Castlepollard Sustainable Energy Community

Castlepollard SEC Energy Master Plan

Baseline Energy Balance, Renewable Energy Potential and Register of Opportunities

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Reviewed by	Cormac Walsh
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Reviewed By	Siobhán Kinahan, Laurence O'Reilly
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Contact Details	Lugh.obraonain@energyco-ops.ie 01 5483788
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1 Executive Summary

The Castlepollard Sustainable Energy Community (SEC[1]) was established as part of the National SEC network is coordinated by the Sustainable Energy Authority of Ireland (SEAI) to stimulate and support communities who seek to become actively involved in the transition to a low carbon future. It provides a wide range learning opportunity, it facilitates peer to peer support and leadership through example opportunities between community groups, and it also provides access to grant support.

An important step in the development of an SEC is to understand the community's current energy consumption. In 2023, the Castlepollard SEC commissioned this Energy Master Plan for the area to establish this energy use.

This document provides an overview of the analysis undertaken by Energy Co-operatives Ireland on behalf of Castlepollard SEC, highlighting the relevant findings on the community's current energy demand, as well as the options available for reducing energy usage and switching to renewable energy sources: what is termed in the document the 'Register of Opportunities'.

The requirement for Ireland to meet its commitments to reduce dependence of fossil fuels and the consequent polluting and climate changing emissions set out in the Climate Action Plan 2023 needs the support of its citizens. This support is most proactive when it is co-ordinated and informed at the community level. This Energy Master Plan aims to provide the information around which that community co-ordination can take place.

The EMP is a living document. It is grounded in the principles of 'Learn-Plan-Do' whereby experience is tested and gained through active ongoing projects. There are resources not published here which are available to the SEC steering committee which can be increased and updated over time to help track the SEC's progress towards its targets.

This study is intended to promote dialog within the community about its recommendations: while we are confident that they are feasible, desirable, and beneficial to the future sustainability of the SEC, the active participation of the community is a pre-requisite of the EMPs success. We therefore see this document as the start of a wider consultation process which will be led by the SEC itself in conjunction with the residents of Castlepollard and the surrounding area.

[1] A full glossary of terms, including acronyms is set out in Section 1.4 below.

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Domestic BER Assessor Michael Coyle of Midlands Energy Consultants, and Ivan Sproule Non-Domestic BER Assessor.

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1.4 Glossary of Terms and Units

Although all efforts have been made to keep the language in this report non-technical, through the use of infographics and normal language it is not always possible. We provide a glossary of key terms used through-out this report and an explanation of their meaning.

Active Travel	Transport where most of the power supplied is from exercise: e.g., walking and cycling
ASHP Air Source Heat Pumps	A highly efficient electrically driven heating system. It is explained further in the Appendices
BER	An energy rating system where A1 is the most energy efficient to G the least efficient. The levels of the energy use for each rating are discussed in the Appendix
BEU	Baseline Energy Use: a study of the energy use in the SEC as its starting point on its sustainability journey: in this case 2022
CEG (Clean Export Premium)	Homeowners are eligible to receive a Clean Export Guarantee (CEG) tariff, for any exported electricity, at a competitive market rate from their electricity supplier
CEP (Clean Export Premium)	A payment received by a micro-generator for electricity exported to the grid
Electoral Division (ED)	A legally defined administrative area comprising a number of townlands and small urban areas. It is a demographic unit in the Central Statistics Office data collection.
Energy Master Plan EMP	A study funded by the SEAI of the total energy requirement of a community as well as a set of recommendations as to how this can be reduced and powered by sustainable energy
EPA	Environmental Protection Agency
EPBD	European Energy Performance of Buildings Directive
EV Electric Vehicle	A vehicle driven by an electric motor powered by a plug-in rechargeable battery - sometimes referred to as BEV (Battery Electric Vehicle)
FCEVs - fuel cell vehicles	These are vehicles driven by an electric motor (similar to EVs) but that use compressed hydrogen as their energy storage
CSEC	Castlepollard Sustainable Energy Community
gCO2	grammes of CO2 emitted
Hybrid	We refer to vehicles that are primarily powered by fossil fuel burning internal combustion engines, but also having supplementary recharging battery that reduces the need for fossil fuels
HVO	Hydrotreated Vegetable Oil (HVO) is a type of renewable diesel fuel that is produced by hydrotreating vegetable oil. It is a high-quality, low-emission fuel that can be used as a direct replacement for fossil diesel in diesel engines

ICE	Internal Combustion Engine: an engine that burns fossil fuels (diesel, petrol, or gas) for its power - usually, and throughout this report, used in connection to road vehicles
kW	kilowatt - a measure of electrical power
kWh	kilowatt hour: a unit of electricity - the application of one kilowatt for one hour. This is determined by electricity suppliers as the basic unit of electricity
kWp	kilowatt peak power: a system that delivers one kilowatt. Over one hour at maximum output it will produce 1 kWh
micro hydro	Small Scale Hydro-Electricity Projects (less than 50kW)
MW	Megawatt = a thousand kilowatts
MWh	Megawatt hour: a thousand-kilowatt hours
Net zero	An energy system where any generation of Carbon Dioxide from energy production is balanced by carbon offset measures such as sequestration by trees, bogs, etc
Payback	The time taken for the nett income from a project amount to the initial investment
Pobal	A state-sponsored organisation in the Republic of Ireland with responsibility for administering and managing government and EU funding aimed at supporting social inclusion and addressing social disadvantage in the country
PV	Photovoltaic: panels that convert light (photons) into electricity (volts).
RoO	Register of Opportunities: a live document provided separately to the SEC which will enable it to track it's progress against the BEU through efficiency, avoidance and generation projects
ROI	Return on Investment. This is a profitability ratio that compares the net profits received for the lifetime of the investment to the original cost of an investment, expressed as a percentage
SEAI	The Sustainable Energy Authority of Ireland
SPA (Special Protection Area)	A special protection area (SPA) is a designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats of migratory birds and certain particularly threatened birds.
Turbine	A machine which converts turning power into electricity
TWh	Terawatt hours: a million-megawatt hours

1.4.1 Units

Throughout this report we present energy use and energy production, in megawatt hours per annum (MWh/yr). This unit of measurement is used regardless of the fuel used. CO_2 emissions are in Kg of CO_2 emitted ($kgCO_2$), unless stated as tonnes of CO_2 emitted (tCO_2). Energy costs are presented in euro spent on energy per annum.

2 Policy and Context of this report

This report is an Energy Master Plan produced by Energy Co-operatives Ireland (ECI) on behalf of Castlepollard SEC (CSEC) supported and funded by the Sustainable Energy Association of Ireland (SEAI).

An Energy Master Plan (EMP) aims to help the SEC to understand the energy demand and supply in the entire community. The EMP focusses on energy efficiency opportunities in the first instance. This is because energy efficiency actions are typically lower risk and have higher payback. It is also widely accepted that reducing the quantity of resources you use is the first step to greater sustainability. This plan is also accompanied by a Register of Opportunities document (provided separately to CSEC) which is a live record of the community's energy status and achievements in its journey to sustainability.

It is intended that the EMP will develop and evolve to a position where it can form the foundation for applications and projects which will achieve the SEC's aims to reduce energy use, promote renewable energy and increase community sustainability.

The community co-designs, develops and focusses its own Energy Master Plan in line with the aims of the Community SEC Charter. No two communities are the same, and thus this EMP is unique to the conditions and opportunities of the Castlepollard area.

This Energy Master Plan provides a Baseline Energy Use report (BEU) to quantify the current energy status of CSEC area as a baseline of its electrical, thermal and transport energy demand. It will identify any existing renewable energy sources within the community – these can be used as a model for further roll-out of renewable energy.

The plan will create a Register of Opportunities (RoO) which accompanies this EMP document is a list of potential projects for energy efficiency and renewable energy. It selects a varied but targeted range of suitable projects for the first three years of CSEC community actions, setting energy reduction targets against the baseline figures. The EMP is designed to allow periodic updating of the SEC energy status to track progress against targets. The EMP also provides a roadmap towards decarbonisation actions to achieve the CSEC's target of 30% reduction of energy use across all sectors and a maximisation of carbon neutral energy production from renewable sources.

2.1 EU Climate Strategy

The EU Strategy on Adaptation to Climate Change[2] addresses comprehensive policies and actions to meet urgent challenges faced by Europe's citizens from climate change. The EU sets the ambitious goal of Europe's energy sector becoming climate-neutral by 2050 thus

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:82:FIN

leading the world's drive to limit climate change. The EU strategy encompasses various initiatives, legislation, and targets designed to reduce greenhouse gas emissions, transition to renewable energy sources, promote sustainable development, and enhance climate resilience.

The EU's central commitment is to achieve *climate neutrality* by 2050, this means that our net greenhouse gas emissions will be reduced to zero (net zero). This goal is laid out in the European Green Deal, which is a comprehensive policy framework document launched in 2019, aimed at making the EU's society sustainable and resource efficient. In addition to this, the EU has set intermediate targets for reducing carbon dioxide emissions by specific percentages, such as 55% by 2030 compared to 1990 levels.

Improving energy efficiency in all sectors is a critical aspect of the EU's climate strategy. The Energy Efficiency Directive[3] sets targets for reducing energy consumption across various sectors, including buildings, transport, and industry. Energy efficiency measures involve improving domestic and non-domestic building standards, supporting energy saving retrofits to existing buildings, encouraging energy-saving practices, and promoting the use of energy-efficient appliances and technologies. Building standards are set by the state. Our recommendations are steered towards the citizen and community level. We therefore put energy retrofitting and efficient appliance and technology use to the fore of this energy master plan (Section 5.1).

To accelerate the shift towards cleaner and more sustainable energy sources, the EU has set binding targets for the share of renewable energy in the overall energy mix. The Renewable Energy Directive aims to ensure that at least 40% of the EU's final energy consumption comes from renewables by 2030. This involves promoting investments in wind (onshore and offshore), solar, hydroelectricity, and other renewable sources while committing to phasing out fossil fuel subsidies and use. We address energy generation from renewable sources in this study at the small and medium scales taking into account what is achievable by the residents, community groups and businesses in the Castlepollard area. Section 5.5.2.

Recognizing the need to manage the social and economic impacts of the transition to a low-carbon economy, the EU has introduced the Just Transition Mechanism. It aims to support regions and sectors of the population heavily dependent on fossil fuels, helping them transition to more sustainable economic activities and ensuring that no one is left behind in the process. The Just Transition Mechanism seeks to protect citizens, most vulnerable to the transition to net zero carbon by facilitating employment opportunities in new sectors, offering re-skilling opportunities, improving energy-efficient housing, investing to combat energy poverty, and facilitating comprehensive access to clean, affordable, and secure energy. We recognise this need for access for all in making the changes needed to make our communities sustainable and provide roadmaps and recommendations as to how this can be achieved (Section 6.1).

[3] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en

Climate change and biodiversity loss are interconnected challenges. The EU has implemented the Biodiversity Strategy, which aims to protect and restore ecosystems, halt biodiversity loss, and ensure the sustainable use of natural resources. Thus, there is an awareness that the infrastructure roll-out that is necessary to facilitate the move towards a net zero carbon energy system must respect the protection of our existing biodiversity resources. Castlepollard has enviable biodiversity resources and so our proposals take into account the need to do no harm in replacing carbon derived energy with renewable energy generation.

2.1.1 Efficiency in buildings

The European Parliament has passed amendments to the Energy Performance of Buildings Directive, focusing on increased reducing CO^2 emissions, improving energy efficiency, and promoting renovations of buildings. The directive includes specific targets, support measures against energy poverty, exceptions for certain types of buildings, and provisions for member states to adapt the targets based on practical considerations.

The European Parliament adopted its position on the Energy Performance of Buildings Directive (EPBD) in March 2023. The revision of the EPBD has the goal of reducing greenhouse gas emissions and energy consumption in the EU building sector by 2030, ultimately achieving climate neutrality by 2050. It also seeks to increase the rate of renovations for energy-inefficient buildings and enhance the sharing of information on energy performance.

Key points of the proposed revision include:

5.1.1.1 CO2 Emissions-reduction targets:

- All new buildings should be zero-emission by 2028, with public authority-occupied buildings required to meet this standard by 2026.
- By 2028, new buildings should incorporate solar technologies where feasible, while residential buildings undergoing significant renovation have until 2032 to comply.

6.1.1.1 Energy performance ratings:

- By 2030, residential buildings must attain at least a BER energy performance class E, progressing to class D by 2033 (on a scale from A to G).
- Non-residential and public buildings must achieve similar ratings by 2027 and 2030, respectively.

7.1.1.1 National renovation plans:

- Member states will develop plans to achieve the prescribed targets and measures. These plans should include support schemes to facilitate access to funding and grants.
- Information points and cost-neutral renovation programs must be established.

- Financial incentives will be provided for extensive renovations, particularly targeting the worst-performing buildings.
- Grants and subsidies should be available to vulnerable households.

There are derogations permitted for certain historic, religious and heritage buildings.

There is therefore a requirement on member states to ensure that public buildings as well as domestic residences are retrofitted to more efficient standard. All new buildings will be required to be net-zero efficiency. All new buildings should be equipped with solar technologies by 2028, where feasible (2032 for residential buildings undergoing major renovation). Residential buildings would need to reach BER class E by 2030, and class D by 2033.

Our survey of buildings (Section 4) in the SEC area found that there are an estimated 122 below level BER E2 (14.1% of all homes) and 562 below level C1 (65.1% of homes)

The recommendations in this study reflect the aim of surpassing the minimum BER D level regulation, instead, reflecting Irish sustainability policy (see below), aiming for C1-B2 standards where technically and economically feasible, therefore achieving greater opportunities in sustainability and value for money they represent.

In April 2023 the Effort Sharing Regulation was amended and Ireland's new 2030 target under the Effort Sharing Regulation is to limit its greenhouse gas emissions by at least 42% by 2030. New binding annual emission limits for 2023 to 2030 for the 42% reduction will be set by the EU later in 2023.

2.2 Irish Climate Act 2021

This is a significant piece of legislation enacted in Ireland to address the issue of climate change. It established a comprehensive framework to guide the country's transition towards a low-carbon and climate-resilient economy. The act set ambitious targets to achieve a net-zero greenhouse gas emissions economy by 2050, aligning with global climate goals. It places an obligation on the government to develop and implement five-yearly Climate Action Plans (see next section), outlining specific measures and policies to reduce emissions across various sectors.

2.3 Targets from the Government's Climate Action Plan 2023

The Climate Action Plan (CAP, latest version is 2023)[4] is an annually revised roadmap developed by the Irish government for taking decisive action to reduce Ireland's emissions by 51% of the 2018 levels by 2030, and net zero by 2050. The statutory national climate objective and 2030 targets are aligned with Ireland's obligations under the Paris Agreement and with the European Union's objective to reduce GHG emissions by at least 55% by 2030, compared to 1990 levels and to achieve climate neutrality in the European Union by 2050.

The CAP targets reduction in energy use in Electricity, Transport, Buildings, Industry and Agriculture. This EMP examines these sectors as they relate to Castlepollard. Our study will look at the tender requirement to map out how the Castlepollard SEC can achieve energy reductions of 30% of the energy usage (of the baseline year 2016) on the study area, within the next 10 years.

2.4 Westmeath County Council Development Plan

Westmeath County Council is the local authority for the SEC. As a county council it is governed by the Local Government Act 2001. The council is responsible for roads and transportation, housing, and community, planning and development, amenity and culture, and environment. The council has 20 elected members split between two Municipal Districts, Athlone-Moate (9 Councillors) and Mullingar-Kinnegad (11 Councillors)[5]. Castlepollard is situated in the latter municipal area. The councillors, drawing on the advice of the count officials are responsible for devising the policy objectives of the county. The County administration and day to day operations is headed by a Chief Executive.

The Westmeath County Development Plan 2021-2027[6] (WCDP) sets out the policies and objectives for the development of the City over the plan period.

The County Development plan contains many policies that are relevant to the aims of this EMP, and the EMP is drawn up to reflect the relevant county policies.

The WCDP includes a chapter on developing Sustainable Communities (though this is not the same as the SEAI's understanding of SECs). According to the plan, 'this includes protection and enhancement of the natural, built, and historic resources of the County, including making effective use of land, minimising waste and pollution, and mitigating and adapting to climate change.

[4] https://www.gov.ie/pdf/?file=https://assets.gov.ie/244355/1c421172-2901-4f9e-baa5-6e4445b342f4.pdf#page=null
[5] https://www.westmeathcoco.ie/en/ourservices/yourcouncil/councillorsandcommittees/councillors/
[6] https://www.westmeathcoco.ie/en/ourservices/planning/developmentplans/countydevelopmentplan2021-2027/

2.4.1 Transport in the WCDP

The Development Plan makes a commitment in the transport sector to: 'Promote walking and cycling as efficient, healthy and environmentally friendly modes of transport by securing the development of a network of direct, comfortable, convenient and safe cycle routes and footpaths, particularly in urban areas and in the vicinity of schools.'[7]

The Plan also reflects the strong rail connection in Mullingar Town which is the closest urban settlement to the SEC. It proposes to increase bus connectivity to Mullingar's hinterland which includes Castlepollard:

'There is a need for increased bus services to improve connectivity between the main urban centres in the north and south of the County and to regional centres. Greater integration of bus and rail services would provide for enhanced services and facilitate the transfer from private car to bus and rail.' WCDP, p300.

The important role of EVs in the decarbonisation of transport is reflected in the policy to improve the charging infrastructure both on street and in new developments, with a commitment to provide charging facilities in all towns and villages in the county.

2.4.2 Renewable Energy in WCDP

The Development Plan supports the increase in use of renewable energy and development of renewable energy infrastructure and initiatives to provide alternatives to fossil fuels.

The plan states County policy supports 'local, regional, national and international initiatives for limiting emissions of greenhouse gases through energy efficiency and the development of renewable energy sources which make use of the natural resources in an environmentally acceptable manner and having particular regard to the requirements of the Habitats Directive.'

Table 1: WCDP Renewable Energy Policies addressed in this report[8].

CPO 10.139. Support local, regional, national, and international initiatives for limiting emissions of greenhouse gases through energy efficiency and the development of renewable energy sources which make use of the natural resources in an environmentally acceptable manner and having particular regard to the requirements of the Habitats Directive.
CPO 10.140 Facilitate measures which seek to reduce emissions of greenhouse gases and support the implementation of actions identified in the Westmeath County Council Climate Change Adaptation Strategy 2019-2024 and any future amendments.

[7] Westmeath County Council, Development Plan, Written Statement, p298
https://www.westmeathcoco.ie/en/media/Volume%201%20Written%20Statement-1.pdf
[8] Ibid, p338.

Sources of renewable energy **relevant to the SEC area** that are identified in the plan include wind, solar photovoltaic (PV), and biomass.

In relation to wind energy, developments must be made in accordance with good planning and with respect for the natural amenity of the landscape and current settlement. Small-scale and micro wind installations are encouraged where feasible, 'provided that they do not negatively impact upon the environmental quality, landscape, wildlife and habitats or the residential amenity of the area'.

The plan reflects a support for community owned renewable projects and 'will encourage communities to co-operate in the development of suitable wind energy projects, be they in rural or urban locations.' WCDP, p.339. The EMP recommendations for medium scale renewable energy generation will reflect this policy approach. (Section 5.5.2)

2.5 Policy and the Recommendations of this EMP

The recommendations in this study and the accompanying reports are co-ordinated with the policies outlined at EU, National and County level. Where there are differences, these reflect the wishes of the commissioning SEC to exceed carbon emission reduction targets. In completing the report, we were very conscious to reflect the special heritage and natural environment which the residents of and visitors to Castlepollard enjoy. We have taken a cautious approach to our recommendations and emphasize carbon reductions through non-invasive efficiency measures first. Only after such actions do we recommend appropriate renewable energy generation opportunities that do not impinge on the character of the local environment.

3 Castlepollard SEC area: Geography and Demographics

3.1 Geography:

Figure 1: Castlepollard SEC area

Castlepollard is situated in the Irish midlands in County Westmeath. The surrounding countryside is relatively flat to undulating with the highest point in the area 150m above sea level at Faughalstown. Castlepollard itself is 80m above sea level. It is designated as the 'Central Hills and Lakes' Landscape Character area of the County[9].

The surrounding land provides good grassland predominantly under pasture with cattle, both beef and dairy predominating, and sheep.

The area of the SEC is 55.8 km^2. The SEC is located between two large freshwater lakes, L Derravarragh (an SPA and part of the Lough Derravaragh Natural Heritage Area) and L Lene. The area is not densely populated at 53 people per square kilometre (p/km^2): it is 52 p/km^2 in Westmeath as a whole. However, the Electoral District[10] of Kinturk (which includes Castlepollard itself) has a density of 126 p/km^2. For comparison the national population density is 68.7 p/km^2.

[99] https://www.westmeathcoco.ie/en/media/Volume2BookofMaps.pdf map 68.

[10] The CSO splits the SEC area into 9 Small Areas or 3 Electoral Districts. We have opted to use the latter census unit as it reflects the economic, social, and geographical characteristics of the SEC best and assists in clarity of energy use statistics.

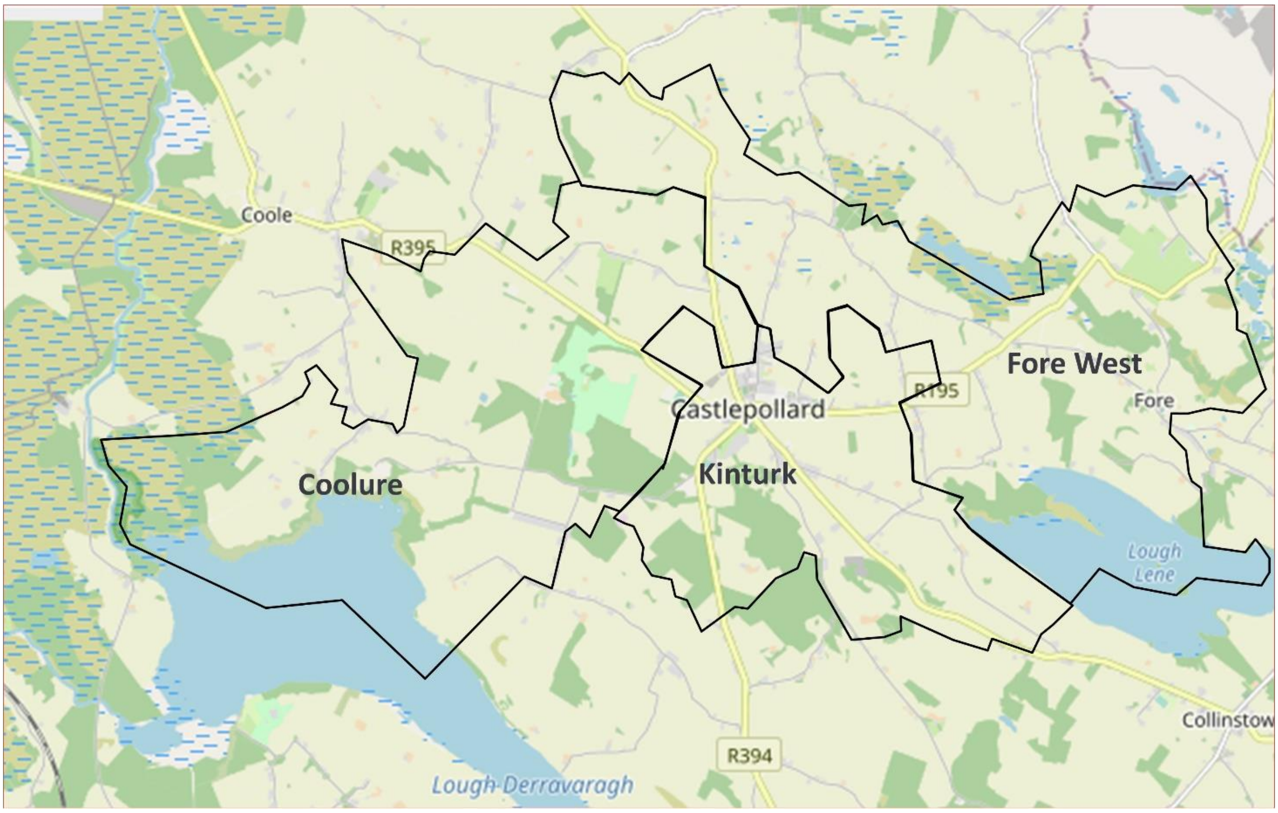


Figure 2: SEC area showing its three Electoral Districts: Coolure, Fore and Kintirk

3.2 Demography

The population of the area in the CSO 2022[11] census was 2,264. The distribution of the SEC's population is shown in Table 2

Table 2: SEC Population as a whole and by ED

	Kinturk	Coolure	Fore West	SEC
Population	1508	352	404	2264

As noted above, this population is not evenly distributed, rather it is concentrated around Castlepollard.

[11] The EMP is required to use 2016 data as the 2022 census has not been published to the requisite detail.

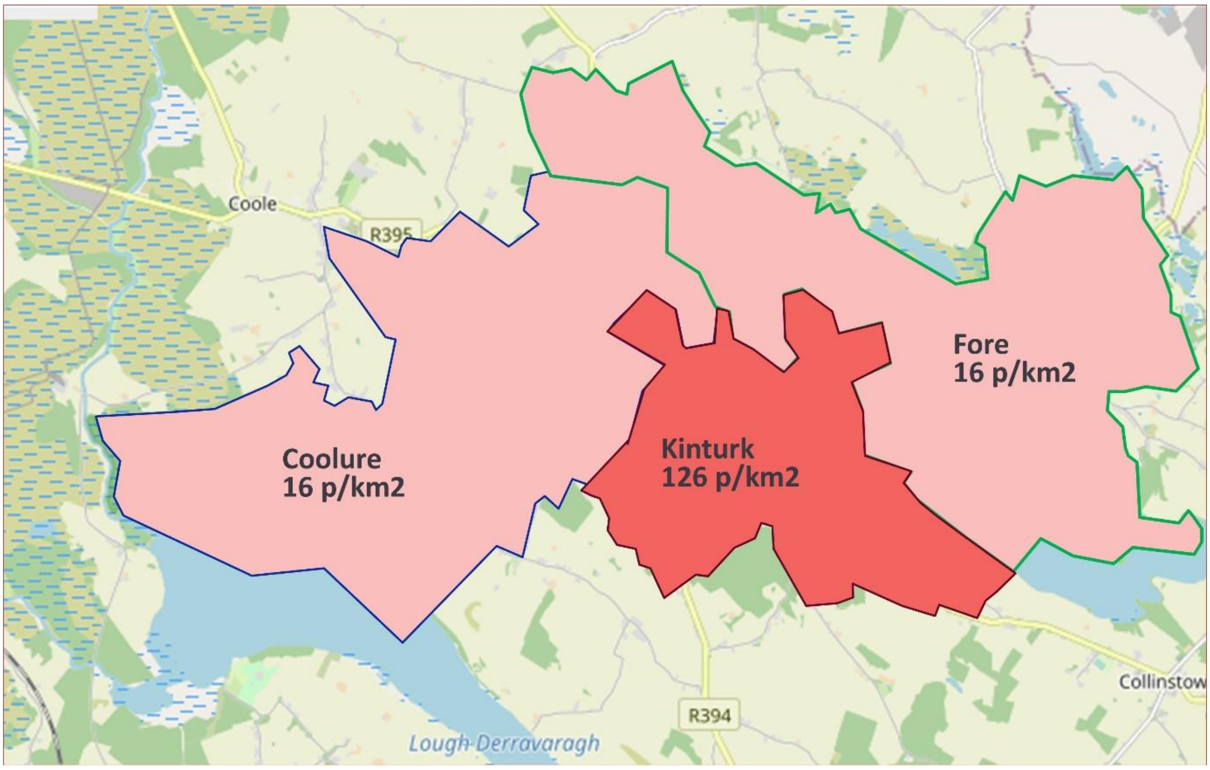


Figure 3: Population Density by ED

3.3 Social Balance

There is a variance across the SEC area in relation to economic advantage. According to Pobal's social disadvantage metric[12], which rates communities across a number of indices to measure levels of socio-economic disadvantage shows that for 2016, all three EDs in the SEC ranked marginally disadvantaged: Coolure was -0.89, Fore -1.7, Kinturk was -8.9. For context, a disadvantaged area is one rated as less than -10 in Pobal's index, and an affluent area is one ranking greater than 10 in the index.

The relevance of the social balance will be referred to in the register of opportunities where suggestions will be made as to how to achieve a balanced distribution of improvements which meets the social and policy needs of achieving a 'just transition'[13] to low carbon.

[12] https://maps.pobal.ie/WebApps/DeprivationIndices/index.html
[13] https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important

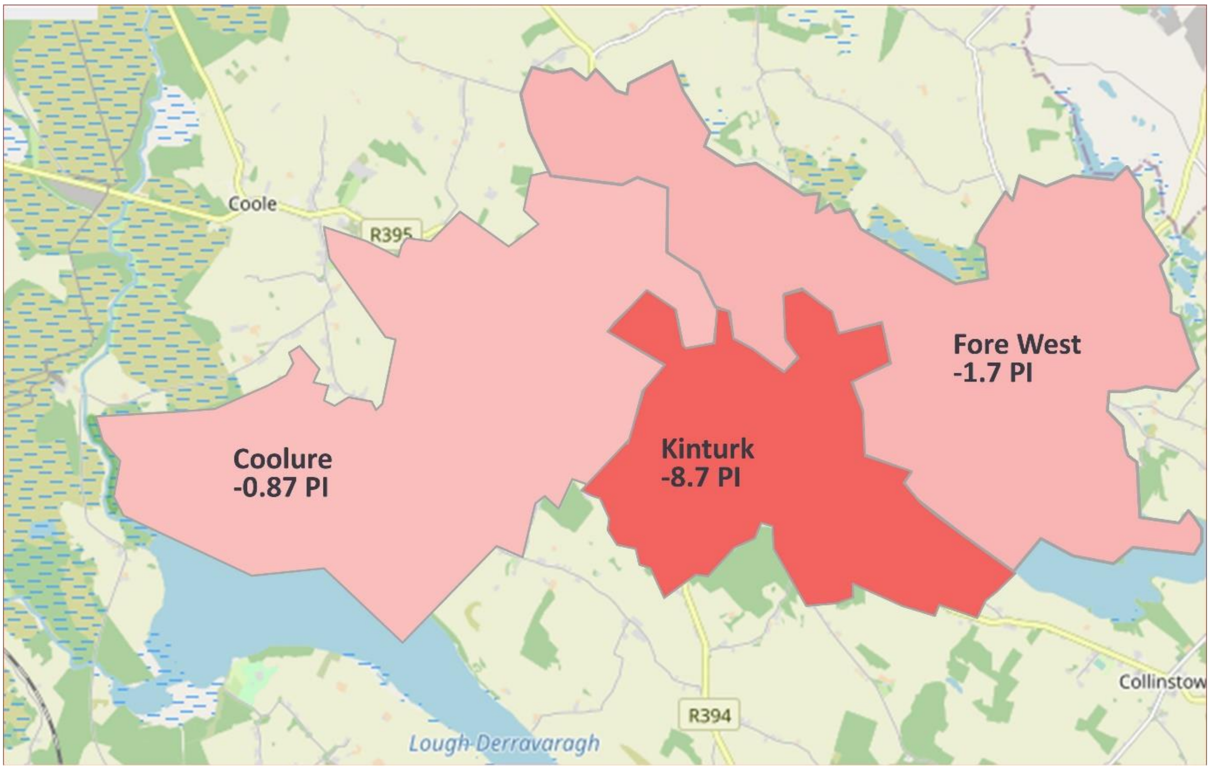


Figure 4: EDs within the SEC according to Pobal's Deprivation Index

4 Baseline Energy Usage

The Baseline Energy Usage (BEU) for the SEC area incorporates the main sectors of the local economy, such as residential, non-residential (including private tertiary, public, and industrial), local authority, and transport. To create the energy usage profile for each sector, we utilized detailed data that accurately represents the local conditions as much as possible. In cases where localized data was lacking, we utilized national energy usage statistics provided by SEAI and CSO for the respective sectors. Additionally, we incorporated socio-economic multipliers that consider the scale of local sectorial activity. We look first at domestic energy use in the home and in transport before going on to look at other sectors.

4.1 Domestic Energy Use

This refers to the energy used by individuals in the home and in their own personal transportation. It is different to non-domestic energy use, which is by businesses, schools, public bodies, etc.

4.1.1 Breakdown and Distribution of Residence Types

The 863 homes in the SEC area as a whole are predominantly comprised of houses (821) as opposed to apartment dwellings (40). While, as we would expect, 70% of the flats are in the Kinturk ED where Castlepollard is located, flats as a proportion of dwelling types varies little across the EDs at on average 4.9%. this is a lower percentage of flats per dwelling type than the rest of Westmeath and reflects the non-urban settlement patterns.

Table 3: Houses v Flats by ED, SEC and for Co Westmeath

Home Type	Kinturk	Coolure	Fore	SEC	Westmeath
House	95.2%	94.7%	95.2%	95.1%	90.2%
Apartment	4.8%	5.3%	4.8%	4.9%	9.8%

The housing stock ages vary across the SEC. Figure 5 shows that the largest age segment of homes in Coolure are pre 1919 (35%), while in Kinturk, 30% of the homes were built between 2000 and 2010 – i.e., during the 'boom' years. There continues to be a fair number of new developments built around Castlepollard. These new estates are built to new Part L standards and so will not require energy efficiency works. However, the majority of homes throughout the SEC area (those built pre-2011) will benefit from fabric upgrades.

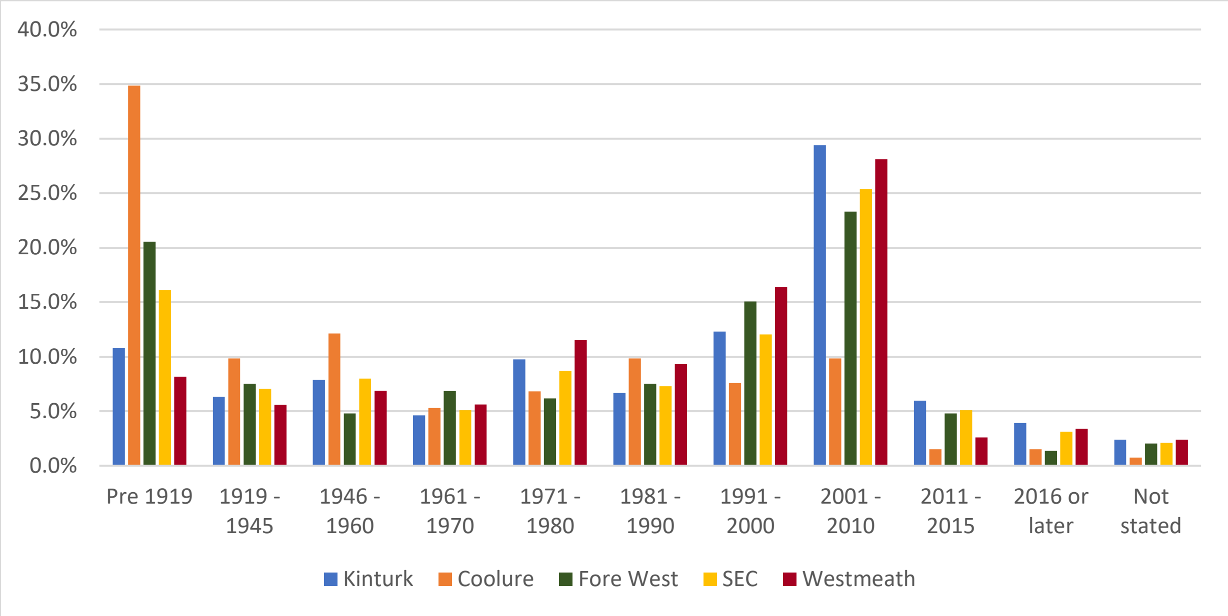


Figure 5: Houses by age

The age of the homes in the SEC may have significance in relation to their energy use, both in degree and in type of fuel used.

Homes size which is relevant to assessing energy use also varies across the SEC. Homes in the SEC in general have fewer rooms than the average for Westmeath. This is due to the fact that five-roomed homes predominate the Kinturk ED (31% of homes) with that ED representing the largest number of homes in the SEC. Fore West on the other hand has a higher-than-average number of homes with 8 or more rooms both for the SEC and for Westmeath. The correlation between density of population and size of homes is very typical.

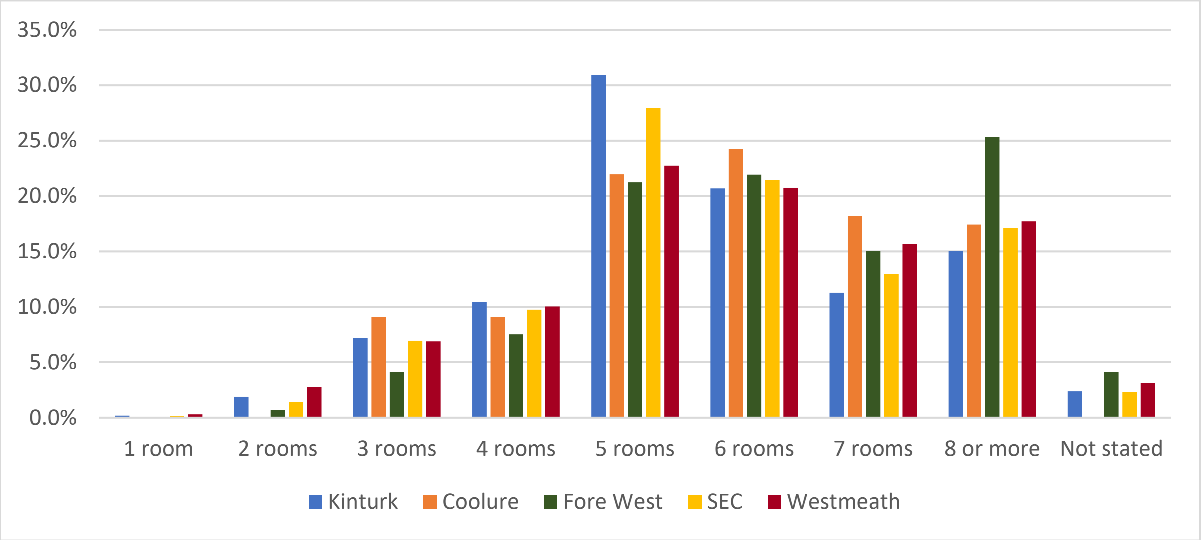


Figure 6: Rooms per home by ED, SEC and Co Westmeath

The number of rooms will be reflected in the home's energy use and also the cost of energy saving retrofitting works: thus, we would expect homes in Kinturk to be lower in energy use and those of Fore West (and perhaps Coolure) to be higher.

4.1.2 Home Energy Use

We adopted a number of approaches to achieve an estimation of the home energy use baseline for the SEC. We discuss our methodology and approach in Appendix Section 7.7.1.

We found that across the EDs there was an estimated 21,588 MWh of energy consumed between space and water heating, lighting, and appliances. Figure 7 shows that in the SEC area, average home energy use at 25,015 kWh/yr is above the National Average of 20,424 kWh/yr energy consumed per home[14].

[14] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/residential/

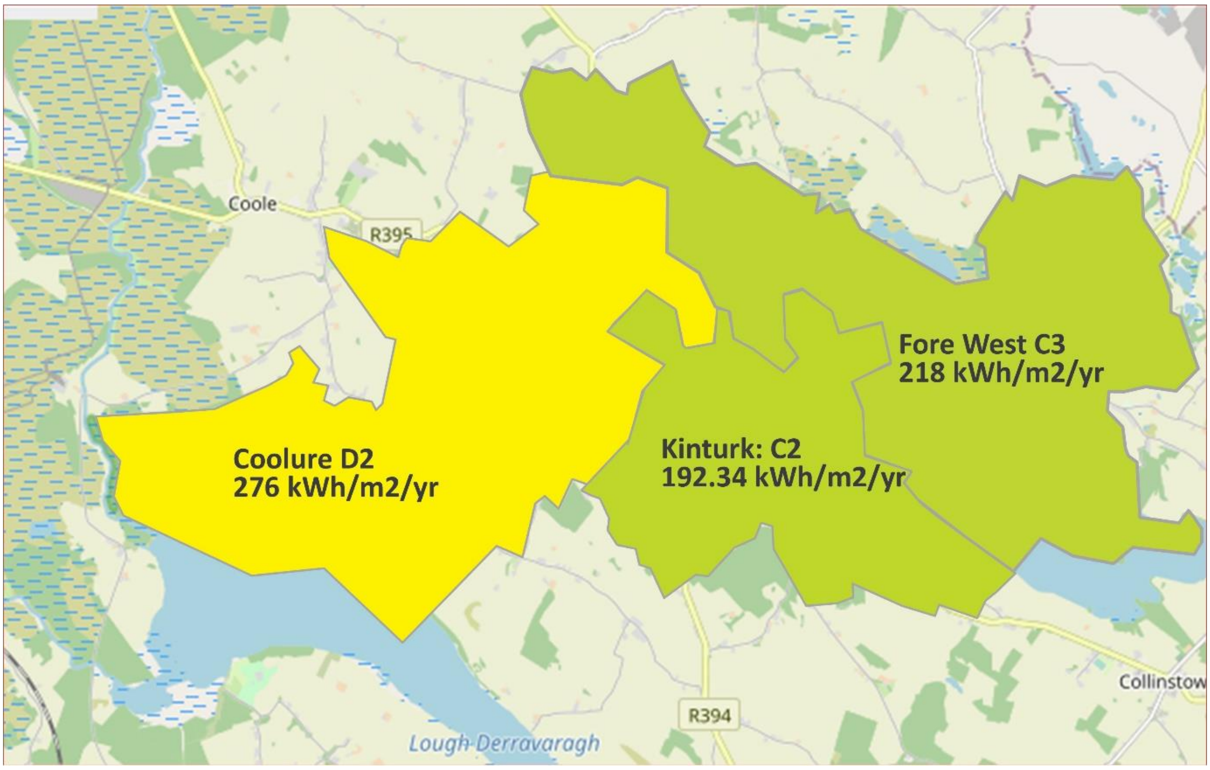


Figure 7: Median kWh/yr Consumed by Homes in Electoral Divisions

4.1.3 Energy Use by Fuel Type in the home

CSO data provides a breakdown of the fuels used in home heating for each Electoral Division and thus for the SEC area as a whole. This is shown in Figure 8 below. It is clear that for the SEC home heating oil is the most common fuel (63.7% of homes), followed by peat (which includes briquettes and sod turf) at 14.8%. Wood is quite widely used as a main heating fuel: in 6.5% of homes. There is Natural Gas used in Kinturk but only at 3.8%. Home Heating oil is carbon intensive and thus the recommendations in Section 5.1 on reducing carbon emissions from the home will focus on reducing the amount of home heating oil use. Electricity use stems from space heating in some homes, secondary water heating in most homes (the ‘immersion’), and lighting and appliances in all homes, and cooking in the vast majority of homes. We address costs and emissions below.

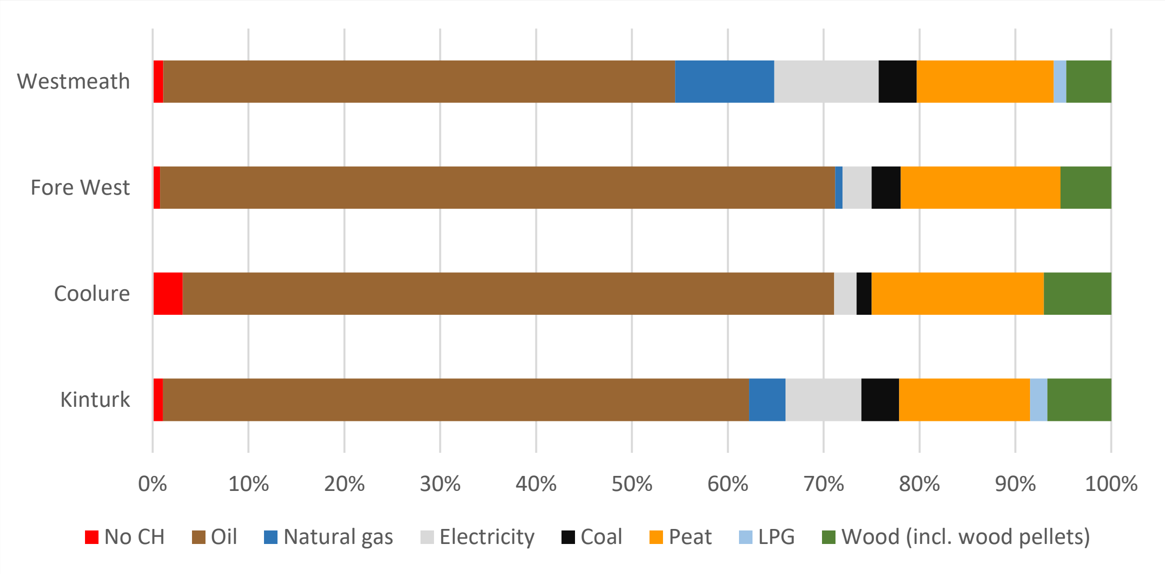


Figure 8: Home heating by fuel type

4.1.4 Total Energy Use in the home

Figure 9 below shows the energy use in the SEC for home heating. As we discussed in Section 4.1.3 above, heating oil dominates the energy use in the home requiring more than 10,000 MWh of energy. For reference this is approximately 1,000,000 litres of fuel. Sod peat fuel amounts to 2,511 MWh – 558,000 kg (558 tonnes) of peat – per year.

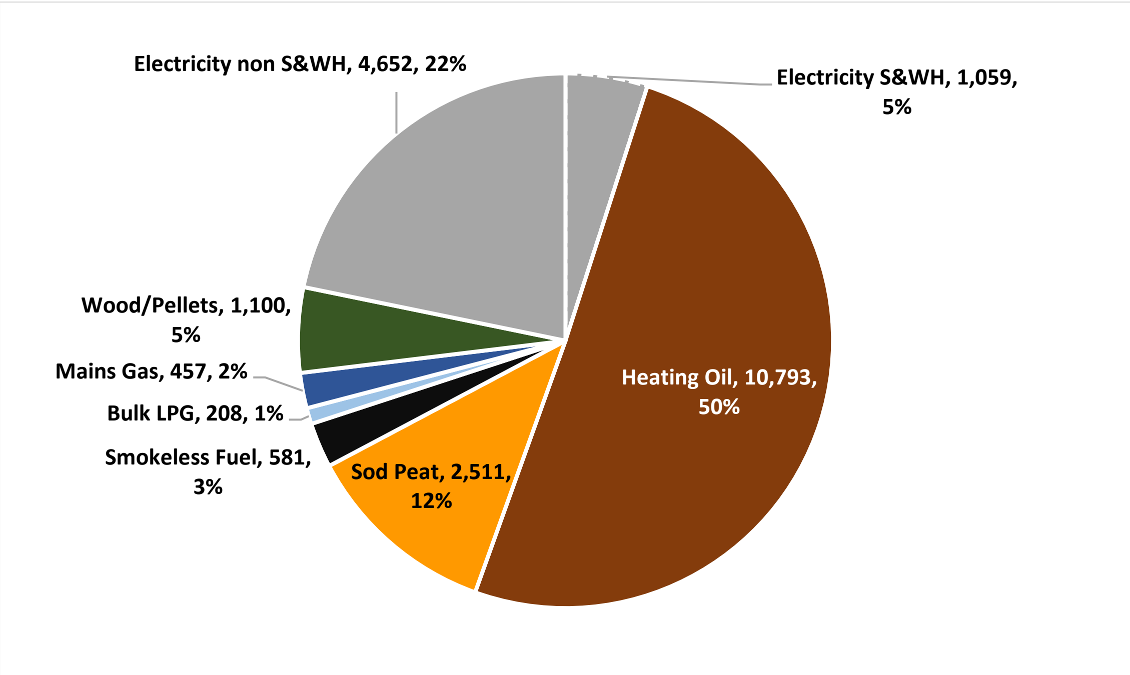


Figure 9: Total Energy use in SEC for Home Heating and Appliances MWh

We separate the electricity used in the home for space and water heating from that used for lighting, pumps, appliances, and cooking. This is because while the energy use for heating can be reduced by efficiencies, that used for other energy demands cannot in any reasonable manner: we will continue to need fridges, TVs, Computers, etc. We assume that most homes have already begun the transition to low energy lighting.

4.1.5 Carbon emissions from home energy.

We are able to calculate the emissions from home energy use by combining the total energy use in the SEC area in kWh/yr with data for Carbon emissions for each type of fuel in grammes of carbon dioxide per kilowatt hour (gCO2/kWh) We use the emissions values published by the SEAI[15].

We found (see Figure 10) that domestic energy use in the homes of the SEC area as a whole is responsible for the emission of 5,948 tonnes of carbon dioxide per year. To put this level of emissions in context, for the SEC area, this level of carbon emissions represents the equivalent amount of CO2 that is offset by 424,857 10-year-old pine trees over a year.[16]

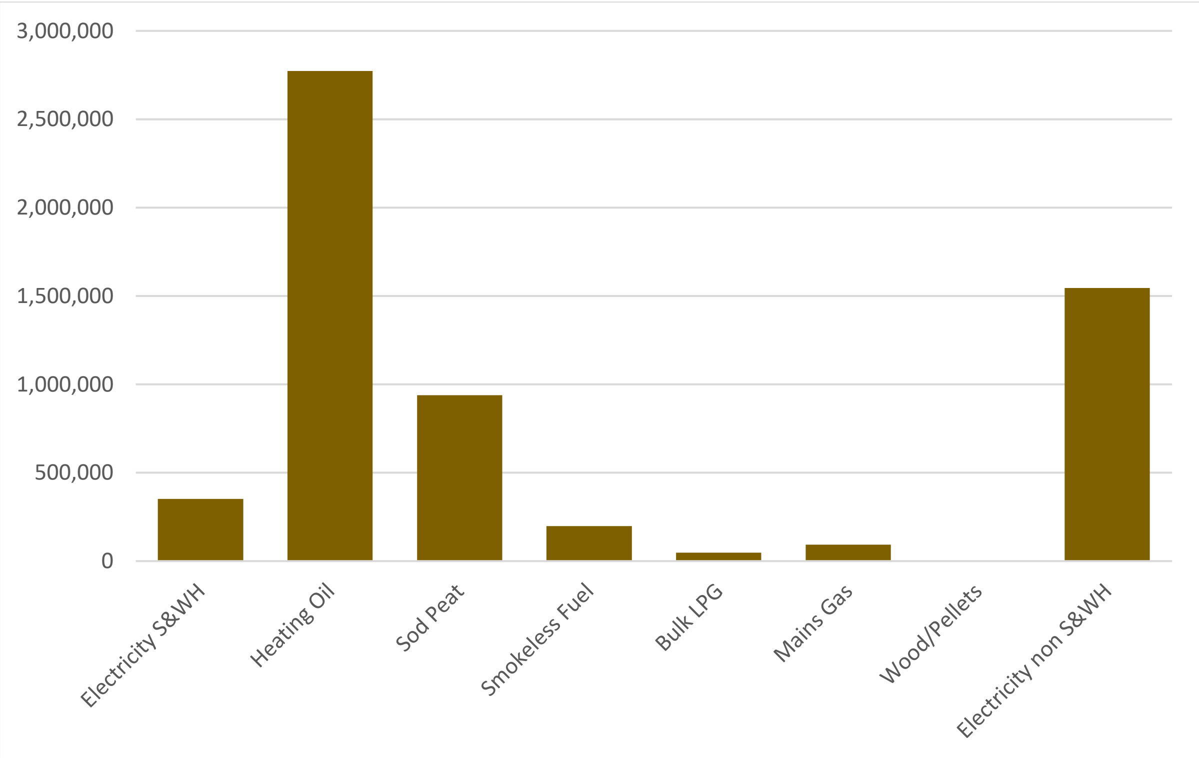


Figure 10: Annual Emissions from home energy use in SEC area in tonnes CO2 per year by fuel

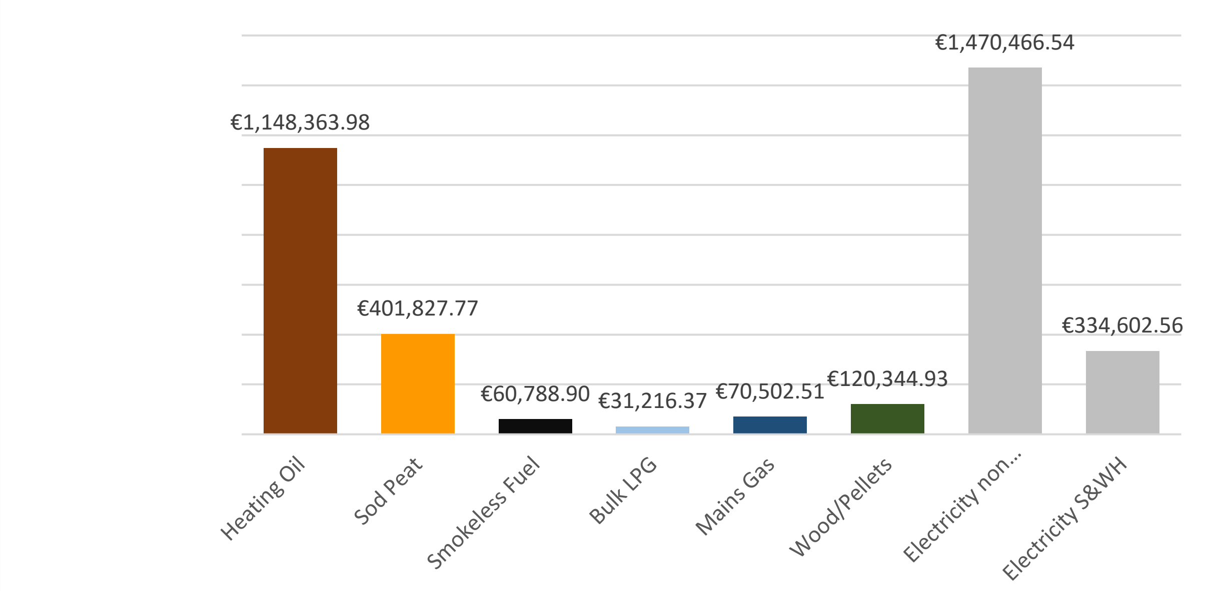
[15] https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/

[16] A mature pine tree will sequester 14kg per year. The more mature tree is larger and will sequester more carbon than a young tree. https://www.treecouncil.ie/carbon-footprint

Note: Wood is considered by the SEAI as a carbon neutral fuel: the carbon emitted when combusted is captured by the wood as it grows. This presumes that for every tonne harvested, more than a tonne is replanted. The zero emissions rating from the SEAI also does not include harvesting, processing, and transport.

4.1.6 Energy Use Cost

The SEC is estimated to spend[17] a total of €3,638,113 on home energy use.



This would amount to €4,216 in total per household. This is more than the typical energy bill quoted elsewhere owing to a number of factors. The BER energy rating system does not directly reflect the energy use practice of individual householder who may choose to under (more usually) or overheat their home (even with adjustments discussed in Appendix Section 7.7.1). The typical national figures that are often referenced relate to Natural Gas as the primary space and water heating source. Natural Gas has traditionally been a relatively cheap form of heating energy (currently it is at €0.15/kWh)[18] For the majority of the homes in the SEC area, Natural Gas connections to the mains are not possible at this time. Therefore, more expensive and or less efficient heating fuels are used.

Solid fuel heating both drastically reduces a home's airtightness while at the same time delivering very poor typical efficiency - 20-30% for open fires. This means that to achieve the same level of delivered energy as a 1,000W electric room heater (costing €0.29 per hour to run) a fireplace will burn 3,000W per hour (costing €0.3585/hr) of fuel.

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[17] https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf
[18] ibid

4.1.7 Energy in travel

There is a limited range of methods of travel available in the SEC area. It is serviced by public bus to Delvin and an intercity bus to Dublin and there is an intercity train available from the station at Mullingar which is 22kms away.

In this section we look at the domestic travel methods – namely walking, cycling and cars, but more specifically cars. Walking and Cycling produce no emissions and are largely free.

We calculated (Table 4) from CSO 2022 and geographical data that there is a lower density of private cars per km^2 in the SEC ($21/km^2$) as in Westmeath County ($29.8/km^2$).

Table 4: Car Densities Compared[19]

Area	Area km2	Cars per km2
SEC	53	21
Westmeath County	1,840	28.9
Ireland	70,273	32

Using this we can extrapolate the number and type of car fuel types in the SEC. Table 5 shows this broken down into Electoral Division.

Table 5: Car by Fuel Type per ED

	Coolure	Fore West	Kinturk	SEC
Petrol	60	66	194	319
Diesel	154	169	497	820
Other Fuel Types	9	10	31	50
Total	224	245	721	1190

Diesel engines are favoured for their perceived efficiency over distances, and CSO National Transport Omnibus found that diesel drivers (at an average of 21,171 km/yr) usually drive further distances than petrol drivers (at an average of 13,220 km/yr)[20]

Thus, we can arrive at a solid estimation of kms driven, energy related carbon emissions, and costs from private domestic transport in the SEC area which we show in Table 6.

[19] Drawn from https://statbank.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=THA17&PLanguage=0

[20] https://statbank.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=THA17&PLanguage=0 We used the year 2019 as the benchmark as the pre-Covid values are more representative of the norm.

Table 6: Cost and Emissions for SEC area Private Car Use

Cars	Total Cost €/yr	Total Emissions tonnes CO2/yr
Coolure	**€377,890**	**516**
Fore West	**€413,317**	**565**
Kinturk	**€1,216,333**	**1,662**
SEC AREA	**€2,007,541**	**2,743**

Private car related emissions in the SEC are estimated at 2,743 tonnes CO2/yr. This would need 195,928 trees to offset this amount of CO2 over the year (which does not take into account NOx from petrol and diesel that are very harmful to human health).

4.1.8 Total Baseline Energy Use Domestic Sector

We are now in a position to measure the total energy use for the residential sector in the SEC area.

We can see from Table 7 the SEC spends €117,176,147 on 642,787 MWh of energy per annum. This would generate 198,404 tonnes of CO2 in emissions: needing 14,171,714 trees to offset.

Table 7: Total Domestic Energy Use, Emissions and Cost by ED

ED	Domestic Sector Energy MWh	Domestic Sector Emissions t CO2	Domestic Sector Costs €
SEC AREA	**31,787**	**8,691**	**€5,645,654**

In terms of emissions the SEC has a mean of per 10.67 tCO2 per Household for home and car transport use.

4.1.9 Renewable Energy in the Home

In the 2022 census, the CSO collected data on the installation of renewable energy technologies in the home for the first time. This is shown in Figure 11.

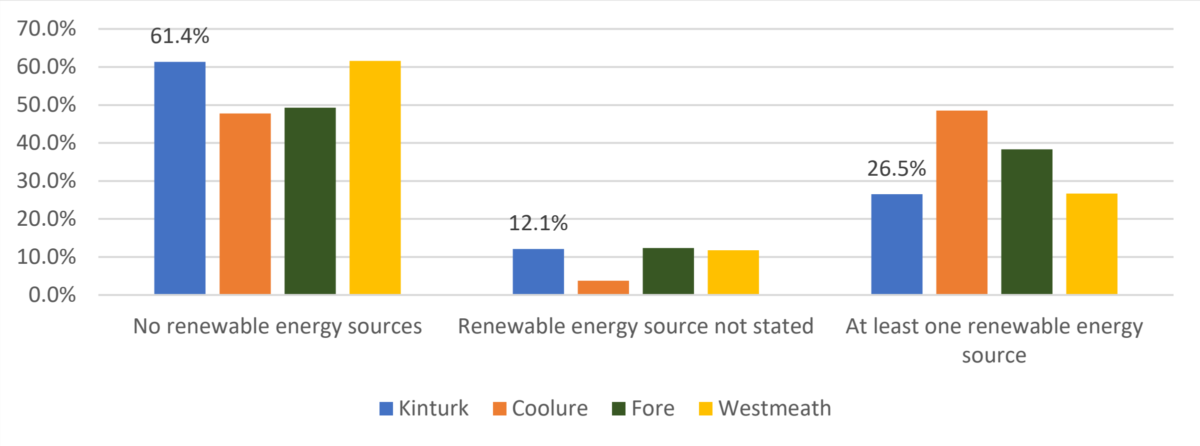


Figure 11: Renewable Energy Installed in the Home by ED, and Co. Westmeath

Coolure and Fore West have higher levels of Renewable Energy installed in the home than Westmeath as a whole: nearly 50% of homes in Coolure have some renewable energy installed. The larger roof areas that are to be found in the more rural sparsely populated Coolure and Fore West EDs can be assumed to make rooftop renewable energy generation more feasible. Average Coolure Ground Floor Area is 131 sqm, Fore West is 168 sqm and Kinturk is 102 sqm. It should however be borne in mind that even for Kinturk, many of the homes would be capable of supporting a 2-3kW PV installation (a 2kW PV installation would require approximately 10m^2 roof space). PV in the home is discussed in detail in Section 5.1.4.2

4.1.10 Sustainability of Domestic Energy Sector

The carbon offset footprint of household energy emissions in the SEC area would require an area of 413 hectares (4.13 km^2) of tree planting. The SEC is 56 km2 in area. Therefore, the area required for planting is 7.4% the area of the SEC.

The breakdown of fuel types is shown in Figure 12 showing that at present almost all of the energy consumed comes directly from fossil fuels. There is an imperative to reduce energy use as much as possible before looking to replace the fuels used by electricity.

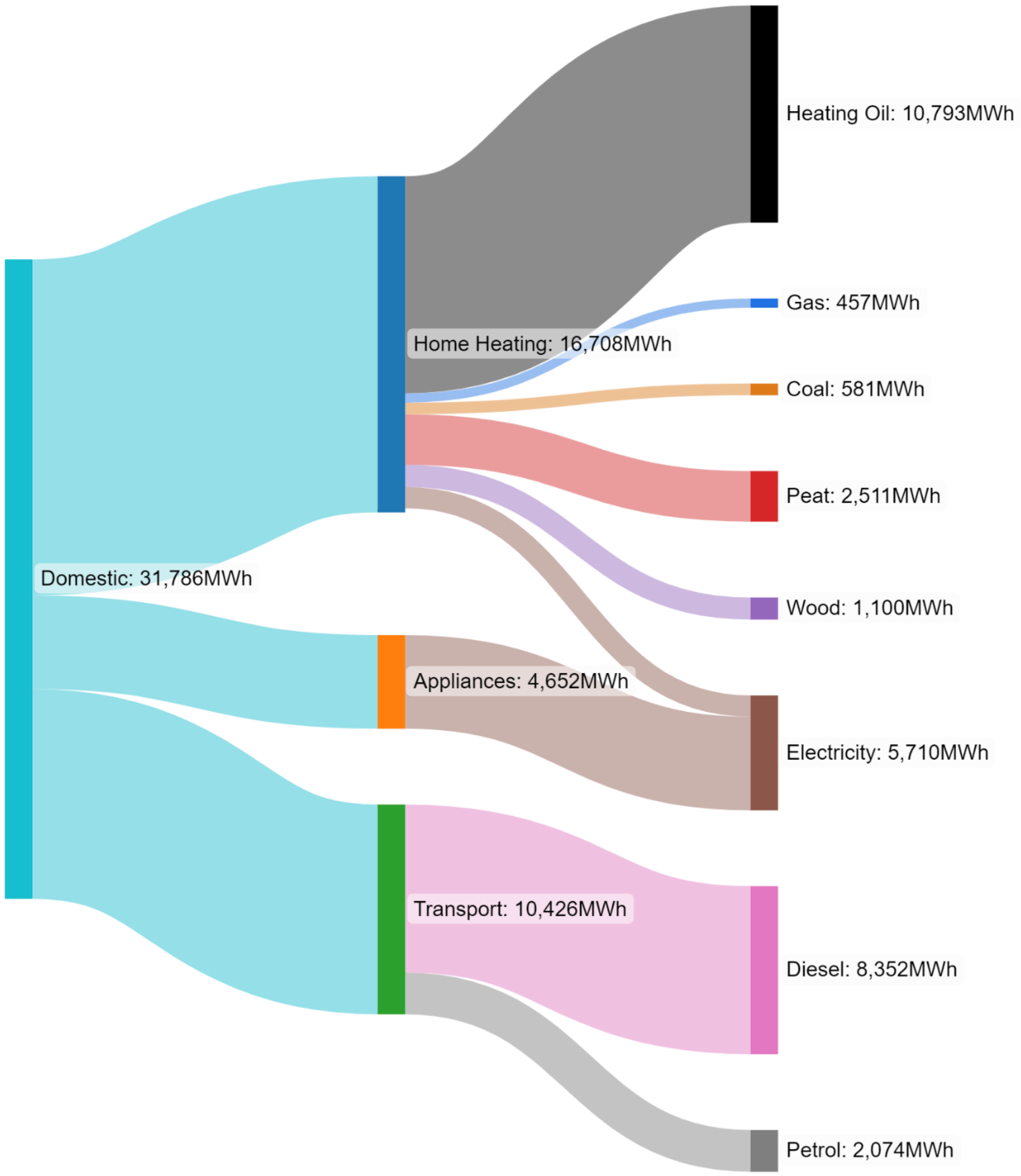


Figure 12: Sankey Graph of Domestic Energy Use by Fuel Type[21]

[21] Sankey Graphs were built using Sankeymatic

4.2 Non-Domestic Energy Use and Emissions

Non-domestic premises includes businesses of all sizes, community premises such as centres and sports clubs, as well as schools, and public buildings. We examine their considerable contribution to the energy use of the SEC area.

4.2.1 Breakdown of Business Types

The CSO classifies business types in their BER statistics. We used these classifications to identify the number of businesses in the SEC area using Geodirectory[22] data shown in Table 8

Table 8: Businesses in SEC area by CSO type

CSO Class	Number in SEC area	m2	kwh/yr
Retail	30	9,270	9,603,720
Office	20	10,600	6,646,200
Restaurant/ public house	10	2,470	2,415,660
Hotel	1	360	262,440
Warehouses	0		
Workshops/ maintenance depot	0		
Industrial process building	5	14,240	9,113,600
Community/ day centre	2	484	223,608
Nursing residential homes	0		
Schools and colleges	4	5,904	743,904
Sports facilities	2	1,994	1,329,998
Total			**30,339,130**

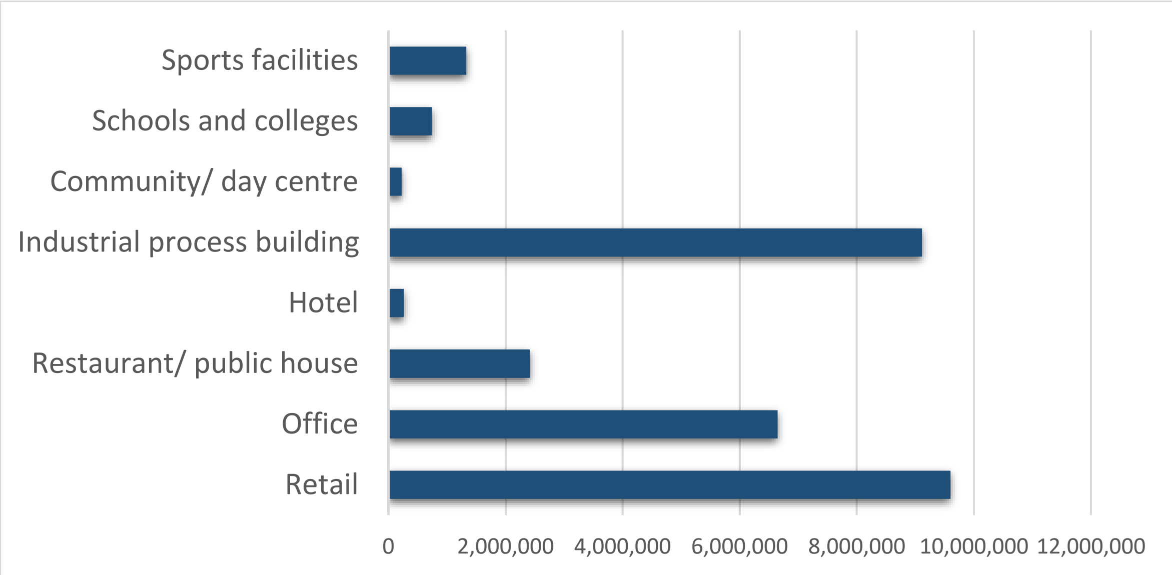
4.2.2 Energy Use

CSO publishes data on building energy use per m^2 for each class of business as well as average building areas for each business type. This enables us to estimate the overall energy use for the SEC area's businesses.

There are an estimated 31,600 MWh of energy used in business premises in the SEC area (i.e., this excludes transport).

[22] https://www.geodirectory.ie/

Table 9: Energy Use in Business in SEC area in MWh



4.2.3 Non-Domestic Energy Use in Premises by Fuel Type

Different businesses use different forms of energy to meet their specific energy requirements. Combining data from the CSO on fuel use in Westmeath[23] across the categories above, we can calculate this varying fuel source type across the categories of businesses in the SEC area.

Table 10: Non-Domestic Energy Use by Fuel and CO2 emissions

Fuel	MWh/yr	tCO2
Electricity	16,351	5,489
Gas	8,272	1,687
Oil	4,592	1,227
Renewables	759	0
Total	**30,339**	**8,404**

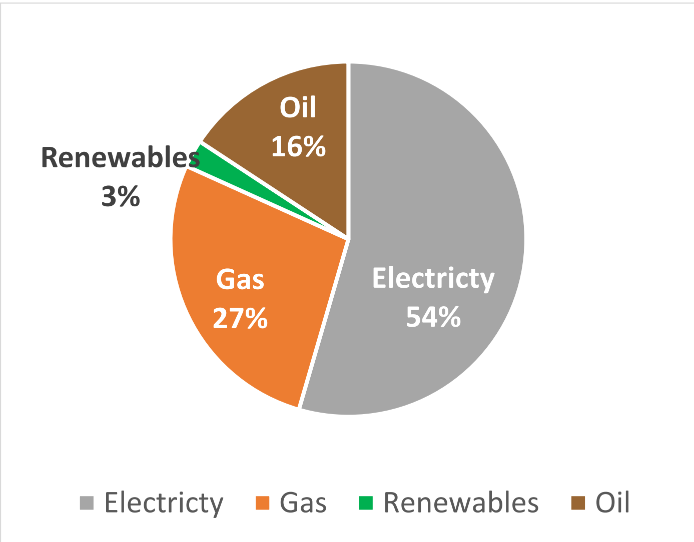


Figure 13: Non-Domestic Energy Use by Fuel

[23] https://www.cso.ie/en/releasesandpublications/ep/p-ndber/non-domesticbuildingenergyratingsquarter32022/

The contrast between non-Domestic energy use (not in travel) shown in Figure 13 and that of domestic use is very clear in the greater use of electricity as a power source in the non-Domestic context. Figure 9 above showed that oil provided 50% of the domestic energy demand and that electricity accounted for 27%. In the non-domestic sector, 54% of the energy demand is met by electricity. In the retail and office sectors, appliances and lighting require electrical power. The relatively high electrical demand in the non-Domestic sector in the SEC area (81%) will call for specific measures to be addressed in the Register of Opportunities specific to the commercial and community sector in Section 5.3 below.

In terms of emissions, the total for the non-Domestic sector (excluding transport) is 8,404 tonnes of CO2 or 143% of the domestic energy demand. This suggests that the non-domestic energy use is very significant in terms of emissions and needs to be addressed in tandem with that of the domestic sector.

4.2.4 Energy in non-domestic transport

4.2.4.1 HGVs, PSVs, Tractors and Machines

From a combination of CSO census and transport omnibus data (2019, i.e., pre-covid period) we can estimate the amount of diesel consumed in the SEC area by goods vehicles (accounting for varying size of goods vehicles), tractors, machines and small PSVs (Table 11)

Table 11: Non-Domestic Transport Fuel Use (excluding buses)[24]

	Goods vehicles	Tractors and machinery	Small PSVs[25]	All Transport
SEC	193	53	6	252
Average km	[Note]	16,782	42,742	-
Total km		892,793	270,529	5,428,106
L/100km	-	36	12	-
Total Liters	672,892	291,051	32,463	996,406
Total MWh	6,729	2,911	325	9,964
Total CO2	1,803	780	87	2,670

[Note] Goods Vehicles are found to have different average kms/yr and different fuel consumption per 100km according to weight class.

Certain forms of commercial transport are readily open to electrification (thus being zero emission). It is very feasible today to use an EV for small PSVs (taxis, minibuses). This means that today 3% of the calculated emissions for 2019 in the SEC's commercial transport sector are open to electrification. This does leave a large amount of emission not immediately and

[24] See Appendix Section 7.8 **Error! Reference source not found.** for calculations.
[25] Taxis and minibuses

seamlessly open to electrification. We will discuss this in the Register of Opportunities in Section 4.2.4.1.

4.2.5 Agriculture

The agriculture in the SEC is almost exclusively grassland. There are a total of 3,572.6 hectares of grassland farmed in the SEC. The majority of this is for cattle (86%), with some sheep grazing in Coolure (25% of grassland) and Fore West (7% of grassland).

There is a carbon emissions consequence from farming, although grass fed farming is low emissions intensive. We calculated that the CO2 emissions from farming in the SEC amount to 24,113 tCO2 per year. This is a very large proportion of the annual GHG/CO2 in the SEC, but is not surprising as agriculture plays an essential and prominent role in the economic life of the SEC.

	KINTURK	COOLURE	FORE WEST	SEC
Total Hectares	522.6	1,519.8	1,530.2	3,572.6
Hectares Cattle	510.0	1,077.0	1,500.3	3,087.3
Hectares Sheep	0.0	375.3	171.0	546.3
t CO2/ha/yr Cattle [Note]	7.1	7.1	7.1	7.1
t CO2/ha/yr Sheep	4.1	4.1	4.1	4.1
t CO2/yr Cattle	3,613.4	7,630.7	10,629.6	21,873.7
t CO2/yr Sheep	0.0	1,538.6	701.1	2,239.7
Total t CO2	3,613.4	9,169.4	11,330.7	24,113.4

[Note] The CSO does not publish data differentiation between dairy cattle (9.52 tCO2e/ha/yr) [26] and other cattle (4.65 tCO2e/ha/yr[27]) for confidentiality reasons. Therefore, we must take the mean value for emissions per hectare for all cattle of 7.1 tCO2 per ha]

4.2.6 Total Energy Use Non-Domestic Sector SEC Area

We can now state the estimated non-domestic energy use for the SEC area. This is 40,303 MWh energy per year (Figure 14). This reflects an energy consumption of 17.8 MWh per person per year (MWh/pp/yr) for the SEC area. This is 14% above to the national average of 15.6 MWh/pp/yr[28].

[26] https://www.teagasc.ie/media/website/publications/2022/2021-Sustainability-Report.pdf p26
[27] Ibid p35
[28] See Appendix Table 25

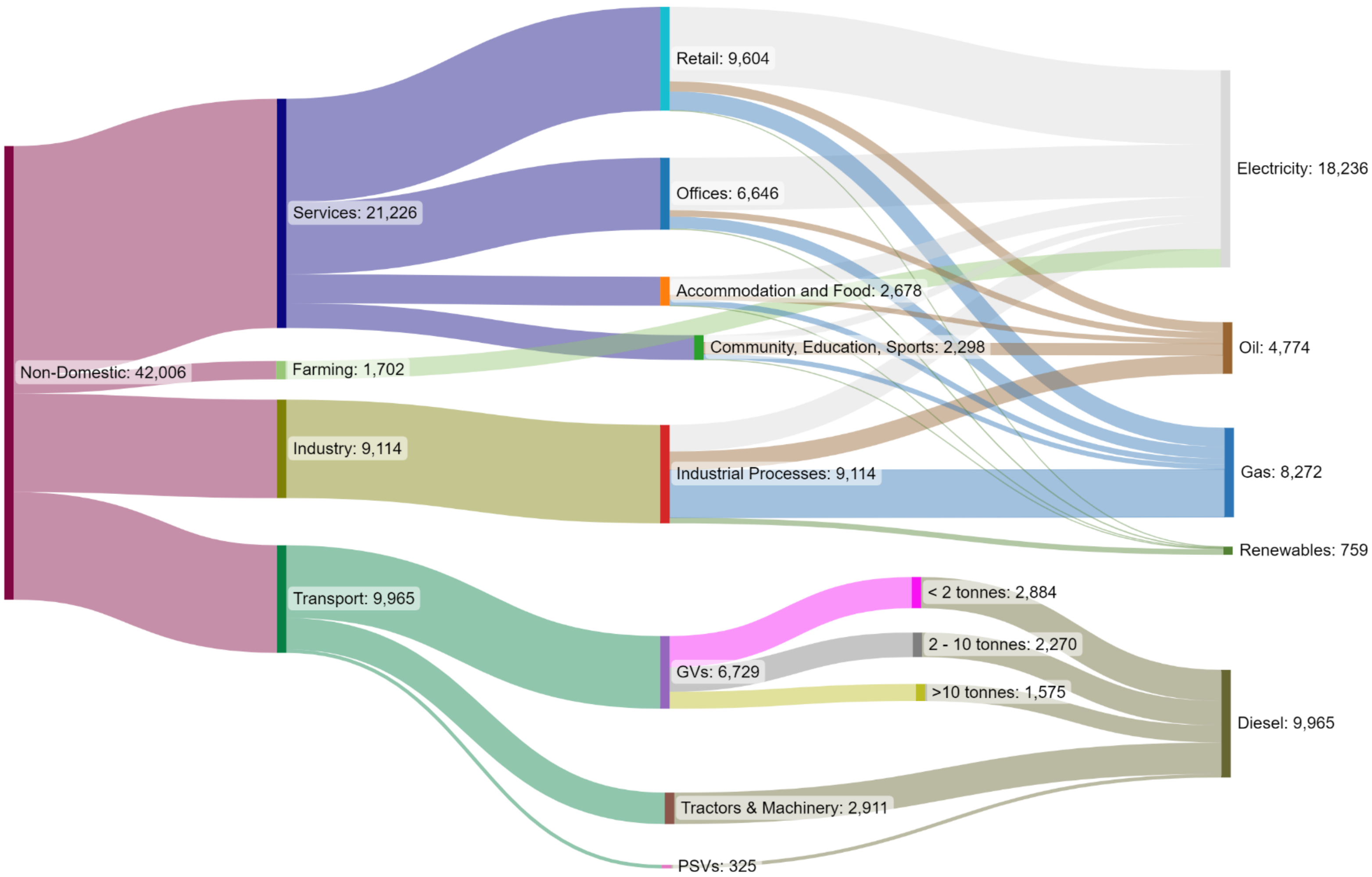


Figure 14: Sankey Graph of Non-Domestic Fuel Use by Sector

The electricity use by the non-domestic sector has both sustainability and economic implications for the SEC. Electricity prices are high and will remain so in the medium term. However, electricity is the required energy source for most applications – in particular in retail and office spaces. Therefore, aiming to reduce costs, we will recommend efficiency and micro-generation opportunities for this sector.

As regards diesel in transport, goods vehicles less than 2 tonnes and PS Vehicles (taxis and minicabs) account for 3,200 MWh of energy use per year. These are amenable to conversion to battery electric vehicles (BEVs) with currently available market ready technologies. However, the remaining 6,756 MWh are not currently served by either BEVs or Fuel Cell Electric Vehicles (FCEVs). There is no one-to-one replacement for diesel in these applications that are cost equivalent. This is discussed further below in Section 5.4

Gas and oil represent 31% of the non-domestic energy mix. It will be difficult at the current state of technologies to replace the gas used in industrial processes. Gas is used to provide high heat temperatures which are difficult to achieve by heat pumps alone – although a combination of heat pump and gas would be possible. Green hydrogen is viable as a carbon free high heat provider replacement to gas, but it is still not available in Ireland, and would not represent an *economic* opportunity for the non-domestic users of gas and oil in the SEC. We will discuss sustainability imperatives and opportunities below.

The main lesson from the non-domestic data is that there should be efficiency-based economic opportunities available. These can be achieved often at low-cost and would be indicated in the first instance by a simple energy audit of a business. We highlight some case studies below in Section 5.3

4.2.6.1 Non-Domestic Carbon Emissions

As we can see from Figure 15 the majority of commercial/community CO2 emissions (50% at 5,489 tCO2/yr) come from electricity. This is due to two factors: firstly, the SEC area's retail and services businesses use more electricity than other forms of energy. Lighting, equipment, and refrigeration in services use large amounts of electricity. There is a relatively high carbon intensity of Ireland's electricity (330.4 kg CO2/MWh). Some of the electricity use is open to decarbonisation but opportunities are site specific. We discuss these opportunities in Section 5.3.

The carbon intensity of Irish mains electricity is due to fall over the long term. There are large-scale offshore wind renewable projects embedded in national policy and due to come on stream by 2030. This will reduce the cost, security and sustainability issues that affect the carbon content of our electricity generation system. The winning bids in the recent offshore auction averaged at €86/MWh which would translate to €.086/kWh. The 2030 targets are for 5GW of wind installed. For illustrative purposes, this would be equivalent to 2.5 Moneypoint generation stations (based on an assumed capacity factor of 45% for offshore wind). This will reduce the carbon intensity of Irish electricity well below current levels.

Thus, as an energy source, we recommend that the medium-term strategy for non-domestic energy users is to match increased building and equipment efficiency with a change over to electricity as a source of power. We make recommendations below as to how this can be best achieved in the short-term using on-site micro-generation where feasible.

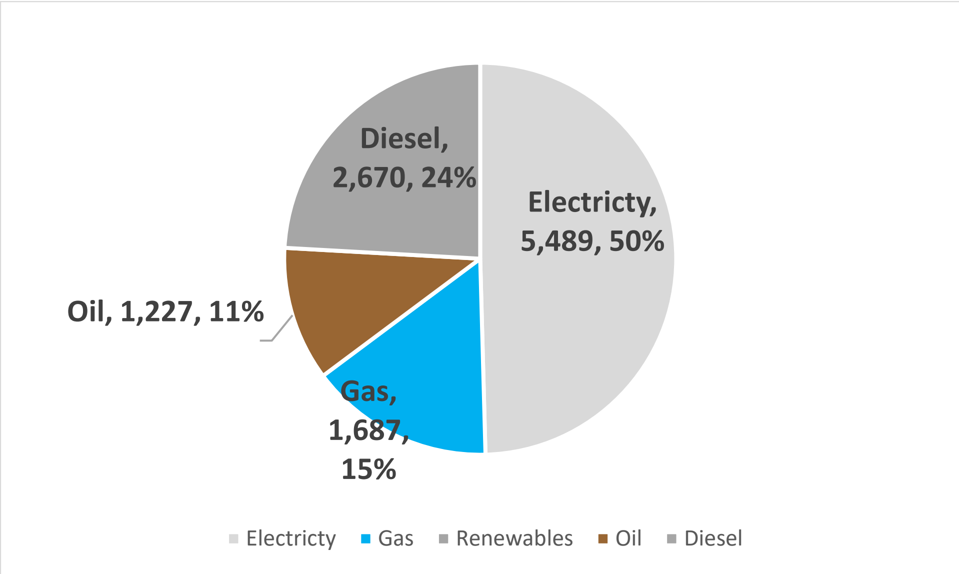


Figure 15: Non-Domestic Energy CO2 Emissions

Aggregated Energy Use by Energy Source

Across all sectors Figure 16 shows that Electricity is the greatest energy source (30.8%). Achieving efficiencies in electricity will not be straightforward: most modern electrical appliances are generally high efficiency as standard. Most homes and businesses have already switched to energy efficient lighting also. Electrical heating can be made more efficient using retrofits. However, the size of homes makes these retrofits costly in the short term which may make retrofitting efficiencies reducing electricity use a challenge. The dispersed density of building and presence of a good degree of suitable roof-space throughout the SEC will provide a good opportunity for PV deployment in both homes and businesses that is not available to many other SECs.

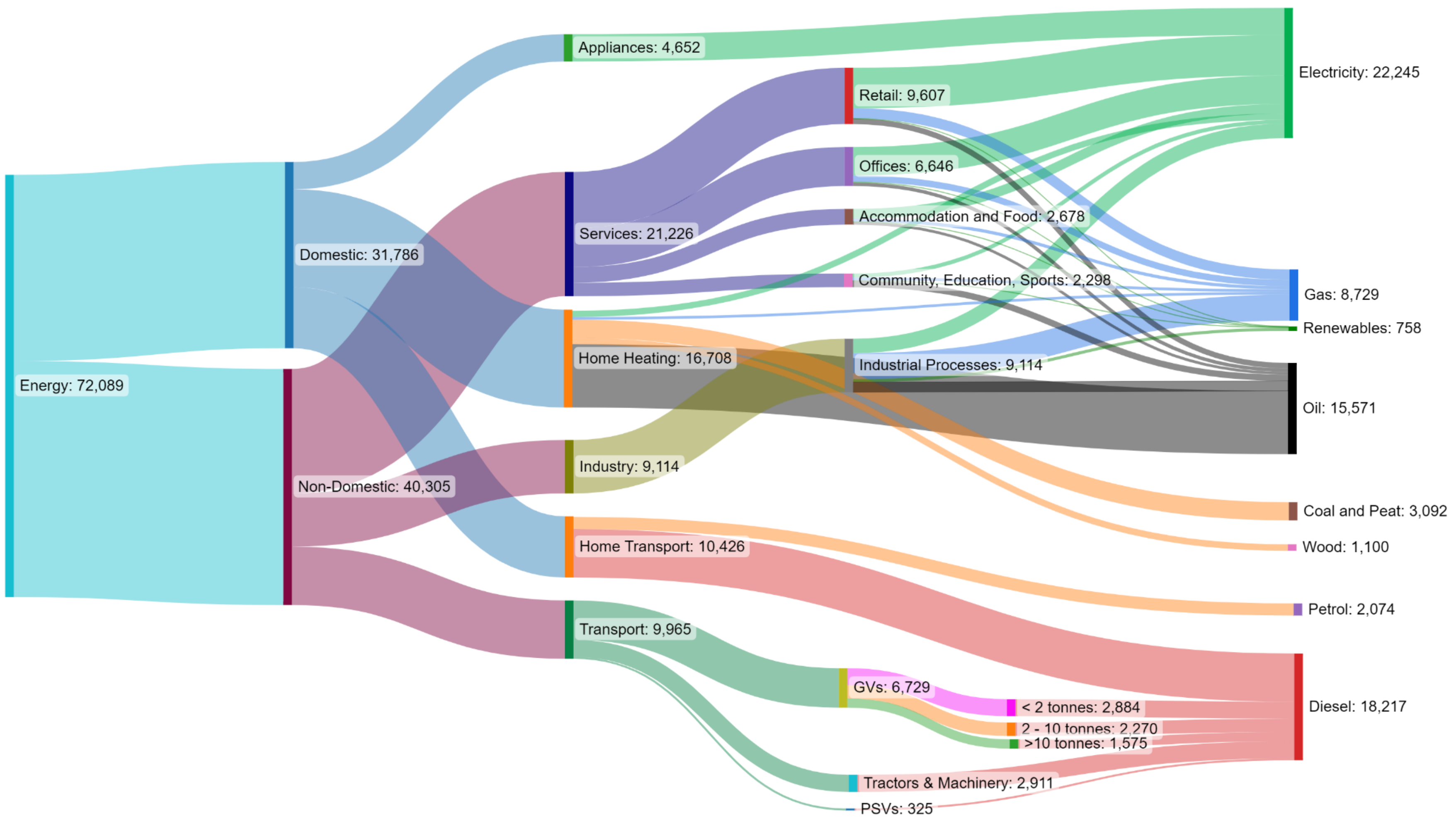


Figure 16: Sankey Graph Showing Breakdown of Fuels Across All Sectors

As noted above in Section, the cost and carbon intensity of electricity is an EU and national level issue. The current carbon intensity of Irish grid electricity which is currently 0.3304 kg CO2/kWh. This is 118% of that of oil and 139.6% that of natural gas in the home.

With great advances made in photovoltaic (PV) technology, government policy, and system economics[29], there will also be opportunities to produce renewable electricity at the local SEC level. The opportunity for distributed micro-scale PV in the home and small business will be well suited to the SECs building stock. Space, orientation, building ownership patterns, and energy use will be critical to the feasibility of PV deployments. We provide an estimate of PV potential to reduce grid electricity use in Sections 5.1.4.2 and 5.5.2.

The economic cost of small-scale PV represents an up-front capital outlay. This though is more than paid back over the life of the installation giving a very favourable Return on Investment (ROI). However, up-front costs could mean that the opportunity PV presents could only be available to the better-off in the community. The SEC committee who commissioned this EMP were keen to stress a need to present options whereby home and building retrofits and micro-generation could be made available to all where feasible. Below, we discuss the potential for preventing personal and family economic resources becoming a restraining factor on participation in what is known as the 'just transition' to low carbon. This has occurred in Co Clare in a community not very different from the of the Castlepollard SEC. The Solar Meitheal concept is now well tried-and-tested, and the details of the process can be seen here: The Solar Meitheal.

Heating oil in the SEC is also significant and represents 21.6% of the area's total energy use. It does present a strong opportunity for energy use and emissions reduction as the required interventions are technically well proven. These measures are initially costly, but they are well supported by grants, they have clearly defined payback periods, and they provide comfort and health benefits beyond the positive sustainability impacts.

The diesel use of MWh (25.3% of the total) in the SEC that we see in Figure 16 is from domestic vehicles, 57% of diesel use, and goods vehicles, at 37%, It will be possible to decarbonise the domestic portion with a switch towards battery electric vehicles. Advances in efficiency, cost reduction and most of all range, have been made to make this a firmly

[29] These are discussed throughout the document below.

feasible option. Increased public transport use as facilities improve as directed by government policy use[30] will also assist in this.

The diesel use of goods vehicles will be harder to reduce under current technology conditions (although this will develop in the coming years). Electric Goods Vehicles (EGVs) under 2 tonne weight are on the market and so with supports and in the right conditions, the 17.6% of the diesel use they represent can be decarbonised in the short to medium term.

GVs above this weight, and tractors and machinery are not readily on the market. There are a number of technologies that are in development, however. Fuel cell vehicles (FCVs) that use hydrogen as their energy storage are in development and there are significant demonstration projects at an EU level that seek to address this[31]. This portion of the overall diesel use (37%) and the energy use of the SEC as a whole (9%) will be difficult to decarbonise in the medium-term, however.

The petrol use for private cars is a relatively small portion of the SEC's energy use (2.9%). It can be readily reduced using EVs. While the carbon intensity of grid electricity at 330.4g CO_2/kWh as noted above is higher than that of petrol at 251.9g CO_2/kWh, Internal Combustion Engines (ICEs) have an average efficiency of only 30%. This means that a petrol engine produces 831.27g CO_2 per kWh delivered. The petrol vehicle also produces this CO_2 and other particulate pollution at roadside level where other road users are put at health risk. The recommendations in Section 5.2 will discuss costs, benefits, and potential synergies in EV adoption.

Solid fuel use makes up a relatively minor component of the SEC's energy use (4.3%). We exclude wood and wood pellets from this as they are deemed carbon neutral. However, our recommendations will include the replacement of open fireplaces with either stoves or electricity. The good news is that solid fuel reduction and replacement measures are much cheaper and more easily achieved than BEV adoption. Replacing fireplaces with stoves is cheap and will achieve considerable energy savings straight away, not least from blocking-up large open vents that are fireplaces in the living spaces in homes.

[30] Climate Action Plan 2021, p148, envisages a 500,000 increase in non-car journeys https://www.gov.ie/pdf/?file=https://assets.gov.ie/224574/be2fecb2-2fb7-450e-9f5f-24204c9c9fbf.pdf#page=null

[31] For example Galway Hydrogen Valley and GH2 projects.

4.3 Carbon emissions

The non-domestic sector accounts for more of the emissions of the SEC (61.8%) than the domestic sector (48%). Most of this comes from the electricity that is used (74.3% of all electricity). As stated before, the Irish electricity system is carbon intensive. We still have coal burning at Moneypoint Power Station (overall, during 2022, gas generated 48% of the total electricity used in Ireland, with wind energy contributing 34% and coal providing 9%).

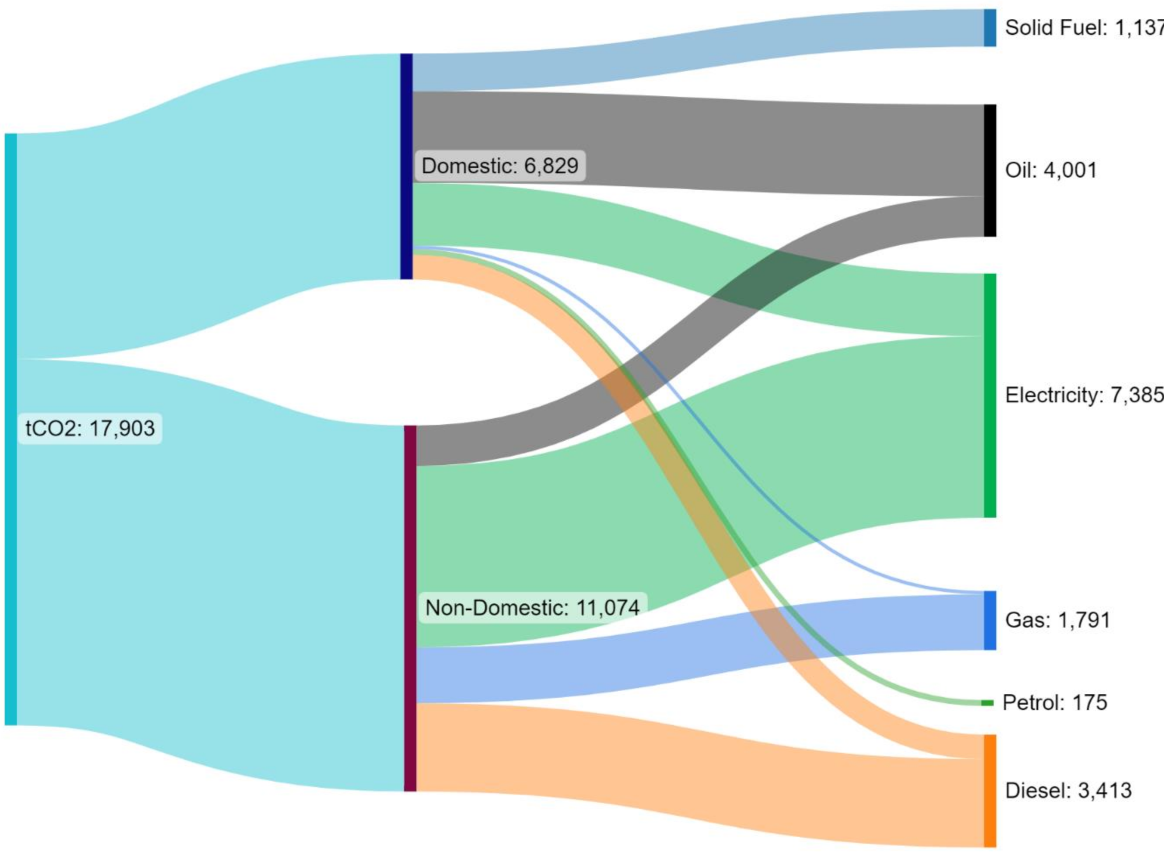


Figure 17: Total SEC CO2 Emissions by Sector t CO2

We can expect that decarbonisation of the Irish electricity supply will have significant beneficial effects on the SEC's carbon emissions from electricity. In calculations we retain the electricity carbon intensity values of 2019, but in our recommendations, we stress the overall benefits of moving in as far as possible towards switching from fossil fuels to electricity in most situations.

4.4 Costs

Costs of energy usage in the SEC are broadly aligned between the residential and the non-residential sectors. Indeed, costs of transport are also aligned in both sectors (Figure 18)

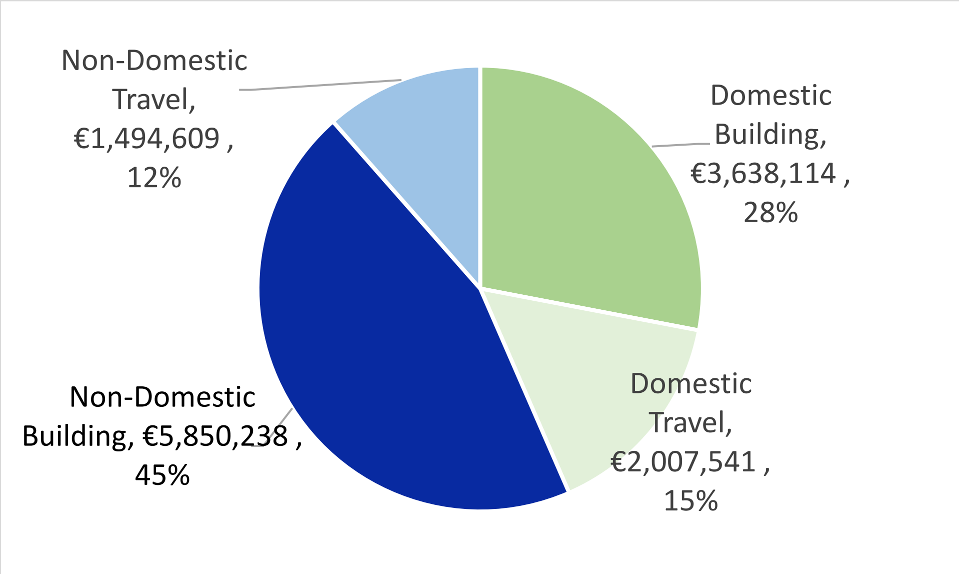


Figure 18: SEC Energy Costs by Sector €

The energy source spend is heavily weighted towards non-transport use (73% in total). Transport in the home and by business are 12% and 15% - this should direct our recommendations to building energy use to achieve the greatest impacts in reducing costs for the SEC as a whole.

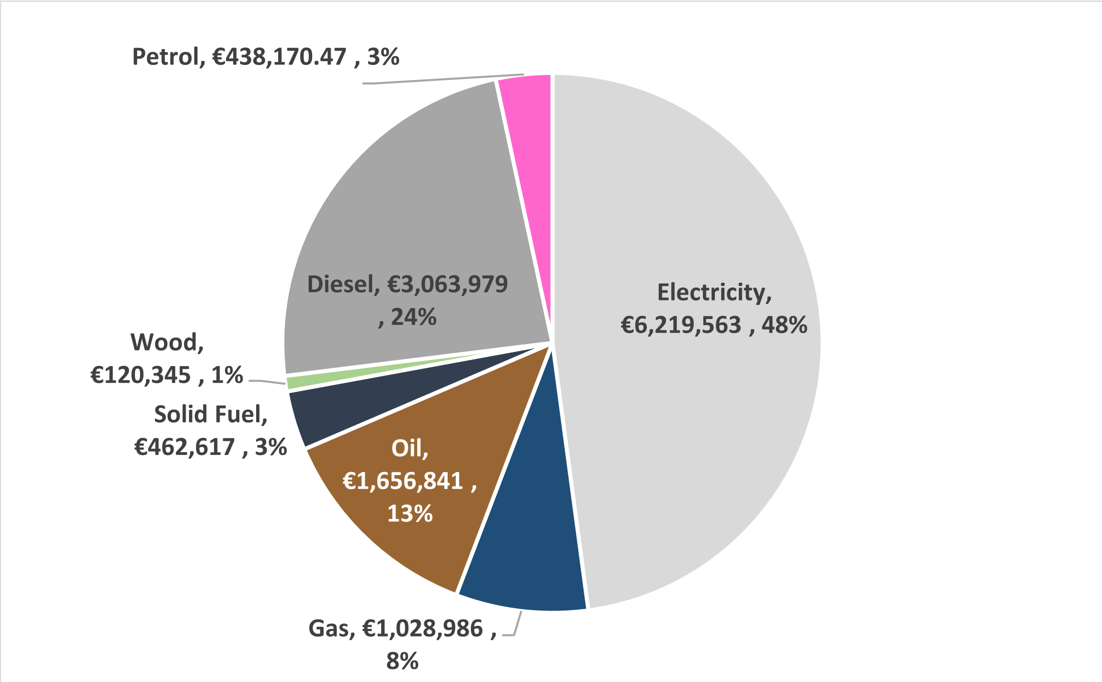


Figure 19: SEC Spend on Fuel by Type €

Heating oil, which is a very avoidable cost when the correct building efficiency measures are taken, cost the SEC an estimated €1.6m. Most of this (69%) falls on the domestic sector where it represents (for the domestic user) a considerable after-tax expenditure. We focus many of our recommendations in Section 5 on reducing this cost.

Electricity amounts to a spend across the SEC of €6.2m. We discuss in our Registry of Opportunities Section below how this considerable cost for both domestic and non-domestic users could be reduced.

5 Registry of Opportunities

This is an assessment of the means by which the SEC can achieve efficiencies to reduce energy demand as well as take up renewable energy generation opportunities. These opportunities are summarised in Section 6.1.

5.1 Domestic Level Retrofits

We lay out a range of opportunities for homeowners and community residents to demonstrate how they can increase their levels of sustainability: by improving the degree of energy efficiency of their homes, assisting transport choices that will be less carbon intensive as well as simple behavioural changes that can reduce their imported fossil fuel dependency. We will also discuss how they can engage in micro-generation at the home level.

5.1.1 Behaviour-change efficiencies

While we are all aware of the scale of the environmental challenge that faces our communities, it is critical that we as citizens are also aware of our own role in addressing that challenge. Research shows that what we do at home can help guide us to taking bigger, more noticeable community actions:

> *Individual behaviour creates the foundation for action in social, economic, and environmental sustainability, and potentially guides our ability to work with one another to make life-affirming decisions. In short, it is a matter of aligning our day-to-day behaviours with our well-stated values that will result in greater sustainable community action.*

Pappas & Pappas (2014)[32]

We present a list in Appendix, Section 7.1, of some quite simple actions that the homeowner can take to reduce the level of energy use in their own home with just behaviour changes. We summarise the highlights here:

[32] https://files.eric.ed.gov/fulltext/EJ1060565.pdf

Cost reduction measures:

- Change your energy provider.
- Consume less electricity and bottled gas, and more oil to heat your home and water.
- Consider switching to smart or night meters: but be aware this should be accompanied by only using immersion, washing machines and dryers between 11pm and 7 am.

Home Improvement Measures:

- Track down and eliminate draughts: check windows, external doors, vents, floor spaces, fireplaces, and stoves.
- Install a stove instead of an open fireplace.
- Check insulation levels in attic, basement, walls (including the meter box), and floor spaces.
- Check your boiler and stove is serviced.

Energy Reduction Measures:

- Switch to more efficient appliances and lower temperature settings
- Don't use standby on devices and turn off lights when possible.

5.1.2 BER

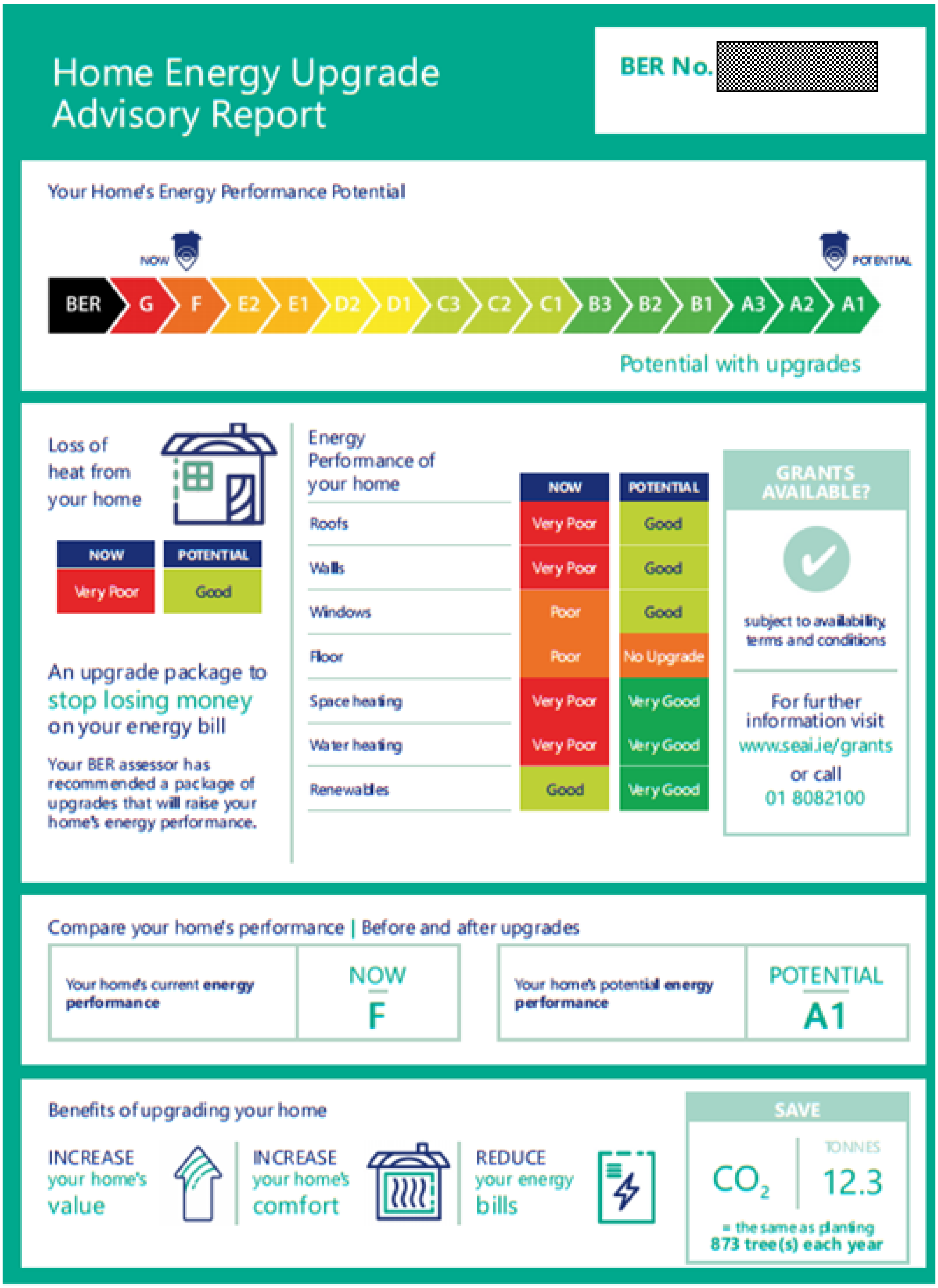
Achieving energy efficiencies through building upgrades and behaviour change are the key to reducing the cost of energy and the carbon emissions in this sector.

We identified opportunities for efficiencies in the homes of the SEC by conducting BER surveys of homes to establish levels of efficiency and across the domestic built environment and then providing each sampled home with a roadmap of measures to move them from their base level efficiency to B2 minimum.

5.1.3 Sample Homes

We advertised for SEC residents to volunteer for a free BER and Home Energy Upgrade report through local flyer and email announcements. We recruited 7 homes whose homes were surveyed by SEAI registered BER assessors. The assessors provided home owners with a set of recommended upgrades which could be carried out to improve the energy efficiency and comfort of their homes. A sample of such a report (which is found in the accompanying Register of Opportunities Document which is a live excel report to which other homes can be added) is shown below. In the sample, the BER Assessor identifies just 5 measures which, when completed in order, will bring the home's BER from an F-rating with estimated energy use of 20,472kWh/yr adjusted[33] (36,557 kWh/yr unadjusted) to just 2,166.5 kWh/yr.

[33] BER is a hypothesized energy consumption for the dwelling and does not reflect the actual energy bill – simply what the bill would be, were the owner to heat the building to normal healthy levels (20C). It is quite



Home Energy Upgrade Advisory Report

BER No. [redacted]

Your Home's Energy Performance Potential

NOW — POTENTIAL

BER | G | F | E2 | E1 | D2 | D1 | C3 | C2 | C1 | B3 | B2 | B1 | A3 | A2 | A1

Potential with upgrades

Loss of heat from your home

NOW	POTENTIAL
Very Poor	Good

An upgrade package to stop losing money on your energy bill

Your BER assessor has recommended a package of upgrades that will raise your home's energy performance.

Energy Performance of your home	NOW	POTENTIAL
Roofs	Very Poor	Good
Walls	Very Poor	Good
Windows	Poor	Good
Floor	Poor	No Upgrade
Space heating	Very Poor	Very Good
Water heating	Very Poor	Very Good
Renewables	Good	Very Good

GRANTS AVAILABLE?

subject to availability terms and conditions

For further information visit www.seai.ie/grants or call 01 8082100

Compare your home's performance | Before and after upgrades

Your home's current energy performance	NOW F	Your home's potential energy performance	POTENTIAL A1

Benefits of upgrading your home

INCREASE your home's value

INCREASE your home's comfort

REDUCE your energy bills

SAVE

CO_2 TONNES 12.3

= the same as planting 873 tree(s) each year

To find out more visit www.seai.ie

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

likely such occupants due to economic pressures may underheat their homes. We therefore apply an adjustment based on a study by Coyne & Denny, 2021, 'Mind the Energy Performance Gap: testing the accuracy of building Energy Performance Certificates in Ireland', *Energy Efficiency*, Vol 14, https://link.springer.com/article/10.1007/s12053-021-09960-1

Home Energy Upgrade Advisory Report

Your journey from BER F **to** BER A1

Your BER assessor has recommended a package of energy upgrades that maximise the energy performance of your home. The recommendations are for guidance only and can be completed at your own discretion.
The recommendations are just one potential pathway to an improved BER and it is open to you to discuss alternative packages with your professional advisors.

Package of energy upgrades to save money, make your home more comfortable and protect the environment

Recommended Package of Energy Upgrades	Cost (Approx.)[5]	Grant Available[6]	Comfort
External doors 1.4 W/m²K average U-Value [1,2]	€	✔	★★★☆☆
Roof insulation; pitched (at ceiling) 0.16 W/m²K, pitched (on slope) 0.20 W/m²K, room in roof (on side) 0.20 W/m²K, flat 0.22 W/m²K average U-Value [1,2]	€	✔	★★★★☆
Wall insulation 0.35 W/m²K average U-Value [1,2,3]	€	✔	★★★★☆
Windows double glazing 1.4 W/m²K average U-Value [1,2]	€	✔	★★★★☆
Air-to-Water or Ground-to-Water or Water-to-Water heat pump with fully integrated heating controls [4]	€€	✔	★★★★☆

1. *Major Renovation is defined in the Building Regulations Part L Technical Guidance Document and means the renovation of a dwelling where more than 25 % of the surface of the dwelling envelope undergoes renovation. Where a dwelling undergoes a major renovation, the energy performance of the whole dwelling should be improved to the cost optimal level by achieving a B2 or by implementing the energy performance improvements as set out in the Building Regulations Part L Technical Guidance Document.*
2. *This energy upgrade will reduce your home's heat loss and is an important first step to improving the energy efficiency of your home.*
3. *For some wall types it may not be appropriate to install the amount of insulation recommended here, particularly in the case of solid walls such as stone and brick built prior to 1950. Please seek the advice of a professional.*
4. *A dwelling should have low heat loss to ensure the heat pump runs efficiently. An ideal heat loss indicator (HLI) is less than 2.0 W/(K·m²). An upper HLI limit applies to SEAI grants. Where the HLI is between 2 and 2.3 W/(K·m²), additional heat pump grant eligibility criteria apply.*
5. *Investment Cost Legend:*
   - € < 5,000
   - €€ 5,000 - < 15,000
   - €€€ 15,000 - < 30,000
   - €€€€ 30,000 - 50,000
6. *A grant for this type of upgrade is available at the time of publication of this report. Grant availability is subject to eligibility criteria and should be checked to see if the works to your own home meet the eligibility criteria. Eligibility criteria are subject to change.*

GRANTS AVAILABLE?

✔ subject to availability, terms and conditions

For further information visit www.seai.ie/grants or call 01 8082100

www.seai.ie

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Home Energy Upgrade Advisory Report

Start your journey to upgrade your home

If you're not ready for the maximum SEAI grant, consider picking one or two energy upgrades, selecting areas with the poorest performance.

GRANT APPLICATION

To start your application today visit www.seai.ie/grants

Simple energy upgrades - quick, cheap, easy

Draughtproofing
Draughtproofing, fitted to windows, doors and loft or attic hatches, improves airtightness and thermal comfort, reduces heat loss, improves noise insulation and reduces dust ingress.

Cylinder insulation
Hot water cylinders without insulation or poorly insulated should be fitted with a hot water cylinder jacket. Replacement hot water cylinders should be factory insulated.

Lighting
Correct lighting levels are essential for visual comfort, safety and for aesthetic effects. Fit efficient electric lighting and maximise the use of daylight.

Potential impact of the **recommended energy upgrades**

Energy upgrade	Now		Potential	
	Value	Energy Efficiency	Value	Energy Efficiency
Home Heat Loss Indicator (HLI)[1]	5.156 W/(K·m²)	Very Poor	2.024 W/(K·m²)	Good
External doors (average U-Value[2])	3.000 W/m²K	Poor	1.400 W/m²K	Very Good
Roof insulation (average U-Value[2])	2.300 W/m²K	Very Poor	0.181 W/m²K	Good
Wall insulation (average U-Value[2])	2.100 W/m²K	Very Poor	0.350 W/m²K	Good
Windows double glazing (average U-Value[2])	2.637 W/m²K	Poor	1.400 W/m²K	Good
Air-to-Water or Ground-to-Water or Water-to-Water heat pump with fully integrated heating controls (Primary Energy Efficiency[3])	59%	Very Poor	200%	Very Good
Lighting	49.41 Lm/W	Fair	66.90 Lm/W	Very Good
Renewable Energy Ratio (RER)	15%	Good	98%	Very Good

1. The Home Heat Loss Indicator (HLI) is a summary of the overall performance of the home. It includes all the fabric and ventilation upgrades listed in the table
2. A U-value is a measure of the heat loss through the building fabric. The higher the U-value, the greater the heat loss
3. Primary energy efficiency is the efficiency divided by the primary energy conversion factor
4. Indicators are based on the average elemental U-values in the BER and where partial upgrades occur, average U-values may remain above the optimum U-value.

Home Energy Upgrade Advisory Report

Your Home's Details

Home Address

[redacted]

House Details

Year of construction: 1850

Dwelling type: Semi-detached house

Total floor area: 86.66 m^2

About the Home Energy Upgrade Advisory Report

This document is a first step to assist you in engaging with a professional to determine suitable energy upgrades for your home.

It was prepared by a BER assessor using general assumptions and information from your BER assessment. The improvement in the BER has been estimated based on the assumption of certain values for energy upgrades and is provided as an indicator only.

This document is for information only and does not constitute professional or legal advice. The homeowner waives and releases any and all claims against SEAI and/or the BER assessor arising from the contents of this advisory report.

Use this document to:

Better understand how your home performs and how to make it more comfortable and affordable to run.

Provide information on home energy upgrades to discuss further with a professional or contractor.

Identify small simple steps you can take to improve the comfort of your home, if grant supported works aren't suitable for you right now.

Start the grant application process with SEAI, who may have substantial support available.

Recommended Energy Upgrades

The recommendations contained within your advisory report have been generated based on the data inputs contained within your BER assessment. SEAI recommends you seek professional advice and use suitably qualified installers to assess the suitability of the recommendations for your own particular home.

SEAI and the BER assessor accept no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or fitness-for-purpose of the information contained herein and do not accept any liability whatsoever arising from the contents hereof.

Further information on upgrading your home is available in **S.R. 54:2014 Code of Practice for the Energy Efficient Retrofit of Dwellings**, available from www.nsai.ie.

Building Regulations

The aim of the building regulations is to provide for the safety and welfare of people in and about buildings. Where applicable, works should be completed in accordance with the relevant Building Regulations. The primary responsibility for compliance with the requirements of the Building Regulations rests with the designers, builders and owners of buildings. Technical Guidance Documents for the Building Regulations and other supporting documents are available from the Department of Housing, Local Government and Heritage website at www.housing.gov.ie.

Costs

The investment cost indicators are guidelines only. Actual costs will vary depending on house size, specification and market conditions. Cost indicators may be calculated based on a partial upgrade if some sections of the building element are already adequately insulated.

Please consider the environment before printing this document.

BER Privacy Notice: www.seai.ie/publications/BER-Privacy-Notice.pdf

Ventilation

Care should always be taken to ensure sufficient levels of ventilation in each room. Signs of inadequate ventilation are persistent condensation and mould growth and should be addressed in the first instance. It is important not to permanently close or cover over air vents as they are required to provide ventilation. Further guidance on ventilation provision when carrying out retrofit works is available in Section 10 Ventilation of S.R. 54:2014 Code of Practice for the Energy Efficient Retrofit of Dwellings.

Radon

Radon gas at high concentration causes lung cancer and is estimated to be responsible for 300 cases per annum in Ireland. Retrofitting provides an opportunity to test for, and remediate for, radon, where indicated. A radon test is low cost and non-disruptive. The only way to know if a home has a radon issue is to test. Further information on radon, including testing, is available on the EPA website www.epa.ie.

Heat producing Appliances

It is important to ensure that there is an adequate air supply to all heat producing appliances e.g. any fixed appliance (including a cooker or an open fire) which is designed to burn solid fuel, oil, bio-fuel or gas and to provide permanent ventilation for all non-room sealed combustion appliances. Useful health and safety information can be found on the Carbon Monoxide safety website: www.carbonmonoxide.ie. Further guidance on air supply for heat producing appliances is available in Section 7 and Section 10 Ventilation of S.R. 54:2014 Code of Practice for the Energy Efficient Retrofit of Dwellings.

Evidence for BER

Documentary evidence of energy upgrades is required for your BER and should be retained and provided to your BER assessor to ensure the energy performance uplift is captured in your BER. Your BER Assessor can advise you on documentary evidence requirements. Further information is available on https://www.seai.ie/home-energy/building-energy-rating-ber/.

www.seai.ie Page 4/4

Adjusted energy costs for the home are €2,251 per year for its current F-rating. However, with upgrading to an A1 rating with potential energy costs would be €649.95 per year (even taking into account a switch from oil at €0.11 per kWh to electricity at €0.30 per kWh). This is a potential 72% reduction of energy costs. The report also indicates the reduction of carbon emissions achievable. In this case, post works the CO2 emissions of the home would be reduced by 12.3 tonnes CO2 which is the equivalent of carbon sequestered by 873 mature trees annually.

An interesting point to note is that the home already has some renewables installed. However, because of the principle of 'fabric first' has not been followed, the benefit from the renewables is limited and has had little effect overall on the carbon emissions from the home. We would always recommend that energy use be reduced in the home, draughts be sealed up and airtightness maximised as a priority.

We produced 7 such reports each representing a home type in the SEC area. These are included in the RoO.

5.1.4 Typical Retrofit Measures

The recommended works are based on a fabric first approach. That is, improve the energy efficiency of the building by sealing off drafts and increasing insulation. It is typical in an energy upgrade to exchange stoves for fireplaces or to block up the chimney altogether. These measures have the immediate benefit of sealing off a major source of drafts. Improving seals to doors and windows is also an excellent first step. Insulation should be installed from the top of the house downwards.

Felt or fiberglass insulation should be laid in two layers with opposite direction. If using fibrous insulation, do not store items on the insulation that would compress it. If you use the attic for storage, you should probably use in-rafter insulation.

Flat roofs can be insulated with purpose manufactured insulation boards. These are typically thicker than 150mm, the key is to achieve a thermal value (U-values) of 0.16 W/m2K for ceiling level insulation or 0.20 W/m2K for rafter insulation. Insulation should be installed by a professional who will guarantee that there will be no gaps between insulation material joins.

Many homes built pre 2007 would probably benefit from external insulation where this is feasible. This can be costly but will refresh and future-proof the home for the generations to come adding to its value as well as saving energy, money and reducing carbon emissions.

Windows and doors upgrading were recommended in most of our audits. Again, these are costly but are often necessary to reduce drafts and loss of heat from thin glazing. It would be essential that you discuss whether you need to upgrade windows to achieve the necessary fabric level.

A reduction in what is known as the 'Heat Loss Indicator' (HLI) is required. This is a measurement of airtightness. In all but exceptional circumstances, an HLI of less than 2 is needed before a heat pump can be installed, although close to 2 can be acceptable where achieving an HLI of less than 2 is not cost effective.

5.1.4.1 Heat Pumps

We recommend a switch to air-source to-water heat pumps (ASHP) (explained more fully in Appendix Section 7.6.1) in all retrofitting projects. This will reduce the amount of energy required to heat the home. Heat pumps have an efficiency of 3:1 which means that for every kWh of electricity is put into the system, 3kWh of heat are produced. Heat pump technology is now very advanced and reliable. There are well over 55,000 heat pumps installed in Irish homes, and the Climate Action Plan outlines plans for 400,000 heat pumps in existing Irish homes by 2030. As a solution to the country's heating needs, heat pumps, in particular ASHPs are a recommended route. They are particularly recommended in areas where there is no gas grid. The economics of the ASHP are very favourable in comparison to an oil alternative.

The cost of installing a heat pump varies from home to home quite considerably. We have done assessments of typical costs however and on the homes in our survey, the typical cost was €12,500. However, an Apartment can qualify for a €4,500 grant from the SEAI and a Semi-Detached/End of Terrace/Detached/Mid Terrace house a grant of €6,500 towards the cost of an ASHP, effectively reducing the cost for a typical heat pump installation to €6,000.

5.1.4.2 Domestic PV

In many of the Upgrade reports, we were able to recommend domestic PV installations (after fabric and heating system upgrades are completed). This will have the benefit of reducing the amount of electricity the home will consume after the heat pump insulation. It will also decarbonise the electricity consumed by the home. The current carbon intensity of electricity in Ireland is 330.4g CO_2/kWh (more than home heating oil), though this will change as more grid scale PV and offshore wind comes into operation.

A domestic solar PV system consists of a number of solar panels mounted to your roof (or in your garden or adjacent field) and connected into the electrical loads within your building. PV systems are rated in kilowatts power (kWp[34]). A 2kWp solar PV system would require 5X400W solar panels on a roof, approximately 10m^2 in area.

[34] Kilowatt peak power: a system that delivers one kilowatt. Over one hour at a *theoretical maximum* output it will produce 1 kWh.

Summary	
PV technology:	Crystalline silicon
PV installed [kWp]:	2.5
Simulation outputs:	
Slope angle [°]:	35
Yearly PV energy production [kWh]:	**2,232.20**
System loss [%]:	14

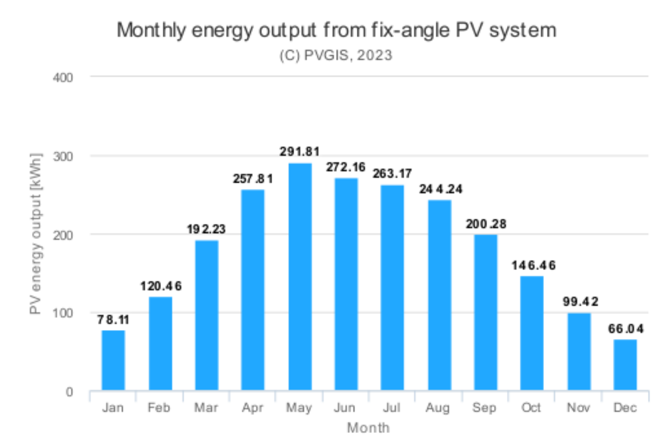


Figure 20: PV output from 2.5 kWp Installation in Castlepollard[35]

A roof mounted 2.5 kWp PV system on a south facing roof in Castlepollard will produce 2,232 kWh per year. The average B2 house in Castlepollard consumes 4,737 kWh of electrical power in a year for lighting, appliances, and cooking[36].

Since a consumer today pays on average[37] €0.32 per kWh to their electricity provider, a 2.5kWp PV panel (if the home is occupied during the day and 50% of the electricity is consumed in the home) will save the homeowner €357 per year. There would also be an additional payment from the Clean Export Guarantee (CEG) (of approximately €279[38] per year in this case) On an installation costing €6,250, this would achieve a simple payback of 6.7 years if the installation qualified for a grant (€1,950).

It should also be noted that the panels will last at least 25 years and so over that period the installation will achieve an income of €15,900 representing an annual rate of return of 10.79%[39]

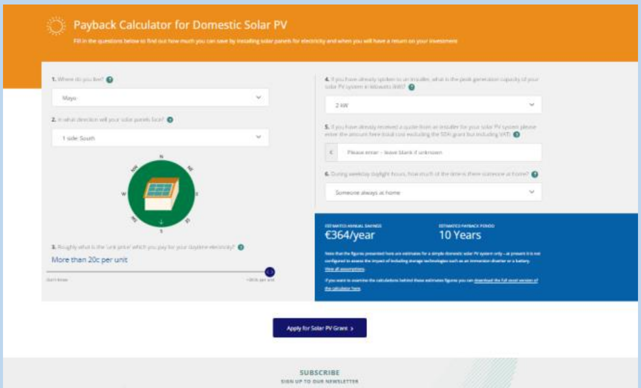
There is a significant grant incentive available from the SEAI for PV installation for homeowners. The full details are available[40] at this link.

[35] https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html
[36] Though not at the times shown in Figure 20 – PV output is highest in the daytime during summer. Electricity consumption is typically highest at night during the winter.
[37] https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf
[38] Below the €400/yr tax threshold
[39] This cannot account for changes in the price of electricity or in CEG for the future.
[40] https://www.seai.ie/grants/home-energy-grants/solar-electricity-grant/

Table 12; SEAI PV Grants for Homeowners

Value	Example
€900 per kWp up to 2kWp	€1800 for 2kWp solar panels
€300 for every additional kWp up to 4kWp	€2100 for 3kWp solar panels
Total Solar PV grant capped at €2400	**€2400 for 4kWp solar panels**

Excess electricity produced can also be stored in a hot water immersion tank or in a battery. The water tank should be well insulated and with a capacity of more than 250 litres – it can be installed at the same time as the PV. Batteries of 5 kWh storage can cost up to €2,500, and this system will only occasionally exceed that level of solar production (in May-August). Excess electricity can also be used to power a BEV that is parked during the day at the home. The CEG exports from the house into the electrical network on the road outside your home for a typical price in 2023 of €0.25 per kWh. The best solution is to manage your electricity consumption (for example diverting power to the hot water tank, using the washing machine and dishwasher) to match the best PV generation times i.e., daytime.



The SEAI has a useful Calculator that shows payback period for typical installations, customisable by county, size of system and retail price of electricity. It is available at this LINK

Economics of a 2.5 kW South Facing System in Westmeath

Annual Savings	Payback Period
€433/year*	6 Years

*It is not assumed that the homeowner will consume all the electricity. This is based on a cost of €0.32/kWh unit electricity.

5.1.5 Community Level Impacts of Measures

If we assume that the homes in the SEC upgrade from their current level to a minimum B3, we can make predictions on the effect this would have on the SEC's energy consumption and carbon emissions. We do not expect homes from B3-A1 to require retrofitting.

If all SEC homes were B3 or above, we can expect a considerable energy saving dividend of approximately 7,382 MWh and home energy related emissions reductions of 1,897 tonnes of CO2. The equivalent carbon offsetting of 135,500 trees.

The *current*[41] home energy use in the SEC would be reduced by 27.2%. However, some of this will be transformed from bought-in grid electricity at 330kg CO2/MWh to domestic-scale PV which is carbon neutral and will have a considerable carbon reduction value.

90.2% of the homes across the SEC are houses, with only 9.8% apartments. If we assume that of these 70% will be able to accommodate 2.5 kW PV. This means that of the 557 houses, 390 will be able to install on average 2.5 kW. With 75% with south-facing roof space and 25% requiring east or west facing roof space this would produce approximately 838 MWh of zero carbon electricity. This will save approximately 277 tCO2.

The sustainability effect of such carbon reduction will be the equivalent of the amount of carbon sequestered by 19,776 mature conifers.

If we add the replacement of mains electricity by PV with the benefits of retrofits in the earlier section, we see that taken together they would reduce the imported energy demand by 30.27% and the SECs domestic carbon emissions by 2,174 or 31.8% the current total.

5.1.6 Costs of measures

Our home surveys in this EMP were not required to cost the retrofits according to current market conditions. However, elsewhere we have costed heating upgrades and PV installations using supplier information at the time of surveys (in Appendix Section 7.8 Table 24). There has been construction inflation (6.2% for 2022) since some of those surveys were carried out, but we include these 2022-23 figures here as useful indicators of the average costs of retrofitting works. We cannot guarantee that these costs will be what a given homeowner will be quoted. The cost of works is site and contractor specific, but the median price per meter from our 2022-23 work was €553/m^2 excluding SEAI support.

There is however a wide range of costs per square metre for retrofits. There does not appear to be any strong correlation between age of build, starting BER, or construction type. We do not propose to draw any strong conclusions for the cost of energy upgrades across the SEC. However, the individual homeowner could benefit from comparing their own home with those surveyed below in Appendix Section 7.8 Table 24.

[41] We use the adjusted energy use value here which is 36% greater than the reported kWh/m2/yr in the BER

5.1.7 Available Supports

Irish homeowners are relatively fortunate in the level of assistance that is available to them for energy efficiency upgrade works. In keeping with the requirement of the commissioning SEC, we emphasise here the benefits of collectively organised retrofitting works – and indeed recommend this approach, although there is a guide to other supports for the individual homeowner in the Appendices.

5.1.7.1 Individual Level Supports

There are three categories of applicants to the SEAI Home Energy Grant Scheme[42] of which this is a brief summary. These are:

- Individual Energy Upgrade Grants towards the cost of various upgrades for a typical family home with SEAI grants
- One Stop Shop Service based on set grants per measure, this can be grant funded by SEAI 45 - 50% of the cost for a typical family home.
- Fully Funded Energy Upgrade for qualifying homeowners in receipt of certain welfare benefits.

These supports are discussed in greater detail in Appendix Section 7.5. There is also a full explanation of the schemes, grants, and levels of funding on the SEAI site here. We noted above that WDZ includes some areas of disadvantage. The individual level supports may not be enough to allow some homeowners to carry out the necessary upgrades. There are improved levels of supports for some qualifying homeowners (Section 5.1.7.3 below)

5.1.7.2 Community Energy Grants

The Community Energy Grants (CEG) scheme is a Sustainable Authority of Ireland (SEAI) scheme to achieve national retrofitting of community and SME buildings and homes. It provides capital grants for energy efficiency projects for communities throughout the country. The criteria for participating in CEG projects are that they must be community orientated with a focus on cross-sectoral approach. This means that they involve homeowners, SMEs, and Community Buildings, and have inputs from private citizens, companies, community groups and if possible municipal and corporate bodies.

There is a mandatory requirement for all projects to support **10 homes** for applications below €1M.

According to the SEAI, successful Community Energy Grant projects demonstrate some or all of the following characteristics.

[42] Available at this link: https://www.seai.ie/grants/home-energy-grants/

- 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 types of measures that are targeted through the grant program are:

- 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

The EMP has therefore collected enough information from community buildings and homeowners to potentially bring together an application with a Community Energy Grant application specialist.

Table 17: CEG 2023 Funding Levels.

Non-Residential	
Type	Funding Level
Not for profit/Charities/State Schools with Charity Status*	Up to 50%
Private sector	Up to 30%
Public Sector	Up to 30%

* subject to prior written agreement with the SEAI's communities team

There is no cap or maximum grant amount permitted to homeowners for upgrade grants. The grants have fixed values for each energy upgrade. The total value of the grant depends on the type of house and what energy upgrades are carried out. It is estimated that to bring a standard detached home from an E to a B2 rating, it will cost approximately €45k but would qualify for a grant of €22.5k covering up to 50% of the costs.

5.1.7.3 100% Support Levels.

Some homeowners qualify for 100% grant funding for retrofits. These are homeowners in receipt of certain welfare benefits:

- Fuel Allowance
- Job Seekers Allowance for over six months with a child under seven
- Working Family Payment
- One-Parent Family Payment
- Domiciliary Care Allowance
- Carers Allowance
- Disability Allowance for over six months with a child under seven

We discuss the SEAI homeowner grants for individual homeowner applicants in Appendix Section 7.2.1.1.

A list of Community Energy Grant Project co-coordinators is available here: https://www.seai.ie/grants/community-grants/project-coordinator/

5.2 Domestic Transport

There are a number of opportunities available to the residents in the SEC area to increase the sustainability of their transport use.

5.2.1 Context

The National Climate Action Plan[43] states that there will be a 42-50% reduction in emissions from the transport sector by 2030 if Ireland is to meet its Climate targets.

To achieve these reductions, a transition towards more sustainable forms of transport is required, including safe and accessible walking and cycle routes to appropriate public transport links serving the needs of the residents, and the implementation of appropriate infrastructure to support the electrification of private cars.

The Climate Action Plan aims to encourage active travel (walking and cycling), with public transport being encouraged over the private car. The SEC area has real opportunities in these areas which are discussed below.

As noted in Section 2.4.1 dealing with the transport policy of Westmeath County Council, policy is in in favour of developing a network of 'direct, comfortable, convenient and safe cycle routes and footpaths, particularly in urban areas and in the vicinity of schools.' This is of particular relevance to Castlepollard itself.

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[43] https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

5.2.1 More Efficient Car Use:

As with individual actions to achieve home energy efficiency, there are actions the citizen can take to reduce the impact of their private car use. These are described in Table 13.

Table 13: More Efficient Car Use

Reduce the most inefficient journeys by car where possible
Save CO2 and money by sharing journeys, particularly those to Mullingar and beyond.
Plan ahead by combining trips (shopping, school runs etc.)
For cars that do not automatically turn off when idling, switch off if you will be stopped for more than 9 seconds
An energy-aware driving style is one which accelerates and decelerates slowly and uses higher gears and lower revs, when possible. This can save 13% on fuel and emissions.
Inflate tyres correctly to manufacturers' recommendations
Avoid harsh acceleration or heavy breaking. Slowing down in good time saves fuel, smooth style around bends
Cars are parked 95% of the time, do you need a second car?
The sunroof fully open consumes up to 4% more fuel, half-open - 3%
A roof rack can increase fuel consumption by 40% and a cycle rack with two bicycles by 10% - 15%
Use air-conditioning sparingly – it increases fuel costs
Rear screen heater's increases fuel consumption by 3% - 5%, so switch it off once the window is demisted
Front windows left half open consume more fuel at higher speeds so use the air vents instead
Do not carry unnecessary weights in the boot, clean it out.
The average new car emits 120g of carbon dioxide for every kilometre. SUV's can emit a staggering 330g carbon dioxide per km.
Consider joining a transport sharing group or **start one yourself**. TFI has an introduction as to how to go about this here: https://www.transportforireland.ie/wp-content/uploads/2021/06/Carpool_Guide_2019_compressed.pdf

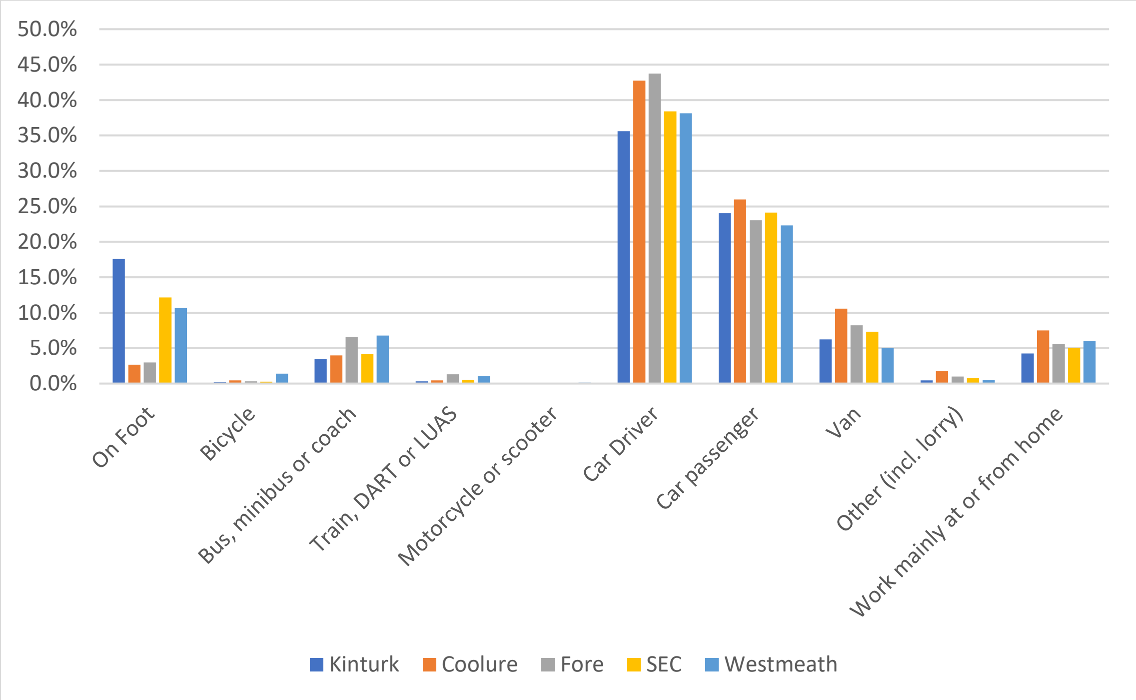


Figure 21: Means of travel to school, college or work.

There are a higher number of people in the SEC who walk to work (12.2%) than Westmeath in general (10.7%). Many of these live in the more relatively densely populated Kinturk ED where Castlepollard is located. In Coolure and Fore West car driving is more common.

Reducing car journeys and increased cycling and walking cuts down on energy emissions. The road infrastructure in an around Catlepollard, but especially in the hinterlands of Coolure and Fore West will make a switch to cycling difficult for many people without a community level campaign.

It should be noted that providing cycling infrastructure alone will not guarantee that people to switch to cycling. Instead, infrastructure improvement and communication outreach should be combined. Mass marketing is simple and impressive at the policy level, but it is often not very effective. Peer-to-peer and norm-defining campaigns to specific target groups tend to be much more effective. The SEC could offer a stimulus to increased active travel to that provided by the Council on an infrastructural level. We propose partnership approach which recognises the on the ground strengths and citizen expert strengths of the former and the resources, policy authority, and engineering expertise of the latter.[44]

There are a number of resources for cycling behaviour change campaigning. These are provided in the Resources Section 7.5 below.

[44] Although have to be quick to recognise that there is specialist engineering expertise in this very area on the SEC committee.

5.2.2 Electric Vehicles

The most sustainable car is the one you already own, but that's kept parked in the driveway. However, cars are considered a standard necessity for modern life, especially in rural areas where services and community hubs are dispersed. In this section we identify opportunities available for drivers.

Replacement of diesel and petrol cars by Battery Electric Vehicles (EV) is a national policy aim in the medium term. The CAP targets 800,000 zero emission vehicles by 2030. There is even still however some slowness of car owners to buy in to this policy, particularly in the Rural Ireland. It is important to note however, that battery range has increased rapidly in the past few years.

Many drivers are not fully aware of their typical driving ranges, and they feel that a typical EV range of 250km as not enough for their social and work needs. Car use data does not agree with this, however.

2019 (i.e., pre-pandemic) car journey data from the CSO[45] shows that 79% of car journeys in Ireland (excluding the Dublin area) was 15 kms and took 22.7 minutes. This is backed up by 2022 Census data: across the SEC, for 73% of commuters, the average journey time is less than 30 minutes probably within a distance of less than 30 kms and thus well within the range of an EV.

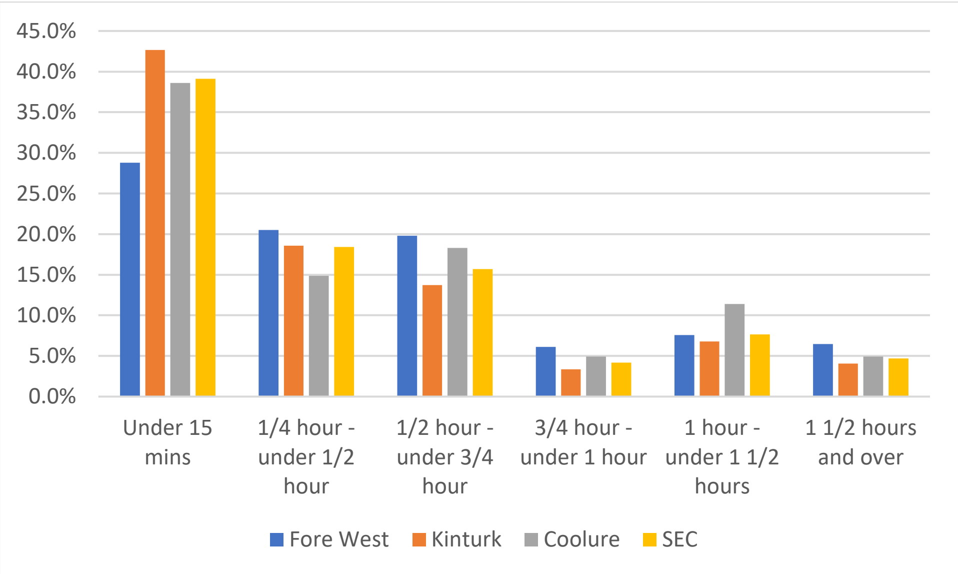


Figure 22: Commute Times by ED and SEC

[45] CSO, 2021, Travel Behaviour Trends 2021, https://www.cso.ie/en/releasesandpublications/ep/p-ntstb/travelbehaviourtrends2021/distanceandduration/#:~:text=The%20average%20journey%20distance%20in,the%20same%20period%20in%202019.

The generally occasional need for drivers to travel further than the standard 250kms range of an EV could be addressed in a variety of means – whether through car share or public transport with an EV driver using park and ride facilities.

It is possible for a person to track their actual travel times and distances over the course of a year using tools such as Google Timeline. We suggest that this could be promoted at transport workshops in the SEC (which is discussed in the RoO) to illustrate quite how occasional a >250km car journey is for most people.

There are still state sponsored incentives for drivers wishing to switch to EVs (see Appendix Section 7.3) through the SEAI. The condition that these be new and of eligible make and model means that they start in price at €24,995, for the Fiat 500e, inclusive of the SEAI grant and VRT relief.

There were 2.3m private cars registered in Ireland in 2021. 104,932 new cars were registered in 2021. This indicates an approximate renewal of 5% of private cars per annum in Ireland. The replacement over time of 5% per annum of the ICE vehicle stock with EVs in the SEC area would have a significantly positive effect on emissions and reduced fossil fuel imports. In effect reducing vehicle emissions by 35% in 2030.

5.3 SME Level Efficiencies and Retrofits

There are SEAI supported programs to assist SMEs identify where they can reduce their energy demands and fossil fuel use. These are outlined in Appendix Section 7.4.

We conducted surveys of one SME and one community building in the SEC area. The details of these surveys have been provided to the building owners themselves, but we summarise the central findings in Table 14

Table 14: Sampled Non-Domestic Energy Savings Summary

Type	Potential Savings kWh	Cost Savings	Cost of measures €	Payback (yrs)[46]	CO2 reduction kg
Shop	28,437	€ 6,477	€ 33,600	5.2	9,690
Community Building	34,710	€ 7,085	€44,300	6	10,400

As we can see that the payback for the SME and community organisation is less than 6 years.

[46] This does not include any SEAI grant assistance that the organisation may also benefit from.

There are a great many SMEs in the area that qualify for the SEAIs supports – that is they are independent businesses, or they are public bodies with a floor area less than 500m^2 and spending less than €10,000 per year on energy.

From our buildings survey we have identified that there are approximately 30 SME offices, 10 restaurants and bars, and 30 retail businesses that would qualify under the SEAI Energy audit scheme (Section 7.4. It is recommended that these building owners/managers apply for assistance in a batched process whereby energy efficiencies and sustainability measures can be identified and carried out. A typical energy review can achieve energy and financial savings of 20-30%.

The actions recommended as opportunities are often not technically challenging, they are proven measures such as installing the right insulation, replacing oil and gas boilers with heat pumps, and installing correctly sized and sited PV panels, as well as simple, very cheap context-specific measures.

Most SMEs receive a grant for energy audits. SEAI's Support Scheme for Energy Audits (SSEA) will offer SMEs a €2,000 voucher towards the cost of a high-quality energy audit. In most cases, this will cover the total cost of the audit. The SSEA is a much more detailed review of your energy use than a domestic level audit. An SSEA runs to 40 plus pages, involves site visits and a close look at energy bills. There is a template for the report here.

5.3.1 Typical efficiency measures

Table 15 shows an extract from an anonymised energy report from an SME that participated in another EMP we carried out[47]. It shows a summary of the measures that are typically recommended.

The SME is at its busiest during the day. By sizing the PV appropriately, and due to the size of the onsite electricity consumption, the payback for the PV was calculated as a very favourable 4.3 years, with an ROI of 471% over 25 years (that is 18% per annum). However, although this is the 'big ticket' item, even a cost-free measure such as adopting a more efficient use of onsite plant (recommendation 8) provides some valuable savings.

[47] For confidentiality reasons, we do not name the Castlepollard SME here (although the building owner has received the audit which is part of the unpublished RoO).

Table 15: RoO for SME Example in the SEC

EEM #	Category	Description	Fuel Type	Delivered Energy Kilowatt-hour savings	Savings [€]	CO_2 Savings (Tonnes)	Estimated Cost [€]	Simple Payback (Years)
2	Thermal/electrical	Energy monitoring and awareness programme for all users.	Smokeless Fuel/Electricity	4,173	€737	1.49	€500	0.7
3	Thermal	Building Fabric, doors, windows	Smokeless Fuel	5,289	€684	1.5	€18,500	27.1
4	Thermal	Pipework insulation	Smokeless Fuel	4,080	€384	1.2	€1,000	2.6
Electrical Energy and Electrical Cost Saving Projects								
5	Electrical	Lighting	Electricity	510	€197	0.2	€300	1.5
6	Electrical	Lighting controls	Electricity	3,187	€1,233	1.1	€300	0.2
7	Electrical	Car Charger	Electricity			0	€1,600	
8	Electrical	More efficient use of Air Compressor	Electricity	3,520	€272	1.2	€0	Instant
Renewable Energy Generation								
9	Electrical	PV Analysis	Electricity	2,678	€1,036	1	€8,000	7.7
10	Electrical	Battery	Electricity	5,000	€1,934	2	€5,000	2.6
TOTALS				**28,437**	**€6,477**	**9.69**	**€33,600**	**5.2**

Most of the measures are low cost – with the exception of the retrofitting of the building's walls and windows. Overall cost for all works is, in the scheme of the businesses overall turnover, quite modest and the costs can be written against taxes due. The 5.2 years payback – with no grant supports – is an excellent return of 382%, or 15.3% per annum, well in excess of current business loan rates of 6.9% if finance is required. Interest on loans is an allowable tax deduction. Grant supports for SMEs is discussed in the next section.

The EMP Registry of Opportunities document provided to the SEC in parallel to this report includes details of energy efficiencies, upgrades, and retrofits that can act as a model for many of the non-domestic buildings in the SEC area. It is proposed that the SEC engage with the relevant groups and stakeholders to hold information workshops that will make the potential savings of energy and carbon emissions reductions apparent.

5.3.2 Summary of available supports for non-domestic energy users.

This section is a brief summary of the supports available to non-domestic building owners and there are more resources in the Appendix.

5.3.2.1 Energy Efficiency Loan Scheme

This supports eligible SMEs to invest in the energy efficiency of their enterprises. Loan amounts from €10,000 to a maximum of €150,000 per borrower, over terms of 1 year up to 10 years.

5.3.2.1 Small businesses

The Energy Efficiency Grant, available through the Local Enterprise Offices, will provide funding to small businesses to invest in more energy efficient technology. It supports the investment in technologies and equipment identified in a Green for Micro Report, GreenStart Report or an SEAI Energy Audit with 50% of eligible costs up to a maximum grant of €5,000. The aim of the scheme is to reduce the impact of enterprises on the environment thereby increasing the agility and resilience of these businesses.

5.3.2.2 Non-Domestic Microgeneration Scheme

The Non-Domestic Microgen Scheme from the SEAI funding ranges from €2,700 to €162,600, to support a wide range of businesses to switch to solar electricity. The scheme provides grant supports for PV installation up to 1,000 kWp (1MWp) capacity. This scheme helps towards the installation of solar PV for business, school, community centres, or other non-profit organisations. PV technology reduces commercial electricity costs and increases security of supply, while enhancing a positive sustainability image. It should be remembered that on site PV generation is carbon neutral while grid electricity has a carbon intensity of 330gCO2/kWh. The scale of installation grant funding is for installation sizes greater than 6 kWp up to 1,000 kWp.

The grant for 6kWp is up to €2,400.

There are also additional grant amounts of:

- €300/kWp for each extra kWp installed between 7kWp -20kWp
- €200/kWp for each extra kWp installed between 21kWp- 200kWp
- €150/kWp for each extra kWp installed between 201kWp-1,000kWp

5.3.2.3 EXEED Grant Scheme

The EXEED Grant Scheme - SEAI is designed for organisations who are planning an energy investment project. Grant support of up to €1,000,000 per project is available.[48]

5.3.2.4 Support Scheme for Renewable Heat

The Support Scheme for Renewable Heat - SEAI is open to commercial, industrial, agricultural, district heating, public sector, and other non-domestic heat users. The scheme offers 30% of installation costs of selected renewable technologies.

5.3.2.5 Community Grant

The Grants for Sustainable Community Projects - SEAI support energy efficiency community projects through capital funding, partnerships, and technical support with grant supports up to €5,000,000. The scheme empowers Businesses, Public Sector Organisations, Communities, Housing Associations and Local Authorities to lead deep energy efficient upgrades on the buildings.

[48] https://www.seai.ie/business-and-public-sector/business-grants-and-supports/exeed-certified-grant/?gclid=CjwKCAjw-eKpBhAbEiwAqFL0moImFi7qM5JSOw8K6NaMlMKsyw2LL8qohWZBL6ZaaWVLQk5gOlTLahoC6JQQAvD_BwE

5.3.2.6 Accelerated Capital Allowance

The Accelerated Capital Allowance - SEAI is a tax incentive encouraging investment in energy saving technology. Companies and sole traders that operate and pay corporation tax in Ireland can avail of the scheme. Technologies and products supported by ACA need to be on the SEAI's Triple E Products Register.

5.3.2.7 Electric Vehicle Grants (SEAI) – co-funding

The Electric Vehicle Grants - SEAI provides grant supports towards the purchase of new electric vehicles for business and public entities. The co-funded 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 EVs.

5.3.2.8 Energy Contracting Support Scheme

The Energy Contracting Support Scheme - SEAI provides financial assistance to implement energy efficiency and decarbonisation projects. The Scheme aims to support the direct external consultancy and/or specialist advisory costs related to project appraisal and procurement of pay-for-performance energy contracts. Find out more about Energy Contracting.

5.3.3 Retrofit Case Study Campaign

The SEC is in a rural area with a strong sense of community. There are excellent peer-to-peer information sharing opportunities available for the SME owners in Castlepollard. Energy audit findings and the opportunities for upgrades can be shared between businesses and community organisations. We propose that each of the buildings audited in this EMP to carry out the measures recommended in a staged process. This would provide an opportunity to provide case studies to other businesses and community organisations in the SEC to recruit additional participants in efficiency programmes. Westmeath County Council, the Mullingar Chamber of Commerce, could also assist the SEC committee in this work.

5.3.4 Impacts of Measures

Our survey of premises in the SEC is a detailed examination of a small fraction of businesses and community buildings there in general. We can look to the generality of the SEAI's experience of helping business to reduce energy use. Based on the SEAI's tracking of business owners' experiences, the average SME could reduce its energy bill by as much as

30% by implementing energy efficiency measures. Typically, 10% saving can be achieved with little or no capital cost[49].

Therefore, if qualifying SMEs in the SEC were recruited to participate in the relevant energy reduction program, we can estimate that it would save up to 12,091 MWh energy, saving local businesses in the SEC €1,755,071 per year and avoiding 2,521 tCO2 emissions.

5.4 Non-Domestic Transport Opportunities

5.4.1 Small PSVs

As discussed above, these represent a very small proportion of the non-domestic carbon emissions (3.26 % of all non-domestic transport related carbon emissions – 87 tCO2). However, they are very amenable to replacement with existing technologies (EVs) and their decarbonisation would play a useful norm-establishing role in the community through their visibility. The cost of an EV is higher than that of a diesel hybrid.[50] The pattern of nighttime driving and daytime charging that is typical of taxi use would mean that while the hybrid driver is achieving a €7.68 cost per 100km and the EV driver is achieving €6.03, the difference of €1.65 would not achieve a realistic payback on its own. There is however a grant scheme that assists small PSV drivers to switch from ICE to EV[51]. In essence this can provide €20,000 in grant funding for a new EV taxi (second hand EVs are granted less) for qualifying drivers. Drivers should be existing SPSV licence holders; and owners of an SPSV registered for at least the previous three years, and with older vehicles (within three years of the maximum permissible age as originally) or vehicles with a mileage of 300,000 km or greater.

This would mean that, even on peak rate electricity charges, an EV taxi could save its owner an estimated €12,695 over ten years.

[49] https://www.seai.ie/business-and-public-sector/small-and-medium-business/why-invest-in-energy-effi/

[50] A Toyota Corolla Luna Sport hybrid costs (at time of writing) €36,000 while a Toyota BZ4X costs €50,000. It would not be feasible to make up the difference of €14,000 on fuel cost alone, bearing in mind that an EV taxi would recharge during daytime at peak electricity cost.

[51] Full details https://www.nationaltransport.ie/wp-content/uploads/2023/03/eSPSV23-Grant-Scheme-Information-Guide.pdf

Figure 23: Toyota bZ4X

The environmental benefit would be considerable, reducing emissions by 4,491 kg CO2/yr (44,910 over a 10-year lifespan). The equivalent of the CO2 uptake of 320 mature trees in a year.

It is important to note that the grant scheme relates to replacement of older and more used vehicles. We can presume that these will be replaced in any event: the contrast is between replacing with ICE or EV.

Over the whole SEC area, the switch amongst PSVs to EVs would save the PSV sector €76,000 over ten years while saving 87 tCO2 yearly: the same as offset by 6,214 mature trees per year.

5.4.2 Tractors and machinery

These were seen to contribute 21.1% to the non-domestic transport energy use and emissions. Reduction in these emissions would contribute to sustainability. This is an area where it is almost impossible to achieve significant energy efficiencies. There are also technical barriers to switching from ICE to EV (or FCEV) in the short term – there are few market-ready EV tractor or construction machinery examples. However, it may be possible to realise emission reductions opportunities from the adoption of HVO. The caveats previously made around the true sustainability of the feedstocks of HVO remain. And it should be borne in mind that the claims of 95% reduction in CO2 over diesel are based largely on the idea that the feedstock sequesters carbon as it grows. Thus, it is a 'low carbon lifecycle' fuel rather than a low carbon fuel. However, it should be possible to establish a supply-chain certification system even in the short term where HVO fuels of European origin from ethically and sustainably managed sources can be guaranteed. This action should be used effectively as a first step: a way to get commercial and agricultural diesel users to consider looking to alternatives.

Technically a switch from diesel to HVO is achievable today. There is an economic cost in that HVO is more expensive by approximately 10% than diesel, but construction companies or farmers may be willing to absorb this in the interests of increased sustainability and bearing in mind that fuel costs represent a pre-tax business or farm expense.

The difference between the costs of the two fuels is more a matter of policy than reality. Diesel as a fossil fuel product is heavily subsidised where it is produced. It is heavily taxed in Ireland where it is distributed. Both subsidy and tax levels are political judgements. It may be that the level of taxation in Ireland for fossil fuels in the future is raised to account for the cost of the established unsustainability of its use.

The **transition to HVO should be seen as a stop-gap measure however** in advance of a move towards electrification: either directly with battery operated vehicles (though these may be ultimately found to be impracticable) or indirectly through fuel cell electric systems (that use hydrogen as their energy storage). HVO produces carbon at theexhaust: it's relatively lesser emissions over diesel are based on the fact that the feedstock (for example rapeseed oil) takes up carbon as it grows. We discuss HVO is greater detail below in Appendix Section 7.6.4, but state here that or view is that **HVO is not feasibly a long term or widely adoptable replacement for Ireland's diesel use**.

5.4.3 Smaller Goods Vehicles (< 5 tonnes)

These accounted for 49.2% of all non-domestic road vehicles. These contributed 48.3% of non-domestic transport emissions however, while goods vehicles (GVs) over 5 tonnes contributed 51.3%. This is because the smaller number of > 5t trucks travel longer distances and use more fuel per km than smaller goods vehicles.

GVs less than 5 tonnes are in effect range from small caddy to medium sized vans. There are numerous EVs on the market that can meet the requirements of this transport segment up to transit type vans. There is a very good independent guide to EV vans costs available in Ireland here.

The price per km for an electric van will be better than was stated for an electric PSV in Section 5.4.1 above, as the owner will be more easily able to avail of night rate electrical tariffs. This could provide the electric van owner with a cost of €3.36 per 100km[52]. For comparison, a Ford transit requires 7.2L/100km which would cost €11.38/100km[53].

Transitioning the small goods vehicles fleet to electric vehicles has clear economic as well as sustainability logic and this are a medium-term opportunity that the SEC could disseminate to the local businesses.

[52] 16.kWh per 100km @ €0.21/kWh night rate.
[53] Assuming diesel price of €1.58/L

5.4.4 Large Goods vehicles > 5 tonnes

The power demand of these vehicles, were they to be battery powered, would require a significant reconfiguration of our electrical grid. There is therefore much attention being given in this sector to FCEV for large trucks typically travelling long distances (as there is for trains and inter-city buses). This is an area that is being investigated by two large research projects in Galway City (GH2 and Sh2amrock[54]). We suggest that the SEC follow developments in these projects and inform the local transport companies of all developments and upcoming opportunities.

HVO has proven its feasibility in this sector. Circle K fuels its delivery trucks with HVO, and other large transport operators have signalled their willingness to switch to this more sustainable fuel. The caveats in relation to HV are discussed above in Section 5.4.2 and Section 7.6.4.

5.5 SEC level Opportunities

In this section we discuss the opportunities for carbon emission reduction across the entire SEC in both the domestic and non-domestic sector.

5.5.1 Efficiencies and fossil fuel avoidance

As we have shown there will be considerable savings achievable from domestic retrofits, renewable transport initiatives, active travel, and non-domestic opportunities. These savings will be both financial as well as in CO2 reductions.

5.5.2 Generation

There are, on first view, opportunities for large-scale energy generation in the SEC area. This is due to the distributed settlement patterns in much of the SEC, in particular Coolure and Fore West. There is an availability of the kind of land that is required accommodate large grid-scale energy generation.

However, there are considerable environmental, planning, local policy and public acceptance issues that would need to be addressed in pursuing this opportunity.

Proximity to the SPA Natural reserve in Coolure (Lough Derravarragh Natural Heritage Area[55]) and the Special Area of Conservation in Lough Lene makes many large-scale renewable generation projects problematic. The presence of flocks of overwintering geese, which are a protected species would have implications for both wind and PV at scale.

[54] The authors of this EMP are involved as partners in Sh2amrock
[55] https://www.npws.ie/sites/default/files/protected-sites/synopsis/SY000684.pdf

5.5.2.1 Wind

In terms of wind generation, we would note that the County Development Plan 2021-2027 designates almost all of Westmeath as having low wind generation capacity (the excepted area is deemed as having none). We do not think that wind generation above the on-farm type with a rating of <50kw (~35m mast height[56]) represents an opportunity for the SEC. On-farm wind generation is sized to meet farm needs and is very site specific. It is not a community scale opportunity.

5.5.2.2 Photovoltaic

Over the past 10 years there has been an increase in the efficiency of new PV panels and a reduction in costs per unit owing to greatly increased volumes of production worldwide resulting in an overall reduction in cost per MWh produced.

3-5MW Scale

In general, 3 MW PV sites require approximately 6 hectares of contiguous land in a relatively low-lying flat location (incline <5 degrees) with an unobstructed South facing aspect, sheltered from the prevailing elements and sea with a good solar resource. A proximity of less than 2km to 38kV substation with open capacity is advantageous.

Community scale PV would be possible in certain areas of the SEC[57] but would require positive community acceptance and even a partnership status within the development to overcome county policy and public acceptance issues.

The economics of a community scale PV system in the SEC are good.

Solar resource for the area is moderate. Figure 24 shows modelled output from a 3MW PV installation in the SEC area over 12 months.[58]

[56] An example of such a turbine is shown here: http://www.nationwide-energy.co.uk/downloads/Endurance%2050kw%20turbine%20(25m%20tower).pdf
[57] We do not discuss suitable sites in this report and confine ourselves to technical and economic feasibility only.
[58] Using Photovoltaic Geographical Information System: https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html

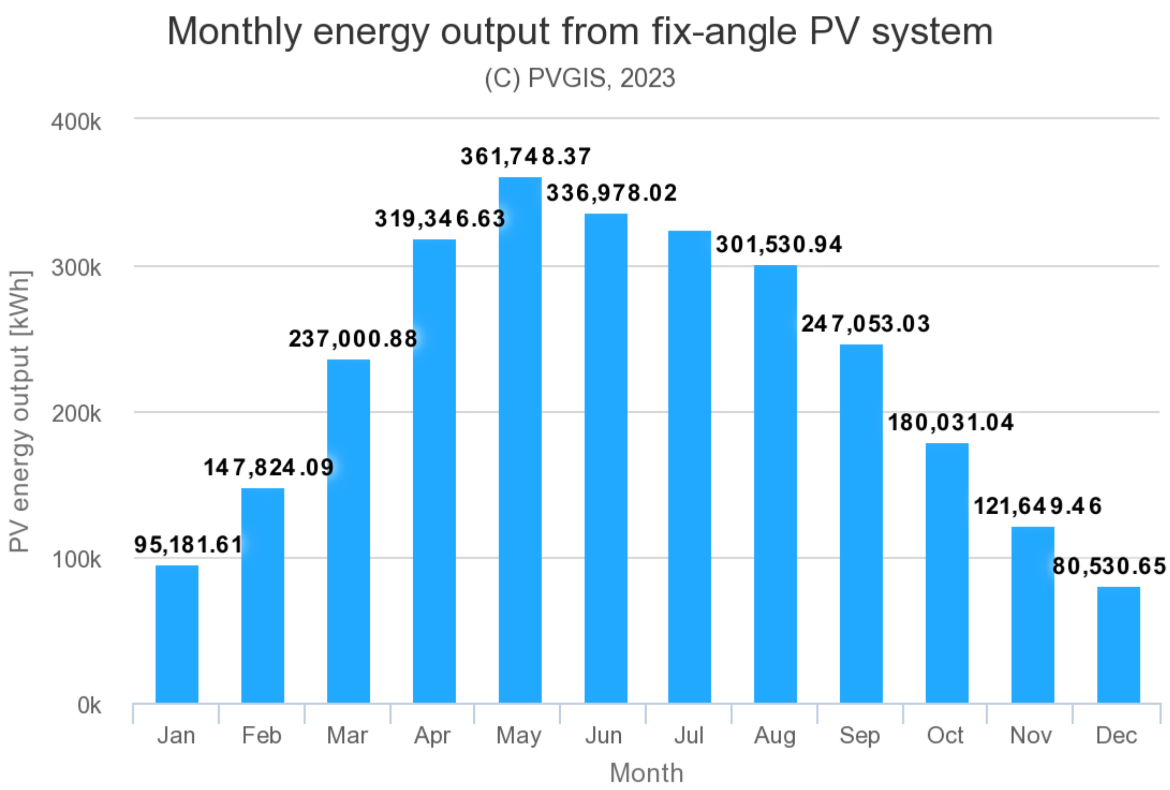


Figure 24: Output from 3MW PV installation in SEC area

The total production would be 2,754 MWh of green electricity. This would have the effect of removing 909 tCO2 from the SEC's energy system[59].

At a realistic projected capital cost of €4m and including a range of OPEX costs for the 25-year lifespan of the project, the LCOE would be €60-90 MWh making it a potentially economically viable project. If a community initiative, the project is likely to qualify for support from the upcoming Small-Scale Generation Scheme[60] (SSGS).

The SEAI has produced a very helpful guide explaining how to carry through Community Energy PV projects to fruition which is available at this LINK.

5.6 Sustainability Effects of Opportunities

The opportunities identified will have considerable benefits to residents and businesses in the SEC area reducing fossil fuel energy consumption and avoiding CO2 emissions. A full

[59] Taking into account the replacement of mix fuel source grid electricity with 'green' electricity
[60] Department of the Environment, Climate and Communications, 2022, *Consultation on a Small-Scale Generation Support Scheme (SSG) in Ireland* https://www.gov.ie/en/consultation/353f2-consultation-on-a-small-scale-generation-support-scheme-ssg-in-ireland/

implementation of the opportunities discussed above will reduce energy use by 31,191 MWh per year or 36%, and carbon emissions by 9,756 tCO_2 per year, or 31%.

Figure 25 clearly shows the areas where the greatest energy savings can be achieved: namely in Domestic and Non-Domestic building retrofits, a switch of 30% of domestic transport to EVs, and the switch of Goods Vehicles to EVs. It is in these areas that the SEC would have the greatest impact. Fortunately, they are also areas well supported by SEAI grants and making use of mature technologies. The economic case for each energy reduction and CO_2 avoidance opportunity is thus very clear.

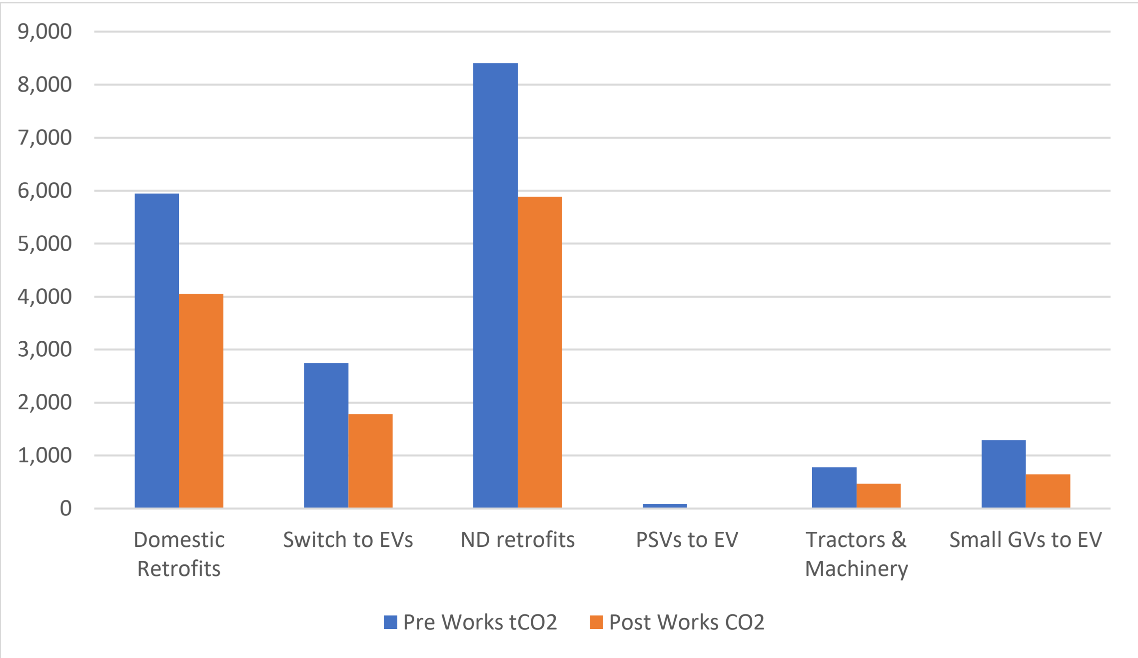


Figure 25: Pre and Post Opportunities Energy Use for the SEC

6 Conclusion: Holistic Effects of Co-ordinated Strategy

In this section we bring together the energy conservation and generation measures to show the potential positive impact of carrying through the Energy Master Plan on a holistic level.

6.1 Strategy Outline

Table 16: RoO Strategy Outline: Priority and Projected Reduction in Co2

Emissions Reductions Each Year in kg Co2/yr									
Priority [1]	Action	2024	2025	2026	2027	2028	2029	2030	TOTAL/yr
1.1	Retrofit 15% of G-C3 homes each year	271	271	271	271	271	271	271	1,897
1.2	15% ND Buildings upgraded each year achieving 35% energy reduction overall	360	360	360	360	360	360	360	2,521
1.3	Information campaign to encourage GV owners to switch to EV Vans	92	92	92	92	92	92	92	645
1.4	Information campaign to encourage PSV owners to switch to EV Vans	12	12	12	12	12	12	12	87
1.5	5% replacement of FF ICE domestic cars with EVs annually	137	137	137	137	137	137	137	960
1.6	Campaign for Tractors & Machinery in SEC to switch to HVO	45	45	45	45	45	45	45	312
1.7	56 homes with 2.5kWp installations with 500 additional homes recruited each year until a target of 390	40	40	40	40	40	40	40	277
2.2	Community/Council Partnership 3MW PV electricity generation project			909	909	909	909	909	4,545
	Total Emissions Reduction tCO2	957	957	1,866	1,866	1,866	1,866	1,866	11,244

[1] Priority level is based on both achievability, the timescale required and the effect on emissions.

The effect of these measures, taken in consort will achieve the ambitions stated by the SEC in their scoping document for this EMP. Figure 26 shows how the actions would achieve a 96% reduction in on-island energy related emissions with a consequent reduction in energy use.

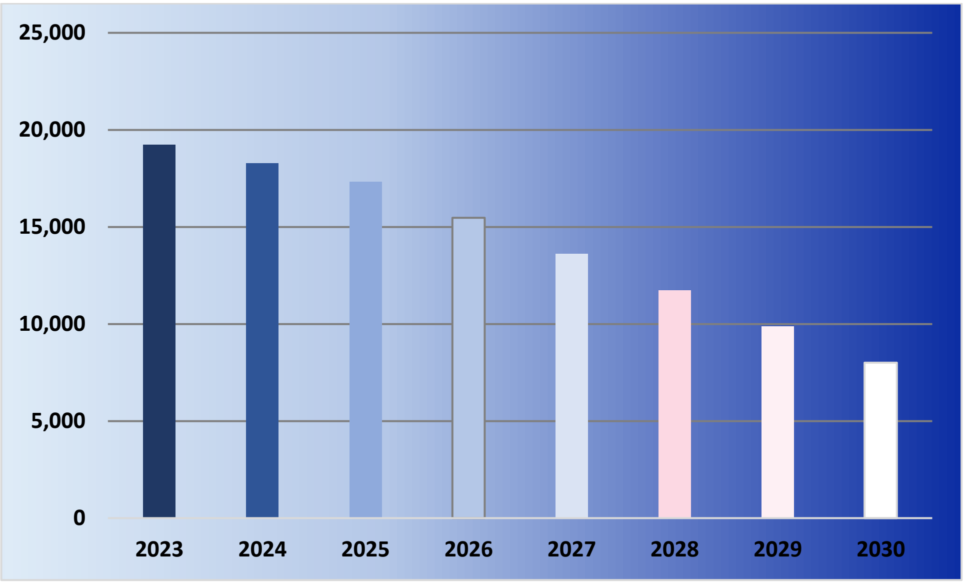


Figure 26: Reductions in Emissions Achieved through EMP Strategy

Financial Savings from Actions are equally significant. Residents and businesses in the SEC will achieve considerable financial benefits to match the sustainability gains that are possible from the actions outlined in this EMP. As we saw in Section 5.1.3 and F rated home could save as much as 80% on its energy bills if upgraded to BER A2.

6.2 Capacities

We would be confident that, with the support of Westmeath County Council, the SEC would be in a position to commence a Community Energy Grant Scheme for 2024 to achieve the recommendations outlined in the Strategy 6.1.

Building expertise and capacities within the group is critical to achieve the success of the SEC. Already there has been a continuous process of 'learning, planning and doing', through the SEC program, and the SEC appears to enjoy good support within the community[61]. Increasing the membership of the group, delegating responsibilities to achieve different

[61] The dissemination event of the reports draft finding in October 2023 was well attended by approximately 60 people from the community.

elements of the Master Plan will have the twin benefits of reducing overload on the individuals as well bringing in fresh perspectives.

We recommend a resources analysis exercise which will help build connections with other stakeholders as well as deepening the reservoir of talent and person-power that is available to the SEC to achieve the ambitious program outlined in the EMP.

This report recommends the SEC promote domestic PV installations. We are aware of a successful community led initiative that could offer a strong practice and business model that the Castlepollard SEC could follow. We have facilitated a communication between CSEC and this group which will help provide the necessary guidance and capacity to assist the CSEC in achieving this opportunity.

6.3 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. We suggest that the SEC host workshop events for each of the community subgroups that are targeted by the sustainability actions outlined in this EMP. These would be:

- Homeowners – in particular the fuel poor in relation to home upgrades
- Community Facilities/School Managers in relation to participation in CEG applications as well as facilitating outreach to residents.
- SMEs in relation to energy efficiency projects
- Local business groups, Chambers of Commerce particularly PSV and GV driver groups

These workshops will enable the SEC to recruit participants in the EMP actions. It is vital that these workshops are pitched appropriately – the needs of each group are very different, even if there are commonalities between all members of the community.

6.4 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.

We recommend that the SEC seek to partner with the local authority in a Community Energy Grant project: this will build capacity and demonstrate the value of the collective approach to sustainability. It will also develop the skill sets within the group. There are CEG specialists who have wide experience in managing successful projects. However, the SEC should remain engaged with every step of a CEG to maximize learnings as well as ensuring widest possible community benefit.

6.5 Continue the Journey with the SEAI

The SEC program has resources in addition to the county level SEC mentoring. The engagement of specialist mentors is possible, as is the Community Enabling Framework program (more information available here)

The SEC can also benefit from the SEAI's funding streams for energy efficiency projects within your community. These are constantly evolving, and the SEC should continue to engage with SEAI mentors to learn what funding and supports are available.

7 Appendix

7.1 Individual Level Behaviour Changes for homeowners

These are some quick and easy sustainability 'wins' the homeowner can achieve while they are planning long term solutions to their reliance on imported fossil fuels.

Step 1: Do Your Own Audit:

- Check windows, external doors, vents, interstitial floor spaces, fireplaces, and stoves with a stick of incense: and track down and eliminate draughts.
- Check insulation levels in attic, basement, walls (including the meter box), and interstitial floor spaces.
- Check your boiler and stove; what age are they? When were they last serviced?
- Collect energy bills and scrutinise them over a year or 2.
- To save money in the short term see if you need to change your electricity supplier.

Step 2: Actions to save 36% of your energy costs and fossil fuel use:

- Turn everything off – don't leave things on standby (2%)
- Use a clothes line when possible – tumble dryers are very energy heavy (7%)
- Wash clothes @ 30 degrees (1%)
- Turn off lights when not in a room, replace bulbs with CFLs at least, or with LEDs if possible (2%).
- Use oil to heat water – not the electric immersion or electric power shower (24%)

Step 3: Save energy by thinking about the way you control and use heat

Close the curtains at dusk to keep heat in the room that would otherwise be lost through the cold windows, and you could save up to 10% of your heating costs.

Consider fitting shelves above radiators as they redirect the warm air that rises from them back into the room.

Ventilate your house 3 to 5 minutes, a couple of times a day, instead of opening windows a little bit all day. Shut off your heating, during ventilation. This can reduce heat loss by 16%.

Maintain room temperature 19^{0}C (this can save up to €350 every year for each degree lower you heat the house)

Bleed your radiators regularly. If there is air in your radiator your boiler burns longer. Always start with the lowest and end with the highest radiator.

7.2 Supports for homeowners.

7.2.1.1 SEAI Supports for Individual Homeowner Applicants

There are three categories of applicants to the SEAI Home Energy Grant Scheme[62] of which this is a brief summary. These are:

Individual Energy Upgrade Grants	One Stop Shop Service	Fully Funded Energy Upgrade
Up to 80% of the cost of the upgrade for a typical family home with SEAI grants	Based on set grants per measure, this can be grant funded by SEAI 45 - 50% of the cost for a typical family home	For qualifying* homeowners in receipt of certain welfare benefits (see below) All home upgrade costs covered by SEAI
Homeowners manage their upgrades including: • contractor selection • grant application • contractor works • pay for full cost of works and claim grants afterwards • follow up BER	*A One Stop Shop contractor manages upgrade including:* • home energy assessment • grant application • project management • upgrade to a minimum B2 BER • contractor works • homeowner pays for the works net of grant • follow up BER	*Service is managed by SEAI and includes:* • home survey • contractor selection • contractor works • follow up BER
For homes built and occupied before: • 2011 for insulation and heating controls • 2021 for heat pumps and renewable system	*For homes built and occupied before:* • 2011 for insulation and heating controls • 2011 for renewable systems	*For homes built and occupied before:* 2006 for insulation and heating systems *Receiving one of the following: • Fuel Allowance • Job Seekers Allowance • Working Family Payment • One-Parent Family Payment • Domiciliary Care Allowance • Carers Allowance • Disability Allowance for over six months with a child under seven

There is a full explanation of the schemes, grants, and levels of funding on the SEAI site here

[62] Available at this link: https://www.seai.ie/grants/home-energy-grants/

Grant name	Grant Value
Heat Pump Systems	€6,500
Central Heating System for Heat Pump	€2,000
Heat Pump Air to Air	€3,500
Heating Controls	€700
Launch bonus for reaching B2 with a Heat Pump	€2,000
Solar Hot Water	€1,200
Attic insulation	€1,500
Rafter insulation	€3,000
Cavity wall insulation	€1,700
Internal Insulation (Dry Lining)	€4,500
External Wall Insulation (The Wrap)	€8,000
Windows (Complete Upgrade)	€4,000
External Doors (max. 2)	€800 per door
Floor Insulation	€3,500
Solar PV	0 to 2 kWp €900/kWp 2 to 4 kWp €300/kWp
Mechanical Ventilation	€1,500
Air Tightness	€1,000
Home Energy Assessment	€350
Project Management	€2,000

7.3 EV Grants

List Price of Approved BEV	Level of Grant
€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
€20,000 to €60,000	€5,000

Grant Eligibility: to qualify for SEAI grant assistance, the purchased vehicle must be new and one of the approved car models. The full list of car models is available at this link.

7.4 SME Supports

7.4.1 SEAI Energy Academy

The SEAI Energy Academy is a free, online, e-learning platform designed to help businesses increase their energy efficiency and reduce their energy related costs.

The SEAI Energy Academy allows anyone to learn with short, interactive, animated modules. It's mobile friendly and offers flexible, self-paced learning with access available 24/7.

Business owners, CEOs, managers, and facilities teams can join the SEAI Energy Academy and start learning. The SEAI Energy Academy courses are also a great way of engaging, up-skilling, and retaining staff. Courses can be implemented into any business's sustainability strategy helping them embed energy efficiency across their organisation.

LINK HERE

7.4.2 Climate Toolkit 4 Business

The Toolkit helps your business get started on your zero-carbon journey. It recommends the most impactful steps to understand and address your environmental impacts.

This Toolkit provides practical and cost-effective actions that every business can take to support this transformation and build resilience.

The Energy bills / usage information calculator asks how much electricity and gas your business uses every year on average.

The Business travel information calculator asks for vehicle fuels (petrol or diesel) volumes or cost as well as flights taken for business purposes in a year.

Waste and Water Usage is also tracked.

LINK HERE

7.4.3 SME Energy Audits

An energy audit is an important step for businesses that want to save money, save energy, and enhance their brand. An energy audit may be carried out on buildings, processes, or systems and it is a three-step process which involves preparation, a site visit and reporting. The audit report that compiles the findings will help you to understand:

- how much energy your business uses.
- the equipment and processes that use the most energy.
- what actions you should take to save energy, and their estimated cost and impact

SEAI's Support Scheme for Energy Audits (SSEA) will offer SMEs a €2,000 voucher towards the cost of a high-quality energy audit. In most cases, this will cover the total cost of the audit. Application to the scheme is easy, with automatic approval for eligible businesses.

Businesses applying to the scheme must be:

- non-obligated entities
- tax compliant
- registered in the Republic of Ireland
- spend at least €10,000 on energy per year at the site being audited.

Non-obligated parties (that is those who are eligible for the scheme) are: small and medium enterprises (SMEs), or public sector bodies with a useful floor area less than 500m^2 and spending less than €35,000 per year on energy.

7.4.4 SEAI SME Guide to Energy Efficiency

This document is an excellent short guide for SMEs. This practical guide is based on the real-world experiences of a team of professionals who've been helping companies improve their energy efficiency for decades, so the recommendations are tried and tested.

> *'Based on experience, the average SME could reduce its energy bill by up to 30% by implementing energy efficiency measures. Typically, 10% saving can be achieved with little or no capital cost. Some investment may be required to get the remaining 20% but the payback is generally around 1.5 years. You won't make a better investment!'*

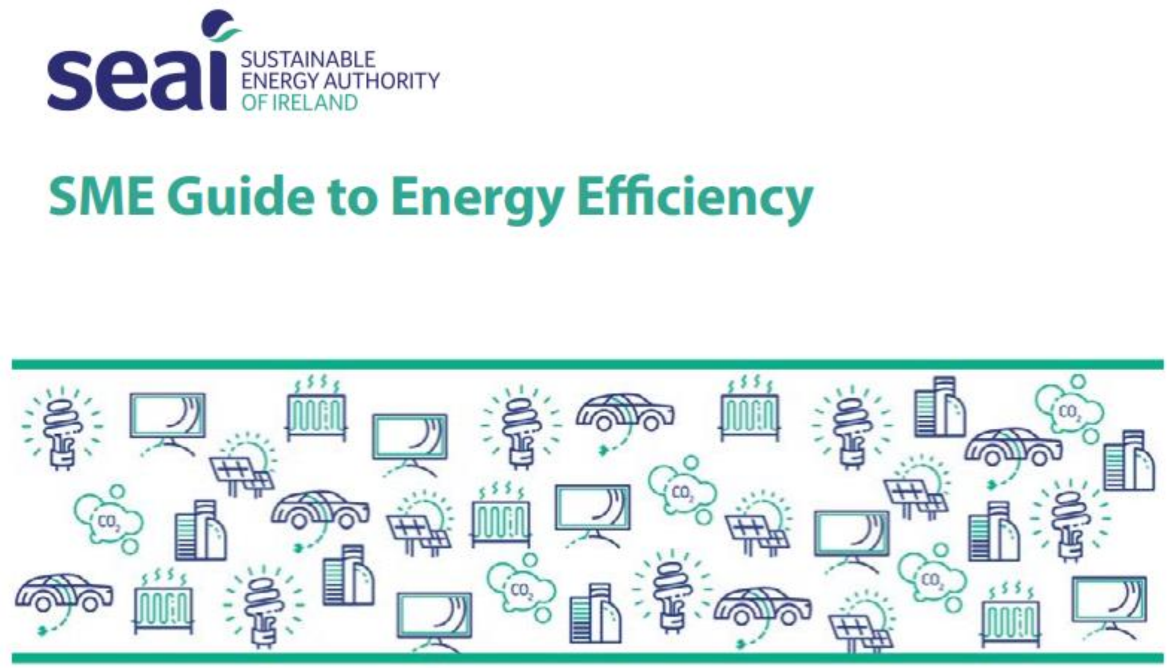


Figure 27: SEAI SME Guide to Energy Efficiency: [LINK HERE]

7.4.5 PSV: EV Taxi Grants

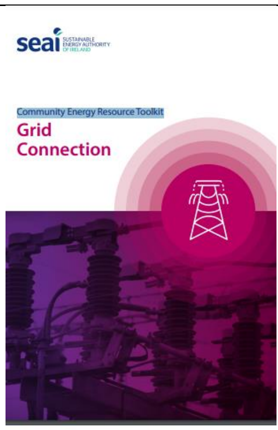
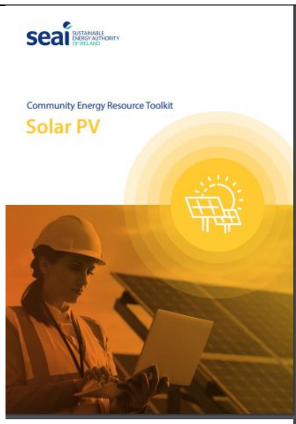
: https://www.nationaltransport.ie/wp-content/uploads/2023/03/eSPSV23-Grant-Scheme-Information-Guide.pdf

7.5 General Resources

7.5.1 Cycling Campaigning

Resource Name/ Description	Link
Carma: Marketing urban cycling Handbook and Case Studies	LINK
Cyclist.ie – The Irish Cycling Advocacy Network	LINK
EMBRACER: integrating public transport (PT) with informal modes (cycling, ride-hailing, car/bike/scooter sharing, on-demand transport, autonomous shuttles)	LINK
Cyclewalk: Best practices and experience on data collecting and processing, to involve users to improve planning of cycling and walking facilities	LINK
Handshake: Sharing Best Practice of Cycling experience from 12 cities (the assessment tool is useful for city planners)	LINK
European Cyclists' Federation: The European umbrella federation of civil society organisations advocating and working for more and better cycling.	LINK

7.5.2 Community Generation at Scale Resources

Community Energy Resource Toolkit: LINK	
Community level PV Guide: LINK	

7.6 Technologies Discussed in this report.

7.6.1 Heat Pumps

Air to Water Heat Pumps (AWHPs) are a type of heat pump that use outdoor air as a source of heat to warm up water for heating systems and domestic hot water. Here's how they work:

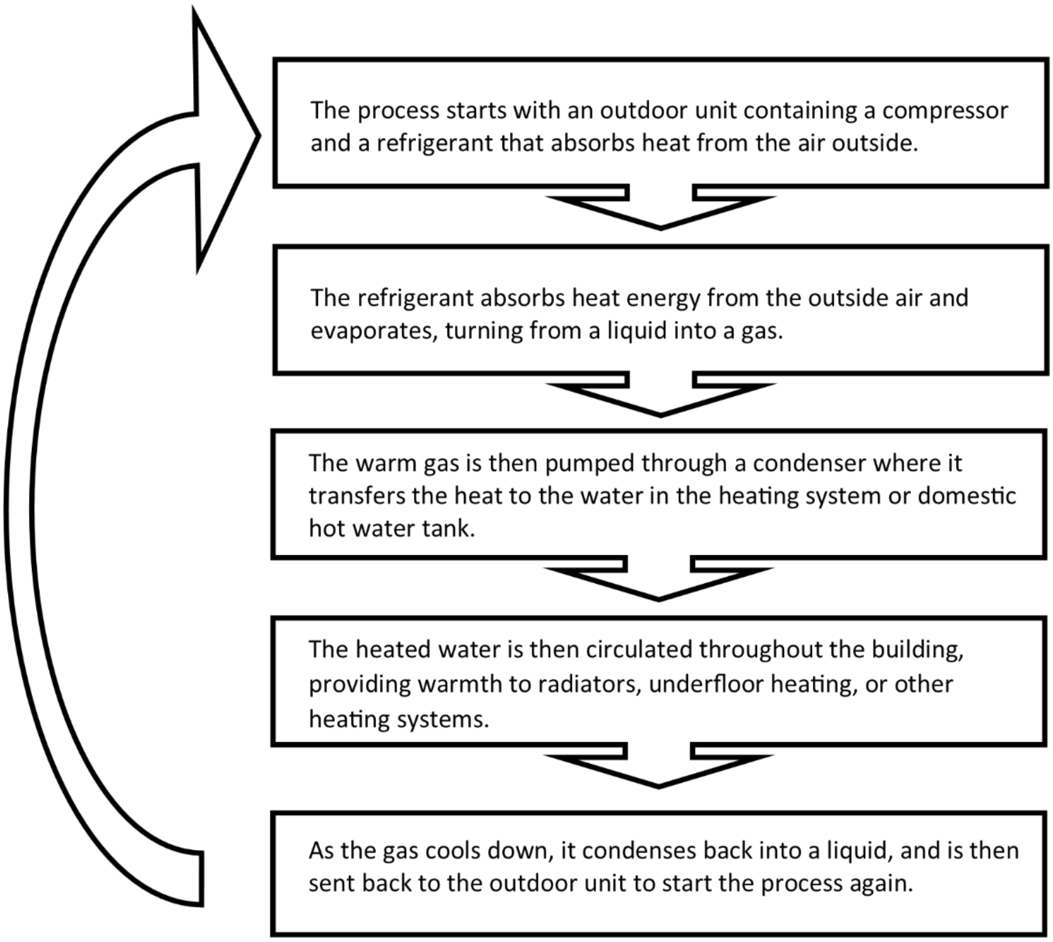


Figure 28: Heat Pump Flow Diagram

AWHPs are highly efficient because they use the freely available heat in the air, and only need a small amount of electricity to operate the compressor and pump. They are also a renewable energy source, as they do not rely on fossil fuels, and can provide significant energy savings compared to traditional heating systems.

AWHPs can have an efficiency of 3:1 which means that for every kWh of electricity is put in, 3kWh of heat are produced.

For further reading, see this SEAI guide: https://www.seai.ie/publications/Heat-Pump-Technology-Guide.pdf

Figure 29: Small Domestic Heat Pump

7.6.2 PV

PV stands for Photovoltaics, which is a method of generating electricity from sunlight. Photovoltaic systems use solar panels made up of photovoltaic cells to convert the energy from the sun into direct current (DC) electricity. This electricity can be used directly, stored in batteries for later use, or converted into alternating current (AC) electricity for use in homes and businesses. PV technology is considered a renewable energy source because it relies on the sun's energy, which is abundant and free, to generate electricity, and it produces no emissions or pollution during operation. PV systems can be installed on rooftops, in fields, or on other open spaces, and they are commonly used for both residential and commercial applications.

PV electricity can be used in the home as well as exported to the grid. The typical modern panel will last 25 years (although it loses some of its efficiency over time). A 2kW power system will require five 400W panels taking up approximately 2m X 5.5m of south facing roof space.

Figure 30: Micro PV installation

https://www.seai.ie/technologies/solar-energy/electricity-from-solar/

7.6.3 EVs

For a list of BEVs on the Irish market see this list compiled by the Irish Credit Union Association: https://www.creditunion.ie/blog/the-best-value-electric-cars-in-ireland/

For an explanation of SEAI supports for BEVs see here: https://www.seai.ie/technologies/electric-vehicles/

BEVs are Cheaper than Petrol Hybrids

A Nissan Leaf (costing €36k) has a range of 385 km from its 62kWh battery. From a Standard rate of electricity this gives a cost per km of 6.2km per kWh = €0.44 which is €0.071/km.

A Nissan Quashquai will cost €35,400 and achieve 5.22 L/100km or 19.16km/l which at a price of 1.60/l petrol is €0.083/km **14% more expensive than the BEV**, excluding tax, VRT, and lower service costs.

7.6.4 Biofuel

We focus on Hydrotreated Vegetable Oil (HVO) here as it is seen as a like-for-like replacement on diesel in most applications, including tractors and construction machinery.

Hydrotreated Vegetable Oil (HVO) is a type of renewable diesel fuel that is produced by hydrotreating vegetable oil. It is a high-quality, low-emission fuel that can be used as a direct replacement for fossil diesel in diesel engines.

The hydrotreating process involves heating the vegetable oil to high temperatures and pressure in the presence of hydrogen gas and a catalyst. This process removes impurities such as sulphur and nitrogen, reducing the carbon chain length of the fatty acids in the feedstock. The end result is a clear, colourless liquid that has excellent cold flow properties and a high cetane number, which is a measure of its combustion quality.

HVO may be considered a transitional sustainable fuel option as it is made from renewable feedstocks and produces lower emissions compared to fossil diesel: although not zero as the lower emissions values relate to the carbon uptake of the feedstock crops: the tailpipe emissions from HVO are slightly below those of diesel. It has also been found to be compatible with existing diesel engines and infrastructure, making it a viable alternative to fossil diesel for transportation and industrial applications in the short and medium terms.

HVO Fuel Suppliers Online

lassoil.ie/

inverenergy.ie/

Certaireland.ie

Eurooil.ie

This is a summary guide to biofuels in general. HVO is discussed p12-15

HVO emits carbon at the vehicle's tailpipe. It is deemed low-carbon (as is wood) because the feedstock takes up carbon from the atmosphere as it grows. However, the source of the feedstock should be a concern for sustainability. If the feedstock originates from palm oil plantation sin poorly regulated environments, the fuel cannot in any circumstance be recommended. However, even if, as is suggested by Irish HVO suppliers, the feedstock is sourced from regulated and sustainably managed suppliers, other concerns in the interest of a holistic scientific approach need to be addressed.

The first of these is the issue concerning how much land used for food crops would be diverted to HVO feedstock crops to meet the demand. Is the replacement of diesel for vehicle use with HVO feasible from the land use perspective in Ireland?

Based on our (as yet unpublished paper on HVO and fuel demand in Ireland) we have found (see Table 17)that meeting the diesel transport requirements of Ireland with HVO would require an estimated 1,620,370 hectares of farming land (31% of the total). There is currently 280,000 hectares of arable land for all crops: the rapeseed demand for HVO to meet the current vehicle diesel demand would be 578.7% of all arable land in Ireland. This cannot be seen as a sustainable answer to our vehicle emissions. Therefore, we recommend

HVO in the EMP as a temporary measure, using feedstocks from waste vegetable oil and EU sourced feedstock from existing crops. The post-2030 solution requires other technologies such as green hydrogen fuel cell vehicles or improved (lighter and linger lasting) batteries.

Table 17: Calculation on land use requirement to meet HVO demand Ireland.

Ireland	Rapeseed	Refrence
Yield tonnes /ha	5	Teagasc LINK
L/t	450	Teagasc LINK
l/ha	2,250	
HVO per litre	0.96	BOSCH LINK
l HVO/ha	2,160	
gross auto diesel/yr	3,500,000,000	CSO LINK
ha/Rapeseed HVO demand	1,620,370	
ha farming- land Ireland	4,900,000	CSO LINK
ha arable land Ireland	280,000	
% farming land to meet HVO demand	33.1%	
% arable land to meet HVO demand	578.7%	

7.7 Methodologies

In this section we outline the methods we used to arrive at our measures of energy use based on the available data.

7.7.1 Domestic Energy Use

In the home, we look at energy used in heating, in appliance use, and in transport. We do this using a variety of methodologies.

Firstly, we process the national data on Building Energy Rating Certificates (BERs) as published by the CSO: these are provided on a national and a county basis here[63]. We then compare these to the SEAI's average breakdown BERs for each CSO Electoral Division which are published by the SEAI. This presents us with a picture of the state of the energy efficiency of the housing stock in the SEC.

[63]https://www.cso.ie/en/statistics/climateandenergy/domesticbuildingenergyratings/ accessed 02/02/2022

The BERs for each ED are classified according to energy use per square meter for space heating (SH), for Water heating (WH), and for lighting and pumps and fans (L). Appliance use is not included in the BER but we do account for it through *estimated* values (see below SEAI and DECC estimates). For SH and WH, we determine fuel consumed (oil, natural gas, electricity, etc) from the BERs. For Lighting and Pumps, we assume electricity as the energy source.

Energy use of the home is measured as kWh per square meter per year (kWh/m2/yr). A low kWh/m2/yr is considered more efficient than a high kWh/m2/yr. The level of consumption for homes from most efficient A1 to least efficient G under the BER system is rated as shown in Figure 31.

Scientific research, as well as homeowner reported feedback on BER energy use estimates, has found that the notional kWh/m2 usage of the BER does not reflect actual use. This is understood in the rating system which calculates the amount of energy required by the building to achieve comfortable occupancy temperatures for the whole home or building (20 degrees C). The actual use of the building (not all rooms may be heated or used) and the temperatures achieved (the home may be heated to less than 20 degrees C) are not within the survey programme parameters: the survey represents the energy the home or building would require regardless of the user's heating or building use practices. Thus, it has been found (Coyne & Denny, 2021)[64] that there is probably an over estimation of energy use per m2 in lower BER homes (E-G) and an under-estimation of energy use per m2 in higher rated homes (B-A). This research was based on 9,923 observations of one year of actual energy use and a further 9,328 observations from the same sample of houses with a second year of actual energy use.

We use the adjustments indicated by this research in our calculation of actual energy use according to each BER type (G-A). These are shown in Table 18.

Table 18: Adjustments of energy use for homes assumed[65]

BER RATING SUBGROUP	Adjustment +/-
B	+36%
C	+0.50%
D	-24%
E	-39%
F	-56%
G	-56%

[64] Coyne, B., Denny, E. Mind the Energy Performance Gap: testing the accuracy of building Energy Performance Certificates in Ireland. Energy Efficiency 14, 57 (2021). https://doi.org/10.1007/s12053-021-09960-1
[65] Ibid, Table 7, https://link.springer.com/article/10.1007/s12053-021-09960-1/tables/7

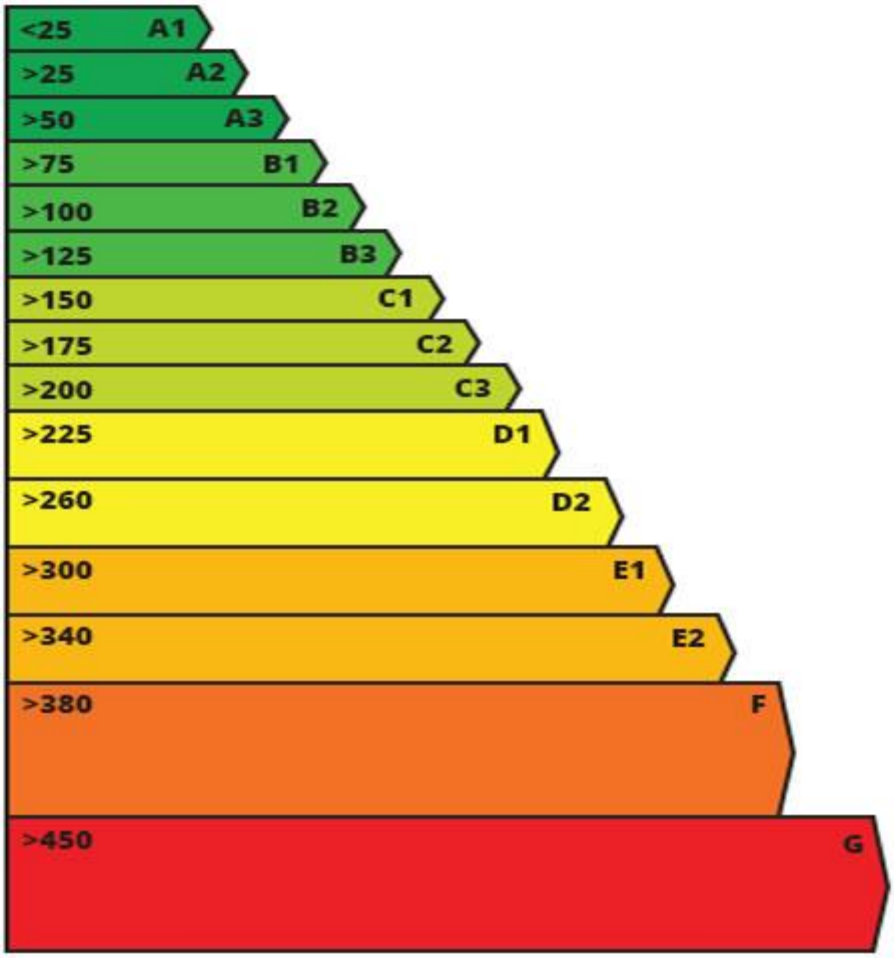


Figure 31: Energy Rating Scale in kWh/m2/yr A1-G

With our method, we calculated the percentage of homes with a BER for each rating A1-G in each ED. We found the results shown in Table 19.

Table 19: Percentage of BER Classes for Each Electoral Division (%)

BER Class	Kinturk	Coolure	Fore West	Westmeath
A	0.0%	0.0%	0.0%	5.0%
B1	2.9%	2.9%	0.0%	1.0%
B2	13.2%	0.0%	4.0%	3.0%
B3	18.6%	2.9%	12.0%	8.0%
C1	7.5%	8.6%	4.0%	10.0%
C2	11.4%	8.6%	8.0%	13.0%
C3	6.4%	2.9%	24.0%	14.0%
D1	10.4%	8.6%	12.0%	13.0%
D2	4.6%	22.9%	4.0%	10.0%
E1	3.9%	5.7%	12.0%	6.0%
E2	8.9%	2.9%	8.0%	5.0%
F	2.9%	11.4%	0.0%	5.0%
G	9.3%	22.9%	12.0%	8.0%

The next step was to find an average energy use for each BER class in each ED. This was achieved by finding the average Space Heating and Water Heating for each class B1-G for both primary and secondary heating in kWh/yr. The SEAI publishes detailed anonymised data from BERs for all homes with a BER, broken down by CSO Small Area[66], which we leveraged to achieve our average energy use (and fuel type) for SH and WH per BER class by ED as well as average m^2 per home for each BER class (340 homes in total).

We did the same for Lighting and Pumps electricity use. This gave an average energy use value for each BER class. This is an important step in our methodology as we found that although the energy consumed per m^2 in some homes is low, the total energy consumed by the home is relatively high: i.e., the home is energy efficient, but it is larger than average. Thus, the total energy consumption and emissions for the home are larger than others in the BER class.

We then estimated the appliance and cooking energy use for each home. This was not assumed to be a simple percentage of the overall energy use added. Appliance use does not relate directly to energy efficiency of the building. An A1 passive house using an electric fridge and kettle will use approximately the same electricity as a C1 house also using an electric fridge and kettle. We arrive instead at an estimated energy use for appliances based on the findings from the SEAI that appliances use on average 10% of the homes energy and cooking 2%. We aggregated the energy use for all homes in the SEC area arriving at an

[66] https://www.seai.ie/technologies/seai-maps/ber-map/

estimate of 2,303 kWh/yr for appliances and 444 kWh/yr for cooking. This is closely related to a figure of 2368 kWh/yr for appliances and 448 kWh/yr for cooking from a 2014 DECC Survey of 250 UK homes[67]. The floor area of the home was also disregarded as we did not consider this to be relevant to appliance use: homes largely use the same electrical appliances regardless of size.

When we added appliance and cooking energy (which here we assume as electrical energy), we arrive at the overall average energy use per BER Class for each ED (Table 20).

[67] Jason Palmer, Nicola Terry, 2014, Powering the Nation 2: Electricity use in homes, and how to reduce it, DECC, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/325741/Powering_the_Nation_2_260614.pdf

Table 20: AVERAGE TOTAL kwh/yr BER Heat for SEC

BER CLASS	MAIN SH adj	2ndry SH adj	MAIN WH adj	2ndry WH adj	All Heat adj	Heat kWh/m2	Av m^2 per BER class	Number of Houses per BEC class	SEC Heat kWh/yr
B1	7,271	2,843	4,578	0	14,692	79.7	184.4	17	250,243
B2	8,279	2,149	4,256	0	14,685	89.3	164.5	68	1,000,494
B3	10,889	2,581	5,807	211	19,488	106.1	183.7	145	2,821,518
C1	9,973	2,180	4,948	249	17,349	93.3	186.0	71	1,231,266
C2	13,383	2,976	4,733	1,348	22,440	112.5	199.4	99	2,229,557
C3	13,886	3,084	5,262	696	22,928	111.8	205.0	71	1,627,195
D1	12,165	2,059	3,818	1,155	19,197	101.5	189.2	97	1,852,900
D2	14,339	2,679	3,737	1,181	21,936	142.6	153.8	60	1,307,715
E1	14,070	1,870	3,183	885	20,009	115.8	172.7	45	908,818
E2	10,860	1,659	4,680	267	17,466	123.8	141.0	68	1,190,001
F	9,255	1,175	2,425	355	13,211	108.7	121.5	31	412,526
G	17,528	2,466	2,533	638	23,164	185.3	125.0	91	2,104,310

Note: Numbers are rounded to first decimal place

Table 21: Energy Use in the Home by BER Class and for SEC

	SEC Heat kWh/yr	Lighting and Pumps Electricty kWh/m2	Lighting and Pumps SEC	Total Non Appliance SEC	Total Appliances	Cooking	Total W Appliances
B1	250,243	8.5	26,744	276,987	31,476	6,295	**314,758**
B2	1,000,494	14.5	162,804	1,163,299	132,193	26,439	**1,321,931**
B3	2,821,518	13.4	357,411	3,178,929	361,242	72,248	**3,612,419**
C1	1,231,266	14.5	191,803	1,423,069	161,712	32,342	**1,617,124**
C2	2,229,557	15.7	311,765	2,541,322	288,787	57,757	**2,887,865**
C3	1,627,195	11.3	165,050	1,792,244	203,664	40,733	**2,036,641**
D1	1,852,900	13.4	245,412	2,098,312	238,445	47,689	**2,384,446**
D2	1,307,715	15.9	145,796	1,453,511	165,172	33,034	**1,651,717**
E1	908,818	14.2	111,661	1,020,479	115,964	23,193	**1,159,635**
E2	1,190,001	13.3	127,796	1,317,796	149,750	29,950	**1,497,496**
F	412,526	15.9	60,240	472,765	53,723	10,745	**537,233**
G	2,104,310	13.6	154,809	2,259,119	256,718	51,344	**2,567,181**
						TOTAL	**21,588,445**

7.7.2 Levelized cost of electricity

$$\text{LCOE} = \frac{\text{Sum of Costs over Lifetime}}{\text{Sum of Electrical Energy Over Lifetime}} = LCOE = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

I_t = Investment expenditures in year t (including financing)

M_t = Operations and maintenance expenditures in year t

F_t = Fuel expenditures in year t

E_t = Electricity generation in year t

r = Discount Rate

n = Life of the system

7.8 Data Tables Used

Table 22: Persons per home by ED 2022

ED	Occupied Homes	Population	Persons Per Home
Coolure	132	352	2.66
Fore West	139	404	2.91
Kinturk	585	1,508	2.57
SEC	856	2,264	**2.71**

Table 23: Car Fuel Assumptions

	km/yr	€/L	g CO2/L	L/100km	kWh/L	Efficiency
Diesel	17,193	€1.88	2640	4.81	10	30%
Petrol	10,704	€1.88	2310	5.52	8.6	25%

Table 24: Guidance Costs for Retrofit Works

Current BER	House Description – Year – Construction Type	Costs	Floor area m2	Cost/m2
C2	Detached Dormer Bungalow – 2003 - Unknown wall construction	€58,864.25	235	€250.49
C2	Detached Home – 2002 –Cavity Block	€59,747.00	238	€251.04
D1	Detached House - 1970 - Cavity wall construction	€74,058.00	239	€309.87
C3	Detached House - 1999 - Timber frame construction	€74,449.00	214	€347.89
C2	Semi-Detached 2-Storey Dwelling– 1985 – Cavity Block	€29,875.47	82	€364.34
D1	Detached House - 1990 - Cavity wall construction	€51,584.00	138	€373.80
C3	Detached Dwelling– 1978 – Cavity Block	€76,905.45	200	€384.53
C3	Detached 2-Storey Dwelling– 1991 – Cavity Block	€124,024.63	318.8	€389.04
C1	Semi Detached Home – 1991 – Cavity Block	€63,610.00	140	€454.36
F	Detached Home – 2002 –Cavity Block	€64,785.80	117	€553.72
D2	Detached Home – 1973 –Cavity Block	€98,378.00	171	€575.31
E2	Detached Dwelling– 1850 – Stone	€116,711.20	201.41	€579.47
E2	Semi Detached Home – 1940 – Mass Concrete	€58,728.69	100	€587.29
D2	Semi Detached Home – 1990	€78,915.45	133	€593.35
E1	Mid Terraced Dwelling – 1932 –Cavity Block	€63,877.80	103	€620.17
D1	Mid Terrace Dwelling – 1973 – Cavity Block	€57,273.65	90	€636.37
E2	Detached Dwelling – 1976 – Unknown	€105,018.76	153	€686.40
C3	End of Terrace – 1984 - Unknown wall construction	€62,566.61	80	€782.08
E2	End of Terrace Dwelling – 1950 – Mass Concrete	€61,337.51	77.68	€789.62
	Median			€553.72

NOTE: The costs for upgrades in Table 24 **do not include** the SEAI grant deduction. The grants are not paid out as a proportion of the total, rather than as a payment for measures carried out.

Table 25: MWh per person per year 2019 County, National and SEC area[68]

County	MWh	Persons	MWh/person
Carlow	395,420	56,875	6.95
Cavan	2,267,850	76,092	29.80
Clare	697,800	118,627	5.88
Cork	5,628,920	542,196	10.38
Donegal	848,990	158,755	5.35
Dublin	111,333,990	1,345,402	82.75
Galway	1,779,390	258,552	6.88
Kerry	1,535,160	147,554	10.40
Kildare	4,686,890	222,130	21.10
Kilkenny	1,686,350	99,118	17.01
Laois	302,380	84,732	3.57
Leitrim	186,080	31,972	5.82
Limerick	9,059,770	195,175	46.42
Longford	441,940	40,810	10.83
Louth	3,349,440	128,375	26.09
Mayo	1,093,220	130,425	8.38
Meath	1,500,270	194,942	7.70
Monaghan	360,530	61,273	5.88
Offaly	2,523,710	78,003	32.35
Roscommon	220,970	64,436	3.43
Sligo	872,250	65,357	13.35
Tipperary	1,837,540	160,441	11.45
Waterford	1,360,710	116,401	11.69
Westmeath	**976,920**	**88,396**	**11.05**
Wexford	1,035,070	149,605	6.92
Wicklow	581,500	142,332	4.09
Average Ireland			**15.60**
SEC	**42,006**	**2,264**	**18.55**

There is a wide variation between MWh per person across counties. Some counties have intensive industry for example Dublin, and some like Cavan have a lot of intensive energy agriculture (pigs and poultry). Westmeath County's below average MWh/pp may be as a result of large parts of the county being rural with non-intensive grass-based agriculture. As we can see, the SEC's rural setting makes it on average a higher energy using community than the surrounding county which includes the urban areas of Athlone, Mullingar, and Kinnegad.

[68] https://www.cso.ie/en/releasesandpublications/ep/p-beu/businessenergyuse2019/ From Table 7a with CSO 2016 population data.

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←--Document ENDS

[69] References to Published Documents are shown here. References to online publications, statistics, etc are given in the relevant footnotes.