The Downs Sustainable Energy Community

Baseline Energy Use Report

04 April 2024

Document Details

Supported by

This Version	Version: Draft In Progress
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Status	**Public**

1 Contents

1.1 List of Figures

1.2 List of Tables

1.3 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
TDSEC	The Downs 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
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

1.3.1 Units

Throughout this report we present energy use and energy production, in megawatt hours per annum (MWh/yr) or kilowatt hours per annum (kWh/yr). This unit of measurement is used regardless of the fuel used. CO2 emissions are in Kg of CO2

emitted (kgCO2), unless stated as tonnes of CO2 emitted (tCO2). Energy costs are presented in euro spent on energy per annum.

2 Background to this document

The Sustainable Energy Authority of Ireland (SEAI) established the National Sustainable Energy Community (SEC) network in 2017 to empower communities seeking proactive involvement in the transition to a low-carbon future. This network offers diverse learning opportunities, facilitates peer-to-peer support, and fosters leadership through exemplary community collaborations. Additionally, it provides access to grant funding. Established in 2019, The Downs SEC[1] is a member of this network formed by local community members.

Understanding a community's current energy consumption is crucial for devising realistic actionable future plans as an SEC. To establish this baseline, The Downs SEC commissioned the present Energy Master Plan (EMP) in 2023.

This document summarizes the analysis conducted by Energy Co-operatives Ireland on behalf of The Downs SEC. It highlights key findings concerning the community's current energy demand and potential avenues for reducing consumption and transitioning to renewable sources, collectively termed the "Register of Opportunities".

Fulfilling Ireland's pledges to reduce dependence on fossil fuels and their polluting and climate-altering emissions, outlined in the 2023 Climate Action Plan, requires citizen support. This support is most effective when coordinated and informed at community level. This EMP provides the necessary information to assist community collaboration.

The EMP is a dynamic document adhering to the "Learn-Plan-Do" principles, where experience is gained and tested through active ongoing projects. Additional resources, not included here, are accessible to the SEC steering committee and can be expanded and updated over time to monitor the SEC's progress towards its goals.

This study aims to stimulate conversation within the community regarding its recommendations. While we hold firm confidence in their feasibility, desirability, and beneficial impact on The Downs SEC's future sustainability, active community

[1] A full glossary of terms, including acronyms is set out in Section 1.3 below.

participation is crucial for the EMP's success. We, therefore, view this document as the initiation of a broader consultation process spearheaded by The Downs SEC in collaboration with residents of The Downs and the surrounding area.

An Energy Master Plan (EMP) aims to help the SEC to understand the energy demand and supply in the entire community. In the first instance an EMP looks at energy efficiency opportunities. Energy efficiency actions are typically lower risk. Many will have a shorter payback period. It is also widely accepted that reducing the total quantity of resources you use is the first step to greater sustainability. Some of these efficiency actions are behavioural and do not require additional spending at all. We look at these in detail in Section **Error! Reference source not found.**.

This EMP document is also accompanied by a Register of Opportunities document (provided separately to TDSEC) 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 the authors have met and discussed the aims and ambitions of the SEC to ensure that this EMP is unique to the conditions and opportunities of The Downs area.

This Energy Master Plan provides a Baseline Energy Use report (BEU) to quantify the current energy status of TDSEC 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 has devised a Register of Opportunities (RoO) which accompanies this EMP. The RoO document is an excel document of achievable energy efficiency and renewable energy actions for the first three years of TDSEC 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 TDSEC's target of 30% reduction of energy use across all sectors and a maximisation of carbon neutral energy production from renewable sources.

3 Policy Context

3.1 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 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 **Error! R eference source not found.**).

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

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:82:FIN
[3] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directive-and-rules/energy-efficiency-directive_en

account what is achievable by the residents, community groups and businesses in The Downs area. Section **Error! Reference source not found.**.

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 **Error! Reference source not found.**).

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. The Downs 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.

3.1.1 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:

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.

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.

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 5) 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.

3.2 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.

3.3 Targets from the Government's Climate Action Plan 2024 (CAP24)

The Climate Action Plan (CAP, latest version is 2024)[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.

Key Targets from CAP24

- **Achieving 80% of electricity demand from renewable sources.**
- **Retrofitting 500,000 homes to a BER B2 or cost optimal equivalent standard.**
- **Installing 680,000 heat pumps.**
- **A 20% reduction in total vehicle kilometres travelled.**
- **845,000 private electric vehicles (EVs) and 95,000 commercial EVs.**
- **5.7 TWh of biomethane used across the heat sector (split between residential, commercial/public services, and industry).**
- **District heating growth to 2.7 TWh.**

[4] https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

- **Methane reduction measures (e.g., slurry additives, reduced slaughter age, feed additives and breeding optimisation).**
- **Reduced fertiliser sales to 300 kt of nitrogen products.**
- **Water-table management on 80,000 hectares of drained agricultural grassland.**
- **Afforestation rates increased to 8,000 hectares per annum.**

This EMP examines these targets as they relate to The Downs. Our study will also look at how to achieve the tender requirement to map out how The Downs SEC can achieve energy reductions of 30% of the **total energy** usage (of the baseline year 2022) on the study area, within the next 10 years.

3.4 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]. The Downs is situated in the latter municipal area. Half the SEC (Heathstown ED) is in the Mullingar EA[6], the other half in Kinnegad EA (Huntington and Killucan EDs). 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[7] (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,

[5] https://www.westmeathcoco.ie/en/ourservices/yourcouncil/councillorsandcommittees/councillors/

[6] Electoral Areas (EA) of which Electoral Divisions (EDs) are a subdivision. The Mullingar EA elected 6 councillors in 2019, the Kinnegad EA elected 5 councillors. https://www.boundarycommittee.ie/Maps/Westmeath%20LEA%20Report%20Map%202018.pdf

[7] https://www.westmeathcoco.ie/en/ourservices/planning/developmentplans/countydevelopmentplan2021-2027/

including making effective use of land, minimising waste, and pollution, as well as mitigating and adapting to climate change.

3.4.1 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.'[8]

The Plan also reflects the strong rail connection in Mullingar Town[9] which is the closest urban settlement to the SEC (Mullingar Train station is 3.3km from the Downs – typically an 8 minute drive, a 30 minute cycle). It proposes to increase bus connectivity to Mullingar's hinterland which includes The Downs. There is a Bus Éireann service from Kilucan to Mullingar[10] that passes through The Downs and serves most of the SEC.

'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.

3.4.2 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.'

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

[9] https://www.irishrail.ie/IrishRail/media/Timetable-PDF-s/Connolly-DART-timetables/07_dublin_-sligo.pdf

[10] https://buseireann.ie/inner.php?id=406&form-view-timetables-from=&form-view-timetables-to=&form-view-timetables-route=190&form-view-timetables-submit=1

Table 1: WCDP Renewable Energy Policies addressed in this report[11].

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.

Sources of renewable energy **relevant to the SEC area** that are examined 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 **Error! Reference source not found.**)

3.5 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 The Downs 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.

[11] Ibid, p338.

4 The Downs SEC area: Geography and Demographics

4.1 Geography:

Figure 1: The Downs SEC area

The Downs SEC is situated in the Irish midlands in County Westmeath. It is comprised of The Downs itself, Coralstown and Killucan. The surrounding countryside is relatively flat to undulating with the highest point in the area 150m above sea level at Liosnabin 1.5km to the NW of Killucan. The Downs itself is just 110m above sea level, Coralstown and Killucan approximately 90m. The area is designated as the 'Central Hills and Lakes' Landscape Character area of the County, but also includes the 'Royal Canal Corridor' and the Royal Canal Greenway [12].

[1212] https://www.westmeathcoco.ie/en/media/Volume2BookofMaps.pdf map 68.

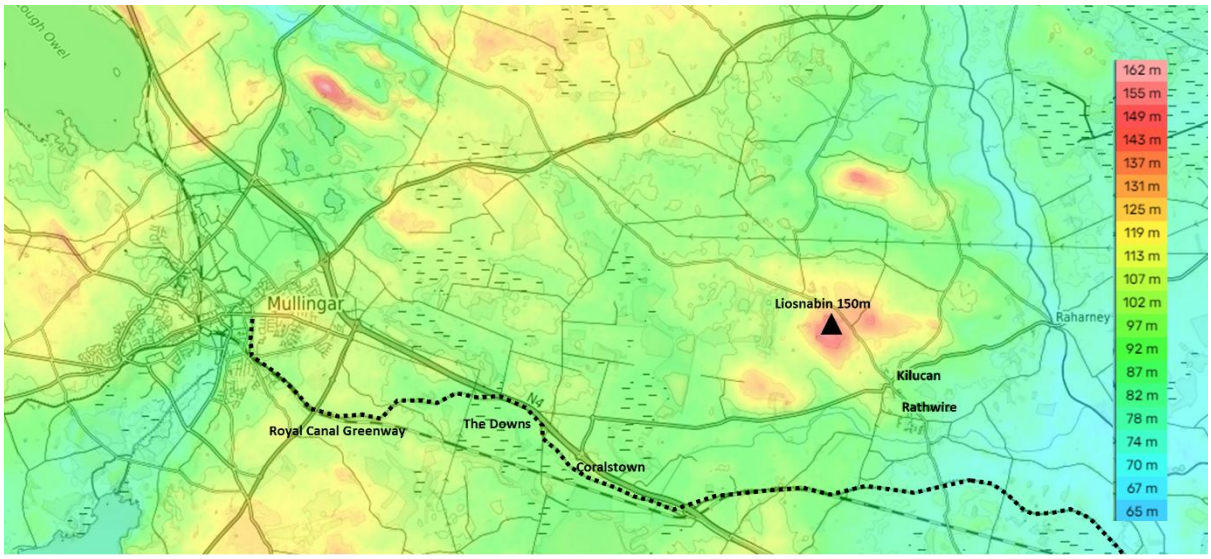


Figure 2: SEC area topographic map showing Royal Canal Greenway

The surrounding land provides good grassland predominantly under pasture with cattle, both beef and dairy predominating, and sheep. The SEC contains within it part of the Wooddown Bog Special Area of Conservation (SAC) – a degraded raised bog still capable of natural regeneration[13]. The area of the SEC is 54.25 km^2. It is for the most part sparsely populated 59.6 people per square kilometre (p/km^2).

The Huntington ED has a population of 23 p/km^2, Heathstown 36p/km^2, but the more built up Killucan has 141 p/km^2. The population density for Westmeath as a whole 52 p/km^2 and for comparison the population density of the Republic of Ireland is 68.7 p/km^2.

[13] https://www.npws.ie/protected-sites/sac/002205

Figure 3: SEC area showing its three Electoral Districts:Heathstown, Huntington and Killucan

4.2 Demography

The population of the area in the CSO 2022[14] census was 3,237. The distribution of the SEC's population is shown in Table 2

Table 2: SEC Population as a whole and by ED

	Heathstown	Huntington	Killucan	SEC
Population	749	449	2,039	3,237

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

[14] https://www.cso.ie/en/statistics/population/censusofpopulation2022/

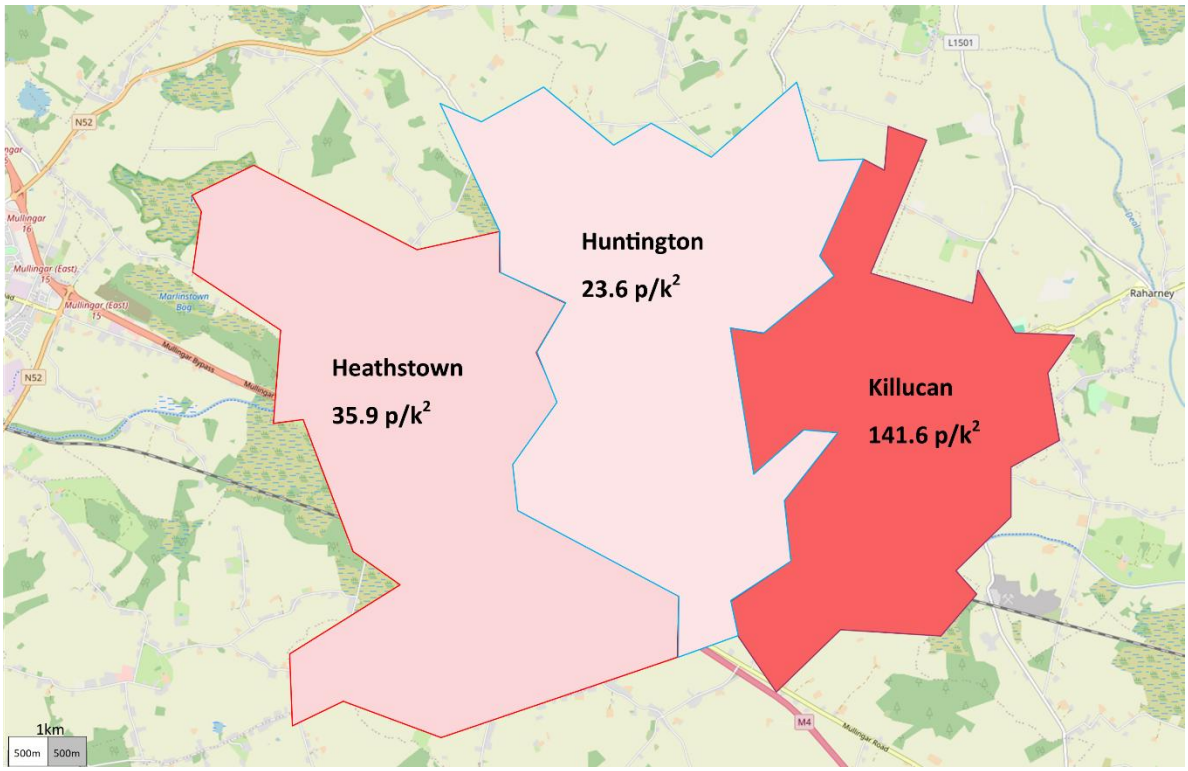


Figure 4: Population Density by ED

4.3 Social Balance

There is a variance across the SEC area in relation to economic advantage. Pobal's social disadvantage metric[15] rates communities across a number of indices to measure levels of socio-economic disadvantage. The 2022 data shows that Huntington and Heathstown are designated as marginally above average in the index[16], Huntington 2.44 PDI, Heathstown 5.2 PDI. 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'[17] to low carbon.

[15] https://maps.pobal.ie/WebApps/DeprivationIndices/index.html

[16] Full data on ranking of the Eds is in the Appendix Section **Error! Reference source not found.** **Error! Reference source not found.**

[17] https://climatepromise.undp.org/news-and-stories/what-just-transition-and-why-it-important

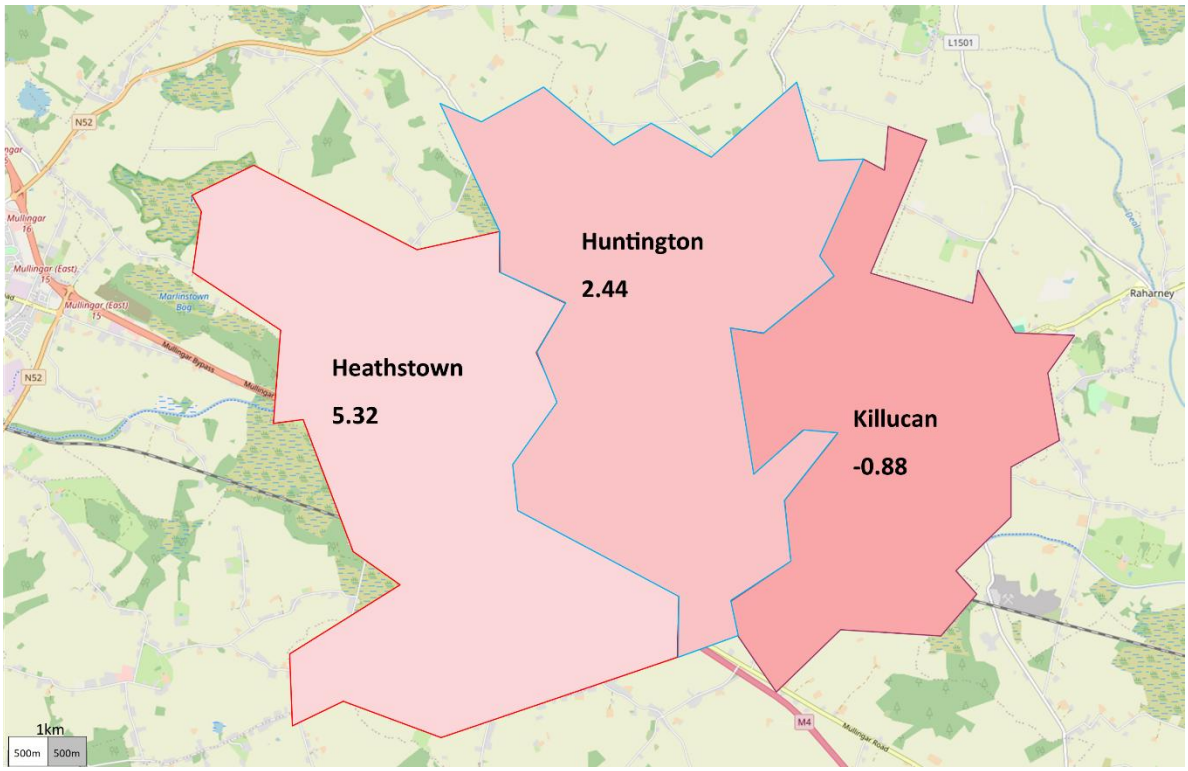


Figure 5: EDs within the SEC according to Pobal's Deprivation Index

5 Baseline Energy Usage

The Baseline Energy Usage (BEU) for the SEC area aggregates the energy use of 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.

5.1 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.

5.1.1 Breakdown and Distribution of Residence Types

The 1,082 occupied homes in the SEC area (Table 3) are predominantly comprised of houses (1,064) as opposed to apartment dwellings (18). As we would expect, 87% of the flats are in the more built-up Killucan ED. The SEC's 1.7% of homes in flats is far lower percentage of flats per dwelling type than the rest of Westmeath (9.6%) and reflects the non-urban settlement pattern across the SEC.

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

Building Type	ALL SEC	Killucan	Huntington	Heathstown	Westmeath	Ireland
House/Bungalow	98.3%	97.6%	100.0%	99.2%	90.2%	86.7%
Flat/Apartment	1.7%	2.4%	0.0%	0.8%	9.6%	13.0%

The housing stock ages vary across the SEC. Figure 6 shows in general the homes in Huntington are older than the national, county and SEC averages, with 26% of homes in the ED built before 1960. It is clear that there was a considerable building boom in Killucan between 2001 and 2010 – i.e., during the 'boom' years. 44% of the homes in Killucan were built in this period. Buildings built during different periods present varying challenges in terms of energy use, heating efficiency and energy upgrade requirements. These will be reflected in the energy data below as well as the Register of Opportunities.

There continues to be new developments recently built around Killucan. For example, The Ivy Court, Killucan. 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.

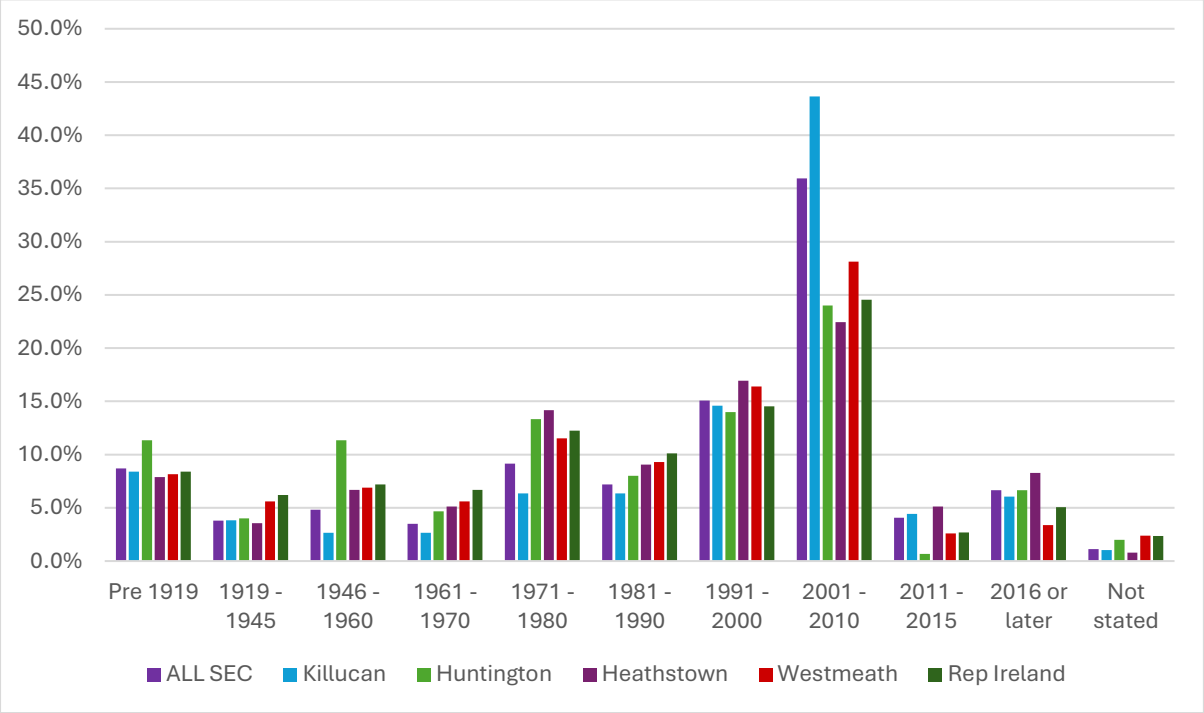


Figure 6: Houses by age: SEC, by ED, Westmeath and Rep Ireland

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 more rooms than the average for Westmeath. This is due to the fact that homes with six rooms or more predominate the SEC, but with homes sizes being slightly smaller in the Killucan ED: The correlation between density of population and size of homes is very typical.

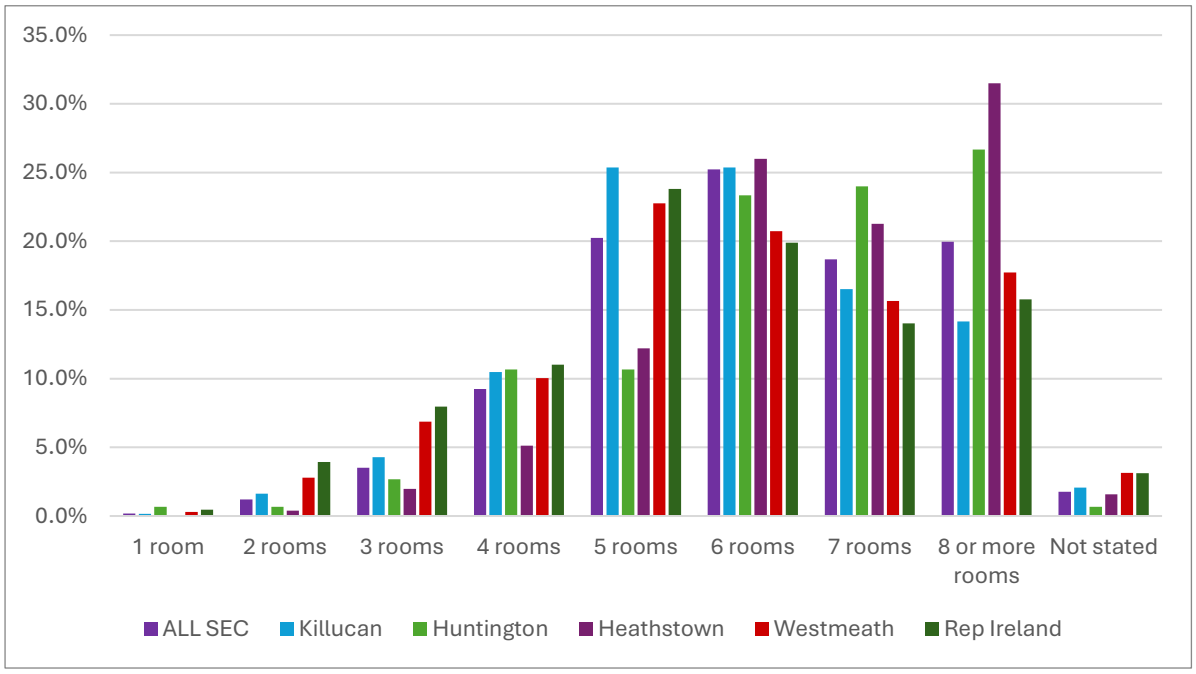


Figure 7: Rooms per home by ED, SEC and Co Westmeath

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 Killucan (50% are 5-6 rooms) to be lower in energy use and those of Huntington and Heathstown (51% are 7-8 rooms) to be higher.

5.1.2 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 **Error! Reference source not found.**.

We found that across the EDs there was an estimated **28,178 MWh of energy** consumed between space and water heating, lighting, and appliances. Thus with 1,082 homes in the SEC, the average energy consumed for light, heat and appliances per home is 26,042 kWh. This average home energy use is 27.5% above the National Average of 20,424 kWh/yr energy consumed per home[18]. This is to be expected given the larger home size on average across the SEC.

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

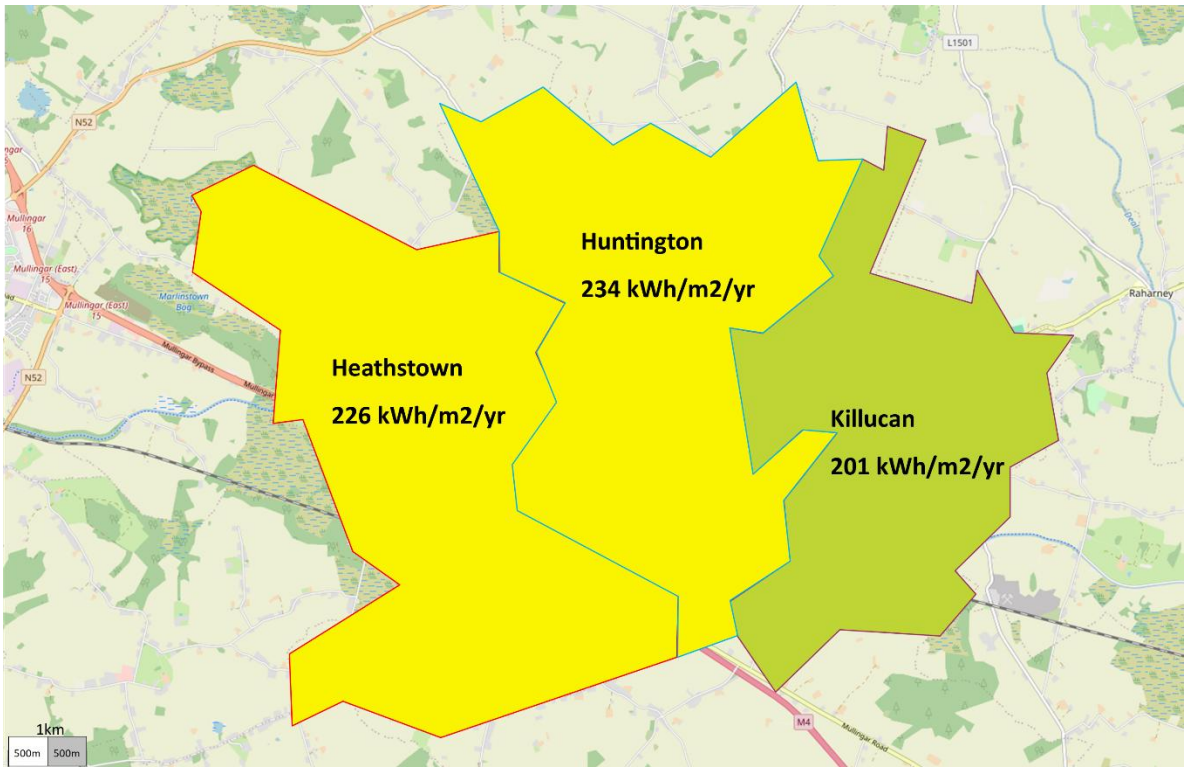


Figure 8: Mean kWh/yr Consumed by Homes in Electoral Divisions

Figure 8 shows that the energy efficiency expressed in energy units (kWh) consumed per square meter of building floor space per year (kWh/m^2/yr) is not even across the SEC. As we predicted above the newer homes of Killucan have in general a better energy efficiency with lower kWh/m^2/yr values than the other two EDs with their older building stock.

5.1.3 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[19]. This is shown in **Error! Reference s ource not found.** below. It is clear that for the SEC home heating oil is the most common fuel (65.5% of homes), followed by Turf at 14.2%. Turf is more widely used in the more rural Heathstown (24%) and Huntington (29%) where there is greater access to turbary, whereas in Killucan it represents only 7.3% of heating fuel source in homes. Wood is quite widely used as a main heating fuel: in 6.5% of all SEC homes. There is Natural Gas recorded as being used in Killucan but only in 3.4% of homes. There is no

[19] We exclude the CSO categories Not Stated or Other as it is not possible to determine their energy type, cost, etc.

mains gas available in the area. It is likely that this is a misclassification and the homeowners intended to state bottled gas in the CSO.

The census was conducted in 2022. Since then, the retail sale of turf has been banned[20]. This is likely to mean that some residents have since switched to smokeless coal or kiln dried wood. Only those with access to small scale turf cutting will stay with the fuel. We discuss the inefficiency of open fires as a heat source below in Section 5.1.6.

Home Heating oil is quite carbon intensive and thus the recommendations in Section **Error! Reference source not found.** on reducing carbon emissions from the home will f ocus 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 in Section 5.1.6.

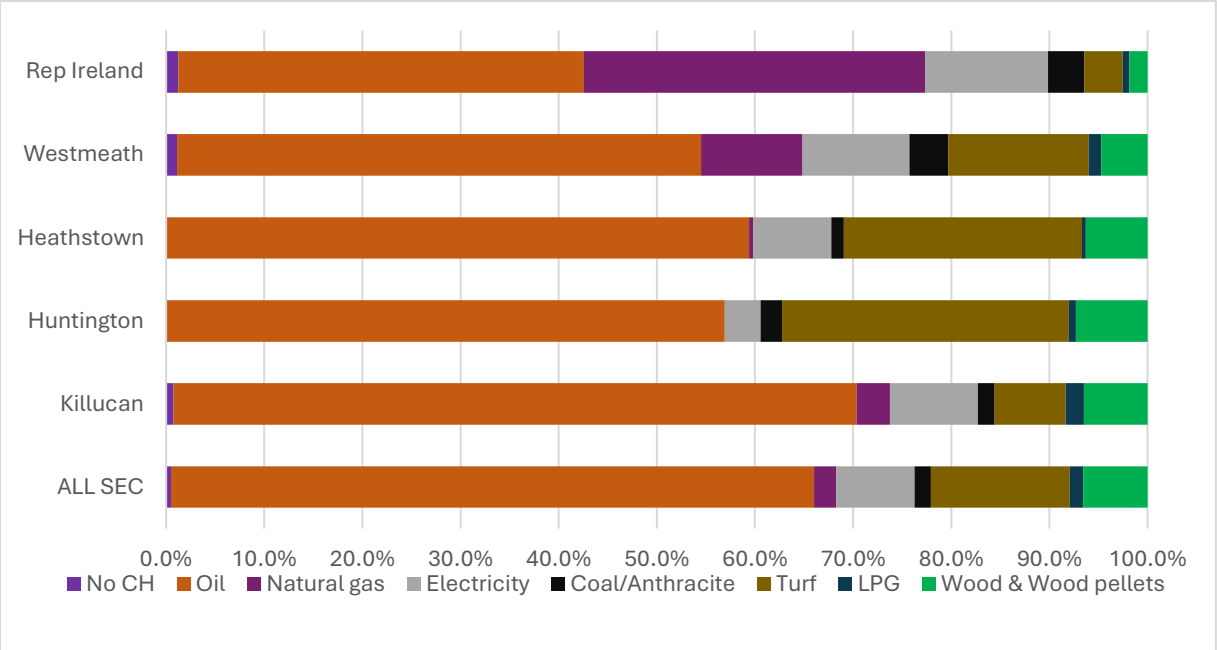


Figure 9 Home heating by fuel type, EDs, SEC, Westmeath, and Rep. Ireland

5.1.4 Total Energy Use in the domestic sector

Error! Reference source not found. below shows the energy use in the SEC for home h eating. As we discussed in Section 5.1.3 above, heating oil dominates the energy use in the home requiring more than 15,910 MWh of energy. For reference this is

[20] https://assets.gov.ie/231777/5deaeb40-64c2-42cc-84fe-49eb5d0e0592.pdf

approximately 1,500,000 litres of fuel. Bottled and Bulk delivered LPG amounts to 2,144 MWh. 3,207 MW of electricity are used for space and water heating.

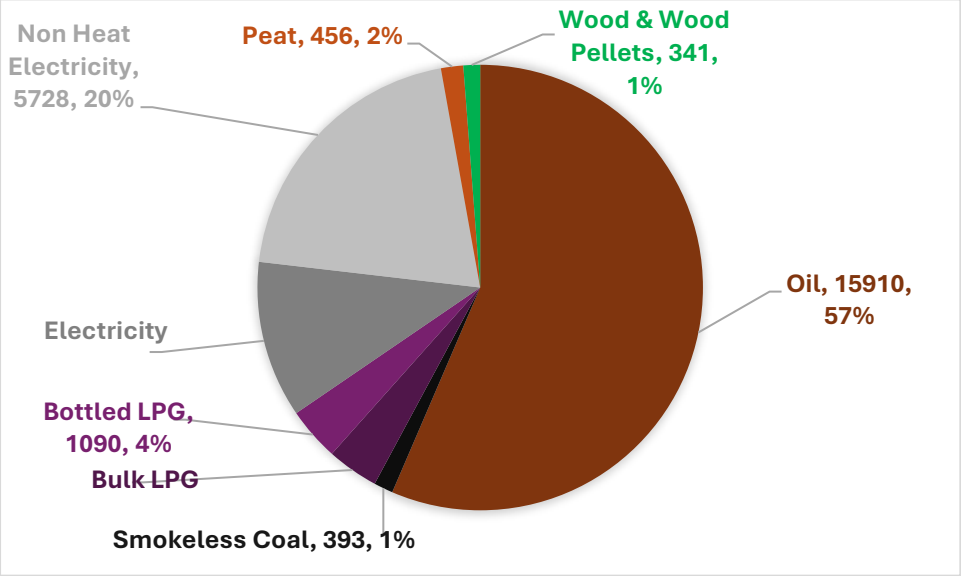


Figure 10: Total Energy use in SEC for Home Heating and Appliances MWh

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.

5.1.5 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[21].

We found (see Figure 11) that domestic energy use in the homes of the SEC area as a whole is responsible for the emission of **7,765** 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 554,642 10-year-old pine trees over a year.[22]

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

[22] 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

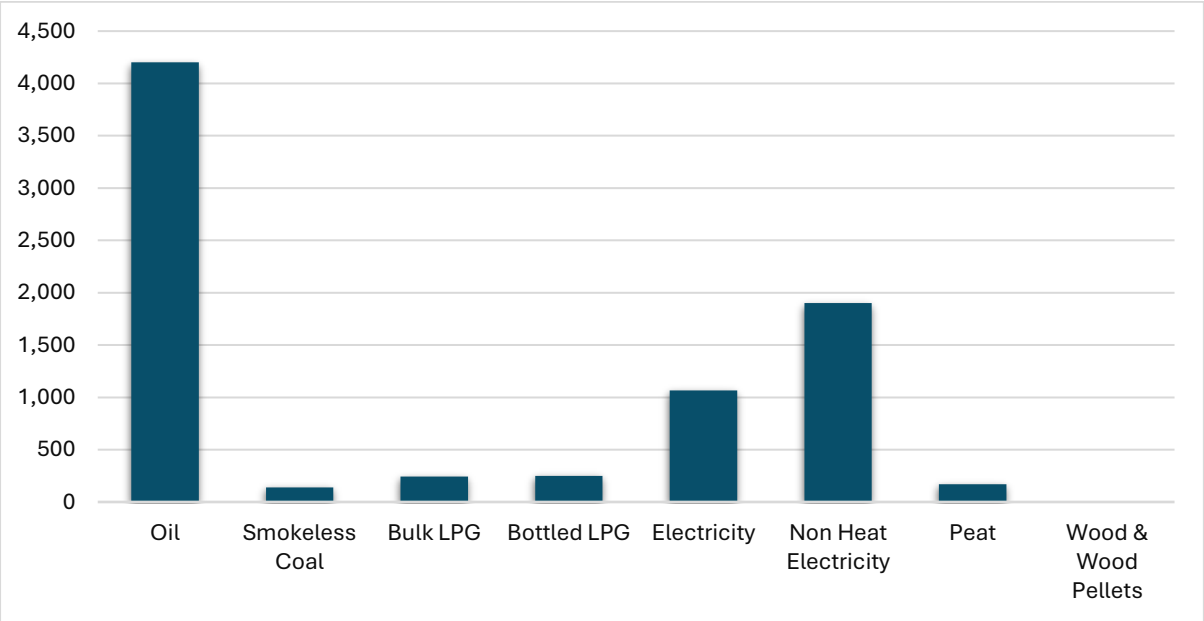


Figure 11: Annual Emissions from home energy use in SEC area in tonnes CO2 per year by fuel[23]

As the recommended spacing for mature spruce 950 trees is per hectare[24], the area required for planting to offset this level of domestic CO2 emissions would be 5km^2.

Between peat and coal there are However, a strong sustainability measure that residents of the SEC could take straight away would be to replace coal and peat with locally sourced dried timber. There are woodlands in the area which could be a source of low carbon fuel where the plantations are sustainably managed. Measures such as firewood from thinnings and replacing felled mature trees with mixed spruce and broadleaf planting would have sustainability benefits. There is also the option for willow coppicing that would have relatively medium-term benefits in local employment, profit, and carbon emission reduction. These will be discussed as a carbon reduction opportunity in Section **Error! Reference source not found.**

5.1.6 Energy Use Cost

The SEC is estimated to spend[25] a total of €5,025,414 annually on home energy use. This would amount to €4723.13 in total per household. This is much more than the typical energy bill quoted elsewhere owing to a number of factors. The BER energy

23 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.

24 https://www.teagasc.ie/news--events/daily/forestry/guidelines-for-the-management-of-productive-sitka-spruce-crops.php

25 For a list of energy cost assumptions, we used the SEAI's quarterly survey of domestic fuel costs. https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf [accessed September 2024]

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 **Error! Reference source not found.**). The t ypical 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)[26]. Natural Gas connections to the mains are not available in the SEC area. Therefore, more expensive and or less efficient heating fuels are used.

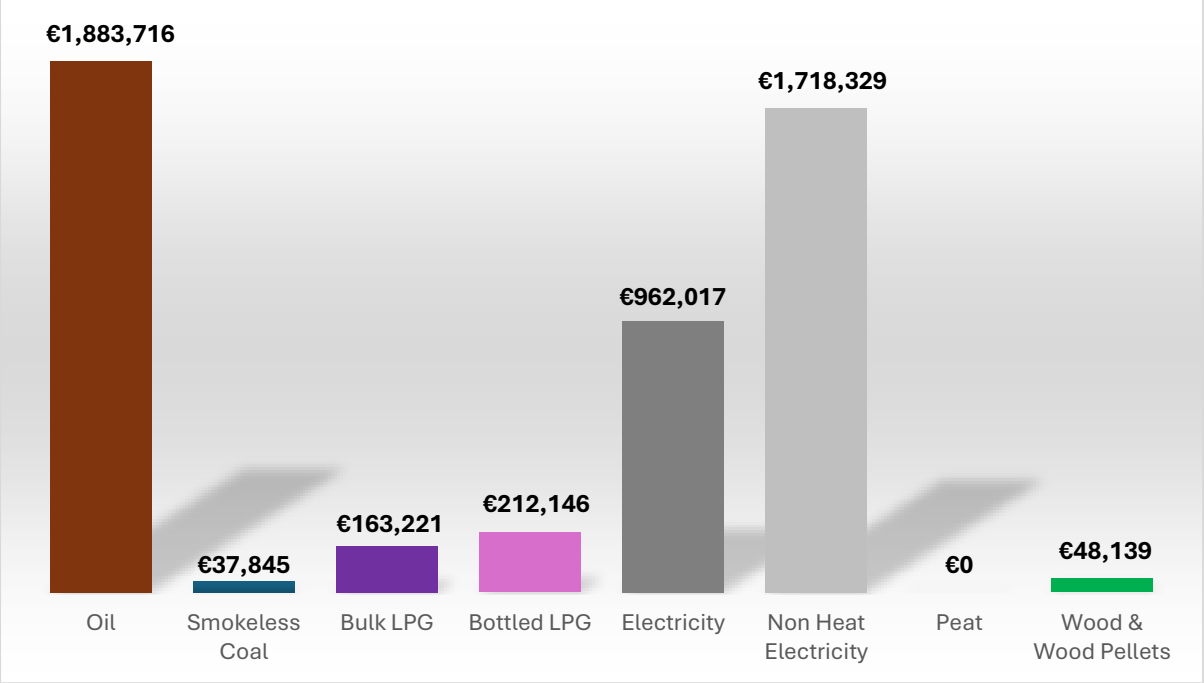


Figure 12: SEC in the Home Energy Costs by fuel type

We give a cost of €0.00 for peat – this is because by law it cannot sold retail. We assume that the homeowner has turbary rights and harvests the peat him/herself.

5.1.7 Energy in travel

There is a wide range of methods of public travel available in the SEC area. It is serviced by the 190 Bus Éireann bus which goes through The Downs and Killucan linking the SEC with the train station in Mullingar which is 15km from Killucan and 7km from The Downs. There is an intercity bus (Route 115) from Mullingar to Dublin with a stop in Corralstown. These resources will have an influence on the adoption of carbon reducing opportunities addressed in Section **Error! Reference source not found.**.

[26] ibid

In this section we look at the domestic travel related energy – namely walking, cycling and cars, but more specifically cars which have a measurable energy content, cost, and carbon emissions footprint. Walking and Cycling produce no emissions and are largely free.

CSO data indicates that there are 1771 cars in the SEC area. This is 1.6 cars per household. We calculate (Table 4) from CSO 2022 and geographical data that there is a lower density of private cars per km^2 in the SEC (32/km^2) as in Westmeath County (26/km^2) but the slightly less than the density of cars as exist for the State as a whole (35/km^2).

Table 4: Car Densities Compared

Area	Area km2	Number of Cars	Cars per km2
SEC	54	1,771	32
Westmeath County	1,840	47,347	26
Republic of Ireland	70,273	2,437,825	35

While it was not feasible to conduct a vehicle census for the SEC, we can extrapolate the number and type of car fuel types in the SEC based on county level data for Westmeath[27] which shows that 25.9% of cars in Westmeath are petrol, 68.4% are diesel and 5.7% are 'other' which we assume as EV or Biodiesel[28]. Table 5 shows this broken down into Electoral Division

Table 5: Car by Fuel Type per ED

Fuel	Killucan	Huntington	Heathstown	SEC
Petrol	275	68	116	459
Diesel	725	180	306	1,211
Other	61	15	26	101
Total	1060	264	447	1771

Diesel engines are favoured for their perceived efficiency over distances, and CSO National Transport Omnibus figures for 2022 indicate that Westmeath diesel car drivers drive an average of 19,808 km/yr which is 38% further per year than petrol car drivers at

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

[28] In the Rep of Ireland in 2023, 19% of new cars were EVs – 16.5% in Westmeath.

an average of 12,225 km/yr and 32% further than drivers of 'other fuel' cars which travel an average of 13,487km/yr.[29]

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.

29 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

	Killucan	Huntington	Heathstown	SEC
Petrol	3,360,279	836,900	1,417,023	5,614,202
Diesel	14,353,192	3,574,757	6,052,714	23,980,663
Petrol L	184,815	46,029	77,936	308,781
Diesel L	502,362	125,117	211,845	839,323
Petrol kg CO2 emissions	427,108	106,374	180,111	713,593
Diesel kg CO2 emissions	1,347,836	335,688	568,380	2,251,904
Total kg CO2 emissions	1,774,945	442,062	748,491	2,965,497
Cost €	€1,168,201	€290,948	€492,628	€1,951,777
MWh[30]				

Private car related emissions in the SEC are estimated at 2,966 tonnes CO2/yr. This would need 211,821 trees to offset this amount of CO2 over the year.

5.1.8 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 €5,637,018 on 40,291 MWh of energy per annum. This generates 10,933 tonnes of CO2 in emissions: needing 780,928 trees to offset.

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

ED	Domestic Sector Home Energy MWh	Domestic Sector Transport MWh	Domestic Sector Emissions t CO2	Domestic Sector Costs €
SEC AREA	**28,178**	**12,113**	**10,933**	**€5,637,018**

[30] 1L petrol contains 9.6kWh, 1L diesel contains 10.9kWh (https://assets.publishing.service.gov.uk/media/5a7987cee5274a684690a3ff/7309-cca-draft-technical-guidance-app-b.xls) however, petrol and diesel engines are usually only 20% efficient, diesel approximately 30%. We will look at kms travelled per vehicle when assessing the energy requirement of switching from fossil fuel powered cars to EVs in the opportunities section.

In terms of emissions the SEC has a mean of 10.11 tCO2 per household for home and car transport use.

5.1.9 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 13.

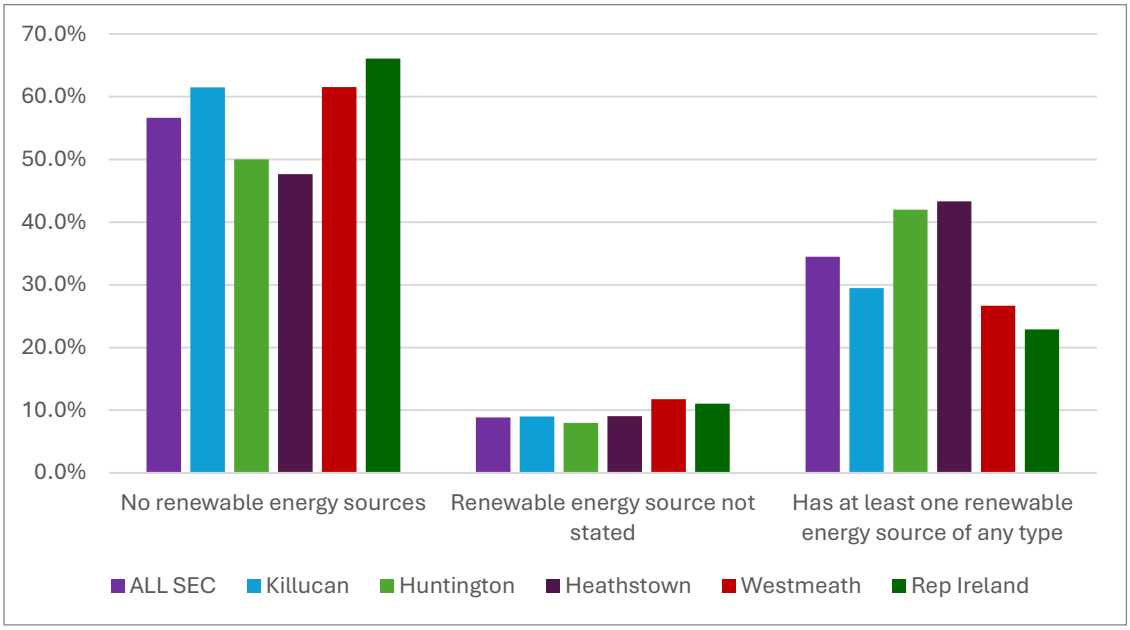


Figure 13: Renewable Energy Installed in the Home by ED, and Co. Westmeath

Huntington and Heathstown have higher levels of Renewable Energy installed in the home than Westmeath as a whole: nearly 43% of homes in Heathstown and 42% in Huntington have some renewable energy installed. The larger roof areas that are to be found in these two more rural EDs can be assumed to make rooftop renewable energy generation more feasible. It should however be borne in mind that even for Killucan, 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 **Error! Reference source not found.**

5.1.10 Sustainability of Domestic Energy Sector

The carbon offset footprint of household energy emissions in the SEC area would require an area of 822 hectares (8.22 km^2) of tree planting. The SEC is 54 km^2 in area. Therefore, the area required for planting is 15% the area of the SEC. This is not feasible as the area's economy is reliant on agriculture (discussed below Section 5.2.5) and thus land availability.

The breakdown of fuel types is shown in Figure 14 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, in particular Home Heating Oil and Diesel.

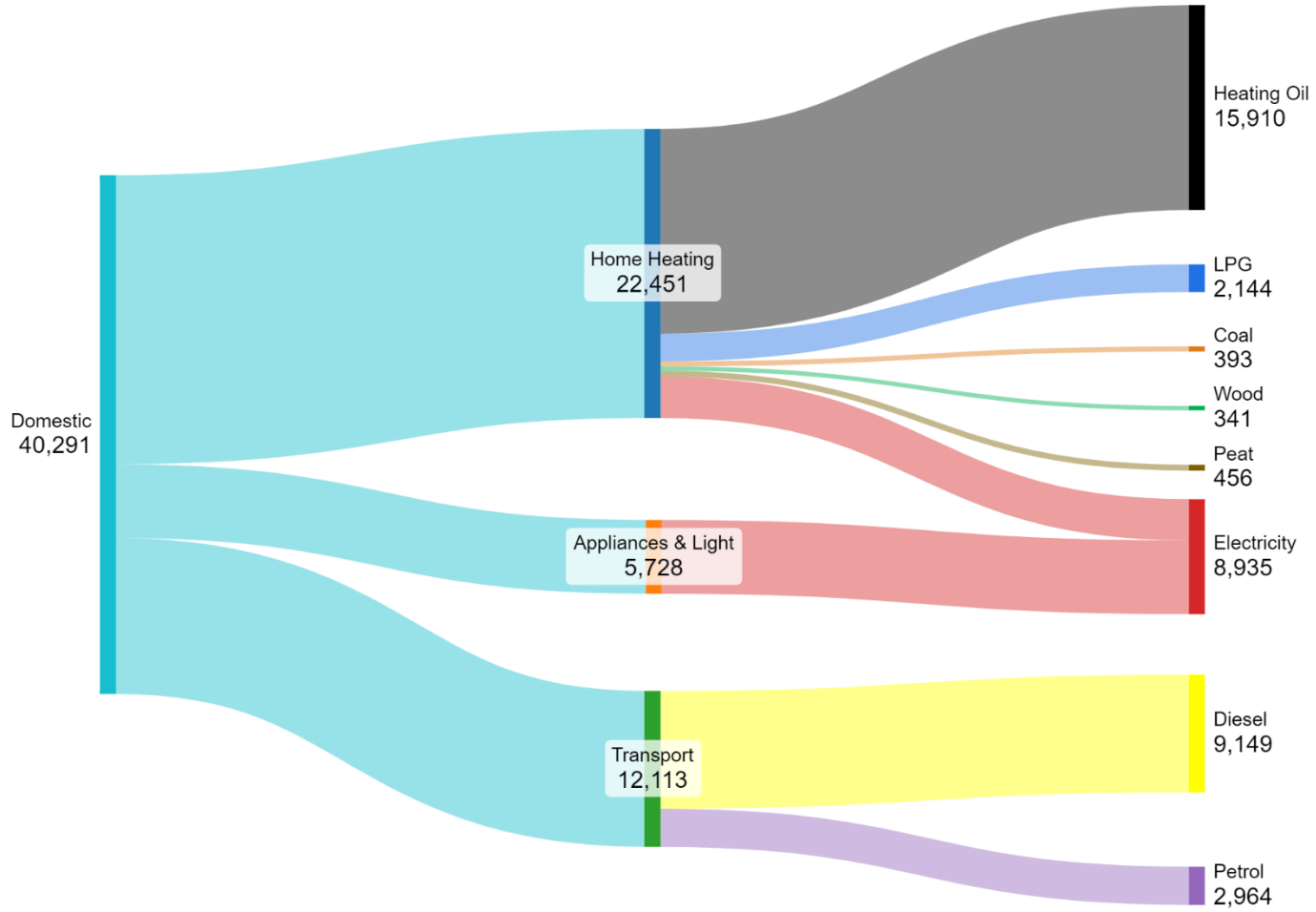


Figure 14: Sankey Graph of Domestic Energy Use in MWh/yr by Fuel Type[31]

[31] Sankey Graphs were built using Sankeymatic

5.2 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.

5.2.1 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. We also conducted an onsite visual survey to record the business and other non-domestic buildings in the SEC and cross-referenced this with Geodata. The survey results were also validated with inputs from members of the SEC. We established through mapping software an estimate of the areas of the non-domestic buildings in the SEC area.

Table 8: Businesses in SEC area by CSO type

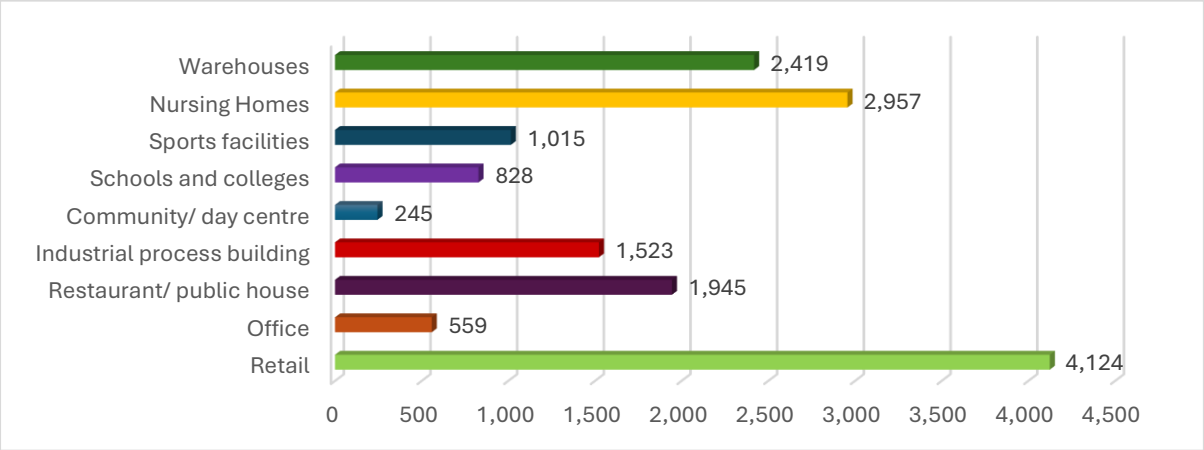
CSO Class	Number in SEC area	m2
Retail	16	4,323
Office	4	901
Restaurant/ public house	9	2,011
Industrial process building	2	2,530
Community/ day centre	2	557
Schools and colleges	5	6,785
Sports facilities	4	1,521
Nursing Homes	2	5,665
Warehouses	2	4,413
Total	46	28,707

5.2.2 Energy Use

The CSO publishes data on building energy use per m^2 for each class of business by county. Combining this with our measured areas of the non-domestic buildings enabled us to estimate the overall energy use for the SEC area's businesses.

There are an estimated 28,707 MWh of energy used in business premises in the SEC area (i.e., this excludes transport and agriculture which are discussed below).

Table 9: Energy Use in Business buildings in SEC area in MWh (excludes agriculture)



As we can see the retail sector is the largest non-agricultural energy user[32] in the non-domestic sector with 4,124MWh/yr (26% of the total). This could be explained by the presence of two large retail outlets in the SEC area. Similarly, there are two large nursing homes in the area which account for an estimated 2,957 MWh/yr of energy use or 19% of the total. We will discuss this energy use as a target for achieving energy reductions in the opportunities sections.

5.2.3 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[33] across the categories above SEAI data on fuel types for each category[34] we can calculate this varying fuel source type across the categories of businesses in the SEC area.

[32] Agriculture energy use is discussed in Section 5.2.5

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

[34] https://www.seai.ie/data-and-insights/seai-statistics/energy-data/ Final Energy Tab (accessed 20.03.2024)

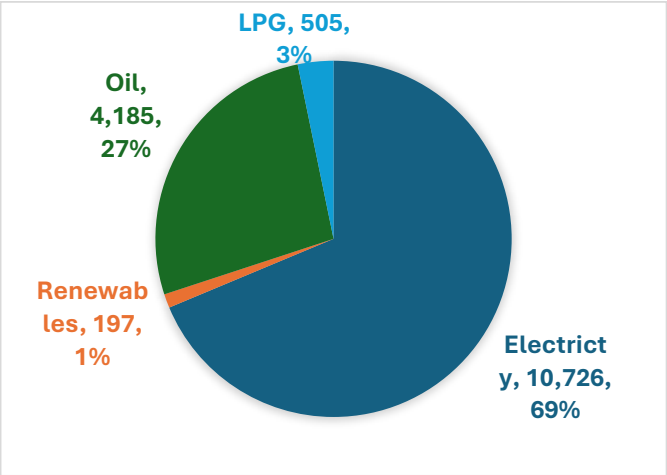


Figure 15: Non-Domestic Buildings Energy Use by Fuel MWh

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

Fuel	MWh/yr	tCO2
Electricity	10,726	3,561
Gas (LPG)	505	116
Oil	4,185	1,105
Renewables	197	0
Total	**15,613**	**4,782**

The contrast between non-Domestic energy use (*not in travel*) shown in Figure 15 and that of domestic use is very clear in the greater use of electricity as a power source in the non-Domestic context. Section 5.1.3 above showed that oil provided 56% of the domestic energy demand and that electricity accounted for 31%. In the non-domestic sector, 69% of the energy demand is met by electricity. In the retail and office sectors, appliances and lighting require large amounts of electrical power. The relatively high electrical demand in the non-domestic sector will call for specific measures to be addressed in the Register of Opportunities specific to the commercial and community sector in Section **Error! Reference source not found.** below.

In terms of emissions, the total for the non-Domestic sector (excluding transport) is 4,782 tonnes of CO2. This is a significant amount of CO2 emissions will be addressed in tandem with that of the domestic sector.

5.2.4 Energy in non-domestic transport

5.2.4.1 HGVs, PSVs, Tractors and Machines

From a combination of CSO census and transport omnibus data (2019, i.e., pre-covid period), we devised a model to 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: Estimated Non-Domestic Transport Fuel Use (excluding buses)[35]

	Goods vehicles	Tractors and machinery	Small PSVs[36]	All Transport
SEC	276	76	9	361
Average km	[Note]	16,782	42,742	-
Total km	6,097,661	1,276,489	386,794	7,760,944
L/100km	-	32.6	12	-
Total Liters	962,081	416,135	46,415	1,424,631
Total MWh	10,294	4,453	497	15,244
Total tCO2	2,578	1,115	124	3,818

[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) and for light duty commercial vehicles (less than 4 tonnes). We estimate that **as of today today 51.5% of the calculated emissions for 2019 in the SEC's commercial transport sector are open to electrification**. This does leave 1,851.7 tCO2 of emissions not immediately and seamlessly open to electrification. We will discuss this in the Register of Opportunities in Section 5.2.4.1.

5.2.5 Agriculture

The agriculture in the SEC is almost exclusively grassland[37]. There are a total of 3,168 hectares of grassland farmed in the SEC. The majority of this is for cattle (86%), with some sheep grazing in Heathstown (20% 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 21,854 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. We will propose some **energy related actions** that farmers in the SEC could take to help reduce the CO2 emissions from their industry.[38]

[35] See Appendix Section **Error! Reference source not found. Error! Reference source not found.** for calculations.
[36] Taxis and minibuses
[37] There were 130 ha of arable planted land in Huntington in 2020 (https://visual.cso.ie/?body=entity/ima/coa&boundary=C03904V04656&guid=2AE196291BDE13A3E055000000000001)
[38] We offer no opinions in this report in relation to stock numbers, types or other crops.

Table 12: Agriculture related CO2 emissions in SEC

	KILLUCAN	HUNTINGTON	HEATHSTOWN	SEC
Total Hectares	1,039.9	1,115.7	1,048.8	3,204
Hectares Cattle	981.3	957.3	1,030.2	2,969
Hectares Sheep	0.0	0.0	200.0	200
CO2/ha Cattle [Note]	7.1	7.1	7.1	7.1
CO2/ha Sheep [Note]	4.1	4.1	4.1	4.1
t CO2 Cattle	6,952.5	6,782.5	7,299.0	21,034
t CO2 Sheep	0.0	0.0	820.0	820.0
Total t CO2	**6,952.5**	**6,782.5**	**8,119.0**	**21,854**

[Note] The CSO does not publish data differentiating between dairy cattle (9.52 tCO2e/ha/yr) [39] and other cattle (4.65 tCO2e/ha/yr[40]) for confidentiality reasons. Therefore, we take the mean value for emissions per hectare for all cattle of 7.1 tCO2 per ha

5.2.6 Total Energy Use Non-Domestic Sector SEC Area

We can now state the estimated non-domestic energy use for the SEC area. This is 29,860 MWh energy per year (Figure 16). This reflects an energy consumption of 9.22 MWh per person per year (MWh/pp/yr) for the SEC area. This is 31% below to the national average of 15.6 MWh/pp/yr[41].

The electricity use by the non-domestic sector has both sustainability and economic implications for the SEC. 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. This will have significant sustainability benefits as currently our electricity production is carbon intensive (.331g CO2/kWh)

As regards diesel in transport, goods vehicles less than 5 tonnes and Public Service Vehicles (taxis and minicabs) account for 7,343 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 4,823 MWh are not currently served by either BEVs or Fuel Cell Electric Vehicles (FCEVs). There is no one-to-one

[39] https://www.teagasc.ie/media/website/publications/2022/2021-Sustainability-Report.pdf p26
[40] Ibid p35
[41] See Appendix **Error! Reference source not found.**

replacement for diesel in these applications that are cost equivalent. This is discussed further below in Section **Error! Reference source not found.**

Gas and oil represent 12% of the non-domestic energy mix. It will be difficult at the current state of technologies to replace the gas used in either industrial or food preparation 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.

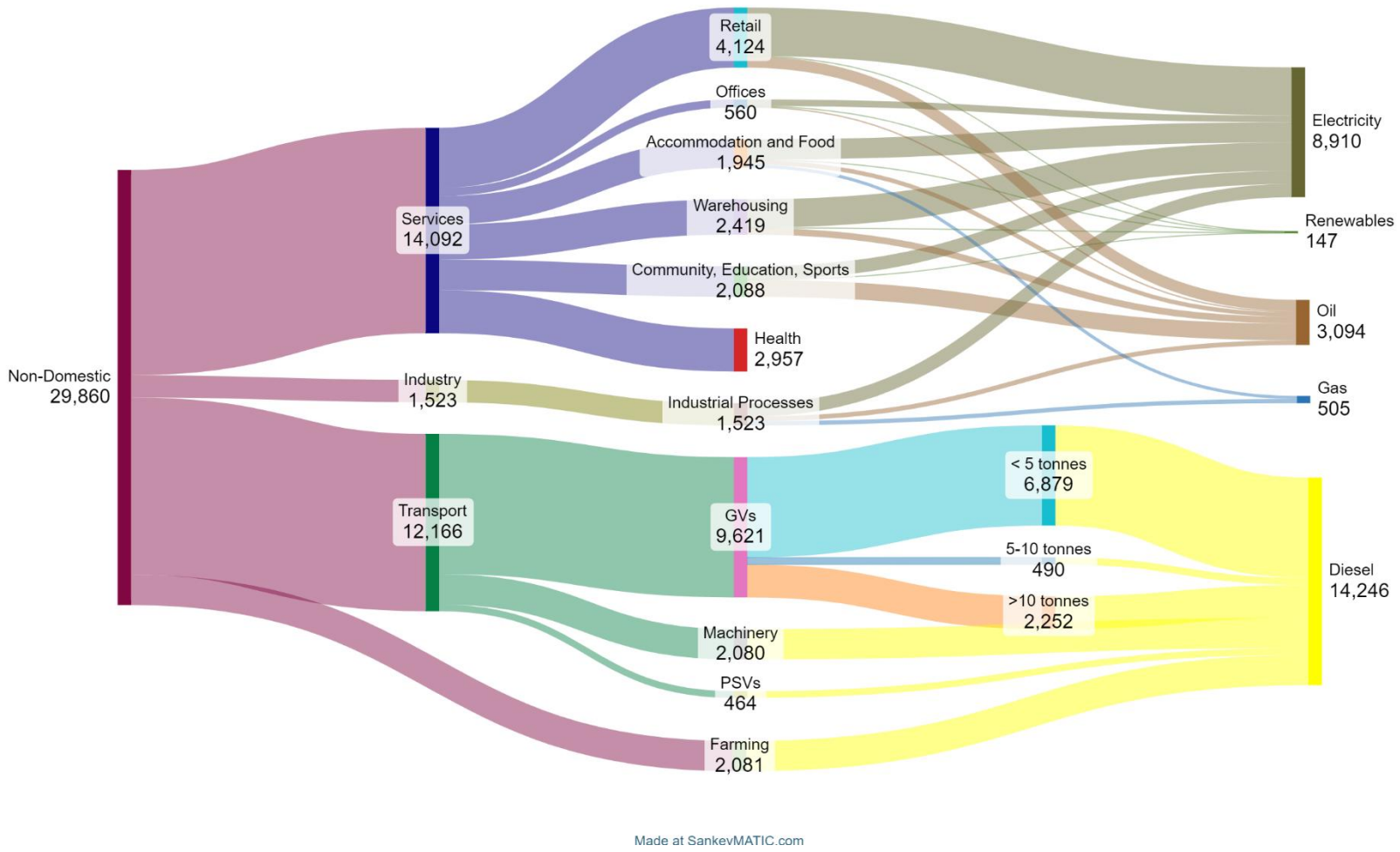


Figure 16: Sankey Graph of Non-Domestic Fuel Use by Sector

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 **Error! Reference source not found.**

5.2.6.1 Non-Domestic Carbon Emissions

As we can see from Figure 17 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 **Error! Reference source not found.**.

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.

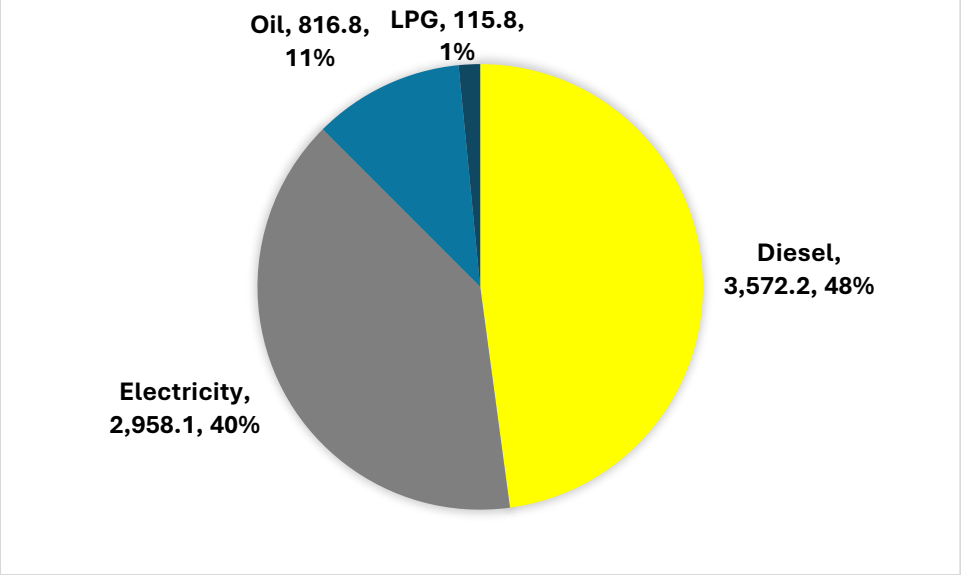


Figure 17: Non-Domestic Energy CO2 Emissions in tonnes CO2

In terms of non-domestic CO2 emissions, diesel at 48% represents the largest source with electricity at 40%. The emissions from both of these can be greatly reduced with readily available cost-effective technology changes and adoption. We discuss these as sustainability opportunities below.

5.3 Aggregated Energy Use by Energy Source

Across all sectors Figure 18 shows that Diesel is the greatest energy source with 33%. This is concentrated in the smaller vehicles sector. We will discuss where this diesel use could be reduced in the opportunities section below. Electricity is the greatest energy source (28%). 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.

The Downs Sustainable Energy Community

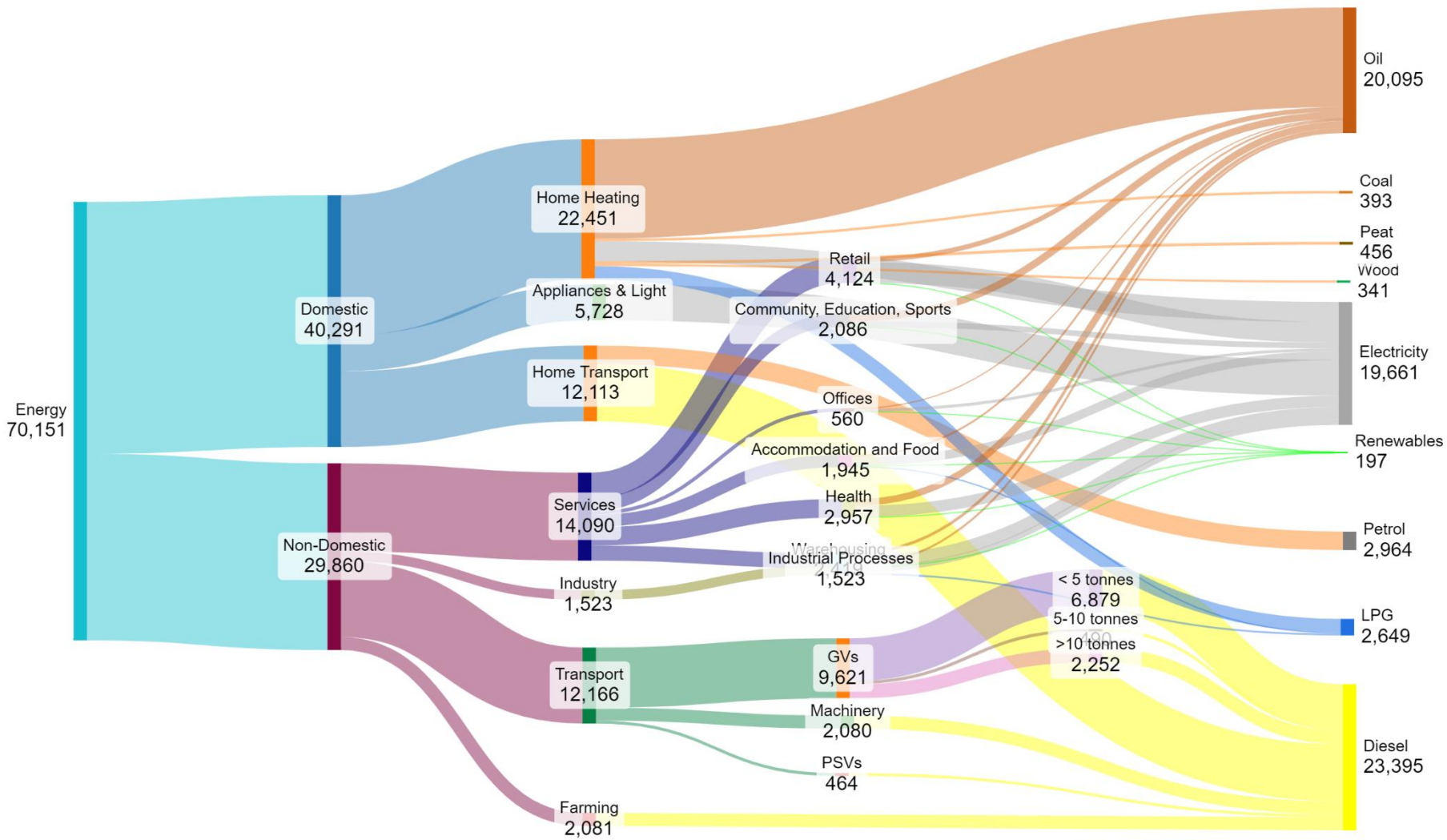


Figure 18: Sankey Graph Showing Breakdown of Fuels Across All Sectors

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[42].

With great advances made in photovoltaic (PV) technology, government policy, and system economics[43], there are currently opportunities to produce renewable electricity at the local SEC level. The opportunity for distributed micro-scale PV in the home and small business is well suited to the SECs building stock. Generally greater roof-space than the national average, building ownership patterns are favourable for domestic PV, but 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 **Error! Reference s ource not found.** and **Error! Reference source not found.**

The economic cost of small-scale PV needs a relatively high up-front capital spend. Though this is more than paid back over the life of the installation giving a very favourable Return on Investment (ROI). However, this up-front cost 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 Downs SEC. A 'Solar Meitheal' concept where neighbours come together in a group project is now well tried-and-tested, and the details of the process can be seen here: Solar Meitheal.

Heating oil in the SEC is also significant and represents 29% 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 (33% of the total) in the SEC that we see in Figure 18 is from domestic vehicles, 51.7% of diesel use, and goods vehicles less than 5 tonnes, at 29.4%. It will be quite feasible to decarbonise the domestic portion with a switch towards battery electric vehicles. Advances in efficiency, cost reduction and most of all

[42] Carbon intensity will reduce over time. Cost will probably reduce in the medium term: https://www.euractiv.com/section/energy-environment/opinion/european-utilities-under-power-price-pressure-from-2026/

[43] These are discussed throughout the document below.

range, have been made to make this a firmly feasible option. Increased public transport use as facilities improve as directed by government policy use[44] 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 5 tonne weight are on the market and so with supports and in the right conditions, the 29.4% 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[45]. This portion of the overall diesel use (27.8%) and the energy use of the SEC as a whole (9.2%) 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 overall energy use (4.2%). It can be readily reduced using EVs. While the carbon intensity of grid electricity at 330.4g CO2/kWh as noted above is higher than that of petrol at 251.9g CO2/kWh, Internal Combustion Engines (ICEs) have an average efficiency of only 30%. This means that a petrol engine produces 831.27g CO2 per kWh delivered. The petrol vehicle also produces this CO2 and other particulate pollution at roadside level where other road users are put at health risk. The recommendations in Section **Error! R eference source not found.** 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 (1.2%). 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.

[44] 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

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

5.4 Carbon emissions

The domestic sector accounts for more of the emissions of the SEC (56.6%) than the domestic sector (43.4%). There is a relatively even split between oil (27%), electricity (33%) and diesel (31%) as the main sources of CO2 emissions. the Most of this comes from the electricity that is used (74.3% of all electricity).

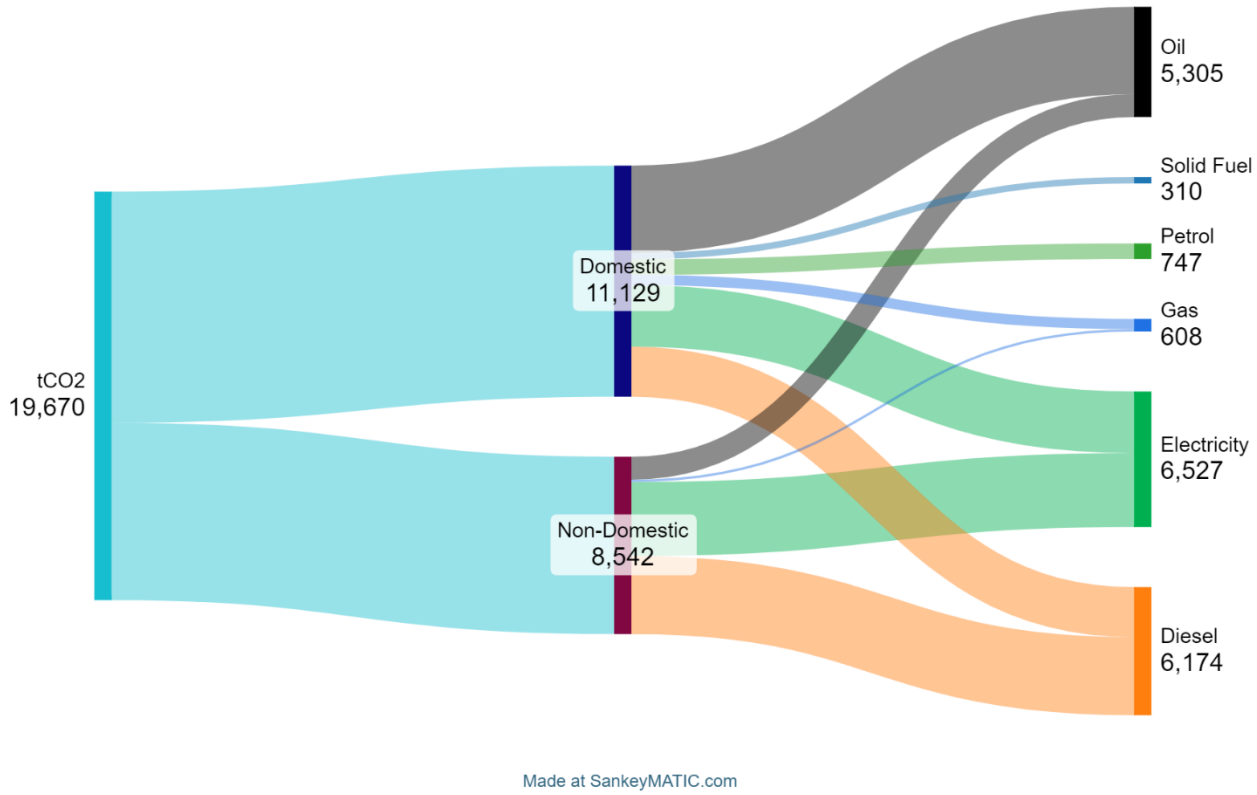


Figure 19: Total SEC CO2 Emissions by Sector t CO2

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.

5.5 Energy Costs The Downs SEC

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 20)

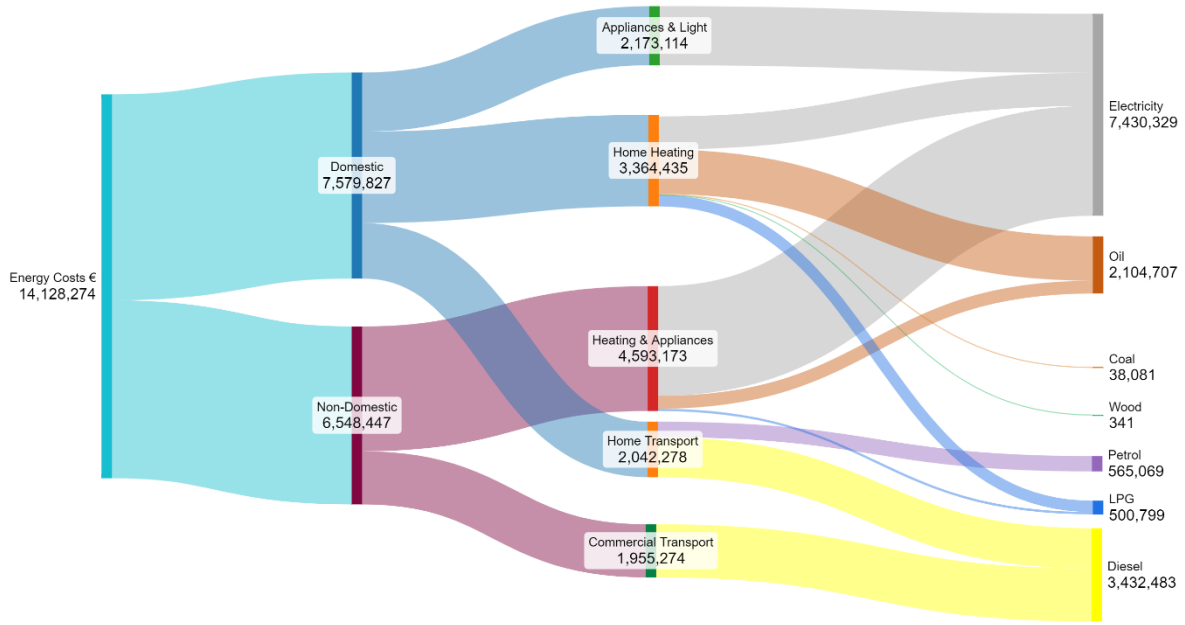


Figure 20: SEC Energy Costs by Sector €

The energy source spend is heavily weighted towards non-transport use (71.7% of total). Transport in the home and by business are 14.5% and 13.8% - this should direct the majority of our recommendations to **building energy use** to achieve the greatest impacts in reducing costs for the SEC as a whole.

Heating oil, which is a very avoidable cost when the correct building efficiency measures are taken, cost the SEC an estimated €2.1m. Most of this (79.2%) 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 **Error! Reference s ource not found.** on reducing this cost.

Electricity amounts to a spend across the SEC of €7.4m. We discuss in our Registry of Opportunities Section below how this considerable cost for both domestic and non-domestic users could be reduced.