 2020 and its primary aim is to address the currently low renovation rate of around 1% a year and raise it to 2/3%. The renovation wave is seen not only as an opportunity to help achieve climate targets but also an opportunity for economic growth. Specifically, the Renovation Wave is seen as an opportunity for relieving some of the stress on the economy from COVID-19. Investment in the renovation sector is known to have a positive knock-on effect on employment in the construction sector. The Renovation Wave initiative also includes plans to upskill the constructor sector to create the necessary capacity to reach the renovation goals.

3.2.8 NewGenerationEU

The EU commission are extremely invested in the European Green Deal plan, so that they have committed 37% of its 750 billion Covid-19 Recovery funding (NewGenerationEU) to the European Green Deal Objectives [18]. The NewGenerationEU along with the EU's long-term budget is said to be the 'largest stimulus package every financed through the EU'. The goal of the financial instrument is to help recover from the economic and social damage brough on by the Covid-19 pandemic. The idea is that the money will be used to invest in a new direction of economy which addresses the goals of the EU. This will mean investment in 'greening', digitalisation and strengthening the economy to be prepared for future challenges.

3.3 Irish Trends

Whilst drivers at a European level are important to keep note of, the deployment of policy and implementation will always be subject to the internal politics and policy objectives of the government. Ireland has a long history of coalition governments, with the last majority government being Fianna Fáil in 1977. With all the coalitions since 1937 being led by either Fianna Fáil or Fine Gael. In the most recent election however, Sinn Fein surprised many by winning the vote share with 24.5% of the vote Whilst Fianna Fáil and Fine Gael received 22.2% and 20.9%. This has fractured Irish politics in that moving forward the choice may no longer be binary for who will lead government. With Sinn Fein still polling well a year after the election [19] this trend looks like it will continue in future elections. Another future trend of major significance was the achievements of the Green Party who won 7.1% of the vote share, their highest ever in an Irish election.

The trend seen is a diversification of voting in Ireland. Despite the clear divergence in many areas of the politics of each party, what has been seen to have broad agreement is the green issues at the heart of all four parties' manifestos. This is a clear indicator that the political parties are reflected the concerns of many of the Irish electorate within their proposed manifestos. This is a clean positive future trend for Ireland, as it indicates the people are in favour of energy transition and the politicians are taking these concerns seriously by showing strong support within their proposals. This is compounded by the Irish government's commitment to increasing funding offered for retrofit, as laid out in the programme for government.

There is, however, the external factor of Brexit at play that could have a negative impact and the potential to choke the development and implementation of these green policies. Despite Brexit being mainly a UK issue, it is likely to have mixed economic, social, regulatory impacts on Ireland due to Ireland's level of exposure to the UK markets and the geographical location of the North/South boarder in Ireland.

A final consideration for the future political landscape for Ireland is the possibility of a border poll to decide Northern Ireland's constitutional status on the island and reunification with the south. The border poll has been a long-standing ambition of SF, who have been the second largest party since 2005. However, demands for a border poll have gained traction with the wider population in NI following Brexit. The implementation of the NI protocol as part of Brexit is particularly significant in this context: the NI economy will be increasingly integrated into an all-island economy and it is possible that the economic and political influence of the EU and Dublin will be grow in significance over time.

3.4 Irish Climate Action Plan

The Climate Action Plan is the strategy for which the government of Ireland have planned to reach their commitments to net zero greenhouse gas emissions by 2050. The plan has some key targets to achieve by 2030, which include increase the number of electric vehicles on the road to 936,000, increase renewable energy to 70% of electricity capacity, upgrade 500,000 existing homes to B2 standard and also install 400,000 heat pumps. These targets are all very relevant for SuperHomes. The surge of electric vehicles and electrified national grid will mean a larger demand for domestic electric vehicle charging points and smart home technology. These considerations will no doubt come up during the

planning of home retrofits. The target for retrofit itself is ambitious and a positive trend for SuperHomes. The action plan mentions the design of specific retrofit policy later seen within the programme for government as well as the design of model for aggregation of home retrofits to create the chance for larger scale funding and delivery. SuperHomes may currently target single consumers but given the ambition of expanding within the market and the drive of the government to drastically increase the amount of home retrofits, the multiple home retrofits will be key to the development of the SuperHomes model.

3.5 Global Trends

A final consideration is the impact of key global political trends. On 20th January 2017, Donald Trump was elected president of the United States of America. Trump is a climate change denier and by the 1st of June 2017, the USA had pulled out of the Paris agreement. Similarly, rises in right wing populism has seen a rise in climate change denial across the globe with notable world premiers including Brazil's Bolsorano and Poland's Duda. However, 2020 has seen several notable changes in political leadership that may be beneficial towards political trends for environmental benefit. Firstly, the transition in leadership in the USA marked an end to the fossil fuel-friendly administration of Donal Trump and brought about a more co-operative and climate concerned administration in Joe Biden has already named John Kerry as a special envoy to the president for climate change and made re-joining the Paris agreement a priority [20].

Alongside this power shift in America is the Regional Comprehensive Economic Partnership trade deal signed in Asia. The RCEP is one of the largest trade deals ever signed and crucially, it has no US involvement. This signals a shift in economic power to the south east Asia, which has been long talked about. This will have significant implications for the West. Whether the implications will be positive, or negative is yet to be seen. However, most of the renewable energy technology that we purchase comes from China. Now the EU economy is going to have to compete with a larger trading block at the other side of the world, it remains to be seen if the supply chain will be affected.

4. Future Financing

The deep retrofit sector has been suffering from a lack of a commercially viable financing mechanism that would enable more customers to reach the market. The high capital expenditure is often too much for people to afford even when the grants and subsidies are taken into consideration. So various financial mechanisms have been piloted and in successful use that may help bridge the gap of the shortfall many people face with capital expenditure.

For financial providers to 'sell' their loans, it is essential that they would along with key stakeholders in reaching their customers. This is due to the barriers that exist with retrofit around engagement, drivers and awareness. Therefore, the future for financing should include closer partnership between lenders and one-stop-shop retrofit businesses in Ireland.

There are several key factors in must be considered by financial providers, as these are real opportunities for the sector. The three key factors for consideration are; commercial, regulatory and reputational.

Commercial drivers exist for financial lenders, the scale of the market opportunity is huge as per the government plans to retrofit 500,000 homes to B2 BER standard by 2030. This 500,000 homes target is equivalent to 10-19.5 Billion Euro of Investment [15]. The lower risk of default is another consideration, as recent studies have shown a positive influence on house value and credit robustness of the homeowner [21]. Finally, there is an opportunity for financial lenders to offer green bonds, this will come with commercial benefits such as pricing benefits, diversification of investor base, positive marketing opportunities and enhanced reputation.

Regulatory drivers also exist for financial lenders, Climate stress testing and climate disclosures are currently being discussed globally by financial regulators as ways of creating resilience for the financial sector. This driver would support the concept of entering the retrofit loan market. Also, the green supporting factor is an idea which may come into play which is a form of recognising the lower risk factors associated with low carbon, green assets.

Reputational factors also exist for financial lenders; corporate sustainability strategy, climate action, attraction and retention of new talent and customers, principle of responsible banking all contribute to building a stronger reputation. In the market, to the public and with stakeholders.
Currently, some financial providers are showing initiative and offering secured and unsecured personal loans as well as mortgage options for customers which is a promising sign. However, these current offers suffer due to the fact that personal loans terms are not that attractive to homeowners despite being cheaper than regular personal loans. Also, Homeowners find the legal and process barriers to top-up mortgages to be overwhelming despite the low cost and favourable terms that can be offered. Therefore, it is essential to explore innovative financing mechanisms. For any advancement to occur, an increased understanding of the retrofit and sustainability market is required from the financial providers.

4.1 Green Finance Institute Portfolio

The green finance institute was formed in December 2019 with the intention of accelerating the transition towards a climate-resilient economy. As part of the institution, the Coalition for the Energy Efficiency of Buildings was formed which intends to develop the financing market for net zero carbon buildings. The coalition is made up of experts from financial services, local and national of the CEEB is the production of a portfolio of 'demonstrator' financial solutions that are commercial, scalable and mobilise capital flows towards retrofit. The demonstrator financial solutions were co-designed amongst the collaboration and it was based on extensive research into the best practice examples of deep renovation and the current state of the market. The portfolio is presented in the report 'Financing energy efficiency buildings: the path to retrofit at scale.'
*OO = Owner Occupied, PRS = Private Rented Sector, SRS = Social Rented Sector.

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Data and enabling frameworks	Energy Efficiency & Property Valuations	Research and development of practical solutions, based on the relationship between energy performance and property valuation, that unlock investment towards net-zero homes.	✓	✓	✓
	Metered Energy Savings	A standardised savings calculation methodology to deliver rich data on real-time energy savings over the lifetime of a retrofitted building.	✓	✓	✓
	Building Renovation Passports	A tool to increase the rate and depth of retrofits, providing information on what measures are possible and a long-term renovation plan that can be achieved at a flexible pace.	✓	✓	✓
	TrustMark 'Call to Action' Platform	A platform to support customers through the full retrofit journey: identifying improvements, sources of funding and linking homeowners to a reputable supply chain.	✓	✓	✓
	Residential Retrofit Principles	An industry-recognised certification for financial solutions that support the retrofit of residential buildings to a high standard, to enhance the confidence of lenders and borrowers.	✓	✓	✓
	Sustainable Housing Label	A certification scheme for green buildings and retrofit projects, spanning the full breadth of tenures, to stimulate demand and investment into the sector.	✓	✓	✓

Table to show data and enabling frameworks for financing retrofit [22].

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Tenancy agreements	Green Leases	Green Leases with an 'Energy Alignment Clause' enable landlords to recover the cost of a retrofit, based on the predicted energy savings, and minimise the landlord-tenant split incentive.		✓	
	Affordable Rent, Affordable Living	Adjust the 'affordable rent' definition to include modelled energy costs, to incentivise landlords to deliver properties where tenants can afford the combined cost of rent and energy bills.			✓

Table to show possible tenancy agreements for financing deep retrofit [22].

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Lending products	Property Assessed Clean Energy 'style' financing	Financial institutions provide long-term capital for retrofit projects, while local authorities or associated independent third parties collect repayments via an additional property charge that is passed through to the lender.	✓	✓	✓
	Green Equity Release	Enables homeowners over the age of 55 to unlock the equity in their property for investment, with favourable terms to incentivise investment into energy efficient improvements.	✓	✓	
	'Help to Green' Equity Loan	Homeowners can borrow against the equity in their property, in order to invest into energy efficiency improvements. Government support, similar to the Help To Buy scheme, could facilitate favourable borrowing terms.	✓	✓	
	Domestic Energy Efficiency Salary Sacrifice Scheme	A salary sacrifice scheme that allows employees to draw a loan through their employer for investment into home energy improvements, which is repaid via gross salary contributions.	✓		
	Leaseholder Financing	Provides an attractive financing offer to private leaseholders, via social landlords or related intermediaries, to foster positive engagement and consent for multi-property retrofit projects.			✓
	Add-to-my-Mortgage Platform	A digital platform to streamline the process for homeowners to apply for a Further Advance (e.g. additional borrowing on their mortgage) at the 'point of sale' of energy efficiency measures.	✓	✓	

Table showing possible lending products for deep retrofit [22].

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Saving and investment products	Community Municipal Bonds	Utilises a crowdfunding approach to create an efficient, scalable and cost-effective source of funding for local authorities to finance projects that address the climate emergency.			✓
	Long-Term Retail Investment	Retail investors to provide capital for home improvements, receiving predictable returns from energy-efficient private rental properties	✓	✓	✓
	Energy Saving ISA	Energy bill savings from a retrofit project can be directed towards an ISA or savings product, to help tenants build up their savings for a mortgage deposit or other investments.		✓	✓

Table showing saving and investment products [22].

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Energy service products	Insurance-backed Comfort Plans	An insurance-backed guarantee mechanism for 'Comfort Plans' to increase confidence amongst early adopters (e.g. social landlords) and improve the financing available for deep retrofit projects.		✓	✓
	Comfort as a Service	Financial mechanisms to unlock the cash savings in energy efficient and optimised homes, to support the investment case for housebuilders and homeowners to achieve high efficiency standards.	✓	✓	✓
	MEES Compliant Funding	An energy performance guarantee that allows private-rental landlords to procure long-term compliance with MEES requirements.		✓	

Table showing energy service products [22].

Type	Name	Demonstrator description	Tenure		
			OO	PRS	SRS
Guarantee mechanism	Government Guaranteed Financing	A government guarantee to support large-scale retrofit projects in the social housing sector, aimed to scale the supply chain and drive economies of scale that benefit all housing tenures.		✓	✓

Table showing possible guarantee mechanism for financing deep retrofit [22].

4.2 Key Opportunities for Ireland

The better energy finance programme from SEAI has also committed to financing innovative finance programmes to be trailed in Ireland with successful programmes becoming integrated into SEAI grant packages. An overview of the trailed financing mechanisms to date;

Financing Pilots 2017/2018

2017/18	Project Lead	Partner Organisation	Description
2017	REIL	CUDA and a no. of Credit Unions	Low cost finance to CU members with end to end offering for upgrade of homes
2017	SSE	Blackraven Staff CU	Low cost finance to staff members of 3 Dublin councils with end to end offering for upgrade of homes
2017	Churchfield Home Energy Services (CHS)	Navan CU (& Tara Mines)	Salary Incentive adaptation with low cost finance to Tara Mines staff by CU and payback through Tara Mines salary- with end to end offering by CHS to upgrade homes
2017	Veolia	SSE	Zero cost finance provided by Veolia to their staff as part of a BEC, to upgrade their homes energy efficiency, with end to end offering provided by SSE on their behalf
2018	Retrofit Energy Ireland Ltd (REIL)	CUDA, The Solution Centre and a no. of CUs	Low cost finance to CU members in 5 CUs across the Dublin area, with end to end offering for upgrade of homes
2018	Churchfield Home Services Ltd (CHS)	Flexifi Consumer Finance	Low cost finance through CHS, using digital marketing and offering value-added enhancements to existing CHS customers, with end to end offering to upgrade homes
2018	REIL	Flexifi Consumer Finance	Low cost finance to REIL customers through testing a number of routes to market engagement including priority contractors, door to door sales, private home infills in social estates and tidy towns engagement; all with end to end offering to upgrade homes

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A table showing financing pilots from SEAI between 2017 & 2018 [23].

As can be seen, there is a wide variety of innovative financing mechanisms under consideration. The most interesting identified for the Irish and SuperHomes context are; Publicly supported low cost loans, discounted green mortgages, on-tax or PACE mechanisms, on-bill mechanisms.

4.2.1 Publicly supported low-cost loans

These are loans are designed to have more favourable conditions than those offered at on the market. They are often provided through government agencies and often are a mixture of private and government finance. To leverage private finance, 'credit enhancement' is used to provide a guarantee to the investor from public funding. These credit enhancement mechanisms are often used by government to achieve goals set out by their policy.

The opportunity to investors is greater with the reduction of risk and therefore more loan opportunities can be made available to consumers. The EU has displayed strong support for this financing mechanism through their plans for the European Green Deal as discussed in Political trends. This financing mechanism has been supported through out other EU member states in financing deep retrofit, including Germany, France, and the Netherlands.

As part of the EUs renovation wave, the Multiannual Financial Framework and COVID-19 recovery plan (NexxtGenerationEU) will be assisting with financial resources. The InvestEU initiative will function as a programme to provide financing using an EU Budget guarantee to funds from investors. The aim is for this initiative to create enough opportunity and certainty for lenders to design their own bespoke packages for deep retrofit. Two key instruments used by the EU leverage private finance are the Smart Finance for Smart Buildings and Private Finance for Energy Efficiency.

4.2.2 Discounted green mortgages

Green mortgages are a popular way to finance deep retrofit currently and it is expected that their prevalence will grow. Green mortgages available in Ireland are based on the energy efficiency improvement of a home, specifically based on the BER rating in order to trigger a green mortgage. For the customer, a green mortgage means covering the capital cost of a retrofit which is the most prevalent barrier to retrofit currently. When compared to an unsecured personal loan alternative, the green mortgage has lower interest rates and a capacity to lend higher amounts. These forms of loans are different from the publicly supported loans as green mortgages are made up solely from the funds of the lending institution.

A popular EU Initiative, the Energy Efficient Mortgages Action Plan highlights a key benefit to lenders for the green mortgage concept. The lender can offer the package with more favourable terms due to a mitigation of risk effect that is seen with properties with high energy efficiency, higher property value and lower probability of default.

Green mortgages also have a straightforward application. Already it is an EU requirement that homes obtain Energy Performance Certificates, with certain standards on assessment also set out. This means that the qualification requirements for green mortgages already exist upon application for the mortgages. However, it is important to note that the time for processing mortgages can have implications for grant funding. This is because the grant funding is subject to annual budgets and therefore has tight deadlines. This has led there to be more customers availing of retrofit through a combination of personal savings and personal loans. Greater funding certainty and funding windows would be required for the mortgage option to become more attractive to customers.

4.2.3 On-tax mechanisms

On Tax Mechanisms were pioneered in the USA. The concept is to secure the finance to the land or property instead of to the purchaser. This is not a new concept to the USA as it has been used in the past for other services, but with the rise in energy renovations the mechanism is also being used to finance deep retrofits. The great advantage of these schemes is that the burden of repayment is on the occupant of the house. This way the house may become retrofitted and sold and the loan amount effectively transfers to the new occupant. Another advantage is that it opens an opportunity to tackle the split incentive dilemma.

There is still a way to go in Europe in terms of catching up to the US with the On-tax mechanisms, a key initiative in Europe leading the way is the EuroPACE project.

4.2.4 On-bill mechanisms

The concept of an on-bill scheme is to pay back the cost of the retrofit through the savings seen on the energy bills. This is attractive to consumers because they would see little to no up-front cost, then they would see no change to their energy bills until the value of the loan is paid off at which point their energy bills will become cheap.

Whilst previous attempts at on-bill schemes in the United States have been successful, attempts in Europe have been less so. In particular, the policy failure of the UKs green deal which was an attempt at on-bill financing for energy efficiency.

Lessons can however be learned from both the successful on-bill schemes across the Atlantic and the botched on-bill schemes in Europe. On-bill schemes may still then become a reality for Irish consumers.

4.3 International Banking Trends

The United Nations Environment Programme Finance Initiative (UNEP FI) is an initiative between the UNEP and the global financial sector. The aim of the initiative is to enable finance for sustainable development. Currently, the initiative has over 350 members from banks to insurers and investors. To achieve the aim, the initiative will inform, inspire, and enable the financial institutions to leverage investments to improve quality of life and enable development in ways which won't harm future generations.

As part of the initiative, three sets of industry-based principles have been established: Principles for Responsible Banking, Principles for Sustainable Insurance and Principles for Responsible Investment. These frameworks help contribute to achieving Paris Agreement targets on climate change as members from banking insurance and investment work together to facilitate learning, initiate collective action and develop practical resources to aid the financial sector in making sustainable choices.
The principles of responsible banking are particularly relevant to SuperHomes. In total, 214 banks worldwide have signed up to these principles including Bank of Ireland. This number represents over a third of the global banking industry, which shoes a clear trend. The principles below are agreed amongst the financial sector and the UNEP. These provide the framework for a sustainable banking system.

A Figure showing the 6 principles of responsible banking.
Specific requirements are put on signatories in order to sign up, they must;
1. analyse their current impact on people and planet,
2. Set targets based on this analysis and where the most significant impact can be made,
3. report on progress.
To summarise, the initiative and principles represent a new integrated approach that banks are taking in their sector. It shows incorporation of the Paris agreement, the UN sustainable development goals and national climate plans into the framework of operation for the banking sector.

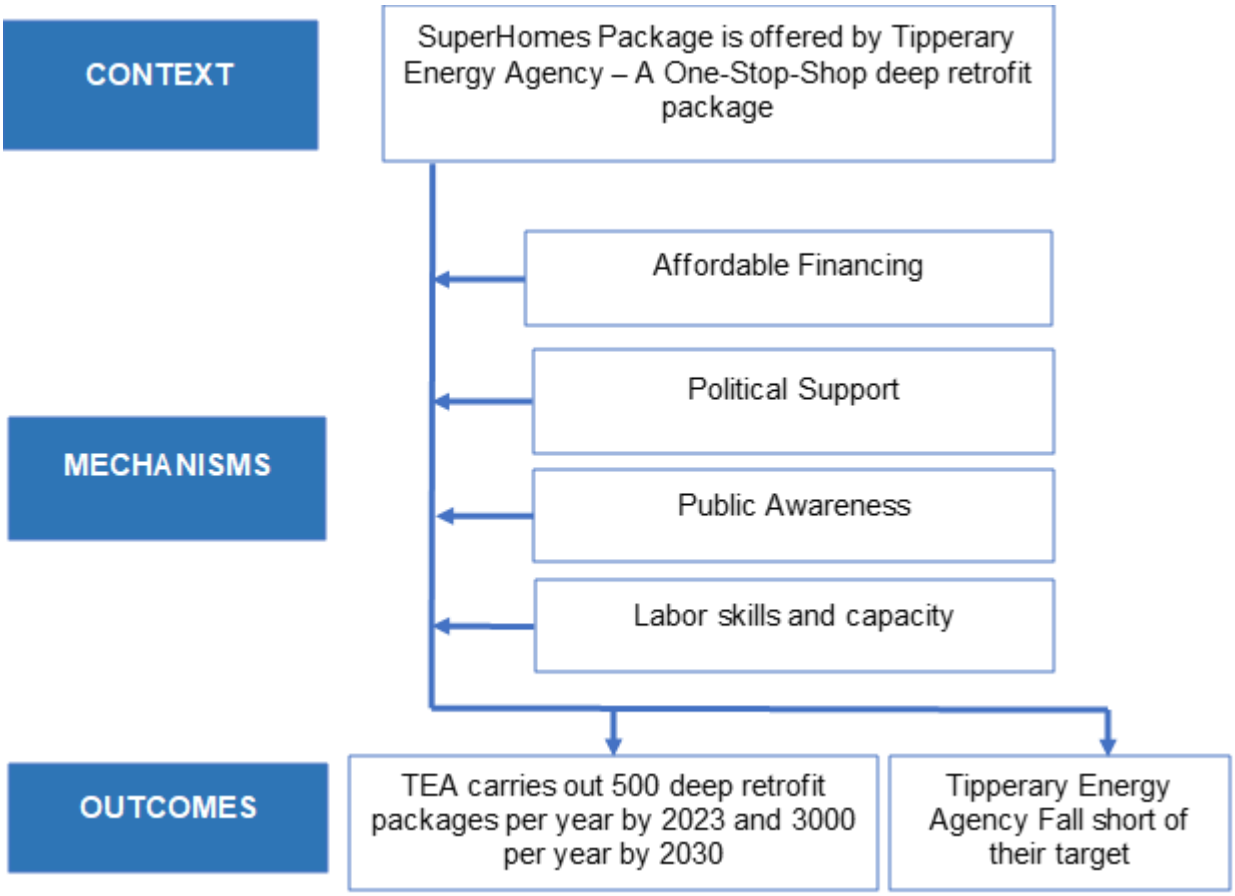
D2.4 Model Ecosystem

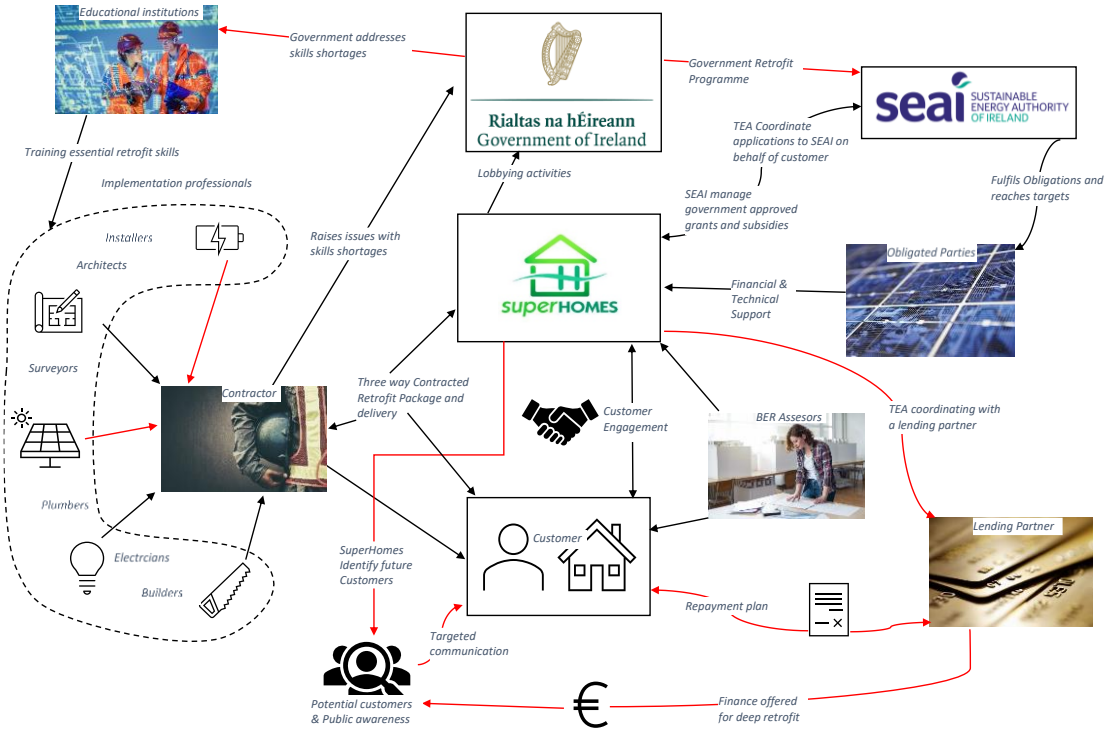
Presented is the SuperHomes Model Ecosystem. The model shows Tipperary Energy Agency in the centre with their SuperHomes offer. Highlighted within the Model are key linkages with critical organisations and institutions. This is a non-exhaustive representation of the linkages that SuperHomes must be aware of but, these have been chosen as key interactions worthy of greater analysis. Highlighted in red are the 'Mechanisms' which will be analysed using a context-mechanism-outcome configuration.

The C-M-O configuration is popularised within social sciences and is applied to the evaluation of programmes or services. It is applicable in the retrofit context because the retrofit industry has a wide variety of industry actors and professions involved. Importantly, the retrofit market is highly reliant on societal, political, and psychosocial factors. Therefore, it is useful to use this form of analysis.

The Context – This is the situation in which a programme or service operates and makes a difference to the outcome. The Mechanisms – These are the 'catalysts' for change that exist, they describe what can be effected about a programme or service. There are multiple mechanisms at play within the configuration. The Outcome – This is either the intended consequence of the programme or it can be an unintended outcome.

For SuperHomes 2030, this is summarised as;





6. Mechanism Analysis

6.1 Affordable Finance

A key mechanism identified for retrofit is financing. Deep retrofit is an expensive process. The energy efficiency grants available in Ireland which were identified in deliverable 2.1 are key enablers to retrofit. Interviewee B also claimed that these grants were what was driving the entire retrofit market currently. Deep retrofit results in savings on energy bills that will eventually 'pay back' the cost of the retrofit, however these payback periods can be long. To afford the cost of retrofit individuals would need a relatively high amount of savings or disposable income. The lack of affordable financing mechanisms means that '70% of homeowners see financing as a barrier to retrofit' according to a recent SEAI report. This shows that the current situation does not work for a large section of the population.

The impact from a lack of financing mechanism is a low uptake of deep retrofit and a challenging expansion of the retrofit market. Therefore, it is critical to have a cost-effective financing mechanism as the current situation does not work for enough people. Despite the expense, from the SuperHomes example people still signed up. Therefore, there is still an available cohort who are willing to go through deep retrofit without financing. The challenge of SuperHomes in leu of an affordable financing mechanism would then be to reach more of this cohort.

Previous report, several innovative financing options were discussed with the An Post offer highlighted as the most favourable option in Ireland. However, more recent feedback from consumers has shown that the An Post offer is very challenging to receive if seeking more than a single measure energy intervention. Therefore, it is not well suited to the SuperHomes One-Stop-Shop model. The report also highlighted that following the example of An Post, several other lenders have now entered the market. This trend tells us that the market for financing options for deep retrofit is growing and bringing in more competition, which should benefit the homeowners by gradually improving the lending conditions offered by the lenders. Both interviewee B & C agreed that an effective financing solution to the Irish retrofit market would include a blend of financing. Some options discussed such as the green mortgage,

the retrofit specific loans could make up this blend of financing. The impact of which would likely see an increase in the uptake of retrofit as one of the major barriers is mitigated.

Long standing grants and subsides would inevitably make the market more certain and thus allow for greater expansion of the labour force. This certainty has been lacking up to now with programmes having a start/stop nature. This sentiment was reflected in responses from all four interviewees as well as the survey respondents and focus group participants carried out for the task Construction Sector Deep Retrofit Opinion Base.

The grants and subsidies work for the government, they are cost-effective and produce many benefits. Firstly, 35% of grants are cost neutral when tax, vat, employment, health and EU fines are accounted for. The government have climate commitments with the EU to cut carbon emissions and reduce energy demand from housing stock. The grants and subsidies enable retrofit which works towards the climate commitments. The added benefit of grants and subsidies is that it also acts as investment into the construction industry as it works to grow employment in the sector. The co-benefits of retrofit are also a sign that the grants and subsidies are working well in Ireland. Healthier homes with cheaper energy bills are two key benefits to the population outside of the reduction in carbon emissions. Another benefit is quality assurance due to inspections and requirements of the deeper retrofit funding schemes.

6.2 Labour Force & Incorporation of Future Technologies.

A Key mechanism for SuperHomes offer is the capacity of the labour force available to carry out deep energy renovations. Deep retrofit requires high levels of skill in all the disciplines involved. Most deep energy retrofits carried out in Ireland will include a heat pump. The Irish government have pledged to install 600,000 heat pumps in households by 2030. Heat pump installation is typically carried out by a plumber with specialist certification in heat pump installation. The design of a deep retrofit is carried out by a design engineer and must be tailored to the individual needs of each individual construction. This process requires knowledge of the performance of buildings, the available solutions and the measures needed to ensure the best possible outcome of the retrofit. The move towards digitalisation means that the designers will likely need the skills to use Building Information Modelling software to stay competitive. Contractors carrying out the retrofit process need to have experience with improving building envelopes and controlling air leakage.

In the national context, the current situation is that the skills are not there to reach the desired outcome national plan. The SOLAS National Skills report highlighted shortages across all disciplines of construction, from project managers, to surveyors, engineers, and installers. This will affect SuperHomes directly, as they would need to utilize a share of the skills available. Training programmes are available for upskilling within the industry and the education system is supplying more labour, but not at a rate for what is necessary for the SuperHomes program.

Contractors in particular struggle to upscale their business operations and fully commit to becoming ‘retrofit contractors’. A main reason behind this is because of the uncertainty in the market and the stop/start nature of government programmes. Also significantly the retrofit area is a specialised area and so training and experience is often required. These business plan implications would then have a knock on effect when these contractors try to access finance to grow.

However, the future may be positive for improving the current situation. As many indicators are suggesting that the retrofit industry will be the basis of a ‘green bounce back’ for the

economy. This can be seen in the investment pledges in the programme for government in Ireland but further investment specifically in addressing skill shortages is the next logical step.

The other aspect to this mechanism is the future technology that is entering the market. Both SuperHomes and the contractors must be aware of these technologies to be able to apply them to retrofit when it will be of significant benefit. Vitally, any standards and requirements must be considered and prepared for, as often new technology requires specific training from the manufacturer before installation is possible.

6.3 Public Awareness & Engagement

A key mechanism for retrofit was identified as public awareness and engagement. The SuperHomes focus group revealed the importance of public awareness, as all participants in the focus group were in some way aware of the retrofit process before deciding to commit to the SuperHomes package [Annex 2]. This is a key finding for SuperHomes as it shows that awareness is key to stimulating the demand side of the market. This was reiterated by interviewee D as the number one action that could help SuperHomes achieve their desired outcome [Annex 1]. Further reinforced by respondents and focus group participants under the task Construction Sector Deep Retrofit Opinion Base.

SuperHomes as part of the 'retrofit trends analysis' in D2.1, trigger points were identified where the consumers may be able to opt for choosing a deep retrofit package. Lessons can be learned from this research as the trigger points can serve as 'pressure points' where targeted communication can be used. Also, interestingly, the idea of 'trigger point creation' by way of offering free energy audits could become a future trend within the retrofit market. Whilst the success of this service can be seen abroad, in Austria for example, it is unclear if it would work in Ireland. Currently, in Ireland some one -stop-shop services offer an over the phone Audit which does not offer an accurate assessment. It is probable that a full audit offered for free would become oversubscribed which would lead to a lack of fulfilment and delays. However, perhaps SuperHomes could develop a more accurate self-audit system that could be offered to potential customers that could stand in for the purpose of trigger point creation whilst not committing to fully costed audits.

6.4 Political support

Political support is a key mechanism for deep retrofit. As discussed in the PESTEL analysis, political agendas and policy initiatives are trending 'green'. As seen, in Ireland, the EU and globally the climate change agenda is prevalent and important to elections. Political support has been an effective mechanism for SuperHomes. When SuperHomes first started deep retrofit in 2015, the participants were mainly those closely linked to the agency. It was not until 2017 that the SuperHomes package began to bring in large numbers of participants. At the time, the government was a coalition between Fine Gael and Independents. They brought out a pilot project of deep retrofit grants, as SuperHomes were pioneers up to this point, it put them in a very good position to expand their operation from there. This is an example of political support aiding the development of the retrofit market, particularly from a SuperHomes perspective. This can be reflected across the entire deep retrofit market.

Looking ahead, it is again positive for the SuperHomes context. Now the government is a broader coalition, which critically includes the Green Party. Political support can be seen to continue for the retrofit market through the government pledges to carry out increased rates of retrofit. Political support is expected to also improve as a coalition party is highly intent on driving the retrofit agenda

7. Conclusion

From the research several key areas for future trends were identified, Technology, political support, innovative business models, and financing opportunities. The research found that technology did not present a barrier to market growth and that future technology would be primarily innovated to improve the process of deep retrofit, reduce costs, or improve the user experience. Particularly, Building Information Modelling was highlighted as a key technology trend for deep retrofit. Not only was it shown to improve the process of deep retrofit from a practical planning and design perspective, but it will also be useful for the entire supply chain in simplifying and standardising information. BIM therefore, will be extremely useful in helping to integrate two huge technology trends entering the modern market in smart home technology and Electric Vehicles. With the current cost of BIM software and training requirements, it would be expensive for small companies to take on and may be more suited to larger 'batch' projects such as with housing associations.

For innovative business models, there is a heavy body of research pointing towards the one-stop-shop business model being one of the most effective business models for delivery of deep retrofit. This is appropriate to SuperHomes as it affirms that the correct general approach has been taken. However, research also pointed to growth in innovative business models that have larger levels of customer involvement such as ESCOs and Co-ops, so perhaps these are future competitors to SuperHomes, or they could be studied further to learn and try incorporate the best elements of these business models into the SuperHomes business model. Evidence from the Construction Sector Deep Retrofit Opinion Base; when asked to Rank preferred Type of Delivery Organization 76% Chose 'One Stop Shop' model as their No. 1 Choice with a further 13% as their No.2 Choice. Compared to the next closest 'Contractor Led' being only 16% as No1 Choice and 58% as No. 2 Choice.

For the future trends within politics, it is clear that on a European level 'greening the economy' is top of the agenda with Ursula Von Der Leyen's cornerstone initiative European Green Deal. The deal goes further and any previous ambition of the EU and for the first time it includes a crucial pillar in that the Just Transition Mechanism aims to bring along and provide aide and support to those communities most effected by the energy transition. This is a key pillar of the green deal as it aims to guarantee the success of transition by persuading everyone onto the same page.

The future trends within financing show that Green mortgages and unsecured personal loans are growing in popularity in Ireland, with a growing number of consumers aware of these products but also more lenders entering the market with packages. The other innovative financing options to enter the market could be on-bill or on-tax financing mechanisms but these still require work before becoming viable and available across Ireland.

The Model Ecosystem is a useful aide to visualise the business ecosystem that SuperHomes operate in. The Model shows concise relationships between the major players within the market and presents an opportunity to analyse specific interactions. The model was then analysed using a context-mechanism-outcome approach which is a methodology popularised for programme evaluation, in this situation the SuperHomes offer was treated as the programme. The Key Mechanisms were analysed and summarized.

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9. Appendices

Appendix 1 – Interview Schedule & Results

Interviews were conducted as part of the primary research for this report. These interviews aimed to explore the views of expert stakeholders on key trends in the retrofit market. Interviews were carried out using a structured interview schedule (see appendix No1) which included generic questions on the retrofit market for all interviewees. Subsequent questioning focused on issues relevant to the individual interviewee's area of expertise All participants were asked introductory questions on current challenges of the retrofit market. Further questions sought to establish participant's view on what strategies might best address these challenges and what future opportunities were presented by the retrofit market. Three interviews in total were carried out interviewees 'B'&'C' both present at one interview).

- Interviewee 'A' is from a key academic stakeholder from Limerick Institute of Technology, they are also involved with TEA and further European projects.

- Interviewee 'B' is a leading expert in the field of sustainable and green finance, whose business consultancy is based in Dublin.

- Interviewee 'C' is an experienced consultant to the public and private sector on alternative and sustainable finance.

- Interviewee 'D' is highly experienced in the home retrofit process. Working for Tipperary Energy Agency as the point of contact for customer engagement.

Interviewee 'A' - Tailored questions for Interviewee 'A' aimed to gain insight into pollical, regulatory, economic, and social factors effecting the retrofit market. Key issues included the interviewee's perception of the current government strategy towards deep retrofit (as per programme of government). Additional areas of discussion included exploring which industry forces are most effective in pushing the deep retrofit agenda (European projects, politicians, financial institutions), existing market failures and which industry actors need to do more to play their part.

Interviewee 'B' & 'C' - Tailored questions for Interviewee 'B' & 'C' firstly, aimed to gather perceptions of the grants, subsidies and loan options that are currently in place in Ireland and the level of exclusion that exist due to the limitation of these options. Next questions aimed to gather insight into what is likely to be the future of financing mechanisms in Ireland and what emerging innovative financing mechanisms are exciting for the Irish context.

Interviewee 'D' - As the SuperHomes offer from TEA is used as a case study for this research, tailored questions for Interviewee 'D' would be specific to the SuperHomes offer. Firstly, questions aimed to build a picture of the SuperHomes offer as a commercial offering, from its beginning to where it is now, how it got there, what challenges it faced and how competitive the market is for SuperHomes. Next questions were asked to gain insider perspective on the goals of the SuperHomes expansion project, how realistic are the targets and what needs to happen to get there. Finally, Interviewee 'D' was asked to view the business ecosystem of SuperHomes and comment on the adaptability of SuperHomes to respond to ecosystem trends.

1.1.1 Interview Schedule

Generic questions

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?

Interviewee A

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?

Interviewees B & C

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?

Interviewee D

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

1.1.2 Results

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 Interviewee D 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. Interviewee B 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. Interviewee C 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 people's day to day lives that is usually caused by a retrofit.

Interviewee D 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.'

Interviewee A identified digitisation as a major opportunity for the deep retrofit market. Interviewee A identified key areas of the retrofit process that can be greatly improved with innovation digitisation, marketing, surveying, designing, management. Interviewee A 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 markets, industry, and politics – Interviewee A

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

Interviewee A, 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, Interviewee A expressed scepticism over the capacity of the state institutions to deliver on that ambition, namely the various state departments, the SEAI and local authorities. Interviewee A 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?

Interviewee A 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, Interviewee A 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. Interviewee A 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 – Interviewees B & C

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

Interviewee B 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, Interviewee B 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, Interviewee B and Interviewee C 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. Interviewee C 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?

Interviewee B quotes the SEAI stats that '70% of people see finance as a barrier to deep retrofit'. Interviewee C 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 Interviewee C and Interviewee B 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 – Interviewee D

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, Interviewee D 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?

Interviewee D 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. Interviewee D 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, Interviewee D 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 Interviewee D 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, Interviewee D 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, Interviewee D 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.

Appendix 2 – Focus Group

A focus group was carried out by TEA to gain insight into several key areas; to identify perceptions of the SuperHomes process from the customers who have completed the process. This is highly relevant data as it contributes to the understanding of customer trends. The data was specifically for the 'SuperHomes' offer and so it contributes to a 'case study' of TEA SuperHomes - a major actor in the market. Participants in the focus group were early adopters of deep retrofit provided by TEA since 2015. The focus group session was split into 4 sections. 1. Awareness & Diffusion. 2. Adoption. 3. Finance. 4. SuperHomes. The questions were a mixture of open questions and some statements which asked participants to 'rank' they agreement, from 1-5.

The TEA focus group findings identified a number of positive trends; in relation to client awareness of Deep Retrofits prior to engaging with the project 50% of respondents 'very much aware' and 50% 'relatively aware. Key responses of those who were 'very aware' included 'I was fairly familiar with it - I am a construction studies teacher' and 'very much aware – I had installed insulation in a previous home'. Those who were relatively aware stated ''I thought all I had to do was buy a heat pump & stick to the side of my house and it'd all work' and not that familiar'. In relation to how clients become aware a wide range of mechanisms were identified including advertisements online, previously installed works, a story Twitter feed, attendance at a TEA information event to visiting a neighbour's retrofit home. In addition, renovation works to previous and current dwellings appears to be an important factor within deep retrofit engagement, however many of those who considered themselves 'very much aware' admitted underestimating the deep retrofit process.
Many respondents identified 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. Findings in relation to the likelihood that a client would recommend a 'deep retrofit' to others were particularly positive with 75% of respondents 'highly likely' to recommend it and only 25% 'less likely' do so. Every participant stipulated that their recommendation would come with a warning to highlight the 'high cost, long installation time, upheaval and mess created throughout the Installation Process.'

In relation to drivers and barriers, the focus group identified several important trends. As expected through research, financial savings through the grant was a significant driver. Environmental concerns were also seen as a significant driver whilst health concerns less so. An important note would be that a high proportion of the participants were 'already planning to carry out' a renovation project. This is important as it calls into question the ability to pull in new unaware clients. For barriers, finance was the seen as the most significant which was expected.

From the focus group 75% of participants said they had installed energy efficiency measure before applying for the deep retrofit. This includes a mixture of measures such as windows, change of heating system, re-insulation, etc. When asked about the possibility of 'trialling' a deep retrofit all percipients indicated that the lack of a 'trial' did not affect their decision making. Key quotes from this answer include 'I also have a friend based up in the Wicklow mountains with a passive house and it's just always warm year-round and its wonderful and that's the extent of a trial that I would have had' and 'I Was going ahead with it anyway'. The deep retrofit grant appeared to be vital for decision making; 'Wouldn't have done it unless the Grant was there' and 'A Major Factor' this was also seen when the participants were asked about carrying out the retrofit if the grant weren't available. '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'and 'I would have just bought more Kerosene'. Finally, when asked about the introduction of green financing and the replacement of most of the grant, the feedback was shown a positive trend toward the grant structure. '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' and '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''.

The final section of the focus group was concerned with the SuperHomes offer from TEA which is used as a case study for this report. When highlighting issues in the SuperHomes process two categories of issues were discussed: issues with architects & buildings and issues with co-ordination & communication. Mixed responses were given for both categories with 38% of participants finding issues with architects & builders and 50% finding issues with co-ordination and communication. These issues were linked with the disruption to lifestyle caused. The participants showed a trend of 'self-awareness' earlier in the focus group, this trend was seen again when they were asked about enhanced forms of communication such as through channels such as the bank or estate agents. Most participants seen this as unsuitable to themselves as they were already aware, however one key answer captured the shared feeling; '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'. When asked about the concept of an information hub based locally, the answer was unanimous, 100% responded yes. '…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'

Overall, the feedback from the focus group was positive. All the participants were in some way aware of the deep retrofit process before beginning. Awareness came from a variety of channels, but some participants had underestimated the process. This finding is particularly interesting as despite 75% of participants indicated they would recommend the deep retrofit to someone else, the common response indicated that the recommendation would come with a warning about the disruption to day to day life caused by the retrofit process. As expected, finance was the key issues for the section on drivers and barriers. The availability of the grant was the key driver, whilst the financial burden left over was the key barrier. Importantly at this stage of the focus group, a high proportion indicated they were 'already planning on carrying out the retrofit' meaning that the focus group sample failed to bring in any participants who had been won over. 75% of participants had carried out an energy efficiency measure before, of which the responses on which measures was varied. The grant was seen as a major factor by all participants in this section, and the commonality relating to the green financing question was that the participants would still opt for the grant + personal savings option instead of the green financing. Perhaps this is because the sample size has access to the personal finances, again another question raised over the mixture of focus group sample. Finally, when asked about the SuperHomes process, 50% of participants found issues with communication & co-ordination whilst 38% of participants found issues with builders & architects, this again points to problems with the retrofit process and disruption that was pointed out earlier in the focus group.