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Better Buildings

A National Renovation Strategy for Ireland

List of Tables & Figures

Introduction

This first version of a National Renovation Strategy has been prepared to fulfil Article 4 of the 2012 Energy Efficiency Directive which requires Member States to set out long-term strategies for mobilising investment in the renovation of buildings.

COMMISSION DIRECTIVE 2012/27/EU ON ENERGY EFFICIENCY, ARTICLE 4 BUILDING RENOVATION

Member States shall establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private.

This strategy shall encompass:

a) an overview of the national building stock based, as appropriate, on statistical sampling;

b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;

c) policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;

d) a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;

e) an evidence-based estimate of expected energy savings and wider benefits. A first version of the strategy shall be published by 30 April 2014 and updated every three years thereafter and submitted to the Commission as part of the National Energy Efficiency Action Plans.

As the recent Green Paper on energy has shown, very few elements of the cost of energy are within our control. This leaves businesses and consumers vulnerable to sharp changes in the price of internationally traded fossil fuels. However, perhaps the single most effective means of reducing this vulnerability is within our ability to influence. By improving the thermal efficiency of Ireland's building stock we can make our homes and businesses more comfortable, healthier and cheaper to run, while replacing expensive imported fossil fuel with domestic jobs.

Making building regulations steadily more effective will drive efficiencies in new construction but the useful lifetime of buildings are long and if we are to see the full benefit of energy efficiency measures, we need to develop a methodology that can promote investment in the renovation of Ireland's existing building stock.

This is no easy task. Any methodology needs to find solutions that can be applied to more than 1.6 million homes, 109,000 commercial buildings, 10,000 buildings in the public sector and another 4,300 industrial sites.

Such an ambitious goal cannot be achieved overnight. It will require the active participation of many stakeholders across the public and private sectors, and nothing less than a sea-change in how we think about our energy usage.

This process has begun. In the residential sector, direct grants have funded efficiency upgrades to 261,000 homes to date. Ireland has set an ambitious target to reduce energy usage in the public sector by 33% by 2020 and in the commercial and industrial sectors, the recently launched Energy Efficiency Fund will provide loans to companies who want to reduce their energy use. Accelerated Capital Allowances and tax rebates allow householders and businesses to save money on their tax bills by investing in energy efficiency.

These programmes are a good start but more is required. Ireland needs a comprehensive framework of policies, measures and regulations that can persuade households and business to invest now to achieve savings that will accrue back to them many times over in the years to come.

In these times of continued economic uncertainty making this case will be challenging but the benefits delivered by renovation works are clear. By leading the way we can create new opportunities for Irish businesses in this emerging market.

Information must be at the heart of a meaningful renovation strategy. To determine the appropriate policy measures required to boost the renovation rate, we first need to understand the characteristics of Ireland's building stock. To achieve this, we have commissioned research that will, for the first time, provide a comprehensive overview of the entire commercial and industrial building stock in Ireland. In addition, this research will identify the most cost effective renovation measures for every category of building in Ireland. Although this research is incomplete, preliminary data has been incorporated in this first version of the renovation strategy. On receipt of the completed research, this strategy will be updated and a thorough public consultation undertaken. It is our intention that a more comprehensive strategy will be issued later in 2014, taking account of the final research findings and the input from the public consultation.

It is clear that inaction is not an option. If Ireland is to remain an export focused economy, with high-technology energy intensive industries, if we are to limit our exposure to expensive imported fossil fuels, while ensuring that citizens can afford to light and heat their homes, we need to make sure that our buildings use as little energy as possible. This strategy is critical to achieving that.

The Opportunity for a Renovation Strategy

Energy efficiency has been consistently lauded by a multitude of international agencies and think tanks as the most effective means of lowering emissions and reducing energy bills. The International Energy Agency (IEA) recommends that governments prioritise energy efficiency by treating it as the "first fuel". Global investments in efficiency measures now rival the sums invested in renewable technologies.

Within energy efficiency the two most important measures are renovating buildings so that they require less energy to heat and light and changing consumer behaviour to prioritise energy saving. Promoting both of these measures will deliver many benefits across the entire economy. Some of these benefits will flow to those undertaking the works while others accrue to the economy as a whole. This section gives a broad overview of the potential benefits that the large scale renovation of buildings could deliver and underpins the rationale for implementing a national strategy on renovation.

Lowering Energy Bills

In the first instance, investing in renovation measures delivers energy savings to consumers and businesses. For householders, lower energy bills mean higher disposable incomes. For those experiencing energy poverty, greater comfort levels can be achieved for the same or a lower cost, and the potential health impacts of living in inadequately heated accommodation avoided. In the commercial and industrial sector, competitiveness is critical. Ireland's energy intensity, that is to say, the amount of energy used to produce our GDP, is among the lowest in Europe. Nevertheless, energy costs represent a significant input cost for business, particularly those businesses competing in international markets. Making it easier for business based in Ireland to further lower their energy bills will thus support domestic employment in those industries. For the public sector, reduced energy bills means that scare resources can be redirected to providing front line services.

Boosting the Domestic Economy

Despite the recent encouraging growth in renewable electricity, Ireland remains overwhelmingly reliant on imports for the vast bulk of our energy supply. This import dependence, estimated at 85%[1] by SEAI, is among the highest in Europe. Improving our energy efficiency is one of the few ways of lowering primary energy demand and thus reducing the amount spent on imported fuel. Diverting funds from imported fossil fuels to upgrading Ireland's building stock will result in more money

[1] http://www.seai.ie/Publications/Statistics_Publications/Energy_in_Ireland/Energy-in-Ireland-Key-Statistics-2013.pdf

staying in the domestic economy, supporting jobs in the construction industry. Studies suggest that a comprehensive programme of renovation could create between 23,000-32,000 new direct jobs in Ireland[2].

Expertise in energy efficiency could also become a competitive advantage for Ireland. With the current differential between average European and US energy prices likely to persist, an active energy efficiency sector could be a unique selling point for companies who are considering locating energy intensive industries in Europe. Research also suggests that energy efficiency improvements boosts the productivity of industry.

Meeting Ireland's Climate Targets

Under the European Union's energy and climate policies, Ireland has an extremely challenging, legally binding, target to reduce emissions in the non-ETS sector by at least 20% by 2020, along with a non-binding target to improve the energy efficiency of the economy by 20%. Furthermore, intensive discussions are underway at a European level to identify the potential future emissions reduction targets that will apply post 2020. Given the limited options in reducing our emissions in non-ETS sectors such as agriculture, energy efficiency is the best method of reaching these challenging targets.

Already, through the National Energy Efficiency Action Plans, Ireland has delivered substantial reductions in energy usage. These actions are projected to deliver approximately 31,925GWh of energy savings by 2020, which represents a fall in CO2 emissions of nearly 5.7 million tonnes. To put this figure in context, natural gas use in electricity generation, responsible for more than 60% of electricity produced in Ireland, accounted for CO2 emissions of just 5.4 million tonnes in 2011[3].

Lowering Energy System Costs

Increasing electricity demand requires investment in new electricity generation capacity which in turn leads to a corresponding increase in investment in transmission and distribution systems. Potentially avoiding or reducing this investment requirement by lowering energy demand will deliver real savings across the entire energy system. This will benefit all energy users.

Marginal Abatement Cost Curve

To assist with the preparation of this strategy, SEAI commissioned in early 2013 primary research to provide a comprehensive dataset on Ireland's building stock and to identify the most cost effective energy efficiency measures. This work is well advanced and will be complete in summer 2014. On

[2] Curtin, J (2009) Jobs, Growth, and Reduced Energy Costs: Greenprint for a National Energy Efficiency Upgrade Programme, Dublin: IIEA.

[3] http://www.epa.ie/pubs/reports/air/airemissions/EPA_GHG_Emission_Proj_pub_2013_FINAL.pdf

receipt of this data, this strategy will be subject to public consultation and will subsequently be revised and updated accordingly. Until then, preliminary data has been used to construct a marginal abatement cost curve for Ireland's building stock.

Energy saving potential for all sectors

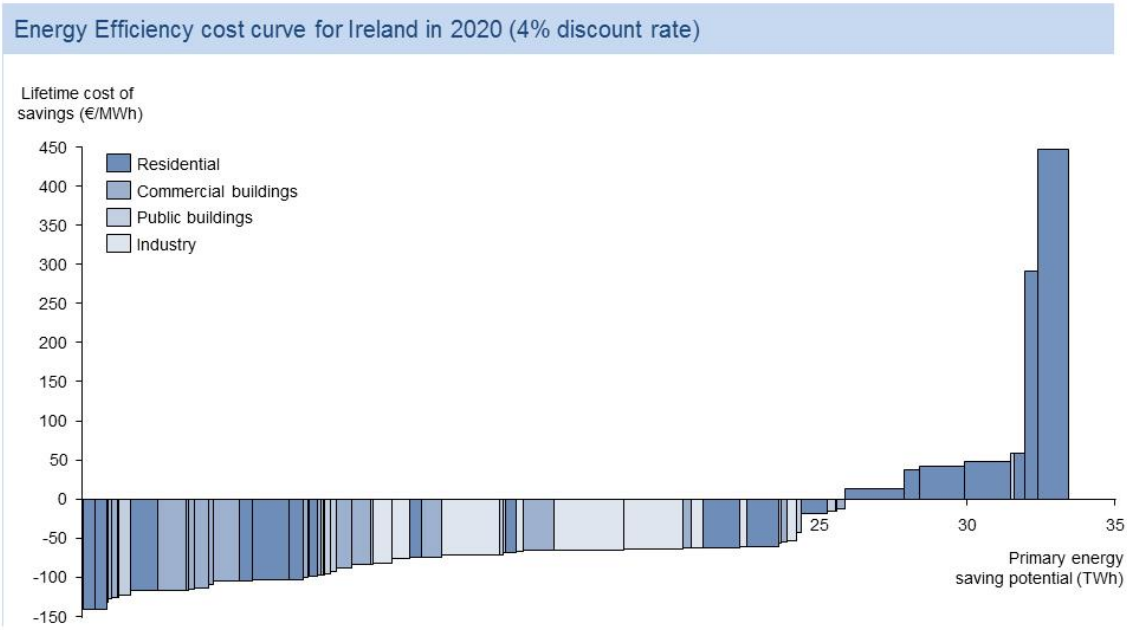


Figure 1: Marginal Abatement Cost Curve for Ireland's Building Stock

In total eighty six energy efficiency measures are included in this preliminary analysis, across the residential, commercial, industrial and public sectors. As the table shows many of these measures are above the line, in that the initial analysis shows that they are a net benefit over their lifetime rather than a cost. Taken together all eighty six measures could deliver primary energy savings of more than 33TWh. Each measure and the potential energy saving associated with that measures is outlined in the table below:

Measure	Energy saving (TWh)	Measure	Energy saving(TWh)
1. Public - Turn off lights for extra hours	**0 - 0.05**	32. Residential - Draught proofing	**11.12 - 11.51**
2. Residential - Air dry instead of tumble dry	**0.05 - 0.46**	33. Commercial - Double glazing	**11.51 - 12.19**
3. Residential - Turn off lights when not in use	**0.46 - 0.85**	34. Industry - Motor efficiency	**12.19 - 14.15**
4. Public - Enable standby features on all PCs and monitors	**0.85 - 0.91**	35. Public - Energy efficient appliances - Office equipment	**14.15 - 14.29**
5. Commercial - Enable standby features on all PCs and monitors	**0.91 - 1.03**	36. Public - More efficient air conditioning	**14.29 - 14.35**
6. Commercial - Turn off lights for extra hours	**1.03 - 1.22**	37. Residential - Energy efficient lighting	**14.35 - 14.71**

Measure	Energy saving (TWh)	Measure	Energy saving(TWh)
7. Public - Energy efficient appliances - Refrigeration	**1.22 - 1.25**	38. Industry - More energy-efficient lighting	**14.71 - 14.95**
8. Public - Energy efficient lighting	**1.25 - 1.65**	39. Commercial - Heat pump	**14.95 - 15.99**
9. Residential - Energy efficient appliances -"Cold" and "Electrical cooking"	**1.65 - 2.58**	40. Industry - Process integration and heat recovery - low temperature proc	**15.99 - 18.36**
10. Commercial - Energy efficient lighting	**2.58 - 3.54**	41. Industry - CHP	**18.36 - 20.38**
11. Commercial - Energy efficient appliances - Refrigeration	**3.54 - 3.63**	42. Commercial - Energy efficient appliances - Office equipment	**20.38 - 20.65**
12. Commercial - Draught proofing	**3.63 - 3.83**	43. Industry - Process integration and heat recovery - high temperature process	**20.65 - 21.06**
13. Commercial - Reducing room temperature	**3.83 - 4.32**	44. Residential - Roof insulation	**21.06 - 22.31**
14. Commercial - Reducing hot water use	**4.32 - 4.47**	45. Industry - More energy efficient steam system	**22.31 - 22.53**
15. Commercial - Roof insulation	**4.47 - 5.33**	46. Residential - Floor insulation	**22.53 - 23.61**
16. Residential - Install efficient shower head and use twice a day	**5.33 - 5.77**	47. Public - External wall insulation	**23.61 - 23.68**
17. Residential - Reduce thermostat from 19C to 18C	**5.77 - 7.03**	48. Commercial - More efficient boiler replacement (gas, oil)	**23.68 - 23.91**
18. Residential - Delay start of heating from Oct to Nov	**7.03 - 7.51**	49. Industry - More efficient HVAC and ventilation	**23.91 - 24.2**
19. Commercial - Cavity wall insulation	**7.51 - 7.65**	50. Public - More efficient boiler replacement (gas, oil)	**24.2 - 24.37**
20. Public - Cavity wall insulation	**7.65 - 7.7**	51. Residential - Cavity wall insulation	**24.37 - 25.24**
21. Residential - Turn off heating in unused rooms	**7.7 - 7.97**	52. Public - Double glazing	**25.24 - 25.55**
22. Commercial - Heating control (room-by-room time and temperature control)	**7.97 - 8.12**	53. Public - Heat pump	**25.55 - 25.58**
23. Public - Draught proofing	**8.12 - 8.19**	54. Commercial - Lighting control	**25.58 - 25.87**
24. Public - Reducing hot water use	**8.19 - 8.22**	55. Residential - Heating control	**25.87 - 27.84**
25. Public - Reducing room temperature	**8.22 - 8.43**	56. Residential - Energy efficient appliances - "Wet" and "Consumer electronic	**27.84 - 28.38**
26. Public - Roof insulation	**8.43 - 8.63**	57. Residential - External wall insulation	**28.38 - 29.9**

Measure	Energy saving (TWh)	Measure	Energy saving(TWh)
27. Commercial - External wall insulation	**8.63 - 9.14**	58. Residential - More efficient boiler replacement (gas, oil)	**29.9 - 31.47**
28. Commercial - More efficient air conditioning	**9.14 - 9.79**	59. Public - Lighting control	**31.47 - 31.58**
29. Public - Heating control (room-by-room time and temperature control)	**9.79 - 9.86**	60. Residential - Heat pump	**31.58 - 31.96**
30. Industry - More efficient refrigeration	**9.86 - 10.5**	61. Residential - Double glazing	**31.96 - 32.38**
31. Industry - More efficient compressed air systems	**10.5 - 11.12**	62. Residential - Solar water heating	**32.38 - 33.43**

Table 1: All measures studied across Residential, Commercial, Industrial & Public Sectors

Residential Sector

Introduction

The residential sector is key to delivering on Ireland's ambitions to reduce our carbon emissions and develop an economy that is environmentally sustainable. The residential sector currently accounts for 27% of all energy usage in the country and emits 10.5 million tonnes of CO2 annually. After transport, this is the single largest source of emissions in the economy and represents a significant proportion of the total emissions attributable to the entire building sector.

Government policy is to reduce the emissions from this sector as close to zero as is technically and economically feasible by 2050. This does not mean that every home in the country will be using zero energy but rather that Irish homes must become more efficient by reducing the avoidable waste of energy and ensure that the energy that is utilised comes from more sustainable sources. There is no doubt that this is an extremely challenging target and one that cannot be delivered without major changes in the way we live and the way we use energy in our homes.

Reducing emissions from the residential sector will partially be achieved by setting gradually increasing and ambitious standards for any new buildings constructed in the residential sector. However, these policies need to be matched by measures that can improve the efficiency of the existing building stock, given that it will still largely be in use by 2050. In practice, this means that the delivery of a near-zero emissions residential sector is dependent on gradually renovating the bulk of homes already constructed.

The total investment required to deliver a near-zero emissions residential sector is daunting. SEAI estimates that an average investment of €21k per home would be required to upgrade every home in the country to a minimum BER rating of B3, suggesting a total investment requirement of around €35 billion. Given the scale of investment required, it is clear that direct Government assistance will not be sufficient to deliver the ambitious goals.

Instead, Government policy must ensure that householders are sufficiently motivated to undertake the improvements themselves and that the tools, mechanisms, supply chains and infrastructure are in place to allow householders to do this. Grasping the opportunity to upgrade the energy efficiency of Ireland's housing stock will be of benefit to the economy as a whole. It will make Irish homes more comfortable, healthier and cost effective to run, while supporting employment in the domestic economy.

Ireland's energy consumption per dwelling is among the highest in Europe[4]. This is partially due to a smaller gas network than is typical on the continent, but to fully account for the differential it must be assumed that our building stock is also less energy efficient than is typical in the rest of Europe. In spite of these disadvantages, Ireland has already begun to make progress on energy efficiency measures. Nearly one sixth of all homes in the country have received some form of Government incentivised energy efficiency upgrade with energy use per household falling by 21% since 2007, when corrected for weather effects.

[4] Energy Efficiency Trends in Buildings in the EU - http://www.odyssee-mure.eu/publications/br/Buildings-brochure-2012.pdf

This section of the National Renovation Strategy presents an overview of the current Irish residential housing stock as well as an analysis of the age of existing dwellings and the climatic conditions in the country. It identifies and outlines potential barriers to the uptake of efficiency measures and highlights the impact current Government initiatives are having. Finally it details the new policies and measures that the Government will be considering over the next three years to renovate the existing residential housing stock.

These measures are underpinned by a thorough analysis of the technical and economic potential of a suite of renovation options in the residential sector. In this first version of the National Renovation Strategy, this analysis is incomplete but will be thoroughly incorporated into the next iteration of the strategy that will be released later this year.

The provisional analysis presented in this Strategy suggests that there are three key barriers to adoption of efficiency measures arise and thus these are the three areas where new Government policies and measures will need to be focused to boost the level of renovation in the residential sector. The three areas are:

- **Information** – There are many benefits to energy efficient dwellings – homes are warmer in winter, have lower energy bills and a higher resale value. Government, working with industry needs to ensure that the populace are well-educated on the benefits of energy efficiency. Easily understood, clear and reliable information from trusted sources that is relatable to a householder's individual circumstances is required. Packages of upgrade measures needs to be standardised insofar as is possible.

- **Economic** – Once householders are sufficiently convinced of the benefits of renovation works, there a needs to be a range of financing options available that allow them to undertake works. Although many householders prefer to finance improvement works through accumulated savings, deeper retrofit measures are quite expensive and are likely to require some form of financing mechanism. A new methodology that makes financing available to householders and proactively encourages retrofit measures by lowering the upfront costs to households, while supporting those in energy poverty is required. These financing mechanisms should be accessible to the householder through both new and traditional financial products.

- **Competition/Trust** – The development of a healthy competitive market for installation works, with an adequate supply of well-trained installers is critical to building consumer trust in energy efficiency measures. Consumers must have confidence that the installer they choose is capable of delivering the required works and that the works when undertaken will deliver the promised benefits. Policies and measures including training, standards and quality assurance procedures that support a healthy, competitive, energy efficiency industry will be critical to boosting the renovation rate among Irish households.

Overview of Residential Housing Stock

The most recent Census, carried out by the Central Statistics Office in 2011, found that there was a total of 1,994,845 dwellings in Ireland. Of these, 14.5% were unoccupied, giving a total number of 1,649,408 occupied households at the time of the census.

This represents a significant upward trend over the past twenty five years. In 1990, the number of occupied households was 1,160,249. The pace of new dwelling construction since 1990 has comfortably exceeded the rate of population growth over that time. However, despite a 64% increase in the number of occupied households, the total CO2 emissions attributable to the residential sector has actually fallen marginally since 1990.

The table below, from the Sustainable Energy Authority of Ireland's (SEAI) Energy in the Residential Sector[5] report illustrates the growth and decline of the emissions associated with various fuels over the period 1990-2011.

	Growth %	Average annual growth rates %				Quantity (kt)		Shares %	
	1990 – 2011	'90 – '11	'00 – '05	'05 – '10	'06 – '11	1990	2011	1990	2011
Coal	-62.4	-4.6	-2.9	1.1	1.3	2,484	933	23.1	8.9
Peat	-66.9	-5.1	-1.7	-1.5	-3.2	3,123	1,034	29.0	9.9
Briquettes	-49.3	-3.2	-5.5	-0.5	-2.2	642	325	6.0	3.1
Oil	164.3	4.7	4.3	2.1	-1.5	1,175	3,106	10.9	29.6
Gas	403.9	8.0	6.7	3.3	-2.0	270	1,359	2.5	13.0
Renewables	-	-	-	-	-	-	-	0.0	0.0
Combustible Fuels (Total)	-8.8	-0.4	2.4	1.6	-1.5	7,052	6,432	65.5	61.4
Electricity	9.0	0.4	-0.6	-1.1	-3.4	3,713	4,047	34.5	38.6
Total	**-2.7**	**-0.1**	**1.1**	**0.6**	**-2.3**	**10,764**	**10,479**		
Total Weather Corrected	**-7.5**	**0.4**	**1.7**	**-2.0**	**-2.6**	**11,210**	**10,364**		

Table 2: Growth Rates, Quantities and shares of Energy-Related CO2 Emissions in the Residential Sector

As can be seen from the data above, this efficiency improvement in the Irish residential sector is attributable to considerable falls in the number of homes heated by coal and peat as well as improvements in energy efficiency and the growth in gas as a home heating fuel.

It is also worth noting that the continued decarbonisation of electricity and the introduction of more efficient generating stations has had an impact upon emissions, as although gross electricity demand from households doubled from 1990 to 2011, the associated emissions increased by only 9% over the same period.

Despite this reduction in energy usage, Irish homes are generally considered to be relatively energy inefficient in comparison to many of our European neighbours. The average thermal performance of

[5] http://www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/Energy-in-the-Residential-Sector-2013.pdf

the residential housing is approximately equivalent to a D rating on the Building Energy Rating (BER) scale.

This is partially as a result of a legacy of no thermal performance standards prior to the introduction of Building Regulations in 1979. Nearly half of the current housing stock was completed prior to the introduction of Building Regulations and would have been subject to less demanding Local Authority Bye Laws or draft regulations, where they were applied. In addition, a large proportion of Irish homes are one-off, rural detached houses. These houses tend to be larger than the average European home, have a greater number of rooms and be off the gas grid. Taken as a whole, Irish dwellings have the fourth largest floor area (104 m2) in the EU behind Luxembourg, Denmark and Malta and the greatest number of rooms at 5.6 rooms per person in 2002. Finally, as illustrated in Table 3, fewer homes in Ireland are connected to the natural gas grid than is the norm in Europe.

Age-Bands

The European Housing Review of 2007 found that Ireland has the youngest dwelling stock in the EU. However, a significant proportion remains dated. Nearly one third of the current housing stock was completed before 1970 and only approximately a quarter dates from 2001 onwards.

The table below illustrates the age bands of the Irish residential housing stock.

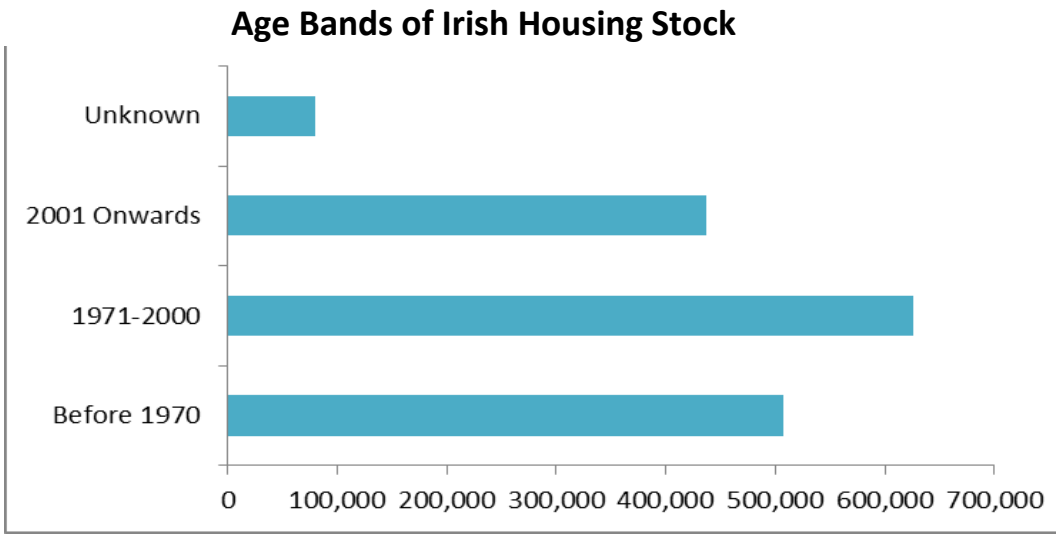


Figure 2: Age Bands of Irish Housing Stock

Since the first mandatory Building Regulations that explicitly addressed conservation of fuel and energy in buildings were issued in 1992 and some 58% of residential dwellings date from before this time, the data indicates that there is likely to be significant potential in the residential sector for major renovation works.

Categories of Dwelling

As well as the age of a dwelling, the type of dwelling is also an important consideration. For example, apartments typically use less energy than detached properties and thus the growth in apartments in Ireland in recent years has likely contributed to the fall in energy usage per dwelling. However, apartments are less likely to be capable of utilising renewable heating technologies or other measures such as heat pumps.

The most common dwelling in Ireland is a detached house, with more than 42% of the total housing stock falling into this category. As previously noted, these detached houses are typically located in rural areas (72%) and are larger than the average European house. This dispersion means that many of these dwellings are not connected to the gas grid and are thus reliant on solid fuels or oil-based heating systems. As a consequence, the emissions attributable to these houses are high but so is the potential for major efficiency gains with renovation works. Recent academic analysis[6] suggests that thermal retrofit measures in the detached housing stock have the potential to realise on average a theoretical 65% reduction in heating costs and CO2 emissions for houses constructed prior to 1979 and around 26% for newer homes.

The next most common housing type in Ireland are semi-detached houses, followed by terraced houses, with apartments representing less than 11% of the total residential dwelling stock. Around 63.7% of the total dwellings in Ireland are in urban areas with the remaining 36.3% classified as belonging to rural areas.

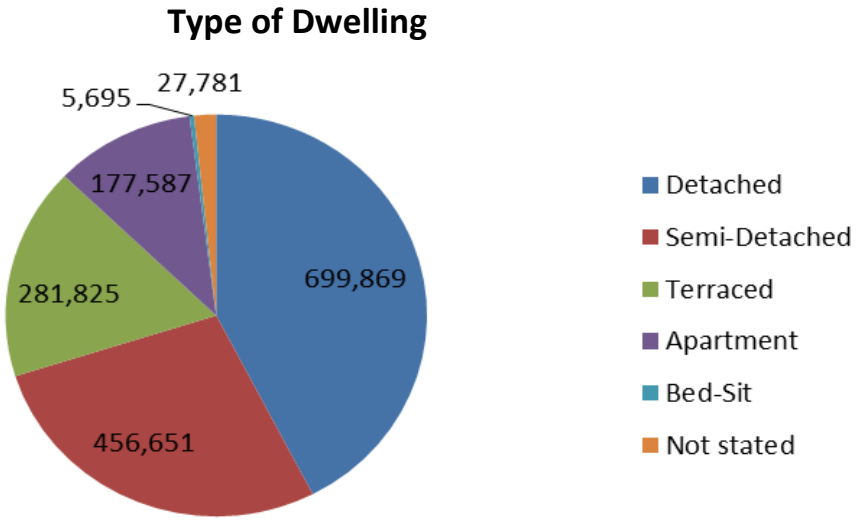


Figure 3: Residential Housing Stock by Building Type

[6] Ahern, C., et al., State of the Irish housing stock—Modelling the heat losses of Ireland's existing detached rural housing stock & estimating the benefit of thermal.... Energy Policy (2013), http://dx.doi.org/10.1016/j.enpol.2012.11.039

Ownership of the Residential Housing Stock

A final consideration worth noting is that, in general, the Irish residential sector is characterised by a high degree of home ownership, with a significant number of householders owning their own home outright, without any mortgage or loan. Nearly 35% of Irish dwellings fall into this category. This is an important consideration for any energy efficiency programme as consumers with different tenures are likely to have differing access to finance and require different incentives.

Ownership of Irish Housing Stock

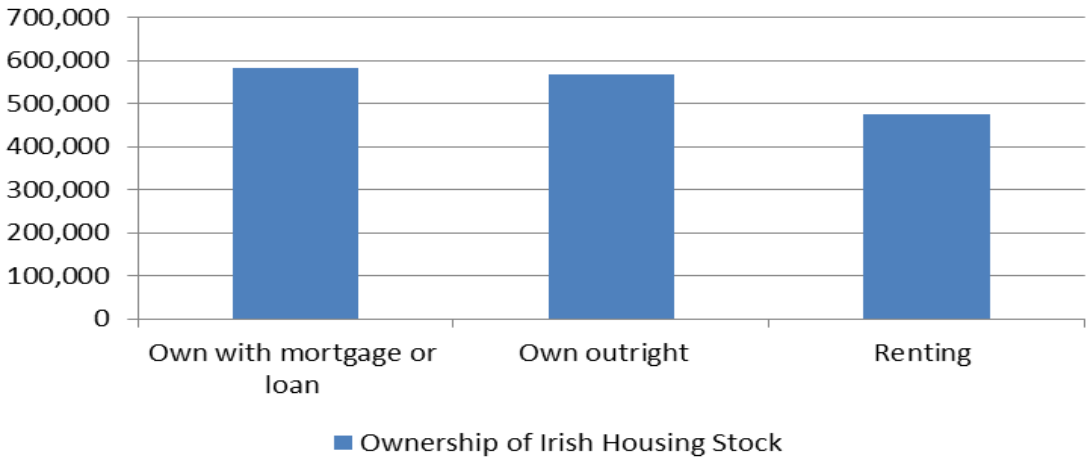


Figure 4: Ownership of Irish Housing Stock

This data suggests that there is a large pool of householders who may have the scope to borrow funds against the value of their property that could be used to undertake deep renovation measures. The data also highlights the importance of measures to encourage efficiency measures in the private rented sector, as although small by European standards, those in rented accommodation sector comprise nearly a third of householders.

Climatic Conditions

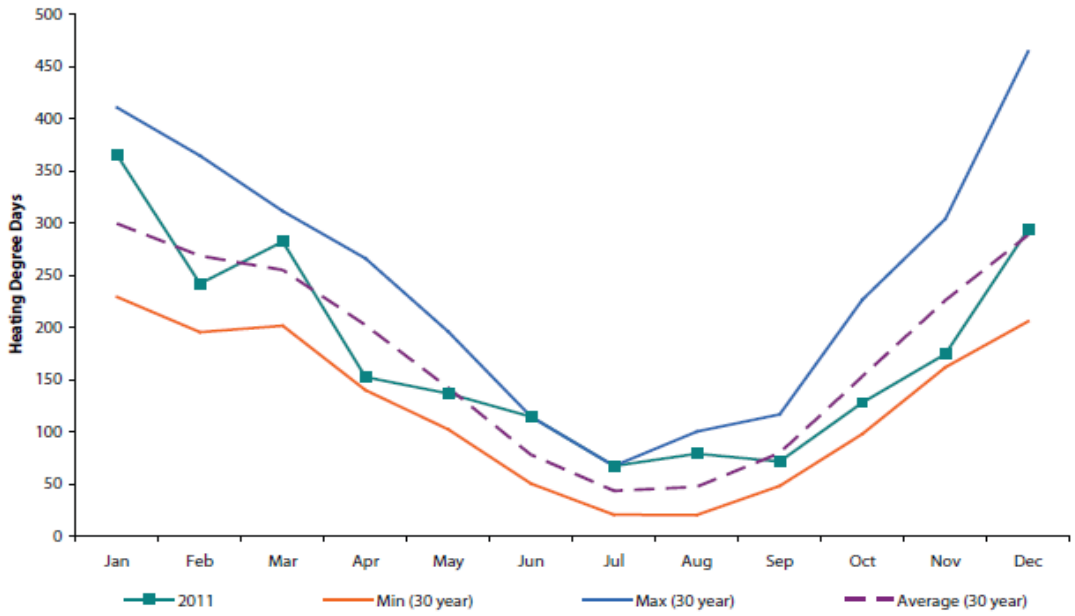
Ireland is a temperate climate with typically warm summers and mild winters. In practical terms, this makes heating in the winter months a significant source of residential energy demand, but the vast majority of properties are not air-conditioned in the summer months.

Weather variations from year to year can have a significant effect on overall energy demand. The typical heating season in Ireland is October to May. The Irish National Meteorological Service, Met Éireann, working with SEAI, measure the impact of weather or climatic variation upon heating load in Ireland through the use of the common "Degree Days" measure.

A Degree Day measures how cold (or warm) it is outside, relative to a day on which little or no heating (or cooling) would be required. It is thus a measure of cumulative outdoor temperature deficit (or surplus) relative to a neutral target temperature (base temperature). It should be noted that the larger the number of heating degree days, the colder the weather. If, for example, the

outdoor temperature for a particular day is 10 degrees lower than the base temperature (15.5 degrees), this would contribute 10 degree days to the annual or monthly total.

The graph below illustrates the minimum, maximum and average degree days for each month for the last 30 years, together with the monthly degree days for 2011.



Source: Met Eireann & SEAI

Figure 5: Heating Degree Day Trends

There is little climatic variation across Ireland. Most of the country is classified as falling into hardiness zone 9[7], with only some inland areas included in zone 10. Critical for the consideration of any energy efficiency measures, this data suggests that retrofit measures to improve the heating performance of Ireland's residential building stock could have a major impact upon energy consumption. However, given the geographical area of the nation and lack of significant climatic variation across this area there is no need to identify discrete bands of climatic zones that might require differing interventions.

Energy Usage in Irish Homes

The average Irish home consumes some 20,000kwh of energy per year. This energy is used for heating, hot water, cooking, cleaning, washing, drying, lighting, cooling and entertainment. Typically around one quarter of total energy usage is attributable to electricity demand, with the remainder being used for heating purposes. This represents an average CO2 emission per household of 6.4 tonnes per annum with 3.9 tonnes (61%) from direct fuel use and the remaining 2.5 tonnes arising indirectly from electricity use. Modelling undertaken by SEAI predicts that current efficiency measures will lead to a decrease in overall residential energy demand of 16% by 2020.

[7] Temperature scale of hardiness zones, showing the average annual minimum temperature in degrees Celsius. The main factors determining average minimum temperature are elevation, latitude and proximity to the coast.

In total, Irish households spent an estimated €3 billion on energy in 2011. Although this represents a large nominal increase when compared to 1990 levels, in real terms the increase has not been significant and falling demand has meant that the average spend per household differed little over this period. Indeed, average spend per household actually fell by 2.3% between 2006 and 2011, even though the weighted average fuel price increase in that period was 37%.

Economic research to date has tended to suggest that demand for energy among households is relatively price inelastic, that is to say, most households have few opportunities to reduce their energy demand in the short term when the price increases. The fall in average energy spend per household experienced in Ireland over 2006-20011, coupled with the rises in energy prices in that same period, shows that, in fact, the increasing price of energy is having a significant impact upon customer behaviour, suggesting that price elasticity of demand for energy may be increasing. As such, continued increases in energy prices may see more people actively searching for new methods to reduce their consumption. This may be reflected in purchasing decisions when it comes to new appliances, with people more cognisant of energy efficiency labelling but it may also lead to renewed interest in renovation measures. This underlines the importance of having in place the appropriate policies and measures that can allow people to undertake efficiency measures in response to any potential increases in the cost of energy.

Barriers to the Adoption of Efficiency Measures

Energy efficiency measures have been consistently promoted as the most cost effective measure to lower emissions, reduce energy costs and increase the comfort of householders. Given the broad consensus on this matter, it could be questioned why a Government strategy is necessary if energy efficiency upgrades are quite so self-evidently beneficial to householders and society at large.

In fact, there is a significant body of research, both domestic and international that highlights the barriers that hinder the adoption of energy efficiency measures. The most recent work undertaken in Ireland is a study on the barriers to the uptake of a national retrofit scheme that was completed by SEAI in 2013. This study[8] built on work previously undertaken by the Energy Trust in the UK and other international research.

The study identified a number of barriers that face householders in their consideration of energy efficiency matters. These barriers are discussed in greater detail below.

Informational/Motivational Barriers

Some of the most important barriers faced by householders considering energy efficiency upgrades to their home are informational in nature. While most consumers in Ireland have a good general awareness of energy efficiency as a concept, many lack the detailed knowledge necessary to evaluate individual options and make the choices that are most appropriate for their specific circumstances and finances.

This multi-faceted informational barrier needs to be addressed and overcome first. Having adequate financing mechanisms in place and a well-trained, competitive industry will not matter if consumers are insufficiently knowledgeable on the benefits of undertaking energy efficiency works.

Focus group research conducted by SEAI suggests that as many as 80% of householders are aware of the benefits of energy efficiency measures but few have detailed knowledge, particularly of the deeper measures available. Many householders found it difficult to differentiate efficiency upgrades from general home improvement, while many more overestimated the potential time and cost involved.

These results also indicate that consumers often do not make the connection between energy efficiency upgrades and things that are important to them such as comfort and the level of their monthly energy bills. Instead consumers tend to view their energy bills as a service, akin to other services such as phone/TV & internet, rather than as a cost that is intrinsic to the characteristics of their home or lifestyle.

To overcome this, the SEAI research suggests that householders would like to see advice that is based on like-for-like analysis of the experience of similar households (for instance comparing the percentage change in electricity usage with that achieved by households of similar size). Providing

[8] http://www.seai.ie/Better_Energy_Financing/Project_Documents/Better_Energy_Financing_Report_on_Barriers_to_the_uptake_of_a_national_retrofit_scheme.pdf

clear, easy to understand and comparable, locally based information will thus be critical to efforts to renovate Ireland's residential housing stock. Research also suggests that the incentives to upgrade energy efficiency should ideally be targeted at moments of transition, i.e. when a householder is already undertaking home improvement works.

Economic Barriers

Once the informational challenges have been addressed, the question of financing for energy efficiency measures becomes critical. In the wake of the financial crisis and the subsequent economic downturn, many Irish households have a high level of savings as a proportion of income but also a high level of net indebtedness, primarily driven by falls in the level of property prices. The latest Central Bank Quarterly Bulletin (April 2014)[9] puts the rate of debt to disposable income in Ireland at about 196%. This is considerably higher than other European nations and suggests that there is limited scope, at least in the short term, for householders to take on additional debt to finance retrofit measures.

In addition, unsurprisingly in the wake of such a severe financial crisis, many householders have a lack of confidence in the banking sector in Ireland. Surveys undertaken by SEAI found that only 15% of participants in upgrade schemes fund their investments through borrowings, with the vast majority funding works through savings.

While using savings to finance efficiency works may be suitable for some shallow interventions, the sums required for deep retrofitting will typically require at least some level of debt financing by households. To give a tangible illustration of the scale of the challenge, work undertaken by SEAI suggests that an average investment of €21k would be required to bring every home in Ireland up to a BER standard of B3, implying a total investment requirement of nearly €35 billion in the domestic sector.

However, retrofit measures are often not the highest priority even for those households who have managed to build their savings. The Economic and Social Research Institute's (ESRI) savings index of October 2012, recorded that 54% of consumers surveyed would use any surplus cash to pay down debt, including their mortgage.

At a more fundamental level, studies have demonstrated that, even when assured they are buying a longer-life product (i.e. through appropriate labelling and information), consumers tend to stick to lower efficiency products, because of the low initial costs.

On the basis of this research, there is a major challenge to change minds and incentivise householders to invest in efficiency improvements. Unless financing options are available that can sufficiently incentivise people to make the right decisions, the required improvements in energy efficiency will not be delivered by simply relying on the market and people's own judgement.

Of course, while homeowners make up the bulk of households in Ireland (nearly 70%), some 474,788 households live in rented accommodation. There are very different incentives for homeowners as

[9] http://www.centralbank.ie/publications/Documents/Quarterly%20Bulletin%20QB%202.pdf

opposed to renters and even the composition of the various pools of ownership has important consequences for the design of any efficiency programme. For example, 75.3% of apartments in Ireland are rented out rather than owner occupied, while scarcely more than 10% of detached houses are rented out.

For landlords, improvements in energy efficiency only make economic sense if the upgrade works undertaken are reflected in a higher rental income received or an increase in the resale value of the property. If there is significant uncertainty among even homeowners on the benefits of energy efficiency upgrades, we can assume that many more landlords will be sceptical about the merits of efficiency upgrades. Research currently underway will contribute to changing this mind-set. For example, a recent ESRI working paper has demonstrated a clear link between the BER attached to a property and that property's resale value[10].

Similarly, although there is no available data on the average length of a typical tenancy in Ireland, it can be assumed that the vast majority of tenants will be unlikely to invest in improvements to a property if they may soon leave that property.

One potential solution to this problem is to consider attaching the cost of energy efficiency upgrades to the property itself rather than on any individual (using the electricity meter for example). However this would certainly complicate the sale or re-letting of a property and thus may be negatively perceived.

Competition/Trust Barriers

Consumer confidence in the range of energy efficiency measures on offer will be critical to any take-up of the financing options developed to support the widespread rollout of energy efficiency upgrades. As previously highlighted, research suggests that householders regularly underestimate the benefits of renovation works, while systematically overestimating the time, cost and effort involved. Part of the challenge in overcoming this barrier is to ensure that consumers have the appropriate information at their disposal, coupled with confidence that the industry can adequately deliver the works as specified.

To build and maintain this confidence among consumers, the industry must be capable of offering a range of measures that both offers choice and engenders confidence that option chosen will deliver the promised benefits. To achieve this, there will have to be a sufficient supply of accredited contractors, delivering measures that meet specified minimum quality levels.

Accreditation need not be onerous. For example, the registration regime in place for contractors who perform works under the Better Energy Homes scheme provides high levels of satisfaction among householders who have availed of the grant scheme, with 90% of participants expressing satisfaction with their contractor. Other innovations, such as the creation of websites that provide

[10] Working Paper No. 478, February 2014 - Changes in Household Fuel Expenditure Associated with Improvements in Building Energy Efficiency - John Curtis and Anne Pentecost
http://www.esri.ie/UserFiles/publications/WP478/WP478.pdf

consumers information on potential contractors as well as allowing them to source quotes from multiple providers, will help to reinforce quality in the marketplace.

However, to support this there needs to be an adequate level of training available to facilitate the creation and development of these skills in the construction industry. Training programmes that cover energy efficiency and installation of energy efficiency products are available from the national training body, Solas, and from various Universities and Institutes of Technology, along with private sector training providers, accredited by a variety of national and international bodies. To register as an installer of energy efficient equipment, and to be eligible to be included as a registered contractor under SEAI Better Energy Schemes, a contractor must be appropriately trained and comply with a code of practice. To date, over 1,800 home energy contractors have been signed up to Better Energy Homes register. This number will need to increase if Ireland is to meet the ambitious retrofit targets necessary to deliver a low carbon residential sector in Ireland.

To assist with this process, the Intelligent Energy Europe funded Build Up Skills Initiative and Qualibuild have developed a training roadmap for the industry in Ireland and are currently developing training to aid the up-skilling of construction trades in energy efficiency practices.

The development of energy efficiency retrofit standards is also critical to ensuring quality retrofit and provides a reference for training bodies, professionals and trades persons. SR 54 "Code of practice for the energy efficient retrofit of dwellings"[11] has been published by the National Standards Authority of Ireland to meet this need.

Other energy efficient system certification schemes for systems and installers also exist. These include those offered by the Irish Agreement Board[12] which provide alternative means of quality assurance for energy efficiency retrofit works.

In addition, community or locally based organisations will be vitally important to building confidence among consumers. The development and support of such organisations will be a key priority for Government and it is recognised that any future large scale programmes to encourage energy efficiency works must work with these organisations that are already trusted by consumers. SEAI has begun this process by working closely with many community bodies through the delivery of the Better Energy Communities Scheme and this cooperation will be expanded and deepened.

Externalities

Although the vast majority of homes in Ireland could benefit from an energy efficiency upgrade and many of these measures would also be a net benefit to the householder, the problem of externalities occur as some of the benefits from upgrading the existing housing stock are diffuse. For example, the improvement of the overall energy efficiency of the housing stock will help the nation meet its binding climate reduction targets. The electrification of heating will help to reduce other forms of air pollution and the promotion of renewable heat could help to develop a domestic

[11] http://www.ili.co.uk/en/S.R.54-2014.pdf

[12] http://www.nsai.ie/agrement.aspx

biomass industry. Some of these benefits will be accrue to individual households through reduced fuel and electricity bills but others will be of benefit to society as a whole. These wider benefits underline the case for Government supported and financed programmes to underpin the transformation of Ireland's building stock.

Technical and Economic Renovation Options for the Residential Sector

To provide an evidence-based economic model to underpin the rationale for investment in energy efficiency measures, new primary research to develop Marginal Abatement Cost Curves (MACC) for the residential sector has been commissioned. These cost curves will identify potential measures that could reduce the energy usage in homes and then attach likely costs and benefits to each of these measures. The results of these calculations do not necessarily provide prescriptive policies, rather the results of this work can be used to identify and examine the case for prioritising those measures that offer the highest benefits for the lowest costs.

The cost of a retrofit measure is the annualised investment cost used to fund the undertaking of that measure with an appropriate discount rate applied, while the benefits include the energy savings associated with the measure. It can often be difficult to accurately quantify the energy savings that may accrue as a result of domestic efficiency improvements, as typically householders take some of the benefits through energy bill savings and some of the benefits through increased comfort levels. In a survey undertaken by SEAI in 2010, it was found that more than 60% of respondents cited comfort gains as the primary motivator of their investment in energy efficiency measures. The anticipated savings on future energy bills were a secondary consideration.

The research work on identifying and quantifying potential residential measures is still underway and the data contained in this section of the renovation strategy is in preliminary form. When the research project has concluded the final data will be incorporated into the next iteration of the strategy.

Behavioural Measures

The graph below illustrates the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with a range of behavioural measures in the residential sector. Behavioural interventions are changes in consumer practices or habits that could result in energy savings. A simple example might be to reduce the temperature of a central heating system by one degree.

Behavioural measures do not require any investment in renovation works and as a result many of them appear to offer savings relatively cheaply. However, meaningfully changing consumer behaviour is difficult, rebound effects can be difficult to quantify and consumer behaviour has a tendency to be sticky, as after an initial period of enthusiasm, people revert to former behaviours.

The Power of One national energy efficiency campaign represented the Government's first attempt to educate people on the merits of energy efficiency and the results of the campaign were mixed[13].

The measures identified in the graph below are the potential benefits that could be delivered by behavioural measures in the residential sector. The costs of implementing such behavioural measures are still being developed. In the next iteration of this strategy the programmes necessary to implement such behavioural changes and their potential costs will be considered to give a clearer picture of the true lifetime cost of savings associated with the measures proposed.

[13] Diffney, S., Lyons, S., Malaguzzi Valeri, L. Evaluation of the effect of the Power of One campaign on natural gas consumption, Energy Policy, 62, 978–988. http://dx.doi.org/10.1016/j.enpol.2013.07.099

More than half of the technical potential in residential buildings has a negative lifetime cost with a 4% discount rate

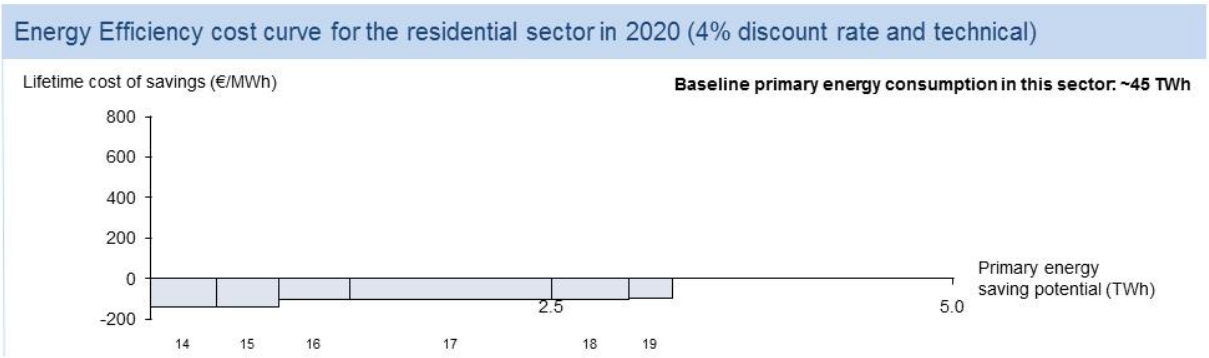


Figure 6: Energy Efficiency Cost Curves for the residential sector in 2020 – Behavioural Measures

Six behavioural measures applicable to the residential sector were analysed and a total potential energy saving of 3.25TWh was identified. The table below details the measures and the anticipated energy savings attributable to each.

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. Air dry instead of tumble dry	0 - 0.41	4. Reduce thermostat from 19C to 18C	1.24 - 2.5
2. Turn off lights when not in use	0.41 - 0.8	5. Delay start of heating from Oct to Nov	2.5 - 2.98
3. Install efficient shower head and use twice a day	0.8 - 1.24	6. Turn off heating in unused rooms	2.98 - 3.25

Table 3: Energy Savings Attributable to Residential Building Measures – Behavioural

Other Interventions

The graph below shows the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with other, more conventional, energy efficiency interventions such as upgrading wall or floor insulations. The benefits and costs associated with the measures identified below have been calculated in line with international best practices and a discount rate of 4% applied.

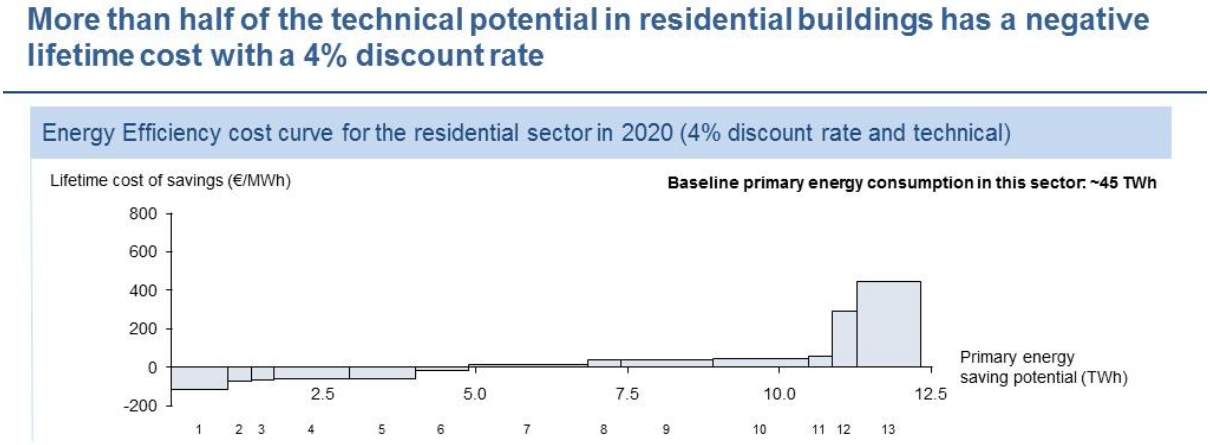


Figure 7: Energy Efficiency Cost Curves for the residential sector in 2020 – Other Interventions

A total of thirteen non-behavioural interventions in the domestic sector were analysed. These measures identified a collective potential energy saving of 12.33 TWh. With a baseline primary energy consumption in the sector approaching 45 TWh, these renovation options represent major energy savings that could be achieved in the domestic sector.

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. Energy efficient appliances - "Cold" and "Electrical cooking"	0 - 0.93	8. Energy efficient appliances - "Wet" and "Consumer electronics"	6.85 - 7.39
2. Draught proofing	0.93 - 1.32	9. External wall insulation	7.39 - 8.91
3. Energy efficient lighting	1.32 - 1.68	10. More efficient boiler replacement (gas, oil)	8.91 - 10.48
4. Roof insulation	1.68 - 2.93	11. Heat pump	10.48 - 10.86
5. Floor insulation	2.93 - 4.01	12. Double glazing	10.86 - 11.28
6. Cavity wall insulation	4.01 - 4.88	13. Solar water heating	11.28 - 12.33
7. Heating control	4.88 - 6.85		

Table 4: Energy Savings Attributable to Residential Building Measures – Other Inventions

Existing Policy Measures

The Irish Government has actively promoted energy efficiency measures since the creation of the first mandatory fuel and energy standards in Building Regulations in 1992. As previously noted, energy usage per home in Ireland has declined considerably over the past number of years. A large proportion of these falls is attributable to the measures highlighted in this section.

Building Energy Ratings

In 2006, regulations were introduced that required every commercial or residential dwelling offered for sale or rent in Ireland to undertake an assessment of the property's energy efficiency from 2009 onwards. These regulations were further updated in 2012 in accordance with the recent Energy Performance of Buildings Directive.

This assessment, known as a Building Energy Rating (BER), is a rating based upon the building fabric and services for typical occupancy patterns (to allow for objective comparison at time of purchase), with the outcome indicated in terms of energy consumption per unit area and ranked on a scale from A-G with A1 being the most efficient.

The results of a BER assessment must be included in any advertisement of the property, with the assessment undertaken by a qualified assessor who must gauge the expected energy use for space and hot water heating, ventilation and lighting based on standard occupancy.

The BER is intended to be an easily understood tool that allows households to see the thermal performance of the dwelling at a glance and compare it with other buildings. It builds on the existing consumer knowledge on energy ratings on appliances.

There are currently 823 registered domestic energy assessors and a further 177 registered non-domestic assessors. To date, these contractors have completed 426,380 domestic BERs and just over 15,404 non-domestic published BERs.

In order to become a BER Assessor, potential assessors must have a National Certificate Level 6 in construction studies or equivalent. After successful completion of a recognised BER course from a listed BER Training Provider, with a minimum 70% pass mark, the potential assessor is eligible to apply for inclusion on the BER register. To be included on this register the assessor must also have the required insurance policies, a valid tax clearance certificate and accept a Code of Practice, along with a number of other criteria.

Based on the results of the BER ratings undertaken to date and analysis of the remaining housing profiles, it is estimated that the current average energy intensity per dwelling is approximately equivalent to a D rating on the Building Energy Rating (BER) scale.

Although the BER scheme has been in operation for a relatively short period of time, as noted in the section on economic barriers to domestic renovation, recently published academic research by ESRI shows that BER ratings are beginning to have an effect on people's purchasing decisions with a higher BER rating having a statistically significant impact upon the sale price of a home. In addition,

the scheme is raising awareness of the importance of energy efficiency matters among householders.

The Government will continue the BER scheme as a mandatory requirement. Compliance with the scheme and the data gathered under it will continue to be monitored and the potential extension of the BER requirements will be considered.

Better Energy Programme

The Better Energy Programme is the umbrella for a number of Government schemes that provide full or partial grants to householders to allow them to upgrade the energy efficiency of their homes. The Government has committed to spending €57 million on the Better Energy Homes Programme during 2014. It is anticipated that this will lead to substantial activity in the domestic construction sector, supporting 3,135 jobs and energy savings at a time of severe budgetary constraint.

Each of the schemes run under the Better Energy Programme is outlined in greater detail below. It is anticipated that the Better Energy Programme will gradually evolve into a Better Energy Financing (BEF) scheme that can promote a higher level of activity with a sustainable level of Exchequer support.

Take-up of the various grant programmes remains good but can often vary, depending on recent climatic conditions – for example, particularly cold winters in Ireland are often followed by increased uptake of retrofit measures the following spring. The Sustainable Energy Authority of Ireland ran an extensive winter advertisement campaign that promoted the availability of grants last year and a further widespread marketing exercise is underway in 2014 to maximise uptake of the schemes.

Better Energy Homes Scheme

The Better Energy Homes scheme provides direct Government grants to homeowners to upgrade their homes with energy efficiency measures. To ensure funds are targeted where they can deliver the most benefits, only homes built before 2006 are eligible to receive grants. Grants are available for ceiling/attic insulation, wall insulation, both internal and external, heating controls, high efficiency boiler upgrades and solar PV installation. Typically a grant under the scheme represents about 40% of the total investment undertaken by the homeowner.

To ensure quality control on the scheme, only contractors who register with SEAI are eligible to undertake the works. This ensures that all contractors meet the required standard and provides an incentive to the construction industry to ensure that their workers are adequately trained in energy efficiency works.

As a further condition of the scheme, any homeowner who receives a grant is required to have a BER assessment of their property undertaken after the works are completed. In 2014, €20m has been allocated to the scheme. It is anticipated that this will lead to an approximately 70 GWh (24 ktCO2) in energy savings, supporting en estimated 928 jobs.

Since the beginning of the scheme a total of over €162.7 million has been paid to homeowners, enabling 155,283 homes to undertake 387,870 energy efficiency measures.

Better Energy Warmer Homes Scheme

To support those low-income earners in energy poverty, the Better Energy Warmer Homes scheme delivers efficiency measures free of charge to consumers who meet certain criteria. €20 million has been allocated to the Better Energy Warmer Homes scheme in 2014 which will support the delivery of energy efficiency measures to approximately 12,000 energy poor homes, resulting in energy savings of 23 GWh, corresponding to monetary savings of €1.5 million (6 kt CO2) and supporting 417 jobs.

Better Energy Warmer Homes is primarily delivered by Community Based Organisations (CBOs), who typically operate back-to-work schemes for the unemployed. In locations where no CBO is active, the SEAI ensures measures are delivered by private contractors, who augment the CBO's in the delivery of measures to eligible householders. The scheme is also delivered through a separate area based strand. Measures available under the scheme include draught proofing, attic insulation, lagging jackets for hot water tanks, low energy light bulbs and cavity wall insulation and are delivered free of charge to the customer.

Following a review of the delivery model for Warmer Homes a new, more streamlined and efficient delivery model, will be introduced in 2015 to provide for the delivery of deeper efficiency measures to more homes.

The scheme has upgraded more than 105,000 energy poor homes since its commencement in 2000, with an overall spend of €116.39 million.

Better Energy Communities Scheme

To better support the delivery of energy efficiency measures to clusters of those in energy poverty, an area based approach to the delivery of the warmer homes scheme was introduced in 2012. This scheme targeted homes in a certain distinct geographic areas at risk of energy poverty. This was complemented by a pilot programme that allowed community and local based organisations to apply for funding to upgrade buildings in the community.

Both of these new schemes have now been amalgamated and €13.5 million in Exchequer funding has been allocated to the scheme in 2014. A call for applications was announced in February, the on-line applications facility was launched in mid-March and the closing date for applications of 30 April 2014. It is anticipated that the unified scheme will generate anticipated energy savings of 100 GWh (24.7 ktCO2), supporting 1,018 jobs.

Tax Rebate on Home Improvement Works

Budget 2014 introduced an additional incentive to householders who wish to upgrade the energy efficiency of their homes. Any home improvement works with a total value of over €5,000 are eligible to receive tax credits equal to the amount of Value-Added-Tax (13.5%) that would have been charged on the works, up to a maximum of €30,000. This tax break will run until the end of 2015.

Since it was only announced in October 2013, it is too early to evaluate how many additional energy efficiency upgrades it will result in, but it is certain to encourage householders to undertake improvements works.

Higher standards of energy efficiency in social housing

Local Authorities are responsible for the maintenance and upgrade of approximately 125,000 social housing units. These homes make up approximately 6.6% of the total residential building stock. In accordance with the Energy Efficiency Directive and the Recast Energy Performance of Buildings Directive, public bodies such as Local Authorities are required to take an exemplar role in the retrofit of social housing.

Under the Social Housing Investment Programme, local authorities are allocated capital funding each year in respect of a range of measures to improve the standard and overall quality of their social housing stock. The programme includes retrofitting measures aimed at improving the energy efficiency of older apartments and houses by reducing heat loss through the fabric of the building and the installation of high-efficiency condensing boilers. The energy efficiency target to be achieved by these dwellings in the period from 2009 to 2012 is C1 on the BER certificate for the dwelling.

Demonstration social housing schemes have been funded to achieve advanced energy efficiency standards with energy ratings beyond that of the Building Regulations. An example of such a scheme is the Tralee Town Council–Towards Carbon Neutral project, phase one of which was completed in 2009[14].

From 2009 to 2012, a total of 7,762 social housing units were upgraded to a BER of C1. In 2013, the retrofits available broadened to target cavity wall insulation and attic insulation in occupied social housing with a further 10,100 occupied social houses upgraded.

In 2014, the budget available for the retrofit of social housing will increase from approximately €10 million to €25 million and the expected savings will increase proportionally. There will also be a further €15 million available for deep retrofit on another 1,500 dwellings and €5 million will be available to local authorities to leverage finance from other sources. The Government expects to make similar level of investment in retrofitting of social housing through to 2020.

Housing aid for older people

The Department of Environment, Community and Local Government administers the Housing Aid for Older People scheme which provides grants of up to €10,500 to assist older people living in poor housing conditions to have necessary repairs or improvements carried out. Grant eligible works include structural repairs or improvements, re-wiring, repairs to, or replacement of, windows and doors, provision of water supply and sanitary facilities, provision of heating, cleaning and painting.

[14] http://www.nba.ie/en/inside_projectDetails.asp?pageId=4&sectionId=4&level=2&typeId=157&parentTypeId=67&projectId=96

Since 2010, more than 21,000 homes have benefitted from these works. It is planned to continue this programme and an estimated 3,000 homes will receive upgrades in 2014.

Demonstration Projects

To address the information barriers associated with energy efficiency improvements, SEAI has a number of schemes that attempt to provide tangible examples to householders of the benefits of energy efficiency. For example, the House of Tomorrow programme was aimed at generating a portfolio of visible examples of superior housing practice.

Homes constructed with the support of the programme were required to demonstrate at least a 40% improvement on prevailing Building Regulations and so provide evidence in favour of more sustainable energy specifications and practices. Accompanying research, development, training and networking activities are also supported through the programme to address systemic gaps in awareness, supporting skills and tools for sustainable energy practice within the industry, and in providing the evidence base to inform public policy.

This year, SEAI is inviting proposals from business, academic and public sector organisations located in Ireland for carrying out further sustainable energy research, development and demonstration projects. This programme will promote research into technologies and options best suited to Ireland's own resources and needs. Projects will be evaluated on a 'first come, first served' basis and are required to be completed by 31st October 2014. Ultimately, the role of such demonstration projects is to act as a catalyst for a virtuous cycle of change in the industry and a continuing drive for innovation.

Information & Awareness Campaigns

The Power of One campaign was a national energy efficiency campaign that was launched by the Government national energy efficiency promotion and behavioural change programme. The core objective of the Power of One programme is to effect real behavioural change among consumers with respect to the energy they use in their daily lives, particularly in their homes and as they drive. The primary message to consumers is that they should "Buy Efficient" and "Use Efficiently".

At its peak, the campaign comprised a broad communications mix including traditional advertising across a very broad range of media including TV, radio, online, PR, outdoor and press. The focus of the campaign shifted in 2009 away from mass awareness and PR activities to more localised and peer influencing activities, though some communication through national media is still considered appropriate.

New Policy Measures

Despite the progress made by the existing policy measures, it is clear that additional measures are necessary to boost renovation rate of Ireland's existing building stock. Highlighted below are a number of new policy measures that the Government is considering to achieve this.

Boost Awareness

Experience to date in Ireland re-enforced by international research, shows that measures that can usefully illustrate the benefits of energy efficiency measures to householders are critical and need to play a major role in any expansion of Ireland's retrofit rate.

The pattern of consumer knowledge on energy efficiency matters in Ireland shows that there is good overall awareness of the broader benefits of efficiency but considerable uncertainty surrounding the cost and savings associated with individual measures. This suggests that further national campaigns promoting the general benefits of efficiency measures are likely to be of limited efficacy.

Hence, at a national level the Government will continue to rely upon simple, easily understood and consistent measures, such as the Building Energy Rating. While this scheme has some limitations, in that a BER is an indicator of a dwelling's thermal performance as opposed to an indicator of actual energy use (which can vary with occupancy), its benefits outweigh any drawbacks. Consumer awareness of the measure is high and research shows that it has already filtered into the consumer's decision making process and has resulted in real and measureable price effects for efficiency measures. With the publication of the House Price Register, which records and publishes the site value of every home, it may be expected that these effects will continue to be reinforced. Nevertheless, the scheme will continue to be refined as further data on its effectiveness is gathered. In particular, the Government Departments and relevant Agencies will continue to evolve the advisory report that accompanies a BER to make it more relevant to householders.

To complement the BER scheme, further new methodologies need to be developed to overcome the lack of specific knowledge among many consumers on energy efficiency measures. Data emerging from the analysis undertaken to support this strategy shows that many residential improvements will be a net benefit to consumers, therefore there is a strong rationale for informational campaigns that can nudge consumers into making the decision to proceed with efficiency works. These campaigns need to be locally based and tangibly illustrate, using real world examples, the benefits of efficiency measures to consumers.

The Department will pilot a number of informational schemes to develop an effective methodology that can provide quality information that is better targeted at consumers. The ultimate aim of such schemes will be to build the confidence of consumers, specifically the confidence that any efficiency measures they are considering will be beneficial – they will save money on energy bills, they will live in greater comfort and they will boost the value of their home.

Mobilise Private Investment through Better Energy Finance (BEF)

As previously noted, there are many retrofit measures that if delivered, would benefit the economy as a whole, as well as being of benefit to householders. However, the scale of retrofit measures that needs to be delivered to achieve a near zero emissions target for the residential sector dwarfs the ability of the Government to fund them through direct grants to householders. SEAI research estimates that a sum of €21k per home would be required to lift the average BER rating from a D to a B3 in Ireland, implying a total investment requirement of over €35 billion. It is clear that alternative delivery mechanisms need to be developed, mechanisms that can mobilise private sector investment in retrofit.

The Government has already established the process through which these mechanisms will be developed. This process is known as Better Energy Financing (BEF). Working with stakeholders, BEF will examine a number of methodologies that raise the required private sector financing while supporting consumer's preferences. As the BEF project is developed, the experience of other European nations will be studied and used to inform the ultimate design of BEF.

In the lifetime of this strategy (3 years) the Government will pilot a number of methodologies under the BEF framework to determine what the most appropriate structures are for the Irish market, given our specific circumstances. Given its critical importance and risks associated with what would be a radical departure from the current framework, any wide-scale launch of BEF initiatives will be thoroughly planned in concert with industry and community stakeholders prior to its commencement.

Energy Efficiency Obligations for Energy Suppliers

For the first time in 2014, every energy supplier in Ireland above a defined threshold is required to deliver mandatory energy savings across the residential, energy poor and non-residential sectors. An annual target of 550GWh, of which at least 20% must be delivered in the residential sector, with another 5% being delivered to energy poor customers has been set until at least 2020. Failure by any supplier to comply with the mandatory targets will result in penalties.

The obligation scheme will encourage every energy supplier to become an energy services company that works collaboratively with its customers to identify potential savings and to share the benefits that these savings could deliver. A variety of similar schemes and approaches are operating in the US, EU, Australia, China, Canada.

Reducing energy demand through energy efficiency obligations will of benefit to everyone in society. Lowered energy demand means less emissions, less transmission and distribution losses and less need for expensive reserve margins in generation. This lower demand reduces wholesale prices for all consumers, not just those who cut their demand.

The operation of the new obligation scheme is a cornerstone of Ireland's ambitious energy efficiency targets and central to the delivery of an increased rate of renovation in both the domestic and non-domestic markets. As the scheme develops, it is anticipated that it will benefit from economies of scale as it creates and matures the market for retrofit measures, thus lowering the average cost of

each installation of measures. As consumers in turn become more comfortable with the concept of renovation works and dealing with their energy suppliers on such matters we anticipate that the market for renovation works will be transformed.

Mandatory Minimum Thermal Efficiency Standards for Rented Properties

While it is clear that there are benefits for homeowners in retrofitting their homes the situation is not so clear cut for landlords. Split incentives and the average length of tenure of a tenant mitigate against the widespread improvement of the rented stock.

Already, it is mandatory for all rental properties to have a Building Energy Rating that must be displayed on any advertisement of a property offered for rent. However, in the current period of constrained supply of rental properties, particularly in urban areas, it is unlikely that the BER rating alone will be sufficient to drive the necessary behavioural changes among landlords and tenants to lead to major efficiency improvements. In time this may change as a greater supply of rental properties promotes more competition among landlords that, combined with a growing awareness of the benefits of efficiency, leads to improvements in the building stock offered for rent.

In the meantime, and to further incentivise and drive up the renovation rate in the rented sector, the Government will examine the feasibility of imposing mandatory minimum thermal efficiency standards for all rented properties.

Already some Local Authorities have implemented such procedures. Where they possess a property that fails to meet the minimum level of thermal efficiency they have specified (typically F or below), their procedures now state that the property must be improved before it can be rented to a tenant. As Local Authorities are the largest landlords in the State, these procedures are gradually improving the quality of Ireland's rented accommodation, as leases come to end of their life.

By making such standards mandatory in the private sector, it would boost the renovation rate of rented properties and eliminate a potential disparity of treatment where the local authority housing stock, reserved for those in financial need, is of a higher efficiency standard than the accommodation available in the private rented sector.

To minimise any potential disruption to the rental market, any mandatory minimum thermal efficiency standards for the sector would be phased in gradually. As with the local authority sector, the proposed regulations would start by restricting those properties with the lowest efficiency standards before gradually becoming more ambitious. This provides the necessary regulatory certainty that will enable landlords to plan for the future and provides the incentives to enable the construction industry to up-skill to meet the new demand.

Upgrading the energy efficiency of the pool of rented accommodation in Ireland will contribute to better outcomes for society as a whole and in the process overcome the barriers that hinder the widespread adoption of energy efficiency in the rented sector. To speed the process and to provide an incentive to complement the mandatory regulatory changes, the Government will investigate the

scope for increasing the level of grant payments available to landlords who upgrade the energy efficiency of their property through the Better Energy Scheme.

Consequential Improvement Requirements

One potential method of promoting the take-up of energy efficiency measures among households is to examine the feasibility of making it a requirement of the planning process that any substantive improvement works to a dwelling must also incorporate a minimum level of energy efficient improvements elsewhere in the dwelling.

There are a number of potential methodologies that could be considered. For example, if a homeowner were to apply for planning permission to construct an extension to their home, the proposed new planning regulations would make it a condition of the planning consent granted that the dwelling must meet a certain minimum energy efficiency standard. An alternative method would to require a specific figure of the total cost of the works to be devoted to efficiency improvements.

As highlighted in the section on barriers, research indicates that efficiency improvements are best delivered at the natural points of transition, i.e. when a homeowner is already considering undertaking improvements works. This proposal would ensure that these moments of transition are properly utilised.

Many countries already have regulations that make such consequential improvements mandatory on industrial/commercial buildings and some have considered their extension to domestic dwellings. Others, most notably the UK, have retreated from such measures due to a combination of factors. If such a proposal were to be considered in Ireland, it would have to be clear that it is of benefit to householders. For example, the requirements could be contingent upon the applicability of a "Golden Rule" type clause, where the additional efficiency requirements are contingent upon the measures being of net benefit to householders.

Smart Metering Rollout

Under the National Smart Metering Programme, the Government has committed to commencing the rollout of smart meters nationwide in 2015/16. This rollout will have multiple benefits that could potentially increase the demand for retrofit measures. If done right, the rollout of smart meters could address many of the informational barriers that arise and hinder consumers from undertaking energy efficiency measures.

Regardless of the final design, all new meters will allow energy users to monitor their consumption in real time, thus giving consumers greater control over their energy usage and boosting their awareness of their day to day energy consumption. It is also anticipated that the smart meter rollout will be accompanied by time-of-use tariffs which will offer lower electricity pricing during off-peak hours in order to incentivise consumers to switch usage from high-demand periods.

Trials undertaken to underpin the smart meter rollout clearly illustrate that these informational measures can have a meaningful impact upon customer behaviour and lead to declines in electricity usage. However, there are potentially more actions that could be considered by a rollout to also highlight to consumers the benefits of undertaking retrofit measures.

For example, tariff options readily available to customers through the in-home display of a smart meter could illustrate to customers at a push of a button the effects of adopting a retrofit measure – showing immediately the impact upon a typical bill and expected reductions in future energy use. Similarly, the meters could show consumers the likely impact of a number of standard retrofit packages against their typical energy usage.

The mechanics of the smart meter rollout are still under consideration but in the final scheme that is deployed, the Government will ensure that the rollout is designed to provide clear and easy to understand information that can support the delivery of increased retrofit activity.

Carbon Tax

In 2010, the Government first introduced a tax that applied to the supply of solid fuel and gas. The rate of tax, with effect from 1 May 2013, is based on a charge of €10 per tonne of CO2 emitted by the fuel concerned. This rate will increase to €20 per tonne with effect from 1 May 2014. Ensuring that the externalities associated with carbon emissions are adequately captured in the price of fuels is at the heart of Government policy to incentivise householders to conserve and reduce their energy consumption and to encourage the transition from fossil fuel heating systems to low carbon and renewable solutions. To ensure that this remains the case, it is anticipated that the carbon tax will be steadily increased as time progresses.

Mature and Develop the Market for Retrofit Measures

Ongoing research on the take-up of energy efficiency measures has found that consumer confidence in the ability of the industry and individual tradesmen to deliver efficiency measures will be critical to boosting the take-up of efficiency measures. To build and maintain that confidence among consumers, Government will continue to focus on the continued development and maturation of the market for retrofit measures. Individual measures to support this goal will be evaluated in conjunction with industry through the BEF programme.

These measures could take a number of forms. For example, the development of representative organisations in the industry will be encouraged. The growth of such organisations makes it easier for consumers to find tradesmen that can deliver efficiency measures and assures customers that the measures undertaken will be of a high quality. Ultimately an accreditation or quality mark scheme for measures or packages of measures could be developed, in conjunction with an industry-wide insurance programme.

Accreditation schemes for installers will also ensure quality of workmanship. It is important that schemes for systems and installers are underpinned by relevant National and EN standards and specifications such as SR 54 to ensure adequate performance levels and consistency of application.

SEAI already performs inspections and quality checks on efficiency measures delivered under the Better Energy Programme and this regime has proven very popular among consumers and contractors. Works subject to Building Regulations (material alterations, change of use, replacement

of services) are also subject to the requirements of Part D of the Building Regulations which requires that all works shall be carried out with proper materials and in a workmanlike manner[15].

A "Green Star" award will shortly be introduced and granted to contractors who perform to a consistently high standard. The granting of this award will be monitored and enforced by SEAI. In contrast to the accreditation regimes which enforce a minimum level of quality standards, the "Green Star" award will encourage the development of best practices in the industry and re-enforce consumer confidence.

In addition, any collaborative ventures that can encourage the development of best practice industry standards will be supported. An example of one such initiative is the LEaPH programme. LEaPH is a collaborative branding initiative that aims to unify best the practices in skills, products and building systems under a common banner. EI will market this Next Generation building capability internationally, particularly in Europe. This will make easier the transition to Low Energy/ Passive standard buildings not just here at home, but allow our companies that currently export skills, products and building systems to the EU make a greater impact.

The Government will also continue to work with the appropriate agencies to ensure that there is an adequate supply of accredited training courses that can train the workforce and develop a consistent level of skills across the sector.

Finally, to ensure that there is sufficient motivation in the industry to adequately up-skill their workforce to cope with any new demands, Government will ensure that any pending regulatory changes are steady and predictable and are done in consultation with stakeholders.

Nearly Zero Energy Buildings

In accordance with the Energy Performance of Buildings Directive (recast) the measures listed above will stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings[16]. Building Regulations require that all dwellings undergoing major renovation will achieve cost optimal performance levels.

Demonstration programmes through SEAI and Social housing will increase the number of buildings refurbished to Nearly Zero Energy performance levels. This performance standard has been set at 125 kWh/m2/yr to 150 kWh/m2/yr for a typical dwelling with the potential to be below 125 kWh/m2/yr with greater use of renewables.

The development of standards and accreditation systems for retrofit materials and installers will also increase the capacity of the market to deliver Nearly Zero Energy Buildings.

[15] http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownLoad,33647,en.pdf

[16] http://ec.europa.eu/energy/efficiency/buildings/implementation_en.htm

Conclusion

Energy efficiency in the residential sector is at the forefront of Government ambitions to deliver a near-zero emissions building sector by 2050. The underpinning rationale is clear, retrofit measures allow people to live in greater comfort, while reducing their energy bills, all the while supporting domestic jobs and industry.

Already, many measures have been introduced to help households to lower their energy needs along with their bills and these measures are having a significant impact. Per capita household energy usage and emissions are declining, consumers are gradually becoming more aware of energy efficiency issues and nearly one sixth of homes have already received some form of Government supported efficiency upgrade.

However, it is clear that there are still many more measures that can be taken to boost the renovation rate to the level required to achieve our ambitious 2050 targets. These new measures will necessitate significant changes in the built environment. Some of them, such as the energy efficiency obligations, are already being rolled out, others remain in development. The centrepiece of Government reform in the sector in the next three years will be the development of an appropriate Better Energy Financing Mechanism.

This mechanism will be complemented by new programmes and schemes designed to counteract the barriers to adoption identified in this strategy and to deliver a gradual increase in the level of retrofit activity, allowing industry to develop the skills that are slowly being built up.

In common with many other European nations, Ireland has a population that is gradually aging. While today, some 11% of the population of over 65, it is projected that this will steadily increase and perhaps reach as high as 25% by 2050. The cost of energy will thus be an issue of increasing importance and if these future pensioners are to have an improved quality of life, the national housing stock needs to deliver homes that can support greater comfort levels for a reduced ongoing expenditure on energy. The path to delivering this future starts here.

Public Sector

Introduction

The building stock in the public sector comprises some of most diverse buildings in the country. As well as typical office buildings, the public building stock includes schools, hospitals, army barracks, nursing homes and universities. Many of these buildings are old, some of them are protected structures and most have varying levels of thermal performance and energy demand. Devising measures that can provide for the renovation of such a diverse portfolio is challenging, particularly in the current economic climate with the very limited availability of public funds.

Nevertheless, the business case for renovation in the public sector is clear. It is estimated that the total energy spend across the public sector is approximately €600 million annually. Reducing this bill means more public funds can be redirected from energy bills to the delivery of front line services to citizens.

The Energy Efficiency Directive already requires EU Member States to reduce energy consumption in those buildings under the remit of central government. This strategy goes further, targeting all those buildings in the public sector, rather than just those under the remit of central government.

Already, the Government has already set a 33% target for energy savings in the public sector to be achieved by 2020. It is estimated that achieving this target by 2020 will save the Exchequer more than €200 million a year. This does not include the value of increased productivity, enhanced asset values and better building environments that would also be delivered by renovating the public sector building stock. Some of this can be achieved through no and low-cost actions, such as encouraging behavioural changes. Others will require investment in low carbon technologies and in the renovation of the public sector building stock. This investment will support local employment, reduce energy imports, improve environmental performance and serve to demonstrate the value of efficiency measures and promote other energy saving projects in wider communities.

The energy savings achievable in the public sector through renovation works vary significantly from public body to public body. At present a small number of large organisations dominate consumption and thus present the largest opportunity for energy savings. Commercial State Bodies, Local Authorities and the Health Service accounted for almost 80% of the known Public Sector Energy spend in 2011, with 45 organisations accounting for about 90% of total energy consumption.

Although the energy saving target of 33% by 2020 is a challenging one, in the longer term the ambition is to reduce energy usage and emissions from the public sector as close to zero as is technically and economically feasible. This will require construction standards that ensure new hospitals, schools and offices utilise the very best in renewable and low carbon technologies but also technologies that can be wedded to the existing stock of public sector buildings.

Finally, it is worth noting the demonstrative role that can be played by the public sector. Many of the barriers to large scale renovation works in the commercial and industrial sectors are around the uncertainty of the benefits of such works. By undertaking renovation measures the public sector can act as tangible, credible evidence of the benefits of energy efficiency.

Overview of Public Sector Buildings

There are more than 10,000 buildings in the public sector. Around half of these buildings are in the education sector, with the vast majority being primary schools. The remainder of the public building stock is comprised of approximately 3,000 offices and a further 2,000 health care facilities.

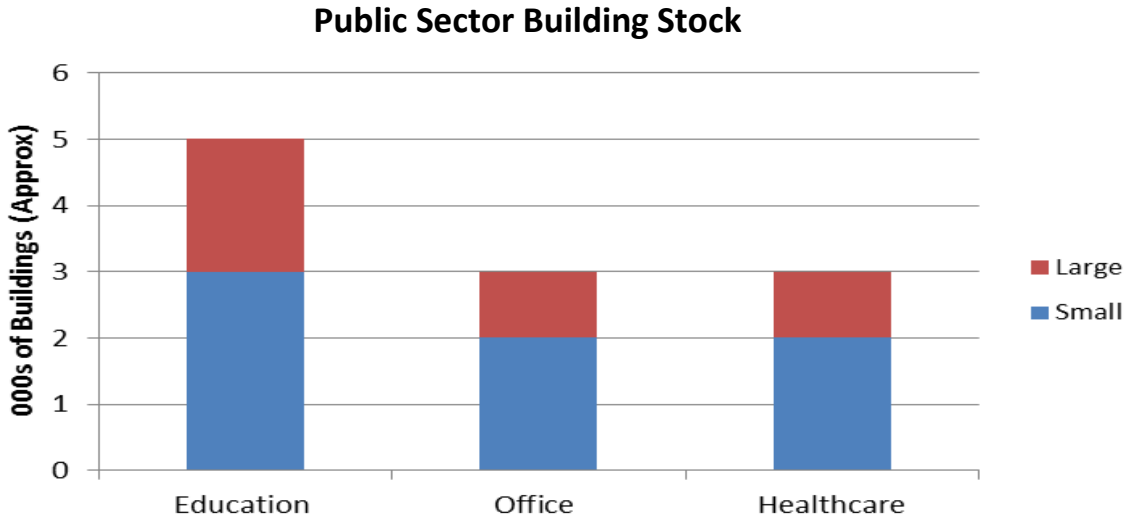


Figure 8: Inventory of Irish Public Building Stock

The Office of Public Works (OPW), responsible for the management of the state's property portfolio, has completed an assessment of those buildings under the management of central government. The results of this were notified to the EU Commission in December 2013. However, the majority of buildings in the public sector are not within the remit of central government. There is no comprehensive assessment of the efficiency of those public buildings outside central government.

To bridge this data gap, all public sector organisations are required to track and monitor their own energy usage[17]. Of the identified annual public sector energy bill of €600m, it is estimated that half of this sum is consumed in buildings – of diverse scale, type, age and energy performance.

SEAIs Energy MAP training programme works with public sector organisations to manage and reduce energy usage in the sector. This programme has already delivered an average of 10% savings from low/no cost actions in public sector organisations it has operated in. In addition, the OPW has achieved 12% energy-related CO2 savings in a portfolio of 250 large buildings through its Optimising Power @ Work conservation campaign. This suggests that there is a high potential for energy savings in most public buildings, with savings of 5-15% possible through low or no cost measures and up to 25-35% achievable with investment in renovation measures. Data gathered to date from nearly one hundred of the largest energy consuming organisations in the sector shows that these public bodies were saving almost €40M annually by 2011. Data on the energy performance of the entire public sector for 2012 and 2013 will be published in Q4 2014.

[17] Statutory Instrument 542 of 2009 - http://www.irishstatutebook.ie/2009/en/si/0542.html

Barriers to the Integration of Efficiency Measures in the Public Sector

Economic Barriers

The most serious barriers to undertaking renovation works in the public sector are financial in nature. Since the beginning of the financial crisis and the subsequent domestic economic downturn, public finances at all levels of Government have been extremely constrained, with priority given to maintaining current levels of service provision. Making investments that require upfront capital but deliver benefits over time has understandably been a low priority.

In addition, the nature of public sector accounting often mitigates against undertaking investments with multi-year payback periods. Typically budgets are set on an annual basis and there is limited scope for multi-year accounting. As such, the benefits delivered by renovation works may not be recycled into a public sector organisation's annual budget. This reduces the incentive for these organisations to invest heavily in renovation works.

Finally, it should be recognised that some of the economic barriers faced by other sectors also apply to the public sector. Although most public sector buildings are owned by the state, a small but significant minority are owned by private landlords. Here the split incentives faced by tenants and landlords faced by domestic and commercial renters also come into play in the public sector.

Information Barriers

In common with other sectors, one of the most important barriers standing in the way of the renovation of building buildings is the lack of awareness in these organisations of the benefits of undertaking energy efficiency measures. This is manifested through uncertainty around the benefits of individual measures, the payback periods and the impact of potential indirect benefits, such as improved comfort and productivity.

This barrier is compounded by the scale and diversity of public sector organisations. Although a small number of public sector organisations are responsible for the majority of emissions, there are still many thousands of buildings that will require renovation. Many of these buildings, such as small schools for example, have few staff members and those staff members are fully occupied with the provision of primary services.

As with the domestic sector, many public sector organisations view energy usage as a fixed cost rather than something that can be managed, controlled and reduced. The provision of accurate, timely data on energy usage in each public sector organisation and building will thus be critical to building the business case for efficiency measures in the public sector.

Already, significant progress has been made in this area, through work undertaken by SEAI in partnership with public sector organisations and through regulatory measures which seek to embed energy management as standard practice in the public sector.

Leadership Barriers

While the progress to date in addressing informational barriers has made the benefits of undertaking renovation works apparent to many in the public sector, there appears to be a gap developing in many public sector organisations. This gap manifests where the concept and potential benefits of efficiency measures are embedded at the top of that organisation but not necessarily throughout it. For example, despite each public body being required to track and monitor its energy usage, many public sector organisations still do not have designated energy champions. It matters little if an organisation tracks its energy usage but fails to take any steps to address it.

It is clear that to achieve the ambitious energy efficiency targets set for the public sector, any new measures proposed must engage and motivate workers at all levels, not just those in senior management positions. This is particularly important for behavioural measures which require active participation from all staff.

In addition, there can often be a culture of risk aversion among public sector staff. This is hardly surprising as energy management has not typically been a core competence of many staff in public sector organisations. This is compounded by a public sector hiring freeze, with many organisations re-focusing on the delivery of their core functions. This may lead to a lack of focus on areas that are not perceived as vital to the organisations primary mission. While this is understandable, in the circumstances it is a barrier that needs to be overcome.

The forthcoming public sector action plan on energy efficiency will set out a number of methods to identify and overcome any leadership barriers to energy efficiency that may persist in the public sector.

Energy Efficiency Cost Curves for the Public Sector

As with the residential sector, the Government has commissioned primary research to identify Marginal Abatement Cost Curves (MACC) for energy efficiency measures in the public sector. These cost curves will identify potential measures that could reduce the energy usage in public sector buildings and then attach likely costs and benefits to each of these measures. The results of these calculations do not necessarily provide prescriptive policies, rather they can be used to identify and examine the case for prioritising those measures that offer the highest benefits for the lowest costs.

The cost of a retrofit measure is the annualised investment cost used to fund the undertaking of that measure with an appropriate discount rate applied, while the benefits include the energy savings associated with the measure.

The research work on identifying and quantifying potential residential measures is a work in progress. As a result and the data contained in this section of the renovation strategy is in preliminary form. When the research project has concluded, the final data will be incorporated into the next iteration of the strategy.

Behavioural Measures

In contrast to the residential sector, where behavioural change can only be encouraged, in the public sector behavioural changes can be achieved by setting policies centrally and then mandating their adoption by public sector organisations. Some of these changes can be delivered by system change alone, others will require active participation from staff.

The graph below illustrates the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with a range of behavioural measures in the public sector.

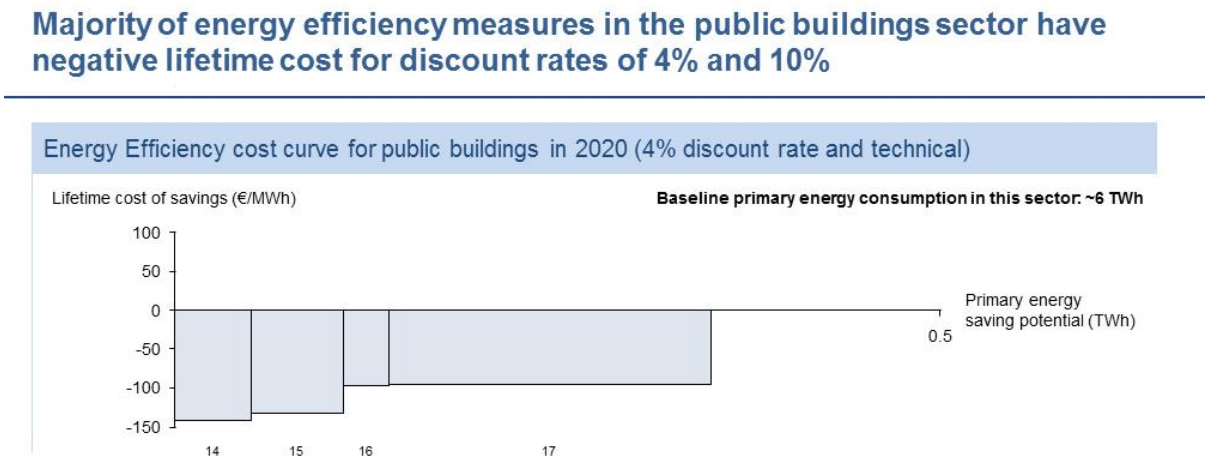


Figure 9: Energy Efficiency cost curve for public buildings in 2020 - Behavioural Measures

The four behavioural measures identified in graph above are:

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. Turn off lights for extra hours	0 - 0.05	3. Reducing hot water use	0.11 - 0.14
2. Enable standby features on all PCs and monitors	0.05 - 0.11	4. Reducing room temperature	0.14 - 0.35

Table 5: Energy Savings Attributable to Public Sector Building Measures – Behavioural Measures

Collectively, the above measures suggest that there is a total potential energy saving of 0.35TWh through behavioural measures alone in the public sector. With an overall energy consumption of approximately 6TWh this suggests that the potential savings in the sector are small, but as previously noted, the OPW has already achieved significant reductions in energy use through its Optimising Power @ Work campaign. Since these measures can be delivered at little cost, the OPW will continue to work with public sector organisations to ensure they derive the maximum possible benefit from behavioural changes.

Non-Behavioural Measures

The graph below shows the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with a range of non-behavioural measures in the public sector.

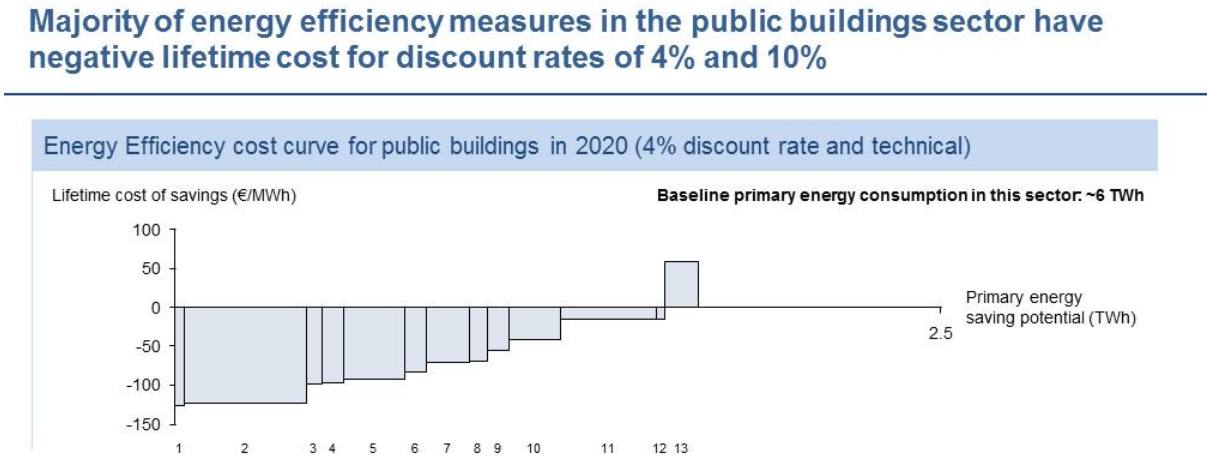


Figure 10: Energy Efficiency cost curve for public buildings in 2020 – Other Interventions

Thirteen potential renovation measures were analysed for the public sector. The potential energy savings attributable to each measure are outlined in the table below:

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. Energy efficient appliances - Refrigeration	0 - 0.03	8. More efficient air conditioning	0.96 - 1.02
2. Energy efficient lighting	0.03 - 0.43	9. External wall insulation	1.02 - 1.09
3. Cavity wall insulation	0.43 - 0.48	10. More efficient boiler replacement (gas, oil)	1.09 - 1.26
4. Draught proofing	0.48 - 0.55	11. Double glazing	1.26 - 1.57
5. Roof insulation	0.55 - 0.75	12. Heat pump	1.57 - 1.6
6. Heating control	0.75 - 0.82	13. Lighting control	1.6 - 1.71
7. Energy efficient appliances - Office equipment	0.82 - 0.96		

Table 6: Energy Savings Attribute Public Sector Building Measures - Other Interventions

The data above suggests that these measures could deliver energy savings of 1.71 TWh in the public sector by 2020. With a total projected in the sector of 6 TWh, the preliminary research suggests that a 33% reduction in energy usage in the public sector by 2020 is a realistic and achievable goal.

Existing Policy Measures

Public Sector Energy Savings Target

The centrepiece of Government policy on energy usage in the public sector is the imposition of a 33% energy savings target for the public sector as a whole. This target was announced in 2008 and aims to be achieved by 2020. On an estimated public sector annual energy bill of €600m, this represents an annual saving of approximately €200 or over €1.4 billion on a net present value basis, not counting the value of increased productivity, enhanced asset values and better building environments. These are funds that rather than being spent on imported fossil fuels, can be re-directed to the delivery of domestic front-line services.

As well as requiring significant behavioural changes among staff and management in the public sector, a target of such magnitude will require the majority of public sector organisations to renovate the buildings they use before 2020.

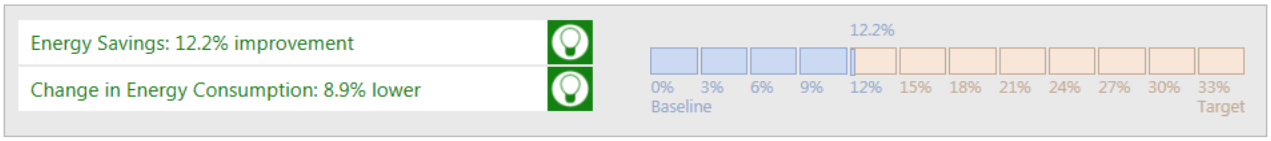
Monitoring and Reporting of Public Sector Energy Performance

The National Energy Efficiency Action Plan (NEEAP) and Statutory Instrument 542 of 2009 require all public bodies to track and report their energy usage annually. These regulations transpose the Energy End Use Efficiency and Energy Services Directive (Directive 2006/32/EC) into Irish law.

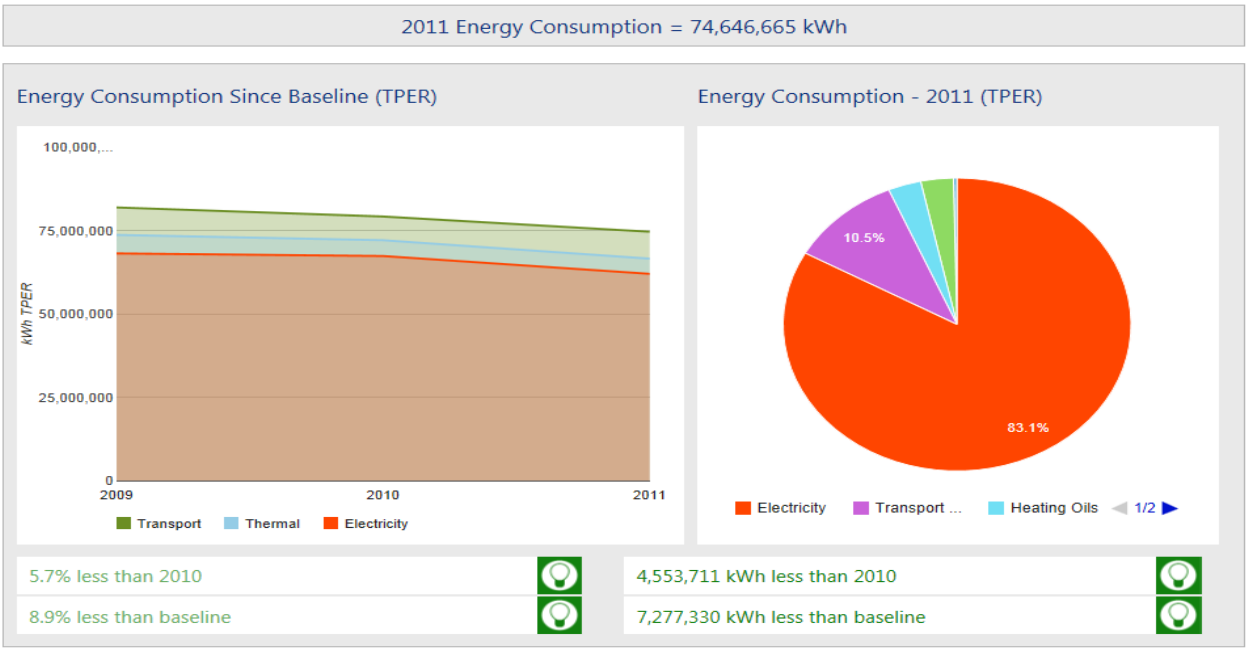
To support public sector bodies in their compliance with these requirements, DCENR and SEAI have developed a monitoring and reporting system that is to be used by all public bodies but is initially targeted at the top 133 energy-using public sector organisations. Each organisation submits its electricity and gas meter numbers, alongside non-network connected energy use such as oil consumption, to SEAI to get online access to its annual electricity and natural gas consumption data. The organisation can then check its progress and performance in achieving its energy savings targets and compare progress to its peers through a unique Scorecard feature.

The graphics below illustrate the kind of data available to public organisations through the reporting and monitoring system:

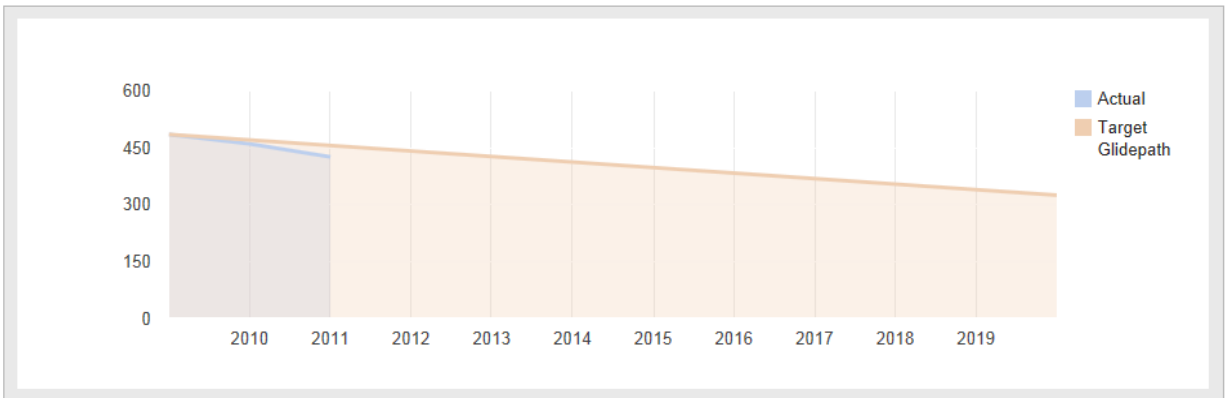
Progress towards 2020 target Energy Performance Indicator (EnPI)



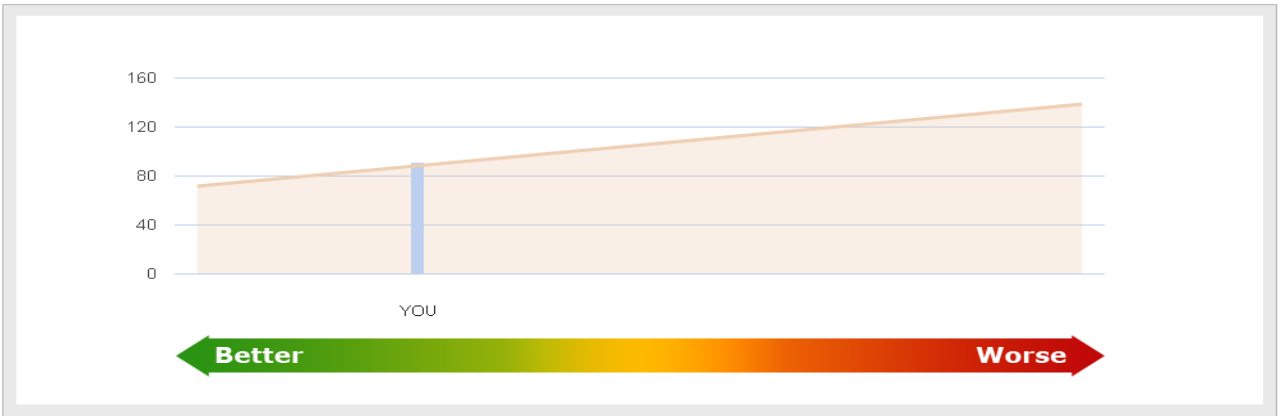
Indicator of historic energy usage breakdown



Glidepath towards 2020 target based on historic activity



Performance relative to organisational peers



This new system, at the leading edge of European and international efforts to reduce Public Sector consumption. It will be gradually built upon to provide public sector organisations with real time measurement of their energy usage.

Green Public Procurement (GPP)

In 2008 the EU Commission's Communication on Public Procurement for a Better Environment proposed a target of 50% of all the EU's public procurement tendering procedures to be "green" by 2010 – "where green means compliant with endorsed common GPP criteria". To implement this, the Department of Environment, Community and Local Government published "Green Tenders - An Action Plan on Green Public Procurement" in 2012.

Up to €14 billion is spent annually on public procurement, representing some 10-12% of Ireland's GDP. This sum consisted of €6 billion for capital works and €9 billion for goods and services. Under the new action plan, public sector contracting authorities need to consider all stages of a procurement procedure and examine where it is most appropriate to insert environmental considerations. Examples of what is possible for public procurers to do at each stage are given in the Action Plan.

The action plan sets out a long term vision for GPP in the construction sector along with a series of actions to achieve this ambition. Of particular importance to this strategy, the action plan requires public sector organisations to prioritise the reuse of existing buildings over new-build construction. In particular it requires public sector organisations to consider Energy Performance Contracting or similar models, along with third party finance to avoid up-front capital costs and any negative cash flow burden on the public body.

SEAI Public Sector Partnerships

As previously noted, there is a significant variety in the type of public sector buildings and a solution that is applicable to one category of building may not be suitable for another. Nevertheless SEAI offers a comprehensive support and engagement programme to public sector organisations. The aim

of this programme is develop best practice management for energy efficiency projects in the public sector and to ensure that these experiences are widely disseminated.

This enables each individual public sector organisation to evaluate a menu of efficiency option and allows them to identify the potential methods that best suit their energy consumption profile, rather than having each organisation work in isolation, “re-inventing the wheel” with each efficiency project.

The programme helps integrate energy management into the general management of public sector organisations and provides central advice and monitoring services to support all public bodies in their efficiency efforts. SEAI guides public sector bodies to develop, execute and maintain energy reduction plans and aims for year on year savings targets of greater than 3%. In return, the public sector organisation makes a formal commitment to engage and drive the programme internally. In addition, SEAI directs public bodies to sources of alternative financing for efficiency projects, and provides advice on procurement.

As part of this programme the SEAI offers a range of services including: - On-site assessments, best practice guidance, training, energy efficient design, dedicated energy advisors, In-depth assessments, monitoring of progress and savings and help with energy reporting.

Many pioneering organisations have proactively and successfully improved their energy performance over recent years by working with SEAI and have made significant progress towards the 2020 target. Examples include:

- The Royal Victoria Eye & Ear Hospital leveraged private sector expertise and finance – with support from SEAI – to install energy efficiency upgrades and a CHP plant to deliver annual savings of €60,000 per annum.
- Dublin Port refurbished the boiler house and retrofitted ventilation controls at its Port Centre - to deliver 13% electricity savings and 27% natural gas savings.
- Kerry County Council – with support from SEAI – retrofitted the Dingle Waste Water Treatment Plant to achieve a 37% saving in electrical energy consumption with no loss in plant performance.
- A County Mayo secondary school saved 18% – or €10,000 per annum – through no/low cost energy management practices alone.

Full details on SEAI's public sector engagement can be found at www.seai.ie/publicsector

New Policy Measures

Public Section Action Plan on Energy Efficiency

Later this year the Government will launch a new action plan on energy efficiency, specifically aimed at the public sector. This plan will detail how the ambitious 33% public sector energy savings target for 2020 will be met. It will set out the progress made to date on the implementation of existing measures and outline the planned new actions that are required to achieve the target. The new action plan will leverage top-level leadership to engage and motivate staff at all levels within central government, public bodies, the supply chain and the general public. As well as encouraging behavioural changes among public sector staff, the action plan will also examine in detail the potential for large scale renovation works in each of the various categories of public sector buildings.

The cross-departmental steering group established to implement the National Energy Efficiency Action Plan will also provide direction for the Plan and to ensure that it is strategically aligned with those of other key stakeholders. The Steering Group will report annually on its progress. Measures under consideration in the action plan include requiring all public bodies to develop and implement energy management programmes appropriate for their organisations. Those public sector organisations with energy spends of more than €5 million annually will be required to publish 3-year energy saving strategies with formal energy saving. In addition, the seventy public bodies that spend more than €½ million annually on energy will be mandated to invite proposals from the market for energy-saving solutions.

Energy Efficiency Fund

The 2013 Government Action Plan for Jobs called for the creation of a mechanism to kickstart activity on non-domestic renovation by overcoming one of the most important barriers standing in the way of this sector – the availability of accessible and appropriately priced finance. To achieve this, the Government has committed €35 million as seed capital for investment in a newly established Energy Efficiency Fund (EEF), with a view to expanding the fund to over €70 million when matched with investment from the private sector. Over its expected lifetime, the Fund has the potential to leverage investment of €300 million in energy saving activity.

The concept of such a Fund to support efficiency measures is analogous to the creation of a green investment bank. The Fund will enhance the level of finance available in the market to support the clear opportunity that exists in both the public and commercial sectors. In addition, by demonstrating the viability of such investments, the fund will help to crowd in finance from other sources into the energy efficiency sector. Sustainable Development Capital LLP (SDCL) has been selected to manage the Fund, which was established on 26 March 2014 and made its first investment on 8 May 2014.

Should the Fund invest all its monies, it is estimated that it will stimulate at least 600 additional jobs and potentially many more depending on the leverage used in individual investments. Furthermore, cumulative energy savings of over 900GWh are anticipated, greatly assisting Ireland to meet our 2020 energy savings target.

Although the Fund is open to any commercial proposal, it is expected that many public sector renovation projects will be among the first to seek finance from the fund, in particular, the public sector exemplar projects trialling the National Energy Services Framework outlined below.

National Energy Services Framework & Exemplar Projects

As identified in this strategy, along with the financial barriers to undertaking energy efficiency measures, many of the obstacles preventing the development of energy efficiency measures are informational in nature. The development of public sector projects that can prove that the business case for undertaking renovation works is robust will be critical to overcoming this barrier.

The National Energy Services Framework (NESF) has put in place an agreed set of standards for energy performance contracting in Ireland and will provide confidence to businesses that the energy savings potential of renovation measures can be measured and delivered on a consistent basis.

The first iteration of the National Energy Services Framework was published in December 2013. This represented the culmination of a significant amount of effort by a range of public and private sector stakeholders.

The Framework creates standard reference material including technical evaluation, procurement advice and model contracts to bring energy suppliers, Energy Service Companies (ESCOs) and clients together under an agreed set of protocols. This marked the completion of a key deliverable under the second National Energy Efficiency Action Plan.

The Framework will stimulate the development of a broad based ESCO market, consisting of small, medium and large ESCOs. These ESCOs will support sustainable employment in construction and professional services. The Framework also aims to provide best-practice guidance to public and private sector client organisations when procuring energy services and engaging ESCOs.

With the publication of the Framework, focus has turned to developing and managing a number of exemplar projects that can make use of framework and provide a proof of concept. The first set of exemplar projects, comprising a total of twenty one projects, eleven of which are in the public sector, was launched in June 2013. Collectively, it is anticipated that the exemplar projects will see investment of up to €55m in energy saving measures, resulting in annual savings of €7m.

A further tranche of potential exemplar projects will be identified and brought through the development phase. In addition, DCENR will identify and address any policy issues that require resolution across Government and will seek to embed and promote the principles developed in the framework across the new institutional arrangements for procurement as manifest in the Office of Government Procurement guidelines.

Behavioural Change Programme

Although not strictly a renovation option, behavioural changes nevertheless have a significant role to play in reducing energy usage in the public sector. As noted in the overview of public sector buildings, the Office of Public Works, responsible for the management of the state's property portfolio, has been operating a behavioural change programme since 2008. This programme known

as the “Optimising Power @ Work” programme, has to date focused on staff energy awareness in central government. This has seen staff in over 270 buildings in the central government portfolio receive training on energy efficiency matters. Average energy savings of over 18% have been achieved, equating to approximately €4.3m per annum in cost savings.

Given the successes achieved to date, the Government will soon roll this programme out to another 500 large buildings from various public sector organisations. This wider campaign is expected to result in energy savings of 1.3 GWh. A total of €9 million over the next three years will be invested in this campaign.

The behavioural change campaign will be carried out by an external specialist service provider and will primarily involve: ensuring that there is an energy officer appointed in each building, ensuring that there is an active energy team established in each building comprising key stakeholders from different business functions within the organisation, setting performance targets for each building, measuring performance against targets, intensively engaging the staff in the buildings to identify areas where energy can be saved, running energy related staff lectures and workshops and preparing monthly reports on progress.

Conclusion

Although the number of buildings in the public sector is relatively small when compared to the commercial and industrial sector, it is nevertheless clear that the public sector has a key role to play in leading the renovation of Ireland's building stock. The sheer diversity of buildings and the energy usage associated with them means that the renovation of the public sector building stock is a microcosm of the issues that will be faced in the broader rollout of renovation measures aimed at the 109,000 commercial buildings in Ireland.

Requiring the public sector to act as an exemplar for other sectors carries risks and with the continued pressure on public finances, there is no margin of error. However, the business case for energy efficiency is clear and with the potential to save €200m a year, €200m that can re-directed to front line services, to say nothing of the potential productivity and health benefits, it is an opportunity that Ireland cannot afford to miss.

Although detailed information about the thermal efficiency and energy usage of every public sector building is not complete, it is hoped that the energy monitoring tool in place for the top 133 public sector bodies can, in time, be expanded to all public sector buildings. This system, particularly when combined with the rollout of smart meters, will give each public sector organisation the tools it needs to monitor and reduce their energy usage.

Addressing this informational barrier coupled with the provision of finance through the launch of the Energy Efficiency Fund and the Exemplar projects, will contribute enormously towards reducing and eliminating the barriers that stand in the way of renovation works in the public sector.

The forthcoming Public Sector Action Plan will provide a range of proposed new actions that will set out in detail the pathway towards achieving the 33% energy saving target in the public sector by 2020. Achieving this target will support up to new 12,000 jobs in delivering the proposed efficiency measures, along with reducing Ireland's CO2 emissions by up to 900,000 tonnes per annum, helping the country meet its climate obligations.

The public sector will thus be uniquely positioned to provide leadership for the wider economy to take action and make savings, thereby facilitating enhanced competitiveness and sustainable growth in business, and cost savings in the home.

Commercial & Industrial Sector

Introduction

The commercial and industrial sectors combined account for close to 30% of total final energy consumption and comprise a heterogeneous mix of organisations, both in terms of activities and scale. There are 109,000 commercial buildings, with activities ranging from office to retail, restaurants, warehouses and hotels. Each activity has a particular energy and use profile. The industrial sector is equally varied in composition, scale and energy use. However, despite the varied nature of organisations within these sectors, there are common themes and approaches to promoting energy efficiency that are applicable across all organisations.

Data on energy use in the industrial and tertiary (public and commercial) sectors is collected and collated by SEAI's Energy Policy Statistical Support Unit (EPSSU) annually. The data on the tertiary sector has traditionally been calculated as a residual following determination of the final energy demand in the residential, industrial and transport sectors. This complicates the determination and reporting of energy use (and energy savings) in the commercial sector. The lack of data in this sector is not specific to Ireland, and provides a challenge which all EU member states will need to overcome. Work on analysing energy use in the sector is ongoing and significant advances in the collection and analysis of data have been made in recent years to improve the understanding of the profile of the commercial sector, energy use and energy saving opportunities.

This section of the National Renovation Strategy presents an overview of the current Irish commercial and industrial building stock, as well as an analysis of the profile of buildings and energy use within buildings. A major project characterising the commercial building stock and energy efficiency opportunities is ongoing and preliminary outputs from this work are presented in this chapter. In this first version of the National Renovation Strategy, this analysis is incomplete but will be thoroughly incorporated into the next iteration of the strategy that will be released later this year.

Potential barriers to the uptake of efficiency measures are identified as are initiatives and policy measures in place to address these barriers. Finally, the new policies and measures that the Government will consider over the next three years to promote and deliver increased efficiency in the commercial building stock are presented.

Overview of the Commercial Building Stock

The 2012 energy balance estimates a total final energy consumption in the commercial sector of 817 kToe with almost 50% of final consumption accounted for by electricity, just under 30% oil and just over 20% natural gas. SEAI has undertaken a major analysis of energy use and energy efficiency opportunities in the commercial sector to augment this top down estimate.

The analysis is based on an extensive survey of commercial enterprises based on a statistically representative model of the commercial building stock, which feeds in to a detailed energy model. The survey and model estimates final energy consumption in the commercial sector at around 800 kToe and provides a detailed breakdown of energy use and opportunities for energy saving.

DCENR and SEAI are developing energy monitoring and reporting systems to satisfy the reporting requirements of the Energy End-Use Efficiency and Energy Services Regulations[18] and the National Energy efficiency Action Plan (NEEAP). Since 2011, public bodies have been obliged to report annually on energy consumption to SEAI which will improve the quality and reliability of data on energy use in the public and commercial sectors.

The survey of the commercial building stock indicates that there are around 109,000 commercial buildings, 82,000 of which are categorised as either "Retail" or "Office". The majority of buildings are categorised as small, that is having a floor area of less than 1,000 m^2. Tables 17 and 18 show the breakdown in building numbers and final energy consumption by building type. Office and retail account for over 80% of buildings, with retail having the highest final energy demand. Although there are relatively fewer hotels, this sub-sector accounts for around 20% of the final energy use due to the more energy intensive nature of hotels. Office buildings have the lowest energy use but still account for a significant proportion of final demand due to the large number of offices.

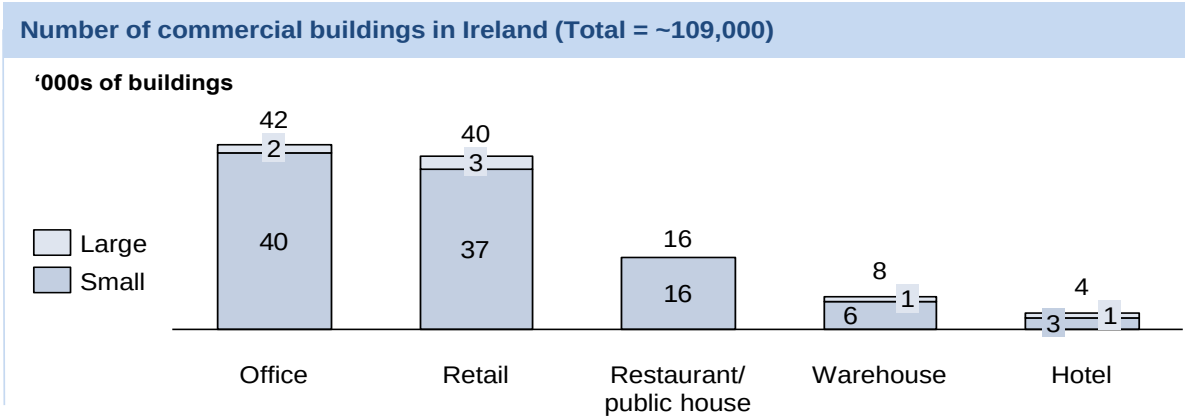


Figure 11: Commercial building stock by activity and scale

[18] SI 542 of 2009

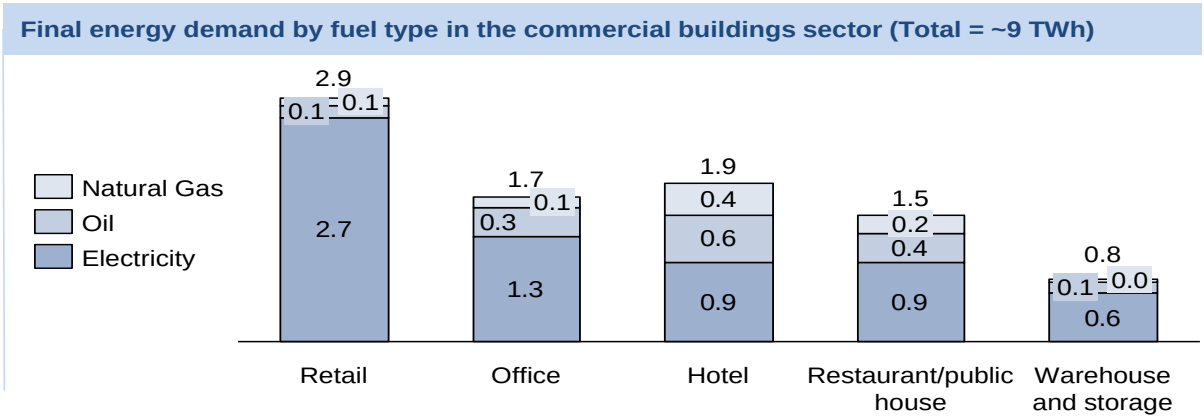


Figure 12: Final energy demand in the commercial sector

The survey and model also provided a detailed characterisation of commercial buildings according to features affecting energy use. The data indicates that relatively basic upgrades such as low-energy lighting could lead to significant energy savings in the commercial sector. The survey found that 27% of all buildings are fitted with less than 20% low energy lighting. A moderate variation was observed between building activity types, with hotels having the largest share of low energy lighting, and warehouses having the lowest share.

A further key finding from the survey is the high proportion of electrical heating in the commercial sector, making up around 60% of the buildings surveyed. It was also found that more than 80% of retail buildings are heated using electricity. In offices and restaurants/public houses, this fraction drops to approximately one half. Hotels were found to be heated predominantly by oil, with only a low share of electrical heating. In addition, almost half (49%) of buildings have heating only (no cooling) with natural ventilation. This would indicate a high level of direct electrical heating and a potential for demand response measures and for substantial primary energy savings.

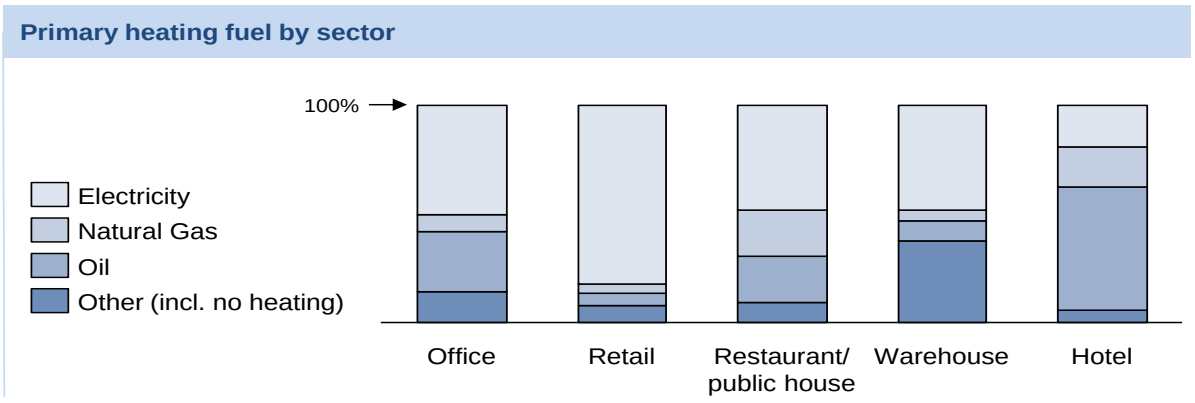


Figure 13: Primary heating by fuel in the commercial sector

The building fabric and thermal properties are significant factors in determining energy demand and opportunities for energy efficiency improvements. As would be expected, there is a strong link between wall type and year of construction, with pre 1919 buildings being predominantly solid masonry with cavity wall and composite construction techniques becoming prevalant in more recent years. Overall, the most common wall type is solid masonry, making up nearly half of the surveyed

buildings. More than one third of the buildings were found to have cavity walls. This reflects a significant opportunity for energy saving through improved insulation of walls. However, this is a longer term investment and uptake may be impeded by the split incentives between building owners and tenants. Similarly, a large proportion of buildings are predominantly single glazed, also reflecting an opportunity for energy efficiency gains albeit with a longer term investment.

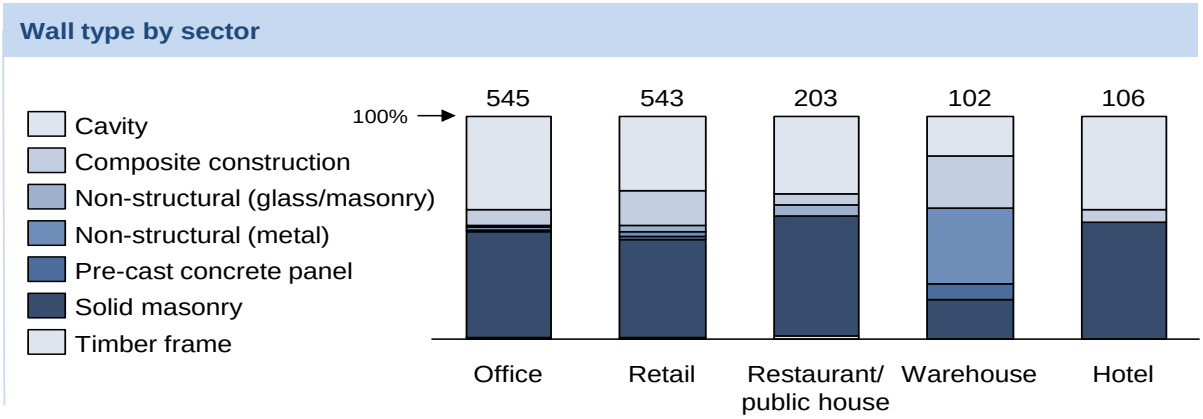


Figure 14: Wall type by sector

Overview of the Industrial Building Stock

The industrial sector had a final energy demand of 2,250 kToe in 2012 representing over 20% of total final energy demand. Energy use within the 161 companies in SEAI's Large Industry Energy Network (LIEN) accounts for over 60% of industrial energy use, indicating that a relatively small number of sites dominate.

The energy consumption in the industrial sector is dominated by process energy demands such as motors and drives, process steam, compressed air, chilled water etc. The principal opportunities for saving energy in the sector are therefore process related rather than in building retrofits as shown by the breakdown of energy saving projects amongst LIEN members. Only a small proportion of industrial energy use is associated with building and energy use within buildings. Indeed, industrial buildings are exempt from the provisions of the Energy Performance of Buildings Directive and from the building renovation provisions of the Energy Efficiency Directive.

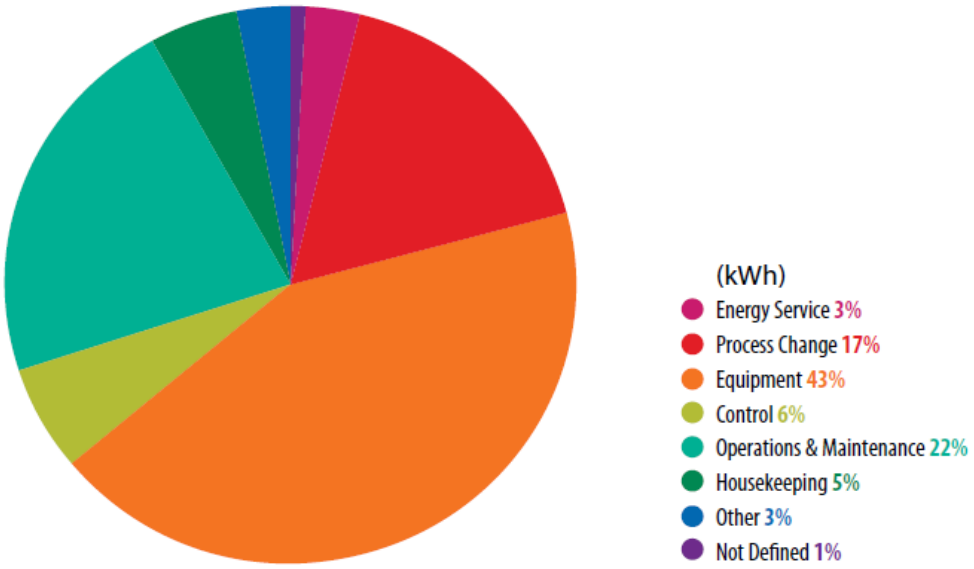


Figure 15: Energy saving projects in industry (Source: LIEN report)

Barriers to the Adoption of Efficiency Measures

Information

A lack of expertise, resources and information is one of the principal barriers to the identification and delivery of energy savings in the commercial sector, particularly in smaller enterprises without dedicated facilities management or energy management resources. The identification of energy saving opportunities requires a degree of information on energy uses within buildings, as well as technologies and techniques available to reduce use.

Energy efficiency cannot be seen. Most commercial energy users get their information on energy use through monthly or bi-monthly energy bills and have no access to information on actual energy use or potential efficiency gains. Energy audits can form an important part of bridging the information gap but recommendations and opportunities are often not acted upon, either due to the manner in which the opportunities are presented, the quality of the energy audit or lack of expertise or resources for project design and implementation.

Provision of targeted summary information on energy use and energy use profiles can assist in overcoming aspects of the information gap by helping end users gain a greater understanding of energy use and factors affecting energy use. Although a national smart metering trial found that SME's achieved only minor energy savings in response to smart metering[19] there is evidence that improved data, in conjunction with other stimuli can lead to energy savings in businesses.

Investment in energy efficient equipment offers the best return when procuring new or replacement energy using equipment, as the incremental capital cost is often very low relative to the life cycle energy costs. When purchasing energy-using equipment, consumers don't always have the knowledge and skills required to determine the optimum balance between investment costs and life cycle operating costs. Equipment labelling can provide information to overcome this barrier and initiatives such as SEAI's TripleE programme which lists eligible energy efficient products and labelling initiatives can assist in overcoming this barrier.

Organisational

The low status of energy management in organisational structures may lead to a lower priority of energy issues and increase the scope for individuals who are opponents to change to impede the implementation of cost-efficient energy efficiency measures.

The experience of SEAI's energy demand management programmes in all sectors is that senior management commitment is key to delivering energy savings in all organisations of all scales. This is emphasised in the delivery of the programmes whereby resources are scaled according to the level of commitment.

[19] Electricity Smart Metering Customer Behaviour Trials (CBT) Findings Report, CER11080a, 2011

Split Incentives

Many commercial buildings are leased by tenants, creating a disconnect in the incentive to invest in energy efficiency projects. In the case where the tenant pays energy bills, there is an incentive to reduce energy use and reduce operating costs but no incentive to invest in the building beyond the term of their lease agreement. In the case where the building owner pays the energy bills, as in serviced offices, there is no incentive for the tenant to reduce energy use although the building owner has an incentive to invest in energy efficient equipment.

The duration of leases and tenure, and indeed the nature and structure of leases, has a significant impact on the extent of the split incentive barrier. Tenants with long term leases of ten years or more generally have sufficient incentive to invest in most energy efficiency projects, barring the highest cost and longest payback measures such as wall insulation or window replacement. There has been some work done on the development of model lease agreements to address the split incentive primarily by transferring some retrofit costs and benefits to the building owner. However, these types of lease agreement have not been widely adopted to date.

Building Energy Ratings and displaying energy certificates help, to some extent, in overcoming this barrier by providing prospective tenants with information on energy efficiency and consequently future energy bills. However, in the circumstances where energy costs are typically in the order of 1-3% of turnover, the extent to which the BER will influence the decision of leasees is uncertain.

Another split incentive exists between building developers and building users. The building design and construction team has a number of objectives in cost control, timely delivery of a building project, compliance with regulations and risk management. The introduction of novel technologies and techniques can conflict with these objectives. However, the combination of Building Regulations, BERs, training and skills development and the demonstration and normalisation of energy efficient technologies provide an effective means of addressing this barrier.

Finance

In general, capturing energy efficiency gains requires investment: either in personnel resources to manage energy or energy efficient equipment and systems. Payback periods for projects can vary from months for certain measures such as replacement of lamps with LEDs, to years for larger projects such as boiler replacement or wall insulation. In order to achieve potential savings, financing for energy efficiency projects is required.

In the current credit constrained economy, capital is scarce in many businesses and investment decisions tend to taken over relatively short timeframes of three years or less. Investment decisions may be made according to high discount rates. The application of onerous payback or rate of return financial assessment hurdles to energy efficiency projects may be a barrier to their implementation. Furthermore, businesses with restricted access to capital will also evaluate the opportunity cost of capital invested in energy efficiency against investment in their core business which may offer more attractive returns than a competing energy efficiency project.

A survey of Italian SMEs on barriers to implementation of energy efficiency projects[20] identified access to capital as the principal constraint. The other constraints identified, in order of priority, were lack of information on energy efficiency opportunities, lack of skills (internal and external), and lack of organisational priority.

In a synthesis study of data collected on barriers to energy efficiency and implementation of energy efficiency projects in Germany and across Europe[21] access to capital was also identified as the principal barrier. The secondary barrier identified was the quality of energy audits which was found to affect the adoption of energy-efficiency measures pointing to the need for quality standards for energy audits, templates for audit reports or mandatory monitoring of energy audits.

The risk associated with investment in energy efficiency is often less understood by businesses than for competing investment opportunities with the revenue stream from such investments not clearly visible or defined. This is compounded by the information gap and by the lack of understanding of energy efficient technologies and, to a degree, by the lack of an embedded measurement and verification methodology within many energy efficiency projects.

The potential role of ESCOs and Energy Performance Contracting (EPC) in addressing the financing and other barriers has been identified for a number of years. The ESRI, in a study on the ESCO market in Ireland, suggested that in-house resources could theoretically deliver on greater energy savings than ESCOs, but in practice don't due to a lack of focus (energy use is but one or two per cent of turnover) and lack of in-house expertise[22]. The study found that the ESCO market was in its infancy and recommended a number of information (eg guidelines, template contracts) and fiscal (grants, fuel tax) recommendations to promote ESCO's.

The ESCO market in Ireland remains in a developmental phase but a series of measures to promote EPCs through the National Energy Services Framework are targeted towards the delivery of energy efficiency projects through third party financing and performance related models.

[20] Trianni & Cagno, Dealing with barriers to energy efficiency and SMEs: Some empirical evidences, Energy 37 (2012) 494 -504

[21] T. Fleiter et al, Adoption of energy-efficiency measures in SMEs—An empirical analysis based on energy audit data from Germany Energy Policy 51 (2012) 863–875

[22] Scott, ESCOs in Ireland: Investigation of Energy Service Companies in 2000, ESRI WP 155, 2004

Energy Efficiency Cost Curves for the Commercial and Industrial Sectors

A major project characterising energy use, energy efficiency opportunities and energy efficiency cost curves is currently underway on the commercial and industrial sectors. This work builds on previous work in developing cost curves and identifying cost effective energy efficiency opportunities. SEAI's Demand Side Management Study[23] identified the high level, economic energy savings potential in the commercial sector at over 400 kToe while a Low Carbon Opportunity Study[24], identified 2 million tonnes of CO_2 savings from negative cost measures in the commercial sector including lighting retrofit, HVAC retrofit and controls and energy efficient ICT.

The current work is designed to provide an evidence-based economic model to underpin the rationale for investment in energy efficiency measures through developing Marginal Abatement Cost Curves (MACC) for the commercial sector. These cost curves will identify potential measures that could reduce energy usage and then attach likely costs and benefits to each of these measures. The results of this work will be used to inform policy development and to prioritise those measures that offer the highest benefits for the lowest costs.

As previously noted, the research work on identifying and quantifying potential residential measures is still underway and the data contained in this section of the renovation strategy is in preliminary form. When the research project has concluded the final data will be incorporated into the next iteration of the strategy.

The graph below illustrates the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with a range of measures, both behavioural and non-behavioural in the commercial sector.

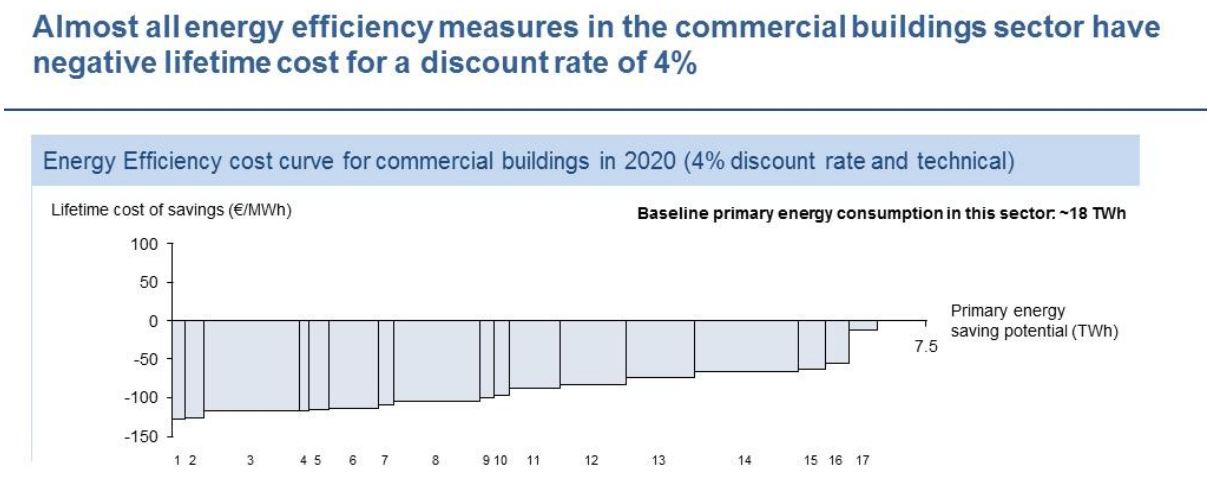


Figure 16: Energy Efficiency Cost Curves for the commercial sector in 2020 – All Measures

[23] Demand Side Management in Ireland - Evaluating the Energy Efficiency Opportunities
[24] Ireland's Low-Carbon Opportunity - An analysis of the costs and benefits of reducing greenhouse gas emissions, SEAI 2009

A total of seventeen measures were examined for the commercial sector. The table below illustrates the potential energy savings associated with each measure:

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. Enable standby features on all PCs and monitors	0 - 0.12	10. Heating control	3.2 - 3.35
2. Turn off lights for extra hours	0.12 - 0.31	11. External wall insulation	3.35 - 3.86
3. Energy efficient lighting	0.31 - 1.27	12. More efficient air conditioning	3.86 - 4.51
4. Energy efficient appliances - Refrigeration	1.27 - 1.36	13. Double glazing	4.51 - 5.19
5. Draught proofing	1.36 - 1.56	14. Heat pump	5.19 - 6.23
6. Reducing room temperature	1.56 - 2.05	15. Energy efficient appliances - Office equipment	6.23 - 6.5
7. Reducing hot water use	2.05 - 2.2	16. More efficient boiler replacement (gas, oil)	6.5 - 6.73
8. Roof insulation	2.2 - 3.06	17. Lighting Control	6.73 - 7.02
9. Cavity wall insulation	3.06 - 3.2		

Table 7: Energy Savings Attributable to Commercial Building Measures – All

A total of 7.02 TWh of energy savings are achievable in the commercial sector against a baseline primary energy consumption in the sector of 18 TWh.

The next graph shows the potential lifetime cost of energy savings, expressed in terms of € per MWh, associated with a range of measures, both behavioural and non-behavioural in the in the industrial sector.

All energy efficiency measures identified in the industry sector have negative lifetime cost with a 4% discount rate, leading to an economic potential of 8.8 TWh

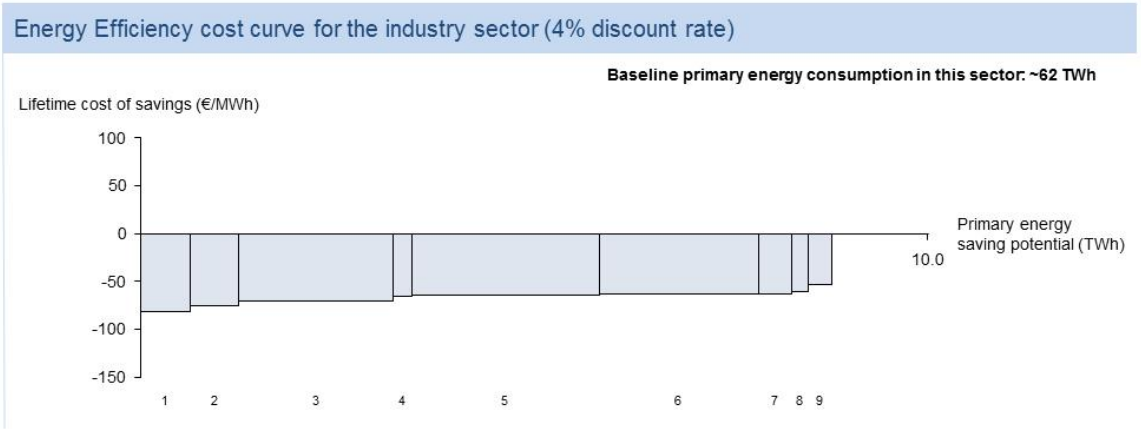


Figure 17: Energy Efficiency Cost Curves for the industrial sector in 2020 – All Measures

A total of nine measures to improve energy efficiency in the industrial sector were considered. These measures could potentially deliver energy savings of 8.77 TWh. The table below illustrates the energy savings attributable to each measure:

Measure	Energy saving (TWh)	Measure	Energy saving (TWh)
1. More efficient refrigeration	0 - 0.64	6. CHP	5.83 - 7.85
2. More efficient compressed air systems	0.64 - 1.26	7. Process integration and heat recovery - high T processes	7.85 - 8.26
3. Motor efficiency	1.26 - 3.22	8. More energy efficient steam system	8.26 - 8.48
4. More energy-efficient lighting	3.22 - 3.46	9. More efficient HVAC and ventilation	8.48 - 8.77
5. Process integration and heat recovery - low T processes	3.46 - 5.83		

Table 8: Energy Savings Attributable to Industrial Building Measures – All

Existing Policy Measures

As a small open economy dependent on imports to provide 85% of our energy needs, energy efficiency in the commercial and industrial sector is critical to insulating businesses based in Ireland from the impact of fossil fuel price fluctuations. In recognition of this and the enormous energy saving potential in the sectors, the Irish Government has already implemented a series of measures intended to overcome some of barriers to efficiency measures. These existing measures are outlined below.

National Energy Services Framework

Energy Performance Contracting and ESCOs have long been recognised as a potential route for overcoming financing and other barriers to energy efficiency projects. While there are recognised barriers to the large scale deployment of ESCO/EPC contracting, the benefits in terms of energy savings are clear.

This National Energy Services Framework aims to overcome barriers to ESCO/EPC models by providing guidance on routes to project development, sources of finance, model contracts and exemplar projects. The exemplar projects are designed as a proving ground for the ESCO model of energy efficiency delivery and as a means to promote and transfer this model to accelerate and leverage energy efficiency investment projects in both the public sector and business sectors.

The EPC framework will provide an integrated resource to organisations that want to implement energy-saving retrofit projects using EPC. The framework will build capacity among organisations for which EPC is the preferred method of procuring and implementing energy saving projects and will be the basis for the delivery and funding of projects through the National Energy Efficiency Fund.

National Energy Efficiency Fund

The 2013 Government Action Plan for Jobs called for the creation of a mechanism to kickstart activity on non-domestic renovation by overcoming one of the most important barriers standing in the way of this sector – the availability of accessible and appropriately priced finance. To achieve this, the Government has committed €35 million as seed capital for investment in a newly established Energy Efficiency Fund (EEF), with a view to expanding the fund to over €70 million when matched with investment from the private sector. Over its expected lifetime, the Fund has the potential to leverage investment of €300 million in energy saving activity.

The concept of such a Fund to support efficiency measures is analogous to the creation of a green investment bank. The Fund will enhance the level of finance available in the market to support the clear opportunity that exists in both the public and commercial sectors. In addition, by demonstrating the viability of such investments, the fund will help to crowd in finance from other sources into the energy efficiency sector. Sustainable Development Capital LLP (SDCL) has been selected to manage the Fund, which was established on 26 March 2014 and made its first investment on 8 May 2014.

Should the Fund invest all its monies, it is estimated that it will stimulate at least 600 additional jobs and potentially many more depending on the leverage used in individual investments. Furthermore, cumulative energy savings of over 900GWh are anticipated, greatly assisting Ireland to meet our 2020 energy savings target.

Tesco Ireland will become the first company to avail of the fund as part of a significant retrofit programme and the first Sustainable Energy Authority of Ireland Exemplar EPC project under the National Energy Services Framework to reach financial close.

The exemplar EPC projects, the National Energy Services Framework and the National Energy Efficiency Fund will, in combination, act as powerful stimuli in promoting the delivery of substantial energy savings in the industrial and commercial sectors through EPC contracting and ESCOs.

Accelerated Capital Allowances and Triple E Product Register

The Accelerated Capital Allowances (ACA) scheme is a tax incentive whereby organisations can write off the full cost of investment in energy efficient equipment in the year of purchase. This assists in cash flow and in the financing of energy efficiency projects. In order to qualify for the ACA, products must be listed on the Triple E product register. Such products must demonstrate superior energy performance according to defined criteria. The register provides independent intelligence to energy end users regarding the products that are best in class from an energy efficiency perspective, as well as offering a financial incentive to organisations to procure them. There are now 52 technologies covered in 10 product categories, comprising over 10,000 products registered.

In addition to defining eligibility for the ACA, the Triple E promotes procurement of energy efficient equipment. The Energy Efficiency Public Procurement Regulations 2011[25] require that all public bodies shall reference this database when procuring new equipment or vehicles.

SME Programmes run by SEAI

A dedicated support programme for small to medium energy users has been operated by SEAI since 2008. The programme offers free energy management advice, mentoring, training and other support services to any business willing to show a commitment to becoming more energy-efficient.

This service delivery includes the provision of an initial energy audit and offers a structured approach to energy management, in a form that can be adapted and tailored to the level of energy costs in the company. The programme has been successful in identifying and assisting in the implementation of energy efficiency retrofits in a large number of commercial buildings.

Enterprise Ireland Grant Programmes

Enterprise Ireland provides a range of supports to help companies to incorporate sustainable practices into the day-to-day running of the business. The supports include the GreenStart programme which provides assistance in the implementation of environmental management systems and achieving improved environmental performance through support in implementing

[25] European Union (Energy Efficiency Public Procurement) Regulations 2011 (S.I. No. 151 of 2011)

environmental standards, quantification of impacts, applying for eco-labels, carbon footprint measurement and grant support towards verifiable environmental improvements. While not specifically targeted at energy efficiency in buildings, building retrofits may be eligible for support as part of an overall environmental improvement programme.

Building Energy Rating

Under the Energy Performance of Buildings Directive as implemented in Ireland[26], all commercial buildings offered for sale or lease are required to have a Building Energy Rating (BER). The BER provides information on the building's energy performance and informs rental or purchase decisions. The BER certificate is accompanied by an Advisory Report that provides recommendations to enable building owners and users to improve the energy efficiency of their properties.

BER assessments have been carried out and certificates issued for over 10,000 non-domestic buildings to date, representing around 10% of the commercial building stock. In addition to providing information to building owners and tenants on energy performance, the BERs provide a valuable dataset for the analysis of energy use in commercial buildings. The non-domestic BER database is a source of data on over 10,000 non-domestic buildings in Ireland, collected through BER assessments.

The Non Domestic Energy Assessment Procedure (NEAP) is the methodology for assessing building energy performance and for generating the Building Energy Rating (BER) and advisory report for new and existing non domestic buildings. It is also central to demonstrating compliance with specific aspects of the Building Regulations related to energy performance.

Building Regulations

Building Regulations have been and will continue to be revised to provide for incremental improvement of energy performance in the commercial sector leading towards planned requirements for nearly zero energy buildings by 2018. The 2005 Building Regulations revision for buildings other than dwellings improved minimum standards set in previous regulations on insulation levels in building fabric, ventilation and air infiltration, avoidance of excessive solar gain, thermal bridging reduction, heating plant efficiency and control, air-conditioning plant efficiency, insulation of hot water storage vessels, pipes and ducts and in overall building performance. Future building regulations will provide for progressively more stringent energy performance requirements within this framework.

By 2020, subject to cost-optimal calculations, it is proposed that all new buildings other than dwellings in Ireland will achieve a 50% to 60% aggregate energy efficiency and CO2 emissions improvement[27].

[26] European Union (Energy Performance of Buildings) Regulations 2012 (S.I. 243 of 2012)

[27] Towards nearly zero energy buildings in Ireland planning for 2020 and beyond Department of the Environment, Community and Local Government, November 2012

The Building Regulations also set out the statutory minimum energy performance standards for existing buildings undergoing extension, material alteration or conversion from a building previously used for different purposes and are thus key to enforcing retrofit standards in major building refurbishments.

Better Energy Workplaces & Better Energy Communities

The Better Energy Workplaces programme, operated in 2011 and 2012, was designed to assist in the energy efficiency upgrade of non-domestic buildings, facilities and services. The scheme was open for applications for projects from publics sector, private-sector and community organisations and provided grant assistance towards retrofit projects with the potential for replication.

The Better Energy Communities programme started in 2012 and is designed to foster innovative and pioneering partnerships for delivery between different organisations to leverage resources and expertise. Partnerships are sought between the public and private sectors, domestic and non-domestic sectors, commercial and not-for-profit organisations and energy suppliers. The programme supported 84 community projects and delivered upgrades to 3,800 buildings in 2013 generating local employment and resulting in significant savings to community fuel bills.

A call for applications for the 2014 Better Energy Communities was announced in February. It is anticipated that the scheme will generate energy savings of 100 GWh (24.7 ktCO2).

Skills Development

As identified, knowledge and skills are one of the barriers to achieving potential energy savings in buildings. There are a range of initiatives to improve knowledge and skills to enable the delivery of energy efficient construction and retrofit of buildings. At a professional level, third level institutions are providing diploma, degree and master's programmes in energy and sustainability-related courses for construction professionals.

In the construction trade, training and supports are in place to facilitate the development of the required additional skills. These initiatives include training through the national training and employment agency (SOLAS) and Institutes of Technology including training schemes for air tightness and thermal bridging onsite skills and the integration of revised Building Regulations guidance in apprenticeship courses.

Build Up Skills is an EU-wide initiative focused on the continuing or further education and training of craftsmen, construction workers and systems installers in buildings. Its aim is to develop a National Qualification Roadmap for each member state, endorsed by all relevant stakeholders, that will contribute to meeting our 2020 sustainable energy targets.

To deliver this objective, DCENR, along with other government departments and agencies, will work with the Build Up Skills for Ireland (BUSI) Consortium to bring forward a comprehensive action plan and roadmap for the future training and upskilling needs of the Irish construction sector.

A core principle of the Irish Build Up Skills Roadmap is one of quality building. To achieve this, the roadmap intends to develop a foundation energy skills programme and implement a "Train the

Trainers" programme to increase the knowledge and competency of trainers involved in construction training. The Irish Build Up Skills Roadmap also highlights the need to back up training provision with mechanisms which allow workers to benefit, in the market place, from having taken such training. Building on experiences from other schemes in Ireland, the project will develop and implement an industry backed Quality Building Training Registration Scheme to be known as Qualibuild.

The Large Industrial Energy Network

The Large Industry Energy Network (LIEN), operated by the Sustainable Energy Authority of Ireland (SEAI), is a well-established networking and information programme for large industrial energy users. It is currently targeted at the larger industrial energy users and engages some 160 of the largest energy users in ongoing relationships, including site visits, workshops and annual performance reporting. LIEN members share information on energy-saving technologies and techniques to maximise savings and maintain competitiveness. The annual primary energy use in LIEN members totals around 25 TWh[28] per annum, around 60% of industrial energy usage and 15% of national primary energy usage. Savings of 123 GWh were achieved through the initiative in 2011.

Support for Combined Heat & Power Generation

In 2012, the Government introduced a support scheme to incentivise the use of Combined Heat and Power (CHP) generation in the commercial and industrial sector. This support for CHP is in the form of feed-in tariffs for electricity produced from biomass CHP plants. It is expected to support up to 150 MWe of cogeneration from anaerobic digestion and solid biomass. The tariffs for cogeneration technologies range from €125 per MWh to €157 depending on the size of the plant and the technology used. In 2012, the operational installed electrical capacity for cogeneration reached 306 MW(e) and the amount of electricity exported to the grid was 1,430 GWh. It is estimated that this resulted in primary energy savings of 2,194 GWh and 511 kilotonnes of CO2 emissions avoided.

Natural Gas fuelled 282 MWe of the operational capacity in 2012. Oil products fuelled 7.7 MWe, biogas 5.8 MWe, biomass 5.4 MWe and solid fuel was used by the remaining 5.2 MWe.

[28] Large Industry Energy Network Annual Report 2011, SEAI

New Policy Measures

This section discusses a number of new policy measures that are being considered by the Government to boost the renovation rate in the commercial sector. A number of these measures, such as the energy efficiency fund, supplier obligations and smart meters will have wider applications in the residential and public sectors but are also relevant for the commercial and industrial sectors.

Energy Efficiency Obligations for Energy Suppliers

Building on the experience of voluntary agreements with energy suppliers, an energy efficiency obligation scheme was legislated for and initiated in 2014[29]. Under the legislation, energy suppliers in Ireland above a defined threshold are required to deliver mandatory energy savings across the residential, energy poor and non-residential sectors. An annual target of 550GWh has been set, of which at least 20% must be delivered in the residential sector, with another 5% being delivered to energy poor customers. The scheme will run until at least 2020. Failure by any supplier to comply with the mandatory targets will result in penalties.

The obligation scheme will encourage every energy supplier to become an energy services company that works collaboratively with its customers to identify potential savings and to share the benefits that these savings could deliver. A variety of similar schemes and approaches are operating in the US, EU, Australia, China, Canada.

Reducing energy demand through energy efficiency obligations will of benefit to everyone in society. Lowered energy demand means less emissions, less transmission and distribution losses and less need for expensive reserve margins in generation. This lower demand reduces wholesale prices for all consumers, not just those who cut their demand.

The operation of the new obligation scheme is a cornerstone of Ireland's ambitious energy efficiency targets and central to the delivery of an increased rate of renovation in both the domestic and non-domestic markets. As the scheme develops, it is anticipated that it will benefit from economies of scale as it creates and matures the market for retrofit measures, thus lowering the average cost of each installation of measures. As consumers in turn become more comfortable with the concept of renovation works and dealing with their energy suppliers on such matters we anticipate that the market for renovation works will be transformed.

Efficiency audits for business

SEAI has promoted the provision of high quality energy efficiency audits for businesses through supports for industry and SMEs including assistance with implementation of certified Energy Management Systems (IS393, EN 16001 and ISO50001) and the provision of energy audits to business through the Advice and Mentoring Scheme. Over 2,000 businesses, representing an annual energy expenditure of over €400 million, have already availed of this programme, with 10% energy

[29] European Union (Energy Efficiency Obligation Scheme) Regulations 2014 S.I. No. 131 of 2014

savings routinely found in the first year and energy cost savings of up to 30% achieved in many cases.

SEAI provides training for energy auditors providing the Advice, Mentoring & Assessment (AMA) services on behalf of SEAI and both SEAI and the DCENR are supporting the development of an industry association for energy auditors and energy professionals. This engagement in the direct provision of energy audits for businesses and in fostering the development of an industry association will assist in the ongoing considerations on mechanisms and programmes to implement Article 8 of the Energy Efficiency Directive.

The Large Industry Energy Network (LIEN) includes the majority of non-SMEs and the majority of these will have conducted energy audits as part of this engagement and network. Regulations are being prepared to ensure that audits are carried out by all non-SMEs.

Smart Metering

Under the National Smart Metering Programme, the Government has committed to commencing the rollout of smart meters nationwide from 2015/16. This rollout will have multiple benefits that could potentially increase the demand for retrofit measures. Smart meters can address many of the informational barriers that prevent businesses in the commercial sector from identifying and implementing energy efficiency measures.

Smart metering will give business greater transparency on how and when they use energy and will improve awareness of usage patterns and potential savings. It is also anticipated that the smart meter rollout will be accompanied by time-of-use tariffs which will offer lower electricity pricing during off-peak hours in order to incentivise consumers to switch usage from high-demand periods.

While the mechanics of the smart meter rollout are still under consideration but in the final scheme that is deployed the Government will ensure that the rollout is designed to provide clear and easy to understand information to electricity users that can support the delivery of increased retrofit activity.

Networking for SMEs

The Large Industry Energy Network has been very successful in promoting energy efficiency in large energy users in Ireland. Expanding the principle of the LIEN to develop a networking forum for SMEs is being evaluated. This would provide SMEs with a resource for sharing information on energy-saving technologies and techniques to maximise savings. The services provided to participating SMEs would include site visits, workshops and annual performance reporting.

Conclusion

The commercial sector acounts for a significant proportion of energy use in Ireland and is central to economic growth and employment. There is considerable scope for achieving energy efficiency gains in buildings, providing multiple benefits in terms of reduced energy use and CO_2 emissions, reduced costs and economic and employment benefits arising through improved competitiveness. The industrial sector has a higher energy usage again but has more limited opportunities for energy efficiency through building renovation with the main savings opportunities being in energy management and process efficiency.

The principal barriers impeding the achievement of potential energy savings are well understood and documented as being information, organisational, split incentives and finance. Without information and organisational commitment the potential savings aren't identified. Split incentives are a major barrier where a building owner has no stake in operational energy savings and a tenant has no stake in long term building performance. Then, perhaps the biggest barrier of all, is in financing energy efficiency projects especially in the current economic environment where access to finance is constrained and where other investment priorities may often take precedence.

A wide range of policy initiatives addressing these barriers and promoting an awareness of energy use and energy efficiency in the commercial sector have been implemented in recent years. These include progressively more stringent Building Regulations for new buildings and those undergoing a deep retrofit, Building Energy Rating to improve awareness of efficiency and help address the split incentive barrier, energy audits, mentoring and training for businesses to help identify and deliver energy savings, grant programmes to incentivise exemplar projects and education and upskilling of building practitioners.

There is currently a major policy focus on the promotion of new business models to deliver energy efficiency projects through ESCOs, Energy Performance Contracts and other models where payment to service providers is linked to energy savings achieved. The National Energy Services Framework provides a comprehensive suite of tools to facilitate organisations seeking to implement projects through EPCs and alternative models. In conjunction with the recently inaugurated National Energy Efficiency Fund, these novel approaches to identifying and delivering energy savings have the potential to unlock major energy savings in commercial buildings.

Forward Looking Perspective

This strategy reaffirms the Government's commitment to delivering on its ambitious targets to achieve a 33% energy saving in the public sector and a 20% improvement in energy efficiency for the economy as a whole by 2020. This transition will not happen by itself. As this report has highlighted, there are considerable barriers that stand in the way of renovation works. These barriers, whether informational or financial, must be overcome. This strategy sets out a clear pathway to overcoming the barriers to renovation works and achieving the national targets by building on the success of existing policy measures, with the addition of new ambitious policy goals, designed to mobilise investment to increase the rate of renovation in the economy.

In the domestic sector, the progress to date achieved by the Better Energy programme will be built upon with the launch of Better Energy Finance. This programme will be designed in a manner that ackowledges the constraints identified in this strategy and will make a compelling case to consumers on the merits of energy efficiency. It will also ensure that there are a variety of financial options open to those consumers when they are considering undertaking renovation works. The national smart meter rollout will also help to overcome barriers by provide consumers with detailed information on their energy usage at their fingertips.

In the public sector, the energy management tools developed by SEAI will allow public sector organisations to take direct control over their energy bills, delivering an unprecedented level of control to each individual organisation. The promotion of exemplar projects through the National Energy Saving Framework will provide templates for public sector organisations considering efficiency projects, while the launch of the new Energy Efficiency Fund will ensure that sufficient finance is available to support new projects.

In the commercial and industrial sector, the most important barriers to overcome are the split incentives and the availability of finance. By requiring each energy supplier to work with their customers to deliver significant energy savings each year, the Government is encouraging energy suppliers to become advocates of efficiency rather than simply energy vendors. Coupled with the launch of the Energy Efficiency Fund, which is intended to complement private sector finance ventures and jumpstart the market for efficiency projects, it is expected that renovation projects will become standardised and a normal part of doing business for a company.

In addition, this strategy commits the Government to ensuring that the regulatory and policy environment generally is supportive of efficiency measures, rather than potentially creating new barriers. Throughout this strategy, the importance of a stable and predictable regulatory regime to provide certainty to consumers and industry alike was highlighted. To provide this certainity, a comprehensive public consultation will be launched on this "first version" of Ireland's national renvoation strategy.

This public consultation will see the Department actively engage with stakeholders to get as broad a participation in the process as possible. The consultation will run until the Autumn and will incorporate opportunities for participation in an active dialgoue, through workshops and events, as well as written submissions.

This public consultation will build on the work undertaken to date to identify the opportunity and the barriers to renovation works in Ireland. As this strategy has demonstrated, there are significant benefits to renovation works, benefits that will accrue to businesses, consumers and the country as a whole. To ensure that these benefits are delivered and the gains to society at large delivered, it is important that this strategy be as comprehensive as possible.

Therefore, on receipt of the completed research and following the incorporation of the results of the public consultation, a new revised version of this strategy will be submitted to the EU Commission and published. In line with the Directive requirements, the strategy will then be revised and updated every three years, alongside Ireland's National Energy Efficiency Action Plan. This will provide a stable platform for industry input and public discourse at regular intervals on Ireland's energy efficiency ambitions and ensure that all sections of society can have their input into the process.