MULLINGAR

ENERGY MASTER PLAN

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Supported by

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

planenergy SUSTAINABLE ENERGY SOLUTIONS

Contents

Glossary of Terms

Building Energy Rating (BER) - BER stands for Building Energy Rating. A BER certificate shows you the energy performance of your home. It is a good indicator of how much you will spend on energy (like heat and light) and how much CO_2 you will release to heat your home to a comfortable level.

The BER rating goes from A to G. A-rated homes are the most energy efficient, comfortable and typically have the lowest energy bills. G-rated homes are the least energy efficient and require a lot of energy to heat the home.

Carbon Dioxide/ CO_2 - Carbon dioxide is a powerful greenhouse gas. It is naturally part of the air we breathe. However, human activities like burning of fossil fuels and deforestation have led to an increase in CO_2 in the air that contributes to climate change.

Carbon Footprint - Carbon footprint measures the carbon emissions linked to a particular activity or product. It includes emissions involved in all stages of making and using a product or carrying out an activity. The lower the carbon footprint the less that a product or activity contributes to climate change.

Energy Efficiency - It is energy efficient when we use less energy to achieve the same result.

Energy Savings - Energy in whatever format it is being consumed usually costs money (€). By reducing the amount of energy consumed you are also reducing the cost associated with providing that energy.

Greenhouse Gas Emissions (GHGs) - Gases that trap heat from the Earth's surface causing warming in the lower atmosphere and slowing down loss of energy from Earth. The major greenhouse gases that cause climate change are carbon dioxide, methane and nitrous oxide.

Kilowatt hours (kWh) - One kilowatt-hour is equivalent to 1000 watts of energy used for 1 hour. For example, a 100-watt lightbulb switched on for 10 hours uses one kWh of electricity.

Megawatt hours (MWh) - A megawatt hour is equivalent to 1 million watts of electricity being used for an hour. 1 MWh is equivalent to 1,000 kWhs. For example, a megawatt hour could be 2 million watts (2 megawatts) of power being used for half an hour

Net zero emissions - This refers to achieving an overall balance between greenhouse gas emissions produced by human activity and greenhouse gas emissions taken out of the atmosphere

Renewable Energy - Renewable energy comes from renewable resources like wind energy, solar energy, or biomass. These resources can regenerate naturally, and we can use them repeatedly without reducing their supply.

Renewable Electricity Support Scheme (RESS) - This Government scheme provides financial support to renewable electricity projects in Ireland to help us achieve our renewable electricity goals. It also aims to increase community participation in, and ownership of, renewable electricity projects. It aims to make sure electricity consumers get value for money and to improve security of our electricity supply

Sustainable Energy Community (SEC) - An SEC is a community in which everyone works together to develop a sustainable energy system. To do so, they aim as far as possible to be energy efficient, to use renewable energy where feasible and to develop decentralized energy supplies.

Units

Throughout this report we present energy use and energy production, in kilowatt or megawatt hours per annum (KWh/yr) and (MWh/yr). These units of measurement are used regardless of the fuel used. As a reference point, a typical house consumes approximately 22MWh per annum. We also present carbon emissions in tonnes or kg of CO_2/annum. Energy costs are presented in euro spent on energy per annum

Executive Summary

The table below provides a holistic overview of the energy consumption, emissions and cost associated with the Mullingar catchment area.

Table 1 – Mullingar SEC catchment area total energy, CO_2 and cost analysis [1]

	Electricity	**Fossil Fuel**	**Transport**	**Total** (MW)
ENERGY MWh	72,164	169,348	80,967	322,479
CO_2 EMISSIONS tCO2	30,836	39,472	19,243	89,551
TOTAL ENERGY COST	€15,859,555	€57,310,936	€10,425,128	€83,595,619

As already mentioned, the EMP breaks down the energy consumption and fuel mix within the community's catchment area into 3 key sectors consisting of:

1) Residential
2) Non-residential
3) Transport

[1] Energy usage calculated using data from Central Statistics Office 2016 census of Ireland (CSO, 2016). CO_2 emissions and Energy Cost calculated using SEAI Domestic and Commercial Fuel Cost Comparison (SEAI, 2022)

The sectoral baseline energy usage analysis, which will be discussed in more detail in later sections, is summarised in Table 2 in the form of an energy balance for the whole catchment area. This provides a full picture of how much energy is used in each sector, which helps identify and prioritise areas for action by the Mullingar SEC.

Table 2 – Sectoral percentage energy consumption (CSO, 2016)

Mullingar SEC catchment area Primary Energy Baseline (kWh)				
Sector	**Electricity**	**Fossil Fuel**	**Renewable**	**Total** (MW)
Residential	40,870,056	109,747,040	931,684	151,549
Non-residential	31,285,271	59,600,651		90,886
Transport	118,571	80,839,107		80,958
Total Energy	72,273,898	250,186,798	931,684	323,392

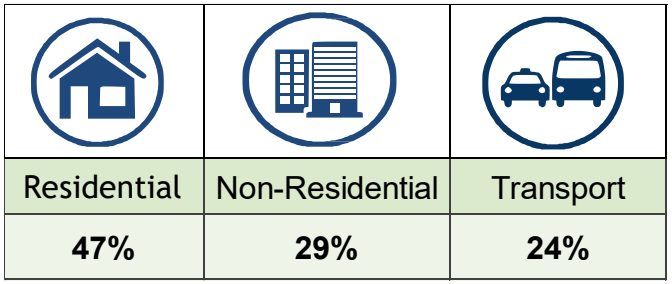


Figure 1 – Primary Energy percentage per sector

Our analysis of the energy consumption within the catchment area has identified that 47% of the energy demand relates to the residential sector, 29% for the Non-residential sector and approximately 24% relates to the Transport sector.

Introduction to the Energy Master Plan

To assist in achieving the Mullingar Sustainable Energy Community's goals, an Energy Master Plan study has been conducted. This Energy Master Plan (EMP) has been funded by SEAI to assist in developing and refining short, medium and long-term plans for the Mullingar Sustainable Energy Community.

The Master Plan aims to help communities understand their current energy usage and carbon footprint so that they can understand where they currently are, thereby allowing them to set reduction targets for the future.

The information gathered and tools developed to review projects will help the SEC strive toward being an exemplar model in the transition to a low carbon community. The Energy Master Plan is based on a mixture of desktop research utilising publicly available information sets from a range of sources CSO, SEAI, Chartered Institution of Building Services Engineers (CIBSE), Pobal, County Council, etc.

Using modelling tools and methodologies developed inhouse by Plan Energy Consulting, the Energy Master Plan will also capture the energy consumption, emissions and spend within the community.

In terms of its structure, the EMP report begins with a sectoral energy breakdown that will give a broad overview of each sector's (Residential, Non-residential, Transport) energy consumption, energy cost and contribution to CO_2 emissions in the Mullingar SEC, followed by a brief discussion on how the SEC compares to national averages.

These sections form the basis of the recommendations and options supplied for a transition to renewable energy sources in each of the sectors as well as opportunities for energy reduction and increased efficiency within the Register of Opportunities document.

The EMP will identify the potential for the implementation of sustainable transport models such as electric vehicle (EV) charging infrastructure, alongside renewable energy generation possibilities from many varying sources such as wind, solar etc.

Reviewing the natural resources available to the community, high level analysis is provided on various renewable energy technologies that the community could further pursue. A wide range of natural resources are often within a community's grasp, however the understanding of how to progress from a concept through to reality can be an enormous barrier.

This EMP outlines the processes required by the SEC to quantify what these resources can offer, alongside how renewable projects can transition from an idea to a system that is owned by the community, contributing to the sustainable, decarbonisation of the area.

Finally, the EMP will conclude with an Action Plan and Register of Opportunities section, which the community can use as a benchmarking tool, as they seek to become more energy efficient and reduce their carbon footprint over the next decade.

Perhaps the primary benefit of the EMP is that it can be used as a roadmap for the SEC's progression towards sustainable energy and can be used to support applications for capital grants to upgrade existing housing, commercial and public building stock.

Additionally, the EMP can also be used as a mechanism to increase awareness in energy efficiency. This process begins through the interactive community survey issued, meetings with the SEC committee, the energy audits alongside the launch of the report at its conclusion.

This report includes recommendations, demonstrating examples of what the community can do to change behaviour and increase the understanding of climate action and how those involved can contribute toward this shared objective of reducing their impact on the environment.

Residential sector

Background

The Residential sector is one of the largest emitting sectors in Ireland, accounting for 29% of CO_2 emissions and roughly a quarter of the energy used in Ireland as per 2020 estimates from SEAI. Therefore, if communities want to make progress towards individual targets, as well as contributing to the national target of reducing all CO_2 emissions 51% by 2030, it is vital this sector is given close focus.

Whilst energy usage from the residential sector has increased by almost 19% from 2014 to 2020, emissions only subsequently increased by 1%. These figures can be explained by higher household incomes and expenditure which led to higher energy usage but have been balanced out by improvements in energy efficiency as a result of updated building regulations and homeowners increasingly more willing to invest in fabric upgrades within their homes.

The momentum within the country has been to ensure that as many homes as possible upgrade their homes insulation ahead of 2030, with the Irish Government setting the ambitious target of 'retrofitting' [2] 500,000 homes to a B2 Building Energy Rating (BER) by 2030. By retrofitting homes in a manner that focuses on enhancing their insulation, homeowners don't have to use as much energy on space heating within their home, which will naturally lead to emission reductions within the residential sector.

The residential section of this report will seek to analyse what retrofit measures may be suitable for properties in the Mullingar SEC based upon Housing age, occupancy, ownership and type.

Furthermore, the fuels used to heat homes within the Mullingar SEC are analysed for their emissions in tonnes of CO_2 equivalent. The fuel mix can have a significant impact on the carbon footprint of a community as each fuel type has its own associated CO_2 output. For example, coal and oil produce approximately 0.4kg and 0.3kg of CO_2 for every kilowatt hour of energy delivered, compared to just over 0.2kg for natural gas.

The BER is based upon the provision of space heating, water heating for domestic purposes, ventilation, and lighting. The BER does not include what are called point load consumption such as plugged-in electric appliances. An excellent reference which provides a breakdown of all energy used in the home is the "SEAI Energy in the Residential Sector 2018 Report.

A breakdown of the communities BER ratings per Small Area Plan is provided, which helps identify those sectors of the community which require most investment in terms of improving their BER. Given that a BER is a reflection of a home's energy efficiency, a lower BER (e.g. G) will imply that homeowners are using more fuel to heat their homes, which is in direct contradiction with the 2030 target's set by the Government. A communities' BER is also closely linked to social deprivation and fuel poverty.

[2] A process where you look at the house's overall energy efficiency and use a combination of measures to improve it.

Given the continued rise in energy costs, a good BER (B2 and above) can alleviate homeowners from fuel poverty and prevent others from going into it.

Method

An analysis of the residential housing stock in the catchment area of has been carried out based on Central Statistics Office (CSO) data and the Eircode data provided by ESRI.

The residential housing stock is based on a baseline year of 2016 and a breakdown of the number of residential units which are vacant or classified as holiday homes is derived from the Eircode Database which is based on a baseline year of 2021. Statistics for residential heating are based on national averages against primary heating type. This allows for future analysis against future census data.

The SEAI Building Energy Rating (BER) Map shown in Figure 7 (Page 17) displays colour coded 'Small Areas' of the Mullingar SEC. The colour of a given small area represents the BER of the median geo-located dwelling in that small area. The map only contains BER Information at the Small Area level for dwellings that have had a BER completed. The medians were derived from all geo-located dwellings with a BER in that particular Small Area.

SEAI's corresponding prices and emission factors as of 2020 were applied to calculate the total spend and CO_2 emissions for various sources of energy and heating.

Results and Analysis

Housing Ownership

Within the catchment area approximately 61.8% of the housing is owner occupied. With 30.5% outright ownership (no mortgage or loan), this can imply a greater appetite to engage in home retrofits as the occupiers are the decision makers in relation to energy upgrades and have a clear incentive to upgrade.

Equally, for rental properties, it is in landowners' best interests to upgrade the homes they own with retrofit measures in line with the projected minimum BER increases for rental properties that the Government are implementing from 2025.

However, given that landlords themselves will not reap the benefits of a warmer home and cheaper energy bills, a strong strategy of engagement and encouragement will be required for landlords until obligatory measures come into effect.

Table 3 – Breakdown of the various different occupancy types in catchment area (CSO, 2016)

Occupancy type	No. of homes	% of homes
Owned with mortgage or loan	2759	31.3%
Owned outright	2685	30.5%
Rented from private landlord	2169	24.6%
Rented from Local Authority	815	9.2%
Rented from voluntary/co-operative housing body	50	0.6%
Occupied free of rent	103	1.2%
Not stated	231	2.6%
Total	**8812**	**100%**

Housing Type

A very significant percentage of the housing stock in the catchment is classified as detached, semi-detached or terraced housing with a smaller percentage classified as flats or apartments. This again is a positive sign for Mullingar SEC, as the options for retrofitting a home increase with detached, semi-detached and terraced housing as there is less chance of interfering with other properties.

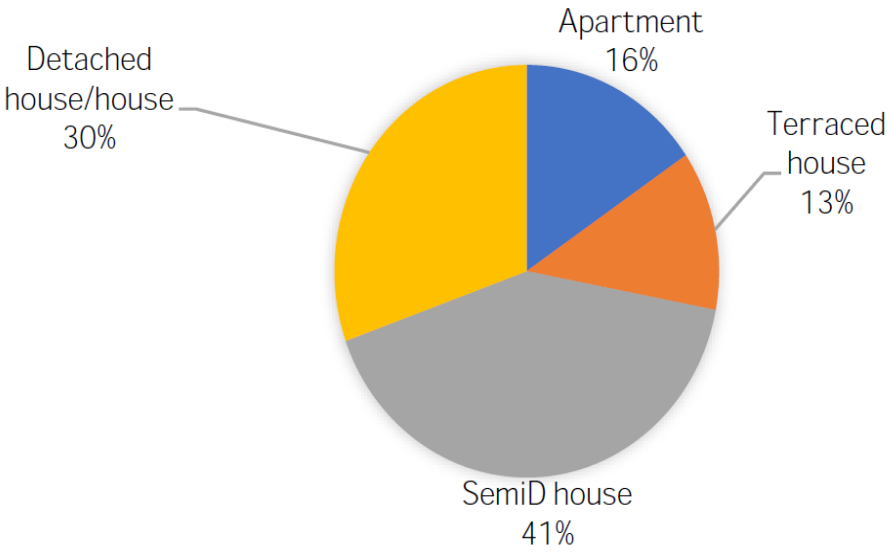


Figure 2 - Housing Stock type within SEC by percentage (Sourced from RetroKits analysis of the catchment area's housing stock

Housing Age

Within the catchment area there is a good mix of housing age types which will each require different energy efficiency measures to achieve a more energy efficient housing stock. 31.8% of Mullingar's housing stock would be considered modern having been constructed after the year 2000, which indicates that measures such as cavity insulation improvements and attic insulation can be promoted.

Housing which was constructed prior to the introduction of the building regulations tended to be solid wall or hollow block construction which is unsuitable for cavity insulation due to the lack of a suitable cavity. These buildings tend to be more suited to internal or external insulation measures[3].

With 41.9% of dwellings having been constructed from pre 1919 – 1990, this strongly indicates that a large number of homes will present opportunities to improve energy efficiency and reduce their energy requirements. However, the types of buildings within lower age bands present many challenges due to the historic construction methods applied from their era and materials used, alongside the importance associated with preserving the cultural heritage of these homes.

[3] External Wall insulation involves fixing insulation materials such as mineral wool or expanded polystyrene slabs to the outer surface of the wall. The insulation is then covered with a special render to provide weather resistance. A steel or fiber-glass mesh is embedded in this render to provide strength and impact resistance.

Table 4 – Age profile of the Mullingar SEC housing stock (CSO, 2016)

Period	No. of homes	% of homes
Pre 1919	337	3.8%
1919 - 1945	302	3.4%
1946 - 1960	457	5.2%
1961 - 1970	567	6.4%
1971 - 1980	1161	13.2%
1981 - 1990	871	9.9%
1991 - 2000	1620	18.4%
2001 - 2010	2685	30.5%
2011 or later	117	1.3%
Not stated	695	7.9%
Total	**8812**	**100%**

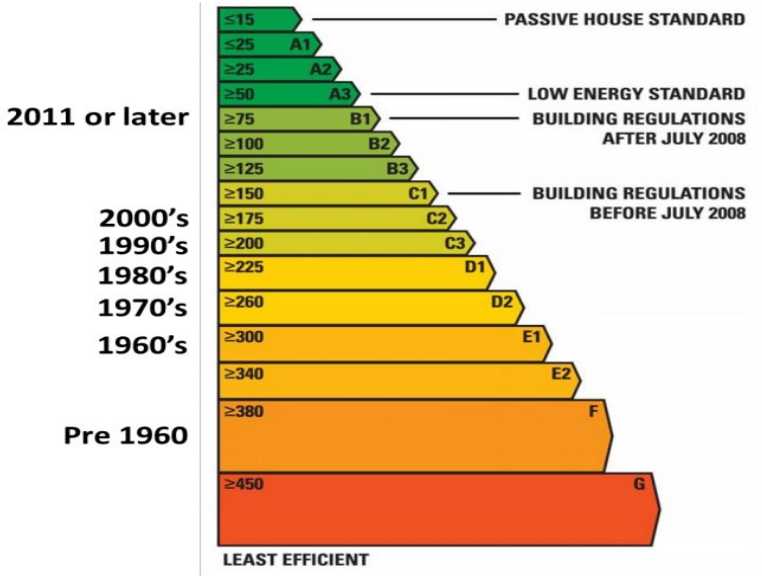


Figure 3 - Typical BER for house age type before upgrade works

Housing Fuel Mix

The residential fuel mix as illustrated in Figure 4 provides a breakdown of the different types of fuel sources used in the community for the heating of residential properties. The CO_2 Emissions associated with Mullingar SEC is linked to the type of fuel consumed within the community. By using different less carbon intensive fuels, a community can significantly reduce the CO_2 footprint from the energy it consumes to heat its homes. The ideal situation for any community is to reduce the level of energy required to heat their homes through energy efficiency measures and to provide the remaining heat requirements from low or natural CO_2 producing fuel sources.

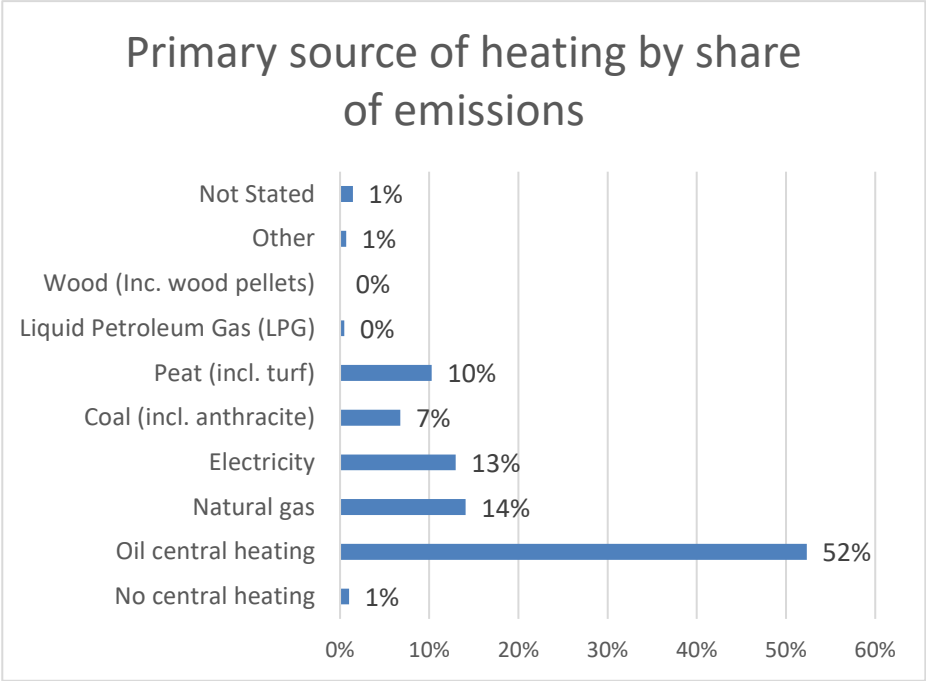


Figure 4 - Percentage emissions in tCO_2e (CSO, 2016)

Table 5 - Residential Fuel Mix (CSO, 2016)

Heating Type	Number of units	Fuel	% of Total Thermal Energy	Thermal TFC (kWh)	Emissions tCO_2e
No central heating	89	Oil	1%	402,665	106.3
Oil central heating	4618	Oil	52%	14,384,860	3796.2
Natural gas	1623	Natural Gas	18%	3,068,585	628.1
Electricity	908	Electricity	10%	6,317,675	3050.2
Coal (incl. anthracite)	462	Coal	5%	3,124,125	1064.1
Peat (incl. turf)	672	Peat	8%	805,330	286.6
Liquid Petroleum Gas (LPG)	48	LPG	1%	819,215	187.8
Wood (Inc. wood pellets)	200	Wood Pellets	2%	374,895	0.0
Other	62	Other	1%	152,735	39.3
Not Stated	130	Other	1%	430,435	110.6
Totals	**8812**			**23,562,845**	**9,269**

Within Mullingar catchment area, the main fuel types are currently oil and natural gas which make up 70% of the total thermal energy consumed. Combined, these two fuel types make up 66% of the CO_2 emissions from the Residential sector. Oil is the primary source at 52% which is typical for a large proportion of houses built pre-2011. Whilst this finding does raise cause for concern, it also demonstrates the huge level of potential for the community to significantly reduce its carbon footprint.

Electricity having such a sizeable share of the heating is surprising as this is not typical in Ireland. The state average is 8.6% compared to Mullingar SECs 10%. The type of heating system this electricity is feeding is unknown but may suggest either heat pump systems, or electric heating through storage heaters or similar. Given the age and occupancy of the housing stock it would be fair to conclude that the latter is most likely.

Housing BER Coverage

An analysis of the Building Energy Rating (BER) of the current residential housing stock within the Mullingar SEC was carried out. The average BER rating has been determined, however this figure is based upon a limited number of buildings which have had BER's carried out on them and should be reviewed in that context.

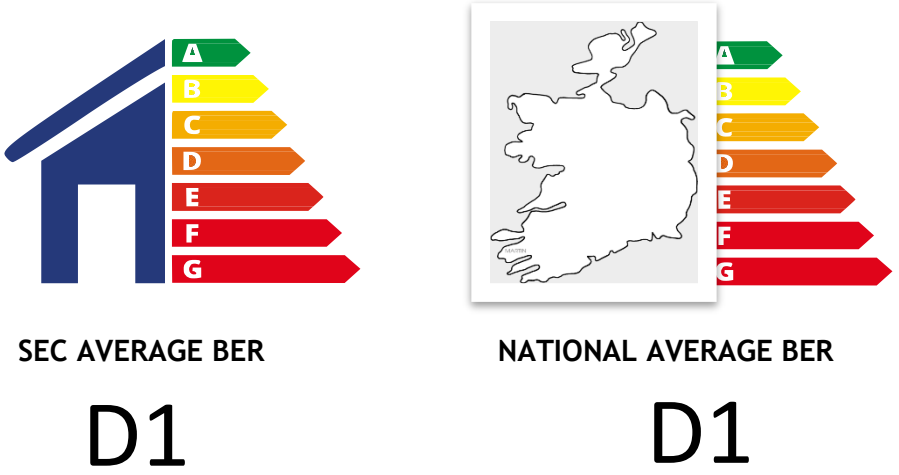


Figure 5 - Building Energy Rating information on the catchment area (SEAI, 2022)

Of the 8,812 homes registered within the catchment area, 41% of these homes have BER certificates. The number of dwellings in Mullingar with a recorded BER of B or greater is marginally lower than the national average (5% vs 11%).

The data in Figure 6 indicates that BERs for a large volume of Mullingar SEC's residential building stock ranges from a C1 to a D2, 75.1% collectively, with such dwellings requiring between 150-300 kWh/m2/yr. of energy.

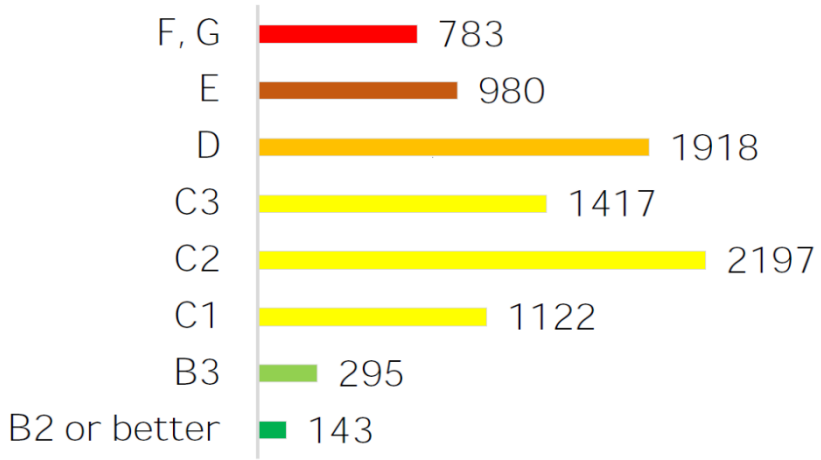


Figure 6 – Estimate of BERs for all homes in the Mullingar SEC catchment area (RetroKit, 2022)

The chart above indicates that 98.4% of the housing stock in the Mullingar SEC lie below the Irish Government's target BER B2. However, of that total, approximately 56.8% lies within a boundary of B3 – C3 which shows that a majority of the housing stock can be brought up to this rating without deeply extensive retrofitting measures.

It's interesting for SECs to see how each subsection of their community fares in terms of BERs. This can reveal insights into fuel poverty and nudges decision makers towards those areas in need of most investment. The map below of the Mullingar SEC illustrates the median BER's which have been recorded in each Small Area Plan.

It should be noted that this information is based on a limited number of BER data and is presented in an illustrated format to allow for comparison in future reports.

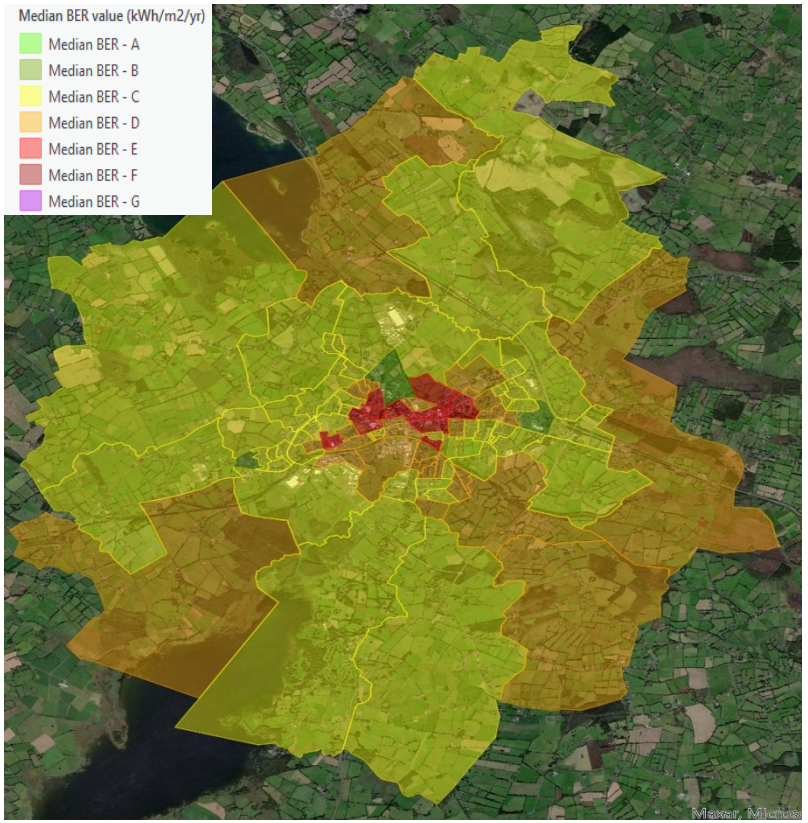


Figure 7 - Map of Median BER in the catchment Area (SEAI, 2022)

When we compare those Small Area Plans with a poor BER rating in the image above, to those which score poorly on the Pobal deprivation index (Figure 8), we can see there is a correlation between the two. This sort of data provides local decision makers and the Mullingar SEC with the appropriate knowledge about their area, so that they can prioritise which areas should receive investment for home energy upgrades. These two images make clear that it is the Mullingar Urban Area, specifically those areas close and adjacent to the town centre which are in most need of investment in terms of upgrading the energy efficiency of homes.

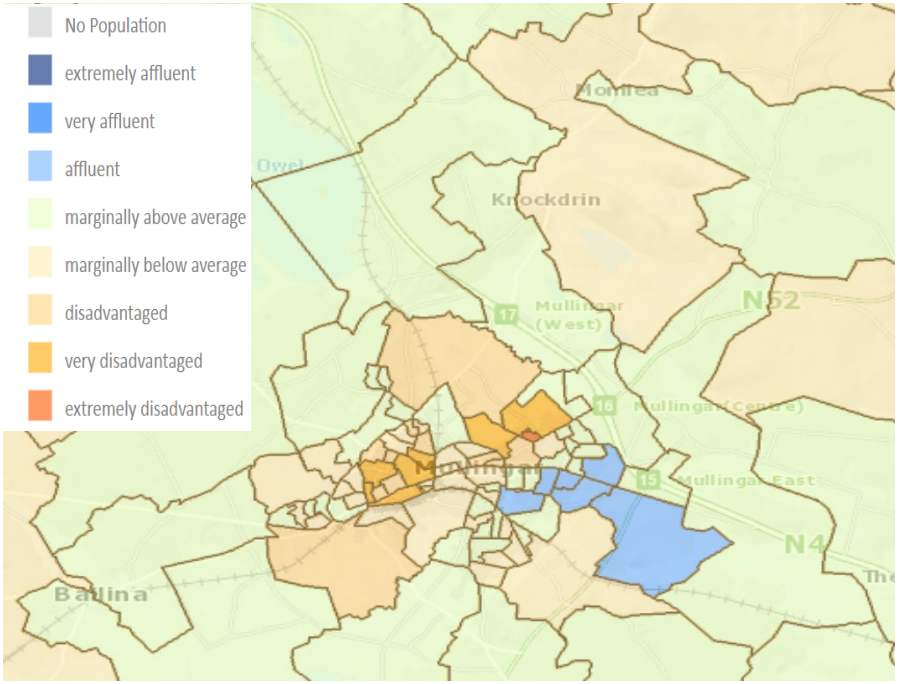


Figure 8 – Trutze Haase Pobal HP Deprivation index for the catchment area (Pobal, 2016)

[4] https://www.gov.ie/en/press-release/government-launches-the-national-retrofitting-scheme/

Residential Energy Baseline

To calculate the residential sector's energy baseline, national residential data was obtained from the Central Statistics office (CSO) Small Area Population Statistics (SAPS), which lists the housing stock present in a specific area by house type and year of construction.

Table 6 - Residential Energy, CO_2 and Spend (CSO, 2016; SEAI, 2022)

	Electricity	Fossil Fuel	Renewable	Total
Total Primary Energy (kWh)	88,401,931	28,668,360	931,684	118,001,974
Total CO_2 (tonnes)	29,438	8,546	0	37,983
Total Spend (€)	€8,010,531	€8,824,468	€209,941	€17,044,940

For homeowners who wish to upgrade their BER's, The Sustainable Energy Authority of Ireland (SEAI) provides financial incentives to homeowners in the form of grants and supports, details of which can be found in the Appendices. It's important that homeowners are supported throughout the application process, so that they are investing in measures that are appropriate for their home.

Whilst the costs of many of the retrofit measures associated with improving a home's energy efficiency may appear prohibitive on the surface for both lower income groups and landlords alike, SEAI's new 'National Retrofitting Scheme'[4] has meant home upgrades are more achievable for homeowners than ever before.

For example, homeowners can now avail of grants equivalent to 80% of the typical cost for attic and cavity wall insulation, with an upper limit of €2,500. These measures have been shown to improve energy efficiency significantly within typical Irish homes and should be an affordable measure for the majority of homeowners in Mullingar SEC.

Furthermore, the Warmer Homes Scheme offers free energy upgrades for eligible homeowners who are most at risk of energy poverty. A budget allocation of €109 million has been provided for this scheme this year. The scheme will target the least energy efficient properties, by prioritising homes that were built and occupied before 1993 and have a pre-works BER of E, F or G. Applications will also be accepted from qualifying homeowners who previously received supports under the scheme, but who could still benefit from even deeper measures.

Given that energy costs are expected to remain at the very least the same level in the coming years, if not increase further, it is vital that homeowners in lower income groups utilise these grant streams to protect themselves against falling into, or further into fuel poverty.

****Please see the Appendix section for a Summary of these grants****

Retrokit

Background

The momentum within the country has been to upgrade the fabric of buildings so that heat pumps can be utilised as the primary heating source. However, in order for heat pumps to be a viable option, buildings need to be insulated to a level where they have a Heat Loss Indicator of 2.0 or less. SEAI define these dwellings as being 'heat pump ready' [5]. If properties are not insulated to an adequately high level, then this technology is not suitable as a primary heat source.

The government's climate action plan has set a BER of B2 as the target for the energy performance of homes. This target is in line with current building regulations - 'Part L conservation of fuel and energy'[6], which specifies that buildings undergoing 'Major Renovations' [7] must achieve a BER B2 or a 'Cost Optimal' level of energy performance. As already referenced, this will require hundreds of thousands of homes across the country to be retrofitted so to achieve a B2 BER or better.

In order to accurately identify the fabric upgrades that need to be carried out to upgrade Mullingar's residential housing stock to a BER rating of B2 (or better) and to achieve "heat pump readiness", a software package known as 'RetroKit' was employed.

Method

RetroKit is a decision-support tool developed by RetroKit Ltd which compiles a wide range of data sources and applies analytics to establish the current energy performance of the housing stock in a community. It generates data on the housing stocks energy use, expenditure, CO_2 emissions, BER rating and Heat Loss Indicator amongst many other variables.

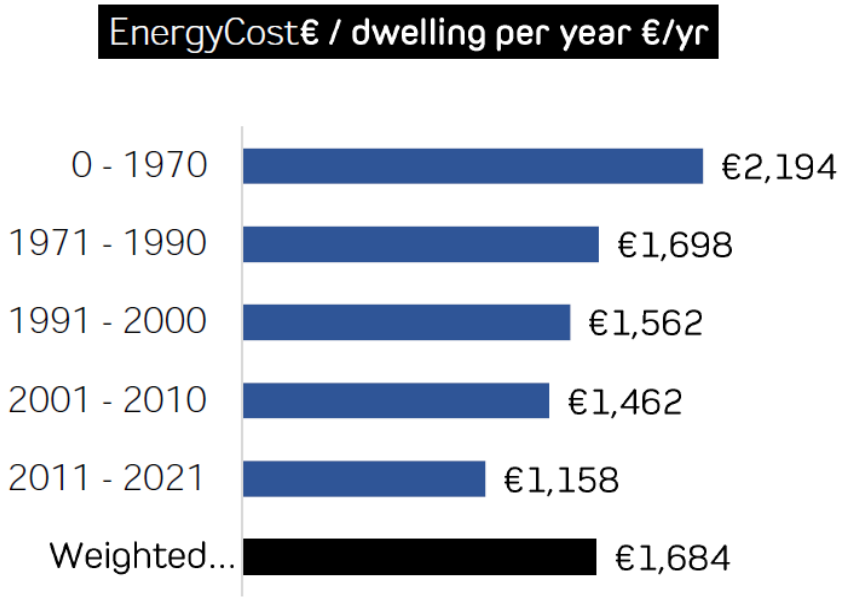


Figure 9 – An example of how RetroKit analyses the catchment areas housing stock

[5] Heat Loss Indicator (HLI) value is the total heat loss per m2 of dwelling floor area. A minimum HLI of 2 Watts/Kelvin/m2 must be achieved to be suitable for a heat pump however in some cases, where upgrades may not be cost- optimal, a value of HLI up to 2.3 Watts/Kelvin/m2 can be accepted provided additional requirements are met

[6] https://assets.gov.ie/180475/e532a9c5-3ec6-4a4c-8309-02f8a653e2d8.pdf

[7] Major renovations refer to upgrades where more than 25% of the building envelope. Painting, re-plastering, rendering, re-slating, re-tiling, cavity wall insulation and insulation of ceiling are not considered major renovation works.

RetroKit then uses this data to compare what impact a range of retrofit scenarios would have on the community's housing stock – analysing those same variables of energy use, expenditure, CO_2 emissions, BER rating and Heat Loss Indicator.

Table 7 - Residential Building Upgrade Scenarios

Retrofit Scenario	Summary of works
Shallow Fabric	Basic measures such as better air tightness, cavity and loft insulation, cylinder insulation, LED lights and wood stove
Medium (boiler)	"Shallow fabric" plus External Wall Insulation, boiler, controls, new door, double glazing
Medium (Heat pump)	"Shallow fabric" plus External Wall Insulation, heat pump, controls, new door, double glazing and Heat Pump
Deep (Heat Pump)	Medium (Heat Pump)" plus triple glazing, sloping ceiling internal insulation, demand control ventilation, Photovoltaic (PV) system

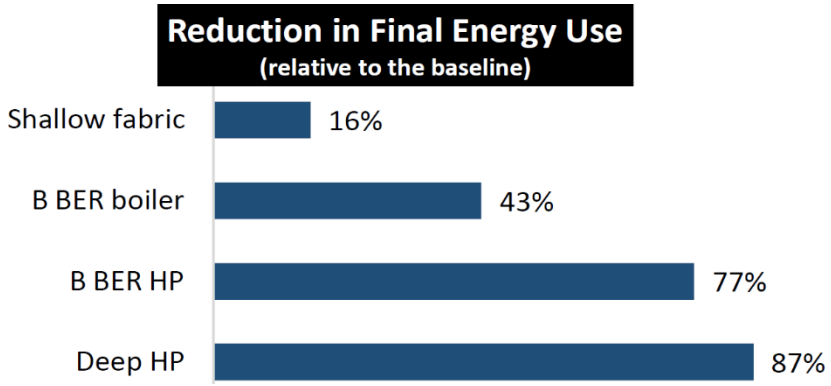


Figure 10 – An example of how RetroKit compares the retrofit scenarios and applies them to the catchment areas housing data

RetroKit Case Studies

Once a baseline analysis to determine the energy usage of the community's housing stock is completed, RetroKit runs a number of customised scenarios, based on the shallow, medium or deep fabric upgrade scenarios mentioned above.

These scenarios are applied against the most common house types in the Mullingar community using the BER Research tool in order to demonstrate what fabric, heating and renewable energy upgrades would take place in each typical home through a tailored home energy upgrade plan. The typical homes are classified based on 5 age bands, 4 dwelling types, 4 main space heating fuels and 3 main external wall types.

This provides most homeowners across the community with a case study very similar to their own dwelling. In the case of the Mullingar SEC, six common property types were selected and are displayed in Table 8.

These home energy upgrade plans will help homeowners in the Mullingar community understand how a house like theirs can be upgraded, the typical costs involved, whilst also including a breakdown of the revised BER rating, energy consumption and energy costs of the investment for the homeowner, along with many other variables for each scenario.

Table 8 – Mullingar SEC RetroKit dwelling selection

Age Band	Dwelling Type	Main fuel type	Main wall type
1971 - 1990	Detached house	Heating oil	Cavity
2001 - 2010	Semi-detached house	Gas or Liquid Petroleum Gas	Cavity
< 1971	Detached house	Heating oil	Solid or hollow
1991 - 2000	Semi-detached house	Heating oil	Solid or hollow
1971 - 1990	Terraced house	Solid fuel	Cavity
2001 - 2010	Terraced house	Gas or Liquid Petroleum Gas	Cavity

Whilst the use of standard assumptions (e.g., fixed heating schedules and hot water usage) and using 'typical homes' means that running costs and energy usage estimated by RetroKit will differ somewhat from actual data for specific dwellings, they provide a highly detailed representation of what the impact of a retrofit project would be for typical homes in the Mullingar community.

*Please be aware that due to the fluid nature of grant schemes, RetroKits' software does not take into account the money that homeowners can earn from grants that would fund the measures outlined in the Home Upgrade Plans. This means that the costs of upgrading the homes and community as a whole, are likely to be notably lower than the costs outlined by RetroKit in their calculations.

A selection of the results from the RetroKit software for the Mullingar SEC can be found in the Appendix. Supplementary data is found in the Appendix.

Non-residential

Background

In order to achieve a 51% reduction in Carbon emissions by 2030 and a subsequent 'Climate neutral economy' by 2050, the Non-residential sector will have to go through a period of transition in the same way as other sectors of the economy. Over the next decade businesses are encouraged to invest in a greener future, through sustainable products, services and business models.

Since the financial crisis, Ireland's economy has shifted from one influenced by the construction sector, to one which is more influenced by SMEs. There are an estimated 234,000 SMEs in Ireland, meaning there is significant potential to reduce emissions within this sub-sector.

Many of the avenues that the sector can take to reduce their carbon footprint and move towards a more sustainable model show crossover with the opportunities in the residential sector. However, there are a significant number of commercial processes such as refrigeration within convenience stores, air compressors at warehouse facilities and lighting arrangements in the hospitality industry which use significant amounts of energy and require tailored strategies to reduce this.

Given the turnover that some SMEs are recording in Ireland it can be difficult to have oversight of all monetary outgoings from a business. Therefore, many business owners simply don't notice the amount of unnecessary energy they are using in the day-to-day running of their business.

For this reason, an important theme throughout all these reports is the importance of engaging employee's regarding good energy management and educating all building users on the ways in which everyone within the building can contribute towards saving energy. Simple measures, such as upgrading to more energy efficient appliances, or switching off IT equipment rather than leaving on standby, have proven to be successful in saving energy.

The recent Government announcement aimed at accelerating the decarbonisation of Irish businesses will see a new €55 million programme to help businesses plan for a more sustainable future and accelerate their decarbonisation journeys. The programme, which will run over the next five years will primarily comprise of the following:

- The Climate Planning Fund for Business, will give businesses a €1,800 grant to devise a personalised plan to identify how best to eliminate their reliance on fossil fuels and up to €50,000 matched funding to go towards specific capacity building

- The Enterprise Emissions Reduction Investment Fund will offer up to €1 million for manufacturing businesses to upgrade their processes. With funding to invest in energy monitoring and tracking, carbon neutral heating processes, smart metering and research and development

Method

An analysis of Non-residential energy consumption within the catchment area was carried out using various data sources including the Chartered Institution of Building Services Engineers (CIBSE) Energy Benchmarks and SEAI's 'Extensive Survey of Commercial Building Stock in Ireland'.

In order to estimate the potential energy usage of all Non-residential premises within the catchment area, a method based on the estimated floor area and business category was designed. Energy benchmarks for various business categories were sourced from "CIBSE TM46 Energy Benchmarks and Energy Consumption Guide" and were applied to the floor area data available.

As part of the energy master plan for Mullingar, three Non-residential premises were given what is known as an 'Ashrae Level 1' audit. This is a simple audit that involves a basic walk-through assessment, review of utility bills and other applicable operating data, and interviews with operations staff to identify any opportunities within these premises for energy efficiency upgrades.

It is recommended that the organisations implement the measures identified in their reports to contribute towards the energy consumption reduction goals as set out in the Climate Action Plan.

The premises that were audited are listed below and a detailed report was provided to each of the property owners, the results of which are located within the Appendices:

- Mullingar Charity Variety Group
- St Oliver Plunketts GAA
- Town Band Hall

Results and Analysis

Table 9 provides an overview of the estimated total energy usage, emissions and spend from the Non-residential sector within the Mullingar SEC. This helps the Mullingar SEC get an idea of just how much their Non-residential sector needs to reduce its energy usage by in order to keep in line with the Irish Government's targets in the Climate Action Plan.

Table 9 - Mullingar SEC Non-residential Energy, CO_2 and Spend (CIBSE, 2012)

Electricity typical benchmark (MW·h)	Fossil-thermal typical benchmark (MW·h)	Illustrative electricity typical benchmark (tCO2)	Illustrative fossil-thermal typical benchmark (tCO2)	Illustrative total typical benchmark (tCO2)	Illustrative total Energy Spend (€)
31285	**59601**	**17223**	**11324**	**28547**	**€53,654,465**

Support for SMEs

Aside from the recommendations contained within the EMP and supplementary Non-residential audits, businesses can utilise the recently created ClimateToolKit [8] website launched by the government to help businesses get started in taking climate action.

This online tool allows SMEs (Small and medium-sized enterprises) to input some simple information and get an estimate of their carbon footprint and a personalised action plan to reduce it. Each tailored action plan includes straight-forward, practical instructions and highlights the relevant help that is available from Government, through agencies such as Enterprise Ireland, the Local Enterprise Offices and SEAI.

SEAI are currently running an energy audit scheme that offers SMEs a €2,000 voucher towards the cost of a high-quality energy audit[9]. These energy audits are suitable for businesses with an annual energy spend of over €10,000. These energy audits delve deeper than those contained within this report, analysing the sites suitability for various renewable technologies, the most significant users of energy in their business and their overall Carbon footprint. A highly detailed audit like this gives business owners the confidence to take appropriate steps to improve both their energy efficiency and reduce their annual energy bills.

The Non-residential audits identified several opportunities within the premises and Mullingar SEC which can be developed into energy efficiency projects. The projects are detailed within the Register of Opportunities document and the full reports are included in the Appendices. Some of the most noteworthy projects are:

Mullingar Charity Variety Group

- Insulate the building on a room-by-room basis to avoid large expenditure

St Oliver Plunketts GAA

- All lighting across the site should be upgraded to energy efficient LED light fittings

Mullingar Town Band Hall

- Install Energy Monitoring Equipment within the building so that targeted interventions can be made, and inefficient processes/appliances can be upgraded

Mullingar SEC

SME's that spend €10,000 on energy per year are eligible for an in-depth energy audit which helps businesses understand:

- How much energy the business uses
- The equipment and processes that use the most energy
- What actions businesses should take to save energy, their estimated cost, impact and suitability for renewable energy

[8] climatetoolkit4business.gov.ie

[9] https://www.seai.ie/business-and-public-sector/small-and-medium-business/supports/energy-audits/

Energy in Transport

Background

Transport in Ireland is currently deeply dependent on imported fossil fuels. Emissions from transport powered by fossil fuels were by far the largest source of energy-related CO_2 in 2020, as they were responsible for 40% of the total and it is the only sector where CO_2 emissions have grown since the end of the recession in 2012. Road transport specifically accounts for 96% of all greenhouse gases associated with transport, so a modal shift is critical.

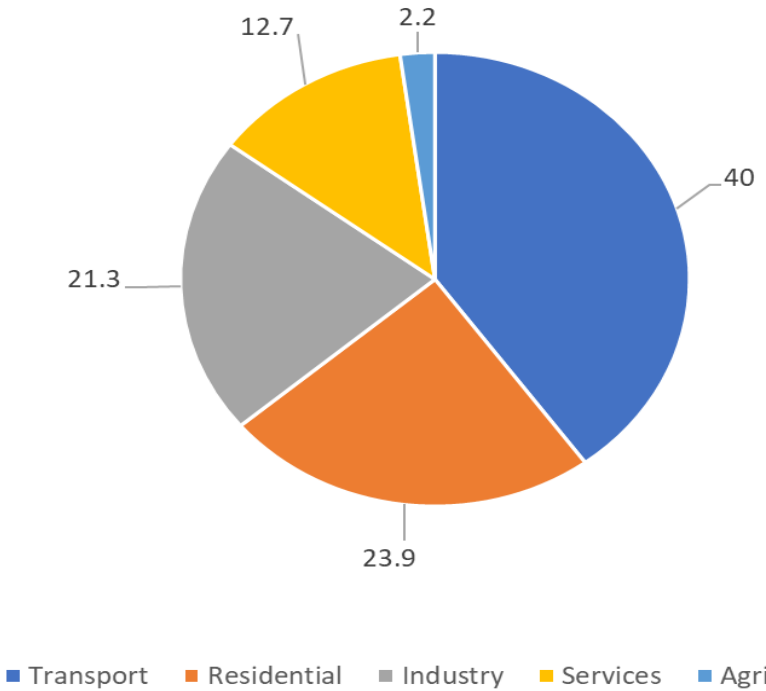


Figure 11 – Percentage share of Energy Related CO_2 by sector for 2020 in Ireland (SEAI, 2020)

The Climate Action Plan stipulates that there must be a 42-50% reduction in emissions from the transport sector by 2030 if Ireland is to meet its Climate targets.

In order to achieve these emission reductions, it is clear that a transition towards more sustainable forms of transport is required. To realise this transition, many forms of transport must be maintained, planned, and provided for the region. This ranges from safe and accessible walking and cycle routes to appropriate public transport links serving the needs of the residents, to the implementation of appropriate infrastructure to support the electrification of private car and fleet vehicles.

The standout targets for the Transport sector as part of the Climate Action Plan are to:

- Provide an additional 500,000 daily public and active transport journeys
- Electrify 845,000 passenger cars
- Electrify mass transportation with up to 1,500 Electric Buses

This will necessitate a change in the traditional ‘road hierarchy’ which has dominated Irish roads for years, starting with active travel and then public transport being encourage over the private car.

Ireland's rapidly growing economy in recent years has brought with it urban sprawl and low-density development which has locked in unsustainable travel patterns and a reliance on private cars, bringing with it entrenched behavioural patterns that will have to be overcome.

The impact of the COVID-19 pandemic, with the introduction of severe travel restrictions and greater remote working practices, is estimated to have resulted in a reduction of 16% of transport emissions (excluding aviation) in 2020 compared to 2019 levels. The pandemic has shown that large scale behaviour change is achievable and that new patterns of mobility and working can play a part in the transition to a more sustainable transport system.

Method

An analysis of the means of transport for workers and students as well as the transport fuel mix in the catchment area has been carried out based on data from the Central Statistics Office (CSO). SEAI's corresponding energy usage, prices and emission factors for various forms of transport as of 2020 were applied to calculate the total spend and CO_2 emissions for various sources of fuel for vehicles in the catchment area.

Results and Analysis

Commuting to work

Commuting to work by private car is the primary method of transport in the Mullingar SEC with 70.5% of workers either driving or being driven by car.

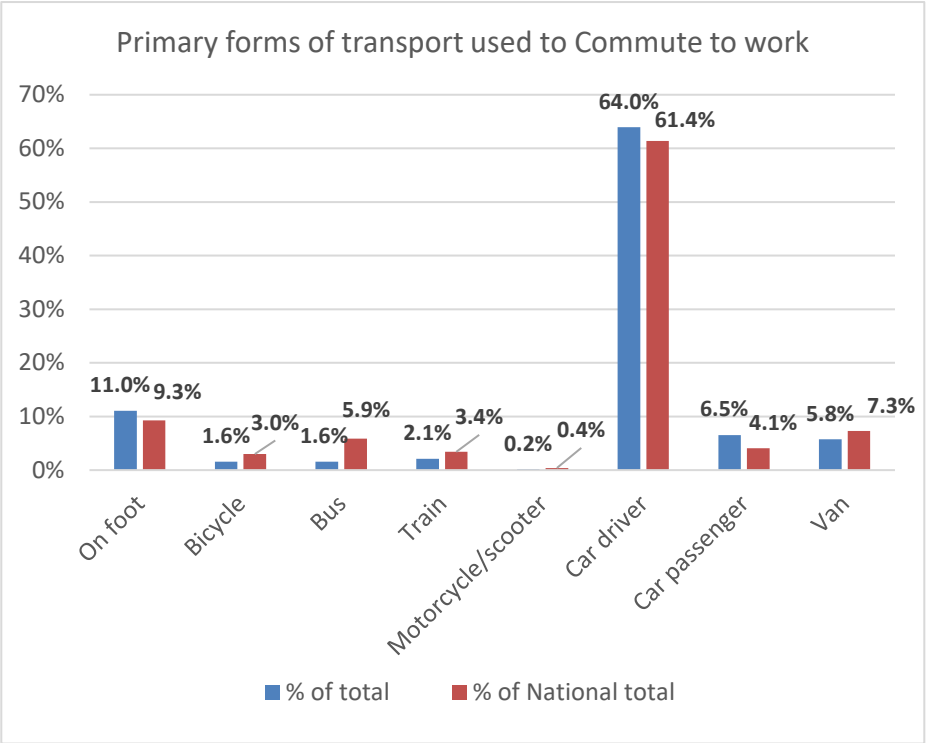


Figure 12 – Primary forms of transport used to commute to work (CSO, 2016)

Mullingar lags behind national averages in public transport usage for commuting to work. To tackle these low levels and shift more commuters away from driving traditional fossil fueled cars, typically we would recommend that the Mullingar SEC try to encourage commuters who travel within a 15km radius of the town to utilise bus services to the surrounding area if they are available. Unfortunately, it is noted in feedback from members of the community that the public transport network around Mullingar is disjointed and lacks regular direct routes to many of the most popular destinations in the surrounding area.

To address this, the SEC and other community groups should lobby Westmeath County Council and/or contact local bus service providers and prove that sufficient demand is there to add more direct and frequent routes. Ultimately, whilst the census results were recorded in 2016 and the percentage of bus users could have risen, the SEC should try to investigate why the number of bus users is so low.

In terms of emissions reductions, whilst it will be difficult for Mullingar SEC to have any meaningful impact on the fuel choice used by the likes of Bus Eireann, they can campaign their Local Link services to begin the decarbonisation of the bus fleet. For example, Laois County Council along with TFI Local Link Laois Offaly has launched its first electric bus that will operate across both counties.

Mullingar SEC could lobby Westmeath County Council to replicate this initiative over the coming years and should be able to justify this given the population of Mullingar and surrounding towns. However, a more pressing matter is perhaps the lack of buses serving parts of the SEC, which may help explain why the service is currently so underused within Athenry.

Services such as Local Link operate successful services to isolated and vulnerable people within the community, as well as offering an alternative means of transport within the region. To ensure the continued operation of its services, it is important that the SEC circulate the operation of such services through as many means as possible social media, local newsagents etc.

Despite these issues, in comparison to many other medium sized towns, Mullingar has a relatively public transport infrastructure, with its own railway station which has ten trains going to Dublin a day. With a commute time of approximately 80 minutes, it is actually a faster option than car at peak hours. Unfortunately, due to its quite central position on the Sligo-Dublin railway line, overcrowding on trains to and from Mullingar can be a problem at certain times.

Given the importance of the Mullingar railway station, both to the town and wider region, county council representatives, councilors and politicians should lobby Iarnród Éireann to add more carriages during peak hours in order to ease congestion and improve passenger experience, making it more attractive for commuters. Conversely, it is important that the availability of such services continues to be promoted within the community, particularly in the wake of the 20% decrease in prices for Iarnród Éireann announced earlier this year.

Reducing car journeys through remote working

The impact of COVID-19 on the profile of transport in Mullingar cannot be understated and will have changed significantly in the last two years, with a greater shift to home-based working and education, thus leading to a reduction in car usage.

NUIG in conjunction with the Whitaker Institute have released data from 8,428 respondents on their experience of Remote Working. At the time of data collection (April 2022), 52% of respondents were working in a hybrid model (sometimes remotely, sometimes onsite), with 40% working fully remotely.

More than half (58%) of respondents said they had never worked remotely before the pandemic and almost all (95%) of respondents either agreed or strongly agreed that working remotely makes their life easier which suggests it will continue to be the norm for a significant amount of the population.

A reduction of 40% in work associated commutes could be achieved by working remotely 2 days a week, which could reduce transport emissions by 42-50%. Mullingar SEC could explore the potential for smart remote working hubs within existing community building infrastructure or as additions onto community buildings with childcare and after school facilities. It can also be used as an opportunity to give derelict buildings within the community a new lease of life.

The Building Block [10] in Sligo town is an excellent example of this, which is a shared working space that prior to its development in 2017, had been unused for 10 years. Key elements which will be required to make this successful are comfortable buildings with high-speed broadband and shared canteen facilities. It is understood that there are already multiple remote working hubs in Mullingar.

The SEC could try to take advantage of the recently announced grant funding for community hubs in the Town and Village Renewal Scheme, in order to modernise existing remote working spaces in the community and make them more attractive for remote working.

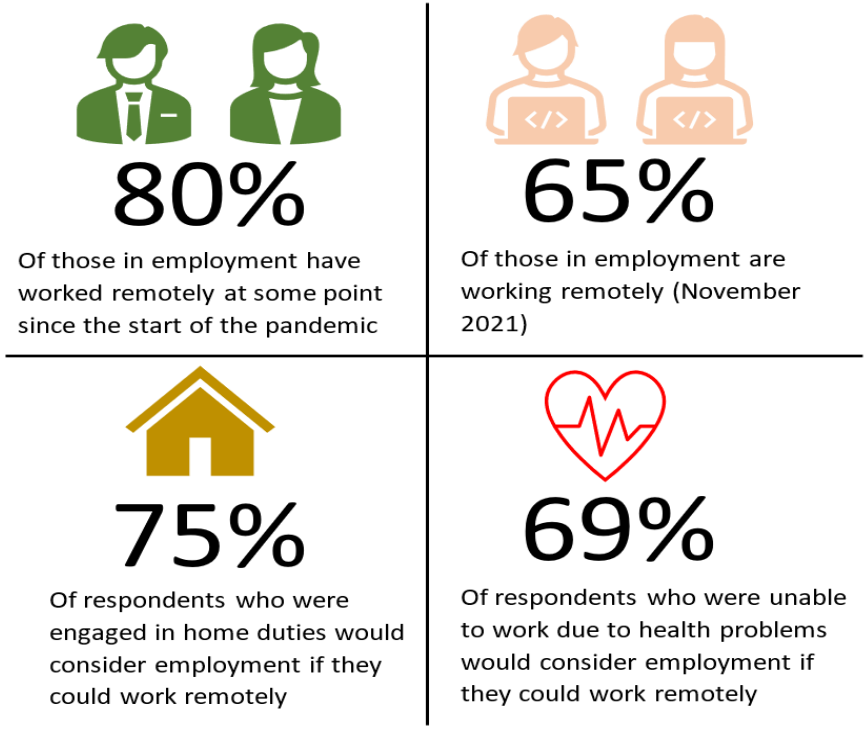


Figure 13 – Results from the CSO 'Our Lives Online: Remote Work' survey from November 2021

[10] https://tinyurl.com/9d756vrx

Commuting to school or college

The outcome is similar for students commuting to primary, secondary and college education. Naturally we would expect the car to dominate for primary school children, so this slightly skews the results. However, the community's low usage of public transport continues amongst the student population, with the Mullingar SEC's usage over 34% lower than the national average.

This may be seen as a cause for concern but could also be viewed as a significant opportunity, as the community could try to address this by lobbying their local councilors and TDs if they can prove there is demand for increased bus services to and from schools.

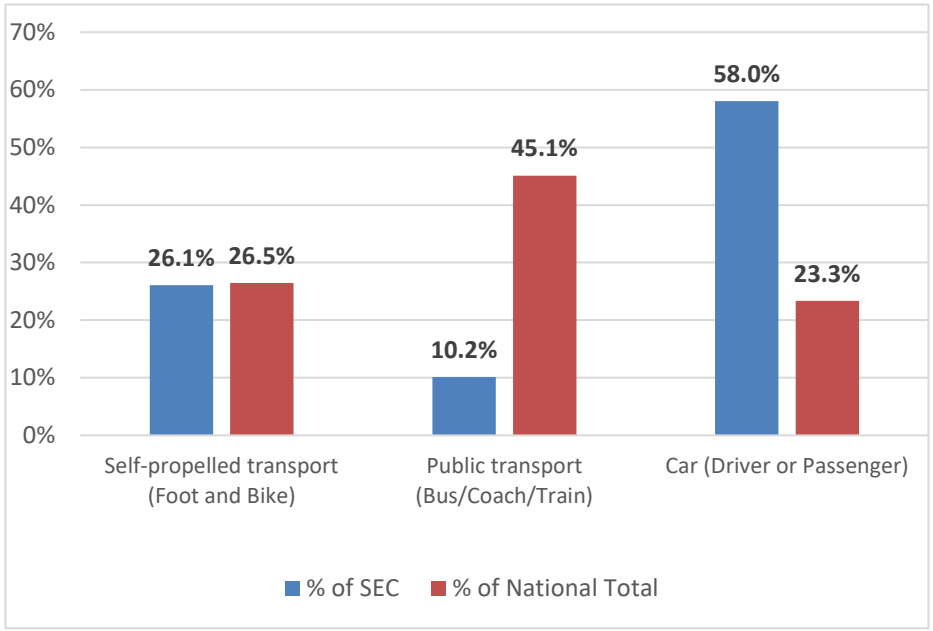


Figure 14 – Primary forms of transport for primary, secondary and college students (CSO, 2016)

Mullingar has a respectable level of students who either walk or cycle to school, with a rate almost identical to the national average. To increase this rate the Mullingar SEC could seek funding or grants in order to improve the active travel infrastructure in their community so that walkways and cycle paths are safer for students.

For example, The Safe Routes to School (SRTS) Programme launched in March 2021 and was open to all schools in Ireland to apply for active travel funding and delivery. Over €15 million was provided in Round 1 of funding to accelerate the delivery of walking and cycling infrastructure on key access routes to schools and on school grounds.

Often times, one of parent's primary concerns about their children using active transport to go to school is their safety when going out alone. One way to combat this is through a 'Cycle Bus'. A Cycle Bus is where students cycle along a designated route to school with parents accompanying them.

It is a parent/guardian/community-led initiative whereby several parents and volunteers lead groups of cycling students to one or more schools. Cycle Buses have a specific route with stops along the way where students can join. Whilst this began as in cities, it has since spread to smaller towns such as Skibbereen, Strandhill and Cootehill. Similar initiatives have popped up over the country, except rather than cycling, parents' guide children by foot in what is known as a 'Walking Bus'.

Energy consumption from transport

An analysis of transport related energy consumption was carried out for the catchment area. This was based upon a statistical analysis of vehicle ownership in the catchment area along with the types of vehicles used and their associated carbon emissions. As already referenced, the Census data shows that the majority of commutes within the catchment area is by car or van.

Table 10 – Means of commuting in the SEC (CSO, 2016)

Commuting to work	No. of people	% of total
Private transport	6580	69.9%
Passenger	616	6.5%
Public transport	348	3.7%
Walking, cycling	1185	12.6%
Work from home	266	2.8%
Other or not stated	417	4.4%
Total	**9412**	**100%**

Based on the information for vehicle ownership within the Mullingar SEC, it is possible to calculate the energy consumption and carbon footprint for the transport sector.

A national stock breakdown has been used to calculate energy consumption and emissions (56.9% diesel, 42.7% petrol, 0.4% Battery Electric Vehicle (BEV)) based on national average km travelled. Based on this information and values, a conservative estimate of energy used in transport is shown in Table 11.

Please note that the renewable portion of the fuels has been taken as follows: renewable content of electricity consumed (40% in 2020 used as 2021 was abnormally low), 5% of petrol consumption and 7% of diesel consumption (per Biofuels Obligation Scheme).

Table 11 - Mullingar SEC Transport Energy, CO_2 and Spend (CSO, 2016; SEAI, 2022)

	Electricity	Fossil Fuel	Total
Total Primary Energy (kWh)	118,571	75,590,887	80,957,677
Energy generated from renewables (kWh)	47,428	4,535,453	4,582,882
Total CO_2 (tonnes)	20.28	19,089	19,110
Total Spend (€)	€14,347	€9,775,747	€10,425,128

Switch to electric vehicles

A significant increase in the availability of long-range electric vehicles (EV) has made this mode of transport more suitable for environments outside of large urban centres. Electric vehicles will become the dominant mode of privately owner vehicles in the coming decade.

The key benefit for the user is the reduced operational costs associated with fuel to power the car. In fact, an analysis of the impact of changing 40% of the existing private vehicle fleet to battery electric vehicles is detailed in Table 12. It indicates that this switch could lead to a CO_2 reduction of 4,877 tonnes and a reduction in energy spend of approximately €2,232,300 per annum.

These are savings which can be recirculated around in the local economy, creating a more economically sustainable community. If the Mullingar SEC is struggling to avoid using cars or shift its residents to active or public transport, then a transition to electric vehicles shows that it can still reduce emissions, therefore aligning with the Climate Action Plan's targets.

Table 12 - Mullingar SEC Transport Energy, CO_2 and Spend with 40% Electric Vehicles (CSO, 2016; SEAI, 2022)

	Electricity	Fossil Fuel	Total
Total Primary Energy (kWh)	11,857,088	48,420,439	64,408,613
Energy generated from renewables (kWh)	4,742,835	2,905,226	7,648,062
Total CO_2 (tonnes)	2028	12,204	14,233
Total Spend (€)	€1,434,708	€6,258,259	€8,192,828

Table 13 - Comparison of CO_2 impacts and fuel costs based on 250km per week (SEAI, 2022; Bonkers.com, 2022)

Vehicle	Weekly fuel cost	Weekly gCO_2
Electric e.g. Nissan LEAF	€9.84	13,800
Volkswagen Golf (Petrol)	€33.40	41,750
Volkswagen Golf (Diesel)	€35.51	28,000

The Mullingar SEC should consider a public EV awareness event to promote awareness of the suitability of electric vehicles for suburban environments. Although it is a significant investment to purchase an EV, households with two vehicles should be encouraged to look at the possibility of having a smaller electric car alongside their first car for shorter journeys as a starting point on the route to electric vehicles. SEAI provides a series of supports to incentivise the transition from fossil fuel-based vehicles towards electric vehicles, details of which can be found in the Appendices.

Table 14 – Avoid–Shift–Improve Transport model

Pillar	Description	Example
Avoid	Avoid or reduce travel or the need to travel	Transitioning to increased remote working. Walking or cycling where possible
Shift	Shift to more energy efficient modes	Using public transport such as bus services
Improve	Improve efficiency through vehicle technology	Moving towards electric vehicles

Whilst we anticipate the accelerated growth of a 'second-hand' market to grow in the next five years, in the short term the Mullingar SEC should focus on implementing the 'Avoid-Shift-Improve' or ASI model for transport within the community.

Car Sharing/Pooling

Car sharing within a suburban environment can be complex due to the distribution of homes, however many people are likely to be travelling to the same locations on a regular basis, such as on school runs. Car sharing or pooling can reduce the number of vehicle journeys and reduce the cost for both the driver and its occupancy by sharing costs. Additional benefits include reduced driving and car maintenance costs as well as being very suitable for longer distance daily commutes.

It's worth noting that Mullingar is part of a Car sharing app known as 'GoCar'. GoGar are a nationwide car sharing scheme that allows members to book cars online or via their dedicated app for as little as an hour, with rates as low as €10 per hour for use. Currently there is 1 car and 1 van available in Mullingar via GoCar, but similar to other locations around the country this total would likely increase with more usage from the community.

E-bikes

Electric bikes (e-bikes) have risen in popularity in urban environments over the past decade and now represent a real alternative to more mature forms of transport when it comes to shorter journeys (<5km). As the name suggests, an e-bike is one with an electric motor. There are many types of e-bikes, from those that only have a small motor to assist the rider's pedal-power, or more powerful e-bikes that do not need to be pedalled at all.

E-bikes can be purchased by users from retailers, but their rise in popularity can mainly be attributed to private companies operating dockless shared schemes. In these shared schemes, private companies make e-bikes and e-scooters available to use for short-term rentals. These are typically "dockless", meaning that they do not have a fixed home location and are dropped off and picked up from certain locations in the service area.

It is noted that a bike share rental scheme already exists in Mullingar in the form of 'Moby' bikes. Mullingar along with Athlone have received 30 bikes each across ten locations this year as part of the scheme, with a potential for more depending on its success.

Now that there is an established presence of a bike share rental scheme within the town, there is an opportunity to expand this model to e-bikes. Whilst more expensive, e-bikes would open up cycling to members of the community who perhaps don't feel confident enough in their cycling ability to navigate the town and surrounding area on a traditional self-propelled bicycle.

It also negates one of the traditional criticisms of bicycles, that when compared to a car that they take longer/are not as convenient, as studies have shown e-bikes to reduce journey times by at least a fifth and up to 45%. This in turn means that longer journeys are more feasible for e-bike users, as less physical effort is required to cycle from place to place. Introducing e-bikes to the SEC would also tie in with the 'Old Rail Trail Greenway' – an uninterrupted cycle path extending from Athlone to Mullingar.

Mullingar SEC could follow the example of the Mulranny SEC who earlier this year announced the launch of a community e-bike rental scheme. What makes the Mulranny SEC scheme stands out is that the e-bikes are charged using electricity generated from Solar PV with battery storage at Mulranny's Tourist Office. Outdoor sockets, powered by the Solar PV array are available to the public as a free E-bike charging point. Mulranny is located on the Great Western Greenway route, so there are parallels to be drawn with Mullingar and the Old Rail Trail Greenway.

'Bolt' is one such example of a 'ride-sharing' company that has begun operating in Sligo Town. The 100-bike pilot scheme has trialled a range of parking options for the e-bikes, with the aim of 'dockless' parking, i.e., being able to park a rented bicycle in a different location across the town after a user is done with it.

Figure 15 – An example of a dockless parking station for the Bolt e-bikes in Sligo

Mullingar SEC should monitor progress in Sligo and if they deem that it could be replicated, they should lobby Bolt or a similar service provider to set up operations in Mullingar. Given the relative similarities in terms of population between Sligo and Mullingar, the Bolt model could provide Mullingar SEC with a template to build on.

E-Scooters

Similar to an e-bike, an e-scooter (Electric scooter) is a small platform with two or more wheels that is propelled by an electric motor. Whilst there are a plethora of start-ups seeking to launch e-scooter services in Ireland, e-scooter operators will have to wait until 2023 to get the green light as the Government formally introduces legislation governing their commercial usage next year.

However, users over 16 are still free to purchase their own e-scooters from retailers without the need for a licence. E-scooters have grown in popularity in recent years, particularly during the COVID-19 pandemic were users sought to find alternative means of transport in urban areas.

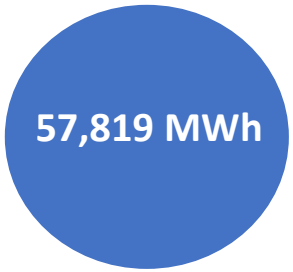
E-scooters have proven to be particularly popular with younger users, which is a positive for Mullingar, were almost 30% of the local population lies between the ages of 15-39 as per the last census results. Mullingar SEC should monitor progress on legislation regarding e-scooters, but in the meantime could begin building relationships with private vendors who have announced their intention to enter the market when legislation comes into force, particularly Irish start-ups to allow for a 'boots on the ground' presence for any proposed launch of a scheme.

Renewable Electricity

If a 20% reduction in electricity consumption could be achieved by Mullingar SEC through energy efficiency measures, there would remain a residual electric demand of 57,819 MWh. In order to offset this demand, it has been calculated that it would require the provision of a 26 MW of wind power, or 66 MW of solar power to service the Mullingar SEC catchment area.

A community led Renewable Electricity Support Scheme (RESS) project which has an upper limit of 5MW would be capable of providing a significant amount of the residual energy demand for the community.

Residual Energy Demand



A detailed set of calculations on the generator size and the arrangements to use the energy locally would need to be carried out under a more detailed scoping study. Initial calculations indicate that that a wind turbine or solar photovoltaic farm correctly sized and installed with the capacity described above could generate sufficient electricity to meet this demand. A battery or other storage solution may also form part of such an initiative.

Renewable Electricity Support Scheme

The Government of Ireland has put in place a scheme called the Renewable Electricity Support Scheme (RESS)[11] which aims to deliver increased community involvement in renewable energy projects. This scheme provides financial support for renewable electricity projects of over 0.5 MW in size in the Republic of Ireland.

RESS is an auction-based scheme, which invites renewable electricity projects to bid for capacity and receive a guaranteed price for the electricity they generate.

The application must be made in conjunction with a Sustainable Energy Community (SEC). The SEC must be identified in the Declaration of a Community-Led Project, together with a description of the relationship between the Applicant and the Sustainable Energy Community. In addition:

- Project size must be between 0.5 and 5 Megawatts
- Fully (100%) owned by a Renewable Energy Community (REC)- primary purpose is community benefit (environmental, economic, or social) rather than financial profit
- Community group must be based on open and voluntary participation
- Participation based on local domicile (within close proximity to the RESS project)

[11] https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/renewable-electricity-supports/ress/Pages/default.aspx

Community Benefit Funds

A key feature of RESS is that all projects must establish a 'Community Benefit Fund' to be used for the wider economic, environmental, social and cultural well-being of the local community. The amount payable by RESS Projects into the Community Benefit Fund by the Government is mandated at €2 per Megawatt hour of electricity generated from a RESS Project. This means there are quantifiable funds made available annually for the benefit of the local community.

This will allow communities to further invest in local renewable energy, energy efficiency measures and climate action initiatives. For RESS-1 alone it is envisaged that almost €4m in annual payments, over a period of approximately 15 years, will be paid into the Community Benefit Funds in communities that host RESS-1 projects.

In terms of electricity supply, one of the most important considerations for community energy projects is the available spare capacity on the electricity grid. It's important to be aware that all substations have a certain amount of capacity for electric generation.

In simple terms, this means we cannot build and connect an unlimited amount of Renewable Energy generating projects to the electricity grid without first upgrading it so that there is sufficient capacity available. It has been noted from feedback with local representatives that currently several Renewable Energy projects are delayed due to grid issues.

Therefore, it is important that the SEC engage with ESB, Westmeath County Council and other influential stakeholders to ensure adequate capacity is available to allow renewable energy projects to connect at reasonable costs.

Sustainable Energy Roadmap

The Sustainability Energy Roadmap is one of the key outputs of the Energy Master Plan as it outlines to the community the scale of the challenge faced in moving the community from their baseline to achieving 2030 reduction targets. The following analysis provides a general path for the Mullingar catchment area to begin its journey to reduce its CO_2 emissions over the next decade. These targets have been broken down in each of the sectors detailed in Table 16 below.

Table 15: - 7% Annual reduction in the Carbon Footprint for Mullingar SEC

Community CO2	
tCO2	**88,030**
% Annual CO2 Reduction	**7%**
Year	**tCO2**
2023	81,868
2024	76,137
2025	70,808
2026	65,851
2027	61,242
2028	56,955
2029	52,968
2030	49,260

Table 16 - Mullingar SEC Plan to 2030			
	Number of Projects	**Primary Energy Savings (kWh)**	**CO_2 Savings (tonnes)**
Community owned Solar Project in MW	5.0	4,380,000	1,296
Solar PV generation on larger Community/Industrial buildings	10	603,150	178
Electric Vehicle car share scheme	1	2,374,376	222
Residential Housing Upgrades from F2 to B2	400	9,768,000	2,250
Residential Housing Upgrades from D2 to B2	800	10,032,000	2,438
Electrical Vehicle (EV) Ownership	40% Change	16,914,067	5,540
Reduction in Car Journeys though remote working & EV Ownership	40% Change	24,111,011	5,631
Total		**68,182,604**	**17,555**

Register of Opportunities (RoO)

The Register of Opportunities (RoO)[12] developed for Mullingar SEC provides a list of projects in three categories which have been identified within the community.

Behavior, Energy Efficiency and Renewable Energy Projects have been identified, which have both short- and medium-term timescales. The RoO provides for a detailed project specific planning tool including project cost, energy impact and carbon savings.

The Register of Opportunities (RoO) is a live document used to identify, evaluate, and plan your energy projects. The Sustainable Energy Community owns this document and is responsible for using, editing and improving the content in order to match its ambitions.

The RoO is presented in an excel workbook because some parts contain formulas to calculate financial and energy savings.

As part of the scope of works for the Energy Master Plan for Mullingar SEC, a number of domestic energy audits and Non-residential audits were carried out on buildings selected within the community. Sections of the register of opportunities was generated from these audits based on the information available.

The key criteria when selecting projects where are suitable to progress are:

1) Return on investment or payback period
2) Complexity of the project
3) Are the project costs known?
4) Is supporting funding available?
5) What impact is the project going to have on the community?

Key standout projects are listed below:

- 5kWp Solar PV generation on 10 schools in the Mullingar SEC catchment area
- Community EV Charging Point
- Feasibility study for a Renewable Energy Support Scheme (RESS) community power project
- Community electric bike scheme

Note: *The costings provided are indicative only and quotations should be sought from suitably qualified contractors following an appropriate design and specification process.*

[12] *Each of the projects are detailed within the RoO spreadsheet, which is a live document attached as Appendix B.*

Action Plan for Mullingar SEC

Capacity Building

One of the key elements in the development of a successful Sustainable Energy Community is the ability to build capacity within the group, which is required for the implementation of successful projects. By increasing the capacity of the SEC there is a higher probability that the group will be able to take on more complex projects as their confidence grows. Capacity building can be achieved by utilising the mentors appointed to the group by SEAI to arrange educational and training initiatives as well as vocational and third level education bodies. The SEC can also work with other established SEC's to exchange shared learnings

Energy Master Plan Dissemination to Community

The dissemination of the Energy Master Plan throughout the community is one of the key actions for the SEC now that the plan has been completed. The Energy Master Plan will provide the community with an understanding of what their current energy profile is and where they as a community should put their efforts in reducing their energy and carbon footprint.

Communication and Engagement Events

Engagement with other community organisations to identify shared needs especially in the development of existing community assets for remote working may be beneficial to the greater community.

The upgrading and reimagining of community buildings through BEC grants to provide remote working hubs, childcare facilities, or social hubs feeds into the DO stage of the SEC's plan. In addition to other community groups, private sector groups such as energy project developers which have community benefit funds may be interested in providing support to the SEC, but only if they are aware of its existence.

Low Lying Fruit First

The SEC is encouraged to develop low-effort, low-cost efficiency projects first to increase their internal capacity and skills. These low-effort, low-cost efficiency measures can be quick wins for the community and encourage the group to tackle more complex, higher effort projects in the future. These projects also provide a focus point for the greater community to prompt discussions and knowledge sharing experiences.

In a residential setting this could include the sharing of a Home Energy Kit around the community, so that individuals can identify significant energy users in their home, allowing them to make more informed decisions about how to reduce their daily energy use.

Enhancing community centres in a way that allows individuals to work remotely will have a sizeable impact on reducing emissions associated with commuting to work.

For businesses or public buildings that operate for 40+ hours a week, they should begin a process of selecting the lowest wattage bulb needed to light the room/area and consider the size of the space and how much natural light the space gets.

Ireland's Climate Action Plan 2021

- The Climate Action Plan (CAP) is a roadmap developed by the Irish government to reduce Ireland's emissions by 51% (compared to 2018 levels) by 2030 and achieve net zero emissions by 2050. The CAP sets out targets for individual sector of the economy – e.g., Electricity and the actions that will need to be taken to achieve these emission reductions. Table 17 shows the proposed emissions reductions sector by sector

- The statutory national climate objective and 2030 targets are aligned with Ireland's obligations under the Paris Agreement along with the European Union's objective to reduce GHG emissions by at least 55% by 2030 (compared to 1990 levels) and achieve climate neutrality in the European Union by 2050

- Targets for each sector of the Irish economy will be updated annually, to ensure alignment with the governments' legally binding economy-wide carbon budgets and sectoral ceilings

- Whilst all the sectors referenced in Table 17 are relevant in some form or another to this EMP, of particular importance are the Electricity, Transport and the Built environment sectors, which feature prominently in the report

Table 17 – Summary of the sectoral targets within the Climate Action Plan

Sector	2018 Emissions (Megatonnes of CO2 equivalent)	2030 target Emissions (Megatonnes of CO2 equivalent)	% Reduction relative to 2018
Electricity	10.5	2 - 4	62-81%
Transport	12.0	6 - 7	42-50%
Built environment	9.0	4 -5	44-56%
Industry	8.5	5 -6	29-41%
Agriculture	23.0	16 - 18	22-30%
Land use, land use change, Forestry & Marine	4.8	2 - 3	37-58%
Unallocated Savings	N/A	4	N/A

- One of the standout targets for the Electricity sector which is particularly relevant for the Mullingar SEC is the target of increasing the amount of electricity generated by renewable sources to 80%. SECs can play their part through small-scale renewable energy generation in the community

- Regarding transport, the expectation is that Electric Vehicles will cover 40% of car journeys by 2030. Conversely, public and active transport services will receive heavy investment, enabling an additional 500,000 daily journeys

- Perhaps the sector of most importance to the Mullingar SEC is the Built Environment. In the residential sector some of the most ambitious targets include:
  - Retrofitting 500,000 homes to a B2 equivalent BER standard
  - Installing 600,000 heat pumps in residential buildings

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[4] SEAI, "Conversion Factors,", Available: https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/

[5] SEAI, "Public Sector Energy Monitoring & Reporting System," 2017, Available: https://www.seai.ie/energy-in-business/monitoring-and-reporting/FAQs.

[6] CSO, “2011 Census - Agriculture.” Central Statistics Office 2012

[7] NSAI, SR54 Code of Practise for the Energy Efficiency Retrofit of Buildings

Appendix A: Grant Streams

Better Energy Communities

Better Energy Communities is the national retrofit initiative which provides capital grants for energy efficiency projects in Irish communities. The BEC programme with grant support of up to €28 million for 2021 aims to deliver energy savings to homeowners, communities, and private sector organisations. Projects must be community orientated with a focus on cross-sectoral approach.

Successful Community projects must demonstrate some or all of the following characteristics.

- Community benefits
- Multiple elements, not a single focus
- Mix of sustainable solutions
- Innovation and project ambition
- Justified energy savings
- An ability to deliver the project

The following list outlines the types of measures that SEAI want to support through the Communities grant program

- Building Fabric Upgrades
- Technology and System upgrades
- Integration of renewable energy sources
- Domestic Combined Fabric Upgrade
- Single Building Demonstration projects will be considered under the Communities Grant

BEC 2022 Funding Levels

The level of funding and processes associated with Better Energy Communities Grants has been changing over the past number of years and is constantly evolving. It is recommended that prospective fund applicants check for the latest processes and funding levels at the time of enquiry. The latest information available at the time of publication of this document can be accessed at: https://www.seai.ie/grants/community-grants/project-criteria-and-funding/Communities-Grant-Guidelines-2022.pdf.

As a rough guide in the past residential funding has generally ranged from up to 35% in private and rented homes, with up to 80% in fuel poor homes.

SEAI's Home Energy Grants

https://www.seai.ie/grants/home-energy-grants/

SEAI primarily has three grants and supports schemes for individual homeowners who wish to make energy upgrades to their home:

- Free Energy Upgrade
- Individual Energy Upgrade Grants
- One Stop Shop Service

Free Energy Upgrade

This SEAI grant provides free energy-efficient home upgrades for homeowners that receive certain welfare payments. Homeowners will receive a free assessment from an SEAI surveyor who will recommend the most suitable upgrades for the property.

Table 18 – Eligible Free Energy Upgrade home improvements

Attic insulation	Cavity wall insulation	External wall insulation
Internal wall insulation	Replacement windows	Heating Systems upgrade
Heating controls	Ventilation	Compact fluorescent lamps (CFLs)
Draught proofing	Lagging jacket	

To qualify for any of these SEAI grants under the Free Energy Upgrade Scheme, homeowners need to meet all of the following criteria:

- The home must be your main residence and you must be the homeowner

- The home was constructed before 1993. It must have also been lived in prior to this date

- The home has an energy rating of C, D, E, F, or G.

- You receive one of the following government payments:
  - Fuel Allowance scheme
  - Working Family Payment
  - One-Parent Family Payment
  - Domiciliary Care Allowance
  - Carers Allowance. You must be living with the person you are caring for
  - Disability Allowance for more than six months. You must also have a child less than seven years old
  - Job Seekers Allowance for more than six months. You must also have a child less than seven years old

The Free Energy Upgrade grant will cover all expenses for a Home Survey, Contractor Selection, Contractor Works and a BER certificate. It is important to note that it will be the Surveyor who decides the improvements to make, the homeowner cannot choose which specific upgrades they would like.

Individual Energy Upgrade Grants

This grant allows the homeowner to choose which home improvements to bring, choose the registered contractor, and complete the work yourself. Despite being more in charge of this grant, you still need to wait for the approval of the grant before starting the project.

Table 19 – Individual Energy Upgrade Grants

Measure	Detached	Semi D/End of Terrace	Mid Terrace	Apartment
Ceiling insulation	€1,500	€1,300	€1,200	€800
Cavity Wall Insulation	€1,700	€1,200	€800	€400
External Wall Insulation	€8,000	€6,000	€3,500	€3,000
Internal Insulation	€4,500	€3,500	€2,000	€1,500
Air to Air Heat pump system	€3,500			
Air to water Heat pump system	€6,000			€4,500
Ground source to water Heat pump system	€6,000			€4,500
Heat Pump Technical Assessment	€200			
Heating Controls (Homes built pre-2011)	€700			
Solar Water heating	€1,200			
Solar PV (Homes built pre-2021)	€1,800 for 2kWp system, additional €300 per kWp up to €2,400			

To qualify for any of the SEAI individual energy upgrade grants, you need to meet all four of the following criteria:

- The home must be your main residence and you must be the homeowner
- For any of the insulation and heating controls grants, your home must have been constructed and lived in before 2011
- For any of the heat pumps and renewable energy systems grants, your home must have been constructed and lived in before 2021
- Your home must not have received the same home improvement government grant in the past

One Stop Shop Service

Under this programme, homeowners will be able to receive a complete home energy upgrade. These will be managed by registered contractors who will manage the entire process for you. From the initial assessment, placing the SEAI grant application for you, conducting the work, and providing the final BER.

Table 20 - One Stop Shop Service grants

Measure	Detached	Semi D/End of Terrace	Mid Terrace	Apartment
Ceiling insulation	€1,500			
Cavity Wall Insulation	€1,700			
External Wall Insulation	€8,000			
Internal Insulation	€4,500			
Air to Air Heat pump system	€3,500			
Air to water Heat pump system	€6,000			
Ground source to water Heat pump system	€6,000			
Heat Pump Technical Assessment	€200			
Heating Controls (Homes built pre-2011)	€700			
Solar Water heating	€1,200			
Solar PV (Homes built pre-2021)	€1,800 for 2kWp system, additional €300 per kWp up to €2,400			

	One Stop Shop Service grants			
Measure	**Detached**	**Semi D/End of Terrace**	**Mid Terrace**	**Apartment**
Ceiling insulation	€1,500	€1,300	€1,200	€800
Cavity Wall Insulation	€1,700	€1,200	€800	€700
External Wall Insulation	€8,000	€6,000	€3,500	€3000
Internal Insulation	€4,500	€3,500	€2,000	€1,500
Rafter Insulation	€3,000	€3,000	€2,000	€1,500
Windows (Complete Upgrade)	€4,000	€3,000	€1,800	€1,500
Project Management	€2,000	€1,600	€1,200	€800
Solar PV - 0 to 2kWp	€900/kWp			
Solar PV - 2 to 4kWp	€300/kWp			

Your home or property needs to meet all of the following criteria to qualify for the One Stop Shop Service grant:

- The home must be your main residence and you must be the homeowner
- Your home must have been constructed and lived in before 2011 for insulation and heating controls grants
- Your home must have been constructed and lived in before 2021 for heat pumps and renewable energy systems grants
- Your property must have a B3 or lower energy efficiency rating and a minimum of a B2 upon completion of the upgrades
- Your property must not have received government grants in the past for the same home improvement

Electric Vehicles

Privately bought EVs

A maximum grant of €5,000 is available for qualifying new electric vehicles when purchased privately. Approved EVs with a List Price of less than €14,000 will not receive a grant. As of the 1st of July 2021, there is a cap of €60,000 on the full price of all vehicles. The full price of the vehicle to the customer includes all optional extras, paint, and delivery for excludes any incentives such as grants or rebates.

Table 21 – SEAI Electric Vehicle (EV) grants

List Price of Approved EV	Grant available
€14,000 to €15,000	€2,000
€15,000 to €16,000	€2,500
€16,000 to €17,000	€3,000
€17,000 to €18,000	€3,500
€18,000 to €19,000	€4,000
€19,000 to €20,000	€4,500
Greater than €20,000	€5,000

Commercially bought EVs

SEAI provides grant supports towards the purchase of new N1 category electric vehicles for business and public entities. N1 category vehicles are typically small goods carrying vans with a technically permissible maximum mass not exceeding 3500kg.

A maximum grant of €3,800 is available for qualifying N1 category EVs when purchased commercially. Approved EVs with a list price of less than €14,000 will not receive a grant. It should be noted that these grants apply to new vehicles only and cannot be claimed on secondhand vehicles.

The grant level depends on the list price of the vehicle. This is the full non-discounted price in the absence of VRT relief or grant support.

Vehicle Registration Tax

Electric vehicles receive VRT relief separately to SEAI grant support as well as reduced motor tax.

Home Unit Charger

SEAI provide a grant up to the value of €600 towards the purchase and installation of a home charger unit.

Benefit in Kind

For commercial electric cars, Revenue provides an exemption for Benefit in Kind.[13]

[13] *https://www.seai.ie/sustainable-solutions/electric-vehicles/*

Appendix B: RetroKit Results

Results and Analysis

Heat pump Readiness

Heat pump readiness is the likelihood of dwellings in the scenario having a suitably low heat loss indicator (2.0 or less, or below 2.3 in certain cases) for a heat pump to perform effectively in the dwelling. A suitably low heat loss indicator is also needed if seeking grant funding for heat pumps. A dwelling should have additional fabric measures applied if a heat pump is to be installed and if it isn't heat pump ready.

As per the graph below, 14% of residences in the Mullingar SEC are Heat Pump ready, however this figure jumps to 42% under the 'Shallow fabric' scenario, meaning a significant proportion of homes in the community would only require a moderate amount of investment to be Heat Pump ready.

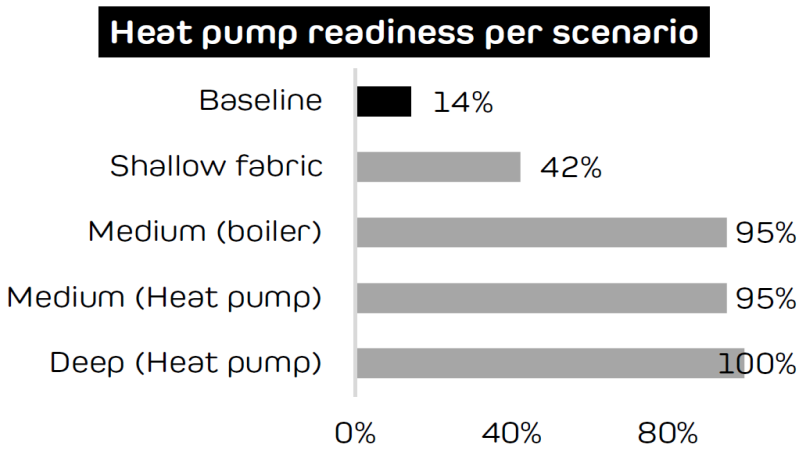

Figure 16 – Heat pump readiness under each RetroKit scenario for SEC

Reduction in Final Energy Use

Reduction in final energy use shows how far 'energy usage' is reduced compared to the baseline if the upgrades associated with each scenario were implemented into every home in the Mullingar SEC.

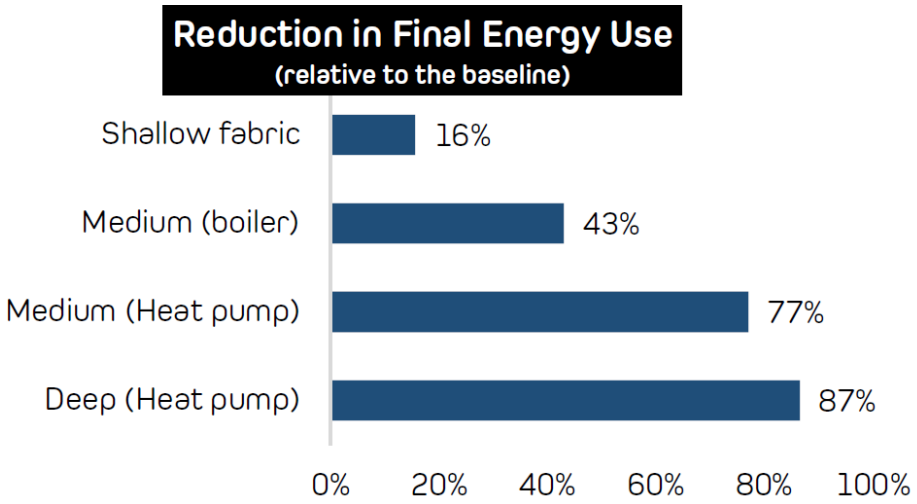

Figure 17 – Reduction in Final Energy Use compared to baseline data in the SEC

As can be seen from the graph above, significant reductions in energy use across the SEC can be achieved under the Medium (boiler) scenario, but particularly in the two Heat Pump scenarios. This is in alignment with the Irish Government's Climate Action Plan and the country's long-term goal of reaching net-zero emissions by 2050.

Total Annual Energy Savings

Naturally, reductions in energy usage will lead to a corresponding decrease in energy costs for the community. The total annual energy savings graph evidences the fuel cost savings per scenario, broken down by the age bands of dwellings in the SEC. As the below graph shows, the Mullingar SEC could save anywhere between €2.1 million - €8.9 million annually depending on which of the fabric upgrade scenarios were adopted by the community.

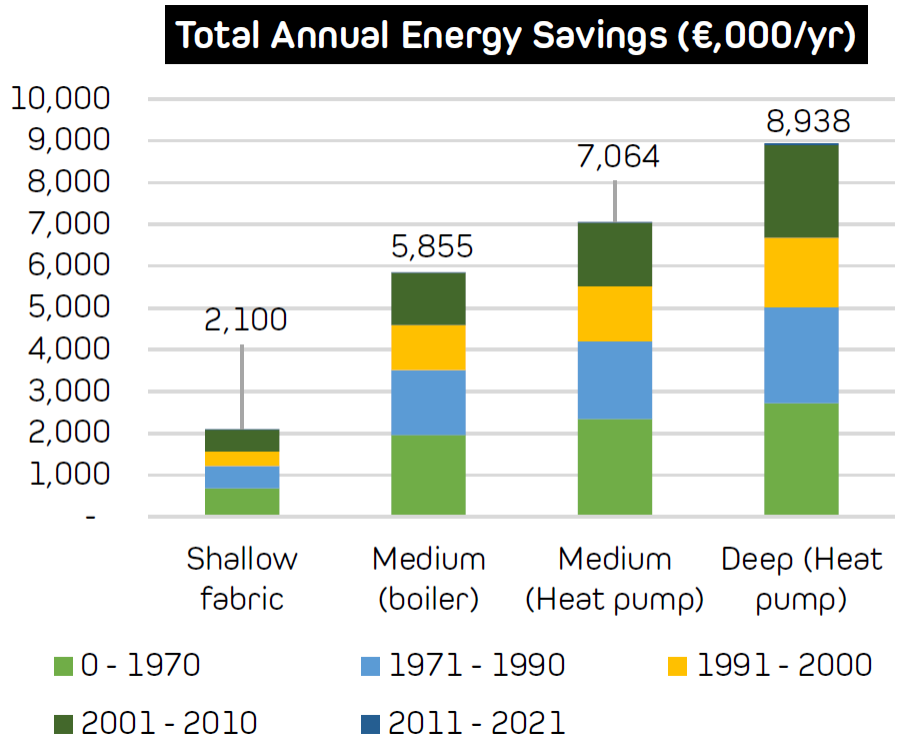

Figure 18 – Total Annual Energy Savings in millions of Euros per year versus baseline conditions if each scenario was adopted by the SEC

Energy Cost per dwelling

On an individual homeowner level, the fuel costs arising from energy usage show significant reductions on an annual basis, with the potential to save €1000 annually if implementing upgrades in their home that align with the Deep (Heat Pump) scenario.

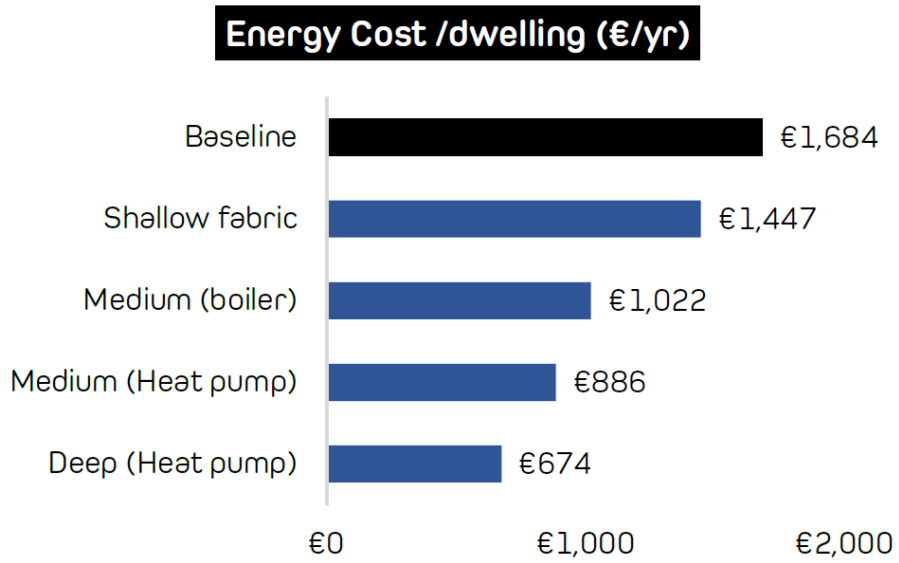

Figure 19 – The average annual energy cost per dwelling under each of the four scenarios

As energy costs look set to continually rise, it is quite likely that the potential savings for both individual homeowners and the community as a whole would also increase under the four scenarios above. It would be hoped that this would create both a more environmentally and economically sustainable community.

Glossary of RetroKit Terminology

Although all efforts have been made to keep the language in the RetroKit Home Upgrade Plans non-technical through infographics and normal language, it is not always possible. In order to mitigate against this, we have provided a glossary of key terms used through-out the Home Upgrade Plans along with their meaning.

Table 22 – RetroKit terminology glossary

Name in HUPs	Description
No fill to FF	*Cavity wall insulation to unfilled cavity wall*
Partial to FF	*Cavity wall insulation to partially filled cavity wall*
No insulation to 300 mm	*300 mm loft insulation at ceiling level where no insulation exists*
70 mm to 400 mm	*400 mm loft insulation at ceiling level where 70mm insulation already exists*
Shallow sealing	*Shallow sealing of draughts for airtightness*
Chimney draft limiter	*Fit chimney draft limiter to open fire*
Open fire to wood fuel stove	*Change open fire for high efficiency wood fuel stove*
Install LED lighting	*Fit low energy lighting throughout property*
Solid + 100 mm EWI	*100 mm external wall insulation to solid wall*
CWI + 100 mm EWI	*Cavity wall insulation and 100mm external wall insulation*
Full window replacement to DG	*Replace windows with double glazed windows*
Door replacement	*Replace door with highly insulated door*
Install lagging jacket & insulate pipes	*New lagging jacket to hot water cylinder. Insulate pipework to hot water tank*
New gas boiler	*New high efficiency gas system boiler*
New oil boiler	*New high efficiency oil system boiler*
Install fully integrated controls	*Fit new heating controls*
El to air to water heat pump	*Install new air to water heat pump*
To low temperature radiators	*Change existing radiators to low temperature radiators*
Replace with factory insulated tank	*Replace hot water cylinder with new factory insulated model*
70 mm bet rafters to 50 mm dry lining	*50 mm internal insulation to sloping roof with 70mm existing insulation*
Uninsulated rafters to 50 mm dry lining	*50 mm internal insulation to sloping roof with no existing insulation*
Deep sealing	*Extensive sealing of draughts for airtightness*
To DCV	*Fit demand control ventilation system*
Full window replacement to TG	*Replace windows with triple glazed windows*
Insulate primary pipework	*Insulate primary pipework - from boiler to manifold and hot water tank*
Install 2kWp solar PV	*Install 2kWp solar electric panels*
Energy Credits	*Please click the link for a full explanation*

RetroKit Housing Upgrade Plans

Housing Upgrade Plan

Rural
Detached house
150m2

Built:1981
Heating oil

Your home energy upgrade will give you

More comfort | Money saved | Healthier home | Warmer home | Better for our planet

How you can achieve this

	Current	Shallow fabric	B BER boiler	B BER HP	Deep HP
BER	C3	C2	B2	B1	A3
Comfort Level					
Roof					
External Wall					
Windows					
Doors					
Floor					
Draughts					
Main Heating					
Water Heating					
Heating Controls					
Lighting					
Ventilation					

Your options to achieve a more comfortable home

Shallow fabric

BER:	Fuel Bills:	Environmental Impact:
C2	€-347/yr	-2270 kgs CO_2/yr

	Cost	Impact
Partial to FF	€1932	★ ★ ★
70 mm to 400 mm	€2745	★ ★ ☆
Shallow sealing	€538	★ ★ ☆
Chimney draft limiter	€187	★ ☆ ☆
Open fire to wood fuel stove	€4255	★ ★ ☆
Install LED lighting	€150	★ ☆ ☆
Energy credits	€838	
Total investment	€8971	

Your options to achieve a more comfortable home

B BER boiler

BER:	Fuel Bills:	Environmental Impact:
B2	€-907/yr	-5436 kgs CO_2/yr

	Cost	Impact
CWI + 100 mm EWI	€22335	★★☆
70 mm to 400 mm	€2745	★☆☆
Shallow sealing	€538	★☆☆
Chimney draft limiter	€187	★☆☆
Full window replacement to DG	€8625	★☆☆
Door replacement	€2111	★☆☆
New oil boiler	€2575	★★★
Open fire to wood fuel stove	€4255	★☆☆
Install fully integrated controls	€1192	★★☆
Install LED lighting	€150	★☆☆
Energy credits	€1754	
Total investment	€42962	

Your options to achieve a more comfortable home

B BER HP

BER:	Fuel Bills:	Environmental Impact:
B1	€-899/yr	-6184 kgs CO_2/yr

	Cost	Impact
CWI + 100 mm EWI	€22335	★ ☆ ☆
70 mm to 400 mm	€2745	★ ☆ ☆
Shallow sealing	€538	★ ☆ ☆
Chimney draft limiter	€187	★ ☆ ☆
Full window replacement to DG	€8625	★ ☆ ☆
Door replacement	€2111	★ ☆ ☆
El to air to water heat pump	€8582	★ ★ ★
Open fire to wood fuel stove	€4255	★ ☆ ☆
To low temperature radiators	€4291	★ ☆ ☆
Install LED lighting	€150	★ ☆ ☆
Energy credits	€2705	
Total investment	€51117	

Your options to achieve a more comfortable home

Deep HP

BER:	Fuel Bills:	Environmental Impact:
A3	€-1103/yr	-6952 kgs CO_2/yr

	Cost	Impact
CWI + 100 mm EWI	€22335	★ ☆ ☆
70 mm to 400 mm	€2745	★ ☆ ☆
Deep sealing	€2965	★ ☆ ☆
Chimney draft limiter	€187	★ ☆ ☆
Full window replacement to TG	€10350	★ ☆ ☆
Door replacement	€2111	★ ☆ ☆
To DCV	€3576	☆ ☆ ☆
El to air to water heat pump	€8582	★ ★ ★
Open fire to wood fuel stove	€4255	★ ☆ ☆
To low temperature radiators	€4291	★ ☆ ☆
Install LED lighting	€150	★ ☆ ☆
Install 2kWp solar PV	€5722	★ ☆ ☆
Energy credits	€2705	
Total investment	€64567	