Irish Climate Policy Evaluation Project

EPA Research Project 2017-CCRP-DS.12

Evaluation of climate change mitigation policies in Ireland's built environment sector

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1. Introduction

The Irish Climate Policy Evaluation (ICPE) project was funded by the EPA (2017-CCRP-DS.12). The aim of the project was to undertake an ex post evaluation of Ireland's policy response to climate change across all sectors since 1996. As an exercise in ex post evaluation, the ICPE project focused on policies and measures already in place at the commencement of the project. Our first ports of call were the NMP, the NAF and data submitted by Ireland under the EU's Monitoring Mechanism Regulation [(EU) No. 525/2013/EU], which requires Member States to report on policies and measures they have adopted to reduce GHG emissions and adapt to climate change. Those policies listed as planned or implemented only in 2017 or 2018 in the NMP were excluded from our analysis. Moreover, policies and measures announced as part of the National Development Plan or the Climate Action Plan fell outside the scope of our analysis.

The project technical description called for an evaluation of "effectiveness, efficiency, coherence and relevance. The evaluation framework utilised should align with standard evaluation criteria and procedures used in ex-post evaluations of EU policies". Accordingly, the ICPE project incorporated the standard criteria of effectiveness, efficiency, coherence and relevance, but, importantly, added two additional criteria: "governance" and "distributional impact". Because of the diverse set of criteria that spans both process and outcome dimensions, the project drew on a diverse set of qualitative and quantitative data and sought to triangulate from multiple sources where possible.

We divided our research into five sectoral work packages. For each of the five work packages, our research commenced with a comprehensive mapping exercise drawing on a wide range of data sources. This was used to produce a sectoral overview that detailed policies in place and undertook an initial evaluation according to the six criteria above. This overview was then presented at a workshop of invited sectoral stakeholders: policymakers from across relevant government departments and public bodies, business, civil society and academia. Input and feedback were sought at these workshops on the research to date as well as on areas suitable for further research.

This document presents the findings of our research on climate change mitigation policies in the Built Environment sector. Section 2 provides a broad overview of the sector in terms of its emissions and energy use, and the number of buildings in the various subsectors. Section 3 presents the actions and measures pertaining to the built environment as laid out in the National Mitigation Plan (NMP). The focus in this section is on actions and measures that are currently in place, not those in the pilot phase. Section 4 evaluates the actions and measures against six evaluation criteria: effectiveness, efficiency, coherence, relevance, distributional impact, and governance. Section 5 presents a case study of the Better Energy Homes programme. Based on the assessment, we put forward recommendations for future actions.

2. Sectoral overview

The mitigation transition objective for the Built Environment sector is defined in the National Mitigation Plan (DCCAE, 2017c) as follows:

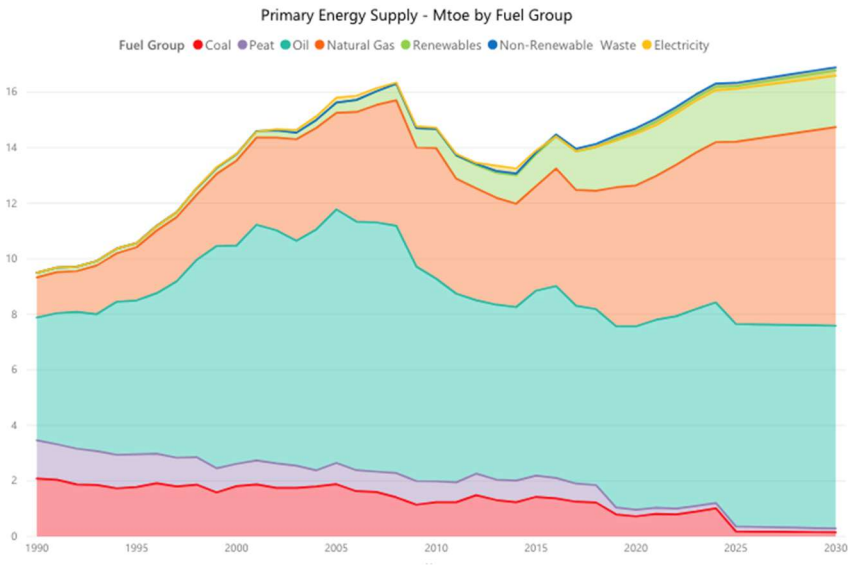
> Decarbonising the Built Environment focuses on action being taken to improve energy efficiency and reduce greenhouse gas emissions associated with Ireland's building stock, sets out the work that is currently underway to prepare for deeper measures after 2020, and provides a 2050 vision for Ireland's built environment.

The built environment as per the National Mitigation Plan (NMP) is defined as Ireland's building stock, meaning residential housing, commercial buildings, industrial buildings, and public buildings. For the purposes of this research project, we also included in our analysis services associated with the built environment that contribute to Ireland's emissions: water and waste. Electricity generation and transport are covered in separate sectoral studies conducted as part of the ICPE project.

The building stock in Ireland at present consists of 2,003,645 residential dwellings (CSO 2017), 109,000 commercial buildings (SEAI, 2015), and public buildings which includes approximately 3,700 schools and 45 hospitals.

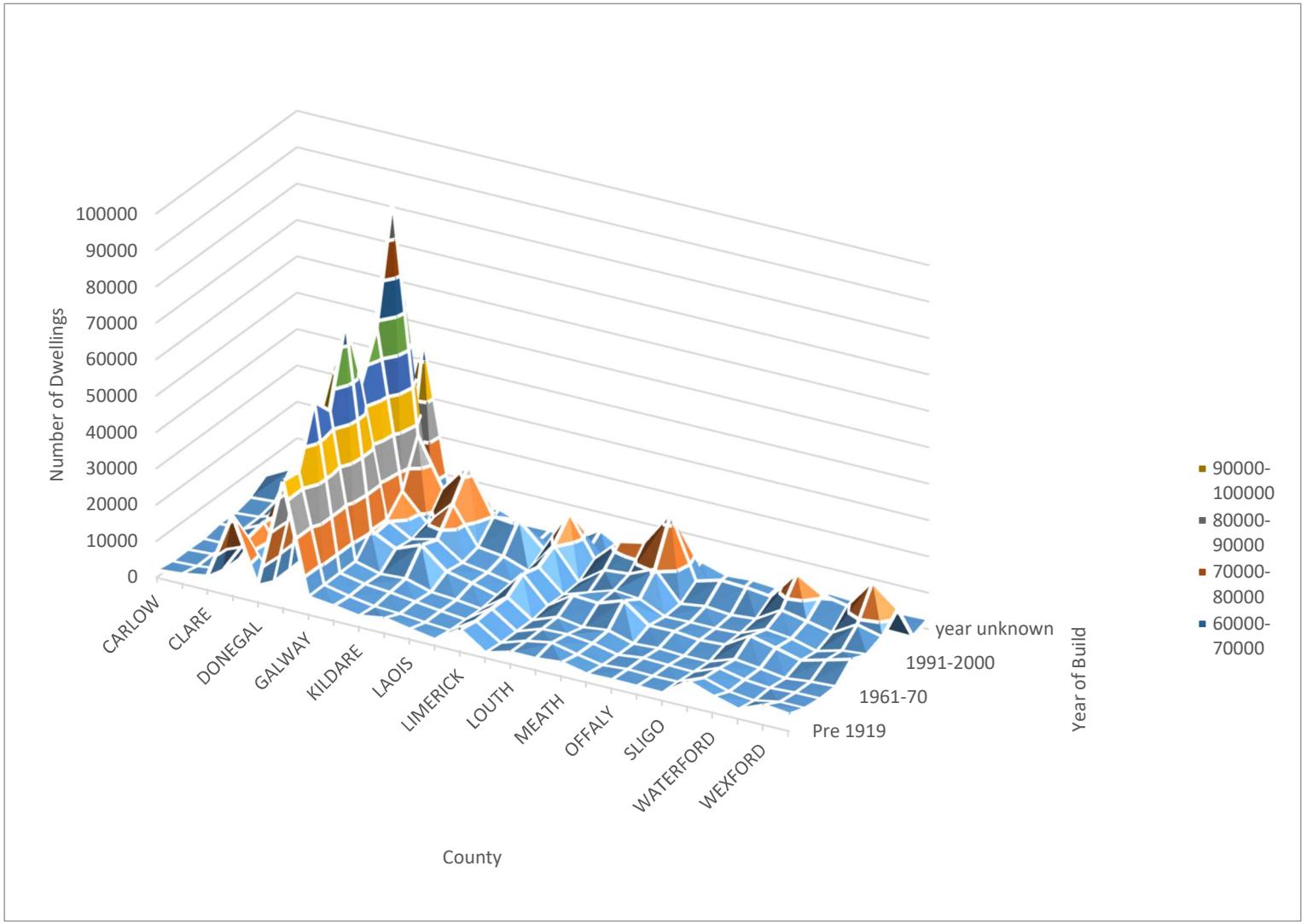
Provisional emissions arising from the built environment for 2018 are as follows: 6.197 million tonnes carbon dioxide equivalent ($MtCO_2eq$) for residential, and 0.980 $MtCO_2eq$ for public services (EPA 2019).

Figure 1: Primary Energy Supply



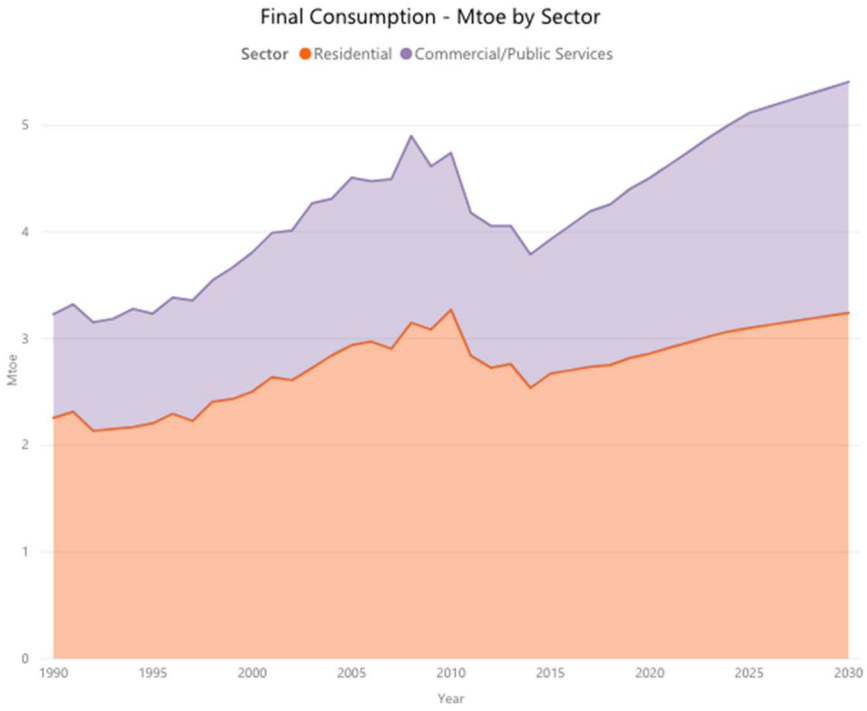
Source: SEAI (2018)

Figure 2: Ireland's Housing Stock by County and Period of Build



Source: CSO (2017)

Figure 3: Final Energy Consumption by Sector (Residential, Commercial/Public)



Source: SEAI (2018)

2.1 Residential

Figure 2 presents the number of houses by period of build and by county. According the NMP (DCCAE, 2017c) and Annual Transmission Statement 2017 (DCCAE, 2017a), 350,000 households have availed of various government grants to retrofit and improve energy efficiency of dwellings. According to the SEAI database for the BEH between 2009 and 2018, 219,988 homes have been upgraded under the Better Energy programme with a total of €225,433,626 in grants issued (see Appendix III) (SEAI, 2018, DCCAE, 2017a). Approximately 20.5% of these upgrades were in Dublin and amounted to 26.3% of total value of the grants issued. Since the introduction of the BER system in 2013 there are 788,445 ratings on the public register; 60.5% of these are between D2 and C1, and 7.2% are rated G and 0.01% are A1 (see section 3.8 for details of the BER system). Energy use and demand are rising as illustrated by Figures 1 and 2.

2.2 Commercial

Addressing energy use in the commercial sector is primarily achieved through the Large Industry Energy Network, a voluntary group of 192 members accounting for 19% of total primary energy and 55% of all industrial energy use (Figure 3 presents commercial and public sector energy use). An SEAI survey in 2015 of commercial buildings indicated that there are potentially significant energy savings to be achieved through upgrades of the building stock (SEAI, 2015).

2.3 Public sector buildings

SEAI is responsible for assisting 300 public sector bodies and 3,700 schools reduce their GHG emissions through energy efficiency measures, retrofits and behaviour change. In 2016, according to the 4th NEEAP, 337 (96%) of public bodies and 1,742 schools reported their energy use to SEAI and it was reported that final energy savings in the public sector for 2016 was 1784 GWh (DCCAE, 2017b).

2.4 Waste and Water

Waste and water are services delivered in the built environment. Waste is a by-product of the built environment and contributes to GHG emissions in several ways: landfill, collection of waste, shipment of waste, and burning of waste. Distribution and treatment of water in the built environment requires energy and produces emissions from this.

3. Actions and Measures in Place

The majority of policies introduced to address emissions by way of reducing energy consumption in existing buildings and setting standards for new buildings were introduced since the beginning of 2009. The policy measures developed in response to EU Directives are of a financial, legislative, or informative/educational nature. They have been administered through the Sustainable Energy Authority of Ireland (SEAI), energy agencies (e.g. Codema, Tipperary Energy Agency, Three Counties Energy Agency (3CEA)) and local authorities.

The local authorities (some with assistance from energy agencies located within their boundaries) have implemented policies and measures that are focused on reducing emissions from social housing and buildings owned by the councils (such as leisure centres, libraries, and fire stations). Appendices I and II below were derived from the MURE (Mesures d'Utilisation Rationnelle de l'Energie) database, the National Mitigation Plan (NMP), and the Annual Transition Statement 2017 (measures with an * in front have been reported on in the Annual Transition Statement). In the NMP, 28 actions and 23 measures related to the built environment are concerned with reducing greenhouse gas emissions from the building stock and improving energy efficiency. Few measures in the built environment sector focus on behaviour change, and there are no measures that address GHG emissions stemming from consumption of goods and services and other day-to-day activities.

This section provides a summary of the actions and measures currently in place. It should be noted that, as this is an ex-post analysis, actions and measures considered are those that are active or completed before July 2018 and not at the pilot stage.

3.1 Better Energy Homes

The Better Energy Homes (BEH) programme was introduced in 2009. Administered by the SEAI, the programme aims to reduce energy household consumption by 1,900 GWh by 2020 (SEAI, 2018; Collins and Curtis, 2016; Collins and Curtis 2017). Up to January 2018, owners of homes built before 2006 could apply for grants to undertake 4 types of energy efficiency

measures: roof or attic insulation, wall insulation (3 types: cavity, external or internal), boiler upgrades (3 types: oil, gas with heating controls, or heating controls only) and solar collector installation.[1] The value of the cash grants depend on the measure or measures undertaken by the homeowner, ranging from €300 to €6,000.[2] Eligibility for the programme is determined by SEAI. Homeowners interested in grants must apply through SEAI, and must provide information on energy use by giving their MPRN (Meter Point Reference Number), the year of build, housing type, and measures to be undertaken. If awarded grant aid, they must complete works within 6 months of receiving approval. SEAI also provides a list of approved contractors, technical advisors, BER assessors, and suppliers of products that homeowners must follow to ensure that works are completed according to the technical requirements.

3.2 Better Energy Warmer Homes

The Better Energy Warmer Homes scheme was established in 2002. The scheme is projected to result in 590 GWh of energy savings by 2020. Unlike the BEH programme, the BEWH scheme covers the full costs of energy efficiency measures. In addition to the upgrades included in the BEH, the BEWH programme includes secondary measures such as lagging jackets, draught proofing, lighting and, if necessary, window and door replacements. To be eligible for the programme, applicants must own and live in their home, which must be their principle residence. The home must have been built and occupied before 2006. Finally, the applicant must be in receipt of either fuel allowance, job seekers allowance for over six months and have a child under 7, working family payment, one-parent family payment, domiciliary care allowance, or carer's allowance while living with the person in care. Homes are assessed by an SEAI-approved surveyor to determine if the home is suitable for works. If a home is deemed suitable, works are undertaken. Broadly, the whole process takes 6 to 9 months on average, depending on the works to be done.

3.3 Better Energy Communities

SEAI's Better Energy Communities (BEC) programme is a national programme that aims to undertake community-level energy efficiency projects. Central to the programme is partnerships between homeowners, communities, and the private sector to develop innovative projects that will deliver energy savings to all involved. Projects are eligible for up to €1 million a year (a total of €28 million in grants are available). Furthermore, all projects must be partnered with a primary energy supplier. Grant applications are evaluated based on key criteria: value for money; membership of SEAI's sustainable energy community; partnership, innovation and technical application; and quality and delivery. Projects are expected to meet the standards set by SEAI, employ contractors registered with SEAI, and upon completion of upgrades the average BER rating of all buildings participating in the project must be C3 or higher. BERs for all homes and buildings included in the project are required before works begin and after they are completed, these are to published (see section 3.8 for details of the

[1] Gas boilers were eliminated in January 2018. Heat pumps were added in April 2018. However, as this ex post evaluation covers measures in place up to mid-2018, we do not consider this change as part of this evaluation.
[2] Lower value of grants has been increased to €400

BER system). The lead applicant is responsible for bearing the initial costs of the project and overseeing all aspects of the project, and may designate a project coordinator who is responsible for selecting BER assessor. Finally, there can be no more than ten beneficiaries of a project, and beneficiaries must be groups of private businesses, community facilities, sports clubs or individual homes, for example. For residential projects, under the BEC there is an option for communities to undertake deep retrofits. Homes in this stream must achieve a BER rating of A3 and must include fabric upgrades, heating, ventilation, and renewable energy technology. An additional 15% of funding is provided for deep retrofits.

3.4 Social Housing Upgrades

Social Housing Upgrades are being achieved through a two-phase retrofit programme funded by the Department of Housing, Planning, Community and Local Government to upgrade 153,000 unit of social housing (DHPLG, 2016). Phase one commenced in 2013 and involved retrofitting all eligible local authority owned social housing with attic and cavity insulation. Phase 2 was piloted in 2015/16 and is currently being rolled out across all local authorities. Retrofits will focus on external fabric upgrades for units with solid/hollow block wall construction. By the end of 2018, €129 million has been spent to retrofit approximately 68,000 units.

3.5 Guidelines for Quality Housing and Sustainable Communities

Emerging from the then Department of Environment, Heritage and Local Government's *Best Practice Guidelines for Quality Housing for Sustainable Communities: Delivering Homes Sustaining Communities* were published in March 2007 (DEHLG, 2007). The guidelines provide stakeholders involved in the development of housing such as architects, engineers, planners, developers, and urban designers with information on housing to align with Government policy in relation to sustainability, architecture to provide high quality living environments, and design to meet life-cycle needs of residents. Furthermore, the guidelines are intended to encourage design that takes into account environmental protection and optimises infrastructure and land-use, in order to create high quality housing in complete communities with density, with access to schools, shops and amenities within walking distance. Additionally, it requires that new houses meet energy performance standards such that emissions are reduced and energy efficiency is improved by 40%, but this target for improvement is not benchmarked.

3.6 Green Public Procurement

Under European Union Energy Efficient Public Procurement Regulations 2011 (SI 151/201), public sector organisations in Ireland are encouraged to procure products that support Ireland's environmental and sustainable development objectives. Given that 10-12% of GDP is connected to public sector procurement of goods, services and works, introducing green procurement guidelines provided an opportunity to stimulate the market for resource-efficient and less polluting goods. To assist public sector bodies with green procurement, the EPA provided guidelines that cover 8 sectors:

1. Road transport vehicles and services
2. Energy
3. Construction
4. Food and Catering services
5. Cleaning products and Services
6. Textiles and Uniforms
7. Office IT Equipment
8. Paper

Finally, public sector bodies that have demonstrated best practice in the area of green procurement have been highlighted in the National Action Plan 'Green Tenders', to encourage further uptake of green procurement practices, which is currently voluntary.

3.7 Accelerated Capital Allowance

The Accelerated Capital Allowance (ACA) is a tax incentive for companies that pay corporation tax to purchase energy efficient equipment (Department of Finance, 2017). The programme was initiated in 2008, and was intended to last 3 years; it was also extended in 2010 to 2014, then in 2014 to 2017 and again in 2017 to 2020 based on a review of the programme's cost effectiveness. Companies are able to write off 100% of the purchase cost for equipment that qualifies against their profit in the year of purchase as opposed to over the usual eight-year period; these products are listed on the ACA specified list. There are ten categories of qualifying equipment:

1. Building Energy Management Systems (BEMS)
2. Lighting
3. Motors and drives
4. Information and Communications Technology (ICT)
5. Heating and Electricity Provision
6. Processing and Heating, Ventilation, and Air-conditioning (HVAC)
7. Electric and Alternative Fuels Vehicles
8. Catering and Hospitality Equipment
9. Electromechanical Equipment
10. Refrigeration and Cooling Systems

It should be noted that the programme does not result in tax being forgone by the State as companies would have qualified for wear and tear allowance; as such the programme provides cash flow for companies.

3.8 Building Energy Rating (BER) Certificates

The Building Energy Rating (BER) programme is managed by SEAI. The BER is a scale ranging from A1 – most efficient to G – least efficient, that is used to indicate the energy performance of a building. BERs became mandatory in 2013 for all housing that is being sold or rented. The objective of providing a BER is to inform home owners and renters of the energy

efficiency of their dwellings. Commercial buildings also have BER ratings. Obtaining a BER for a building is undertaken by a qualified BER assessor. As part of this the SEAI has provided guidance for professionals to understand how BERs are assessed through the Dwelling Energy Assessment Procedure (DEAP). The DEAP is the official methodology used for calculating BERs and consists of software to assist in calculating BER. The DEAP also ensures compliance with Part L of the Building Regulations (see next section). By providing DEAP, the SEAI ensures that projected energy consumption and CO_2 emissions are standardized and therefore comparable. Critically, it enables the publication of BER certificates which show the building's or dwelling's energy consumption and CO_2 emissions, along with recommendations by the assessor to improve the energy performance of the building or dwelling. BERs are publicly available via the SEAI website.

3.9 Part L of the Building Regulations

Part L of the Building Regulations sets out the standards for energy conservation in new dwellings and buildings:

> A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide (CO2) emissions associated with this energy use insofar as is reasonably practicable. (DECLG, 2011)

To assist with compliance, in 2011 the then Department of Environment, Community and Local Government produced a technical guidance document for the application of Part L in both new and existing dwellings (where a material change occurs) (DECLG, 2011). The guidance is specifically for dwellings, and there is separate guidance for buildings that are non-dwellings.

3.10 Energy Efficiency Obligation Scheme

The Energy Efficiency Obligation Scheme (EEOS) is administered by SEAI to ensure compliance with Article 7 of the Energy Efficiency Directive. Under the EEOS, obligated energy suppliers are required to achieve a cumulative energy savings target measured as a 1.5% decrease in annual energy sales. Each obligated energy supplier's individual target is based on their share of the energy supply market.

3.11 Large Industry Energy Network and SME Support

For over 20 years SEAI has worked with large industry energy users to reduce their energy use and increase their energy efficiency through the Large Industry Energy-users Network (LIEN). Large industry users are defined as those whose annual energy bills exceed €1 million per annum. At present there are over 200 members in the network, at various stages of energy management. There are a range of strategies and initiatives available to LIEN members to support their energy management plans and projects such as: EXEED, ISO 50001, technical workshops and training.

ISO 50001:2018 provides a framework of requirements for organizations to:

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the policy works
- Continually improve energy management

For SMEs, SEAI has developed a comprehensive guide to advise business owners on actions that they can take to reduce their energy costs. It provides suggestions that range from maintaining office comfort by installing thermostats and choosing horizontal blinds to avail of solar gain and reduce demand for artificial lighting, to actions that can be taken in the office kitchen. Beyond the office, the guide provides advice for SMEs involved in production and manufacturing, and eco-driving tips for businesses that require transportation.

3.12 Qualibuild

Qualibuild started in 2013 as an EU project under the European Commission BUILD UP Skills Initiative. The scheme was an effort to create employment and assist Ireland in meeting its EU 2020 Energy Efficiency target, and was completed in July 2016. It involved a partnership between Limerick Institute of Technology, the Irish Green Building Council, Institute of Technology Blanchardstown, Dublin Institute of Technology, and the Construction Industry Federation. The programme achieved the following (IGBC, 2017):

(a) Developed and rolled out the Foundation Energy Skills Programme 200 construction workers;

(b) Developed and rolled out the Train the Trainers programme to increase the knowledge and competency of trainers involved in construction training;

(c) Developed and rolled out a communications campaign to home owners on the importance of employing trades upskilled in quality and energy efficiency.

3.13 Public Sector Energy Efficiency Strategy

As part of its 2020 targets, the public sector in Ireland is expected to achieve a 33% energy efficiency target. This has primarily been tracked through the Monitoring and Reporting system (M&R) operated by SEAI. The M&R was introduced in 2009 by SEAI as a pilot under the Energy Services Directive and the NEEAP. Since 2010, public sector bodies are required to report their energy management and performance data annually to SEAI. This was formalised under SI 426 of 2014. Reporting energy use requires that public sector bodies report energy management and performance against a baseline year. Data is provided for an annual cycle and entered into the M&R, covering consumption by fuel type and drivers of demand. This

information is then verified and validated by SEAI assessors and used to produce a scorecard on savings performance for the year and for the 2020 target.

At present, 97% of public sector bodies report their energy use through the M&R. 58% of schools report to SEAI (SEAI, 2017). The 2017 report indicates that, in spite of improvements, there was a plateau in energy efficiency with the public sector at 20% of its 2020 target (SEAI, 2017). From 2017, this system has been enhanced to include energy management and stronger governance structures to ensure that public sector bodies achieve their target. Under this program in 2017, schools were provided with additional assistance to undergo upgrades to reduce energy use, improve energy efficiency and performance.

3.14 House of Tomorrow and Low Carbon Homes Scheme

The House of Tomorrow was introduced in 2008, offering support for demonstration projects that tested technologies, products and systems to inform the future design of housing that would have high energy performance. It was deployed geographically as follows: Dublin region; Rest of Leinster (excluding BMW countries); Cork catchment; Rest of Munster; and BMW counties. Houses in the private market and in social housing were eligible. Building on this programme, in 2008 the Low Carbon Homes (LCH) scheme was launched. To facilitate the uptake of energy efficient technology, renewables, and use of smart technology in new builds, the scheme provided grants for up to 40% of eligible expenditure, to a maximum of €15,000 per unit.

3.15 'Power of One' Information Campaign

Launched in 2006, the Power of One campaign sought to build awareness of energy efficiency by highlighting what individuals could do to reduce their consumption of energy. It was a brief programme that, due to resource constraints, was not continued (Diffney et al., 2013).

3.16 HARP/ Boiler Efficiency Information Campaign

The Home Heating Appliance Register of Performance (HARP) Database is managed by SEAI and was developed for the benefit of homeowners and BER assessors by using the UK Building Research Establishment (BRE) to assess the energy efficiency of products. HARP was used in the Boiler Efficiency Information Campaign to promote energy efficient boilers, and to ensure compliance with the Building Regulations 2011 Boiler Efficiency Requirement (SI 259 of 2011), which requires that all new dwellings have boilers that meet the seasonal efficiency standard of 90%. The Boiler Efficiency Information Campaign was not limited to boiler replacement. As part of the campaign building owners were educated on the importance of regular boiler servicing to maintain effectiveness.

4. Evaluation of climate mitigation policies in the built environment sector

The evaluation of actions and measures presented in section 3 are considered in terms of their effectiveness, efficiency, relevance, governance, coherence and distributional effects. This section considers the actions collectively, and provides a high level overview of the policies in the context of mitigation objectives.

The analysis of the actions and measures was dependent on data available from the SEAI, the CSO, and other stakeholders involved in the built environment. Data included databases (for example the BER database and the CSO), reports on programmes or projects (Qualibuild) and discussions with key stakeholders through a project workshop hosted at the Royal Irish Academy in October 2018 and correspondence. Table 1 provides a summary of the actions and measures proposed in the NMP and registered in the MURE database against the evaluation criteria; 'Y' is used to indicate that it was possible to assess, while 'U' indicates that we were unable to assess the action or measure against an evaluation criterion. Notably, governance and distributional impacts are a challenge.

Table 1: Actions and Measures Against Evaluation Criteria (continued on next page)

Actions	Mitigation Measures	Effectiveness	Efficiency	Relevance	Coherence	Governance	Dist. Impacts
Commission study on the wider economic costs and benefits of potential extensions of the Irish Natural Gas network, and related funding options		U	U	U	U	U	U
	BE1 - Better Energy Homes	Y	Y	Y	Y	Y	Y
	BE2 - Better Energy Warmer Homes	Y	Y	Y	Y	Y	Y
Housing Assistance Package	BE3 - Housing Assistance Package	U	U	U	U	U	U
	BE4 - Better Energy Communities	Y	Y	Y	Y	U	U
Warmth and Wellbeing Scheme evaluated with a view to a possible national rollout	BE5 - Warmth and Wellbeing Pilot Scheme	U	U	U	U	U	U
Implement the Deep Retrofit pilot.	BE6 - Deep Retrofit Pilot -	U	U	U	U	U	U
	BE7 - Social Housing Upgrades (DHPCLG)	Y	Y	Y	Y	Y	U
	BE8 - Green Procurement & Accelerated Capital Allowance (ACA) ("Triple E" List)	U	U	U	U	U	U
	BE9 - Energy Efficiency Fund	U	U	U	U	U	U
	BE10 - Building Regulations – Nearly Zero Energy Buildings	U	U	U	U	U	U
New BER Advisory report to be introduced	BE11 - Building Energy Rating (BER) Certificates	Y	Y	Y	Y	Y	Y
	BE12 - Energy Audits for Large Energy Users	Y	Y	Y	Y	U	U
	BE13 - Energy Efficiency Obligation Scheme	U	U	U	U	U	U
Roll out EXEED Programme	BE14 - Large Industry Energy Network	Y	Y	Y	Y	U	U
SME Support – Publish new Energy Audit Handbook.	BE15 - SME Support - Encourage and support SMEs to undertake energy efficiency measures	U	U	U	U	U	U
SME Support – Publish new interactive SME Guide		U	U	U	U	U	U
SME Support – Develop and pilot new targeted grant support actions.		U	U	U	U	U	U

	BE16 - Qualibuild	Y	Y	Y	Y	Y	Y
	BE17 - Schools Technical Bureau						
Establish new Behavioural Economic Unit in SEAI	BE18 - Behavioural Economics Unit	U	U	U	U	U	U
Implementation of Public Sector Energy Efficiency Strategy (PSEES).	BE19 - Support Network for Delivery of Public Sector Energy Efficiency Targets	Y	Y	Y	Y	Y	Y
	BE20 - Renewable Heat Incentive	U	U	U	U	U	U
	BE21 - Smart Metering	U	U	U	U	U	U
Minimal Thermal Standards in rental properties – Public Consultation underway	BE22 - Minimal Thermal Standards in Rental Properties	U	U	U	U	U	U
	BE23 - Voluntary Housing Association Upgrades	U	U	U	U	U	U
House of Tomorrow		U	U	U	U	U	U
Part L - Energy Conservation Standards for New Dwellings (Revised Building Regulations) 2002		U	U	U	U	U	U
The Greener Homes Scheme		U	U	U	U	U	U
Power of One -Information Campaign		Y	Y	Y	Y	U	U
Low Carbon Homes Scheme		U	U	U	U	U	U
Best Practice Design for Social Housing		U	U	U	U	U	U
Boiler Efficiency Information Campaign		U	U	U	U	U	U

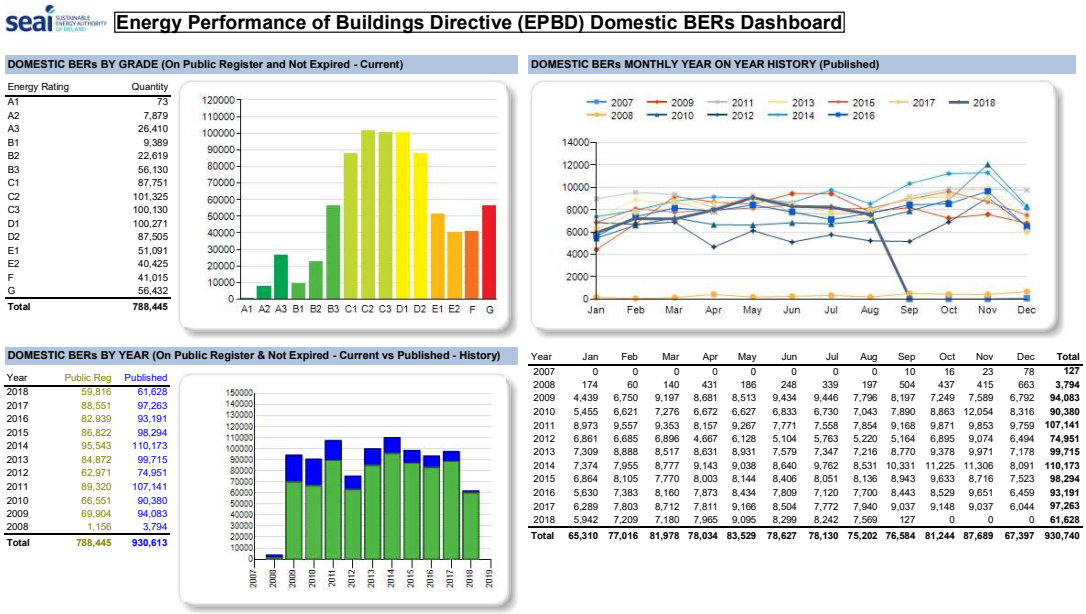
4.1 Effectiveness and Efficiency

Effectiveness and efficiency are considered together as they are both concerned with the outputs and outcomes of an action or measure. The absence of baseline data for the various measures poses challenges in terms of assessing effectiveness and efficiency. Actions and measures that are in place to reduce emissions and increase energy efficiency directly in the built environment are: Better Energy Homes (BEH), Better Energy Warmer Homes, Better Energy Communities, and Social Housing Upgrades and the Large Industry Energy Network.

The BEH is analysed in greater detail in section 5. For the Better Energy Warmer Homes scheme, approximately 135,000 households have been upgraded at no cost to residents (SEAI, 2018). It is not clear how much energy households have saved following upgrades. According to the most recent SEAI report, 50 projects have been completed across the country through the Better Energy Communities programme (SEAI, 2018). 1,965 houses have been upgraded as part of this. A report by ESRI (Coyne et al., 2016) assessed the experience of householders involved in a BEC project run by *Respond!* Housing Association. Broadly, participants viewed their experience positively. However, in assessing the effectiveness of the upgrades in enabling households to pay utility bills, the researchers found an improvement in both the control group and the group that received upgrades, such that there was no difference between the two groups. This may be due to the fact that participants knew they were participating in a research project. As such it is challenging to assess the effectiveness of the programme on household costs, even though pre energy use data is collected before upgrade works are undertaken.

For the LIEN, the latest report by SEAI (SEAI, 2017) shows that there was a 286GWh reduction in primary energy use across all members from 2014, along with a 60% improvement in energy performance. The progress of companies is reported on the SEAI website and includes information on the factors affecting the ability of companies to reach their targets. Examples include details on the measures undertaken by companies to achieve their targets from building management systems, chillers (physical changes) to awareness campaigns (behaviour changes). This is a voluntary programme and, as such, demonstrates the value of the environment and energy to international businesses such as Google, IBM and Irish companies such as Kerry Foods.

Figure 4: Domestic BERs[3]



Energy Rating	Quantity
A1	73
A2	7,879
A3	26,410
B1	9,389
B2	22,619
B3	56,130
C1	87,751
C2	101,325
C3	100,130
D1	100,271
D2	87,505
E1	51,091
E2	40,425
F	41,015
G	56,432
Total	**788,445**

Year	Public Reg	Published
2018	59,816	61,628
2017	88,551	97,263
2016	82,939	93,191
2015	86,822	98,294
2014	95,543	110,173
2013	84,872	99,715
2012	62,971	74,951
2011	89,320	107,141
2010	66,551	90,380
2009	69,904	94,083
2008	1,156	3,794
Total	**788,445**	**930,613**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007	0	0	0	0	0	0	0	0	10	16	23	78	**127**
2008	174	60	140	431	186	248	339	197	504	437	415	663	**3,794**
2009	4,439	6,750	9,197	8,681	8,513	9,434	9,446	7,796	8,197	7,249	7,589	6,792	**94,083**
2010	5,455	6,621	7,276	6,672	6,627	6,833	6,730	7,043	7,890	8,863	12,054	8,316	**90,380**
2011	8,973	9,557	9,353	8,157	9,267	7,771	7,558	7,854	9,168	9,871	9,853	9,759	**107,141**
2012	6,861	6,685	6,896	4,667	6,128	5,104	5,763	5,220	5,164	6,895	9,074	6,494	**74,951**
2013	7,309	8,888	8,517	8,631	8,931	7,579	7,347	7,216	8,770	9,378	9,971	7,178	**99,715**
2014	7,374	7,955	8,777	9,143	9,038	8,640	9,762	8,531	10,331	11,225	11,306	8,091	**110,173**
2015	6,864	8,105	7,770	8,003	8,144	8,406	8,051	8,136	8,943	9,633	8,716	7,523	**98,294**
2016	5,630	7,383	8,160	7,873	8,434	7,809	7,120	7,700	8,443	8,529	9,651	6,459	**93,191**
2017	6,289	7,803	8,712	7,811	9,166	8,504	7,772	7,940	9,037	9,148	9,037	6,044	**97,263**
2018	5,942	7,209	7,180	7,965	9,095	8,299	8,242	7,569	127	0	0	0	**61,628**
Total	**65,310**	**77,016**	**81,978**	**78,034**	**83,529**	**78,627**	**78,130**	**75,202**	**76,584**	**81,244**	**87,689**	**67,397**	**930,740**

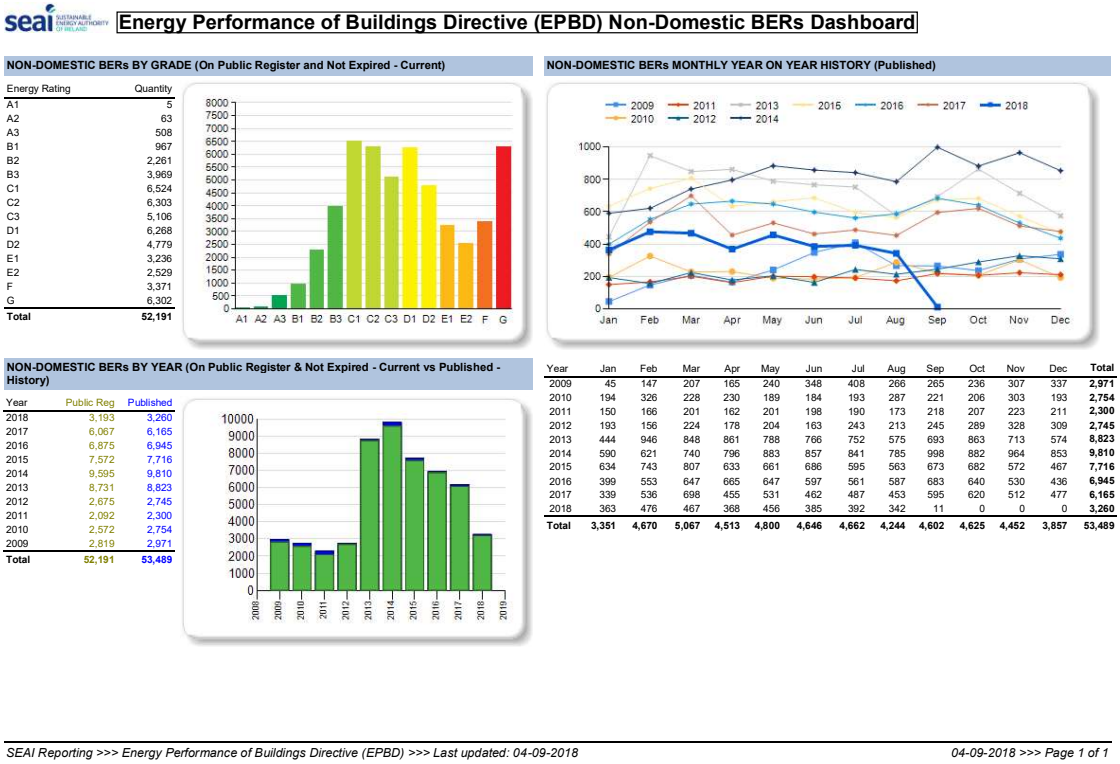
Source: SEAI website

By contrast, the Public Sector Energy Efficiency Strategy is provided for under SI 426 and requires that all public sector bodies report their energy use to SEAI through the M&R system. As would be expected, compliance is nearly 100 percent. The *Annual Report 2017 on Public Sector Energy Efficiency Performance* from SEAI shows that in 2017 total primary energy use for the public sector was 9,375 GWh, amounting to €563 million. Compared to 2016, energy consumption was reduced by 2,336 GWh, representing a saving of €133 million and 520,000 tonnes of CO_2 (SEAI, 2017). Public sector entities can use ISO 50001 to achieve their energy efficiency objectives or work with energy agencies to undertake projects. The breadth of actions undertaken by public sector bodies includes lighting upgrades, heating, building fabric, and awareness campaigns. It was not possible for the purposes of this research to identify the

[3] It is not clear if each record is unique or if they are re-assessed dwellings that have undergone renovations.

exact measures undertaken by each public sector body and to examine the costs to each body to achieve their individual CO_2 savings.

Figure 5: Non-Domestic BER



seai Energy Performance of Buildings Directive (EPBD) Non-Domestic BERs Dashboard

NON-DOMESTIC BERs BY GRADE (On Public Register and Not Expired - Current)

Energy Rating	Quantity
A1	5
A2	63
A3	508
B1	967
B2	2,261
B3	3,969
C1	6,524
C2	6,303
C3	5,106
D1	6,268
D2	4,779
E1	3,236
E2	2,529
F	3,371
G	6,302
Total	**52,191**

NON-DOMESTIC BERs MONTHLY YEAR ON YEAR HISTORY (Published)

NON-DOMESTIC BERs BY YEAR (On Public Register & Not Expired - Current vs Published - History)

Year	Public Reg	Published
2018	3,193	3,260
2017	6,067	6,165
2016	6,875	6,945
2015	7,572	7,716
2014	9,595	9,810
2013	8,731	8,823
2012	2,675	2,745
2011	2,092	2,300
2010	2,572	2,754
2009	2,819	2,971
Total	**52,191**	**53,489**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2009	45	147	207	165	240	348	408	266	265	236	307	337	**2,971**
2010	194	326	228	230	189	184	193	287	221	206	303	193	**2,754**
2011	150	166	201	162	201	198	190	173	218	207	223	211	**2,300**
2012	193	156	224	178	204	163	243	213	245	289	328	309	**2,745**
2013	444	946	848	861	788	766	752	575	693	863	713	574	**8,823**
2014	590	621	740	796	883	857	841	785	998	882	964	853	**9,810**
2015	634	743	807	633	661	686	595	563	673	882	572	467	**7,716**
2016	399	553	647	665	647	597	561	587	683	640	530	436	**6,945**
2017	339	536	698	455	531	462	487	453	595	620	512	477	**6,165**
2018	363	476	467	368	456	385	392	342	11	0	0	0	**3,260**
Total	**3,351**	**4,670**	**5,067**	**4,513**	**4,800**	**4,646**	**4,662**	**4,244**	**4,602**	**4,625**	**4,452**	**3,857**	**53,489**

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Source: SEAI website

Building Energy Rating (BERs) were introduced in 2008 as part of complying with EU legislation (Directive 2002/91/EC) and were made mandatory for all new homes, sales of homes, and new rental agreements in 2013. Approximately 778,445 dwellings have been assessed, as shown in Figure 4. However, it appears that this is a cumulative number of assessments. The data does not indicate the type of dwelling, or if it is a re-assessment. Moreover, these are assessments that have been registered by BER assessors. Data should include a geocode to assess full impact. Data showing the change in energy demand and use and the change in BER for homes that have been retrofitted under the BEH programme, is needed to assess effectiveness and efficiency. In the broader context, it would be valuable to understand how much it costs to upgrade homes from a BER F to a C3, for example. It would be valuable to be able to link changes in housing prices in relation to upgrades; as this may give value to energy efficiency upgrades and contribute to the uptake of NZEB standards, and the uptake of the future landlord upgrade programme if a monetary value is attached to changes in BER.

We acknowledge that a study on the value of housing and BERs has been done, which found a 1% increase in value with each step change in BER (Stanley et al., 2016). However, the study did not consider if the 1% increase was greater than the cost of upgrades to achieve the increase in BER, or if upgrades were undertaken prior to the sale of the dwelling. This is would be valuable in incentivising upgrades. Finally, details of the upgrades in terms of what was done

to houses would be useful in creating brief guidelines to owners of various housing typologies. For example, in the NEEAP 2017 it is stated that under the Better Energy programme, since the beginning of the BEH, 475,190 energy efficiency upgrades across 191, 338 homes have been undertaken. It is not clear what each of the upgrades are. It is known that €202.4 million in grants have been used to improve energy efficiency through attic insulation, wall insulation, solar thermal, heating system upgrades and BER assessments.

In terms of non-domestic BERs, based on Figure 5, 52,191 commercial properties have been assessed, approximately 47.9% of all commercial properties in Ireland. Ultimately for both domestic and non-domestic BERs it would be valuable to understand if building owners are using the BER assessments to make changes to their dwellings.

4.2 Distributional Impacts

Understanding the impact of actions and measures geographically, socially and economically is valuable in assessing the outcomes and, critically, provides a means for holistically evaluating an action or measure. For the built environment, data is readily available on the housing stock in Ireland by county. As such, it is possible to evaluate the impact of energy efficiency and retrofit programmes on the physical housing stock in terms of geography. With regard to other relevant data such as energy use per household, data on income would provide a more detailed assessment of the social and economic impacts of actions and measures, but this is more challenging to obtain and therefore assess the distributional impacts within these contexts. Households with financial means to undertake energy efficiency upgrades are well-placed to do so; while low income households avail of the better energy warmer homes scheme as described above (Collins and Curtis, 2016; Collins and Curtis, 2017). (More detail on the distributional impacts of the BEH programme is provided in section 5.) Households with incomes that do not fall into either category are not catered for by either programme. It is not known whether these households have undertaken retrofits or not. However, the BER database may be a way to identify whether households have done so. However, this is possibly tenuous, because checking one of the researcher's BER assessment indicates that it is perhaps merely viewed as a requirement for selling and renting dwellings as opposed to being a tool to spur upgrades. Further, even if upgrades are undertaken, their impacts may be insignificant.

A report by the Irish Green Building Council at the end of the QualiBuild training programme stated that 1.6 million dwellings in Ireland need upgrades (IGBC, 2017). The QualiBuild programme has trained 200 individuals involved in the construction sector to undertake retrofits and build energy efficient homes. What is not evident yet is the impact of the programme on the 1.6 million dwellings that need to be upgraded. There is no data available on how many houses participants in the programme have undertaken upgrades, or built to a particular BER standard. This information coupled with location and dwelling typology would be valuable to informing future policies in relation to energy efficiency in the built environment.

In terms of the non-residential sector, large industry receives support and has capacity to address energy efficiency through the Large Industry Energy Network (LIEN). The progress

of these companies is reported on in the SEAI's annual LIEN report (SEAI, 2016). From these reports, it is evident that companies are taking action to reduce energy consumption. However, it is not clear if this is a result of physical changes to buildings in which companies are housed, operational changes, or employee loss. Data on the companies' profits and losses as well as employee numbers may provide a comprehensive and holistic understanding of the energy efficiency gains of companies. Moreover, this would inform how small and medium sized enterprises can be assisted. This is an action put forward in the NMP.

While compliance is high with the PSEES, data in the *Annual Report 2017 on Public Sector Energy Efficiency Performance* is presented as a whole in terms of geography (SEAI, 2017). In other words, while there are sectoral breakdowns within the report, all local authorities are combined together to give their total share of energy use. Additional categories include civil service, commercial state body, education, health, justice and defence, non-commercial state body/state agency, and schools and ETBs. The report contains examples of projects undertaken by various entities that fall into these categories as well as a list of all entities and their performance improvement as relative to their baseline. However, some local authorities are performing better than others, and it is not clear why. For example, there could be economic, social and political factors linked to their geographical location that enable certain local authorities or other public bodies to undertake energy efficiency measures. A better understanding of this will enable non-conforming public bodies to learn from better performing public bodies. It will also identify where government needs to direct resources.

4.3 Coherence and Relevance

The actions and measures currently in place respond to directives from the EU. The actions and measures are narrowly focused both in terms of instrument and target group, as well as the options for achieving emissions reduction. On the latter, there is a focus on the quantifiable nature of the actions and measures. The actions and measures tend to be directly linked to a measure of energy from which to calculate GHG savings. This ignores the interaction of the actions and measures in the broader system. Measures that aim to increase energy awareness by requiring sellers of homes and landlords to advertise BERs have had little effect in the midst of an affordability crisis when demand is high. BER registration peaked in 2014 with 110,173 assessments recorded, and has dropped in recent years. House prices and rent have increased by approximately 56% and 75% respectively over the same period, and vacancy has decreased by 20.3% from 2011 (SEAI, 2018; CSO, 2017; Daft, 2018).

BER ratings are recognised to not be reflective of actual day-to-day energy use. The calculation of BER is based on assumptions regarding how a building should perform under standardised conditions rather than the behaviour of individuals using the building. There is a growing call for GHGs to be measured based on actual energy consumption, which in the context of the built environment is challenging to carry out but highlights areas where there is a deficit of policy actions and measures (C40, 2018). Although a better BER rating may be a worthwhile objective, there is still a need to address consumption behaviour, because energy efficiency might lead to induced demand for energy, by way of encouraging individuals to be less

concerned about how much they are using by leaving the lights on. This would be mitigated by information campaigns similar to the Power of One.

> ***Box 1: Consumption based GHG accounting: The Future***
>
> Consumption-based GHG accounting is an alternative to the sector-based approach to measuring city GHG emissions. This focuses on the consumption of goods and services (such as food, clothing, electronic equipment, etc.) by residents of a city, and GHG emissions are reported by consumption category rather than GHG emission source category (C40, 2018).

The Public Sector Energy Efficiency Strategy provides support to public sector bodies from SEAI to undertake energy efficiency projects. For example, local authorities may receive funding to improve the energy efficiency of social housing, leisure centres, and libraries. However, there needs to be greater understanding of the barriers, challenges and learnings from local authority staff tasked with implementing actions and measures.

In terms of the private sector, actions and measures targeting upgrades for older building stock are primarily voluntary. While new building stock post 2020 will need to comply with Near Zero Energy Building (NZEB) standards, policies need to address existing stock as this policy will only affect buildings constructed after 2020.

A particular gap in the existing measures and actions is housing in the rental market. This will be a challenge in the context of rising rents and affordability. Government has put forward policy in the NMP that proposes to incentivise landlords to upgrade housing under the Housing Assistance Programme (HAP):

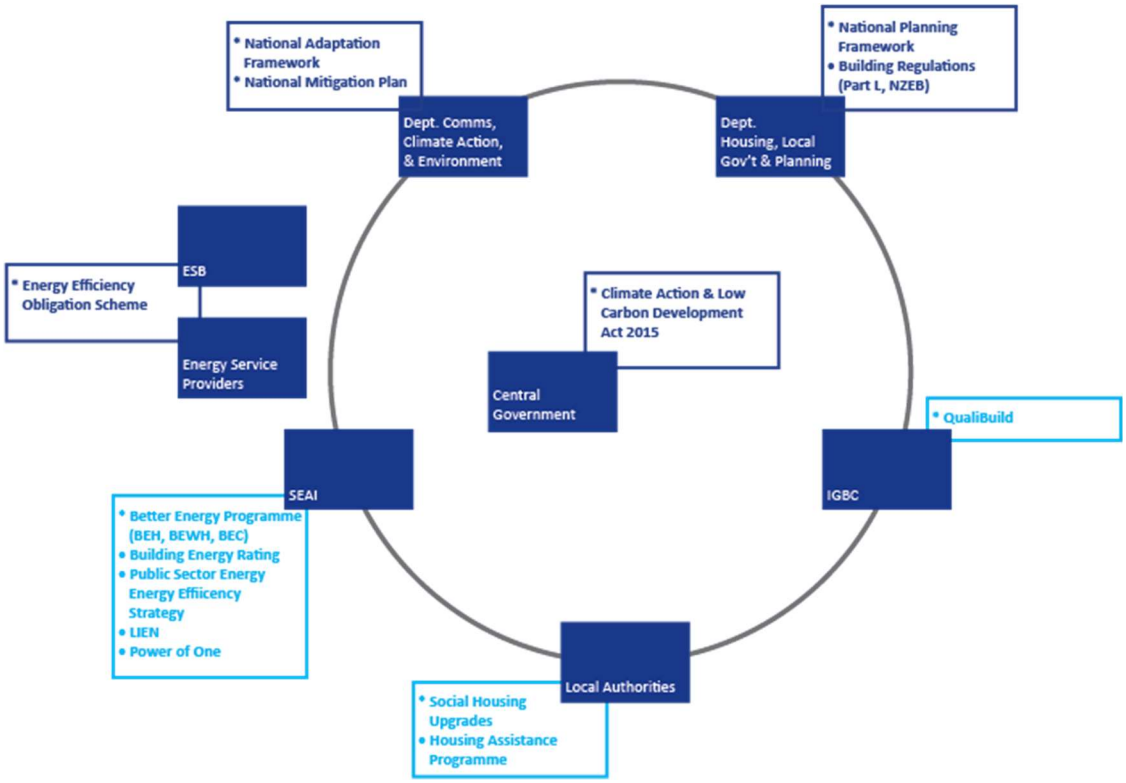
- BE3 - Housing Assistance Package: A pilot scheme as part of the Better Energy Programme to encourage landlords participating in the Housing Assistance Package (HAP) to avail of the Better Energy Programme to incentivise energy standard improvements in the rental sector;
- BE46 & 47 - Minimal Thermal Standards in rental properties: Consider consultation submissions and where warranted, introduce measures to help facilitate landlords achieve compliance with envisaged new regulations.

However, there are potential challenges with this. Because BER ratings are only required in the case of new rental agreements since January 2013, it is very likely that the ratings of a significant proportion of the rental market are unavailable, as no report could be found on BERs in the rental market from the CSO, Daft or the Rental Tenancy Board. As discussed above, BER calculations are not an indicator of actual energy use in a household or building. The challenges with the rental market are discussed in more detail in the section on the BEH.

Policies actions and measures need to be broader in their scope and should consider the environment in which buildings exist, including green infrastructure and its role in reducing the energy demands of buildings, not just as an adaptation measure for urban heat islands and

flood alleviation. Energy use is not determined solely by a building but the environment in which the building is constructed.

Figure 6: Stakeholders – Actions, Measures, and Legislation



4.4 Governance

The breadth and depth of stakeholders involved in addressing emissions from the built environment in Ireland is complex and we have attempted to synthesize a simplified stakeholder map (see Figure 6). We have included the actions and measures for which specific stakeholders are responsible in the map above. SEAI is primarily responsible for developing programmes to support the uptake of energy efficiency measures by both private sector and public sector stakeholders. However, funding remains a challenge as will be discussed in section 5 below. Furthermore, collaboration is needed between stakeholders to ensure that quality of buildings and to build awareness of programmes and opportunities to implement measures to achieve energy efficiency and energy conservation in the built environment sector.

5. Case Study: Better Energy Homes

The Better Energy Homes (BEH) programme was introduced in section 3.1 above. To assess the ex-post impact of the BEH programme within the framework of the ICPE project evaluation criteria, we used publicly available data on the programme from the SEAI. Additionally, we requested key individuals in SEAI to review our assessment of the programme, which builds on a study of the programme that was undertaken by SEAI in partnership with ESRI to assess the programme's impact from March 2009 to October 2015. That study sought to understand

householder decision making, scheme engagement, funding efficiency, and incentive design. As such, the case study presented here uses this study and additional information from SEAI and NEEAP to evaluate the programme based on our evaluation criteria. Furthermore, consideration is given to the broader context, such as Ireland's economy and society, to understand the impacts of the program and to put forward recommendations for the programme in relation to key priorities (energy obligation targets) and emerging issues (energy poverty, housing, cost of living and affordability).

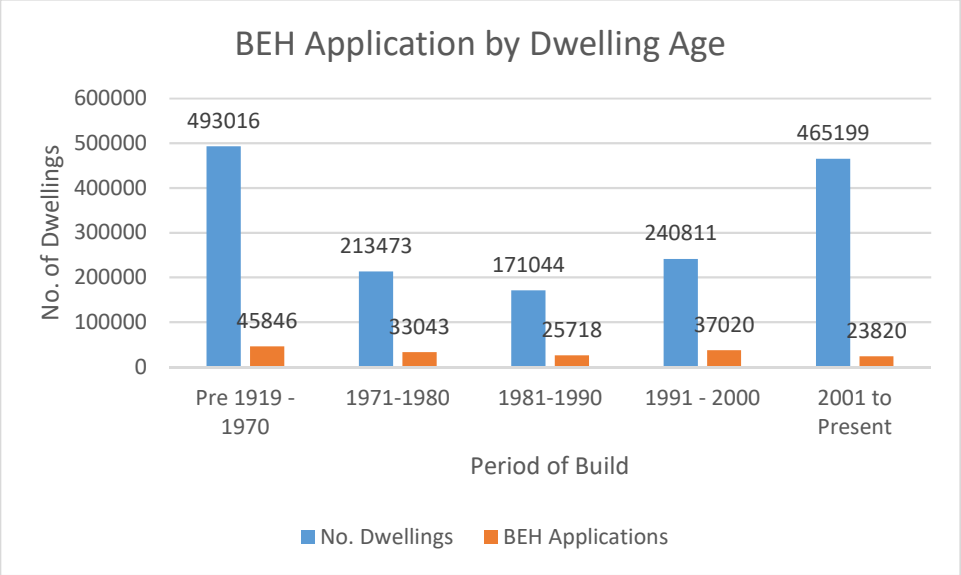
5.1 Effectiveness

According to SEAI's BEH database, between 2009 and August 2018 219,988 homes have been upgraded under the programme with a total of €225,433,626 in grants issued (see Appendix III) (SEAI, 2018). This amounts to just over 10% of the total housing stock in Ireland (Figure 8). Of the housing stock constructed up to 2006, 12.4% of the households eligible for upgrades have been upgraded (Figure 7). It should be noted that this number does not include houses that may have undergone upgrades under the Better Energy Warmer Homes Scheme, the Better Energy Communities Scheme, social housing or housing that has been upgraded without grant assistance from SEAI. For the time period of the ESRI study (March 2009-October 2015), it is estimated by Collins and Curtis (2016 and 2017) that the programme has contributed a cumulative €64 million savings on energy costs for participating households. This has resulted in over 236,000 tonnes of CO_2 being saved in the residential sector, at a cost of approximately €1000/ tonne of CO_2.

In their research Collins and Curtis (2017), found that the number of applications has decreased in recent years following a peak in November 2010. However, there was an increase in the number of applications involving an obligated party, which are energy service providers such as Electric Ireland, SSE Airtricity, and Panda Power. The decrease in applicants could be for several reasons such as changes in technology, costs and ease of applying. These are discussed in greater detail in the recommendations section. It is possible also that the introduction of the Home Renovation Incentive used to stimulate the construction sector could have impacted on the number of applicants to the BEH scheme as well.

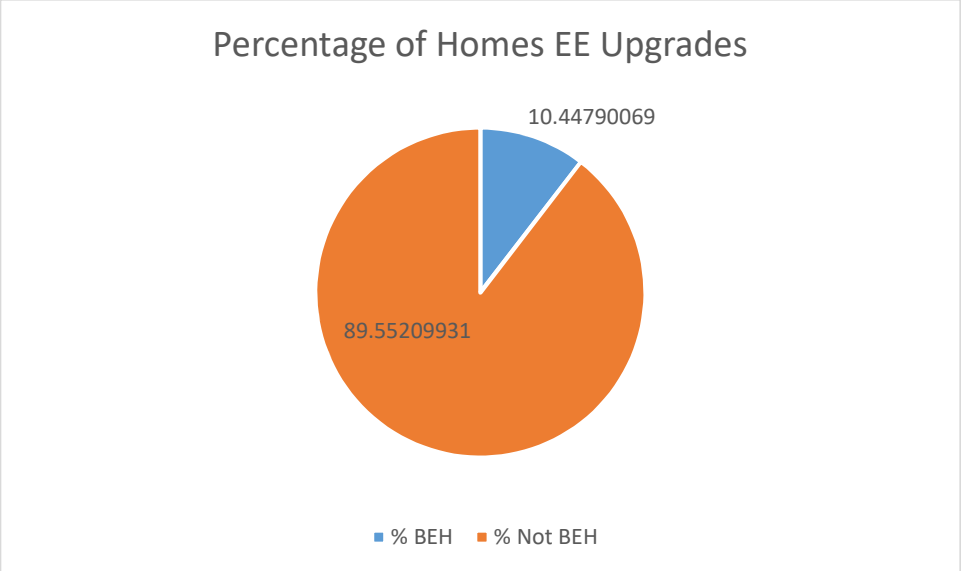
There are limitations to using the number of applicants to the programme as an indicator of effectiveness. As part of their study with SEAI, Collins and Curtis (2017) investigated the rate of abandonment of applications, which was about 15% of applications. One possible reason for abandonment is that the target for energy efficiency improvements may be challenging to reach depending on the age of the home with the technologies available under the grant. Pre-21st century homes likely require deep retrofits, while for 21st century homes the energy savings may not be significant enough to incur the cost of upgrades. Applicants in rural areas were more likely to abandon their application. There seems to be a relationship between the marginal cost and the marginal utility of the energy efficiency upgrades that needs to be investigated with consideration to the age of buildings, household income, location and technology choice, which will add value to understanding the efficiency of the programme.

Figure 7: BEH Applications by Dwelling Age



Source: CSO (2017) and SEAI (2018)

Figure 8: Percentage of total housing stock upgrade under BEH



Source: CSO (2017) and SEAI (2018)

Collins and Curtis (2017), also suggests that there are other factors contributing to decreasing applications. Wage growth was significantly lower than the rise in cost of living, resulting in a decline in disposable income. Furthermore, with the rising costs of housing in the rental market, the capacity for renters to purchase a home decreased as their ability to save for a

deposit was hindered by rising rents. It is likely, that the cohort of owner occupied households for grants has stagnated.[4] This leads to a need to understand the efficacy of the programme.

5.2 Efficiency

At present, applicants to the programme have the choice of four technologies to improve the energy efficiency of their homes and save on their energy costs. Grants for the measures differ and have changed marginally over the lifetime of the scheme. It does not appear that this has had an impact on the programme, if it is considered in the context of the trend over time of applications to the scheme as discussed in Collins and Curtis (2017).

It is unclear if upgrades have reduced energy use in households availing of grants as this data is absent. Therefore, it is challenging to assess the cost efficiency of the programme. For example, if we consider the issue of decreasing applicants and abandonment, it may be that households are not applying to the programme due to choice of technologies, and because of the cost of undertaking works relative to the benefit of future savings. Acknowledging this, it is valuable to be able to link individual upgrades and combinations of upgrades to energy bill savings. However, this would require changes in the programme. For instance, applicants should be asked to provide more detailed information at the application stage, such as energy bills for the previous two years, and the number of individuals living in the household. At present, households applying to the BEH provide their MPRN to show energy use. However, it is not stated in the guidelines how far back the SEAI considers the household's energy use. This would require that energy use be monitored for one or two years post-works to understand the impact of the upgrades on the household energy bills and, critically, the behaviour of householders. A key issue with regard to energy efficiency upgrades is 'induced demand' or the 'rebound effect': Due to householder perception of the upgrades being more efficient and less polluting, they may use more energy and as a result, counteract the 'good' achieved by the upgrades. As such, measurement and verification of energy use is critical to understanding the efficacy of the programme (and others), at the household level and at the country level.

Furthermore, in the context of increasing energy use (see Figures 1 and 2) and GHG emissions, understanding energy use at the household level is ever more critical for programmes that have as their objective the improvement of energy efficiency. While increasing population leads to increased demands for energy, it is likely that this is only part of the equation. As shown in Figure 7, approximately one-third of Ireland's housing stock was built in the 21st century, constructed under Building Regulations that require energy efficient design. Of the remainder of the housing stock, which was built under earlier or non-existent building regulations, approximately 10% has been retrofitted under the BEH programme. Data for these dwellings on tenure type (owner occupied or rented), energy use, and works done is needed. Knowing

[4] We acknowledge that renters are able to avail of the grants. However, considering the limited capacity of renters to request that landlords undertake retrofits, this is unlikely to happen. The first reason for this is due to laws that permit landlords to increase rent when significant upgrades of a dwelling are undertaken. As such renters may way this risk against their energy costs. Secondly, connected to this, is the demand for rental market housing. While BERs are required to rent properties, there is no connection to the amount of rent charged by landlords and BER, as such there is no incentive for landlords to undergo energy upgrades.

what works have been done and should be done is potentially insightful given the data showing that owners of older homes are not applying to the BEH programme. Furthermore, it is not clear whether owners of these homes are undertaking retrofits without BEH support and, if they are, what works are being done to improve energy efficiency. Knowing what works are being done may inform the BEH programme and improve the relevance of the programme going forward.

5.3 Relevance

Under the BEH programme householders can avail of four technologies for energy efficiency upgrades, either individually or in combination:

1. Attic or roof insulation
2. Wall insulation either cavity in-fill, internal or external
3. Boiler upgrade either oil, gas with heating controls, or heating controls only[5]
4. Solar thermal panels for heating

At the outset of the programme in 2009, these technologies were, according to an SEAI representative, selected based on a technology assessment. The choice of technologies has not evolved since then to consider technological changes or demand for different technologies, such as heating, ventilation and air condition (HVAC) systems, solar PV, micro wind generation, or energy storage systems. Considering that, according to the Irish Green Building Council, 1.6 million houses in Ireland are still in need of deep retrofits to meet Ireland's residential energy targets, broadening technology options eligible under the grant may incentivise homeowners to apply (IGBC, 2017).

The changes that have been made are to the value of grants for the technologies in differing contexts. This would appear to have been an effort to encourage uptake by owners of differing housing typologies without consideration to the varying needs of the differing typologies in terms of retrofits.

At present, the programme remains somewhat prescriptive and is relevant for houses but not apartments, and primarily houses constructed between 1970 and 2006, as houses built in this period account for 71.1% of grant applications (SEAI, 2018). This cohort of homes only represents approximately 35.1% of Ireland's total housing stock (CSO, 2017). It is possible that these older homes and households that may find the value of the grants and technology insufficient for the upgrades, or they may have availed of other programmes depending on whether the owner is in receipt of government grants such as the Working Family Payment.

5.4 Coherence

The BEH scheme is connected to other programmes such as the Better Energy Communities (BEC) programme and the Better Energy Warmer Homes (BEWH) programme, as they are under the Better Energy Programme umbrella. Similar to the BEH programme, the BEC and

[5] In April 2018 boilers were removed from the programme and heat pumps were introduced.

BEWH schemes are focused on providing grants to communities and households to undertake energy efficiency measures. In the BEWH scheme, individuals who are in receipt of government assistance can apply to have energy efficiency upgrades for free. This programme has been in place since 2002 and could be considered the precursor to the BEH programme. In the BEC scheme, communities of at least ten households in partnership with an obligated party[6] can undertake energy efficiency projects that deploy a range of technologies and can receive up to 80% grant funding. Households in this scheme must collectively achieve an average BER rating of C3 or A3 if the houses under go deep retrofits.

The BEH programme itself has requirements that align with EU and national regulations, such as SI 243, Part L of the Building Regulations (due to the requirement for BER assessments), and the Energy Efficiency Obligation Scheme (in the case of applicants who apply with an obligated party). Applicants are required to undertake a BER assessment when they apply to the programme. The assessment provides householders with information about the dwelling's energy efficiency in a standardized form. The advisory report provided by the BER assessor lists the energy efficiency measures the householder should undertake and their potential impact. However, the BER assessor is not required to engage in a detailed discussion with the householder about which measures will be suited to their energy use and needs. As a result, householders' choice of energy efficiency measures may be based on value for money in the short term as opposed to the long term. Consequently, householders may undertake measures that may not yield cost savings in long run as measures may not align with their energy use, due to a lack of education around energy use in the home and a lack of understanding of the BER assessor report.

At the outset, the programme was promoted through the Power of One campaign, as part of an energy awareness campaign. However, due to challenges with linking the Power of One Campaign to participation in the BEH (and other awareness programmes associated with the campaign) and valuing these outcomes, funding was discontinued for the programme (Diffney, et al., 2013). Since then, the BEH has not had a dedicated information and education campaign. This is possibly reflected in the decrease in applications, as awareness of programmes plays a role in uptake.

Finally, in 2017 the Better Energy Homes scheme was incorporated into the Better Energy Programme, which includes the Better Energy Warmer Homes program, the Better Energy Communities programme, the warmth and well-being pilot, Deep Retrofit Pilot programme and BER programme.

[6] An obligated party in this context is an energy services provider such as Electric Ireland, SSE Airtricity, Energia, Panda Power, BE Energy and Bord Gais Energy

Box 2: Better Energy Programme – Snapshot – SEAI (2018)

The Better Energy Programme is operated on behalf of the Department of Communications, Climate Action and Environment by the SEAI. It provides grant aid to householders, communities and people at risk of energy poverty to make energy efficiency improvements. In 2017, €69 million in capital funding was invested under the Programme:

- 6,550 homes of those in energy poverty received free upgrades under the Better Energy Warmer Homes Scheme at a cost of €22.6 million;
- 50 projects were completed under the Better Energy Communities Programme, delivering energy upgrades to 1,965 homes and 491 public, private and community buildings at a cost of €22.7 million;
- 14,616 homes received grant aid under the Better Energy Homes Scheme resulting in 33,704 energy efficiency measures being carried out at a cost of €16.3 million;
- 360 homes were completed under the Warmth and Wellbeing Pilot Scheme at a cost of €6.5 million;
- The Deep Retrofit Pilot Programme was launched;
- 103,389 Building Energy Ratings were published.

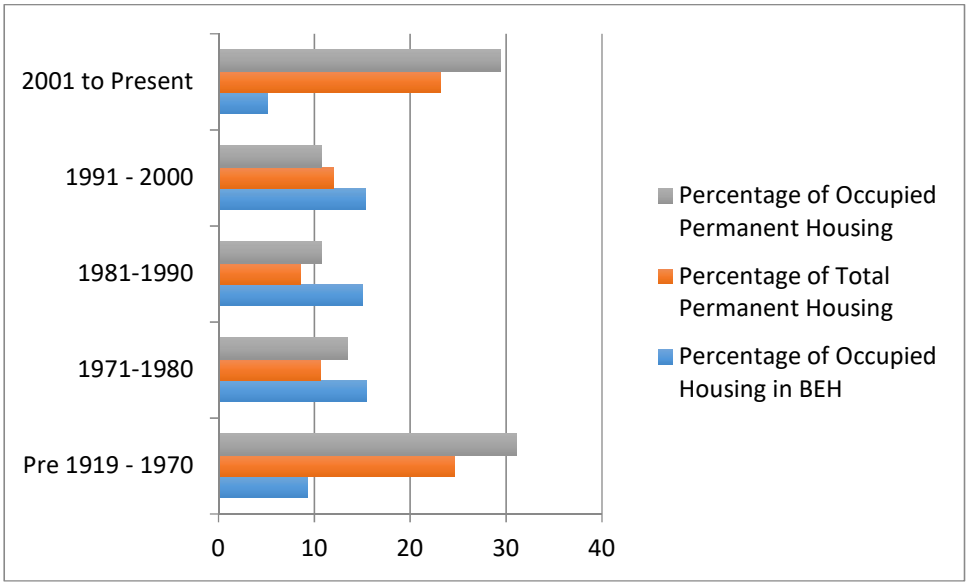
€471,000 in capital funding was made available to support the Sustainable Energy Communities network

5.5 Distributional Impacts

The BEH programme is open to all homeowners across the country. In their study of the BEH programme, Collins and Curtis (2016 and 2017) analysed the data from the programme. The majority of participating households are houses (98%), and the majority of households have undertaken simple retrofits (88%) of one (32.7%) or two (62.6%) measures. In terms of the physical distribution across geographical classifications (Greater Dublin Area, County with city i.e Cork, Limerick and Waterford, Border Midlands West and South & East), the majority of upgrades have been undertaken in counties with cities (33.2%). Recent data (current to August 2018) shows that approximately 20.5% of all upgrades were in Dublin and amounted to 26.3% of total value of the grants issued.

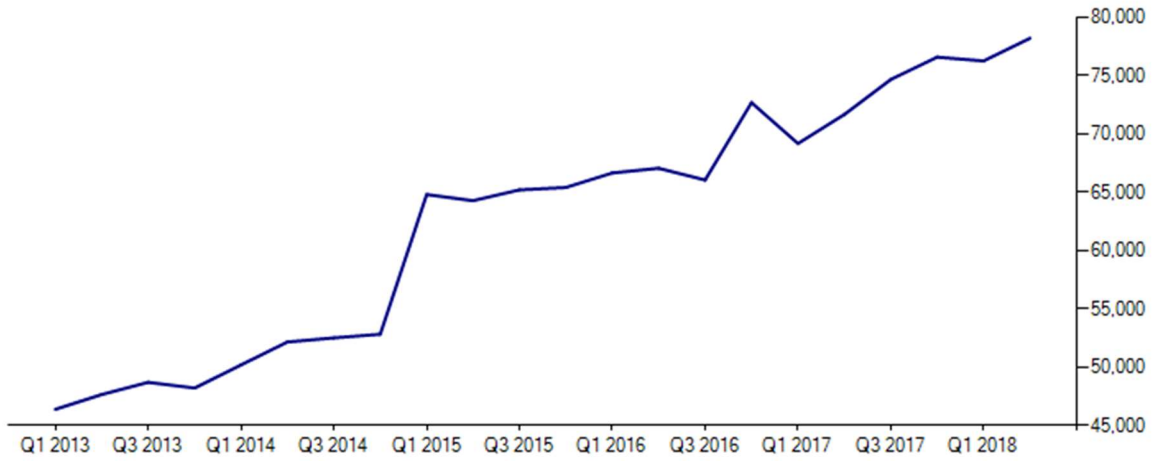
As mentioned above, approximately 72.3% of the applications are for houses built between 1970 and 2006 (houses built between 1970 and 2000 represent 35.1% of Ireland's housing stock). Collins and Curtis (2017) noted that older houses perhaps find it challenging to research the energy efficiency targets in the application as a possible reason for their low uptake. This is critical, because approximately 31.1% of Ireland's housing stock was built before 1970. These make up 27.7% of BEH applications.

Figure 9: Percentage of Occupied Permanent Housing and BEH by Period of Build



Source: CSO (2017) and SEAI (2018)

Figure 10: Ireland's GDP (Constant prices, SA), €m



	2013	2014	2015	2016	2017	2018
Q1	46,410	50,211	64,808	66,657	69,181	76,257
Q2	47,679	52,180	64,285	67,061	71,666	78,200
Q3	48,720	52,529	65,210	66,059	74,666	
Q4	48,232	52,841	65,416	72,687	76,582	

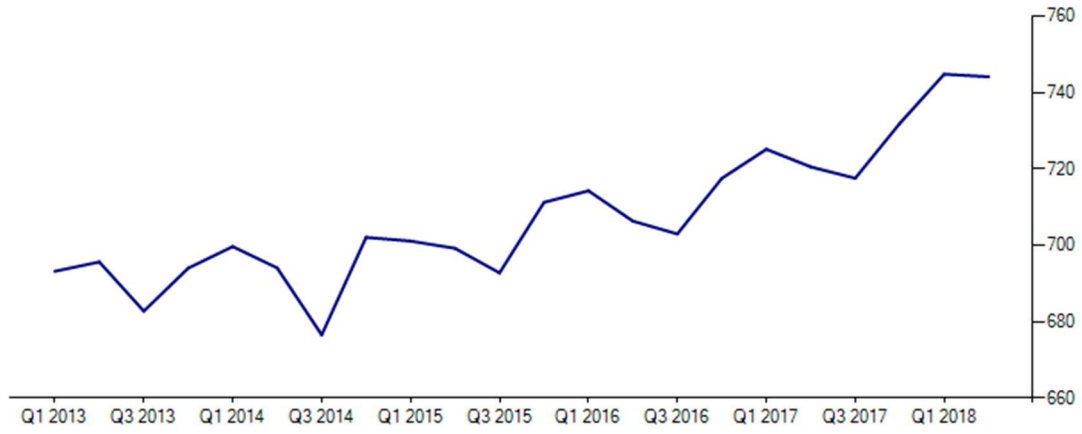
Source: CSO (2018)

Beyond geographical distribution, there are questions with regard to the socio-economic distribution of the programme. While Ireland's economy started to recover from the recession in 2012, the number of applicants to the BEH programme has been declining. Collins and Curtis (2018) investigated willingness to pay for retrofits, which provides some insights into who is availing of grants. It is clear that households in higher socio-economic groups are availing of grants, and would in the absence of grants undertake retrofits. Approximately 7%

and an additional 8% would have participated with lower grant amounts. This is supported by the fact that in order to receive the grant, households must pay for the full upfront costs of the retrofits, placing those with the disposable income available in a better position to undertake upgrades (Collins and Curtis, 2018). Recent OECD (2018) statistics for Ireland show that private household debt, calculated as a percentage of net disposable income, is 170.5%, while household disposable income is growing at 2.9% annually. Recent OECD (2018) reports show that GDP has increased by 9.1%, making Ireland the fastest growing economy in Europe (Figure 10).

Average weekly earnings have increased by approximately €50 between Q1 of 2013 and Q2 of 2018 (see Figure 11). Average annual earnings are approximately €35,000/year. Housing and rent prices have increased much more rapidly. According to a Daft report from 2018, the asking prices for rent increased on average by 75% and housing prices by 56%, relative to their lowest levels in 2012 (Daft, 2018). It is evident that affordability affects participation in the BEH programme. This in itself is complex. While Ireland's wealth is increasing, its distribution is uneven. In depth research is needed to understand the relationship between these variables and propensity of people (householders and renters) to participate in the BEH and other energy efficiency retrofit programmes. For the purposes of this study, hypotheses can be put forward for future research.

Figure 11: Average weekly earnings



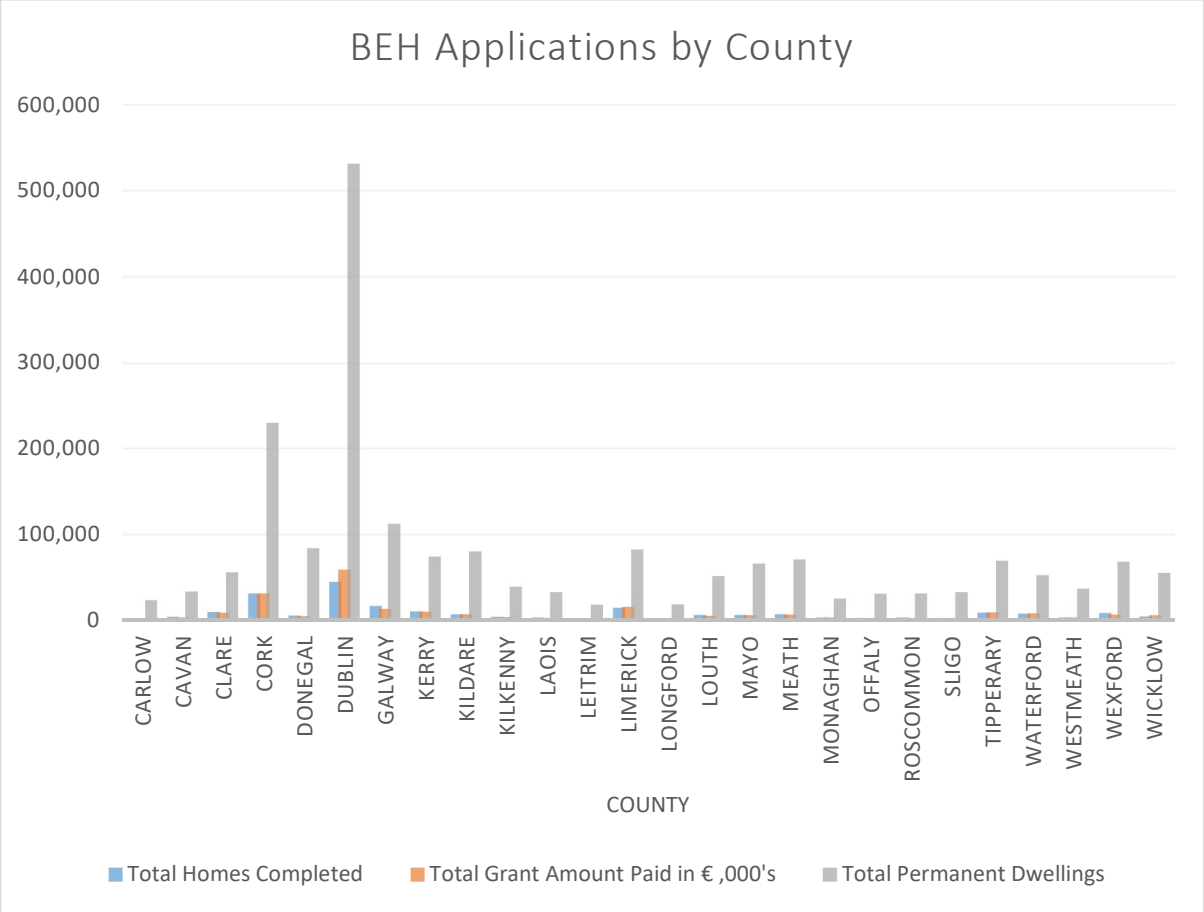
	2013	2014	2015	2016	2017	2018
Q1	693.21	699.67	701.11	714.26	725.12	744.76
Q2	695.65	694.08	699.22	706.33	720.52	744.08
Q3	682.79	676.58	692.79	702.97	717.55	
Q4	694.03	702.07	711.23	717.52	731.86	

Source: CSO website

In recent years, wages have not increased in line with the rising costs of living which include housing, utilities, transportation and food. Consequently, we hypothesise that individuals who would be purchasing homes and undertaking retrofits are either not entering the market, or entering the market and saving for future upgrades. Yet as mentioned, growing household debt is a barrier to home ownership. For example, according to data from March 2018, to be able to

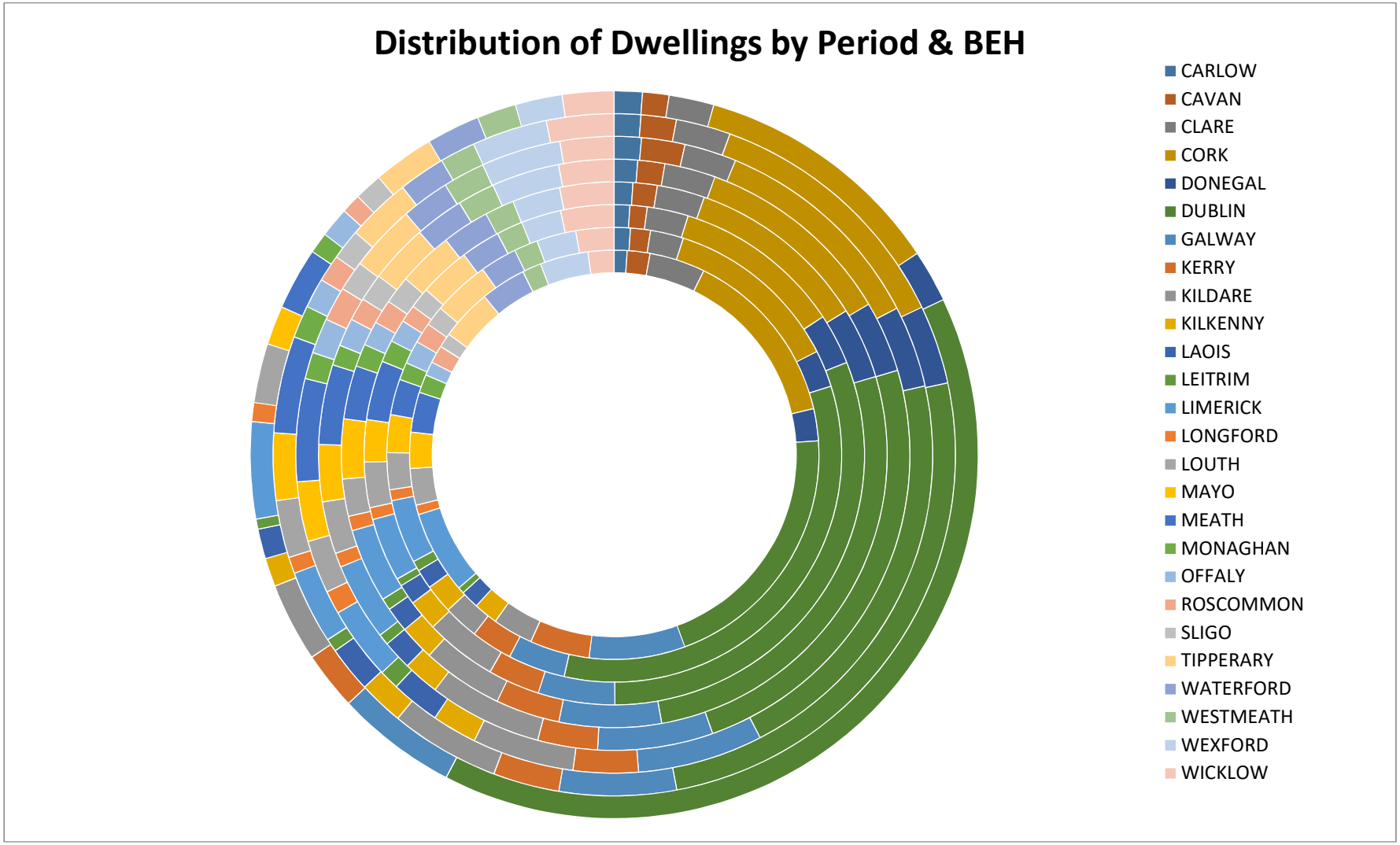
afford a mortgage to purchase a home in Dublin under the Central Bank of Ireland mortgage lending rules, a single person would need an average annual salary of €81,000 (Reddan, 2018). Furthermore, in the cohort that are renting, saving for a mortgage is challenging and whilst they may be able to suggest upgrades to landlords, they face risks of increased rent, and the possibility of losing their housing if they cannot afford the increased rent. This is an area in need of further research, particularly in the context of future policy being proposed to support landlords in undertaking upgrades. It is an area that will need careful consideration in the broader context of housing affordability and the absence of legislation that provides adequate protection to tenants.

Figure 12: BEH by County



Source: CSO (2017) and SEAI (2018)

Figure 13: Distribution of Dwellings by Period of Build and BEH



Source: CSO (2017) and SEAI (2018)

5.6 Governance

The BEH scheme is operated by the SEAI and there are two options for householders applying for grants. The first is directly, which accounts for 91.6% of applications. In this instance, the householder is responsible for the application and hiring the contractor to carry out the works and declare the completion of works to SEAI. This is a clear process.

In the second option (8.4% of applicants), there are a number of stakeholders: involved contractors, Obligated Parties (OPs), and a counter party. From the data, it seems that while certain OPs are more active, Collins and Curtis (2017) highlight that, due to their obligations under the EEOS, they may be encouraging retrofits that yield the highest number of credits, as opposed to retrofits suited to the needs of customers.

Without follow-up data to assess the BEH householders' experience with the programme and the outcomes of the measures, it is difficult to assess whether their feedback was applied to the programme. In the absence of data, and based on the available data, it could be assumed that external stakeholders were not consulted to modernise the programme in line with changing technology, affordability, and to target householders who are not participating in the programme but would benefit from doing so.

6. Recommendations

This section outlines the recommendations developed as a result of this evaluation. At a sector-wide level, the actions and measures currently in place need to be strengthened. Further actions and measures, and their evaluation, would benefit from the following:

- **Data:** The available quantitative data is focused on the cost of actions. It was acknowledged during a project stakeholder workshop convened in October 2018 as well as through project research that policy decisions should take account of a wider range of factors. Data should be broadened to include aspects of what was done, who was impacted, and other qualitative factors. This could be done by the Department of Housing, Planning and Local Government (DHPLG) and SEAI in partnership with the Irish Green Building Council (IGBC). This would enable a deeper understanding of an action's impact, and could guide future actions.

- **Better tracking of buildings:** As an example of the need for more and better data, the QualiBuild programme is an asset to retrofitting existing buildings and to constructing new buildings. The programme has trained 200 individuals. However, it is not clear if the training has been put into practice. Data needs to be collected on how many dwellings individuals have retrofitted and/or constructed in a given year; as well as the type of dwelling, its BER rating and its location. This could be done by DHPLG and SEAI in partnership with IGBC. This could help to capture households that are undertaking retrofits outside of the Better Energy Programme.

- **Smart Metering**: It is important to know whether upgrades have resulted not just in energy efficiency but changes in energy consumption. Smart metering will enable householders to better manage their energy use, and will provide data on progress towards targets, although smart meters alone may not achieve significant behaviour change and may need to be combined with other behaviour change measures. In the roll-out of smart meters it will be important to address concerns about data privacy.

- **Options for financing**: It is evident that while a grant is beneficial in undertaking retrofits, having to pay for the upfront costs of the upgrades is a barrier. It would be advisable to explore the potential of alternative financing mechanisms to align with financial capacity of households, such as green energy bonds, energy efficient mortgages, and low interest loans.

6.1 The Better Energy Homes Scheme

The BEH Programme aims to reduce energy consumption by 1,900 GWh by 2020. However, this target is to be achieved in a context of population growth and a government commitment to building 500,000 new homes. To ensure that the energy savings aimed to be achieved by the BEH are not lost due to other policies, measures need to be taken to strengthen the capacity of the programme and to apply the learnings to other policies. Following from our evaluation of the BEH programme, we put forward recommendations for the programme as well as for policies addressing residential energy use that aim to reduce emissions by introducing energy efficiency retrofits. The recommendations fall into three interconnect categories: data availability, information/education, and scheme design.

6.1.1 Data availability

Better data collection is important for monitoring progress. This applies both to the BEH programme's effectiveness and efficiency and to broader national targets as well. Currently, it does not appear that information on householders' energy use prior to retrofits and post works is available. Furthermore, in research undertaken by SEAI and ESRI, it appears that Collins and Curtis (2016 and 2017) did not have access to information on householders' income levels, awareness of environmental issues, and number of individuals in the household.

Based on this, we recommend that energy use data be provided by householders for at minimum 2 years pre-works and 2 years post-works. Combining this data with details of upgrades undertaken will allow for analysis of which measures are effective in terms of housing typology, household size and energy use. Furthermore, collecting data on energy use may also enable better monitoring of energy services providers in terms of their compliance with EEOS.

Detailed data collection will provide insights for the future direction of the programme and other policies being developed to address energy use and energy efficiency in the all sectors, by permitting more detailed analysis to identify gaps in programme coverage.

6.1.2 Information & Education

Recognising that in an era where collecting personal data is fraught with concerns of security, it is important for householders understand why their energy data is being collected. The Power of One campaign was terminated before its full potential could be understood. An ESRI study of the scheme focused only on changes in natural gas consumption but acknowledged that other factors may play a role and called for further research (Diffney, et al., 2013). Information and education around energy use is essential, as retrofits and upgrades will likely only achieve a fraction of what is needed to achieve targets. Behaviour change is critical.

Upgrades may lead to induced demand resulting in more energy being used. It has been highlighted that the BER assessment undertaken as part of the grant application programme does not include the BER assessor working with householders to select upgrades suited to their house and energy needs. Furthermore, the BER assessment is indicative of a building's energy efficiency, not of the householders' behaviour. In applications where obligated parties assisted householders, Collins and Curtis (2017) warned that obligated parties may choose measures that yield the most credits towards their EEOS targets, as opposed to meeting the needs of households.

We recommend that the BEH (and other programmes) include information and education campaigns that educate people around energy, specifically:

- Energy sources;
- How they use energy;
- How they can reduce their use.

The boiler campaign is an example of an information campaign that provided information to people on the importance of regular maintenance for the effective operation of their boiler. Looking outside of Ireland, the Canadian Federal Government's Local Energy Efficiency Program is administered provincially. In British Columbia (BC), BC Housing oversees its implementation. As part of encouraging the construction of energy efficient low carbon homes, BC Housing has produced a series of videos and guidelines that are informative and show how to maintain homes and their energy systems. It would be valuable to provide information to people, not solely for the value of energy efficiency but also to reduce waste stemming from retrofits.

6.1.3 Scheme Design

At present, the design of the BEH scheme is inadvertently biased towards households that can afford the upfront costs of the upgrades. In practice this limits the availability of the programme and the technologies that applicants can choose from for upgrades. In an effort to understand how to draw more applicants to the programme, Collins et al. (2018) investigated alternative scheme designs via surveys (conducted by an external company) of randomly selected households. The study sought to understand the preferences of householders for differing financing mechanisms for retrofits. The study considered age, gender, socio-

economic status, ownership (outright vs. mortgaged) and dwelling typology. It did not focus on income levels explicitly. The study proposed six choices for financing retrofits:

- Cash back once the work is complete (status quo);
- Discount on the cost of work upfront;
- Reduced property tax based on a better energy efficiency rating;
- Tax credits for each year of the loan term;
- Ability to pay through your employer via your salary/wages;
- None.

The preference was for the status quo, followed by a discount on the cost of work upfront. Only 15% of the survey respondents had availed of grants. It was not reported whether householders decided to apply for grants as a result of participating in the survey. Socio-economic status did not seem to have had an effect on decision making.

The proposed grant options are not exhaustive. All are primarily incentive-based measures. Considering that landlords are eligible to apply to the programme but do not appear to be doing so, and with government set to introduce policies to support landlords to undertake upgrades, it is perhaps worth considering regulatory measures to achieve compliance. Furthermore, it is important to acknowledge that a discount on property tax rates will adversely affect local authorities. Therefore, if incentives are to be used, one option may be to consider rent income tax rates based on the BER of the dwelling.

The available data indicate that retrofits are primarily undertaken by households that are owner-occupied (Collins et al., 2018). This presents several issues that have knock on effects: energy poverty due to rising energy costs, poverty in general due to affordability issues, and health impacts. Another aspect of the programme that was addressed in the section on relevance is technology. In terms of technology, the scheme is limited, particularly in comparison with the technologies available in the BEC, technologies supported by the Building Regulations, and programmes with similar aims internationally, such as the Canadian Federal Government's Local Energy Efficiency Program. The exclusion of new technologies is a possible reason for the lack of engagement in the programme in recent years. Moreover, it is recognised that the upgrades that have been undertaken are shallow retrofits. Technology choice needs to be expanded.

Considering these factors and recommendations for data and information/education we propose the following for scheme design:

1. **Means testing for eligibility**: It is not clear that existing support through BEH are targeting those who need upgrades but cannot afford upgrades and are not eligible for the Better Energy Warmer Homes programme. Applying means testing to applicants would ensure that the programme is equitable and does not contribute to energy poverty by guaranteeing that grants are given to those who do need and will benefit from upgrades.

2. **Tiered grants based on income and need:** Building on means testing, we recommend tiered grants based on income level and need. A proposed structure could be:

Household Income	Grant %
Under €40,000	100% (BEWH)
€40,000 – 50,000	50%
€50,000 – 60,000	30%
€60,000 – 70,000	10%
Over €70,000	Not eligible

3. **Options for financing**: Although a grant is beneficial in undertaking retrofits, having to pay for the upfront costs of the upgrades is a barrier. While this was indicated as the preferred method of financing retrofits based on a survey conducted by Collins and Curtis (2017), the survey limited the choice of options and did not ask the respondents to suggest a financing mechanism. It would be advisable to explore the potential of alternative financing mechanisms to align with financial capacity of households. For example:
   a. Green Energy Bonds linked to the value of the property.
   b. Energy efficient mortgages issued by banks to new homeowners based on BER of the property. Energy efficiency mortgages, which have been used in the US, are loans that enable new or existing home owners to refinance their home to finance the costs of undertaking energy efficiency upgrades.
   c. Low interest loans, paid back in 5 to 10 years depending on the works completed.
   d. Energy performance contracting, which would incentivise BER assessors and Obligated Parties to advise householders to choose retrofits that result in reduced energy use as there would be an incentive to educate householders about energy use.
   e. Explore the feasibility of rebates on home insurance or health insurance – Companies such as MunichRE, and Genworth offer Energy Efficiency insurance and mortgage insurance rebates for energy efficiency upgrades. For health insurance, given the call for healthy buildings amidst the growing body of research on the health impacts of buildings and indoor air quality such as the impacts of mould on respiratory illnesses and neurological systems (Cedeno-Laurent et al., 2018; Inamdar et al., 2013; Watts et al., 2015), there is potentially an opportunity finance upgrades through rebates on health insurance. A challenge with this is getting insurance companies to partner with SEAI, but the knowledge that the likelihood of a pay-out is decreased through improvements to dwelling may be sufficient.

4. **Technology selection based on detailed consultation with BER assessor:** This final consideration for scheme design emerges from the recognition that: a) technology has

evolved since the introduction of the BEH programme; b) the choice of technologies may not match the needs of householders; and c) retrofits are typically shallow and therefore benefits are marginal. We recommend that grants be opened to all technologies that would lead to energy efficiency improvements. However, to mitigate the risk of householders selecting the most expensive technologies, they must choose technologies in consultation with a BER assessor and approval from SEAI. By permitting a wider range of technologies to be eligible, retrofits of dwellings built before 1970s may increase.

6.1.4 Consideration for landlords

A final recommendation is made with regard to landlords. From the available data it is evident that landlords typically do not participate in the BEH programme even though they are eligible to do so. Furthermore, tenants are eligible to apply for upgrades but typically they do not. The government is proposing to provide assistance to landlords to undertake upgrades. Acknowledging the existing housing crisis that has led to rising costs and demands for housing in the rental market, the government ought to consider carefully the design and implementation of policies targeting landlords.

There are several key risks with this, the first of which is displacing existing tenants during the period in which upgrades are being undertaken. In a strained rental market this is not ideal. Government ought to consider compensation for tenants as part of any proposed grant scheme, such as temporary housing. Secondly, there is a risk that landlords will use the opportunity to increase rents and price tenants out of their accommodation. Current rental laws permit allow landlords to raise rents for significant upgrades to a dwelling. "Significant upgrades" is not clearly defined. Government ought to specify clearly that energy efficiency upgrades funded by government do not constitute "significant upgrades" and that landlords would not be allowed to increase rent. Ensuring efficacy of the programme means measuring and verifying energy use. Given that energy bills can be paid by either the tenant or the landlord this will be challenging. However, if smart metering is introduced this may address this issue.

There is potential to address the affordability crisis by designing the scheme to penalise landlords who do not undertake upgrades to improve the quality of housing in the rental market. The tax on rental income for dwellings that have undergone upgrades could be linked to the property's BER. There is an opportunity to address the housing crisis and energy efficiency simultaneously. It will require collaboration and consultation with the Department of Housing, Planning and Local Government, the Residential Landlords Association, the Residential Tenancies Board, and possibly others to develop a policy that achieves energy efficiency gains without contributing to a growing affordability crisis.

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APPENDIX I – Actions and Measures

Actions	Mitigation Measures	Year Introduced
Commission study on the wider economic costs and benefits – including in the areas of climate, decarbonisation and rural development – of potential extensions of the Irish Natural Gas network, and related funding options		2017
	**BE1 - Better Energy Homes (BEH) - Improving the energy efficiency of homes to reduce occupants' energy consumption, costs and emissions. Renovate an increased quantum of homes by end 2020 to deliver a cumulative projected GWH savings of 1,900*	2009[7]
	BE2 - Better Energy Warmer Homes (BEWH) - Improving the energy efficiency of the housing stock of those in energy poverty to help reduce their energy consumption, costs and emissions. Renovate an increased quantum of homes by end 2020 to deliver cumulative projected GWH savings of 590 Gwh.	2002[8]
Housing Assistance Package – Local Authorities signed up to participate and scheme operational.	BE3 - Housing Assistance Package - A pilot scheme as part of the Better Energy Programme to encourage landlords participating in the Housing Assistance Package (HAP) to avail of the Better Energy Programme to incentivise energy standard improvements in the rental sector.	2017
	*BE4 - Better Energy Communities (BEC) - Improving the energy efficiency of clusters of buildings in community based settings to reduce occupant's energy consumption, costs and emissions. Cumulative projected GWH savings of 2,280 assuming current level of uptake maintained.	2017
Warmth and Wellbeing Scheme – 1,500 homes will be upgraded for occupants who qualify for the scheme	*BE5 - Warmth and Wellbeing Pilot Scheme - Provision of deep retrofits to the homes of people aged 55 and over or aged 12 and under suffering chronic respiratory conditions relating to the thermal efficiency of their homes. Research on the outcomes and impacts including on reduction in hospital bed nights alleviating pressure on the health system will inform better understanding of the wider benefits of upgrading homes to improve energy efficiency.	2017

[7] First introduced and included in MURE database
[8] First introduced and included in MURE database

Warmth and Wellbeing Scheme evaluated with a view to a possible national rollout		2017
Implement the Deep Retrofit pilot.	*BE6 - Deep Retrofit Pilot - The initial focus will be on the residential sector. Deep retrofit is the significant upgrade of a building towards nearly zero energy requirements where is practically feasible and achievable. The aim of the pilot is to fund fuel switching to low carbon heating technologies to demonstrate the multiple benefits of energy efficiency and investigate how best to support consumer decision-making and investment in deep retrofit.	2018
	BE7 - Social Housing Upgrades (DHPCLG) - Phase 1 commenced in 2013 to retrofit all relevant local authority dwellings with cavity wall and attic insulation; this programme will continue in 2017. Phase 2 was piloted in 2015/2016, and will be formally rolled out to all local authorities. Phase 2 will focus on the external fabric upgrade of those social housing units with solid/hollow block wall construction.	2018
	BE8 - Green Procurement & Accelerated Capital Allowance (ACA) ("Triple E" List) - More energy efficient equipment used in the public and private commercial sectors	2017
	*BE9 - Energy Efficiency Fund - If fully subscribed, the fund of over €70m has the capacity to leverage potential investment of €300m in energy efficiency.	2017
	*BE10 - Building Regulations – Nearly Zero Energy Buildings (NZEB) - Review of Part L of building regulations for buildings other than Dwellings in 2017 to give in the order of 60% improvement in energy and CO2 performance and to introduce cost optimal requirements for Major Renovations Review of Part L of building regulations for Dwellings in 2018 to give in the order of 70% improvement in energy and CO2 performance over 2005 requirements and to introduce cost optimal requirements for Major Renovations.	2017
New BER Advisory report to be introduced	BE11 - Building Energy Rating (BER) Certificates - A BER is an indication of the energy performance of a dwelling on a scale of A (most efficient) to G (least efficient) arrived at following an energy audit. By providing purchasers/renters with such information it promotes more awareness and understanding of energy efficiency. All dwellings offered for sale or rent must display their BER rating. The scheme is operated by SEAI on a cost-neutral basis. From early 2018 BER Certificates and reports will be enhanced to provide more detailed information to owners/buyers/occupants on how much more comfortable and cost effective the home could be if specific energy efficiency measures were undertaken. The new BER documentation will also feature the emissions levels associated with the dwelling more prominently to help raise awareness of these emissions and how they could be managed.	2017
	BE12 - Energy Audits for Large Energy Users - Some 600 large businesses (Larger than SME) and some public sector bodies are required to undertake these audits.	2017

	BE13 - Energy Efficiency Obligation Scheme - Energy suppliers expected to deliver annual energy savings of 0.75% of their final energy sales to consumers. Energy suppliers need to work collaboratively with customers to identify potential savings and to make the investments to deliver those savings or they face a fine. This results in increased levels of renovation in domestic and non-domestic markets.	2017
Roll out EXEED Programme[9].	BE14 - Large Industry Energy Network - The Large Industry Energy Network (LIEN) is a well- established networking and support programme for large business energy users supported by SEAI. LIEN is a voluntary grouping of companies, facilitated by the SEAI that work together to develop and maintain robust energy management.	2017
SME Support – Publish new Energy Audit Handbook.	BE15 - SME Support - Encourage and support SMEs to undertake energy efficiency measures	2017
SME Support – Publish new interactive SME Guide		2017
SME Support – Develop and pilot new targeted grant support actions (Variable Speed Drives (VSD's) in the farming sector and lighting in SMEs).		2017
	BE16 - Qualibuild - To promote the up to date skills and knowledge in the construction sector to deliver a high standard of build and best practice in energy efficiency. This initiative is run by the Green Building Council	2017
	BE17 - Schools Technical Bureau - Provision of tailored advice, training and support by SEAI to enable schools and the Department of Education and Skills to identify and take advantage of opportunities to reduce energy use and improve energy performance when making facilities upgrades to schools including through maintenance, summer works and capital programmes. In 2017, a new €4.5m capital fund (shared between DCCAE and DES) was established to build a schools retrofit programme. 10 schools were retrofitted in 2017, with the funding scheme expected to grow from 2018.	2017

[9] The EXEED Certified Program was developed by the SEAI as a mechanism to independently certify assets as Energy Efficient Design entities. The objective is to apply a standardised framework for energy efficient design and management of assets in order to identify and implement opportunities for optimum energy performance and energy management over the life of an asset. The EXEED grant scheme provides grant support of up to €250,000. The grant level may be extended by 20% for small enterprises and by 10% for medium enterprises. Results achieved over the 2016-7 period involving 45 projects show average energy efficiencies of 28% being achieved. For 2016, EXEED supported 24 projects with grant assistance of €1.885m which resulted in 2.62 GWh of efficiency gains. The programme will see an increase in investment from €2.6m in 2017 to €10m for 2018. To complement the EXEED programme, the tax code provides for accelerated capital allowances (ACAs) for energy efficient equipment supporting the reduction of energy use in the workplace and the awareness of energy efficiency standards in appliances. This measure was extended in Budget 2018 to the end of 2020.- Annual Transition Statement

Establish new Behavioural Economic Unit in SEAI	BE18 - Behavioural Economics Unit - To better understand the important role that behavioural economics and psychology plays in decision making and to encourage and facilitate more people choosing energy efficient and sustainable options, the SEAI established a dedicated Behavioural Economics Unit in 2017, to provide input to policy development and coordinate with the use of this discipline across wider government policy formation. The unit will trial and test interventions including how best to communicate effectively with target groups to achieve the desired outcomes and will assess the impacts	2017
Implementation of Public Sector Energy Efficiency Strategy (PSEES).	BE19 - Support Network for Delivery of Public Sector Energy Efficiency Targets - The SEAI supports public sector bodies to achieve their 33% energy efficiency target through technical assistance. From 2017 these supports, which include the Monitoring & Reporting System have been enhanced in support of the new Public Sector Energy Efficiency Strategy and the energy management and governance process the strategy establishes.	2017
PSEES – All PSBs will have nominated Energy Performance Officers (EPOs) and the Steering Group will be in place.		2017
PSEES – Initial pipeline projects identified.		2017
PSEES – First progress report to Government.		2017
PSEES – Implement the 2017 Central Government Building Energy Retrofit Fund pilot and report to DCCAE on outcomes		2017
PSEES – Deliver the 2017 National Energy Efficiency Upgrade Pilot programme for schools.		2017
	*BE20 - Renewable Heat Incentive	2017
	BE21 - Smart Metering	2016
Minimal Thermal Standards in rental properties – Public Consultation underway	BE22 - Minimal Thermal Standards in Rental Properties	2017
Minimal Thermal Standards in rental properties – Consider consultation submissions and where warranted, introduce measures to help facilitate landlords achieve compliance with envisaged new regulations.		2017
	BE23 - Voluntary Housing Association Upgrades	2017
House of Tomorrow		2001

Energy Conservation Standards for New Dwellings (Revised Building Regulations) 2002		2003
The Greener Homes Scheme		2006
Power of One -Information Campaign		2006
Low Carbon Homes Scheme		2006
Best Practice Design for Social Housing		2007
Boiler Efficiency Information Campaign		2007
Condensing Boilers - Minimum Boiler Efficiency		2008
Better Energy Homes (Residential Retrofit)		2011
Smart Metering		2016
TOTAL ACTIONS: 28	TOTAL MEASURES: 23	

Instrument Types & Target Groups

Broadly the measures developed in response to legislation are the onus of public sector to carry out or to enforce. There are also several programs that have been implemented by SEAI that aim to provide support to the public sector: Energy Map/ ISO 50001, Energy Link (which now has specialised groups focused on ESCOs, public lighting etc, and the Public Sector Monitoring and Reporting system. Financial (grants) and information-based (campaigns and guidelines) measures aim to gain voluntary compliance with legislative commitments in the private sector.

Missing from the range of measures are: tariffs, and cooperative measures. Voluntary agreement is related to informative/ education instruments as the objective is voluntary compliance with a policy. There is scope to understand why certain tariff measures remain unused in the context of the built environment or if there are any that would incentivise key sectors to make necessary changes to building stock.

Table A1. Types of Actions and Measures & Target Group

Instrument	Number	Target Group
Legislative	~16	Public Sector
Financial	~5	Public Sector, Private Sector, individuals
Information/ Education	~10	Private Sector (SMEs) and individuals.

APPENDIX II - Measures and Actions & Related Acts & SIs[10]

Actions	Mitigation Measures	Related Act/ SI
Commission study on the wider economic costs and benefits of potential extensions of the Irish Natural Gas network, and related funding options		
	BE1 - Better Energy Homes	*S.I. No. 243/2012*
	BE2 - Better Energy Warmer Homes	*S.I. No. 243/2012*
Housing Assistance Package	BE3 - Housing Assistance Package	S.I. No. 243/2012
	BE4 - Better Energy Communities	
Warmth and Wellbeing Scheme	BE5 - Warmth and Wellbeing Pilot Scheme	S.I. No. 243/2012
Warmth and Wellbeing Scheme evaluated with a view to a possible national rollout		
Implement the Deep Retrofit pilot.	BE6 - Deep Retrofit Pilot -	S.I. No. 243/2012
	BE7 - Social Housing Upgrades (DHPCLG)	Social Housing Strategy; Quality Housing for Sustainable Communities; Rebuilding Ireland - Action Plan for Housing and Homelessness; Social Housing Strategy
	BE8 - Green Procurement & Accelerated Capital Allowance (ACA) ("Triple E" List)	
	BE9 - Energy Efficiency Fund	
	BE10 - Building Regulations – Nearly Zero Energy Buildings	Building Regulations, Part L
New BER Advisory report to be introduced	BE11 - Building Energy Rating (BER) Certificates	S.I. No. 243/2012
	BE12 - Energy Audits for Large Energy Users	
	BE13 - Energy Efficiency Obligation Scheme	
Roll out EXEED Programme	BE14 - Large Industry Energy Network	

[10] Policy Actions and Measures are affected by: Roads Act, Arterial Drainage Acts, Waste Management Act, Litter Pollution Act, Protection of the Environment Act 2003; Government Policy on Architecture; Land and Conveyancing Law Reform Act, 2009; Planning and Development Act; Design Manual for Urban Roads and Streets (DeMURS); Urban Regeneration and Housing Act 2015; Planning and Development (Housing) and Residential Tenancies Act 2016; Regional Planning Guidelines/ Regional Spatial and Economic Strategies; National Planning Framework/ Project Ireland 2040 and S.I. No. 232/2018 - European Union (National Emission Ceilings) Regulations 2018.

SME Support – Publish new Energy Audit Handbook.	BE15 - SME Support - Encourage and support SMEs to undertake energy efficiency measures	Retail Planning Guidelines
SME Support – Publish new interactive SME Guide		
SME Support – Develop and pilot new targeted grant support actions.		
	BE16 - Qualibuild	Construction Strategy 2020; Quality Housing for Sustainable Communities
	BE17 - Schools Technical Bureau	
Establish new Behavioural Economic Unit in SEAI	BE18 - Behavioural Economics Unit	
Implementation of Public Sector Energy Efficiency Strategy (PSEES).	BE19 - Support Network for Delivery of Public Sector Energy Efficiency Targets	
	BE20 - Renewable Heat Incentive	
	BE21 - Smart Metering	
Minimal Thermal Standards in rental properties – Public Consultation underway	BE22 - Minimal Thermal Standards in Rental Properties	S.I. No. 243/2012
	BE23 - Voluntary Housing Association Upgrades	Quality Housing for Sustainable Communities; Construction 2020;
House of Tomorrow		*Education campaign
Energy Conservation Standards for New Dwellings (Revised Building Regulations) 2002		Building Regulations; S.I. No. 243/2012; Rebuilding Ireland - Action Plan for Housing and Homelessness
The Greener Homes Scheme		Building Regulations
Power of One -Information Campaign		*Education campaign
Low Carbon Homes Scheme		*Education campaign
Best Practice Design for Social Housing		Building Regulations; S.I. No. 243/2012; Rebuilding Ireland - Action Plan for Housing and Homelessness; Social Housing Strategy; Quality Housing for Sustainable Communities;
Boiler Efficiency Information Campaign		*Education campaign
Condensing Boilers - Minimum Boiler Efficiency		Part L. amendment – S.I. No. 847 of 2007
Smart Metering		

APPENDIX III – Better Energy Homes summary, 2009-2018

County	Total Homes Completed	Total Grant Amount Paid
Carlow	2,206	€1,889,656
Cavan	3,969	€3,286,911
Clare	9,671	€8,972,774
Cork	31,195	€31,057,952
Donegal	5,547	€4,896,404
Dublin	45,083	€59,183,212
Galway	16,640	€13,394,486
Kerry	10,376	€10,104,921
Kildare	7,026	€6,986,250
Kilkenny	4,176	€3,600,923
Laois	3,167	€2,407,761
Leitrim	1,141	€1,039,880
Limerick	14,420	€15,512,138
Longford	1,644	€1,427,248
Louth	6,366	€5,252,350
Mayo	6,289	€6,028,007
Meath	6,932	€6,630,534
Monaghan	3,180	€3,346,958
Offaly	2,417	€2,214,508
Roscommon	3,086	€2,679,540
Sligo	2,518	€2,332,112
Tipperary	8,898	€9,299,499
Waterford	7,859	€8,275,593
Westmeath	3,281	€3,191,814
Wexford	8,410	€6,446,042
Wicklow	4,491	€5,976,156
Grand Total	**219,988**	**€225,433,626**