Durrow Sustainable Energy Community Co. Laois

Energy Master Plan

August 2023

Photo Credit for Durrow aerial photo Andy Walsh http://noalphabet.com/

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Table of contents

List of Tables

Table of Figures

1. Introduction

1.1. Durrow SEC

Durrow SEC is a community group set up in 2021. It is comprised of local volunteers with an interest on the topic of sustainability in their local community.

Their vision in the Durrow SEC is to develop an energy responsible community that contributes to a healthy environment in tandem with a sustainable community.

They will do this by decreasing their energy usage in public buildings while promoting better energy choices through local engagement and awareness with businesses and homeowners. They plan to work together to become a leader for other rural areas who wish to reduce their energy usage and utilise renewable energy supply where feasible.

They will work together with a wide range of local representatives and share knowledge and resources so all in the community benefit.

An immediate goal is to reduce energy usage within the SEC by 3% per year for three years, alongside a plan toward a 50% reduction in carbon emissions and 50% increase in energy efficiency by 2030.

Objectives along the way include:

- Increase energy awareness in the community.
- Accessing and maintaining energy records for local public buildings.
- Engaging with local homeowners, businesses, schools, clubs etc to promote energy awareness.
- Providing access routes to funding support to assist in achieving energy efficiency and carbon reduction targets.

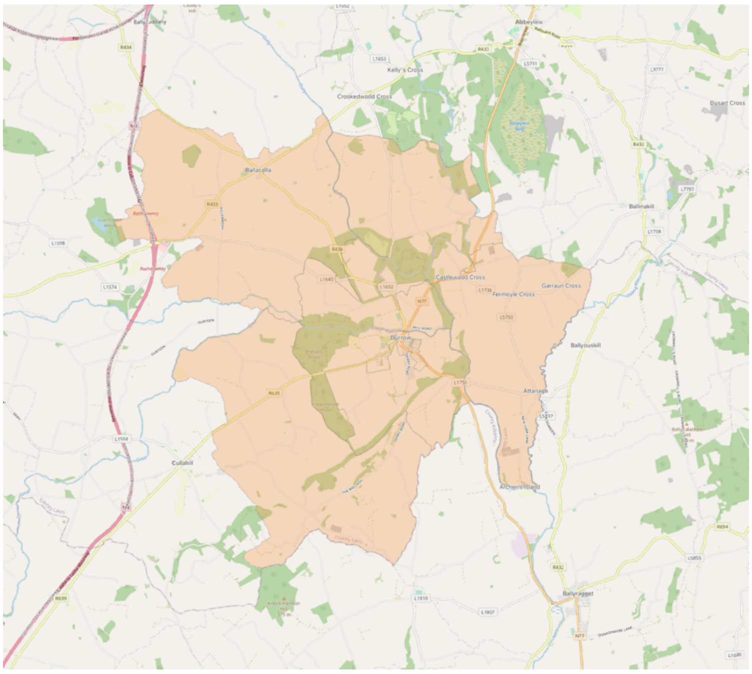

Figure 1 – Durrow EMP study area

The Durrow SEC geographical area is as shown within Fig1 above and this represents the Durrow EMP study area. Within this area the analysis of the key points of the Central Statistics Office (CSO) data using the available census data from 2016 shows:

- 2,251 people (605 families)
    - 52% aged between 25 and 65
    - 57% in paid employment
- 934 homes
    - 46% owned outright
    - 59% built prior to 1990
    - 24% built 2001-2010
- 1247 cars
    - 90% of residents have 1 or 2 cars
- 88% of residential energy from fossil fuels
    - Oil, Turf, Coal
    - The remaining 12% use possibly electric heat pumps of wood.
- €3.4 million annual energy spend

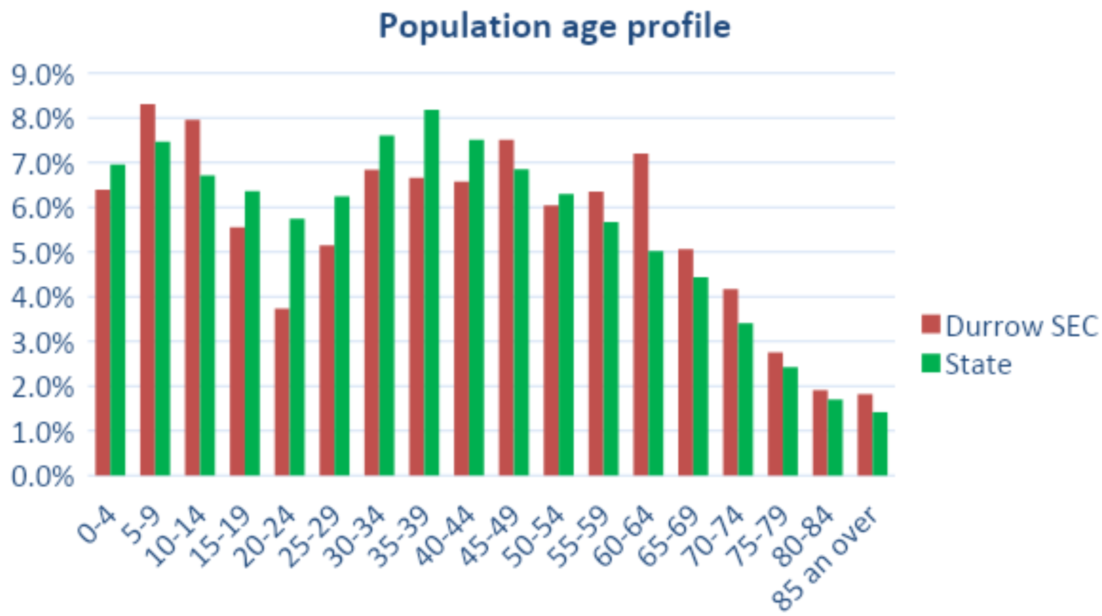

Figure 2 – Durrow SEC Population Age Profile

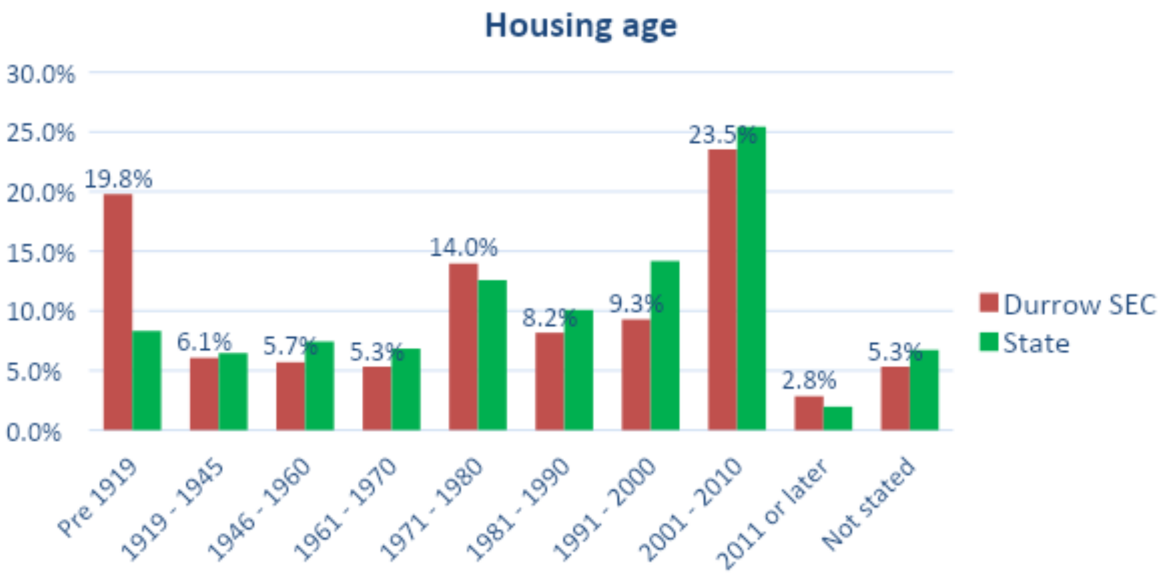

Figure 3 Age Profile of Housing Stock

1.2. Durrow Energy Masterplan

The aim of this Energy Master Plan is to enable Durrow SEC to understand its current and future energy needs in order for them to make informed decisions and prioritise actions.

This EMP will demonstrate opportunities to Durrow SEC such that their community can become more energy efficient and transition to renewable energy where possible.

The committee of Durrow SEC comprises individuals with connections across the local community.

This EMP was developed during January to July 2023 in collaboration with Climate 23 and the SEC Area Mentor.

This EMP provides an impetus for Laois County Council and the Durrow SEC to coordinate and collaborate on local climate action, and specifically sustainable energy.

Durrow's vision is

- *"To Inform the community and raise awareness on how to reduce energy usage & carbon emissions and access funding opportunities for a more sustainable future."*

It hopes to achieve this by developing a wider Community Interest and involvement in:

- Behavioural change/energy education
- Energy efficiency & financial savings for dwelling occupiers
- Sustainable/low carbon community
- Sustainable transport

1.3. Sustainable Energy Communities

SEAI have invested over €400 million in sustainable energy projects throughout the country through the Better Energy Communities programme (BEC). This has saved the Irish economy over €1 billion during that period. Therein lies an opportunity for Durrow SEC to avail of BEC funding and other grant aid in order to become self-sufficient and sustainable in all its activities.

According to the SEAI, in Ireland many communities are working together to become more sustainable in how they use energy. Changing the way energy is used has one of the biggest impacts for sustainability and the environment. When people act together this impact goes even further.

Energy bills can be reduced for homeowners and businesses in the community by doing local energy projects. This means more money is available to spend in the community in the longer term.

Quality of life, especially for the vulnerable in the community can be greatly improved and retrofitting homes and buildings means warmer, healthier homes and community buildings and less costly to run.

1.4. Climate 23

Climate 23 is a climate consultancy focused on community energy management. Bringing together experience in the community / voluntary sector with nationally recognised technical expertise in energy and carbon measurement.

2. Energy Master Plan (EMP)

2.1. Scope and outputs

There are no heavy industries located in the target area. The scope of the EMP therefore includes the following:

- Analysis of energy and related CO_2 emissions and costs within the residential sector including a high-level quantitative analysis using the SEAI Building Energy Rating data and CSO data for the area.
- Building Energy Rating (BER) analysis of selected and representative households
- BERWOW analysis of selected representative house types
- Energy assessments of relevant buildings / businesses within the target area
- Identifying potential for energy audits under the SEAI SSEA scheme
- Review of transport opportunities

The EMP references potential for local initiatives

- addressing energy poverty via the SEAI Warmer Homes scheme
- Local Authority rental properties

Summary of the EMP outputs include:

- Baseline of energy use
- Sustainable Energy Roadmap for each sector
- Register of Opportunities for each sector

2.2. Methodology

The key elements of the methodology employed are detailed in the table below. Specifically in the residential energy use study a top down analysis was completed using the Central Statistics Office (CSO) data on residential sectors and the SEAI Building Energy Rating (BER) data, to develop a residential energy use baseline for the area.

Table 1 Methodology for EMP development

Methodology		
Data and tools used	**SEC input**	**Consultant input**
CSO & BER data	Collation of data from CSO and SEAI source	Data analysis of BER/CSO data to model existing housing stock against new B rating targets Shallow and deep retrofit solutions identified and costed up together with energy CO2 and cost savings for the residential sector
Energy survey – non-residential local small business and community facilities	Outreach to local businesses for participation Identification/selection of facilities / buildings for audit Coordination with owners/managers	SME commercial sites to be assessed ROO Presented for each Energy audits

Data and tools used	SEC input	Consultant input
Home energy survey	Outreach to local community for participation Home Energy Consultation visits Identification/selection of key home types for audit Coordination with homeowners	BEW WOW Case studies of a sample of dwellings Analysis of results Cross reference to CSO/BER data Energy analysis & report Retrofit menu / ROO
Local development plans and zoning maps	Identification of relevant maps	Analysis for Renewable Energy project potential
ESBN Generation Capacity Maps Designated areas maps	Identification of potential Renewable Energy Generator sites	Analysis for Renewable Energy project potential
Any other relevant tools		**BER WOW used to model and present case studies.**

2.3. Approach used in this study

This report uses a top-down approach using SEAI Building Energy Rating (BER) data mined by the Sligo Institute of Technology (IT) Contracts Research Units (CRU), Central Statistics Office (CSO) 2016 census data, other data sources and tools such as the BERWOW-Home[1] online tool developed by BERWOW Ltd[2] . This tool was developed to guide homeowners through the options, costs and benefits from different retrofit home improvement decisions.

The shift towards decarbonisation in the residential sector will require a combination of awareness building, behavioural change, energy demand reduction measures through deep energy retrofits, and electrification of heating systems in dwellings using heat pump technology as the primary source.

An initial target BER of residential dwellings of B2 was set for the analysis with the option to consider deep retrofit as part of a drive towards Near Zero Energy Buildings (NZEb) being proposed by 2050.

BER analysis using the Dwelling Energy Assessment Procedure (DEAP) methodology and the BERWOW[3] platform on selected homes as part of the overall work commissioned the Durrow SEC was used to compile approximate costings for the upgrades.

[1] https://www.sseairtricity.com/ie/home/home-upgrade-calculator/ accessed through the SSE Airtricity website

[2] https://berwow.ie/#products

[3] https://berwow.ie/#products

3. SEC Baseline Analysis

This section provides a sectoral baseline of energy use. Figures are expressed in primary energy kWh, Tonnes of CO_2, and € as much as possible. CO_2 is the most important in terms of Climate objectives and Euro (€) are the most tangible for communities. The costs are estimated from the kWh figures using SEAI fuel cost comparison or similar.

The high-level analysis in the residential sector was undertaken using a combination of data from the CSO and from the SEAI small area maps BER data.

The high-level analysis of the non-residential sector was completed using two methodologies,

I. the CIBSE TM46: Energy Benchmarks to estimate energy consumption combined with floor area data estimated/calculated using Valuation Office data (https://opendata.valoff.ie/api/).
II. analysis of energy use based on the energy assessments undertaken.

The energy cost data used was taken from the most recent 2023 SEAI fuel cost comparison and also from analysis of energy use based on the energy assessments undertaken. The valuation office data provided a list of 152 commercial non-residential facilities.

A register of opportunities has been developed for the facilities. This is included in Section 5 Register of Opportunities.

3.1. Energy Audits

Direct energy audits are a valuable way to engage greater local participation in the EMP. They also provide a quick path to implementing energy upgrade projects.

The facilities were chosen in conjunction with the SEC Committee and represented a range of energy uses across the local area.

3.2. Analysis of Residential Sector

Summary of key challenges for the residential community:

- The analysis suggests that around 94% or over 850 out 902 dwellings may require some intervention to achieve the target B2 rating.
- Approximately 185 will be shallow retrofit for dwellings constructed in the last 15 years which will be a relatively modest outlay to bring it up to the standard.
- The analysis of the data indicates that almost 670 dwellings or over 70% were constructed after 1990's, before introduction of building regulations governing levels of insulation and so they will require substantial capital outlay under a deep retrofit even with the grant.
- There were 50 (A3) "A" rated dwellings identified in the analysis.
- 15% or 123 of the dwellings are rented from private landlords or the local authority. Older rented properties can be less energy efficient than owner occupied properties because of the "split incentive problem". A split incentive happens because landlords, who would have to

meet the cost of the improvements, do not reap the benefits of a warmer home and cheaper energy bills. Tenants, on the other hand, do not own the property and therefore have little incentive to invest.

- The predominant heating type is oil fired central heating at 71%

Table 1 (repeated later as table 18: Numbers of Homes requiring some form of intervention to get to a B2 or better.

No of Houses	Upgrade Measure
Attic Insulation	852
Heat Pump and heating controls	852
Walls pumped/drylined	850
Windows and doors	850
Ventilation and airtightness	794
Total Projects	4,198

3.2.1. Dwelling Types

There were 808 occupied dwellings on the night of the 2016 census including three mobile homes. The dwelling profile is dominated by house/ bungalow at 97% of units (86% nationally). Flats and bedsits account for a less than one percent. The latter is well below the national average where 12% of dwellings are in this category. The remaining 2% were bedsits, mobile homes or not stated.

3.2.2. Dwelling Tenure

80% of dwellings in the area are privately owned or owner occupied.

Private landlords account for over 9%, and local authority and housing association almost 6%. Occupancy for the remaining 5% is rent free or not stated.

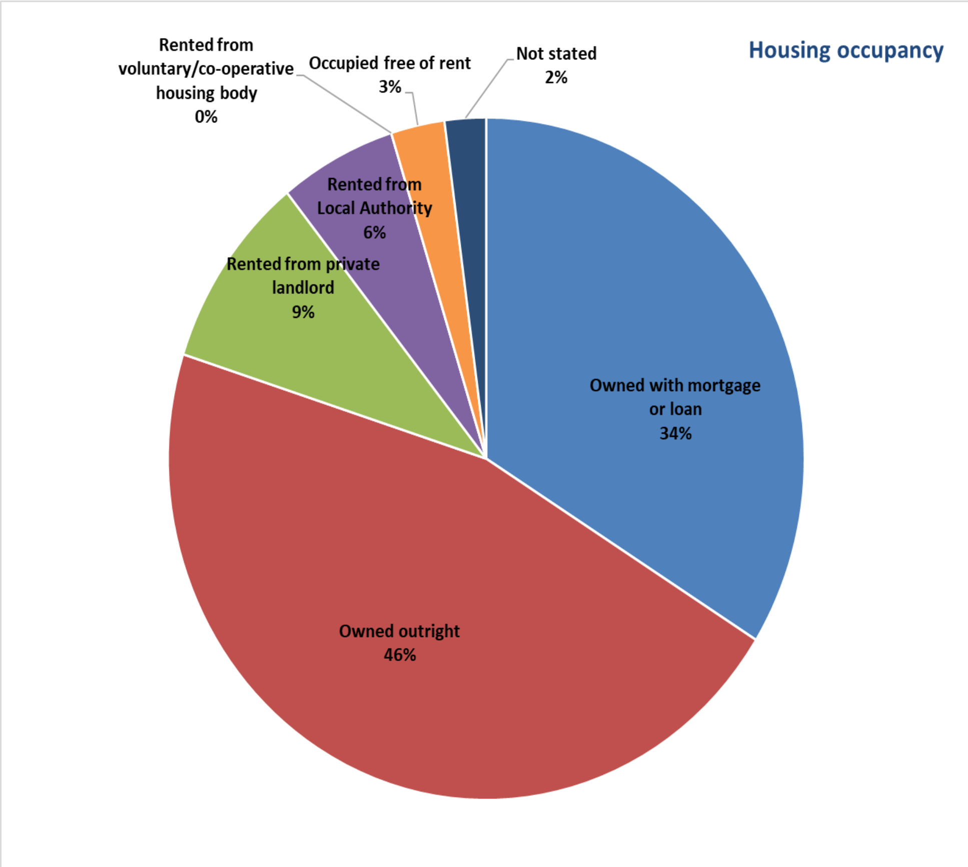

Figure 4: Dwelling Tenure

3.2.3. Energy Rating of Dwellings

The energy rating of dwellings in the Durrow SEC area were modelled using the BER small maps area data from the SEAI This profile or distribution of dwelling numbers by BER is detailed below in Figure 5. A BER is required when a dwelling is constructed or at the point of sale or rental:

- 20% of dwellings in the target area had BERs undertaken.
- Almost 50% of dwellings are in an E to G rating category.
- Less than 1% of dwellings are estimated to meet or surpass the target average B rating as outlined in the government's Climate Action Plan (CAP).
- The average rating across the whole portfolio is an E2 rating or 352kWh/m^2/year

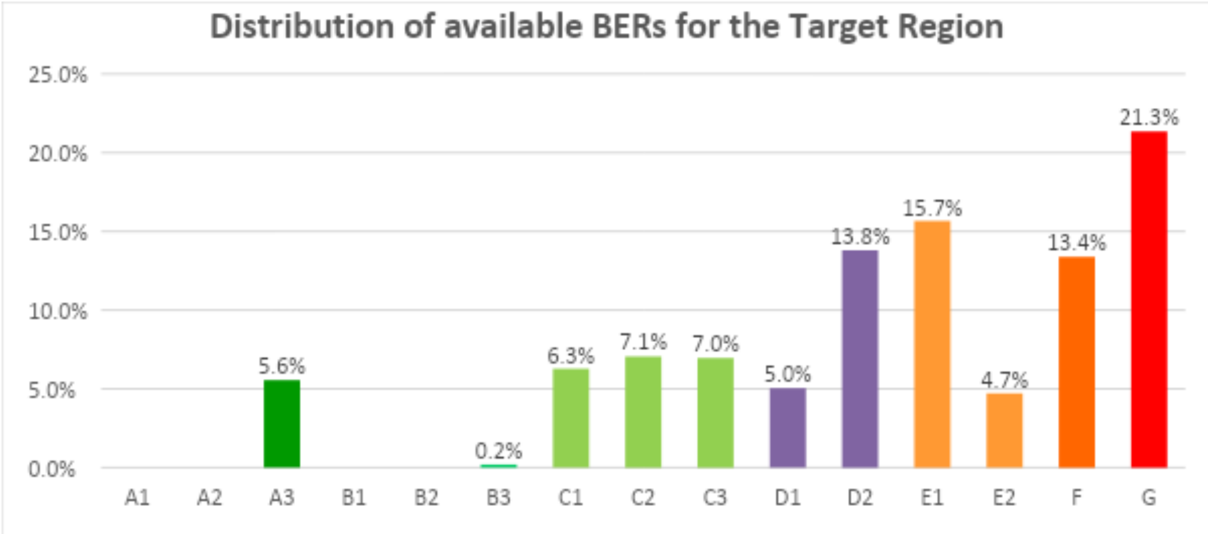

Figure 5: Energy Rating of Dwellings

The rating scale used by the SEAI DEAP methodology is shown below. The target B2 will have a rating of 100kWh/m2 primary energy. Primary energy is all the energy inputs and takes into account the energy used to generate electricity.

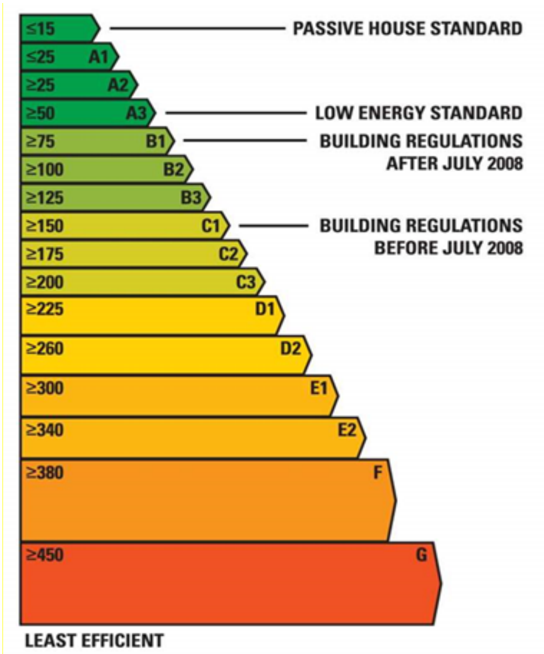

Figure 6: BER Rating Scale

3.2.4. Heating Systems Profile by Primary Fuel Source

Figure 9 below shows the full breakdown of system types available from the CSO. An analysis of heating system types indicated the following:

- 60% of dwellings had oil fired central heating as their primary source of heating.
- The second most popular source was solid fuel at 30% with turf accounting for 18% and coal for 12%.
- the remaining 10% of dwellings use LPG, “other sources” or have no heating at all.

Oil fired system would typically have an efficiency of between 60% and 70% over the whole heating season. A replacement condensing oil boiler would deliver savings of about 20%.

There are no SEAI grants available for upgrading fossil fuelled systems to fossil fuel so any retrofits like this would have to be self-financed or else renewable heat pumps installed which would possibly require a complete upgrade to the distribution system radiators and the domestic hot water cylinder.

Heat pumps which use electricity as main fuel (there are gas driven ones as well) have efficiencies of upwards of 350%.

Homeowners wishing to push out the boundaries in terms of going beyond a B2 rating to an A2 or A3 for example would ideally need to consider a heat pump as the preferred option. These systems are quite expensive to install and more than likely the radiators will need to be replaced with low temperature radiators or underfloor heating. These upgrades with the heat pump will drive up the install costs but generous grants are available from the SEAI through the Better Energy Homes Scheme, or the Better Energy Communities Scheme. To qualify for the heat pump grant, the dwelling must achieve a minimum BER of B3/C1 before a heat pump grant can be considered

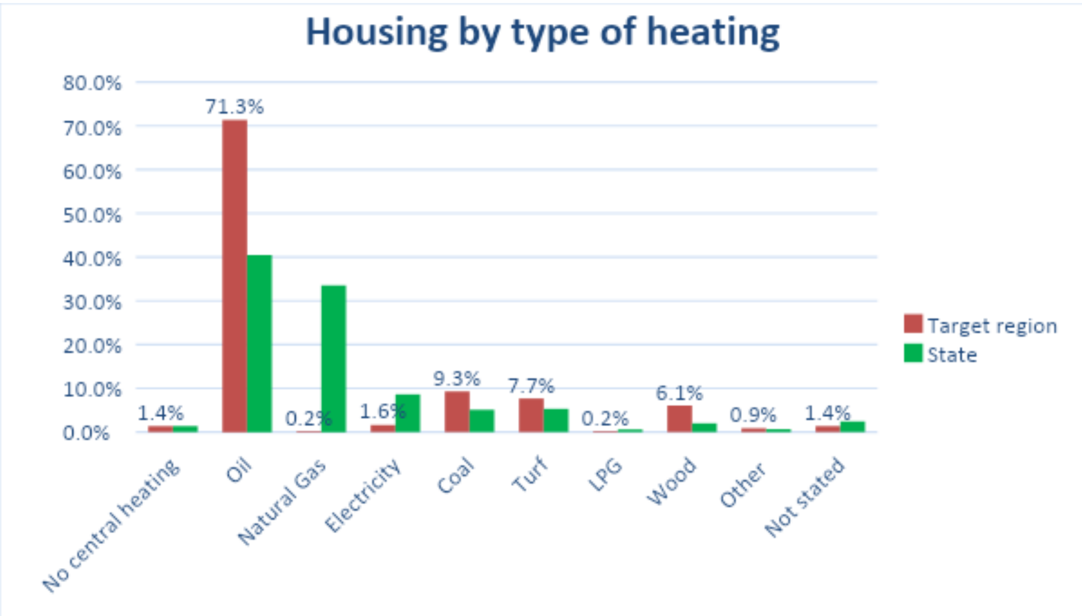

Figure 7: Breakdown of Central Heating by Fuel Types

3.2.5. Window U-Values in the Durrow SEC

Thermal transmittance, also known as U-value, is the rate of transfer of heat through a structure (which can be a single material or a composite), divided by the difference in temperature across that structure. The units of measurement are Watts/meter squared/degree kelvin (W/m²K). The better-insulated a structure is and hence performance, the lower the U-value will be. The main observations for the BER sample is as follows:

- Current regulations aim for a U-value of 1.4 or less, just 56 of dwellings would closely align with this range. Homeowners aiming for a B2 should target this level during the upgrade.
- 17% of dwellings have a U-value of 4 or higher which would suggest single glazing so potential to reduce the losses by about 66% (2/3) by upgrading to low energy types.
- 65% of dwellings have windows in the range of 2 to 3 which is typical of 1990's to 2000 period dwellings. This is good when compared to age profile of dwellings indicating that some dwellings may have had some form of window upgrade completed previously

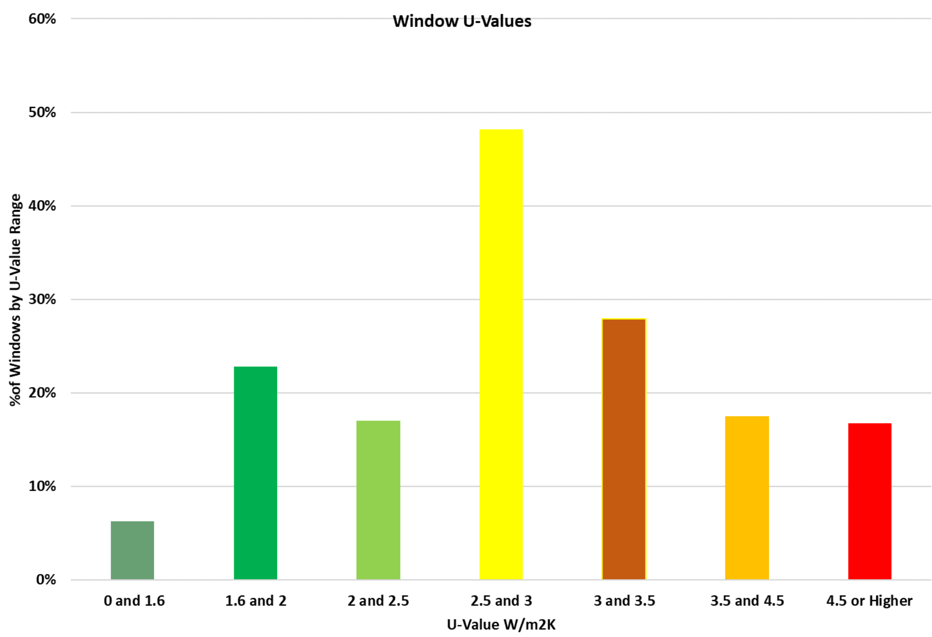

Figure 8: Breakdown of Window U-Value Range

3.2.6. Wall U-Values in Durrow SEC

As is the case with windows, the same holds true for walls. The better-insulated the wall is, the lower the U-value. The percentage of dwellings by wall u-value is shown in Figure 8 below. The main observations of wall U-values are as follows:

- Current regulation guidance is for a U-value of 0.16 $W/m^2/k$ of better (lower), the analysis indicated that 10% of dwellings within the range and another 48% up to a 1998 standard.
- Over 43% of the dwellings (U value >= 0.5) have very minimal wall insulation or none at all!

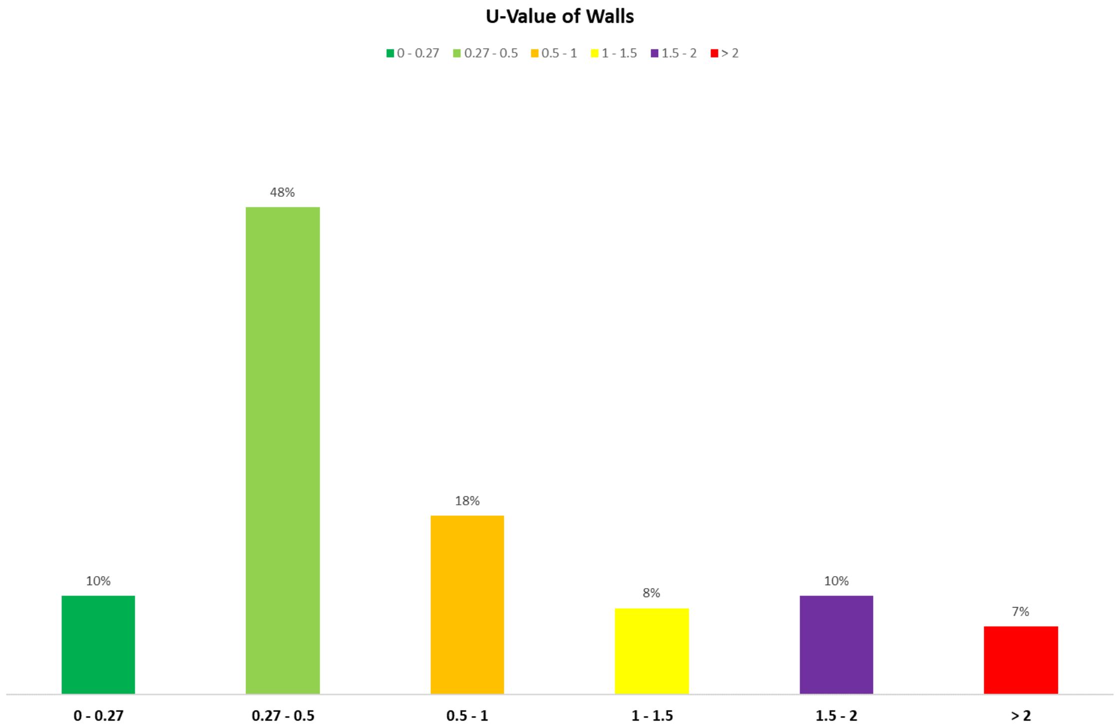

Figure 9: Breakdown of Wall U-Value Range

The analysis of wall types are shown in Figure 12 outlining the various wall construction types. This is dominated by unfilled cavity at nearly 45% of dwellings. These walls could use pumped cavity wall insulation to bring them to 0.27 $W/m^2/k$ as part of a shallow retrofit solution.

- About 20% are of hollow concrete block or solid walls and will have U-values of between 1 and 2 $W/m^2/K$, the retrofit options will include either internal dry lining with insulated plasterboard or outside insulation.

- Just 30% of the dwellings have some form of insulation which will be of reasonable standard such as partial filled or full filled cavity, and modern timber frame houses.

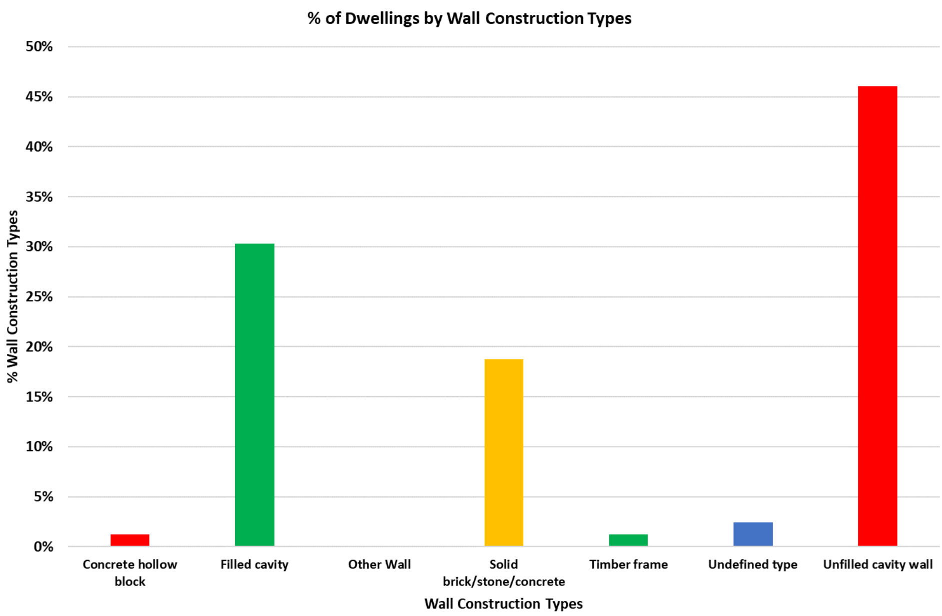

Figure 10: Breakdown of Wall Construction Types

3.2.7. Roof (Attic if present) U-Values in Durrow Dwellings

Figure 13 below indicates the percentage of dwellings by roof U-value. The following observations can be made:

- Over 28% of dwellings have a U-value of 0.5 or higher which suggests that insulation level ranging from zero to 50mm (two inches) of insulation will be applied.
- 72% of the dwellings have some insulation
- Over 45% of the dwellings fall into in the range to be expected from a B2 or better in line with NZEB[4] constructed houses (less than 0.16 $W/m^2/K$). These home owners probably upgraded attic insulation as a shallow retrofit measure which was cheap and easy to do.
- Over 55% of dwellings which can be insulated, would need attic insulation upgrades to bring them in line with the government's B2 target rating!

[4] https://www.seai.ie/business-and-public-sector/standards/nearly-zero-energy-building-standard/

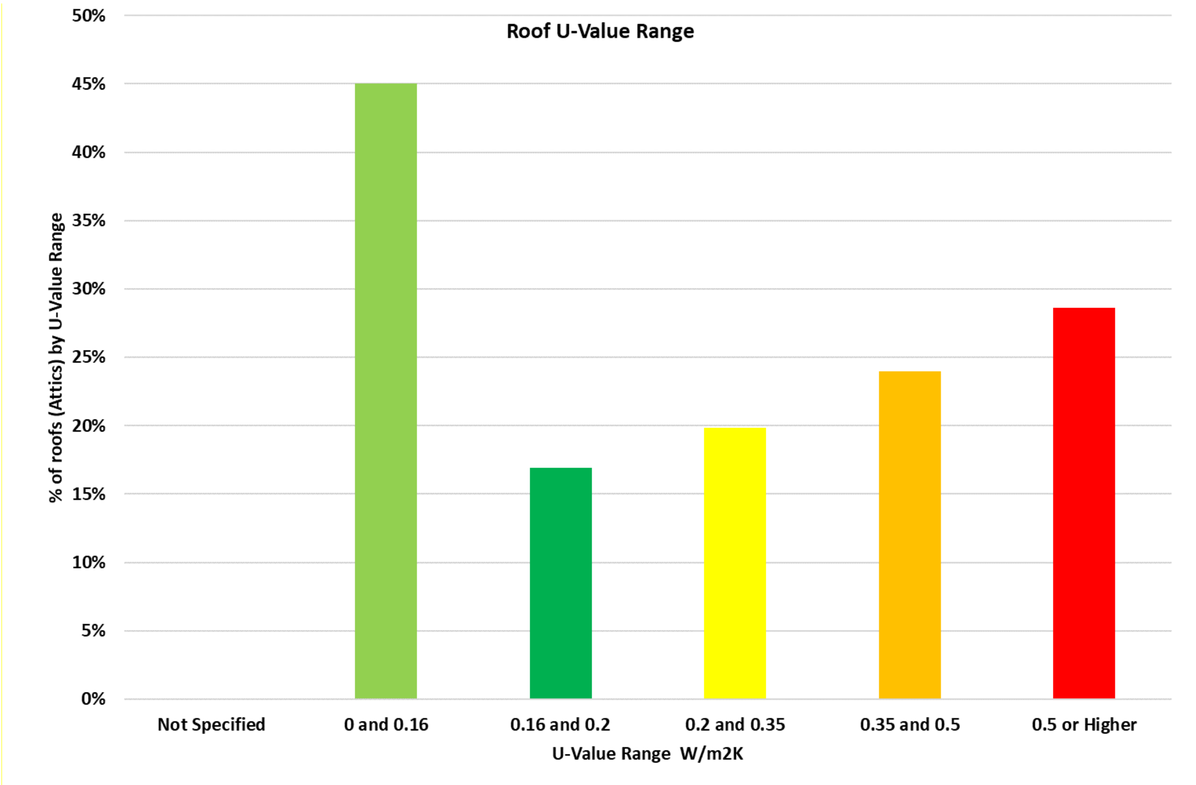

Figure 11: Roof U-Value Range

3.2.8. Space heating Controls

The BER data analysis indicated the 80% of dwellings had no thermostat for heating controls. Thermostats provide the ability to control the space or water heating automatically to the desired comfort levels and hold them at that level so the overheating is minimised. When overheating occurs, occupants tend to open windows to reduce the overheating as opposed to switching off the heating or turning it down:

- **82% of dwellings had no controls, this is significant as 30% of space heating energy can be saved with good simple controls.**
- 17% had a basic programmer which allowed for some degree of time control over the course of the day or week.
- Just less than 1% of dwellings have full time and temperature controls of space and water heating.

Potential savings will vary between 5% to 30%[5] or even higher. Simple basic controls such as time clocks with thermostatic radiator valves could be introduced and more complex controls such as programmable thermostat with zone controls and boiler interlock could also be

[5] https://www.seai.ie/publications/Homeowners-Guide-To-Heating-Controls.pdf

considered. More modern controls use mobile phone Apps or other systems with live displays with which to program heating using wireless internet technology.

Generous grants are available for such upgrades from SEAI. It should be noted that these modern controls may not necessarily be the most practical for all homeowners and so a cautious approach in consultation with occupiers should be considered.

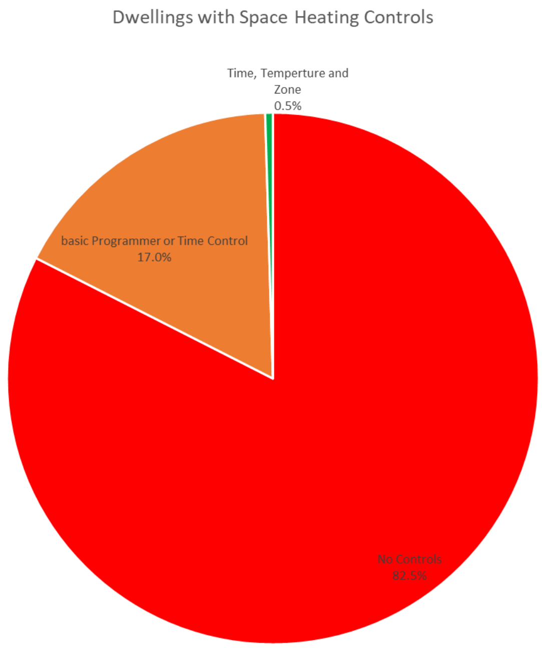

Figure 12: % of Dwellings with heating controls

3.2.9. Analysis of the Energy Use in the Residential Sector

Analysis of CSO data combined with general data from SEAI Building Energy Rating (BER)[6] from the SEAI BER small area maps data provided by the Sligo IT has been analysed and extrapolated against the 1760 dwellings in the area to produce a baseline of the energy use in the residential sector in the area.

The BER data covers 153 dwellings which represents about 16% of dwellings in the target area. According to the CSO data there are 163 rented dwellings and by law a tenant should receive a BER certificate for the rented property, this would suggest that if all renters have received their BER Certificates as required by law then there are just 10 other dwellings with BER certificates in the target area in the privately owned properties.

[6] https://renewables.maps.arcgis.com/apps/webappviewer/index.html?id=360f7b3f6f484d7d89b967b41231daef

In 2022, Laois County Council retrofitted 160 of their housing stock improving the liveability of these homes with measures including: external insulation wraps, new windows and doors and heat pumps replacing fossil fuels and new radiators. https://www.youtube.com/watch?v=Dp1S2ao-ozQ

Prior to the retrofit works by Laois County Council the average BER E2 and as a result of the works, the BER was uplifted to an A3. Savings of €2000 a year on heating bills were demonstrated.

Knowledge gained from these retrofits can be shared with the Durrow SEC in order to support their goals and objectives.

Table 2: Baseline Summary Analysis

No. of dwellings in BER data set	902	
Total kWh	**Total Cost**	**Total kgCO2**
34,684,049	€3,609,757	12,893,916
Average kWh/dwelling	**Average Cost/dwelling**	**Average kgCO2/dwelling**
38,572	€4,016	14,344

Baseline Summary Analysis Overview

- 902 dwellings located within the Durrow SEC area based on the small area maps analysis (808 based on CSO data including mobile homes)
- Average BER is 353kWh/m^2 which equates to an E1 rating.
- 34GWh of primary energy used.
- Energy cost of just over 3.6 million[7] and average cost per household estimated at €4,016 per annum.
- 12,900 tonnes of CO_2 emitted or about 14 tonnes per household.

3.2.10. Scenario Analysis

Using the SEAI guidance coupled with BER data, the energy use profile was developed in order to determine the potential energy, emissions, and cost savings by undertaking a retrofit of the houses in the community.

Two scenarios were modelled to analyse the data:

1. All houses brought to BER B2 Standard of <100kWh/m2/year
2. All houses brought to an A2/A3 <50kWh/m2/year

The high level recommendation or retrofit solutions that would potentially increase the BERs to a B2/A3/A2 rating would include some or all of the upgrade items listed below, depending on the individual entry point on the BER scale.

Given that 94 % of dwellings fall outside the B2 rating (i.e. **Only 5.6% of houses in the SEC area currently meet the B2 or better rating**) then it is likely that most of these solutions will be needed:

[7] Electricity price €0.30/kWh and Fuel price at €0.13/kWh (€1.30/litre)

- Attic Insulation to 300mm.
- Cavity Wall upgrade where needed.
- Full outside/internal Wall insulation (outside only where full cavity or solid wall).
- High efficiency solid fuel stove or wood pellet stove/room heater in place of open fires.
- High performance double glazed or triple glazed windows and doors U-value 1.4w/m2/^{O}C or lower.
- Improved airtightness
- Demand-controlled ventilation.
- Energy efficient lighting
- Heating Controls
- Heat pump.
- Solar PV

The impact of these measures in a B2 retrofit is shown graphically below in Fig 13

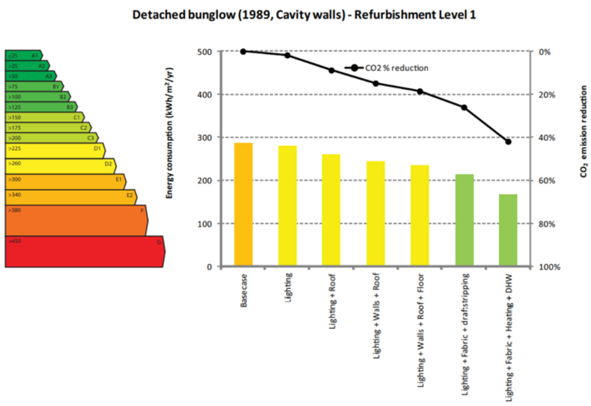

Figure 13: Impact of shallow retrofit measures on a typical bungalow[8]

An estimated average investment of up to €38,440 would see a BER of B2 rating being achieved from the E1 rating of 353 kwh/m^2/yr to B2 100kWh/m^2/yr.

The table below shows the B2 standard model, in this case over 20,854 kWh primary energy will be saved and resulting in a cost saving of over €1,748 per dwelling.

Table 3:Target B2 rating

Modelled BER B2		
Total kWh	**Total Cost**	**Total kgCO2**
9,270,880	€1,081,526	3,076,111
Average kWh/dwelling B2	**Average Cost/dwelling**	**Average kgCO2/dwelling**
10,348	€1,199	3,410

[8] Graphics reproduced from NSAI SR 54 Code of Practice - https://www.nsai.ie/about/news/publication-of-sr-542014-code-of-practice/

Table 4: Durrow B2 Headline data

Overall Headline Data		
Potential Energy Savings kWh	**Potential Cost Savings €**	**Potential kg CO2 Savings**
25,413,169	€2,528,231	9,817,805
Savings per Household		
Potential Energy Savings kWh	**Potential Cost Savings €**	**Potential CO2 Savings**
28,224	2,817	10,934

- Potential energy savings are estimated at €2.53 million or 73% equating to about €2,817 per household at a B2 rating.
- Final energy cost per household is estimated at €1,200 per annum at a B2 rating.
- CO_2 savings estimated at 10,934 tonnes
- Potential cumulative saving of €2.53million for all B2
- Savings of over 10 tonnes per dwelling.

A further model was developed to determine the potential cost savings if all houses were brought up to a potential A2/A3 rating under a deep retrofit upgrade.

The table 6 below shows the potential savings if an A2/A3 rating was achieved through the retrofit measures identified.

Table 5: Modelled Data A2/A3

Modelled BER A2/A3		
Total kWh	**Total Cost**	**Total kgCO2**
5,660,980	€783,713	2,121,845
Average kWh/dwelling B2	**Average Cost/dwelling**	**Average kgCO2/dwelling**
6,319	€869	2,352

Table 6: Durrow Headline Data A2/A3

Overall Headline Data		
Potential Energy Savings	**Potential Cost Savings**	**Potential kg CO2 Savings**
29,023,069	€2,826,044	10,772,071
Savings per Household		
Potential Energy Savings kWh	**Potential Cost Savings €**	**Potential CO2 Savings**
32,253	3,147	11,992

- Final energy cost at an A2/A3 rating would be €869 per dwelling per annum or an 84% energy reduction.
- Potential cumulative saving of €2.83 million for home owners in an A2/A3 rated dwelling. Cost savings of 78% achieved per dwelling.
- Savings of almost 12 tonnes of CO_2 per dwelling
- The equates to an expenditure of between €17,250 and €52,400 per dwelling.
- Promote the Durrow SEC as a "green" location potentially attracting in new businesses and associated revenue and employment potential.
- Potential for job creating through residential energy retrofit/renewable energy generation projects.

Table 7: Residential Performance Indicators

Residential Performance Indicators			
Total number of Dwellings	% B rated or better	% of Fossil Fuel Heating Systems	% of Renewable Energy
902[9]	5.6%	88%	<1%

Table 8: SEC Residential Energy, CO2 and Spend

SEC Residential Energy, CO_2 and Spend				
	Electricity	Fossil Fuel	Renewable	Total
Total Primary Energy (kWh)	5,837,051	27,747,239	1,099,759.08	34,684,049
Total CO2 (tonnes)	5,559	7,334		12,893
Total Spend (€)	1,291,223	2,221,121	97,413.75	3,609,757

It would cost an estimated €52,400 per house to get from an E1 rating to a BER of A2/A3 rating.

The impact of these measures in a A2/A3 retrofit is shown graphically below in Fig 11

[9] 902 dwellings modelled as contained in the BER small area maps data, CSO data had a lower number.

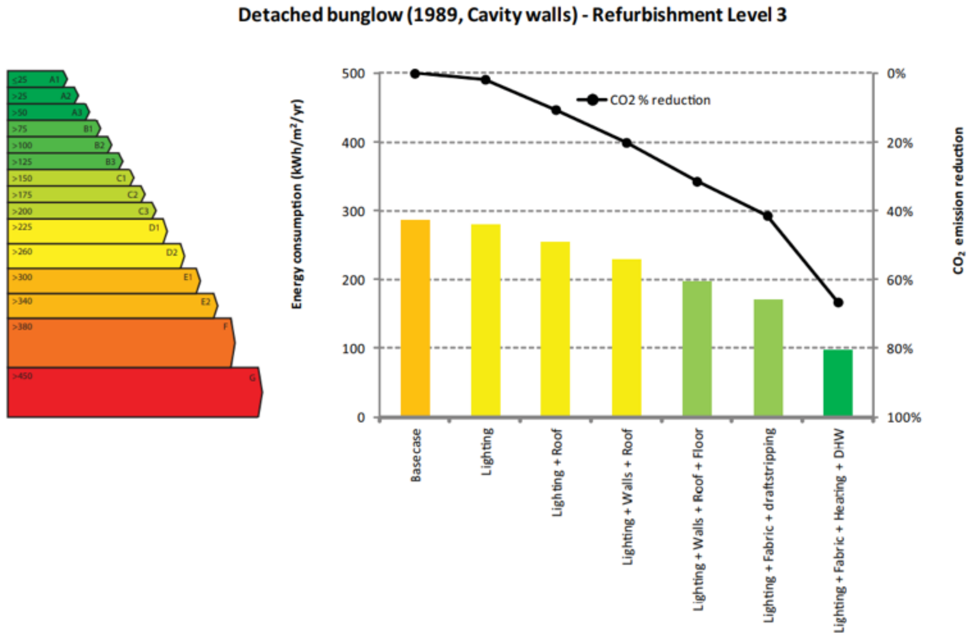

Figure 14: Impact of deep retrofit measures on a typical bungalow

3.2.11. Overall Headline numbers for the residential housing stock:

- 902 dwellings located within the Durrow SEC area.
- Average BER is an E1.
- 34.7 GWh of primary energy used.
- Energy cost of over €3.6 million and average cost per household estimated at €4,016 per annum.
- 12,900 tonnes of CO_2 emitted or about 14 tonnes per household.
- Potential energy savings are estimated at 73% or about €2,817 per household at a B2 rating.
- Final energy cost per household is estimated at €1,200 per annum at a B2 rating.
- Final energy cost at an A2/A3 rating would be €869 per dwelling per annum.
- Potential €2.82 million savings cumulative for home owners at an A2/A3 rating.
- The overall investment in energy retrofit measures is estimated at between €2.7 million to B2 rating and €35.6 million to a deep retrofit A2/A3 rating.

Some of the immediate benefits for the Durrow SEC will include:

- Between €2.5 million and €2.8 million extra income to be spent in the local community.
- Improved living conditions and increased comfort due to better insulated homes and thus it will contribute to better health and well-being of the residents.
- Reduced heating and running costs for homeowners.

- Contribute towards and exceed the national CO_2 emissions reduction targets of ~51% by 2030 and carbon neutral by 2050.
- Promote the Durrow SEC as a "green" location potentially attracting in new businesses and associated revenue and employment potential.
- Potential for job creating through residential energy retrofit/renewable energy generation projects.

3.3. Analysis of Non-Residential Sector

3.3.1. General

The high level analysis of the non-residential sector was completed using two methodologies:

- the CIBSE TM46: Energy Benchmarks to estimate energy consumption combined with floor area data and estimated/calculated using Valuation Office data (https://opendata.valoff.ie/api/).
- The energy cost data used was taken from the SEAI fuel cost comparison and also from analysis of energy use based on the energy assessments undertaken. The valuation office data provided a list of 95 private sector facilities and five public sector facilities.

The SEC provided a list of non-residential facilities broken down by facility type and approximate size (small, medium, large).

The table below provides an overview of the level of engagement with the sector:

Table 9: Non-Residential Engagement

Non- Residential Sector Engagement			
Sector	**No of Facilities Identified**	**Audited/Assessed**	**%**
SME	152	3	2.6
Medium	1	1	100
Public	0	0	0
Community	0	0	0

- The four SME facilities engaged in this study included a cross sector mix of retail outlets, and services.
- Public facilities - none recommended
- Community facilities -None recommended

As part of the Durrow SEC programme, many local organisations and businesses were contacted regarding participating. They were offered a free Level 1 audit to help identify potential projects that could be implemented as either part of the community programme or separately by the various businesses/organisation. The audit also helps to identify the possible energy saving in the business/commercial sector in the Durrow SEC.

A Level 1 audit is the most basic level of audit, often called the “walk-through analysis.” This type of audit is designed to give businesses a starting point to make changes or to complete more in-depth audits. The auditor takes a high-level view of a building’s energy usage and operations. Level 1 audits were undertaken at the following organisations;

1. Happy Days Crèche, The Square Durrow Town Park, Laois
2. Bowes Food Hall & Café, The Square Durrow Town park, Laois
3. Lawler’s Gala Shop, The Square Durrow Town Park, Laois
4. Castle Arms Hotel, The Square Durrow Town Park, Laois

The main objective of the audits was to identify opportunities to reduce energy costs. The project scope included each building’s electrical and thermal energy usage. These audits were carried out on 24th March 2023.

Table 10: Energy Audit Summary Data

SEC Audit Energy, CO_2 and Spend				
	Electricity	Fossil Fuel	Renewable	Total
Total Primary Energy (kWh)	443,893	226,957		670,850
Total CO_2 (tonnes)	150	59		209
Total Spend (€)	**190,055**	**22,696**		**212,751**

Based on an average electricity price of €0.30/kWh and thermal energy cost of €0.10/kWh

Table 10 above is based on the audits completed

3.3.2. Agriculture

Due to the evolving situation in relation to climate action plan targets and grant aid for agriculture, it may be that agriculture would be better addressed later in the development of the SEC.

Rural economic sectors remain very important in Laois. According to Census 2016 data, 7.2% of Laois' workforce is engaged in Agriculture, Forestry and Fishing. In the Agricultural Census 2010, 72% of land in Laois was used for farming purposes, while 14.7% is associated with forestry.

3.3.3. Large Industry

There are no large industries in the community, a large industry is defined as one employing over 250 people or with a turnover in excess of €43 million and balance sheet in excess of €50 million.

3.3.4. Non-residential sector baseline (Excluding Transport)

The non-residential baseline is shown below

Table 13: SEC Non-Residential (Commercial) Energy, CO_2 and Spend (Excluding Transport)

Table 13 – SEC Non-Residential Energy, CO_2 and Spend				
	Electricity	Fossil Fuel	Renewable	Total
Total Primary Energy (kWh)	7223651	9239934	0	**2767713**
Total CO2 (tonnes)	1066	3392	0	**4458**
Total Spend (€)	**2167095**	**924000**	**0**	**3091095**

The breakdown of the non-residential energy by sector is shown below

3.3.5. Commercial sector business types by number in the SEC

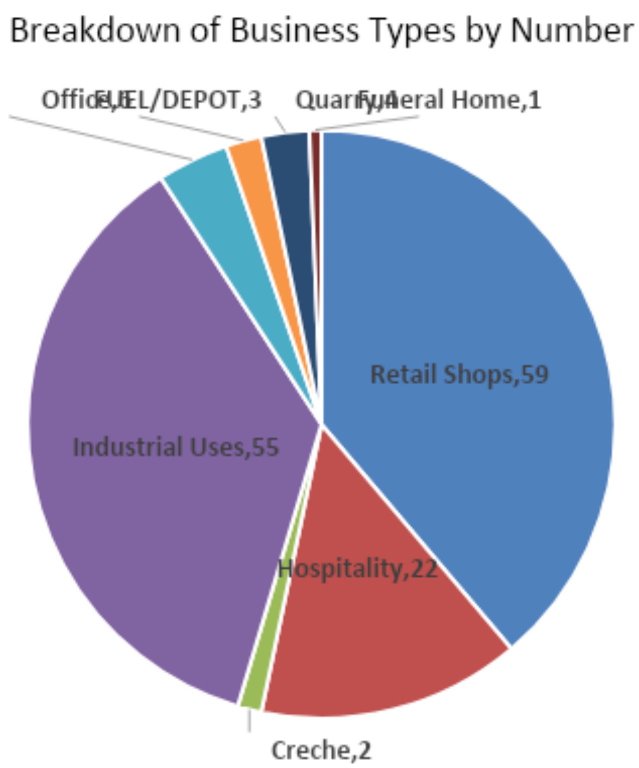

Figure 24: Commercial sector business types

3.3.6. Total Energy breakdown % for Commercial Sector

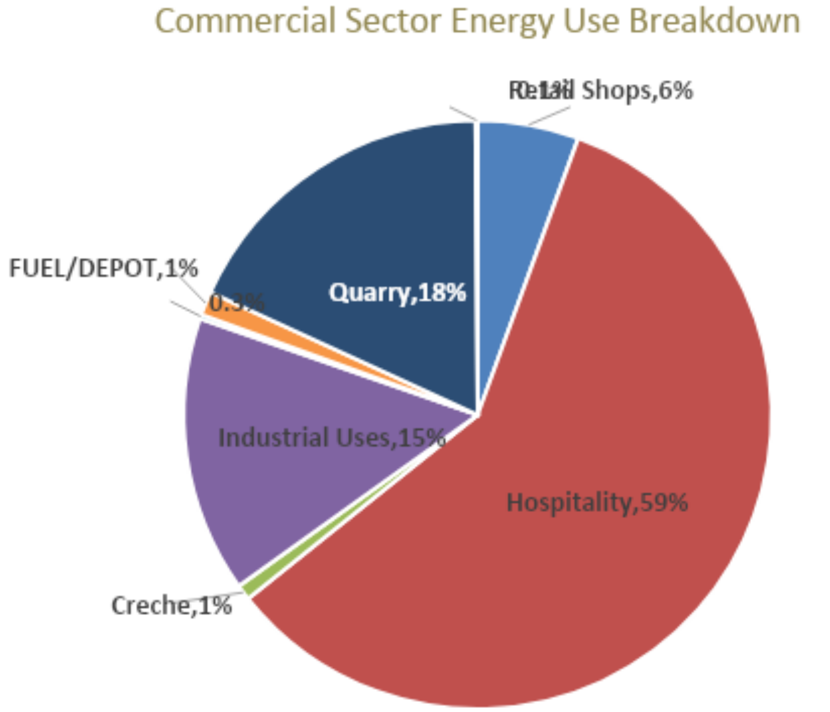

Figure 25: Commercial Sector

3.3.7. Total CO_2 emissions % for Commercial Sector

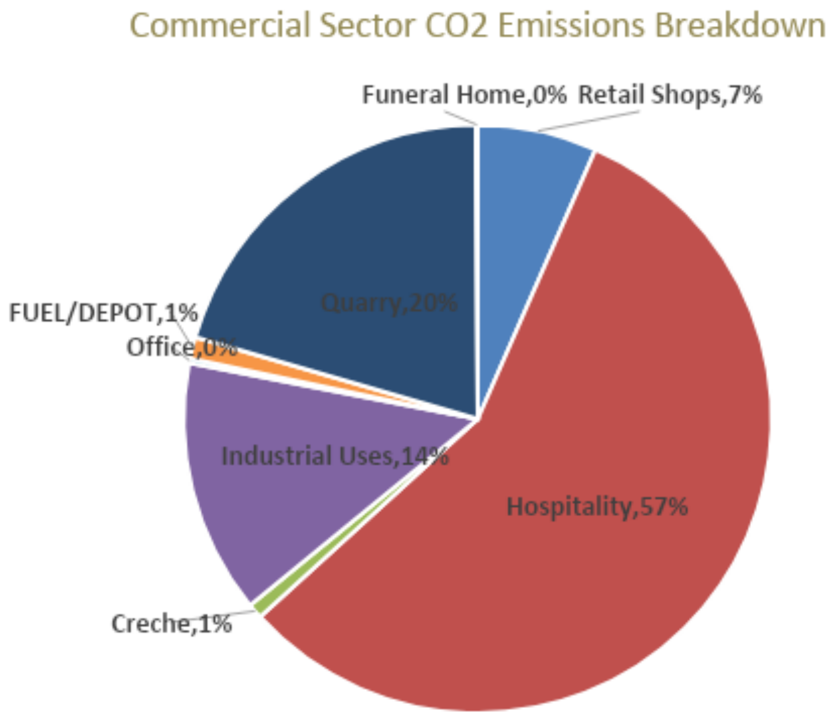

Figure 26: Commercial Sector CO_2

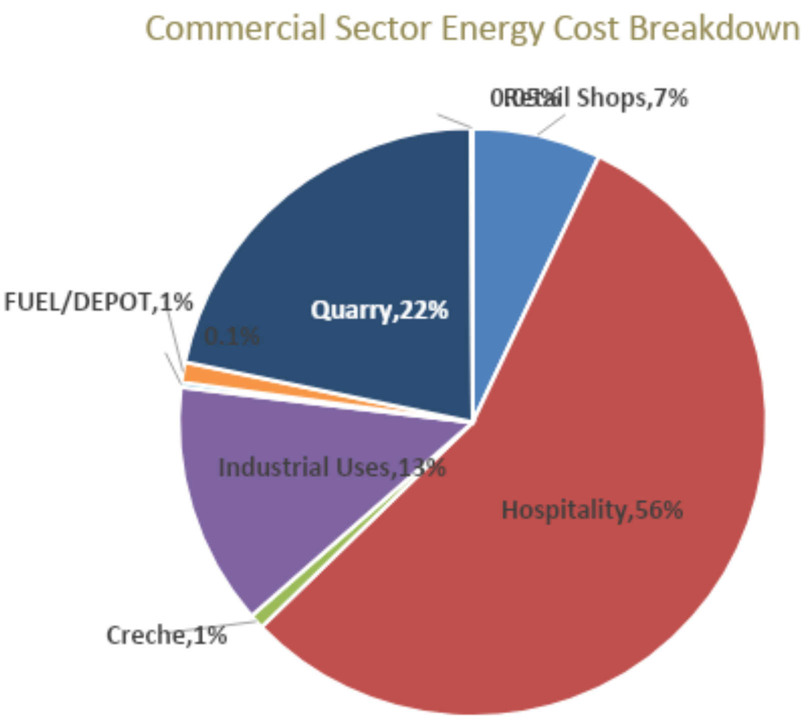

Figure 27: Commercial Sector Costs

3.4. Transport

The Transport energy use, emissions and costs were calculated in accordance with SEAI guidance in terms of emissions for the various vehicles as outlined in Table 12 above and extrapolated out against the vehicle statistics for Co. Laois and the mileage travelled by each vehicle archetype as provided again by SEAI.

Table 14 – Private Vehicle Transport Energy and CO2 impacts				
		National average annual km	kWh/km (TPER)	gCO2/km
Car	Petrol	12,113	0.73	167
	Diesel	19,681	0.70	167
	BEV	12,958	0.38	65
Motorcycle		2,741	0.41	94
Van		19,787	1.01	243
Truck		44,671	3.47	832

Table 15: SEC Transport Energy, CO_2 and Spend[10]

Table – SEC Transport Energy, CO_2 and Spend				
	Electricity	**Fossil Fuel**	**Renewable**	**Total**
Total Primary Energy (kWh)	584,182	14,329,264	1,201,269	**16,114,715**
Total CO2 (tonnes)	29	2,509	0	**2,538**
Total Spend (€)	**26,558**	**2,178,508**		**2,205,065**

NOTES:

The renewable portion was taken as the renewable content of electricity consumed (40% in 2020), 5% of petrol consumption and 7% of diesel consumption (as per the Biofuels Obligation Scheme).

It was assumed that a hybrid car would consume 50% fossil fuel and 50% electricity

3.4.1. Cars

There are a total of 1,247 cars in use in the Durrow SEC according to the CSO analysis. The department of transport data indicates that the average distance travelled in 2020 by car in Laois is 20,208[11] kilometres, this is over 12% higher than the national average of 18,000km.

Extrapolating out the number of cars against the number of cars registered in county Laois (2019 data)[12] by fuel type would indicate that 70% or over 867 cars are diesel. Over 28% 348 will be petrol and the remaining will be electric or electric (diesel/petrol/Ethanol) hybrid versions.

Just 8% of houses have no cars, while 39 have one car and 14 houses have not stated how many cars. The remaining households have 2 or more cars and 14 of these have 4 cars.

Fuel	**Number of Vehicles by Fuel Type**	**%**
Diesel	867	70%
Diesel Electric	1	0%
Diesel/Plug In Hybrid Electric	0	0%
Electric	4	0%
ETHANOL/DIESEL	0	0%
ETHANOL/PETROL	3	0%
GAS	0	0%
HYBRID	0	0%
PETROL	348	28%
PETROL/ELECTRIC	19	2%
PETROL/PLUG-IN HYBRID ELECTRIC	4	0%
PLUG-IN HYBRID ELECTRIC	0	0%
Total	1,247	100%

10 EV Cost Savings | Electric Vehicle Business Benefits | SEAI

11 Road Traffic Volumes - CSO - Central Statistics Office

12 Transport | Energy Statistics In Ireland | SEAI

Table 11 Number of Cars in SEC by Fuel Type

3.4.1.1. Commuting

73% of those in employment use their cars to travel to work, over 7% above the national average. Just 2% using public transport and over 4.8% work from home.

Students travel to school mainly by car at almost 54% and a further 30% travel by bus. Less than 1% or 0.2% cycle.

There are no car sharing/car clubs stationed in the area that the SEC is aware of.

3.4.1.2. Cycling in Durrow

The following cycle lanes were identified as being in the vicinity of the Durrow SEC.

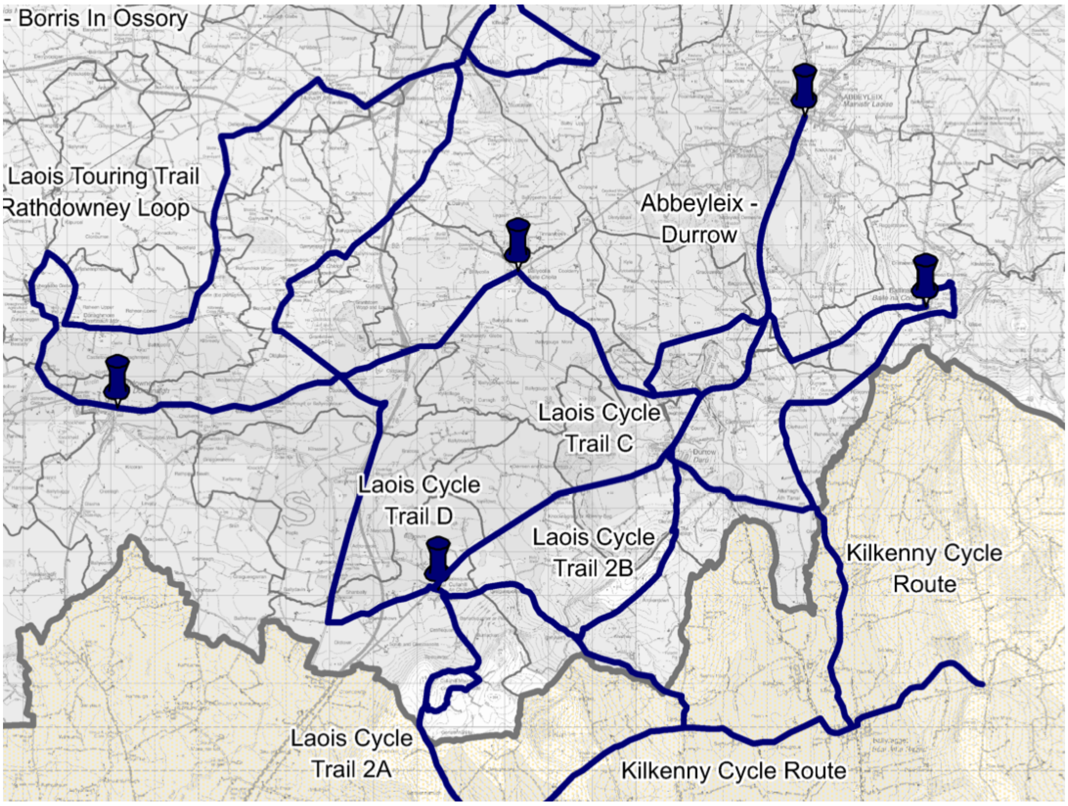

Figure 15: Cycling Routes Map - County Development Plan[13]

The "Tour of Durrow"[14] cycling route commences and ends in Durrow. This is a leisure route provided for tourists and cyclists.

[13] https://laois.ie/wp-content/uploads/10-2-Cycling-Routes-Maps.pdf

[14] Tour of Durrow

3.4.1.3. Public/Bus Transport Services

Route 828/858[15] operated by M & A Coaches on behalf of the National Transport Authority provides a daily journey each way to/from Durrow, County Laois, Abbeyleix and Portlaoise from Cashel/Urlingford.

Durrow is not on the mainline rail network so travellers will have to use the bus link to the railway station in Portlaoise or Thurles to travel onwards to Dublin.

There are no specific bicycle parking or E-Bike charging facilities provided in the villages however locations have been identified in the local development plan.

3.4.1.4. Walking infrastructure

The following walking trails were identified in the area.

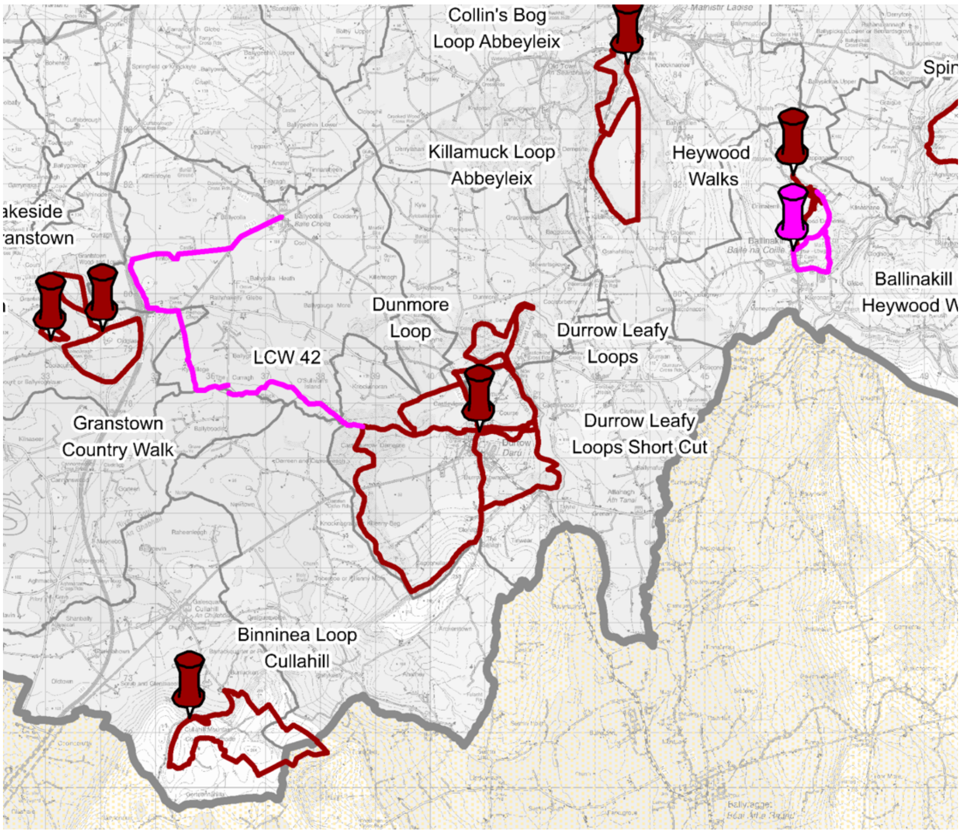

Figure 16: Walking Trails Map - County Development Plan[16]

3.4.1.5. Battery Electric Vehicle (BEV) Charging

There are no public electric vehicle charging points in the target area, the nearest points are:

- Portlaoise Plaza on the M7 where there are four Rapid chargers[17]. These are 22 km from Durrow.

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15 TFI Bus Timetable

16 https://laois.ie/wp-content/uploads/10-1-Walking-Trails-Map.pdf

17 https://esb.ie/what-we-do/ecars/charge-point-map

- Two 22kW charge points available in Abbeyleix, 9 km form Durrow
- Four type 2, and fast charge units in Ballacolla, on the M8, 7 km away
- Tesla chargers, Portlaoise and possibly M7/M8

Ideal locations would include the central "Square" area, the Scouts Den car park, and specific grants are now available for these facilities through the SEAI.

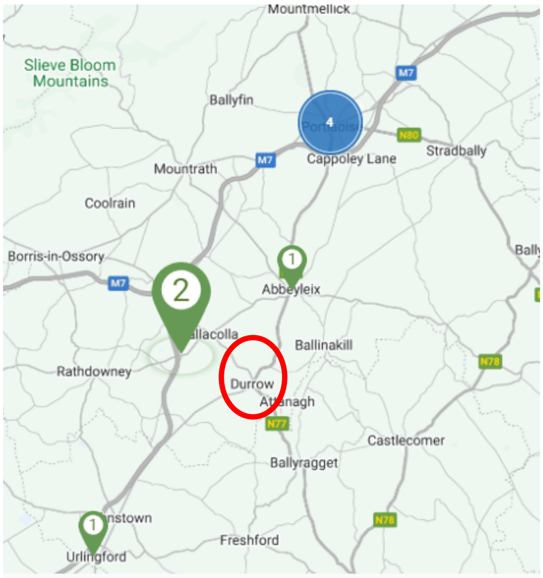
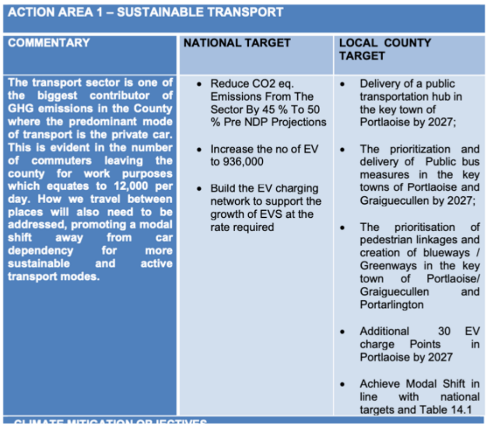


Figure 17: Public Charging Infrastructure in the area

EV Charging points targets are referenced in the Laois County Development plan 2021-27



ACTION AREA 1 – SUSTAINABLE TRANSPORT		
COMMENTARY	**NATIONAL TARGET**	**LOCAL COUNTY TARGET**
The transport sector is one of the biggest contributor of GHG emissions in the County where the predominant mode of transport is the private car. This is evident in the number of commuters leaving the county for work purposes which equates to 12,000 per day. How we travel between places will also need to be addressed, promoting a modal shift away from car dependency for more sustainable and active transport modes.	• Reduce CO2 eq. Emissions From The Sector By 45 % To 50 % Pre NDP Projections • Increase the no of EV to 936,000 • Build the EV charging network to support the growth of EVS at the rate required	• Delivery of a public transportation hub in the key town of Portlaoise by 2027; • The prioritization and delivery of Public bus measures in the key towns of Portlaoise and Graiguecullen by 2027; • The prioritisation of pedestrian linkages and creation of blueways / Greenways in the key town of Portlaoise/ Graiguecullen and Portarlington • Additional 30 EV charge Points in Portlaoise by 2027 • Achieve Modal Shift in line with national targets and Table 14.1

Figure 18: EV projections from County development Plan [18]

Table 12: Breakdown of Energy, Cost and CO2 Emissions for Transport Sector

Table – SEC Transport Energy, CO_2 and Spend				
	Electricity	**Fossil Fuel**	**Renewable**	**Total**

[18] https://laois.ie/wp-content/uploads/Volume-1-Written-Statement-of-Adopted-LCDP-2021-2027-including-Ministerial-Direction-amendments.pdf

Total Primary Energy (kWh)	584,182	14,329,264	1,201,269	**16,114,715**
Total CO2 (tonnes)	29	2,509	0	**2,538**
Total Spend (€)	**26,558**	**2,178,508**		**2,205,065**

3.4.1.6. Electric Vehicle Charging Planning Regulations

The specific planning regulations concerning electric vehicle (EV) charging points are set out in the Planning and Development Regulations 2001-2018. These regulations classify EV charging points as either exempted development (not requiring planning permission) or development that requires planning permission.

Exempted Development:

EV charging points that are installed on an existing building or within a car park that has been in use for more than 7 years are considered exempted development and do not require planning permission.

EV charging points that are installed on the boundary of a property are also exempt from planning permission requirements, provided that they do not interfere with the use of any public roads, footpaths or cycle tracks.

Development that requires planning permission:

EV charging points that require significant changes to the electrical infrastructure, such as the installation of a new substation or transformer, will require planning permission.

Publicly accessible EV charging points, such as those located in public car parks, on public roads, or other publicly accessible locations, may also require planning permission as they may have a visual impact on the surrounding area.

The planning permission process may involve consultation with the local authority and consideration of factors such as the visual impact of the charging point, the potential impact on traffic flow, and the suitability of the location.

3.4.1.7. Electric Vehicle Charging Infrastructure Strategy

The installation of EV chargers is defined in the strategy for 2022-2025 and as shown in the extracts shown below;

Figure 19: EV Charging Infrastructure Strategy 2022-2025 Summary

Publicly-Accessible Charging Station

Publicly-accessible charging stations are charging stations that are available to all (or a specific public grouping of) EV drivers. This includes charging stations that are privately-owned but accessible to the public. Publicly-accessible charging stations can be located on either public properties (such as public car parks) or private properties (such as supermarket car parks).

In some cases, a charging station may be located on private property, with access granted to a specific public group of users (such as clients or patients). Such a charging station would still be considered to be publicly-accessible.

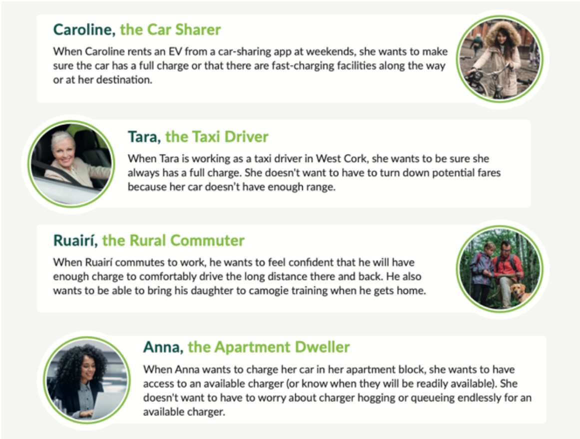
However, if a charging station (located on private property) is only available to a very limited, determinate circle of persons, it cannot be classed as publicly-accessible. An example of this is a charging station in an office car park, where only employees or authorised persons have access.

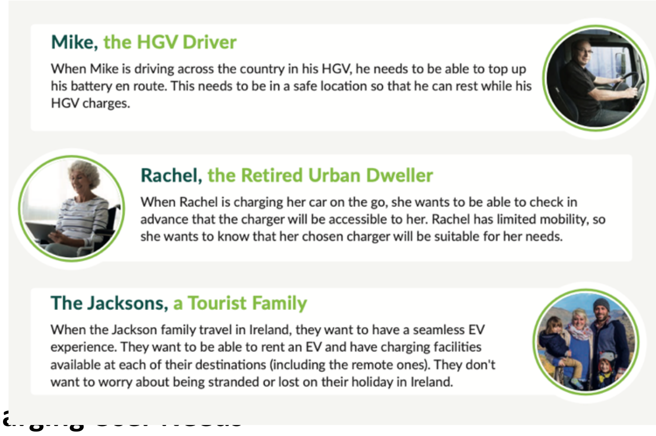
Charging stations for car-sharing schemes should only be considered accessible to the public if they explicitly allow access for third-party users.

Figure 20: EV Charging Infrastructure Strategy 2022-2025 Charging Stations

3.4.1.8. Purpose of Community Charging Point

The national strategy emphasises that "charge at home" is the preferred approach for charging, however for the Durrow SEC a benefit there may be other needs as identified in the User Needs of the EV charging strategy





3.4.1.9. Example of Charging Point in the Community

3.4.1.10. An example of a private partnership

An example of a commercial installation is EasyGo who will install EV charging points for free and split the revenue with the landowner. The Easy Go business model install their branded charging points nationwide and to then charge a subscription fee for their use. Installation uses grid electricity rather than solar

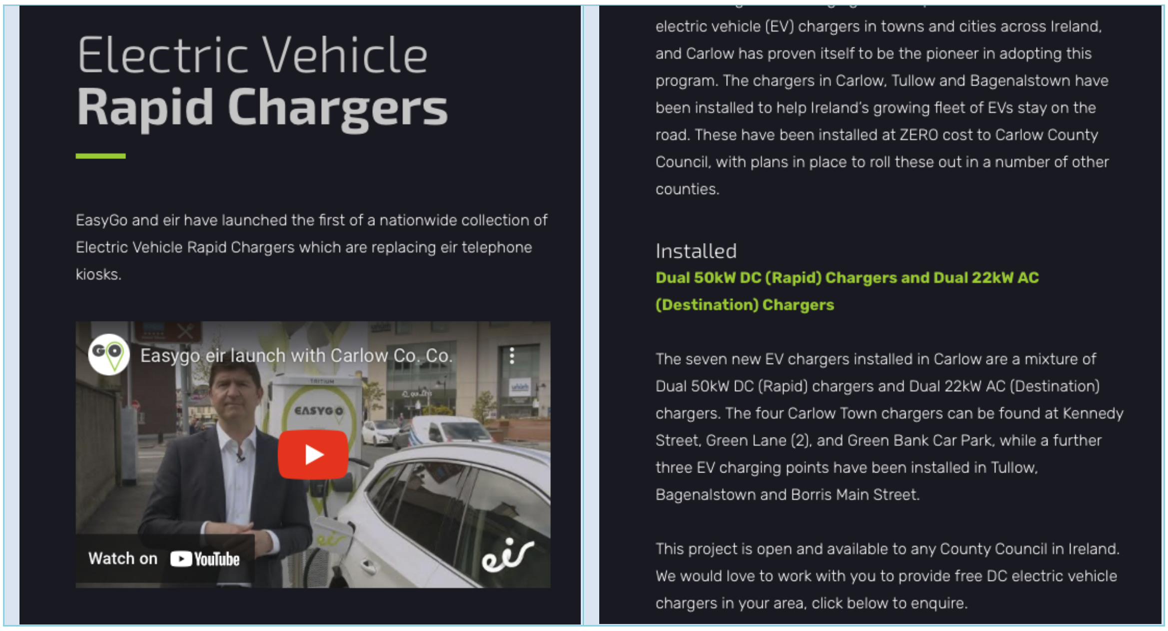


Figure 22: EV Charging Private Partnership [19]

3.4.1.11. An example of a community partnership

An example of a community owned installation that is relevant to SEC's is the Solar PV powered installation in Callan, Co. Kilkenny https://fedarene.org/best-practice/irelands-first-community-owned-ev-charging-point/

[19] https://easygo.ie/partner-with-us/eir-county-council-project/

3.4.1.12. Support for a Community partnership

There are a number of funding options for SEC's to engage with in relation to the installation of charging points as follows

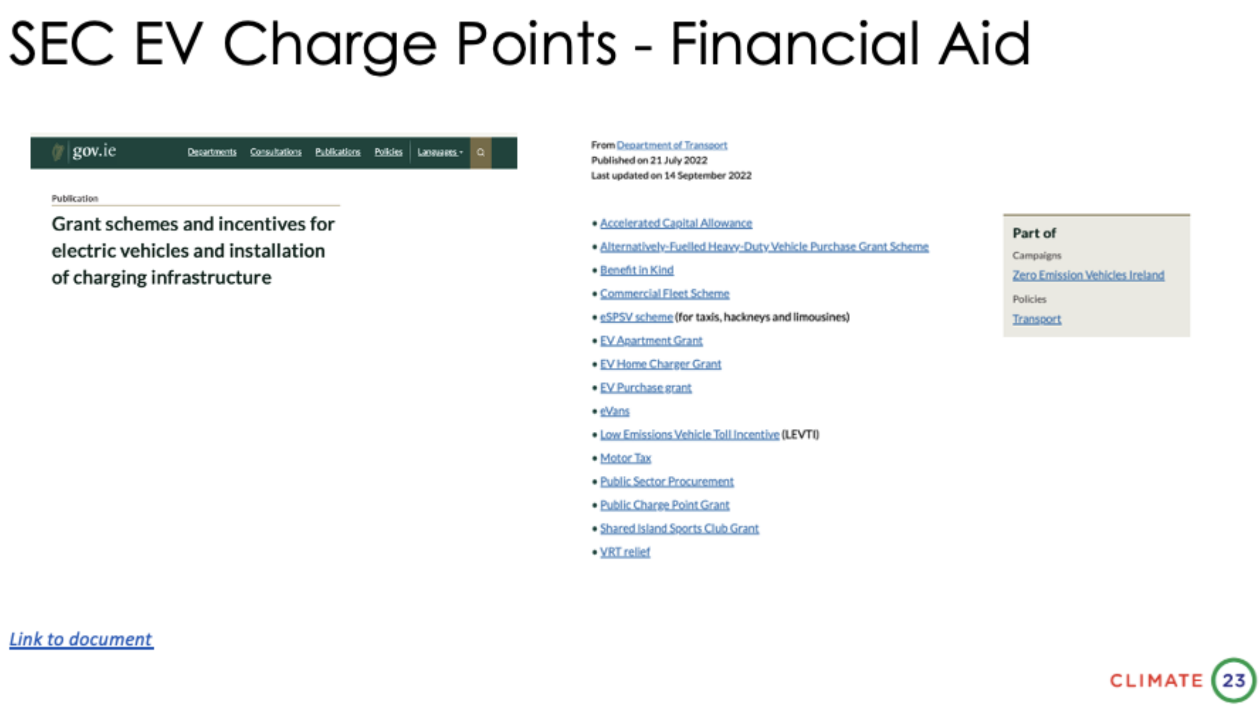


Figure 23 EV Charging Grant Incentives

3.4.1.13. EV Charging Points Logistics

There are a number of logistical issues and equipment requirements associated with the installation of the charging point e.g.

1. Charging Unit
2. Electrical Supply Equipment
3. Construction / Ground Works
4. Road Markings
5. Street Furniture
6. Signage

3.5. Transport

T

3.6. Energy Baseline

The table below provides a summary of overall energy use across the various sectors within the community.

Table 16: Energy Baseline Summary

Sector	Electricity	Fossil Fuel	Renewable	Total
Residential	5,837,051	27,747,239	1,099,759.08	34,684,049
Non-residential (Commercial)	7,223,651	9,239,934	0	2,767,713
Transport	584,182	14,329,264	1,201,269	**16,114,715**
Other (Public Sector)	0	0	0	
Other (Community)	0	0	0	
Total Energy	**13,644,884**	**51,316,437**	**2,301,028**	**53,566,477**

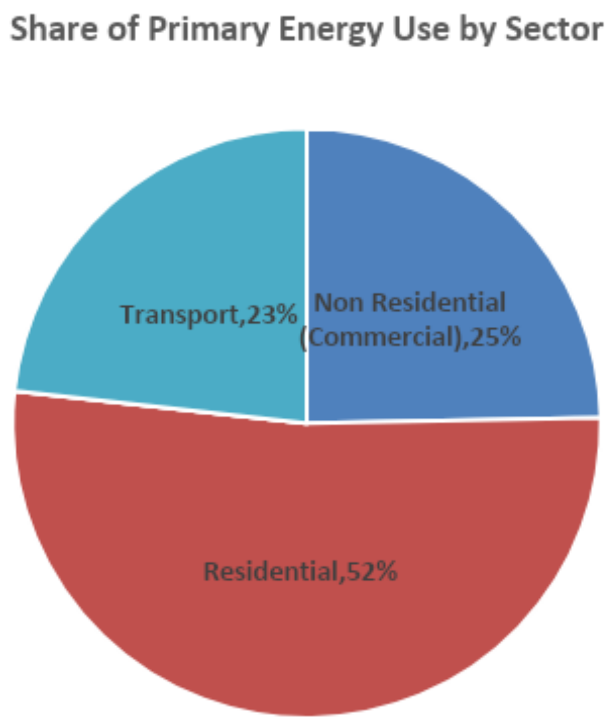


Figure 28: Share of Primary Energy Use by Sector

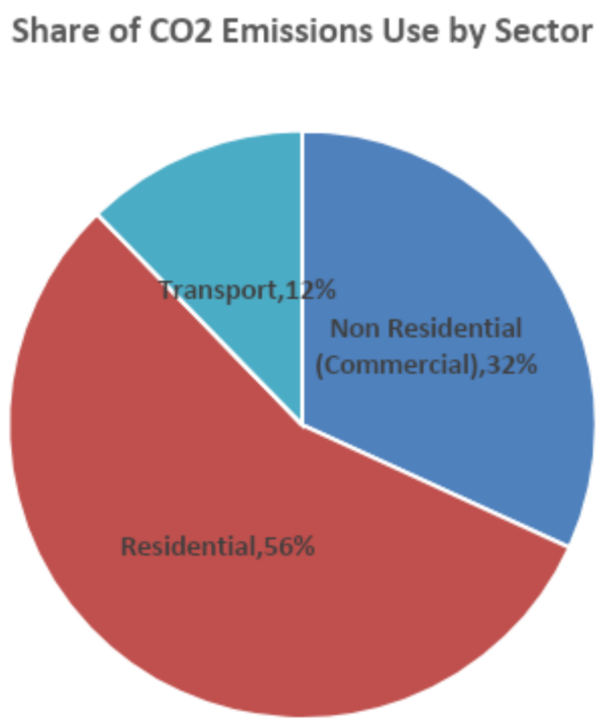


Figure 29: Share of CO_2 Emissions by Sector

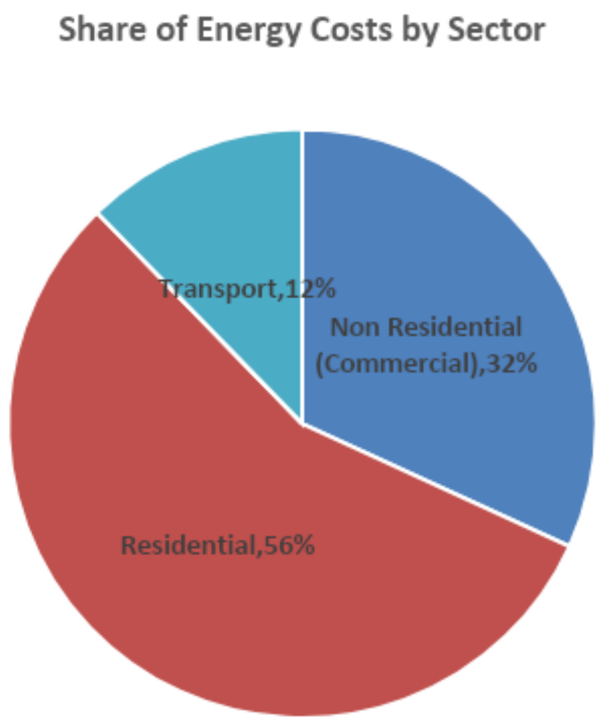


Figure 30: Share of Energy Costs by Sector

4. Sustainable Energy Roadmap

A sustainable energy roadmap in the form of a 3-year action plan for the period 2023-2026 has been developed and is indicated below. This is for further development by the SEC committee as time and expertise evolve.

This Sustainable Energy Roadmap is an important output for Durrow SEC and is additional to the Register of Opportunities.

Focus Areas	TIME	2023	2024		2025		2026
	LEAD	JUL - DEC	JAN - JUN	JUL - DEC	JAN - JUN	JUL - DEC	JAN - JUN
A. SEC Development							
How can the SEC group support the community around local climate action?							
Project A1 - SEC Participation in Existing Community Events	ALL						
Project A2 - RYU Energy Management project with School(s)	ALL						
Project A3 - EV Community Charging Point	PM						
B. Residential Sector							
How can the community enable B2 retrofits for the local housing stock?							
Project B1 - Energy Upgrade / Retrofit pathways information campaign	ALL						
Project B2 - Collect candidates and coordinate for one stop shop	ALL						
Project B3 - Local Retrofit Supply Chain	ALL						
C. Commercial Sector							
How can the community enable business owners to meet carbon reduction targets?							
Project C1 - Communicate supports & benefits	ALL						
Project C2 - Showcase completed examples	ALL						
Project C3 - Connect with other SEC's	ALL						
D. Public Sector							
How can the community have a say in the climate actions planned by the council to meet 2030 targets?							
Project D1 - Community Council means of collaboration							
Project D2 - Lighting upgrades							
Project D3 - Other							

Figure 31: Action plan to 2026

The focus areas in the 3 year action plan are designed to support the project pipeline as identified in the table below. Details of these projects are contained in the Register of Opportunities. More information on how to develop these projects is given in section 6 Project Development Strategy.

Table 17: Projects required to deliver on targets to 2030

Roadmap Plan to 2030			
	Number of projects	Primary Energy saving (kWh)	CO_2 saving (tonnes)
No. houses to be refurbished to a B2	852	25,413,170	3,410
Potential from commercial sector	152	4,940,000	1,337
Potential from Public Sector	0	**0**	**0**
Potential from Community Sector	0	0	0
Renewable Energy potential	526	3,049,724	518
EV potential	740	9,009,300	1,300
Total saving potential	**2,084**	**42,412,194**	**6,565**

The above table provides an informed perspective on the scale of the challenge faced By Durrow SEC in order to achieve the 2030 reduction targets. The SEC cannot deliver these targets on their own – finance and logistics are key to the delivery of successful projects – however the one stop shop (as below) and the SEAI community grant schemes for businesses offer a framework that will evolve to support communities meet the 2030 targets.

A new PV grant for businesses was also announced with funding up to €162,000 of large scale systems.

There are a minimum number of residential projects necessary to achieve the B2 BER 2030 target. The One Stop Shop (OSS) model provides a financial and logistical solution to some homeowners who don't have the capacity to manage a grant application on their own. The degree of upgrade and level of retrofit will largely depend on the BER received and this too will determine the retrofit pathway to be selected. The indicative number of upgrades identified in the residential sector are shown on Table 20 below.

Table 18: Numbers of Homes requiring some form of intervention to get to a B2 or better.

No of Houses	Upgrade Measure
Attic Insulation	852
Heat Pump and heating controls	852
Walls pumped/drylined	850
Windows and doors	850
Ventilation and airtightness	794
Total Projects	4,198

The role of the SEC is to collect details of those residents motivated to undertake an energy upgrade and to support them in their application for grant aid support. A lead in period of 18 months for an OSS project may present an opportunity for the SEC to identify behavioural based energy efficiency projects which would be appropriate for the residents and that would be appropriate within the community.

The analysis of CSO data indicated there are 46 people on some form of disability allowance, and a further 303 retired. It is possible that some of these families would qualify for the "Fully Funded Energy Upgrades" (formerly the Warmer Homes Scheme). Durrow SEC should work with the relevant agencies to identify the families and provide information and support to these families. This should be prioritised as these are likely to be the most vulnerable and potentially in fuel poverty as a result of the current high energy prices.

4.1. Renewable Energy Potential

Renewable energy in Ireland comes in many forms. The primary sources are wood, water, wind, wave and some wastes. Others include tidal power, solar power (thermal and Photovoltaic (PV)), biomass and biofuels.

Electrically driven heat pumps are also considered renewable because, while they require energy to operate, they extract and produce more than they use from the air, water or the ground which is deemed to have been heated by the sun.

The 2021 Climate Action Plan being implemented by the Government includes an average 7% annual reduction in greenhouse gas emissions over the years 2021-2030, which equates to a reduction of 51% by 2030. Government has also set a target to achieve a 80% of supply of renewable electricity on the grid by 2030. All homeowners and businesses can retrofit solar PV onto their premises/buildings.

The renewable energy options open to the Durrow SEC include the following:

Table 19: Renewable Energy Potential

Local Renewable Energy suitability				
Technology	**Scale range (kW, MW)**	**Target application**	**Suitability (RYG rating)**	**Rationale**
Wind	1MW	Some large-scale wind farms within the SEC boundary, potential to develop a community scale project may be possible	Medium potential	Some turbines are located in the target area as terrain is suitable to capture the resource. No large industry to benefit from auto generating. New Renewable Energy Support Scheme 3(RESS 3) to be launched shortly.
Solar PV	2kWp in 50% of residences 10kWp in 50% of businesses	Roof integrated	High potential	Some already installed, savings based on 2kWP per 50% of dwellings and 3kWP in 50% of non-residential premises.
Hydro		Refurbishment of old hydro power site	Low potential	Cost of development may be prohibitive, planning permission
Biomass	Largely Privately owned forests with some state owned	NA	Low potential	No large industry/public/commercial scale facilities to present commercial opportunity.

Biogas	0	Potential for biomethane raw material supplies to centralised biomethane plant supplying large businesses in Laois.	Medium potential in the target area	Bord na Móna applied to Laois County Council for planning permission to develop a renewable gas facility at Cúil na Móna Bog. The proposed facility is designed to treat 80,000 tonnes per annum of biodegradable and organic waste material through an anaerobic digestion process to produce a renewable gas for injection into the local natural gas network. This proposed development is aligned with and will significantly contribute to achieving the targets and objectives set out in National and Regional policy by contributing to the development of a low carbon economy, achievement of renewable energy targets and the provision of much needed waste treatment capacity for the management of biodegradable waste.[20]

4.1.1. Residential Photovoltaic (PV) Electricity Generation

PV probably offers the biggest potential for renewable energy generation into the Durrow Energy SEC. The Solar PV electricity generated could offset some of the imported grid electrical energy used in dwellings mainly during summer months.

Using renewable electricity generation would be particularly important if dwellings are undergoing a retrofit with electric heat pumps being the preferred source of heating. Also, if residents are to switch from hydrocarbon fuelled internal combustion engine (ICE) cars to full battery electric vehicles (BEV).

Combined with additional hot water storage, this might allow some flexibility to "store" the excess electricity for periods when excess electricity is available outside the normal demand periods. Residents could install a 'diverter switch' which diverts any unused electricity to heat hot water in the storage cylinder. In this way some of the energy generated is stored as hot water, which can be used later in the day. As the penetration of wind energy and solar farms producing electricity on the grid increases nationally then "Storage Systems" will become an increasingly important feature in this scenario.

Currently any excess electricity that is exported/spilled to the grid will generate no income, but this situation is evolving with feed in tariffs being available from certain suppliers.

The simplest way to use a higher percentage of the electricity generated is to design the PV system to meet the electricity demand of the house. This means the value of electricity produced will offset a large proportion of the electricity used with little or no export and therefore saving at your current kWh charge. It should be noted that electricity has to be used when it is generated otherwise it will be spilled into the grid.

[20] https://consult.laois.ie/en/consultation/draft-laois-county-development-plan-2021-2027/chapter/chapter-9-rural-laois#:~:text=9.2%20Agriculture,14.7%25%20is%20associated%20with%20forestry.

Many dwellings in the target area have roof spaces with the orientation to accommodate PV panels. Ideally the roof should be south facing or east/west but the latter not as effective as the south facing systems. The potential for solar electric generation is based on 50% of the detached/semi-detached houses to have a southerly orientation with 2kWp installed and also 50% of the business and public sector facilities utilising 3kWp.

- Assuming that 2kWp[21] installed and so will generate approximately kWh for 370 dwellings.
- Assuming that 10kWP installed for the non-residential facilities, then kWh will be generated.
- Value of electricity saved is €638,466.
- Potential CO2 savings of 471 tonnes per annum.
- Overall cost of install is estimated at €2,000,000, simple payback of just over 3 years.

Table 20: PV savings

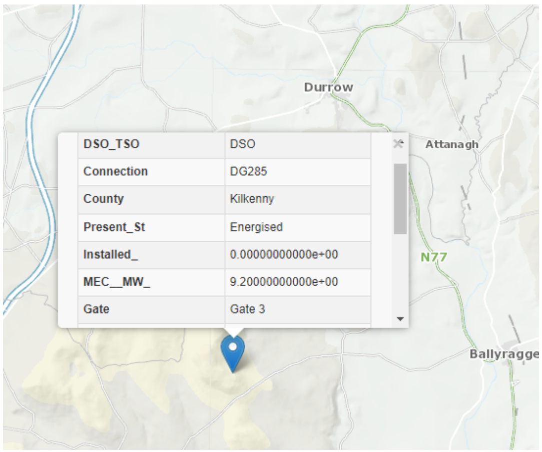
PV					
	Total Facilities	**Modelled facilities**	**kWp**	**kWh**	**€@40ct/kWh**
Residential	902	450	900	826,650	€330,660
Commercial	152	76	760	698,212	€279,284
Public					
Total kWp			1,660		

4.1.2. Wind Electricity Generation

Wind Farms have an obligation to provide community funds within their local area

An 'Area of Benefit' or AOB is a radius of up to 10km around a wind farm, which is set to ensure that communities directly neighbouring wind farms benefit most from the funds. Applications from within the AOB will receive priority.

The diagram below illustrates wind farms near the SEC. This farm is inside the 10km distance from the SEC so they should seek to avail of the Community Benefit Fund.



[21] According to SEAI a simple 2kWp system or less is appropriate for most Irish homes.

Figure 32: Wind Farms and SEC Area of Benefit[22]

The funds are available to not-for-profit community and voluntary organisations for projects which are based in the vicinity of one of our wind farms. These include, but are not limited to;

- Registered charities.
- Community development groups.
- Tidy town committees.
- Sports, and recreation clubs.
- Primary, and secondary schools.

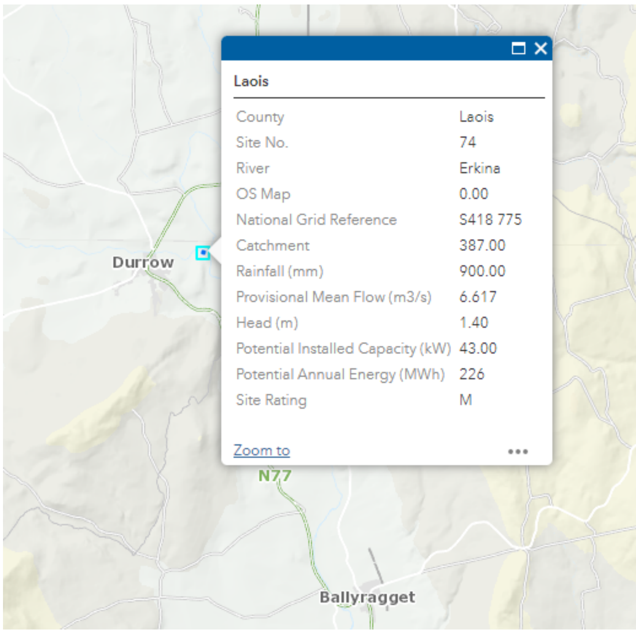
The funds support projects which focus on the following themes:

- Education and skills
- Health, safety and well-being
- Environment and habitat conservation
- Energy efficiency and sustainability
- Culture and heritage
- Recreation, sport and social inclusion
- Tourism

Details on how to apply are available https://windfarmcommunityfunds.ie/application-form/

4.1.3. Hydro Power Electricity

There is one potential hydro site within the SEC area, located on the Erkina river, this site has a head of 1.4 metres and generation capacity of 43kW and annual output potential of 226,000 kWh. It would seem to be on the site of an old mill.



22 https://data.gov.ie/dataset/wind-farms-in-ireland/resource/f7e87ec6-6dd9-463c-9580-9c61e9672a82/view/90c947cd-1b34-489e-ab08-cae461f95f6a

Figure 33: Hydro power in SEC Area of Benefit[23]

4.1.4. Bio Energy

Bioenergy is a broad term which encapsulates a diverse range of technologies and feedstocks. There is potential for the Durrow SEC to form partnerships with other SEC's in the area and to participate in the development of a biogas network for the benefit of local farms, businesses and residents

Bord na Móna applied to Laois County Council for planning permission to develop a renewable gas facility at Cúil na Móna Bog. The proposed facility is designed to treat 80,000 tonnes per annum of biodegradable and organic waste material through an anaerobic digestion process to produce a renewable gas for injection into the local natural gas network. This proposed development is aligned with and will significantly contribute to achieving the targets and objectives set out in National and Regional policy by contributing to the development of a low carbon economy, achievement of renewable energy targets and the provision of much needed waste treatment capacity for the management of biodegradable waste.

4.1.5. Grid Connection for Community Renewable Energy Projects

In order for future community owned solar installations to be viable, a local connection to the electricity grid is required. For solar production of 0.5 – 1 MW the MV Network is suitable and the capacity locally is as shown below.

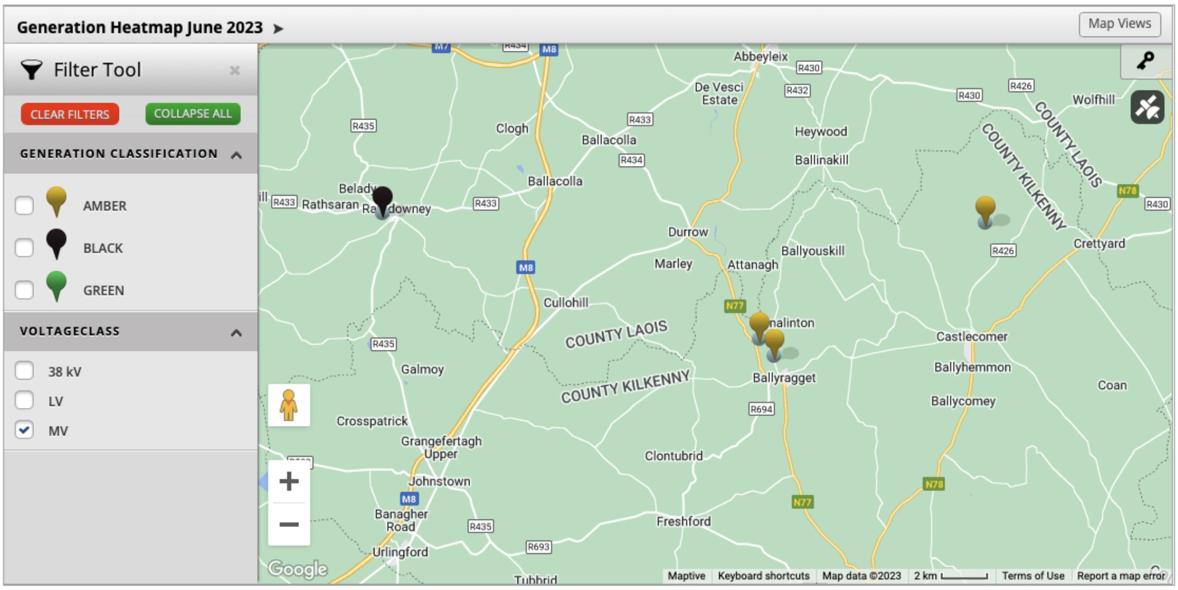


Figure 34 Durrow SEC MV Connection – ESB Networks Availability

For solar production of 1 – 5 MW, the 38KV Network is suitable. There is capacity available. However the distance is further and thus the costs of connection will be increased as shown below.

[23] https://www.seai.ie/technologies/seai-maps/hydro-power-map/

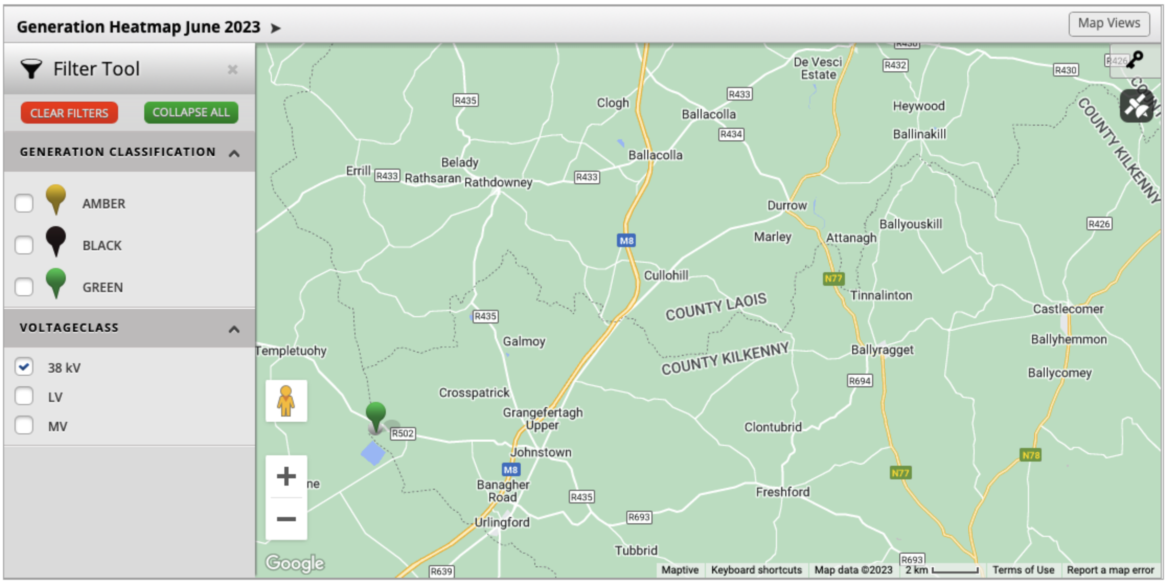


Figure 35 Durrow SEC 38KV Connection – ESB Networks Availability

Generation Classification: 38kV and MV

GREEN   Greater than 15 MVA

AMBER   Between 0 and 15MVA

BLACK   No capacity available

5. Register of Opportunities

6. Purpose of this register

The Register of Opportunities (RoO) is intended to provide the data and information necessary for Durrow SEC to develop a 3-year sustainable energy roadmap for their local community.

This roadmap will identify the opportunities that have potential for application to the SEAI Community Energy Grant programme or other grant aid such as the Community Centres Investment Fund from the Department of Rural and Community Development.

The RoO enables energy efficiency and renewable energy projects to be prioritised, as it provides preliminary capital costs and expected energy savings.

The Durrow SEC ROO will be developed using the SEAI template and made available as an Microsoft Excel workbook. It is intended that this workbook is developed over time and considered as being a "live" document.

The Register of Opportunities will focus on projects that have the greatest potential from the residential and non-residential building audits completed as part of the EMP process.

7. Non-Residential Opportunities

7.1. Scope

The Register of Opportunities has focused on participants that have the greatest potential for projects. These opportunities were identified during the non-residential building audits undertaken as part of the EMP process.

The participants are listed below. These locations are well known to the Durrow SEC committee and existing relationships should be developed to start addressing the climate emergency.

The Level 1 energy audits of the four SMEs have identified potential annual savings of €12,470 (102,607 kWh), which equals 37 tonnes of CO_2 emissions; detail is provided in the register of opportunities.

The main area that should be given priority in short to medium term is as follows;

- Upgrade all lighting to LED
- Installing PV panels
- Upgrade all heating controls
- Organise staff awareness meetings
- Monitor energy use.

Actions which should be considered in the longer term are as follows;

- Deep retrofit of building insulation fabric
- Installing Heat Pumps
- District Heating - The District Heating Steering Group was formed as part of the Government's commitment to further expanding district heating in the State. The Steering Group coordinates the rollout of policies and measures to support district heating in Ireland. Durrow SEC should consider undertaking a study on installing a renewable district heating scheme. Many buildings are old, and bringing them to a building fabric standard suitable for heat pumps will be very costly. A district heating scheme could offer a viable option and offer the potential for a centralised renewable heating system for Durrow to become a carbon-neutral area. Further information can be found on the following links.

https://www.seai.ie/blog/developing-district-heati/

https://www.dublincity.ie/residential/environment/dublin-district-heating-system/reports-district-heating-dublin

Table 21: Non-Residential Opportunities

Ref	Opportunity	Estimated Annual Savings				Cost Range	Financial	
		Fuel Type	[kWh]	[€]	[kgCO2]		Capital Cost	Simple Payback
	Happy Days Creche							
1	Staff awareness programme	Other	4,990	€0	1,721.6	No / Low	€0	Instant
2	PV panels	Electricity	6,328	€1,202	2,183.2	No / Low	€9,600	7.99
3	Space heating	Oil	1,918	€166	504.4	No / Low	€500	3.01
4	Heating Controls	Oil	6,716	€580	1,766.3	Medium	€2,000	
	Lawler's Gala Shop							
5	6kWp PV	Electricity	6,307	€1,900	2,200.0	Medium	€9,600	5.05
6	Staff awareness programme	Electricity	1,757	€531	600.0	Medium	€0	Instant
	Castle Arms Hotel							
7	Staff awareness programme	Oil	10,254	€3,333	4,000.0	Medium	€12,000	3.60
8	Pipe insulation	Oil	3,143	€195	898.9	No / Low	€600	3.08
9	Building insulation upgrades	Other	17,597	€1,100	5,032.7	No / Low	€10,000	9.09
	Bowes Food Hall							
10	Staff awareness programme	Other	8,461	€1,565	3,000.0	No / Low	€0	0.00
11	PV 6kWP (Could go up to 10kWp)	Electricity	6,328	€1,200	2,200.0	Medium	€9,600	8.00
12	Space heating upgrade	Oil	1,918	€166	504.4	High	€500	0.17
13	Heating controls	oil	6,716	€580	1,766.3	Medium	€2,000	3.45

Note 1: The high differential unit cost between heating oil and electricity impacts the viability of installing heat pumps, and there is usually also the additional cost of building fabric upgrades. Heat Pump installations need a more detailed investigation and consider the building fabric's condition, the increase in the MIC, and the need for companies to decarbonise.

Note 2: The capital costs listed in Table 22 are indicative only and are best estimates based on the author's experience. For more detailed costing, equipment suppliers should be contacted. It is recommended that equipment monitoring is undertaken before any decisions are made on capital expenditure on energy-saving projects.

Note 3: Savings shown are based on individual actions and don't consider their interactive effect.

Note 4. Energy Cost has increased significantly recently, so payback will have improved. Still, knowing how long the increase will continue is impossible to say, so the payback periods can be deemed conservative.

SEAI has several grant schemes to help support organisations, as follows;

1. Clean Energy Grants https://www.seai.ie/grants/community-grants/
2. PV Microgeneration grant https://www.seai.ie/business-and-public-sector/business-grants-and-supports/commercial-solar-pv/
3. EXEED http://www.seai.ie/publications/EXEED-Grant-Guidelines.pdf
4. Renewable Heat Programme/ Heat Pumps & Biomass Boiler. https://www.seai.ie/business-and-public-sector/business-grants-and-supports/support-scheme-renewable-heat/
5. Non domestic microgeneration grant: https://www.seai.ie/business-and-public-sector/business-grants-and-supports/commercial-solar-pv/
6. Electric vehicle Grants https://www.seai.ie/grants/electric-vehicle-grants/

Also, the Energy Efficient Obligation Scheme (EEOS) supports the business through the leading energy supplier. Further detail can be found on the following link;

https://www.seai.ie/business-and-public-sector/business-grants-and-supports/energy-efficiency-obligation-scheme

7.1.1. Non-Residential Headline Opportunities

- Potential reduction in annual energy use 4,939,080 kWh
- Potential reduction in annual energy costs €602,262
- Potential reduction in CO_2 emissions Tonnes 1,337
- Capital cost of investment €3.6 million
- Payback periods 6 years
- Additional renewable energy savings using PV for electricity generation 431,388 kWh
- Additional renewable energy cost savings using PV for electricity generation €172,555
- Capital investment €0.50 million
- Payback period with new grant[24] < 5 years

7.1.2. Next Steps

- Identify potential beneficiaries for the Clean Energy Grants Funded Energy Efficiency Upgrade programme
- Consider project grouping to encourage price reductions and savings for participants
- Work with one of the obligated energy suppliers[25] or aggregators
- Communicate the availability and impact of grants
- Finalise 3-year plan

7.2. Residential Opportunities

7.2.1. Scope

The Register of Opportunities has focused on how the Durrow SEC and projects will contribute to the Government target of 500,000 homes retrofitted to B2.

- 666 dwellings will require deep retrofit which includes heat pump upgrades and PV
- 252 homes will require shallow retrofits which will also include some insulation/airtightness improvements and could also include heat pumps and PV

7.2.2. Residential Headline Opportunities

- Potential reduction in annual energy use 25,413,170 kWh
- Potential reduction in annual energy costs €2,528,230
- Potential reduction in CO_2 emissions tonnes 3,410
- Capital cost of investment €35 million

[24] https://www.seai.ie/business-and-public-sector/business-grants-and-supports/commercial-solar-pv/

[25] https://www.seai.ie/business-and-public-sector/business-grants-and-supports/energy-efficiency-obligation-scheme/

7.2.3. Next Steps

- Communicate the availability and impact of grants
- Residential Workshop with Questionnaire Respondents
- Finalise 3 year plan

7.3. Transport Opportunities

There are 1,247 cars in use in the community emitting over 2,500 tonnes of CO_2. In order to deliver on the Climate Action Plan targets of a 51% reduction then 500 diesel cars and 240 petrol cars would need to be replaced with Battery Electric vehicles (BEVs).

There are currently no public charging points visible on the Ecars charge point map in either Durrow or locality[26]. The nearest location is on the M7 and M8, 13 km away.

Next Steps

- Consult with relevant authorities to have a number of public charge points installed.
- Identify grant funding opportunities and apply for same
- Promote the use of BEVs at various events

[26] https://esbecars.esb.ie/ecars/charge-point-map

8. Project development strategy

For Durrow SEC to be able to develop projects within their local area, we suggest that three requirements need to be in place; -

- Having a targeted and resourced action plan, against which progress can be tracked
- Having a team of people meeting regularly
- Partnerships for collaboration

These requirements are discussed below.

8.1. Action Plan 2023-2026

Options for local project developments exist within the public, residential and commercial sectors of the Durrow SEC.

These can be summarised as follows:-

- SEC Development
  - Engagement with existing community events, such as summer fetes will help promote the work of the SEC in the local area. Supporting schools around energy measurement help build awareness of the role of the SEC in the local community.
  - Other focused opportunities can include;
    - Development of EV community charging point
    - Solar PV Installation Collective
    - Solar PV support for the Farming Community
- Residential Sector
  - The SEC can create awareness in the local population of what is involved in a home energy upgrade, thus creating a project pipeline for one stop shops and/or other financial or logistical solutions.
- Commercial Sector
  - The SEC can enable local businesses to come together as a group to promote energy efficiency – all energy savings go straight to the bottom line.
- Public Sector
  - Engagement with Laois County Council may prove to be mutually beneficial in relation to climate actions.

The action plan as shown below is divided into 6 monthly intervals. This allows for short- and long-term tracking of progress. The action plan should be evaluated twice a year and successes celebrated.

Focus Areas	TIME LEAD	2023 JUL - DEC	2024 JAN - JUN	2024 JUL - DEC	2025 JAN - JUN	2025 JUL - DEC	2026 JAN - JUN
A. SEC Development							
How can the SEC group support the community around local climate action?							
Project A1 - SEC Participation in Existing Community Events	ALL						
Project A2 - RYU Energy Management project with School(s)	ALL						
Project A3 - EV Community Charging Point	PM						
B. Residential Sector							
How can the community enable B2 retrofits for the local housing stock?							
Project B1 - Energy Upgrade / Retrofit pathways information campaign	ALL						
Project B2 - Collect candidates and coordinate for one stop shop	ALL						
Project B3 - Local Retrofit Supply Chain	ALL						
C. Commercial Sector							
How can the community enable business owners to meet carbon reduction targets?							
Project C1 - Communicate supports & benefits	ALL						
Project C2 - Showcase completed examples	ALL						
Project C3 - Connect with other SEC's	ALL						
D. Public Sector							
How can the community have a say in the climate actions planned by the council to meet 2030 targets?							
Project D1 - Community Council means of collaboration							
Project D2 - Lighting upgrades							
Project D3 - Other							

Figure 36: Action Plan Focus Areas

8.2. SEC Capacity Development

To develop projects in the SEC requires a mix of technical and local knowledge. A key focus of the Durrow SEC is to develop residential projects. To this end, it may be helpful for additional specialists and community representatives to join the SEC committee. Additional capacity of knowledge and expertise in home energy upgrades, may support the SEC in the delivery of their 2023-26 action plan. In addition, a series of energy upgrade pathways are contained in the appendix to this document

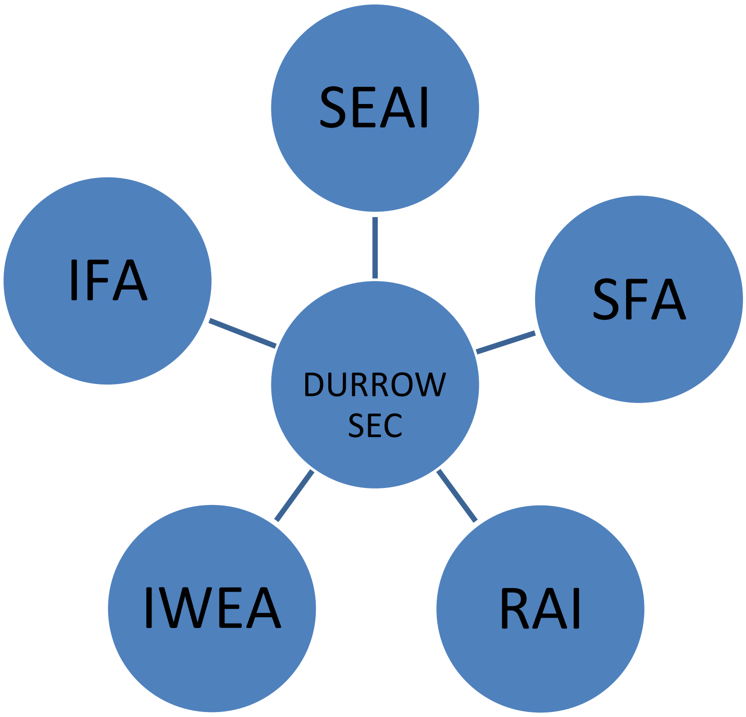


Figure 37: SEC Team

Key requirements that the SEC team need to have the capacity to deliver on are

- Knowledge of currently available grants and support schemes
- Raising awareness
- Coordinating small groups
- Building partnerships

The capacity of the Durrow SEC team can be regularly evaluated and developed using the SEAI Competency Compass tool as shown below.

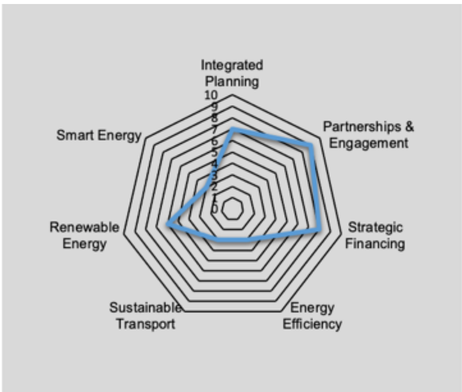


Figure 38: SEAI Competency Compass

8.3. Partnerships for Collaboration

For SEC Grant projects, key partnerships are vital. For Durrow SEC these partnerships may include

- One Stop Shop
- Project Coordinator
- Energy Agencies
- EEOS Participating Energy Supplier

Initial discussions between the SEC team and a One Stop Shop / Project coordinator have proved insightful and informative for other communities.

9. Appendix

9.1. Energy Upgrade Pathways

These Energy Upgrade Pathway documents provide logistical and financial guidance to motivated homeowners and can be used as part of the project development strategy.

9.1.1. Residential Audits

These Energy Upgrade Pathway documents provide logistical and financial guidance to motivated homeowners and can be used as part of the project

9.1.1.1. Homeowner A

House Type: Detached

Location: Durrow, Co. Laois

Year of Construction: Pre 1900

Floor Area (m^2): 237

Current Rating: D1 -

Target Rating: - A3/A2 –

Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	**D1**
1	Roof Insulation	Loft insulation top-up to achieve 300mm- 400mm across all roof areas.	€2,700	**D1**
2	Wall Insulation	Internal dry lining	€22,500	**C1**
4	Heating System	Heating controls and boiler upgrade**	€5,000	**B3**
5	Ventilation	Improved sealing and airtightness measures	€2,100	**B1**
6	Lighting	LED lighting	€150	**B1**
7	Heat Pump		€16,900	**A3**
8	Solar PV (2kWp)		€8,000	**A2/A1**
	Total Cost		€57,350	

	Grant		**€18,250**	
	NET COST		**39,100**	

*Individual grants assumed

- Attic €1,350
- Drylining €8,000
- Heat pump €6,500
- 2kWp PV €2,400

<u>Heat Loss Indicator (HLI)</u>

2.0, this value should be less than 2.0 to qualify for the heat pump grant, upgrading attic, wall insulation and windows will easily push house below the 2.0.

<u>Building Regulations</u>

The assumption is made that the house was built to 2005 building regulation standards, however the prevailing regulations would be those in place when planning permission was obtained and so the regulations in place could be the 1998/2000 standards. If this is the case then the HL will be much lower and so inclusion of upgraded windows will be necessary to achieve the relevant HLI target.

9.1.1.2. Homeowner B

House Type: Semi-Detached

Location: Durrow, Co. Laois

Year of Construction: 1980

Floor Area (m²): 120

Current Rating: -C3 -

Target Rating: - A3/A2 –

Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	C3
1	Wall Insulation	Pump Cavities in older sections	€3,000	B3
2	Heating System	Heat Pump, radiator and controls upgrade	€16,500	B2
3	PV System	3kWp	€7,000	A3
	Total Cost		€26,500	
	SEAI Grant		-€12,200	
	Net Project Cost		**€14,300**	

*Individual grants assumed

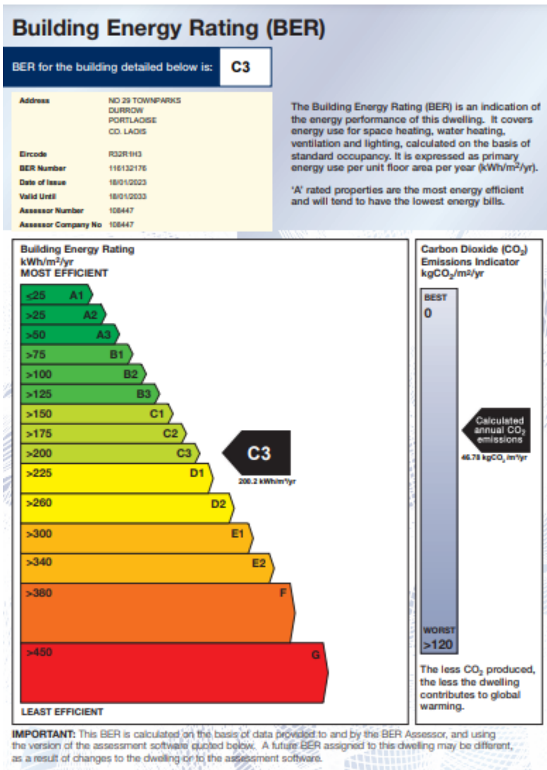
- Attic €1,500
- Cavity wall €1,700
- Heat pump €6,500
- 3kWp PV €1,920

BER

This house has a BER and indicates a rating of C3 and HLi of 2.4. Pumping the attic and installing heating controls should easily push this house to a B3 which would mean it would have a HLI of about 2 and so qualify for a heat pump grant.

Heat Loss Indicator (HLI)

2.0, this value should be 2.0 or less to qualify for the heat pump grant, upgrading wall insulation and windows, heating controls will easily push house below the 2.0 as it is already at the target.



Dwelling Dimensions	Area (m2)	Average Height (m)	Building Elements	Area (m2)	Results	Heat Loss (W/K)
Storey 1	83.30	2.20	Floors	41.65	Windows	45.752
Storey 2			Roofs	68.40	Plane Elements	128.326
Storey 3	35.00	1.80	Walls	56.03	Fabric	156.720
Other Storeys			Doors	5.05	Total Heat Loss	238.931
Room In Roof			Windows	18.17	HLI (W/K/m2)	2.020
Total Dwelling Area			Total Element Area	189.30	Adjusted Infiltration Rate (ac/h)	1.012
Living Room Area	20.00					
Living Room %	16.91					

9.1.1.3. Homeowner C

House Type: Detached

Location: Durrow, Co. Laois

Year of Construction: 2000

Floor Area (m²): 225

Current Rating: **- B3-**

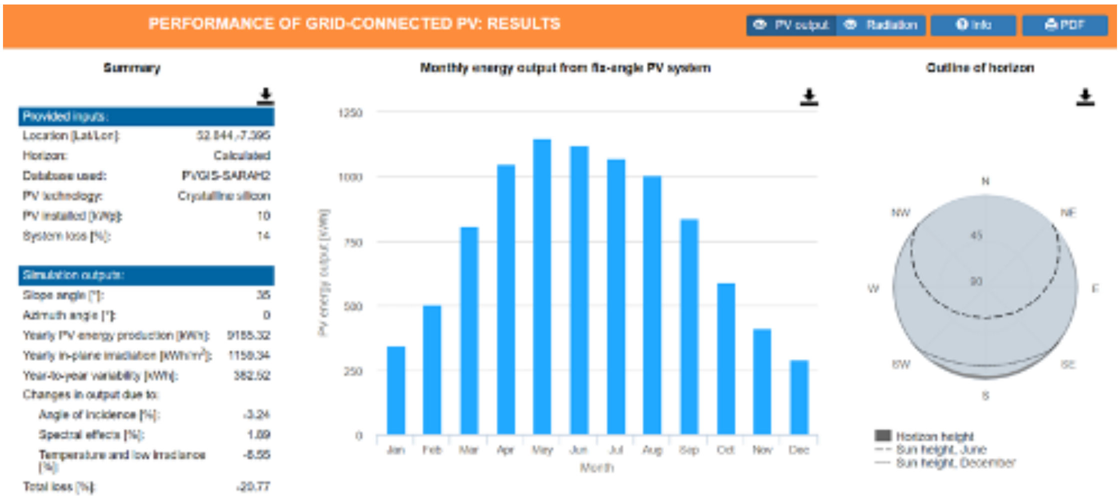
Target Rating:

Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	**B3**
1	PV Panels	10kWP PV	€15,000	**A3**
2	Attic Insulation	Increasing the attic insulation to 300mm	€2,500	**A2**
	Total Cost		€17,500	
	Grant		-€3,900	
	NET COST		**€13,600**	

The house currently has a B3 rating of 143.7 kWh/m2

Measures recommended which will improve the rating to an A2 include:

- Install closed appliance to existing open fire, this could be a stove or fire front. A designated air supply for this appliance should also be provided.
- Adding 10kWP of Photovoltaic panels would deliver 9,185kWh of electricity which would give a reduction of about 81.6kWh of primary energy. This would reduce down the present B3 rating of 143.76 kWh/m^2 to an A3 62 kWh/m^2.
- 150mm of attic insulation could be upgraded to 300mm thereby improving the u-value from 0.26 watts/m^2/^{O}K to 0.13 watts/m^2/^{O}K would bring it to an A2 rating



9.1.1.4. Homeowner D

House Type: Detached

Location: Durrow, Co. Laois

Year of Construction: 1985

Floor Area (m²): 130

Current Rating: C3 -

Target Rating: - A3/A2 –

Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	**C3**
1	Roof Insulation	Loft insulation top-up to achieve 300mm- 400mm across all roof area.	€1,500	**C3**
2	Wall Insulation	Pump cavity	€3,000	**C2**
3	Upgrade windows and doors	Triple glazing	€20,000	**C1**
3	Heatpump	Air source heat pump with heating controls	€16,400	**B1**
4	PV System	3kWp	€9,000	**A2/A3**
	Total Cost		**€49,900**	
	SEAI Grant		-€12,100	
	Net Project Cost		**€37,800**	

*Individual grants assumed

- Attic €1,350
- Drylining €8,000
- Heat pump €6,500
- 2kWp PV €2,400

Heat Loss Indicator (HLI)

2.5, this value should be less than 2.0 to qualify for the heat pump grant, upgrading attic, wall insulation and windows will easily push house below the 2.0.

Building Regulations

The assumption is made that the house was built to 1985 building regulation standards. Lots of upgrades to floors and heating system have been completed and controls to heating and hot water. A new highly insulated cylinder has also been installed.

BER C3

kWh/m2/yr

kgCO2/m2/yr

Dwelling Dimensions	Area (m2)	Average Height (m)
Storey 1	130.00	2.30
Storey 2		
Storey 3		
Other Storeys		
Room In Roof		
Total Dwelling Area		
Living Room Area	50.00	
Living Room %	38.46	

Building Elements	Area (m2)
Floors	130.00
Roofs	132.00
Walls	44.62
Doors	5.13
Windows	36.11
Total Element Area	347.86

Results	Heat Loss (W/K)
Windows	73.017
Plane Elements	203.628
Fabric	255.807
Total Heat Loss	324.859
HLI (W/K/m2)	2.499
Adjusted Infiltration Rate (ac/h)	0.632

9.1.1.5. Homeowner E

House Type: Detached

Location: Durrow, Co. Laois

Year of Construction: 2000

Floor Area (m²): 225

Current Rating: **- B3-**

Target Rating: **- A2 -**

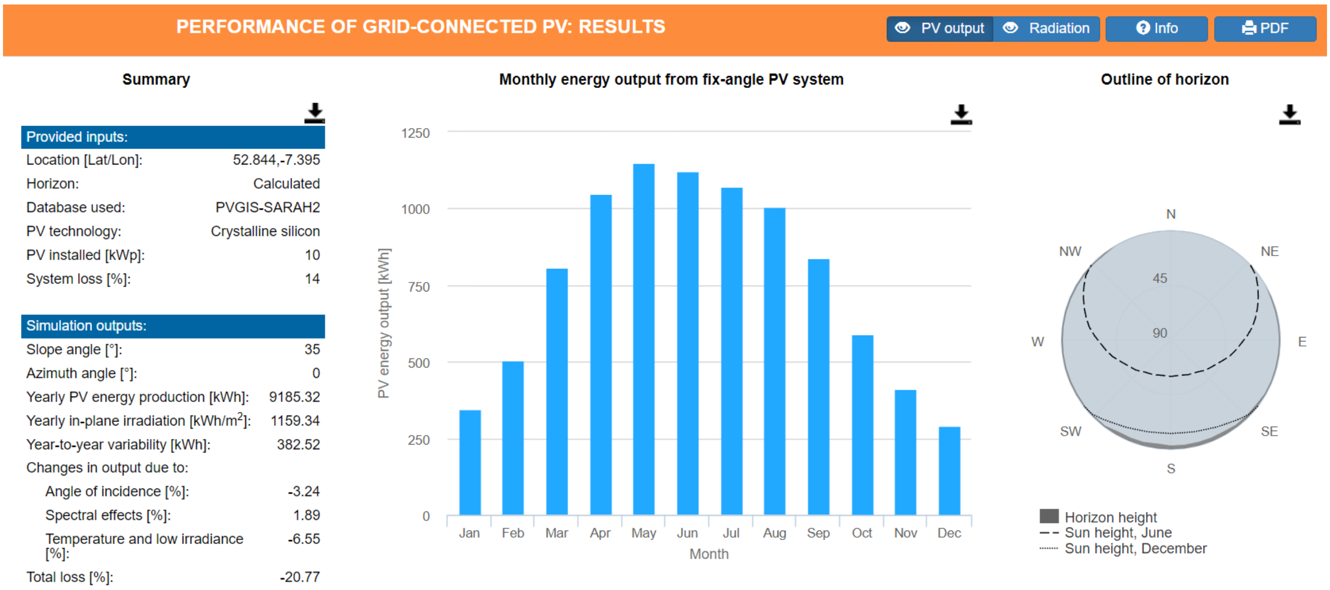
Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	**B3**
1	PV Panels	10kWP PV	€15,000	**A3**
2	Attic Insulation	Increasing the attic insulation to 300mm	€2,500	**A2**
	Total Cost		€17,500	
	Grant		-€3,900	
	NET COST		**€13,600**	

The house currently has a B3 rating of 143.7 kWh/m2

Measures recommended which will improve the rating to an A2 include:

- Install closed appliance to existing open fire, this could be a stove or fire front. A designated air supply for this appliance should also be provided.

- Adding 10kWP of Photovoltaic panels would deliver 9,185kWh of electricity which would give a reduction of about 81.6kWh of primary energy. This would reduce down the present B3 rating of 143.76 kWh/m^2 to an A3 62 kWh/m^2.
- 150mm of attic insulation could be upgraded to 300mm thereby improving the u-value from 0.26 watts/m^2/^{O}K to 0.13 watts/m^2/^{O}K would bring it to an A2 rating



Photovoltaic electricity generation model

9.1.1.6. Homeowner F

House Type: Detached

Location: Durrow, Co. Laois

Year of Construction: 2000

Floor Area (m^2): 168

Current Rating: **- B1-**

Target Rating: **- A1 -**

Domestic Retrofit Upgrades (Step by Step)				
Energy Efficiency Measure			***Cost***	***BER Impact***
0	No upgrades		€0	**B1**
1	Heating system upgrade	Heat pump with integrated heating controls	€15,000	**A2**

2	Windows	Energy efficient windows with U-value of 1.4 w/m2/OK or less	€15,000	A1
	Total Cost		€30,000	
	Grant		€6,500*	
	NET COST		**€13,600**	

*NO grant for windows as you must achieve an uplift of 100kWh/m2 on the BER to avail of a One Stop Shop grant which would cover windows.

The house currently has a B1 rating of 76.68 kWh/m^2 and a heat loss indicator (HLI) of 1.626 (K-m^2). As this value is less than 2 then it is deemed heat pump ready by SEAI and so could avail of a €6,500 grant to install a heat pump.

Measures recommended which will improve the rating to an A1 include:

- Install a heat pump
- Install energy efficient glazing

The **BER does not point out that a very poor level of heating controls** exist in this house. Fitting wireless zone controls along with programmable thermostats would help to improve performance and reduce oil use on existing system if the heat pump upgrade is not availed off.

Electricity use seems high even with the PV system installed, it is suggested to install a EDDIE to divert PV generated electricity into the hot water cylinder to reduce costs.

9.1.2. Commercial Sector Audits

9.1.2.1. Happy Days Crèche

Address: Happy Days Crèche, The Square Durrow Town park, Laois.,

Happy Days Creech provides daycare facilities through playgroup, Montessori, full-day care and after-school services. It operates from 8 am to 6 pm, Monday to Friday, for 50 weeks of the year. The original building dates back 150 years, with an extension added in the last 10 years and a plan for a new extension.

9.1.2.1.1. Annual Energy Consumption & Cost

The Crèche has an annual energy cost of approximately €5,050, based on the information provided on the annual electricity cost and estimated cost of heating oil. Based on an average unit cost for electricity at 20 c/kWh and 70 c/litre for heating oil, the annual energy consumption is 55,936 kWh, as shown in Table 3 below. The delivery cost of heating oil based on the thermal efficiency of 80% is 2.43

times lower than electricity. The invoice period does not consider recent changes in energy cost, where in some cases, the unit cost of electricity has increased to as high as 40 c/kWh.

Table 22 Annual Energy Electricity Consumption & Cost

Energy Type	Usage kWh	%	€	%	Delivery Cost c/kWh	Useful Cost c/kWh
Electricity	10,250	18%	2,050	41%	20.00	20.00
Heating Fuel	45,686	82%	3,000	59%	6.57	8.21
Total	**55,936**	**100%**	**5,050**	**100%**		

9.1.2.1.2. Brief Overview of Heating System

Heating is provided by a two oil-fired boiler as follows;

- Original Building Boiler No. 1 rating 23 kW
- Extension Boiler No. 2 rating 21-26 kW

The plan to add a new extension means that boiler no.2 must be removed and relocated. This provided the opportunity to replace this boiler with a heat pump and investigate the possibility of linking the two heating systems to be supplied by a single heat pump.

Although the heat pump will operate at a lower temperature, the flow temperature is reduced in the Crèche for health and safety reasons. However, there still may be a requirement for the insulation level to be improved in the old building. All windows have a double-glazed PVC, and the original and the new extension attic have 300 mm of insulation installed. Still, his has been compressed to allow for flooring in the attic, so this will need to be increased to at least 450 mm of insulation. Ensuring the new extension meets current building regulations should make it suitable for a heat pump, but a more detailed analysis is required for the original building.

Replacing a boiler with a heat pump will require a much more detailed study as there would be a requirement to improve the building fabric insulation levels and possibly a heat recovery ventilation system. Heat pumps operate at a much lower operating temperature, say 40°C, than the existing gas boilers, which operate at 80°C. A simple test could be to operate boiler No.1 with the boiler thermostat setting of 40°C during a very cold period and leave it running longer, i.e. set the time to start the boiler, say 3-4 hours earlier in the morning, to see if it can meet the building heating requirements. Should the building not reach the required temperature level, then a heat pump is not capable of heating the original part of the building. It is recommended that the installation of a heat pump for the new extension and its potential to be extended to the original building should be discussed with the heating system installer. The estimated energy and financial saving of installing a heat pump are outlined below. The financial saving is influenced by the differential cost between electricity and heating oil, which needs to be considered should a heat pump be installed. The simple payback based on the current energy cost is 35 years.

Heat Pump	**Save kWh**	**Save €**	**Save CO2**	**Capital €**	**SPB yr.**
Save	33,503	563	8	20,000	35

9.1.2.1.3. Photo Voltaic (PV) Panels

The southward-facing rear of the building, with no obstructions such as trees, makes it suitable for installing PV panels. The roof area available is approximately 5 m long by 4 meters wide slanting roof, providing an area of up to 20 m^2 for PV. The roof is in good condition, with easy access.

The new SEAI Micro-Generation scheme provides a grant of €2,400 for a complete installation of 6 kWp. Therefore, installing 12 PV (5.16 kWp) panels is calculated to reduce the site imported electricity by 5,424 kWh, a saving of €1,085 based on the average unit cost of electricity at 20 c/kWh. The simple payback is approximately 9 years. Such an installation would reduce the building's carbon footprint by about 1.9 Tonnes of CO_2.

Therefore, this is a project to be considered in the short term. It is suggested that a PV contractor be contacted regarding a quote to install a PV system, including its potential energy output and financial savings.

9.1.2.1.4. Lighting

The lighting combines energy-efficient bulbs and fluorescent-type fittings with a few LEDs. LEDs consume at least 60% less electricity than equivalent fluorescent tubes. Replacing Crèche fluorescent fittings with LEDs offers an excellent potential to reduce costs. The savings, capital costs, and payback period are estimated as follows;

Option	**Save kWh**	**Save €**	**Cost**	**SPB yrs.**
LED	1,218	244	1,400	6

9.1.2.2. Bowes Food Hall & Café

Bowes Food hall & café main building is approximately 150 years old, with a new extension added in the last 10 years. It is open almost all year round from 9 am to 6 pm, Monday to Saturday.

9.1.2.2.1. Annual Energy Consumption & Cost

The annual energy consumption and costs for electricity consumed by the Café are shown in the table below at 233,174 kWh and €36,825, respectively. Electricity accounts for 85% of the total energy cost, with an average unit cost of 18.5 c/kWh. The Maximum Import Capacity (MIC) is 15 kVA. Appendix A calculates the annual electricity used based on Café cost for 181 days and the average use per day and night. Current energy unit costs are higher than those shown in appendix A, so the payback on any project will be shorter. The current climate makes it difficult to predict energy costs.

Table 23 Annual Energy Consumption & Cost

Energy Type	Usage kWh	%	€	%	Delivery Cost c/kWh	Useful Cost c/kWh	Tonne CO_2
Electricity	169,214	73%	31,305	85%	18.5	19.00	59
Heating Oil	63,960	27%	5,520	15%	8.63	10.79	17
Total	**233,174**	100%	**36,825**	100%			**76**

9.1.2.2.2. Brief Overview of Technologies

Electricity is a Café significant energy user, and an approximate breakdown of the annual energy consumption and cost is shown below in table 5.

Table 5 Breakdown of Electricity Use

Area	kWh	Cost	%
Kitchen	118,450	22,505	70%
ACU	14,400	2,736	9%

Refrigeration	13,978	2,656	8%
Lighting	5,057	961	3%
Other	17,329	3,293	10%
Total	**169,214**	**32,151**	**100%**

The main potential to save energy is to ensure equipment is switched off when not required. Most of the equipment is manually controlled, except the refrigeration cold room and freezer. During the site visit, it was suggested that the electricity meter should be read for a week at the following time to get a better understanding of the breakdown when energy is in use, for example;

- Monday 8.00 am & 6 pm
- Tuesday 8.00 am & 6 pm
- Wednesday 8.00 am & 6 pm
- Thursday 8.00 am & 6 pm
- Friday 8.00 am & 6 pm
- Saturday 8.00 am & 6 pm
- Monday 8.00 am

Note; These readings should be taken before the kitchen start-up in the morning.

This will provide the following information;

1. Use during café opening hours
2. Use when the café closed each evening to the following day
3. Use when close on Saturday until the following Monday morning.

This information could be used as part of an energy awareness programme, with a 5% reduction in annual electricity consumption target by staff being more energy aware. This equates to a saving of €1,565 (8,461 kWh) and 3 Tonnes of CO_2. The meter monitoring exercise could be repeated every quarter to check how effective the energy awareness programme is.

Most lighting is LED or energy-efficient bulbs with just a few fluorescent-type fittings, which will eventually replace by LED lighting. Therefore, the potential to reduce light cost is low other than it being part of the energy awareness programme, i.e. Switch off Lights when not required, for example, if the new dining area is not in use, ensure the lights are switched off, and there should be a staff member responsible for this action.

9.1.2.2.3. Photo Voltaic (PV) Panels

The rear of the building is south facing and has a flat roof area suitable for installing PV panels. The roof is in good condition with reasonable ease of access. The SEAI Micro-Generation scheme provides a grant of €2,400 for a maximum installation of 6 kWp. Therefore, installing 14 PV (5.2 kWp) panels is calculated to reduce the site imported electricity by 6,328 kWh, a saving of €1,202 based on the average unit cost of electricity at 18.5 c/kWh. The simple payback is approximately 8 years. Such an installation would reduce the building's carbon footprint by about 2.2 Tonnes of CO_2.

9.1.2.2.4. Heating System

The Café space heating and domestic hot water (DHW) are provided by an oil-fired Firebird Enviromax Heatpac C35kW condensing boiler with an SAP seasonal efficiency rating of 91.4% with a maximum power output of 35 kW. The boiler was installed in 2020, so replacing it with a heat pump will need to be considered in the next 10 years. A two-pipe radiator heating system provides space heating with radiators in all parts of the food hall and café. DHW is provided by 300 litres Joule insulated cylinder heated by the boiler. The heating schedule is controlled through a single daytime switch, i.e. the boiler operated even on a Sunday although the Café is closed. Replacing the time switch with a 7-day time is estimated to save €166 (1,918 kWh) and CO2, with a simple payback of 3 years.

There is no temperature control for the space heating system other than the boiler thermostat. A boiler thermostat will control the boiler water temperature based on its setting and will not be influenced by the outside or building temperature. There are wireless control systems such as Climate, Hive, Nest EvoHome, Genius, Tado and Netatmo etc.; These are all smart, intelligent wireless heating control systems that can be operated through a phone or an iPad. They usually include a base controller for setting a schedule and the boiler temperature, plus smart thermostat radiator valves (TRV), which can be individually programmed to control the heating in each area of the footfall and the café, for example on the day of the site visit the heating was on full in the new food hall but it was not in use. They are suitable for the small system due to the individual cost of the item. For example, the wireless TRV can cost €100 each. It is estimated that installing an intelligent wireless heating control system will allow the café manager to control better the heating system; installing an intelligent heating control system is estimated to save €580 (6,716 kWh) per annum, with a capital cost of €2,000, providing a simple payback in 3.5 years.

9.1.2.3. Lawler's Gala Shop

Lawler's Gala Shop is a small supermarket and bookstore with opening hours of 7.00 am to 9 pm seven days a week.

9.1.2.3.1. Annual Energy Consumption & Cost

The annual energy consumption and costs for electricity consumed by the shop are shown in Table 6 below at 59,347 kWh and €26,689. Electricity accounts for 100% of the total energy cost, with an average unit cost of 44.97 c/kWh, which reflects the energy cost increase over the last 12 months. The Maximum Import Capacity (MIC) is 88 kVA. Appendix B includes details of the 2022 electricity invoices.

Table 6 Annual Electricity Consumption & Cost

Energy Type	Usage kWh	%	€	%	Delivery Cost c/kWh	Useful Cost c/kWh	Tonne CO_2
Electricity	59,347	100%	26,689	100%	44.97	44.97	21
Total	**59,347**		**26,689**				**21**

Appendix B includes details of the 2022 electricity invoices. It shows that electricity use at night accounts for 32% of the total usage, partly due to the significant refrigeration demand and the cooking in the early morning.

The average demand is at a maximum of 15 kW, so I could be estimated that it would rise to maybe two or possibly three times higher, especially in the summertime when the refrigeration demand will be at its peak, at, say, 45 kW, as there is also a very high electrical demand for cooking. Therefore, there may be some potential financial savings by reducing the MIC, say to 60 kVA. Before any decision on reducing the MIC, more details are required on the actual maximum demand (kW). Also, any plan which would increase the shop's electrical demand and, therefore, its MIC would be costlier to increase should the current MIC be reduced.

9.1.2.3.2. Brief Overview of Technologies

An approximate breakdown of the annual energy consumption and cost is shown below in table 7.

Table 7 Breakdown of Electricity Use

Area	kWh	Cost	%
Fridges	42,559	12,871	48%
Cooking	17,566	5,312	20%
Cold/Freezer Room	7,884	2,384	9%
AC Units	8,190	2,477	9%
Lighting	5,405	1,635	6%
Other	6,649	2,011	8%
Total	**88,253**	**26,689**	**100%**

The potential to save energy is low as the shop lighting is all LED. Also, three new Mineral, Dairy and Frozen Foods refrigeration units, including doors, have recently been installed. It would be good practice to better understand the energy use on-site by taking the meter for a week at 7 am & 9 pm each day to compare the out-of-shop usage to the normal working day usage. These readings should be taken before the cooking start-up in the morning.

Staff could save energy by ensuring that cooking equipment is switched off when not required. A 10% reduction in annual electricity consumption target by the team being more energy aware is estimated to save €531 (1,757 kWh) and 0.6 Tonnes of CO_2.

9.1.2.3.3. Photo Voltaic (PV) Panels

The rear of the building is south facing and has a flat roof area suitable for installing PV panels. The roof is in good condition with reasonable ease of access. The SEAI Micro-Generation scheme provides a grant of €2,400 for a maximum installation of 6 kWp. Therefore, installing 15 PV (6 kWp) panels is calculated to reduce the site imported electricity by 6,307 kWh, a saving of €1,907 based on the average unit cost of electricity at 30.24 c/kWh. The simple payback is approximately 9 years. Such an installation would reduce the building's carbon footprint by about 2.2 Tonnes of CO_2.

9.1.2.4. Castle Arms Hotel

Address: Castle Arms Hotel, The Square, Durrow Town park, Laois,

Castle Arms Hotel is a 16-bedroom hotel with Bar and ballroom and originates back to 1955 when the Murphy family purchased the building. The Front of the hotel was renovated in the 2000s.

9.1.2.4.1. Annual Energy Consumption & Cost

The annual energy costs and consumption for electricity and heating oil by the hotel are shown in Table 8 below at €73,984 and 322,393 kWh, respectively. Electricity accounts for 64% of the total consumption and 90% of the cost, with an average unit cost of 32.50 c/kWh. The high cost of electricity is impacted by the recent event in Europe regarding energy supply, and as shown in Appendix C, the average units cost in February 2022 was 28.75 c/kWh. In September and October 2020, it was 50.53 c/kWh and 36.27 c/kWh, respectively. As shown in Appendix C.1, keeping track of the hotel's monthly energy cost should form part of the hotel energy management programme. Appendix C.2 shows the heating oil's annual use and cost.

Table 8 Annual Electricity Consumption & Cost

Energy Type	Usage kWh	%	€	%	Delivery Cost c/kWh	Useful Cost c/kWh	Tonne CO_2	kWh/m^2	CIBSE Benchmark kWh /m2
Electricity	205,082	64%	66,659	90%	32.50	32.50	71	254	105
Gas Oil	117,311	36%	7,326	10%	6.24	7.81	24	145	330
Total	**322,393**		**73,984**				**95**		

Note: Not included in table 8 is LPG, used mainly for cooking, and DHW for the kitchen.

The Maximum Import Capacity (MIC) is 80 kVA. Appendix C.1 shows that the maximum average daytime demand is 24 kW. It would be expected that the actual market (MD) would be 2-3 times this value, i.e. 48 kW to 72 kW, during periods of significant activity, for example, when there is a wedding or an event in the ballroom, as the kitchen and bar are in full use. Without more details on the maximum monthly demand, it is impossible to suggest if the MIC should be reduced. Also, plans for extensions or replacing the boiler with a heat pump will require a higher MIC, so it would be prudent to leave this in the short term until more details are available on the actual maximum demand and future plans.

Also, the monthly consumption fluctuates, for example, April and May 2022 have significantly higher consumption compared to other months of the year, and again the activity level in the hotel is most likely the reason for the increase, but taking weekly meter readings and recording use against the corresponding activity level will help to indicate any excess consumption and possible opportunities to save energy costs.

It is recommended that monitoring weekly use is part of the hotel energy management programme. The ability to read the meter weekly and record usage, including maximum demand, should be part of the hotel energy management programme. Access to the electricity meter and understanding how to read the meter, including the maximum demand, should be discussed with the meter reader at their next visit.

The average nightly use is 19%, excluding February 2022. This seems reasonable, as the kitchen starts before 8.0 am GMP and refrigeration equipment is also in the kitchen and bar.

In 2008 the Chartered Institute of Building Service Engineers (CIBSE) published electrical and fossil fuel (thermal) benchmark figures for buildings in TM46. These were based on actual surveys and represented best practices. The CIBSE Guide for hotels is shown in table 8, and it can be seen that the electricity benchmark is 142% higher and the Thermal (heating oil) is 56% lower.

The CIBSE figures are indicative and should not be taken as absolute targets. The CIBSE benchmark was set in 2008 and is based on data that precedes that date. These figures need to consider the technical improvements to equipment that have taken place in the interim or the progress in building insulation regulations. Benchmarks are useful for comparing similar sites, i.e., similar size hotels. However, saying that the thermal energy benchmark is very low indicates it is very well controlled, even if the system is inefficient.

9.1.2.4.2. Brief Overview of Technologies

An approximate breakdown of the annual energy consumption and cost is shown below in table 9. More detailed measurement is required to provide a more accurate analysis of the hotel's electricity usage.

Table 9 Breakdown of Electricity Use

Area	kWh	Cost	%
Kitchen	89,328	29,035	44%
Lighting	45,640	14,834	22%
Electrical Heating	20,800	6,761	10%
Bar	20,702	6,729	10%
Extract Fans	5,256	1,708	3%
Other	23,356	7,591	11%
Total	**205,082**	**66,658**	**100%**

The kitchen and the bar account for approximately 54% of the hotel's energy use. Therefore, the hotel should consider installing sub-meters for the kitchen and bar to give a more precise breakdown of use, which should be read weekly as part of the hotel energy management programme.

Most lighting is LED, or energy-efficient bulbs and any light replaced is ben replaced by an LED equivalent. Therefore, the potential to reduce light costs is low other than being part of the energy awareness programme, i.e. Switching off Lights when not required. However, it was noticeable during the audit that areas outside of us had their lights switched off.

There is a policy that rooms should be warm when guests arrive and when in their rooms if heating is required. A number of the bedrooms have an electrical heater installed in areas where it is impossible to extend the heating distribution system. Ensuring that heaters are not left on unnecessary should be part of the cleaning staff's duty.

9.1.2.4.3. Staff Energy Awareness

Table 9 shows that electricity is nearly 2.5 times the CIBSE benchmark. One question arises: Is electrical heating been used to supplement the hotel space heating, i.e. are the saving made on fuel oil been lost through electrical heating? At present, electricity costs approximately four times the cost of gas oil, therefor the inefficient oil-fired heating system is more cost-effective when providing space heating requirements.

A staff energy awareness programme should be implemented as part of the hotel energy management programme, with an energy champion in a specific area such as the kitchen, bar, cleaning staff (bedrooms) and lighting in the ballroom and corridors. Taking that electricity is the hotel's significant energy user and is high compared to the CIBSE benchmark, this needs better control. Therefore, setting an achievable target of a 5% reduction would equate to a saving of €3,333 (10,254 kWh) and 4 Tonnes of CO_2. Installing sub-meters in the bar and kitchen and the weekly monitoring of the main meter would be an important part of the energy awareness programme to monitor performance.

9.1.2.4.4. Heating Systems

Table 9 shows that electricity is nearly 2.5 times the CIBSE benchmark. One question arises: Has electrical heating been used to supplement the hotel space heating, i.e., has the saving made on fuel oil been lost through electrical heating? At present, electricity costs approximately four times the cost of gas oil, therefor the inefficient oil-fired heating system is more cost-effective when providing space heating requirements.

A staff energy awareness programme should be implemented as part of the hotel energy management programme, with an energy champion in a specific area such as the kitchen, bar, cleaning staff (bedrooms) and lighting in the ballroom and corridors. Taking that electricity is the hotel's significant energy user and is high compared to the CIBSE benchmark, this needs better control. Therefore, setting an achievable target of a 5% reduction would equate to a saving of €3,333 (10,254 kWh) and 4 Tonnes of CO_2. Installing sub-meters in the bar and kitchen and the weekly monitoring of the main meter would be an essential part of the energy awareness programme to monitor performance.

The pipe insulation in the boiler house must be replaced, as only approximately 50% of the pipework is insulated and effective. Installing 50 mm of insulation to the boiler house pipe work is estimated to save €195 (3,143 kWh), with a simple payback of 3 years.

The front of the building was constructed in 2000s, which includes the bedroom and receives most space heating demand. From the discussion, the level of attic insulation is estimated to be 100 mm with a u-value of approximately 0.4 w/m^{2}deg.c, and a roof heat loss is estimated at 25% of the total thermal energy used. By increasing the attic insulation from 100 mm to 450 mm to achieve a u-value of, say, 0.16w/m^2 deg. c is estimated to save €1,099 (17,597 kWh), with a simple payback of 10 years.

The potential to install a heat pump needs a more detailed analysis. The building fabric may need to be upgraded or the heating distribution upgrade to allow for higher outputs from the radiator when operating at a lower temperature.

The estimated energy and financial saving of installing a heat pump are outlined below.

Heat Pump				
Technology	**kWh**	**Cost €**	**CO2**	**Capital €**
Boiler	111,384	6,956	29	
Heat Pump	27,846	9,051	10	
Save	**83,538**	**-2,095**	**20**	30,000

The financial saving is influenced by the differential cost between electricity and heating oil, which is currently 4.2 times lower for heating oil. It, therefore, shows that there is no financial payback for installing a heat pump. This should be re-evaluated when the boiler needs to be replaced, assuming electricity costs will eventually reduce. Still, the building fabric upgrade or radiator sizing will need to be considered, adding to the project cost.

It may be more economical to consider switching to a bio-LPG, which would be carbon neutral, but the financial saving will depend on the cost of the bio-LPG. Still, the boiler would be 10-15% more efficient and may achieve some financial savings.

Ideally, the ballroom oil-fired air heat could be replaced with an air-to-air heat pump, but installation may require some modification to allow the existing ducting to be used. This is unlikely to achieve significant savings due to its low annual operating cost but should be considered when the unit needs replacing.

9.1.2.4.5. Photo Voltaic (PV) Panels

The hotel has recently installed 60 PV panels. Assuming a rating of 0.4 kW output per panel equates to a 24 kW peak load. The PV system is estimated to reduce the site's imported electricity by 12% and save €1,907 (25,229 kWh). The 24 kWp load matches the average demand of 24 kW, as shown in appendix C.1, indicating that all the electricity generated will be used within the hotel. The recent increase in electricity cost improved the project payback, estimated to be 4-5 years.

The hotel should monitor and record the monthly output of the PV system in a table with the electricity invoices, similar to appendix C1.

Appendix A

Bowes Food hall & cafe

Supplier	Flo Gas
MPRN	10011979518
Acc. No.	50018237
TARIFF:	DSG NSAV
MIC	15

Date	No. Days	Day kWh	Night kWh	Total kWh	Cost ex vat	% Night	Ave. €/kWh	Ave kW	Ave Day kW	Ave Night kW
11/11/22 to 12/12/22	32	18,605	4,946	23,550	4356.82	21%	0.185	30.66	38.76	17.17
13/10/22 to 10/11/22	30	10,589	2,815	13,403	2,479.64	21%	0.185	18.62	23.53	10.42
27/09/22 to 12/10/22	16	4,726	1,256	5,982	1,106.65	21%	0.185	15.58	19.69	8.72
14/09/22 to 26/09/22	13	7,830	2,081	9,911	1,833.52	21%	0.185	31.77	40.15	17.79
15/08/22 to 13/09/22	30	8,616	2,290	10,907	2,017.75	21%	0.185	15.15	19.15	8.48
11/02/22 to 14/03/22	31	8,236	2,189	10,426	1,928.80	21%	0.185	14.01	17.71	7.85
14/01/22 to 10/02/22	28	7,322	1,946	9,269	1,714.72	21%	0.185	13.79	17.43	7.72
Total	**180**	**65,924**	**17,524**	**83,448**	**15,438**	**21%**	0.185	**31.8**	**40.2**	**17.8**
Annual	**365**	**133,679**	**35,535**	**169,214**	**31,305**	**21%**	0.185	**31.8**	**40.2**	**17.8**

Typical Use per day	kWh/Day	day/wk.	Wk./yr.	kWh	AUP c/kWh	Annual €
Day	194	6	50	58,200	0.25	14,550
night	52	6	50	15,600	0.12	1,872
Total	246			73,800	0.185	16,422

Appendix B

Lawler's Annual Electricity Invoices

Date	No. Days	Day kWh	Night kWh	Total kWh	Cost Inc. vat	MIC	Day Unit c/kWh	Ave. c/kWh	Ave kW	Ave Day kW	Night kW
1 Feb to 28 Feb 22	28	4,725	2,259	6,984	2080.42	88	29.79	29.79	10.4	11.3	9.0
1 Mar to 31 Mar 22	31	5,686	2,719	8,405	2493.59	88	29.67	29.67	11.3	12.2	9.7
1 Apr to 30 Apr 22	30	3,518	1,357	4,875	1,506.13	88	30.89	30.89	6.8	7.8	5.0
1 May - 31 May 22	31	4,663	2,249	6,912	2,063.78	88	29.86	29.86	9.3	10.0	8.1
1 July to 30 July 22	30	4,578	2,561	7,139	2,099.70	88	29.41	29.41	9.9	10.2	9.5
1 Jul to 31 Jul 22	31	4,364	2,103	6,467	1,936.37	88	29.94	29.94	8.7	9.4	7.5
1 Aug to 31 Aug 22	31	4,491	2,164	6,655	1,990.27	88	29.91	29.91	8.9	9.7	7.8
1 Sept to 30 Sept 22	30	4,612	2,223	6,835	2,040.90	88	29.86	29.86	9.5	10.2	8.2
1 Oct to 31 Oct 22	31	7,126	3,737	10,863	3,384.53	88	31.16	31.16	14.6	15.3	13.4
1 Nov - 30 Nov 22	30	5,503	2,624	8,127	2,559.76	88	31.50	31.50	11.3	12.2	9.7
Total	**303**	**49,266**	**23,996**	**73,262**	**22,155**	88	**30.24**	**30.24**	**14.6**	**15.3**	**8.8**
Annual	**365**	**59,347**	**28,906**	**88,253**	**26,689**		**30.24**	**30.24**			

Appendix C.1

Castle Arms Hotel Electricity

Acc. No. 8857529668

TARIFF: LVMD

MIC 80

Date	No. Days	Day kWh	Night kWh	Total kWh	Cost	Day Unit c/kWh	% Night	Ave kW	Ave Day kW	Ave Night kW
1 Feb to 28 Feb 22	28	17,240	1,040	18,280	5256.01	28.75	6%	27	41	4
1 Mar to 31 Mar 22	31	9,820	2,180	12,000	3178.44	26.49	18%	16	21	8
1 Apr to 30 Apr 22	30	19,160	3,990	23,150	5,337.84	23.06	17%	32	43	15
1 May to 31 May 22	31	8,800	1,920	10,720	2,792.83	26.05	18%	14	19	7
1 July to 30 July 22	30	19,360	4,960	24,320	5,518.18	22.69	20%	34	43	18
1 Jul to 31 Jul 22	31	14,400	3,520	17,920	4,244.00	23.68	20%	24	31	13
1 Aug to 31 Aug 22	31	13,220	3,100	16,320	3,949.64	24.20	19%	22	28	11
1 Sept to 30 Sept 22	30	13,620	3,300	16,920	8,549.64	50.53	20%	24	30	12
1 cot to 31 Oct 22	31	11,140	2,620	13,760	4,990.16	36.27	19%	18	24	9
1 Nov - 30 Nov 22	30				9,366.26					
1 Dec to 31 Dec 31	31				6,919.44					
1st Jan - 31st Jan 23	31				6,556.06					
Total	**365**	**126,760**	**26,630**	**153,390**	**66,659**	**43.46**	19%	**18.5**	**24.0**	**9.4**
Adj Annual Total	**365**	**169,478**	**35,604**	**205,082**	**66,659**	**32.50**				

Appendix C.2

Castle Arms Hotel Heating Oil

Gas Oil

Delivery Date in 1 year	Litre	€/litre	Total Cost ex. vat	kWh	c/kWh
26/07/2022	1,667	0.640	1,178.45	17,587	6.70
23/08/2022	1,200	0.585	782.32	12,660	6.18
11/10/2023	1,438	0.059	937.48	15,171	6.18
11/11/2022	1,684	0.585	1,097.85	17,766	6.18
13/12/2022	1,915	0.585	1,248.45	20,203	6.18
09/02/2023	1,627	0.569	1,034.66	17,165	6.03
approx. 9 months (winter)	**9,531**		**6,279**	**100,552**	**6.24**
approx. 12 months (Inc. summer)	**11,120**		**7,326**	**117,311**	**6.24**