Inishturk Sustainable Energy Community

Energy Co-operatives Ireland Ltd
energyco-ops.ie

Inishturk SEC Energy Master Plan

Baseline Energy Balance, Renewable Energy Potential and Register of Opportunities

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1.1 Executive Summary

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

An important step in the development of an SEC is to understand the community's current energy consumption. In 2023, Inishturk SEC commissioned Energy Co-operatives Ireland (ECI) to produce this Energy Master Plan for Inishturk.

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

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

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

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

[1] A full glossary of terms, including acronyms is set out in Section 1.1.3 below.

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1.1.1 List of Figures

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1.1.3 Glossary of Terms

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

Air-Source Heat Pump (ASHP)

An air source heat pump takes heat from the air and increases it to a higher temperature using a compressor. It transfers this heat to the heating system in a building. Most ASHPs have a >3 input to output ratio, meaning that for every unit of energy put into the system, three units or more are put out in heat. ASHPs are very commonly installed in Ireland in energy efficiency retrofits and new-builds.

Auto-consumption

In this case the term relates to the production of energy (usually electricity) which is consumed onsite. For example, PV panels which generate electricity which is used to power appliances on the premises *before* it is sent to the electricity meter for export.

Baseline Energy Balance: The amount of energy assessed to be used across all domestic, commercial and industrial activities in a community, before energy efficiency and generation measures have been implemented. In this study it refers to all the energy being used by the community in Inishturk at time of publication.

Battery Electric Vehicles (BEV)

These are vehicles powered by a battery that does not include any fossil fuel use (petrol of diesel). Most new BEVs have a range of 300km or more and cost about €30,000 new. This EMP recommends second hand BEVs for use on Inishturk and mid-range BEVs on a vehicle shared scheme on the mainland. There is information on BEVs on the Irish market here and here:

Biodiesel

A vegetable or alga derived fuel which can be mixed with diesel and used in a conventional internal combustion engine (in a car or a boat engine for example). It is usually only used in combination with fossil fuel diesel as an additive up to 20%.

Building Energy Rating (BER) - BER stands for Building Energy Rating. A BER certificate shows you the energy performance of your home

Carbon Dioxide/ CO2 - Carbon dioxide is a powerful greenhouse gas. It is naturally part of the air we breathe. However, human activities like burning of fossil fuels and deforestation have led to an increase in CO2 in the air that contributes to climate change.

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

Carbon Intensity

The amount of carbon that is emitted per unit of energy (kWh). This varies according to the energy source. For example, in Ireland onshore wind energy has a very small carbon intensity per kWh. Electricity in the National Grid has an intensity of .390kg per KWh because some electricity generators burn gas and coal and averaged out this included in the measure of our electricity's carbon intensity. On Inishturk, electricity is generated by diesel which has a carbon intensity of .648 kg/kWh when the carbon content of a litre of diesel, its energy content and the efficiency of the generator is taken into account (about 40% fuel to energy).

Community Grant

The SEAI (Sustainable Energy Authority of Ireland) Community Grant is a program designed to support community-based groups and organizations in implementing energy efficiency and renewable energy projects. The grants are intended to help communities reduce their energy use, lower their carbon footprint, and promote sustainable living practices. The grant program is open to a wide range of organizations, including community groups, sports clubs, schools, and businesses.

EMP – Energy Masterplan – this document

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

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

Ground Source Heat Pumps

Where a pipe is laid in the ground (either horizontally or vertically) and the earth's natural heat is drawn off and supplied to a building. These are not common in Ireland and not recommended on Inishturk in this EMP.

Heat Loss Indicator (HLI)

Is based on the loss of heat from a building either from what it is made from (the blocks in the walls, the tiles on the roof, etc…) or through gaps and drafts in how the building fits together (poorly fitting windows and doors, pipe inlets, etc). The lower the HLI the warner the building will be. All buildings should aim at a HLI of less than 2.0, very few built before 2010 achieve this. It is absolutely necessary to have a HLI of less than 2.0 before considering installing any heat pump.

Hydrotreated Vegetable Oil (HVO)

HVO is a type of renewable diesel fuel that is produced by hydrotreating vegetable oil. It is a high-quality, low-emission fuel that can be used as a direct replacement for fossil diesel in diesel engines. In Ireland HVO is commonly produced using feedstocks such as rapeseed oil, waste fats, and oils.

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

The Levelized Cost of Electricity (LCOE)

A measure used to estimate the average cost of producing electricity over the lifetime of a power-generating asset or facility. It takes into account all of the costs associated with building, operating, and maintaining a power plant, including the cost of fuel, financing, capital expenditures, and any other expenses. LCOE is typically expressed as the cost per unit of electricity generated (e.g., euros per kilowatt-hour or cents per kilowatt-hour).

PV: Photovoltaic

These are panels that turn solar energy into electrical energy. The panels are usually 1.7m long and 1m wide, although they can be installed vertically or horizontally. A new good quality panel costing approximately €500 will be rated 400W. On Inishturk a 1kW installation optimally sited and aligned will generate approximately 872 kWh per year. A full discussion of PV panels is in Appendix Section 9.5.1

Register of Opportunities (RoO) - The Register of Opportunities is a list of projects or opportunities within your community which if executed will result in energy efficiency and a reduction in energy use and the associated CO2 output.

Renewable Energy - Renewable energy comes from renewable resources like wind energy, solar energy, or biomass.

Renewable Electricity Support Scheme (RESS) - This Government scheme provides financial support to large scale >500kW renewable electricity projects in Ireland to help us achieve our renewable electricity goals.

SEC – Sustainable Energy Community

A Sustainable Energy Community (SEC) is a community that works together to improve energy efficiency, reduce energy costs, and increase the use of renewable energy sources in order to achieve sustainable energy goals. The SEAI (Sustainable Energy Authority of Ireland) supports the development of SECs by providing information, advice, and funding.

Small-Scale Generation Scheme (SSG)

This will replace the community projects preference category that was removed from RESS 3. It is expected that it will support 100% community owned energy generation schemes between 50kW and ~5MW. The details of the scheme will be announced after the public consultation (now closed) is reviewed.

Units

Throughout this report we present energy use and energy production, in kilowatt hours per annum (kWh/yr). This unit of measurement is used regardless of the fuel used. Energy costs are presented in euro spent on energy per annum.

2 Context of this report

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

An Energy Master Plan (EMP) aims to help the SEC to understand the energy demand and supply in the entire community. The EMP focusses on energy efficiency opportunities in the first instance. This is because energy efficiency actions are typically lower risk and have higher payback. It is also widely accepted that reducing the amount of resources you use is the first step to greater sustainability. This plan is also a live record of the community's energy status and achievements in its journey to sustainability. It is intended that it will evolve to form the foundation for other applications and projects.

The community designs, develops and focusses its own Energy Master Plan in line with the aims of the Community SEC Charter. No two communities are the same, and thus their EMPs are also unique.

This Energy Master Plan will quantify the current energy status of Inishturk as a baseline of electrical, thermal and transport energy demand. It will identify any existing renewable energy sources within the community – these can be used as a model for further roll-out of renewable energy.

The plan will create a Register of Opportunities (RoO) which is a list of potential projects for energy efficiency and renewable energy. It will select suitable projects for the first three years of Inishturk community actions, setting energy reduction targets against the baseline figures. The EMP is designed to allow periodic updating of the SEC energy status to track progress against targets.

2.1 Targets from the Government's Climate Action Plan 2023

The Climate Action Plan (CAP, latest version is 2023)[2] is an annually revised roadmap developed by the Irish government for taking decisive action to reduce Ireland's emissions by 51% of the 2018 levels by 2030, and net zero by 2050. The statutory national climate objective and 2030 targets are aligned with Ireland's obligations under the Paris Agreement and with the European Union's objective to reduce GHG emissions by at least 55% by 2030, compared to 1990 levels and to achieve climate neutrality in the European Union by 2050.

The CAP targets reduction in energy use in Electricity, Transport, Buildings, Industry and Agriculture. This EMP examines these sectors as they relate to Inishturk. Our study will look at the tender requirement to map out how the Inishturk SEC can achieve energy reductions

[2] https://www.gov.ie/pdf/?file=https://assets.gov.ie/244355/1c421172-2901-4f9e-baa5-6e4445b342f4.pdf#page=null

of 30% of the energy usage (of the baseline year 2023) on the study area, within the next 10 years.

2.2 Energy Context

There have been significant disturbances to the energy market in recent years. The Covid 19 pandemic lead in the first case to a breakdown of normal market practices with travel bans reducing the needs for transport fuels and industrial shutdowns affecting supply chains. There was a certain amount of pent-up demand for goods and services which when released during 2022 led to inflationary effects on fuel prices. The War in Ukraine has had a more consistently inflationary effect on the cost of energy.

Heating oil prices nearly doubled in Ireland during 2022, with the average price of 1,000 litres of kerosene in Mayo rising from €690 in 2021 to €1,258 in 2022 (a rise of 82%)[3]. These prices have begun to decline and stood at €970 in March 2023

Coupled with these cost effects, the issue of energy security has come to the fore at both a policy and citizen awareness level. There has been a noted shift in the public attitudes towards energy saving and locally generated renewable energy.

It is expected that there is a rebalancing of the energy supply market taking place as Russian Gas is replaced with alternatives easing pressure on Natural Gas process and consequently on wholesale electricity prices. We cannot predict medium term electricity or oil prices. However, it is necessary that we establish a baseline for energy costs against which to compare potential savings on energy costs to the community of Inishturk should the energy efficiency actions we recommend be taken.

In this study we will apply five-year average energy costs which is outlined in Appendix Section 8.1.

Needless to say, there is an environmental imperative to achieve sustainability across all energy uses. We would also point out the social benefits of sustainability to the community of Inishturk from successfully implementing a sustainability strategy.

[3] https://www.oilprices.ie/County/Mayo

3 Inishturk SEC: Geography and Demographics

3.1 Geography:

Inishturk is one of an archipelago of islands (three inhabited) off the Galway-Mayo Coast (see Figure 1. The island is 11km at its closest point from the mainland of Mayo, 16 km by ferry from the quay at Roonagh near Louisburgh, which it shares as an access point to the mainland with Clare Island. The island is small, but comparable to its inhabited neighbours (Clare and Inisboffin Islands). It is 13.3kms in circumference, 6.22kms^2 in area.

The island is of rugged terrain with its highest point is 191m, the geology of the island is predominantly sedimentary rock (sandstone, tuff, mudrock)[4]

The settlement pattern on the island is of the typical sráidbhaile[5] type common in the West of Ireland, but as shown in Figure 1 there are concentrations of habitation in the eastern side of the island centred around the pier in Garranty and the townland of Ballyheer.[6]

The vegetation of the island is predominantly grassy pasture of relatively poor quality (see Agriculture Section 4.4.2). However, like many of the western islands, the flora of the island is considered to be of international significance[7].

The island's confined area which is considered to be of natural heritage significance may limit many energy generation opportunities that the community wished to pursue, for example onshore wind or community scale PV. Lack of grid connection to the mainland may also hinder RESS or SSG scale generation. There are also limits on opportunities from group heating schemes by the geography of the island. While the geology is designated as suitable for vertical closed loop domestic geothermal[8], this technology is more expensive than other energy efficiency technologies and not recommended for Inishturk in this report.

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[4] Taken from Geological Survey Ireland Mapping Programme https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0

[5] O'REILLY, BARRY. "'A Shower from the Sky': Legitimating the Traditional Hamlet in Ireland." Traditional Dwellings and Settlements Review, vol. 29, no. 2, 2018, pp. 23–38. JSTOR, https://www.jstor.org/stable/26877321 . Accessed 15 Mar. 2023.

[6] Inishturk is not a Gaeltacht Island thus the placenames used in this report are English language versions.

[7] https://walks.mayo.ie/media/Media,10490,en.pdf

[8] https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=9ee46bee08de41278b90a991d60c0b9e

Figure 1: Inishturk SEC

3.2 Demography

There are 21 permanently occupied homes and three commercial properties on Inishturk according to Geocode data[9].

In the 2016 census, Inishturk and Clare Island are within the same CSO Small Area. This means that the demographic statistics for both islands are aggregated. There are 109 registered homes on Clare Island (giving a total of 129 homes across both islands – thus Inishturk has 16% of registered homes). However, it can be presumed that some of these are holiday homes and were unoccupied at time of census. We will not assume therefore to allocate 16% of the data from the CSO Small Area 2016[10] to Inishturk. It is not possible to use the full range of statistical techniques to present a clear demography of either island. However, it was recorded that there were 51 residents of Inishturk in the 2016 census[11].

We can therefore make approximations of the relevant data from the 2016 based on the fact that Inishturk represents approximately 25% of the population of the Small Area.

Demographically, the Small Area has an older population than Ireland as a whole or County Mayo.

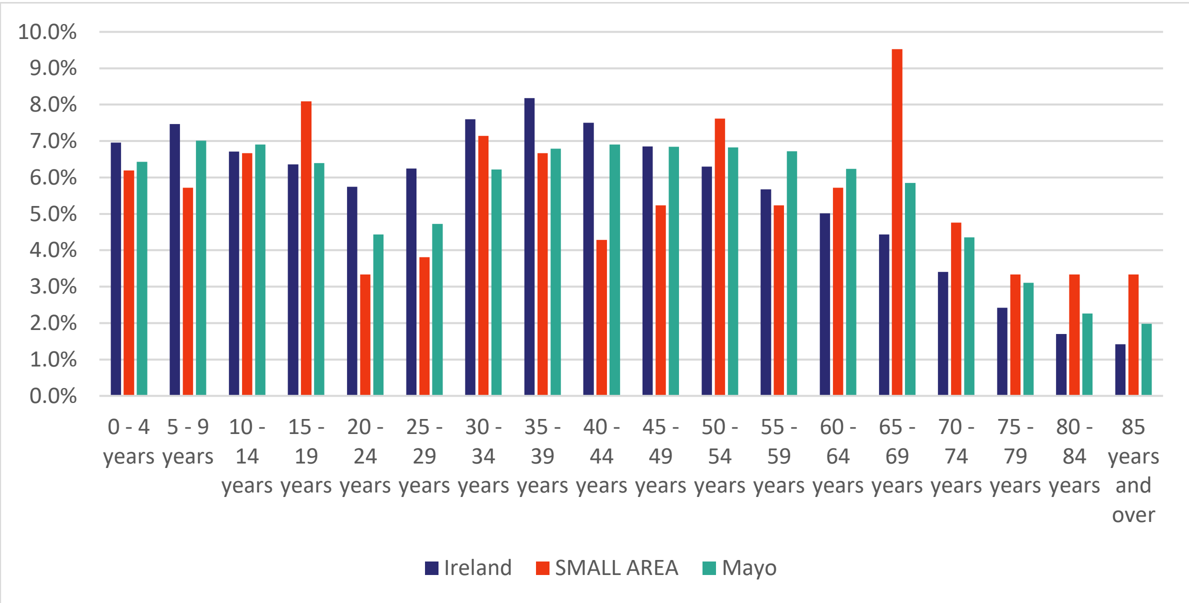

Figure 2: Demographics of Small Area, Ireland, and Mayo

[99] https://www.geodirectory.ie/knowledge-centre/address-search-tool
[10] Small Area No. 157050001 (https://visual.cso.ie/?body=entity/ima/cop/2016&boundary=C03736V04484&guid=4c07d11d-f56a-851d-e053-ca3ca8c0ca7f)
[11] https://www.gov.ie/en/publication/31da3-populated-off-shore-islands/ the census data for 2022 have not yet been published for each the two islands.

3.3 Economy & Infrastructure

The principal economic activities on the island are agriculture (sheep farming), fisheries (mainly inshore, shellfish such as lobster) and tourism. There is no hotel on the island, but there are two B&Bs and a 'glamping' site (currently closed).

There is a large community centre on the island (The Community Club) which serves as a social and cultural hub (with bar and restaurant) as well as providing hub-working facilities with internet access.

There is a Community Health Centre and a Church in Garranty, and a small national school (St Columba's NS) with three students in Ballyvaum. Secondary schooling is off-island.

3.3.1 Transport

Travel to the island is by diesel fuelled passenger ferry (the Naomh Ciarán) which is not roll-on-roll-off) from Roonagh Pier on the mainland near Louisburgh. The ferry service is operated by O'Malley Ferries twice daily return five days per week, and once daily return twice a week, with an extended service in July and August. The ferry journey is approximately 16kms, taking 50 minutes.

3.3.2 Energy

There is no grid connection to the mainland. Electricity is instead generated using three 100kVA diesel generators and distributed to consumers via a 11kVa network. Energy use and emissions data for the electrical system on the island is discussed in detail in Section 4.5.

Figure 3: Generating Station Inishturk (housed generators in grey building in background)

4 Baseline Energy Balance

We assess the energy balance of the SEC area with regard to the following contexts: Residential, Transport, Services, and Industry. We will assess each in turn.

4.1 Residential Energy Use

In the home, we look at energy used in heating, in appliance use, and in transport. We do this using a variety of methodologies. We process the national data on Building Energy Rating Certificates (BERs) as published by the CSO: these are provided on a national and a county basis here[12]. We then compare these to the SEAIs average breakdown BERs for each CSO Small Area. We further surveyed specific houses on Inishturk through a public recruitment process (described in Appendix Section).

Inishturk is unusual as a SEC in that it comprises only part of a CSO Small Area survey unit. The Small Area Number also includes Clare Island. We therefore cannot simply apply CSO data to the SEC.

Our combination of direct surveying and disaggregation of CSO information provides us with the most accurate picture of domestic energy use feasible for the study.

We use this as the basis for assessing the opportunities for energy and financial savings in the Register of Opportunities in Section below.

Transport was assessed using a combination of the CSO data from 2016 and ‘on the ground’ survey work.

4.1.1 Housing Stock

4.1.1.1 Building Type

Unsurprisingly for a rural area, housing in the SEC is universally detached houses of one or two stories. This has implications for energy use which we discuss below.

Home Floor Areas

The survey of homes found that the average floor area for the houses surveyed (181m^2) was greater than that of the national average for detached houses (162m^2). It is not unexpected that a sparsely populated rural community would have larger homes than average as land in this context is at less of a cost premium. The significance of this is that cost of efficiency

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

measures per home will be above the national and county averages also as efficiency measures are costed at materials quantities – and this is increased by transport costs.

4.1.1.2 Year of Construction

As shown in Figure 4 the housing stock surveyed on Inishturk is considerably older compared to the Republic and County Mayo. This is true of the CSO Small Area statistics which includes Clare Island – though this is mainly in the pre-1919 category. The lack of homes built post-2010 may be an artifact of recent restrictions in new build one-off housing planning permissions.   The comparative age of homes will likely contribute to a need for energy efficiency upgrades to be carried out on many homes within the SEC area.

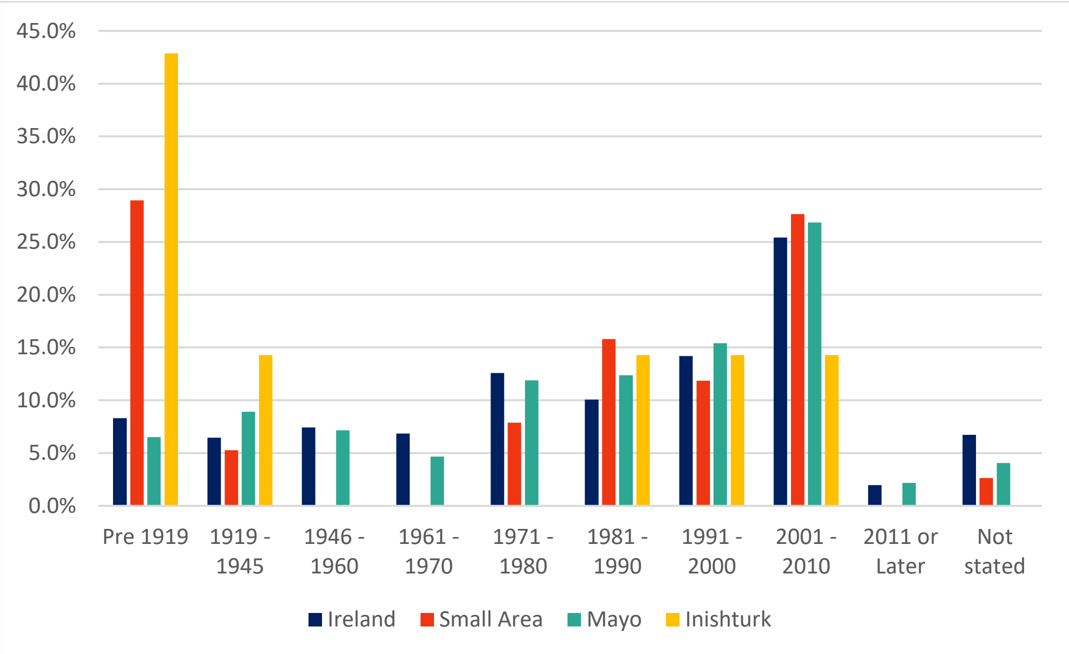

Figure 4: Small Area/Ireland/Mayo Housing Stock Age

4.1.1.3 Type of Ownership:

As we can see in Figure 5 the level of home ownership in the Small Area is greater than that in Ireland. 72%[13] of the homes in the area are owner occupier, either with or without a mortgage. This compares to 67.6% in Ireland as a whole. This has significance for the Register of Opportunities to be discussed later. Owner occupiers are likely more inclined to finance retrofits as the benefits of lower fuel bills and greater comfort accrue to the occupiers of the homes.

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[13] There were an unusually high number of households that were occupied free of rent (10.5%). It is presumed that these were houses owned by family members of the occupants..

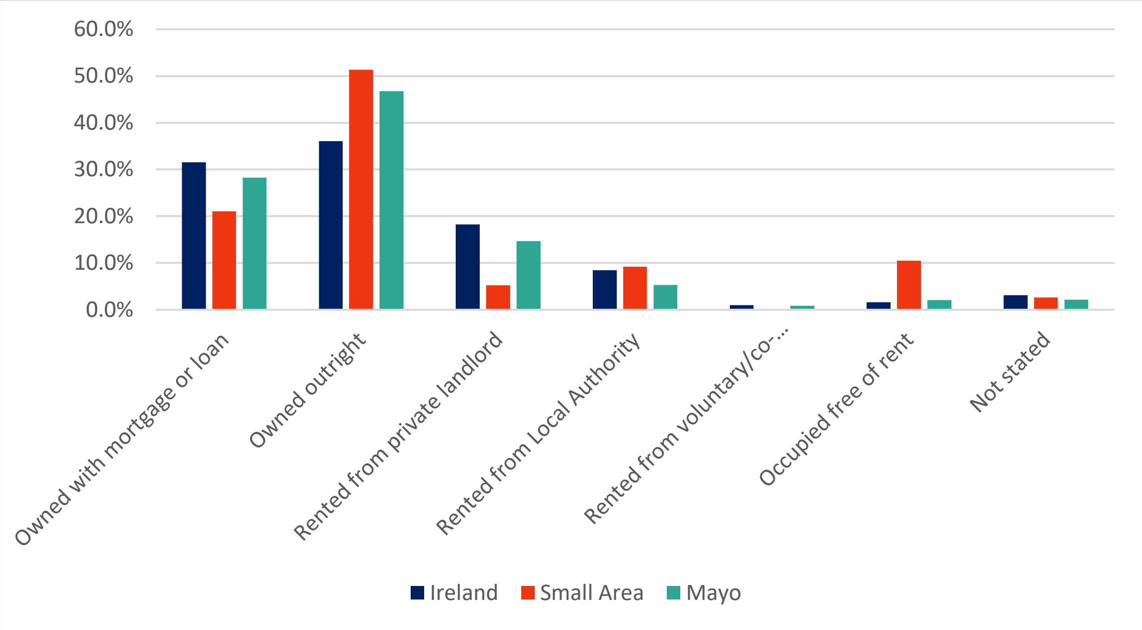

Figure 5: Homes by Ownership Type: SEC/Ireland/Mayo

4.1.2 Residential Heating Fuels

There is no access to the national gas grid on the Inishturk. There are also no opportunities for turbary as there are no bogs on the island. It is therefore unsurprising that according to CSO figures for the Small Area, most of the homes are heated using home heating oil, with a minority using coal and anthracite. It should be noted that these are both expensive and inefficient heating fuels relative to gas and electricity. These fuels are also imported to the island by boat not only affecting their cost but also their carbon emissions[14].

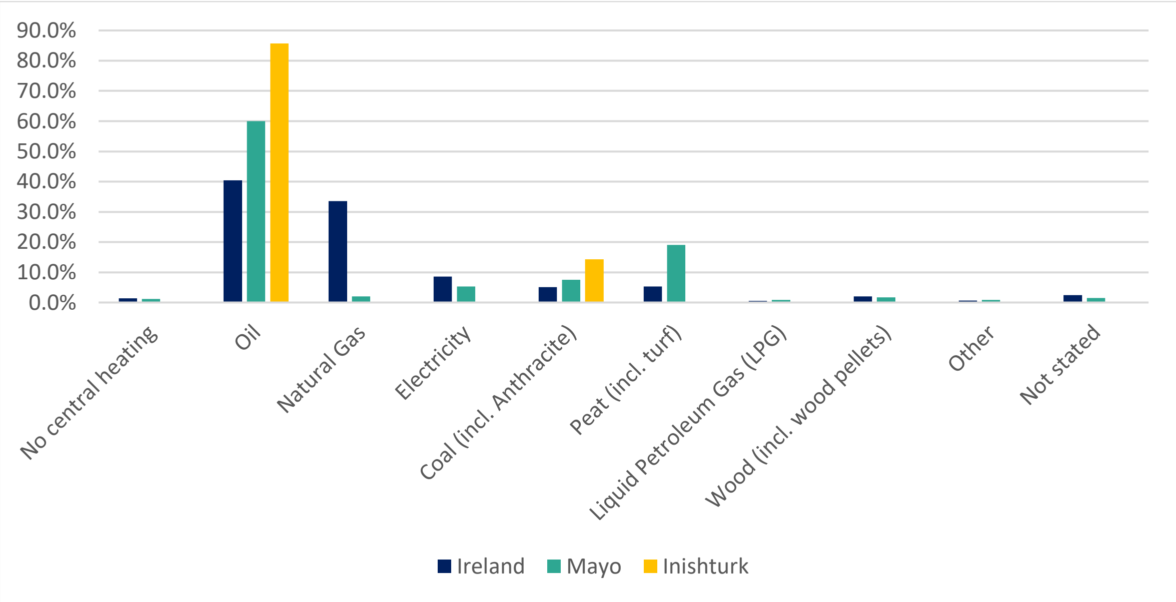

Figure 6: Central Heating Fuel Small Area, Ireland, and Mayo

[14] The transport of the fuel also involves truck and marine emissions which are not calculated here.

4.1.3 BERs

The SEAI has a building energy use certification system which classes buildings according to the amount of energy that they use for heating and hot water[15]. This BER system rates building energy ratings from A1 (most efficient) to G (least efficient). Efficiency is expressed in terms of the energy use (kilowatt hours – kWh) of the building in question per meter sq per year (kWh/m^2/yr). The BER system is discussed in detail in Appendix Section 8.2.

There were 18 homes in the Small Area which were recorded as having BER Certificates before this study. There are now 25. Table 1 shows the percentage of homes with BERs across all categories for Ireland, Mayo, Inishturk surveyed, and Inishturk.

Table 1: Building Energy Ratings SEC-Mayo-Ireland

	Ire %	Mayo %	Inishturk Surveyed %	Inishturk Adjusted
A	11.0%	6.0%	0.00%	7.4%
B1 rated	2.0%	1.0%	0.00%	0.0%
B2 rated	4.0%	2.0%	0.00%	0.0%
B3 rated	8.0%	5.0%	0.00%	11.1%
C1 rated	11.0%	9.0%	14.29%	8.5%
C2 rated	12.0%	13.0%	0.00%	0.0%
C3 rated	11.0%	14.0%	28.57%	28.0%
D1 rated	11.0%	13.0%	14.29%	8.5%
D2 rated	9.0%	11.0%	14.29%	12.2%
E1 rated	5.0%	6.0%	14.29%	4.8%
E2 rated	4.0%	5.0%	0.00%	3.7%
F rated	4.0%	6.0%	0.00%	11.1%
G rated	6.0%	10.0%	14.29%	4.8%

[15] https://www.seai.ie/publications/Your-Guide-to-Building-Energy-Rating.pdf

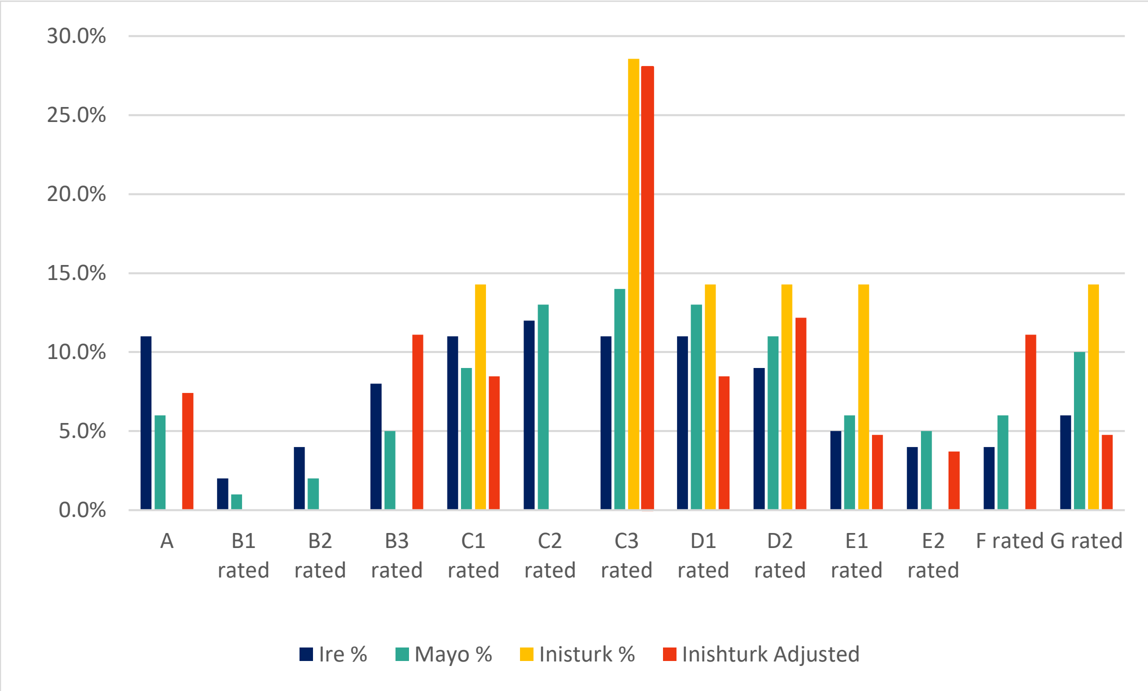

Figure 7: Distribution of BERs Ireland, Small Area, and Mayo

Figure 7 shows that the BER ratings for the Inishturk are weighted towards the lower end of the BER scale for national and Mayo. This will have an effect on the overall energy use in the domestic sector for the Island.

Using the Survey data, existing BER data in conjunction with the CSO data we can now extrapolate the entire energy use for the domestic housing sector on Inishturk.

Table 2: Domestic Energy Use SEC area Space and Water Heating: permanently occupied homes – excluding holiday homes.

Homes in Inishturk			SH & WH Energy Use kWh/yr/m2	Total Area Est from CSO Areas Detached[16]	total est SH & WH Energy Use kwh/yr
BERs form SEAI and Survey	% of homes	Number of homes			
A	7.4%	2	37.5	281.3	10,550
B1 rated	0.0%	0	87.5	0.0	0
B2 rated	0.0%	0	112.5	0.0	0
B3 rated	11.1%	2	137.5	422.0	58,025
C1 rated	8.5%	2	162.5	321.5	52,248
C2 rated	0.0%	0	187.5	0.0	0
C3 rated	28.0%	6	212.5	1,065.0	226,323

[16] 162m^2 X Number of homes in category.

D1 rated	8.5%	2	242.5	321.5	77,970
D2 rated	12.2%	3	280	462.2	129,413
E1 rated	4.8%	1	320	180.9	57,874
E2 rated	3.7%	1	360	140.7	50,640
F rated	11.1%	2	405	422.0	170,910
G rated	4.8%	1	500	180.9	90,429
Total	100%	21	-		924,381

Table 2 shows that we estimate that the total home energy use on Inishturk for space and water heating is 924,381 kWh/year. This provides us with an estimated energy consumption per home of 39,429 kWh/yr. This is well above the national average of 20,424kWh per home in 2021[17]. This is not altogether unexpected as the housing stock on the island is generally older than the national average and all the homes are detached (section 4.1.1 above). It does suggest that **there will be significant savings and emissions gains achievable on the island** if the efficiency measures that are outlined in the registry of opportunities section of this report are implemented.

4.1.4 Energy Use by type

For 2020 the SEAI estimated that 61% of all energy used in households was for space heating, 20% for water heating, 16% for lighting and appliances, and 2% for cooking[18].

4.1.4.1 Domestic energy use: Including electrical demand.

Taking the gross estimate of energy use for home heating from Table 2 above and using the data for electrical demand as a fraction of overall demand, we can estimate the amount of electrical demand by homes on the island[19].

Table 3: Total Domestic Energy Demand

	21 Homes	total est kWh/yr Space & Water Heating	Lighting, Appliances & Cooking kWh/yr	Total kWh/yr	SH & WH kg CO2/yr	Appliances kg CO2/yr
BERs from SEAI and Survey						
A	2	10,550	2,344	12,894	2,888	1,519

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

[18] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/residential/#:~:text=Final%20energy%20by%20end%2Duse&text=These%20include%20space%20heating%2C%20water,%2C%20and%202%25%20for%20cooking. Nearly if not all of the homes use electricity for cooking.

[19] Since SH and WH amounts to 81% of demand, and lighting 2% (both captured in the BER/Energy Audits), we assume non heating and lighting electrical demand is 14% of the BER calculated load.

B1 rated	0	0	0	0	0	0
B2 rated	0	0	0	0	0	0
B3 rated	2	58,025	12,894	70,919	19,290	8,356
C1 rated	2	52,248	11,611	63,858	17,369	7,524
C2 rated	0	0	0	0	0	0
C3 rated	6	226,323	50,294	276,617	75,240	32,590
D1 rated	2	77,970	17,327	95,296	25,921	11,228
D2 rated	3	129,413	28,759	158,172	43,023	18,636
E1 rated	1	57,874	12,861	70,735	19,240	8,334
E2 rated	1	50,640	11,253	61,893	16,835	7,292
F rated	2	170,910	37,980	208,890	56,818	24,611
G rated	1	90,429	20,095	110,524	30,062	13,022
	21	924,381	205,418	1,129,799	307,305	133,111

The total demand for energy from the domestic sector on the island as shown in Table 3 is 1,129,799 kWh/yr.

4.1.5 Home Energy Use by Fuel

We can break this down using the survey data form our study of the homes on island. Bearing in mind our study surveyed over 33% of the permanently occupied homes, we are confident that this represents an accurate estimate.

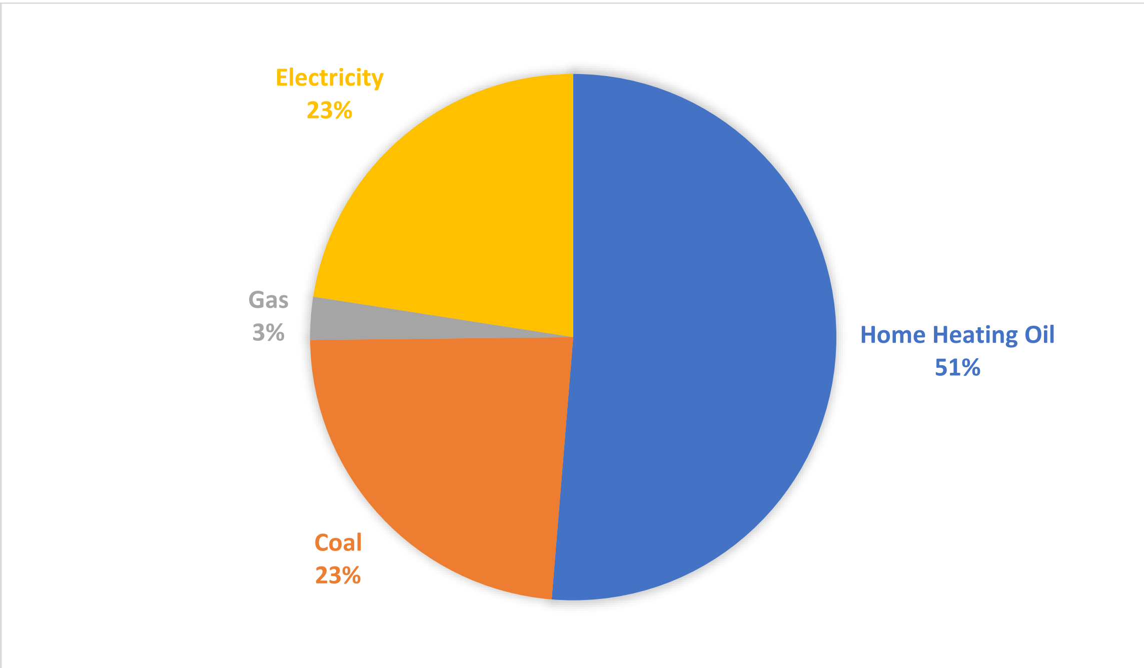

Figure 8: Domestic Energy Use in the Home by Fuel

As expected, Home Heating Oil is by far the largest fuel source in the home. It is the primary space and hot water heating system in all of the homes surveyed (6 out of 7). Coal was the preferred secondary heating fuel in all homes except one here it was the primary heating fuel and another where the secondary heating fuel was gas. In all homes electricity was the secondary water heating fuel (via an immersion) and was the energy supply for appliances.

4.1.6 Home Energy Costs and Emissions

Combining the figures for total amount of energy consumed per home with the fuel type, we can calculate the typical energy spend and CO2 emissions for the homes on Inishturk.

Table 4: Home Energy Costs

Energy Source	Cost per kWh[20]	Percentage Energy Use	kwh from total island use	Cost	kg CO2/yr
Home Heating Oil	€0.139	51.31%	579,657	€80,572.30	148,972
Coal	€0.099	23.52%	265,759	€26,394.91	90,518
Gas	€0.225	2.63%	29,690	€6,688.71	6,808
Electricity	€0.281	22.54%	254,693	€71,568.79	165,041
Total		100.00%	1,129,799	€185,224.71	411,338
Average Per Home			**53,800**	€8,820.22	19,588

As we can see from Table 4, the survey data from the homes shows that the average home on the island is probably spending a considerable sum on energy. There are a number of observations and caveats here. Firstly, **the home heating and lighting consumption is based on assumed values from the BER assessments**. Homeowners may by necessity underheat their homes, in an effort to reduce their actual energy bills. This is by no means an ideal situation. The recommendations that the master plan makes are based on recommended heating levels (i.e., what is presumed healthy and comfortable) and so we assume in all of our calculations the home heating levels that are deemed reasonable and safe.

The average CO2 emissions for each home and for the Island as a whole are also shown in Table 4. We can see that the average home on the island emits 19,588 kg CO2 each year. This is well above the national average of 3,800kg CO2 as reported by the EPA[21]. Contributing to this is the relative size of homes on Inishturk (which are also detached houses and thus exposed on all sides) as well as the lack of availability of natural gas which is much less carbon intensive than most other home heating fuels. The electricity supply has a calculated carbon intensity of 648g CO2/kWh as it is produced by diesel generators. This is far above that of grid electricity (347.8 gC02/kWh[22])

To illustrate what the level of carbon emissions represents for each home, a single 10-year-old coniferous tree will sequester 14kg CO2 in a year[23]. This means it would require *1399 trees* to offset the carbon produced by each home. Requiring 29,382 trees for the island's home energy use as a whole. Needless to say this would not be possible given the terrain of the island.

[20] These costs are outlined in Appendix Section 10.1 and are based on Inishturk prices including import.
[21] https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/Ireland's-Final-Greenhouse-gas-report-1990-2021_April-2023.pdf p17
[22] https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/ 2021 value
[23] https://www.treecouncil.ie/carbon-footprint

4.1.7 Domestic Vehicle Use

As CSO data was not directly applicable to the island, we surveyed the number of cars on the island directly and estimated that there are 30 cars. All of these are used for short journeys as there is no roll-on-roll-off ferry for Inishturk. The car stock is old. The vehicles are split between saloon type and SUV-type high body 4X4 drives. The roads on the island are generally rough with steep inclines over large parts of the island, and as is typical in the West, vehicles regularly to double duty as personal transport and work vehicles.

We estimated[24] that average age of the cars on the island at 10 years with all using diesel. The typical daily journey is assumed as 5km per day. As Table 5 shows, the relatively low cost and carbon emissions for domestic driving on Inishturk is a factor of the limited distances travelled. This has contrasting effects. In the first instance, there are limited savings to be made from switching from Internal Combustion Engine (ICE) vehicles to Battery Electric Vehicles (BEVs). The range issues that are seen to a barrier to BEV adoption in the rural setting in Ireland do not apply to Inishturk where the journey distances are very short. However, driving conditions may be a significant factor obstructing 100% adoption of BEVs.

We discuss the effects of this in our register of opportunities below but can summarize here: it would be recommended for some of the islanders to switch from old diesel vehicles to second hand electric vehicles with a very modest range (~20kms per charge). These vehicles will be cheaper, they will be cleaner and emit less CO2 and NOx. They will also provide a secondary benefit by providing an end-of-life use for older BEVs enabling current owners to upgrade to higher spec BEVs. There is no need for expensive fast charging on the island, home charging will be more than sufficient. Finally, when taken alongside recommendations for micro-PV roll-out which relates to home energy in general, they will have synergised sustainability benefits for householders. We recommend that drivers who need SUV type vehicles should look to switch to HVO

Table 5: Private Cars Fuel Consumption Cost and Carbon Emissions

	Total Private Cars	Estimated kms per year	litres diesel	kWh	Cost €	Carbon: kgCO2
Inishturk	30	54,750	3,285	34,493	5,913	8,804

Combustion of one litre of diesel is estimated to produce 2.68kg CO2[25] and where one litre of diesel is estimated to cost €1.539[26]

[24] Visual survey by the authors conducted April 2023
[25] https://www.tcd.ie/news_events/articles/are-diesel-cars-really-more-polluting-than-petrol-cars/

[26] The price of diesel in the calculations is not taken to be that at time of writing: diesel price fluctuates over time. The rational for this value of €1.39 is discussed in Appendix 1 Section 3.

4.2 Gross Domestic Energy Demand Inishturk

We have aggregated the various energy demands in the domestic sector in Table 6 which shows that there is more than 1,164,291 kWh energy consumed in the domestic sector in the SEC area (**on-island**). This produces approximately 420,142 kg of CO2. If the SEC community were to attempt to offset this amount of carbon by forestation, it would require 30,008 mature conifer trees.

Table 6: Total Domestic Energy Demand SEC Sector

	Space Heating & Hot Water	Lighting Appliances & Cooking	Transport	Total Domestic
kWh/a	875,106	254,693	34,493	**1,164,291**
percentage	75.16%	21.88%	2.96%	
kg/CO2	246,297	165,041	8,804	**420,142**

The breakdown of energy uses is significant. As Figure 9 shows, the energy used in the domestic sector for space and water heating is by far and away the most significant at 75.16% of the total energy demand. Electricity to power appliances, lighting, and cooking accounts for 21.88% of the island's domestic energy demand. On-island transport (in this case car driving) accounts for just 2.96%.

Figure 10 shows that there is a greater level of emissions from electricity than would be expected from its share of energy use. It is 39% of emissions but only provides 22% of the energy consumed. This is as a result of the level of emissions from electricity generated by diesel.

Therefore, the register of opportunities will focus on reducing the energy required for heating while also addressing the need to reduce electricity consumption provided by the island's diesel generators and the replacement of the island's transport fleet.

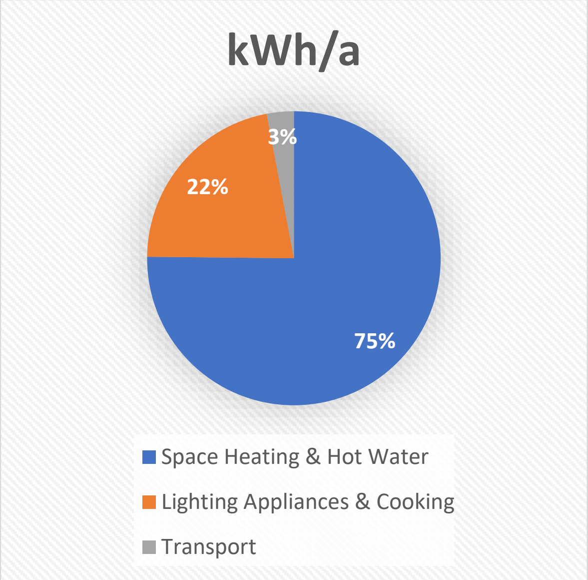

Figure 9: Domestic Energy Consumption kWh/yr

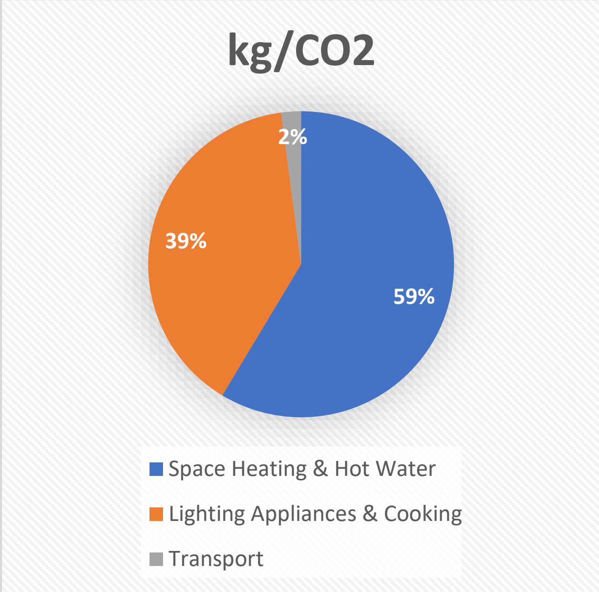

Figure 10: Domestic CO2 emissions kgCo2/yr

4.3 *Sampled* Residential Energy Use on Inishturk

4.3.1 Purpose of the sample

An Energy Master Plan is required to conduct sample energy assessments on businesses and homes in the SEC area. This has a number of purposes. It helps generate awareness within the community that the EMP is occurring. It provides a corroborative sample which helps inform the generalised data collected at the macro level (see Section 4.2). It also provides an opportunity to demonstrate the range, costs and feasibility of measures that can improve energy efficiency in homes and buildings. To this end this EMP surveyed 7 homes (33% of the total permanent dwellings) and three community/public buildings on the island.

4.3.2 Methodology

The full methodology of the sample and reporting is outlined in Appendix Section 8.3 below. In summary the seven homes and three community buildings were selected through an advertising recruitment campaign and for auditing. SEAI recognised building energy assessors were used: in the case of the homes, these were 2eva Ltd. In the case of the community buildings, the assessments were conducted by Sproule Energy Consulting Ltd.

4.3.2.1 Building Energy Ratings

A Building Energy Rating (BER) Certificate helps you to understand the energy efficiency of a home. The certificate system is discussed in detail in Appendix Section 8.2. A BER is a good indicator of how much you will spend and how much carbon you will produce to heat the home to a comfortable level. The rating scale looks like the energy rating labels for household appliances. It rates the home on a scale from A-G.

A-rated homes are the most energy-efficient and comfortable. They tend to have the lowest energy bills. G-rated homes are the least energy-efficient. They typically require a lot of energy to heat the home and have the highest energy bills.

A BER is calculated based on the amount of energy the home requires for space and hot water heating, ventilation, and lighting.

4.3.3 Summary of home audits

In Table 7 we give anonymised information here on the homes surveyed by 2eva.ie. This shows the upgrade potential of each home and the energy and costs savings possible. To note, five out of the seven upgrade recommendations proposed retaining the existing solid fuel system as a secondary space heating system: fireplaces were replaced by stoves, but smokeless coal use was still possible for these homes.

Table 7: Energy and Costs Savings from Surveyed Homes

Current BER	Total Energy Use kWh/yr	Emissions kg CO2/yr	Est Costs[27]	Potential BER Upgrade	Energy Use Post Upgrade	Potential Cost Savings
E1	47,795	13,000	€6,643.51	A2	3,951	€5,789.99
D2	66,288	18,030	€9,214.00	A2	7,520	€7,602.14
C3	27,040	7,355	€3,758.56	A2	3,764	€2,850.12
C1	41,760	11,359	€5,804.64	A2	6,131	€4,542.03
C3	30,174	8,207	€4,194.19	A2	4,123	€3,224.20
D1	48,576	13,213	€6,752.06	A2	5,326	€5,633.72
G	80,631	21,932	€8,008.19	A2	5,099	€7,148.80

The average cost saving by upgrading to an A2 for the homes surveyed was €5,255.86, or 81.9% of total estimated heating and lighting costs.

There is a caveat here in that the energy use for heating is estimated according to average safe and comfortable levels. Some homeowners may currently reduce the temperature of their homes below these levels and thus may have lower actual heating costs.

[27] Cost estimates for each fuel type given in Appendix Section 8.1. The costs are broken down according to the amount of each fuel type recorded as consumed in the building surveys.

4.4 Non-Residential Sector

There is no industrial use of energy on the island, any SMEs are accounted for in Community, Agriculture or Fisheries sector.

4.4.1 Building Energy Use

There are only four occupied non-domestic buildings in the SEC area. We exclude B&B accommodation and farms. This is due to the fact that these buildings also serve as homes, and thus the energy use of these buildings will fall into the energy use benchmarking above (Section 4).

The non-domestic buildings are;

- Community Club Inishturk
- St Columba's Church
- St Columba's National School
- Inishturk Health Centre, Garranty

The energy use of three of these buildings was surveyed, that of the remaining building is estimated.

Table 8: Energy Use by type of premises

Premises	Energy Use kWh/yr	Cost €/yr	Emissions kg CO2/yr
Community Club, Shop and Bar	116,176	€23,388.55	36,320
Health Care Centre *Estimated*	62,800	€10,423.54	20,805
National School	12,691	€2,821.56	5,291
Church	11,500	€4,218.00	7,452
TOTAL	**203,167**	**€40,852.10**	**69,868**

4.4.2 Agriculture

In common with much of the west of Ireland, agriculture is generally non-intensive and small-scale livestock breeding and rearing. There is extensive sheep throughout the island.

According to the CSO Agricultural Census[28] there are 58 registered farms CSO Small Area of which approximately 10 are on Inishturk. The livestock is almost entirely sheep with less than approximately 250 head. This level of stocking would produce an estimated 19,763 kg CO2 per year.

This is essence means that the carbon intensity of the island's agriculture is much less than that in other parts of Ireland owing to the lack of cattle and pig farming.

[28] https://www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020detailedresults/agriculturalstatisticsbyelectoraldivision/

Average energy inputs for Sheep (93 kWh/yr) are much less than those for other animals (store cattle require 2,239 per animal per year). We estimate that the 250 sheep on Inishturk would require approximately 23,250 kWhr/yr.

4.4.3 Fishing

The Fisheries sector in Inishturk is significant, but not large in volume. There are 3 vessels >10m (the largest is the Aspire II at 12m), and 5 under 10m[29]. According to a Bord Iascaigh Mhara study[30], the average fuel costs for vessels in the 10-12m class is approximately €7,000/yr. This would equate to 21,000L in total at 210,000kWh emitting 54,000kg CO2. The energy use of the 5 boats under 10m can be estimated to be 15,000L emitting 39,000 kg CO2. This means that the energy use and emissions in the Marine sector are slightly larger than the community buildings sector. We also do not see the replacement of diesel engines in Atlantic Fisheries as a viable medium term carbons emissions reduction opportunity in this EMP. We discuss developments in the use of biofuels. In particular, HVO, in the marine sector in Section 5.6.

4.4.4 Non-Domestic Transport: Ferry

The direct public transport provision to the island is by ferry. We did not include this as an energy use or carbon emissions source in this EMP as it was deemed by the SEC to be beyond the EMP's scope. We do note however, that marine diesel for ferries played a large part (approximately 50%) in the assessed energy use in the Aran Islands' EMP. An energy study carried out by KRA Renewables on Inishboffin[31] found that that ferry service used 1,450MWh of diesel fuel (22% of the island's total energy use) and was responsible for over 380 tonnes of carbon emissions.

We discuss the possibilities for emissions reduction in the marine transport sector in the Register of Opportunities Section 5.6 below, but only in passing to ferry traffic.

4.5 Aggregated Energy Use SEC area

As we see in Table 9 the SEC area uses 1,615,708kWh (excludes ferry) of energy across all measured sectors per annum. This energy demand generates as much as 669,227 kgs of carbon dioxide or 13,122 kgs per person[32]. This excludes dietary, and off-island travel emissions. This is significantly higher than the EU average of 8,200 kg CO2/pp/a. To mitigate offset this level of carbon emissions, the SEC area would need to plantation of 47,800 conifers (more if native woodland species). Needless to say, given the island's geography, this would not be possible.

Table 9: All Sectors Energy Use, Carbon Emissions, cost

Energy	kWh/yr	kg CO2/yr	Cost

[29] https://www.gov.ie/en/organisation-information/5907a-sea-fisheries-administration/?referrer=http://www.agriculture.gov.ie/seafood/seafisheriesadministration/
[30] https://bim.ie/wp-content/uploads/2023/03/BIM-An-economic-analysis-of-the-Irish-small-scale-fleet.pdf
[31] KRA Renewables, 2022, Energy Transition Plan for Inishbofin Island, https://www.krarenewables.ie/projects/energy-transition-plan-for-inishbofin-island
[32] Based on population of 51 as recorded in 2016 census: there are no population figures from 2022 yet.

Residential Heat	924,381	307,305	€113,656
Residential Electricity	205,418	133,111	€71,569
Residential Transport	34,493	8,804	€5,913
Community	203,167	69,868	€40,852
Agriculture	23,250	19,763	€4,118
Fishing	225,000	93,000	€36,000
TOTAL	1,615,708	669,227	€272,107

4.6 Analysis of Energy Use by Sector

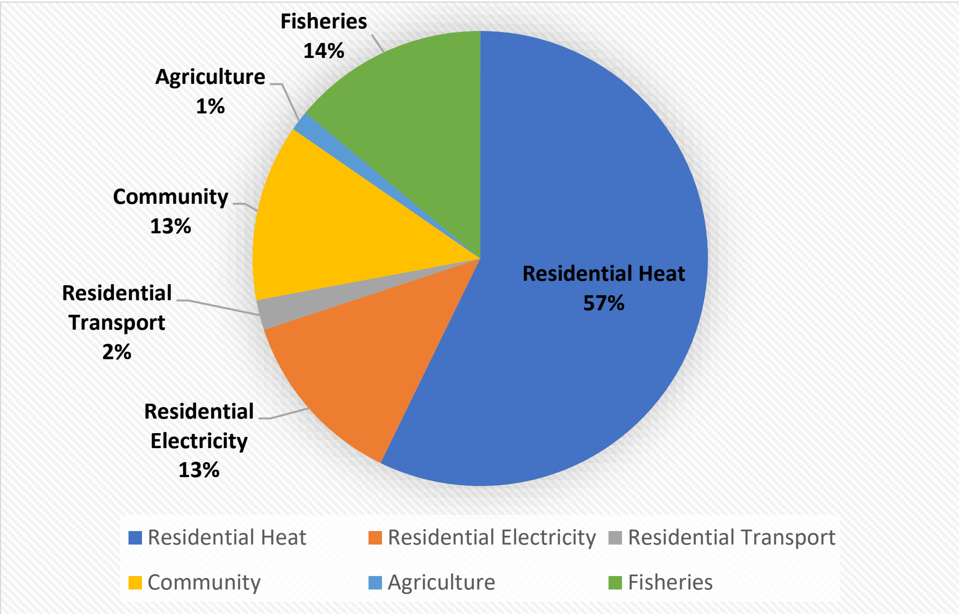

Figure 11: Energy Use by Sector (kWh/yr)

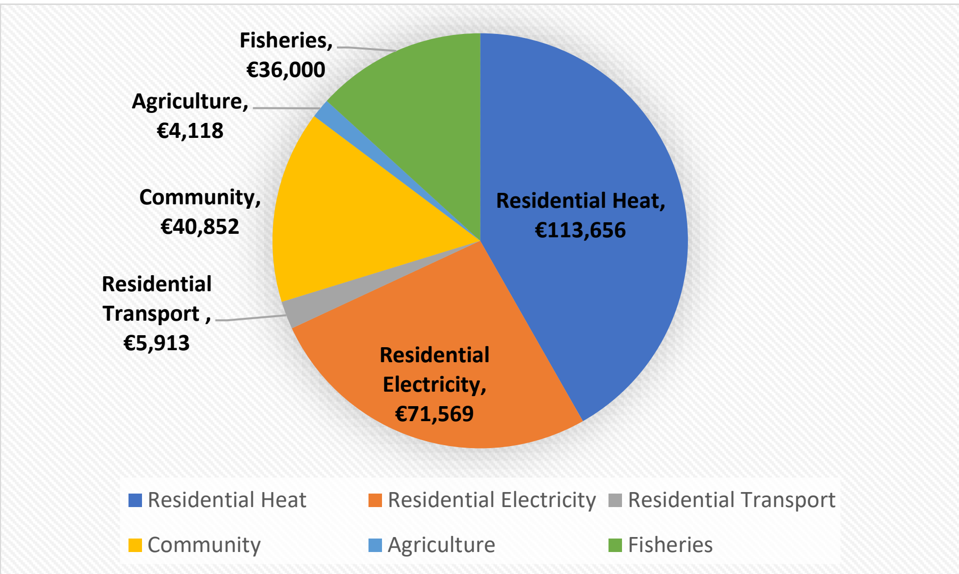

Figure 12: Energy Cost per Sector €/yr

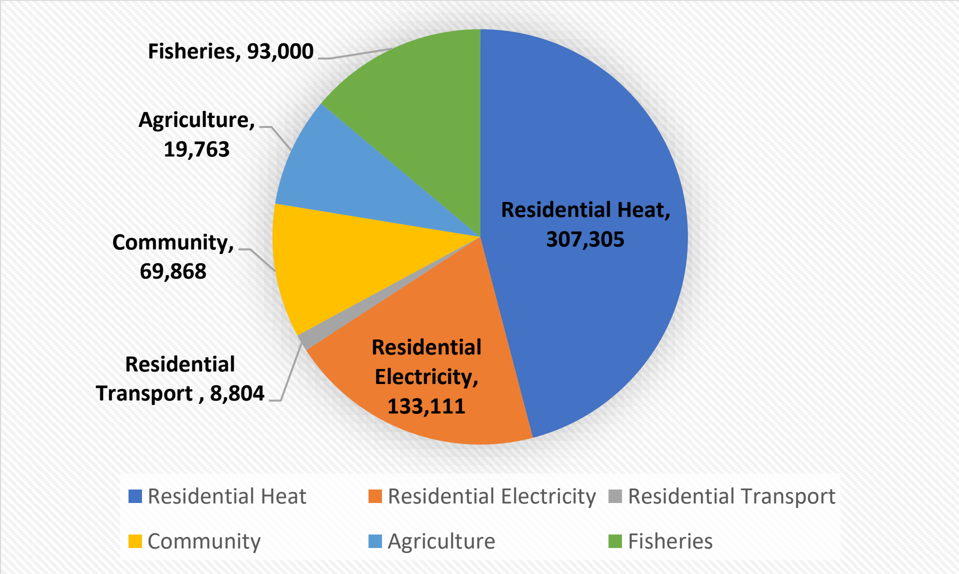

Figure 13: Emissions per sector kg CO2/yr

4.6.1 Residential Heat

This represents 57% of energy use, but only 46% of emissions and 42% of the energy spend. This is because it is predominantly home heating oil which is generally less expensive than other forms of energy and less carbon intensive than, for example, the island's electricity supply (see Section 4.6.2 below). Nonetheless as the largest by far across all measures, the residential heating of the island is central to the island's energy demand. The Registry of Opportunities (RoO) (in Section 5.1) will focus on how the island residents can reduce this energy requirement, save money and impact on carbon emissions.

4.6.2 Domestic Electricity

Inishturk is unusual amongst Irish islands in that it does not have a connection to the mainland grid. It does have its own distribution grid however which is good condition and is suitable for renewable energy inputs. Electricity is currently mainly used for lighting, appliances, and cooking which in general are not energy use areas that are open to radical behaviour impacts. The RoO below will discuss these. What is clear is that the fact that the electricity consumed on the island comes from diesel generators means that it has a much higher carbon intensity than on the mainland (twice the amount of CO2 per kWh). This highlights the need to reduce in as far as possible, the amount of electricity that is required from the generators (which will be required for backup for the medium term).

4.6.3 Community Buildings

The energy consumption of community buildings (which on Inishturk includes the commercial sector) accounts for roughly 13% across use, emissions, and costs. These are very amenable to energy reduction and renewable generation measures. For example during the course of the EMP study, the Community Club has installed PV which will have demonstrable auto-consumption benefits as well as sale-to-grid benefits. This will help meet the Club's considerable electrical load (49,339[33] kWh/yr – costing €16,069) while at the same time will enable export of renewable electricity to the local distribution grid thereby reducing the island's emissions in general and generating an income for the Club. There are equally social, sustainability and economic benefits to be gained from the energy efficiency measures which this EMP produced for Inishturk's community buildings – these are discussed in the RoO below.

4.6.4 Agriculture

Agriculture while widely practiced on the island has a relatively low energy use and cost (2%). However, it has a disproportionate emissions footprint (9%)[34]. More than half of this (i.e. 37,377 kg CO2) comes from the animals themselves and so far, there are few means of reducing this. The 23,250 kWhr/yr from energy inputs is largely transport diesel and shed heating which are amenable to emissions reductions strategies. We will focus on these elements of the agriculture sector in the RoO Section 5.5.

4.6.5 Fisheries

With regard to fisheries, direct energy use measurement was not part of the EMP. However, we did run estimates on the basis of the BIM[35] study for small vessels. This suggested that the sector accounted for 15% of energy use, costs, and emissions. We discuss opportunities to reduce environmental impact through the use of biodiesel in the RoO Section 5.4.

4.6.6 On-Island Residential Transport

Again, this is a relatively small amount of the energy demand, cost, and emissions of the island. It was a requirement of the commissioning of the EMP that this be examined and that recommendations be made. We do this in the RoO, but in the knowledge that it represents only approximately 2% of the island's energy demand, costs, and emissions.

4.6.7 Energy, Costs and Emissions not measured by EMP

The ferry, off-island car use, diet, and air transport emissions were not assessed in this EMP. This was largely due to resources allocated. However, these areas can play a significant role in the island's energy use. We discuss measures that can be taken to reduce this in the RoO.

[33] We do not include energy generation or energy import avoidance that this installation may achieve as it has not been energised at time of writing and so there is no data as to auto-consumption versus export to grid available.
[34] We did not include the emissions from the animals themselves in the CO2 audit in Figure 13.
[35] https://bim.ie/wp-content/uploads/2023/03/BIM-An-economic-analysis-of-the-Irish-small-scale-fleet.pdf

5 Register of Opportunities

The Register of Opportunities is a database of potential energy-saving projects and measures that can be implemented by the community of Inishturk. The purpose of the register is to provide information and guidance to residents on how to reduce their energy consumption, save money on energy bills, and decrease their carbon footprint.

The Register of Opportunities contains a wide range of energy-saving measures that businesses can consider, including lighting upgrades, insulation, HVAC upgrades, renewable energy systems, and energy-efficient equipment. It also provides information on available grants, financing options, and other incentives that can help businesses to finance and implement these measures. By implementing energy-saving measures, residents can not only save money but also reduce their environmental impact and demonstrate their commitment to sustainability.

5.1 Residential

We look at a range of opportunities for homeowners and community residents to have a positive impact on increasing the sustainability of their lives: through improving the energy efficiency of their homes, their transport choices as well as simple behavioural changes that can reduce their imported fossil fuel dependency.

5.1.1 Individual Level Behaviour Changes

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

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

Pappas & Pappas (2014)[36]

We present a list in Appendix, Section 9.1, of some actions that the homeowner can take to reduce the level of energy use in their own home with simple behaviour changes. We summarise the highlights here:

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

FIRST EASY WINS:

Cost reduction measures:
- Change your energy provider.
- Consume less electricity and bottled gas, and more oil to heat your home and water.

Home Improvement Measures:
- Track down and eliminate draughts: check windows, external doors, vents, interstitial floor spaces, fireplaces, and stoves.
- Check insulation levels in attic, basement, walls (including the meter box), and interstitial floor spaces.
- Check your boiler and stove: do they need servicing, cleaning?

Energy Reduction Measures:
- Switch to more efficient appliances and lower temperature settings
- Don’t use standby on devices and turn off lights when possible.

5.1.2 Home Energy Upgrade Case Studies

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

Our survey of homes and domestic energy upgrade reports show that considerable efficiencies can be achieved.

5.1.3 Method

We discussed the methodology of the sampling, building energy assessments and upgrades in Section 4.3 above.

The assessors provided home owners with a set of recommended upgrades which could be carried out to improve the energy efficiency and comfort of their homes. As sample of such a report is shown below (Figure 14). This has been provided to the SEC as a live excel report to which other homes can be added.

Dwelling Type		**Single Storey Detached Dwelling c1850**	
	M2		
Total Building Area:	**153.88**		
Exisisting Heating System	**Cost when surveyed**	**Co2 Emissions**	
Solid Fuel	0.12 €/kWh	0.3406	Kg CO2/kWh

G

Element	BER Rating	Energy Value	Co2 Emissions	Potential Energy Savings	Total Annual Space Heating	Space Heating in Kw/hour	Heat Loss Indicator	Space Heating costs per year	Carbon Emissions
		(kWh/m2/yr)	KgCO2/m2/yr)	€	kWh/yr		(HLI) w/km2		
Dwelling Current Condition	**G**	**527.34**	**27,638.70**	**€8,153.30**	**81,147**	**42.26**	**4.97**	€9,737.65	27,639

		Element	BER Rating	Energy Value	Co2 Emissions	% Energy Saving	Total Annual Space Heating	Energy Requirement per hour for space Heating	Heat Loss Indicator	Space Heating Cost per year	Overall Carbon Emission KgCo2/Year
				(kWh/m2/yr)	KgCO2/m2/yr)	%	kWh/yr	Kwh/Hour	(HLI)	€	KgCO2/year
1	**Insulation Attic**	Upgrade Attic Insulation to 300mm+	F	427.99	145.8	**18.84**	65,859	**34.30**	3.91	€7,903.09	22,432
2	**Roof Insulation**	Flat Roof Insulation	E2	362.58	123.5	**31.24**	55,794	**29.06**	3.25	€6,695.26	19,003
3	**Internal Insulation**	92.5mm PIR Insulated Plasterboard internally on original stone walls	E1	316.68	107.9	**8.70**	48,731	**25.38**	2.8	€5,847.69	16,598
4	**External Insulation**	Extension Walls	D1	253.97	86.5	**11.89**	39,081	**20.35**	2.2	€4,689.71	13,311
5	**Windows**	Change Single Glazed Windows to < 1.1 w/m2k or better	D1	323.15	110.1	- **13.12**	49,726	**25.90**	2.17	€5,967.16	16,937
6	**Secondary Heasting System**	Remove Rangne Cooker & Draught Stipping attic hatch	D1	248.8	84.7	**14.10**	38,285	**19.94**	1.99	€4,594.24	13,040
7	**Heating System**	*Install Air to Water Heat Pump for heating and hot water (zoned full time & temperature controls)	B1	77.26	26.3	**32.53**	11,889	**6.19**	1.99	€2,615.53	4,049
8	**Photovoltaic**	Add 6 No. PV Panels to South facing roof 2.19 Kwp (assuming 365 watts per panel)	A2	46.80	15.9	**5.78**	7,202	**3.75**	1.99	€1,584.35	2,453

A2

* The Heat pump used in this Assessment is a Mitsubishi 6.00 Kw - The Heap Pump installed MUST be specified by the Installer and/or Manufacturer.

Carbon Dioxide Savings per year	**25.19**	**Tonnes**
Equivalent Planted Trees	**1,799**	**Trees**

Figure 14: Sample Page from Excel Energy Report

5.1.4 Recommendations

There is a recognised need to decarbonise home heating by replacing oil and gas-powered boilers with heat pumps. For Inishturk, these are recommended to be Air Source Heat Pumps (ASHP[37]). These heat pumps are electrically powered and as the country's electricity supply becomes increasingly decarbonised so does the energy source for a heat pump. Heat pumps are more efficient than oil or gas boilers as the convert input to output in a 1:3 ratio: i.e., for every one kWh of energy put into the system the equivalent of 3kWh of heat is produced for the home. As a solution to the country's heating needs, heat pumps, in particular ASHPs are a recommended route[38]. They are particularly recommended in areas where there is no gas grid. The economics of the ASHP are very favourable in comparison to an oil alternative.

A very real technical requirement for the successful installation and operation of an ASHP is that the building achieves a low Heat Loss Indicator (HLI). An HLI of less than 2.0[39] is required – this HLI would mean that the home does not lose heat through drafts or uninsulated building elements such as walls, roofs, windows, or doors. Therefore, it is a requirement that for nearly every building where an ASHP is to be installed, a full upgrade on the fabric of the building must also be carried out.

Our recommendations for building upgrades operate on the fabric first approach and this is reflected in the steps outlined in the sample above.

The example in Figure 14 shows that a G rated home (which is the lowest BER level) can be upgraded to an A2 rating saving up to €8,153.30 per year in heating costs and 2,150 kg of CO2 emissions. We cannot define exactly how much each measure will cost in this example, or in a similar home on Inishturk, as contractors prices vary widely. However, with this level of energy cost savings possible, a favourable payback period can be predicted.

One of the recommendations is to install 2.16kW of PV panels. This will produce approximately 2612 kWh of energy. Some of this may be used to power the heat pump, but some will be distributed to the grid. Any electricity sent to the grid will earn a premium of approximately 20 cents per kWh from the home's energy supplier under the Microgeneration Support Scheme**. This is true of Inishturk regardless of the fact that the island itself is not connected to the national grid on the mainland**.

[37] ASHPs are cheaper to install and require much less space than GSHPs

[38] Initial concerns about the effects of atmospheric salts on the lifespan of ASHPs in the West of Ireland particularly have been addressed by both the manufacturers and the installers. A typical ASHP in the West of Ireland will operate sustainably for up to 10-15 years

[39] Homes should have a Heat Loss Indicator (HLI) of 2 Watts/Kelvin/m2 before the SEAI will grant a Heat Pump installation, but a HLI of 2.3 Watts/Kelvin/m2 will be considered with some caveats.

5.1.5 Community Level Effects of Retrofitting Programs

Our sample indicates that on average, homes on Inishturk would greatly benefit economically and environmentally by implementing a bottom-up approach to domestic upgrades. This would target the worst BER rated homes (G and F rated) with uplifts moving up to D2-C3 homes.

Table 10: Community Effect of Average Upgrade to A2 in all homes.

Current BER	Total Current Average Energy Use kWh/y	Emissions kgCO2/y	Current Energy Costs €/y	Potential Cost Savings €/y[40]	Potential Emissions Savings kgCO2/y[41]
G-F	261,339	124,513	€52,645.20	€48,982.73	120,233
E1-E2	108,514	51,701	€21,859.60	€19,906.28	49,418
D2-C3	433,705	206,637	€87,367.56	€76,135.98	193,510
C2-B3	110,273	52,539	€22,213.81	€17,696.76	47,260
Total	**913,831**	**435,390**	**€184,086.17**	**€162,721.75**	**410,421**

As we can see from Table 10, there are considerable savings possible (€162,721.75) for the island community from energy upgrade works as well as carbon emissions savings of more than 410,241 kgs of CO2 which would be the equivalent of planting more than 29,000 trees: which is not feasible on the island.

It should also be borne in mind that this retrofitting work would in effect also amount to the complete physical upgrading of all the homes on the island making them more modern, comfortable, and healthy to live in.

It should also be realised that retrofitting the homes on an individual basis may be problematic as a contractor specialist may not be very quick to tender for an individual home upgrade on Inishturk given its logistical challenges (for a solution to this see below Section 5.1.7). We recommend group applications that make use of the capacities discussed below.

5.1.6 Supports

Irish homeowners are relatively fortunate in the level of assistance that is available to them for energy efficiency upgrade works. We emphasise the benefits of collectively organised retrofitting works, although there is a guide to other supports in the Appendices.

[40] We took an average cost for energy (€/m^2) for all homes post retrofit works (which would now be A2). This was calculated to be on average €6.08/m^2. We applied this value to the total areas of the homes for each BER type.

[41] The average CO2/m2 for the upgraded homes on Inishturk was 7.1kg Co2/m2/yr. We applied this value to the total areas of the homes for each BER type.

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

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

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

5.1.6.1 Community Energy Grants

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

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

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

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

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

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

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

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

Table 17: CEG 2023 Funding Levels.

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

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

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

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

- Fuel Allowance
- Job Seekers Allowance for over six months with a child under seven

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

We discuss the SEAI homeowner grants for individual homeowner applicants in Appendix Section 9.2.

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

5.1.7 Capacities

Over the course of the EMP study, the SEC has carried out a community enterprise building project whereby to homes of a very high standard of energy efficiencies were constructed for holiday lets as an income generation opportunity for the Inishturk Community Club. Over the course of the project, contacts were established that lead the EMP authors to be confident that any issues with regard to contractor recruitment for energy retrofits stemming from the island's relative geographical isolation have been overcome. We are confident that the capacities to carry out a wider-ranging CEG project are available.

We note that the new homes on Inishturk discussed above are being carried out by SEAI registered AWHP and Building insulation contractors. In addition, the Community Club has recently had PV installed by a registered contractor.

Therefore, all the capacities, from Project Management through to registered contractors available and willing to install the required retrofitting and energy generation are established. It is a key recommendation of the EMP that work begin on a full CEG application for 2024 to retrofit all homes and community buildings on the island begin as soon as possible.

5.2 Private Transport

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

5.2.1 Context

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

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

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

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

5.2.2 More Efficient Car Use:

As with individual actions to achieve home energy efficiency, there are actions the citizen can take to reduce the impact of their private car use. These are described in Table 11: More Efficient Car Use Table 11.

Table 11: More Efficient Car Use

Reduce the most inefficient journeys by car where possible
Save CO2 and money by sharing journeys on the mainland.
Plan ahead by combining trips (shopping, school runs etc.)
For cars that do not automatically turn off when idling, switch off if you will be stopped for more than 9 seconds
An energy-aware driving style can save 13% on fuel and emissions
Inflate tyres correctly to manufacturer's recommendation
Avoid harsh acceleration or heavy breaking also slowing down in good time saves fuel, smooth style around bends
Cars are parked 95% of the time, do you need a second car?
The sun-roof fully open consumes up to 4% more fuel, half-open - 3%
A roof rack can increase fuel consumption by 40% and a cycle rack with two bicycles by 10% - 15%
Use air-conditioning sparingly – it increases fuel costs
Rear screen heater's increases fuel consumption by 3% - 5%, so switch it off once the window is demisted
Front windows left half open consume more fuel at higher speeds so use the air vents instead
Do not carry unnecessary weights in the boot, clean it out!
The average new car emits 120g of carbon dioxide for every kilometre. SUV's can emit a staggering 330g carbon dioxide per km.
Consider having a transport sharing social media group: In particular in relation to mainland cars which could be high spec BEVs that are shared.

5.2.3 Active Travel on Inishturk

The terrain on the island is rugged and elevated in places. Cycling is challenging. However, electric bikes have been trialled elsewhere (see Rathlin Island[44]) where conditions are similar. A trial of electric bikes may be valuable in bringing about a reduction in the level of car use. Many homes have multiple on-island cars. We recommend that the SEC committee reach out to the local authority and tourist bicycle hire companies[45] for a six-month trail scheme that would be cost effective as a proof (or disproof) of concept.

5.2.4 Private Cars

Replacement of Diesel cars by Battery Electric Vehicles (BEV) is a national policy aim in the medium term. There is still however some slowness of car owners to buy in to this policy, particularly in the West of Ireland. It is important to note however, that battery range has increased rapidly in the past few years. Journey data shows that the car journeys driven by residents in the SEC on the island area are well within the range of even the most decrepit of BEVs.

There are still state sponsored incentives for drivers wishing to switch to BEVs (see Appendix III, Section 9.3) through the SEAI. The condition that these be new and of eligible make and model means that they start in price at €24,995, for the Fiat 500e, inclusive of the SEAI grant and VRT relief.

There were 2.3m private cars registered in Ireland in 2021[46]. 104,932 new cars were registered in 2021[47] This indicates an approximate renewal of 5% of private cars per annum in Ireland. The replacement over time of 5% per annum of the diesel vehicle stock with BEVs in the SEC area would have a significantly positive effect on emissions and reduced fossil fuel imports. In effect reducing vehicle emissions by 40%.

The specifics of the vehicles on Inishturk means that a focussed solution must be proposed. For smaller diesel saloon type cars (approximately 50% of the fleet), there are clear BEV alternatives. Since the distances driven are very short, second-hand options are available. While these will not qualify for grant assistance, at much lower costs than new cars, they will be still cost effective.

5.2.5 SUVs

We noted in Section 4.1.7 that there is a large number of SUVs driven on the island owing to terrain and multi-functional use. For SUV-type rough road vehicles, these are not yet widely available on the second-hand market. Their adoption will be pushed to the end of the 2030 strategy period.

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[44] The Rathlin Island project was directed at tourist use, but the island is similar in its geography (although bigger – Rathlin has 12km of road network, Inishturk 5km)

[45] Second hand or end of season cycles would be cost effective. Many companies change their stock frequently.

[46] https://ec.europa.eu/eurostat/statistics-explained/images/6/6a/Passenger_cars%2C_2016-2021_%28number%29_v3.png

[47] https://www.simi.ie/en/news/2021-new-car-registrations-up-19

We recommend that decarbonisation take the form of switching from Diesel to HVO for these vehicles. HVO, while more expensive than diesel produces far fewer emissions and as it is an organic product has a very low carbon intensity. Since the level of diesel use is relatively low, we would recommend that the additional cost of HVO be absorbed: given that the other recommendations of the RoO will achieve considerable savings for residents.

HVO can be used in traditional combustion engines and would require no new vehicle purchase or change of driver habits. Cost of switching fuels could be minimised by a collective arrangement between drivers and a mainland HVO supplier.

5.2.6 Off-island Driving

This was not required to be examined in the EMP. However, for the sake of a comprehensive picture we address it here.

There is a car park on the mainland at Roonagh pier. Some residents on the island have cars here. This is to enable mainland travel as there is no scheduled bus service to Roonagh pier. In the absence of this, the recommendation is for islanders to share two or three electric vehicles. Long range high spec BEVs are not required as the distance to the rail hub at Westport is 30km. Two to three dedicated EV charging points at Roonagh would be required. It is proposed that this be discussed at a community meeting hosted by the SEC steering committee.

5.3 Community Sector

As we have seen there are a great many of short as well as long term interventions that can be made to reduce energy consumption and thus reliance on fossil fuels in the domestic sector. The SMEs in the SEC area have very similar needs as homes: there are 2B&Bs which to all intents and purposes are homes – their BER data is included with the residential energy demand.

There are SEAI supported programs to assist SMEs identify where they can reduce their energy demands and fossil fuel use. These are outlined in Appendix III, Section 9.4.3.

Since the main non-domestic premises were audited in the EMP, the recommendations are described in detail in the audits given directly to each building manager. However, in summary, recommendations (listed in Table 12) were made for small scale PV and efficiency measures which would result in savings of up to 50-85% of energy and emissions, as summarised in Table 13).

Table 12: Measures Recommended for Inishturk Community Club

Action	Energy saving per yr (€)	Emissions reduction per yr (t CO_2e)	Cost of action (€)	Payback period (years)	First step
Install heat pump	€ 1,325	2.68	€ 12,000	9.06	Own funds a will not qualify for grant
Timers on bottle beer/drinks cabinets	€ 60	0.06	€ 70	1.17	Communities grant application
Building Fabric Upgrades	€ 1,422	2.49		Long	Communities grant application
Heating Controls on space heating	€ 829	1.69	€ 70	0.08	Communities grant application
Lighting upgrades	€ 328	0.33	€ 1,800	5.48	Communities grant application
Occupancy sensors in toilets and stores	€ 141	0.14	€ 500	3.55	Communities grant application
Energy Monitoring and Staff Engagement	€ 2,339	3.77	€ 5,000	2.14	Communities grant application
Total	**€ 6,444**	**11.16**	**€ 19,440**		

Table 13: Energy Opportunities Community Club Example Summary

Premises	Energy Use kWh/yr	Cost €/yr	Emissions kg CO2/yr	Energy Use Post Works kWh	Cost €/yr post works	Emissions Post Works kg CO2/yr	Cost of Works
Community Club, Shop and Bar	116,176	€23,388	36,320	65,059	€16,944	14,100	>€19,440

5.4 Fisheries: HVO

There is a long-term need to move away from fossil fuels as the energy source of our fisheries. Bord Iascaigh Mhara (BIM) have produced a useful document on the issue[48]. While overall, the seafood sector in general can be considered a low-carbon industry and food source, BIM suggests the drive to decarbonise the Irish seafood sector will intensify. The main contributors towards emission reductions will be:

(i) international obligations to achieve Net Zero emissions by 2050,
(ii) maintaining ecosystem biodiversity and sustainability,
(iii) consumer demand for low-carbon products, and
(iv) increasing fuel costs

There is still a long way to go in terms of technology and supply chain development for zero emissions vessels either BE Vessels (powered by electricity) or FCE Vessels (powered by Hydrogen). While both are considered valid long-term opportunities, there are more short-term options we can recommend here.

[48] https://bim.ie/wp-content/uploads/2023/02/BIM-Carbon-footprint-report-of-the-Irish-Seafood-Sector-1.pdf

Biodiesel has moderate a carbon emissions reduction possibility for the Inishturk fishing boats as an additive to diesel. HVO has been seen as a 100% drop-in option for some boats[49]: it requires no engine modifications and is seen as achieving a 90% level of carbon emissions. It is sold in Ireland. Achieving a 90% reduction in the carbon emissions of the fishing ion Inishturk would be no small achievement and should be investigated by the relevant members of the community. We provide a list of HVO suppliers in Appendix Section 9.5.3

5.5 Agriculture

The authors of the EMP did not identify any key energy reduction opportunities in the agriculture sector.

The energy use in Sheep Farming in the West of Ireland is generally quite low. Farms are generally contiguous and adjacent to the homestead and therefore transport to and of animals is not mechanised. Lighting and some heating for lambing sheds is required, and therefore some micro-PV generation would ordinarily be suggested. However, two key elements to note in relation to this are that PV output is low in Mayo generally and even that is at its weakest when ewes are bearing young, and lambs may require being housed. PV generation in an agricultural setting in the SEC area is likely not to be for auto-consumption (by the farm itself), instead it would more likely be classified as micro-generation for export to grid. We address this in the renewable energy generation section of the EMP below in Section 6.

Mayo County Council has produced a report on carbon reduction opportunities on farms Mayo farms which is available at this LINK[50]

There are possibilities for reducing the (low) emissions in the agriculture sector on Inishturk through the replacement of agri-diesel with HVO. This will of course have cost implications as agri-diesel (currently at per €1.05 litre) is heavily subsidised while HVO (at about €1.50 per litre) is not. We show HVO suppliers' information in Appendix Section 9.5.3

5.6 Marine Transport

The recommendations for the Marine Transport sector are in line with those for the fisheries sector. However, we understand that the owners and operators of the ferry were not consulted directly in the preparation for the report as this sector was not covered by the EMP commissioning document. We feel that it does represent an opportunity, however, as a 90% reduction in emissions in any sector is significant, in particular when it would be in a sector that may well be the largest source of carbon emissions for the islanders (see Section 4.4.4 above).

There will be regulatory concerns with using HVO in the fuel supply of a ferry. This has been examined by the European Maritime Safety Agency[51]. We propose that this could be investigated with the department of the marine.

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[49] https://www.mby.com/features/hvo-renewable-diesel-miracle-fuel-124733
[50] https://www.mayo.ie/getmedia/71434eff-5b07-4ad4-94ed-118769f748b1/A-Sustainable-Agricultural-Strategy-for-Mayo.pdf
[51] https://www.emsa.europa.eu/publications/download/7321/4834/23.html

5.7 Energy Demand by Scale and Type post Efficiency Opportunities Implementation

So as to assess the requirements of the energy generation opportunities discussed in Section 6 below, we need to estimate the energy demand of the island that will exist of the energy efficiency and change of energy source recommendations discussed above are put into place.

Table 14: Post Recommendations Energy Profile

Sector	Electricity	Oil	Coal	HVO
Homes	134,469	7,137	33,252	
BEVs (n=15)	17,246			17,246
Non-domestic	82,587		15,000	
Fisheries				225,000
Agriculture	9,300			13,950
Total	381,904	7,137	48,252	693,489

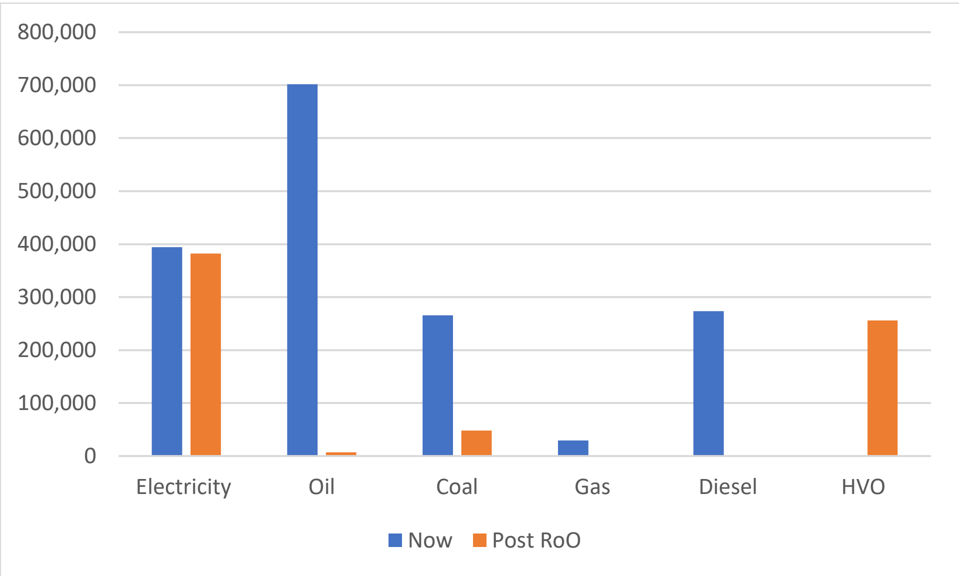


Figure 15: Fuel Demand Profile Current v Post RoO kWh

As we can see post adoption of RoO, the electricity demand, while less than now, is still sizeable. This is because:

- The heat pumps still have an electrical demand not met by rooftop PV.

- Appliances and lighting will still require electricity: approximately 3,100kWh per home.
- There will be an electrical demand from transferring half the islands cars to BEVs

Diesel will still be required for SUV-type and agricultural use, as well as fishing boats. Though it is hoped that the road vehicles can move to HVO.

Oil and gas will effectively no longer be part of the fuel mix – oil may still be used in a few buildings where heat pumps were not possible. There will still be some coal use as a secondary space heating fuel which may have aesthetic benefits for some householders.

A key figure to note is the predicted 381,904 kWh of electricity demand post RoO efficiency measures. This will be relevant where we discuss electricity generation opportunities.

6 Renewable energy options

6.1.1 Wind energy

In common with much of the West of Ireland the SEC area is well resourced in wind energy (Figure 16). It is therefore reasonable to investigate whether there is an opportunity to generate renewable energy in the SEC which could offset the energy use and carbon emissions produced locally.

Important to note is the fact that there is no connection to the national grid. In this case the generation would not qualify for RESS, and may not qualify for SSG.

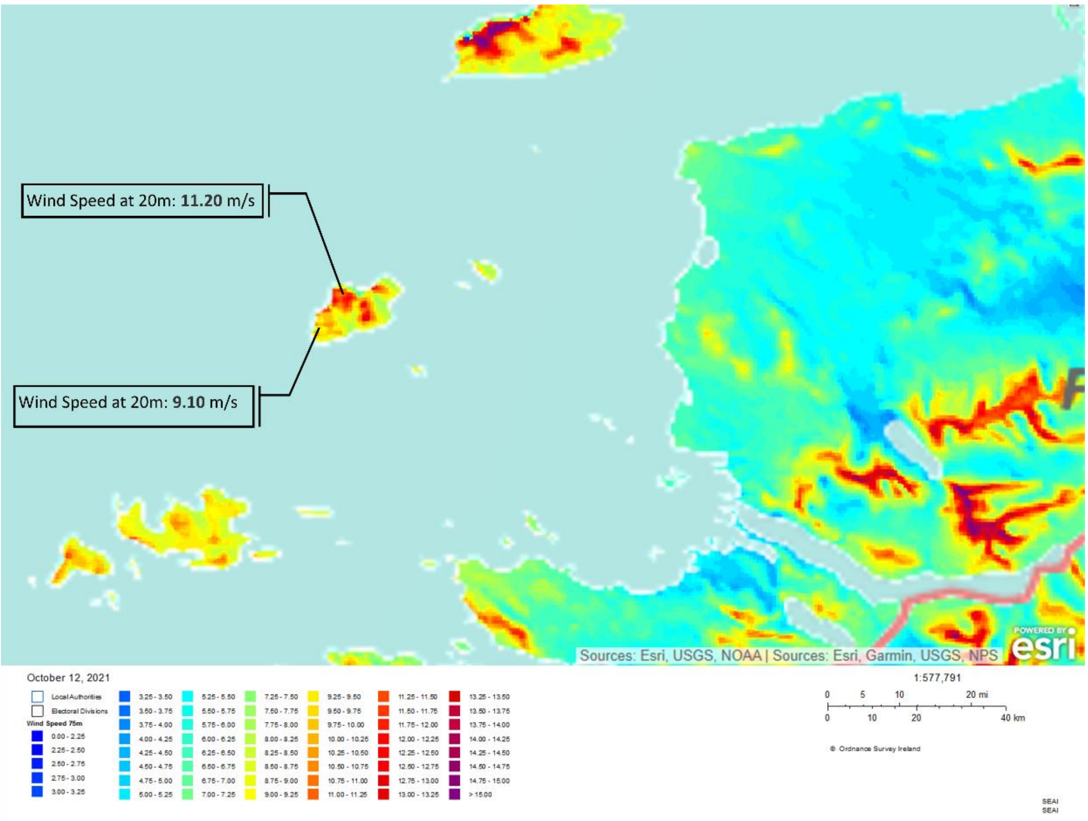


Figure 16: Wind Speeds SEC area

Source: SEAI Wind Mapping System[52]

The available wind energy onshore on Inishturk is determined by the modelled Wind Distribution pattern shown in below in Figure 17 . The estimated output of a 100kW turbine on Inishturk where there is an average wind speed of 9-11 m/s would produce approximately 350,000 kWh/yr. This is above the predicted electricity demand post RoO and

52 https://gis.seai.ie/wind/ accessed 10.05.22

88% of the current electricity demand. This would on the face of it represent a very productive wind resource, should planning policy and an economic price for power be achieved (see below). It could in effect offset 91,530 kgs of CO2[53] annually, 13.7% of the SEC area's total emissions.

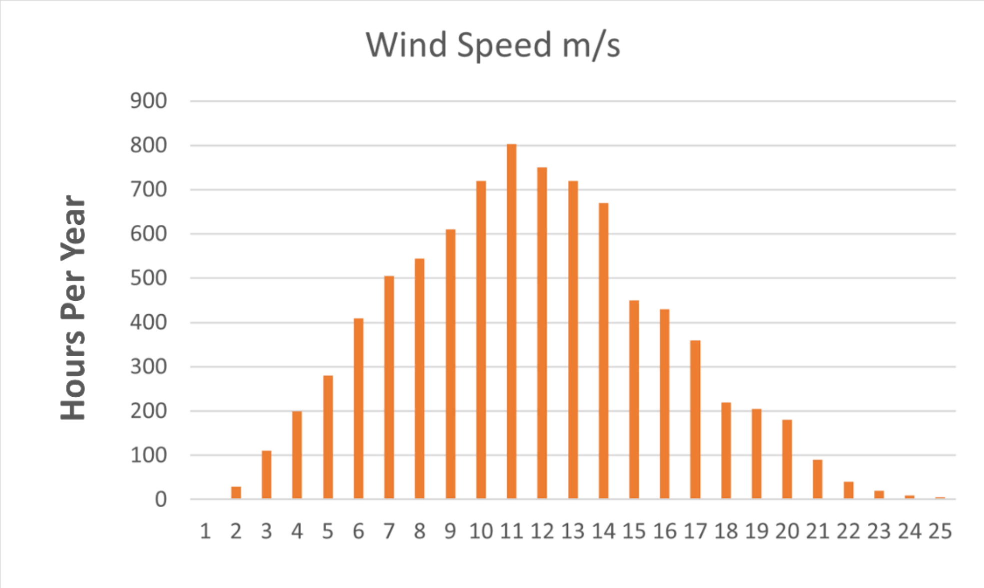


Figure 17: Wind Speed Frequency Distribution Inishturk

A 100kW turbine is relatively small ranging in hub height from 22m. For reference, the telecommunications mast on Inishturk is 17.5m. Figure 18 shows how these two heights relate.

This EMP does not make any recommendations as to possible locations for a wind turbine. All discussion here is for the purposes of information which the community may choose to investigate.

There is no connection to the national grid on Inishturk. As discussed earlier, electricity is supplied by three 80kVa diesel generators (which do not run at full capacity). The sizing of the turbine takes the local distribution grid into account. There will be a need to retain the diesel generators even in the event that a wind turbine is installed for back-up in ties of low or very high winds.

Energy storage options should also be investigated. The electricity generation from a turbine will frequently exceed demand. With no national grid to spill over onto, the turbine would frequently have to be constrained.

It is significant that the ESBN is carrying out trials for using domestic BEVs as backup storage for the grid[54]. In this scenario, the cars would take power when the supply is high and would

[53] The CO2 per kWh of electricity (carbon intensity) on Inishturk is estimated to be .648 kg CO2/kWh as it is generated by diesel (https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/electricity/#:~:text=CO%E2%82%82%20emissions%20intensity%20of%20electricity&text=In%201990%2C%20the%20CO2,gCO2%2FkWh%20in%202020.).

[54] https://www.esbnetworks.ie/docs/default-source/publications/the-dingle-electrification-project-customer-flexibility-trial.pdf?sfvrsn=3ee2c0b0_15

allow for their battery to push to the grid when demand was high. It would be very advantageous to the Island's progress towards sustainability and decarbonisation to discuss the possibilities of Inishturk taking part in the further demonstration of the validity of such a project.

There are further significant needs in relation to the ownership and management of the local distribution grid which need to be investigated in the case of Inishturk. Before any progress is made, investigatory discussions with ESBN would be necessary.

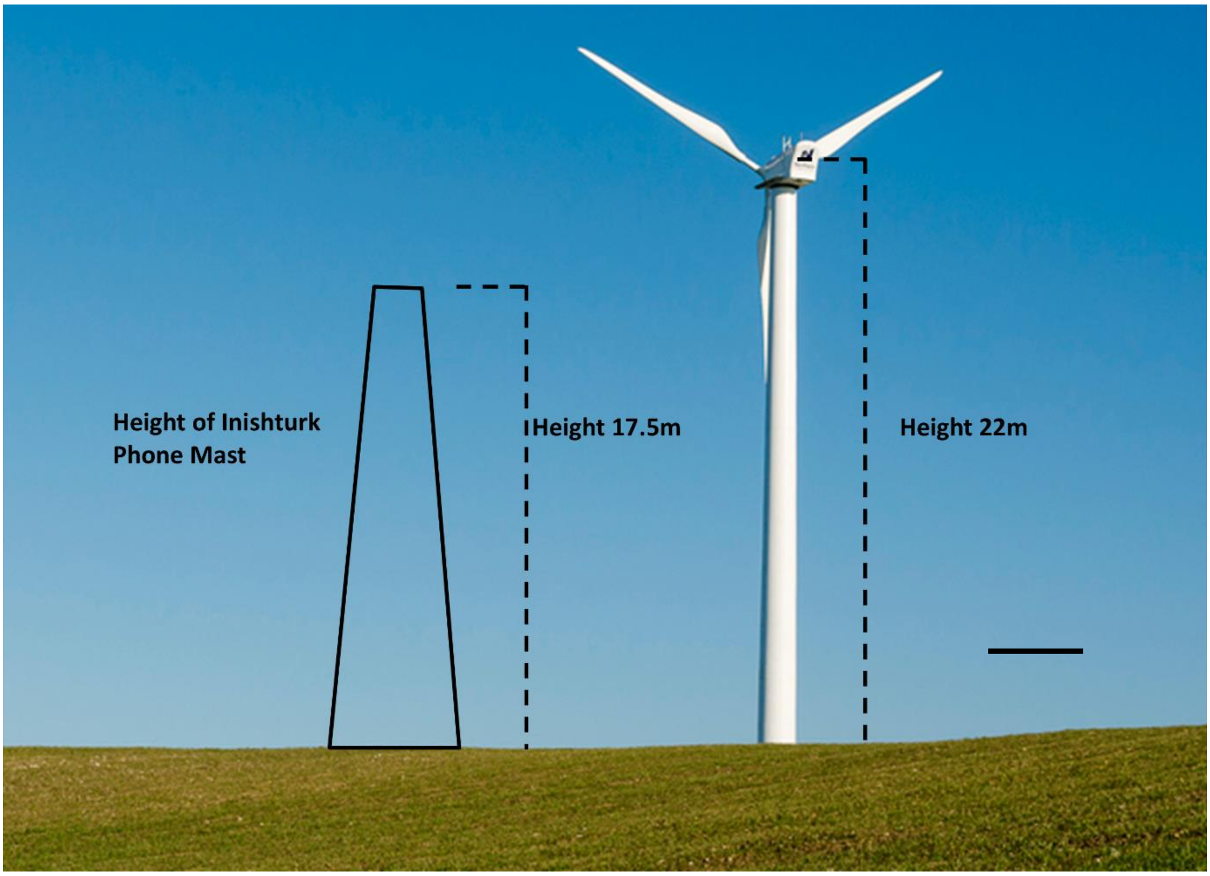


Figure 18: Height of Communications mast v 100kW turbine

As this opportunity is tentatively proposed, it involves multiple potential partners and is sensitive from the point of view of planning (Section 6.1.1.1 below), we cannot carry out any detailed economic analysis. There are too many scenarios and variables. However, we would be on fairly safe ground to assume that the cost per kWh of diesel generated electricity could be as high as €0.368/kWh[55]. This would mean that a wind generator on the island would provide a very competitive price. A 100kW turbine on Inishturk could reasonably hope to achieve a LCOE of less than €0.192/kWh.

6.1.1.1 Planning Restrictions

In the Mayo County Development Plan 2021-2027, Inishturk Island is located in 'Policy Area 1, Montaine Coastal Zone': this highly restricts the acceptable forms of development in the area.

[55] See Appendix Section 8.1.1 for calculations

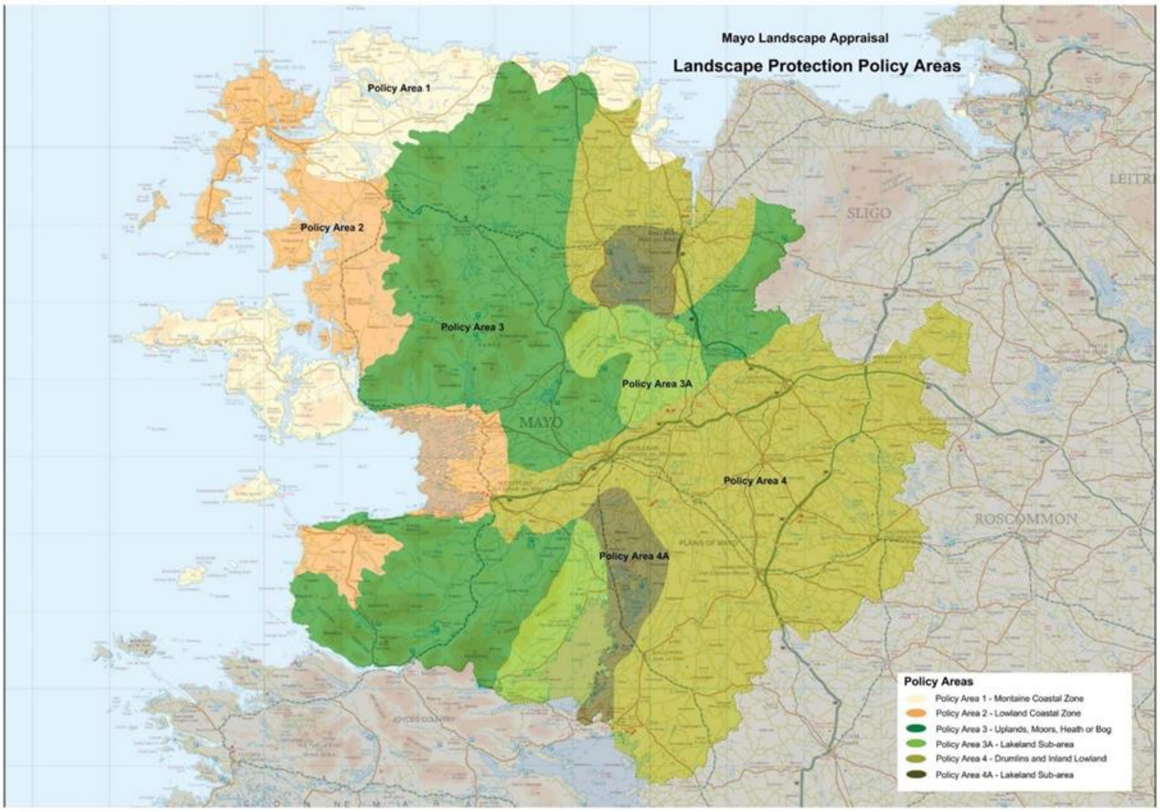


Figure 19: Mayo Landscape Protection Policy Areas

Source: Mayo County Development Plan, 2022 – 2028[56]

The Policy Area 1 designation restricts wind turbines and grid developments specifically as having:

‘High potential to create adverse impacts on the existing landscape character. Having regard to the intrinsic physical and visual characteristics of the landscape area, it is unlikely that such impacts can be reduced to a widely acceptable level.’

It is therefore the assessment of the authors that there would be barriers to an onshore wind development that would need to be addressed. If there was a site proposed that the community were in favour of, then this would be helpful. The fact that there was a community[57] acceptance of the need for a similar structure (the communications mast) in recent planning history may work in a wind turbine’s favour. It is also significant that without an onshore renewable energy source, the island will be obliged to use diesel to

[56] https://www.mayo.ie/getmedia/d64fadfc-f8b5-4f1c-971d-624fd9527e04/Landscape-Appraisal-of-County-Mayo.pdf
[57] https://www.con-telegraph.ie/2021/01/10/mast-upgrade-to-support-remote-working-and-learning-on-inishturk/

supply all of its electricity. This would run counter to the overall national policy goal of decarbonisation through increased electrification[58].

6.1.2 Solar PV

We will examine the case for PV in the SEC areas at two scales: Small Scale (50kWp-500KWp) and micro scale (<50kWp)

6.1.2.1 Solar Resource

In comparison to other locations in Ireland, Inishturk receives less solar radiation. This by no means indicates that PV generation at Small Scale is unfeasible. As shown on Figure 20 the estimated output of power for a 1kWp panel on Inishturk is approximately 914kWh/yr[59].

6.1.2.2 Energy Outputs for 500 kW PV Farm

Figure 20 shows the expected power outputs by month for a ground mounted southern aspect 500 kW power solar PV farm at a suitable site on Inishturk. The total generation would be 457,000kWk/yr. These figures take into account system losses of 14%. System losses are all the losses in the system, which cause the power actually delivered to the electricity grid to be lower than the power produced by the PV modules. There are several causes for this loss, such as losses in cables, power inverters, and dust on the modules.

[58] ESRI, 2022, 'Decarbonising heat through electricity: costs, benefits and trade-offs for the Irish power system', https://www.esri.ie/publications/decarbonising-heat-through-electricity-costs-benefits-and-trade-offs-for-the-irish

[59] https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html

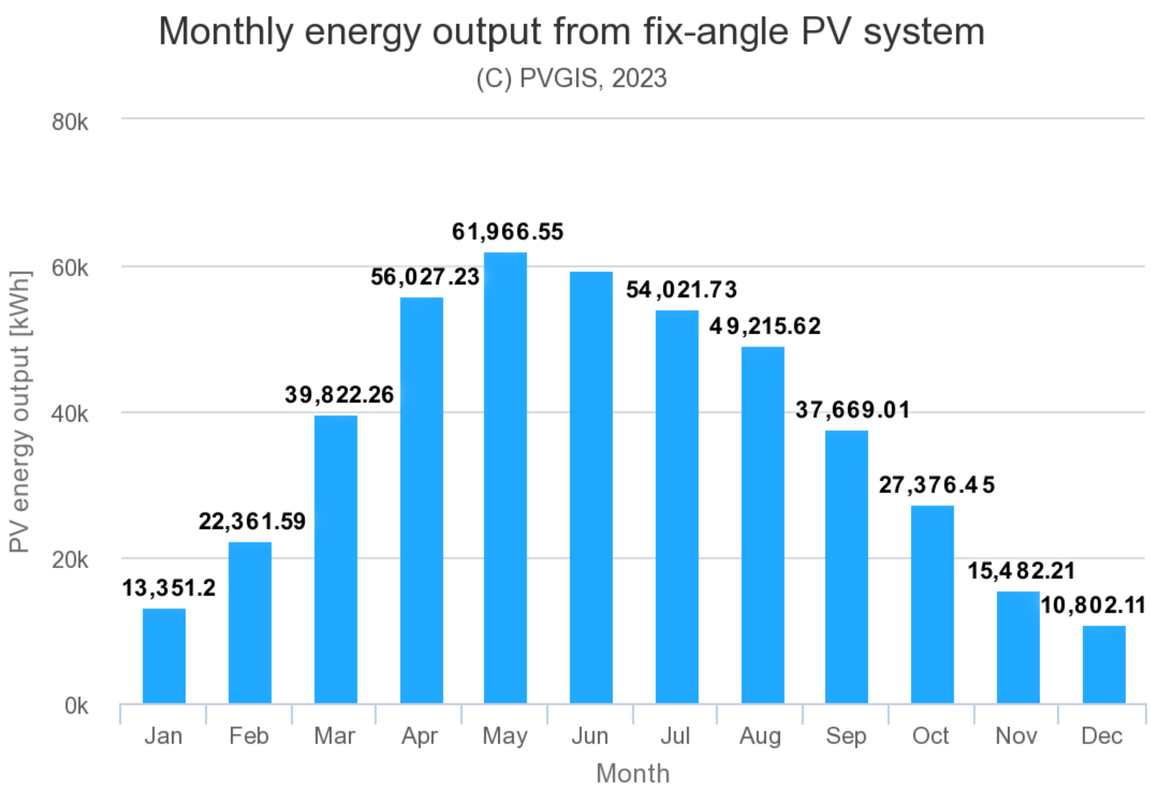


Figure 20: Monthly energy output from 500kW fix-angle PV system in kWh (total=914kWh)

6.1.2.3 Geography and Land Requirements

A 500kWp PV installation would require approximately 1 hectare (2.5 acres). For illustration purposes, the Inishturk Community Activity Pitch is one half hectare. A PV installation would require 1 hectare of even south facing land not over exposed to the elements. Our survey of the island did identify some locations that met these characteristics.

6.1.2.4 Economics of 500kW PV system:

The same caveats apply here as to wind turbine economics in Section 6.1.1 above. However, for the sake of clarity we can make some broad brush-stoke economic observations.

Levelized cost of electricity is a measure of the average net present cost of electricity generation for a generating project over its lifetime.

It is described by the following formula in Appendix Section 9.6.

The LCOE for a grid connected PV installation at a hypothetical location on Inishturk is approximately €0.154/kWh[60]. This is in large part due to assumed higher than average installation costs, in particular any grid upgrades required, and also the relatively reduced solar radiation available on the island.

[60] Estimated Capex €850,000. This does not include any landowner’s rental.

The LCOE above indicates that a PV installation would be viable economically in comparison to diesel generated electricity.

It is therefore recommended that the SEC initiates a public consultation process within the community on Inishturk as well as the ESB and the local authority as to the acceptability of a 1 hectare 500 kW PV for local distribution project. In advance of this a scoping exercise with relevant landowners may be worthwhile.

The SEAI has produced a very helpful guide explaining how to carry through Community Energy PV[61] projects to fruition which is available at this LINK.

6.1.2.5 Micro Scale PV

This option is also addressed in the domestic sector retrofitting opportunity above in Section 5.1.2.

A domestic solar PV system consists of a number of solar panels mounted to your roof (or in your garden or adjacent field) and connected into the electrical loads within your building. Solar PV systems are rated in kilowatts (kWp). A 1kWp solar PV system would require 3 or 4 solar panels on your roof.

Since a consumer pays approximately €0.28 per kWh to their electricity provider, a 2kWp PV panel (if the home is occupied during the day) will save the homeowner €418 per year. On an installation costing €5,000, this would achieve a simple payback of 8 years if the installation qualified for a grant. There would also be an additional payment from the Clean Export Guarantee (CEG) Tariff (of approximately €75 per year in this case)

There is a significant grant incentive available from the SEAI for PV installation for homeowners. The full details are available[62] at this link.

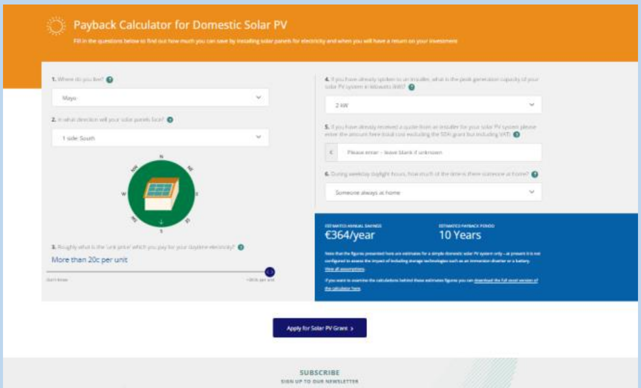
Table 15; SEAI PV Grants for Homeowners

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

Any excess electricity produced can be stored in a hot water immersion tank or in a battery. It can also be used to power a BEV that is parked during the day at the home. It can also be exported from the house into the electrical network on the road outside your home for

[61] https://www.seai.ie/publications/Community-Toolkit-Solar-PV.pdf
[62] https://www.seai.ie/grants/home-energy-grants/solar-electricity-grant/

€0.135 per kWh. The best solution is to manage your electricity consumption to match the best PV generation times i.e., daytime.



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

Economics of a 2kWp System on Inishturk

System Cost (with grant)	Annual Savings	Payback Period	Lifetime** Profit
€3200	€418/year*	8 Years	€5,996

*It is not assumed that the homeowner will consume all the electricity. This is based on a cost of €0.28/kWh unit electricity.

**A typical PV System has a 22-year lifespan. This does not include any increase in cost of electricity which will increase the lifetime profitability.

7 Conclusion: Holistic Effects of Co-ordinated Strategy

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

7.1.1 Strategy Outline

		Emissions Reductions Each Year in kg Co2						
Priority	Action	2024	2025	2026	2027	2028	2029	TOTAL
1.1	Retrofit 25% of G-C3 homes each year	76,826	76,826	76,826	76,826			307,305
1.2	2 Community Buildings upgraded each year achieving >50% energy reduction overall	41,611	28,257					69,868
2	5 homes with 2kWp installations with 5 additional homes recruited each year until a maximum of 21	2722	2722	2722	2722	544		11,431
3	Community/ESB/Mayo Co Co Partnership 100kW-500kW electricity generation project			130,312				130,312
4	20% replacement of Diesel saloon cars with BEVs annually n=3	880	880	880	880	880		4,402
5	Replacement of Diesel by HVO in 20% of the SUV fleet n=3	352	352	352	352	352		1,761
6	Replacement of Diesel by HVO in 20% boats per year		18600	18600	18600	18600	18600	93,000
	Total Emissions Reduction	**122,391**	**127,637**	**229,692**	**99,380**	**20,377**	**18,600**	**618,079**

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

The effect of these measures, taken in consort will achieve the ambitions stated by the SEC in their scoping document for this EMP. Figure 21 shows how the actions would achieve a 96% reduction in on-island energy related emissions with a consequent reduction in energy use.

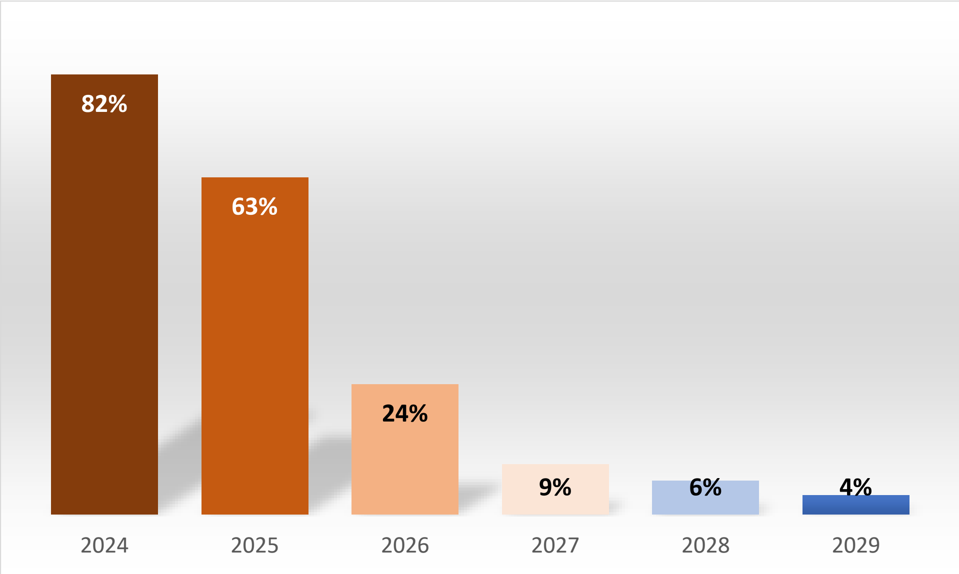


Figure 21: Reductions in Emissions Achieved through EMP Strategy

Financial Savings from Actions are equally significant. The SEC will achieve considerable financial benefits to match the sustainability gains that are possible from the actions outlined in this EMP.

As was seen in Section 5.1.4, a G-Rated home can reduce its energy costs by as much as €8,153.30 per annum. However, we have also included a community level partnership for electricity generation on the island. Depending on the form this partnership takes, it may provide the householders on the island with electrical costs as well as emissions savings.

The cost difference between HVO and Diesel is approximately 20-50% more expensive than diesel, but it represents the best option at present to decarbonise certain applications (marine and agriculture) in the short term.

7.1.2 Capacities

The Inishturk SEC has demonstrated a local ability to manage complex and demanding projects. It has built up a series of contacts with relevant energy efficiency contractors who understand the geographical and logistical demands of carrying through projects on the island and appear to be willing to work with the community on achieving its ends. We would be confident that a group Community Grant Scheme is feasible for 2024 to achieve the recommendations outlined in the Strategy, Section 7.1.1.

Building expertise and capacities within the group is critical to achieve the success of the SEC. Already there has been a continuous process of 'learning, planning and doing', both through the Community Futures Program and the SEC program. Increasing the membership of the group, delegating responsibilities to achieve different elements of the Master Plan will have the twin benefits of reducing overload on the individuals as well bringing in fresh perspectives.

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

7.1.3 Energy Master Plan Dissemination to Community

The dissemination of the Energy Master Plan throughout the community is one of the key actions for the SEC now that the plan has been completed. The Energy Master Plan will provide the community with an understanding of what their current energy profile is and where they as a community should put their efforts in reducing their energy and carbon footprint. We suggest that the SEC host workshop events for each of the community subgroups that are targeted by the sustainability actions outlined in this EMP. These would be:

- Homeowners – in particular the fuel poor in relation to home upgrades
- Community Facilities/School Managers
- Farmers
- Fishermen

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

7.1.4 Low Lying Fruit First

The SEC is encouraged to develop low-effort, low-cost efficiency projects first to increase their internal capacity and skills. These low-effort, low-cost efficiency measures can be quick wins for the community and encourage the group to tackle more complex, higher effort projects in the future. These projects also provide a focus point for the greater community to prompt discussions and knowledge sharing experiences. We recommend that the SEC seek to partner with the very pro-active local authority in a Community Grant project: this will build capacity and demonstrate the value of the collective approach to sustainability. It will also develop the skill sets within the group. There are CEG specialists who have wide experience in managing successful projects. However, the SEC should remain engaged with every step of a BEC to maximize learnings as well as ensuring widest possible community benefit.

7.1.5 Continue the Journey with the SEAI

The SEC program has resources in addition to the county level SEC mentoring. The engagement of specialist mentors is possible, as is the RESS Community Enabling Framework[63] program (more information available here)

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

7.1.6 Other Partnerships

Inishturk is in the unusual position of having on-island electricity generation through the ESB into a local distribution grid not connected to the national grid. Any community-level energy generation will require close partnership with the ESB. We propose that this proceeds with the assistance of the SEAI, at this point.

[63] https://www.seai.ie/community-energy/ress/enabling-framework

8 Appendix I

8.1 Fuel Prices:

Fuel	Price per kWh	Source	Notes
Home Heating Oil	€0.139	https://www.cheapestoil.ie/heating-oil-prices/Mayo	Based on 500L delivered
Electricity	€0.281	https://www.electricireland.ie/switch/new-customer/price-plans?priceType=D	Standard Tariff no discounts, incl VAT, excl Charges
Coal	€0.099	https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf	Bagged Coal: delivered
LPG	€0.225	https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf	Bottled Butane, delivered
Diesel	€1.70	https://www.theaa.ie/motoring-advice/fuel-prices/	Checked 21/04/2023

8.1.1 Cost Electricity from Diesel Generator

Using this formula:

Cost Per kWh = (price 1L gas oil bulk[64] commercial rates/10.5kWh per litre/generator efficiency @30%)

Diesel Generator Cost Per kWh = (€1.16/10.5/30%) = **€0.368/kWh**

8.2 Building Energy Rating Certification Explained

A Building Energy Rating (BER) is an energy label for homes. The rating is a simple A to G scale. A-rated homes are the most energy efficient and will tend to have the lowest energy bills. The number of energy units (kilowatt hours per meter squared – kWh/m2) that are required by the home to maintain comfort and appliance uses in the house show how energy efficient your home is. The BER will also show what energy sources (gas, coal, oil, electricity) are used to meet this demand. This allows the report to show what the carbon emissions are for the home over a year. The lower the carbon emissions, the better for the planet. The report also indicates how many trees are needed to offset this amount of carbon – which is a measure we can all understand.

[64] https://www.seai.ie/publications/Commercial-Fuel-Cost-Archive.xlsx

8.2.1 Example of Home Energy Upgrade Advisory Report

Home Energy Upgrade Advisory Report

BER No. Removed

Your Home's Energy Performance Potential

NOW: G — POTENTIAL: A3

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

Potential with upgrades

Loss of heat from your home

NOW	POTENTIAL
Very Poor	Good

An upgrade package to stop losing money on your energy bill

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

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

GRANTS AVAILABLE?

subject to availability, terms and conditions

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

Compare your home's performance | Before and after upgrades

Your home's current **energy performance**	NOW G
Your home's potential **energy performance**	POTENTIAL A3

Benefits of upgrading your home

INCREASE your home's value

INCREASE your home's comfort

REDUCE your energy bills

SAVE

CO_2 TONNES 17.2

= the same as planting **1227 tree(s) each year**

To find out more visit **www.seai.ie**

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Home Energy Upgrade Advisory Report

Your journey from BER G **to** BER A3

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

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

Recommended Package of Energy Upgrades	Cost (Approx.)[5]	Grant Available [6]	Comfort
Roof insulation; pitched (at ceiling) 0.16 W/m²K, pitched (on slope) 0.20 W/m²K, room in roof (on side) 0.20 W/m²K, flat 0.22 W/m²K average U-Value [1, 2]	€	✔	★★★★☆
Wall insulation 0.27 W/m²K average U-Value [1, 2, 3]	€€€	✔	★★★★★
Windows triple glazing 0.8 W/m²K average U-Value [1, 2]	€€	✔	★★★★☆
Air-to-Water or Ground-to-Water or Water-to-Water heat pump with fully integrated heating controls [4]	€€	✔	★★★★☆
Solar Photovoltaic (PV) electricity System 2kWp.	€€	✔	N/A
Whole-house extract ventilation	€	N/A	★★★☆☆

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

GRANTS AVAILABLE?

✔ subject to availability, terms and conditions

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

www.seai.ie Page 2/4

Home Energy Upgrade Advisory Report

Start your journey to upgrade your home

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

GRANT APPLICATION

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

Simple energy upgrades - quick, cheap, easy

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

Cylinder thermostat
Space heating and hot water systems should have separate and independent time and temperature controls. The cylinder thermostat controls the hot water cylinder temperature.

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

Potential impact of the **recommended energy upgrades**

Energy upgrade	Now		Potential	
	Value	**Energy Efficiency**	**Value**	**Energy Efficiency**
Home Heat Loss Indicator (HLI)[1]	5.245 W/(K·m^2)	Very Poor	1.828 W/(K·m^2)	Good
Roof insulation (average U-Value[2])	1.316 W/m^{2}K	Poor	0.168 W/m^{2}K	Good
Wall insulation (average U-Value[2])	2.054 W/m^{2}K	Very Poor	0.270 W/m^{2}K	Good
Windows triple glazing (average U-Value[2])	3.100 W/m^{2}K	Poor	0.800 W/m^{2}K	Very Good
Air-to-Water or Ground-to-Water or Water-to-Water heat pump with fully integrated heating controls (Primary Energy Efficiency[3])	54%	Very Poor	168%	Very Good
Solar Photovoltaic (PV) electricity System 2kWp.	N/A	N/A	1,718 kWh/y	N/A
Whole-house extract ventilation	N/A	N/A	0.30 W/l/s	Very Good
Lighting	11.20 Lm/W	Very Poor	66.90 Lm/W	Very Good
Renewable Energy Ratio (RER)	0%	Very Poor	48%	Very Good

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

Home Energy Upgrade Advisory Report

Your Home's Details

Home Address

REMOVED

House Details

Year of construction: 1920

Dwelling type: Detached house

Total floor area: 92.82 m^2

About the Home Energy Upgrade Advisory Report

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

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

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

Use this document to:

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

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

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

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

Recommended Energy Upgrades

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

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

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

Building Regulations

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

Costs

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

Please consider the environment before printing this document.

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

Ventilation

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

Radon

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

Heat producing Appliances

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

Evidence for BER

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

8.3 Domestic Energy Use Estimates Methodology

8.3.1 Sampling Methodology

Inishturk FREE BER and Energy Upgrades Report (Closing Date 20th Jan 2023)

This information is needed to make sure we have a good sample of all the different kinds of homes in Inishturk in our Energy Master Plan study. We need to do this to make sure that as many types of homes on the island are represented.

We can't guarantee that your house will be accepted if you apply: there will be a selection process based on how your home reflects the sample we need. This selection process is based on the characteristics of the building.

We will contact you one week after the closing date to let you know if your home has been selected or not. If your home is not selected (as according to our data policy) we will remove your details from our database.

You may ask us to delete all contact information that we have received from you at any time by emailing info@energyco-ops.ie

Q1: Is Your Home a

Detached ☐ Semi-Detached ☐ End of Terrace ☐ Mid Terrace ☐ Apartment ☐

Q2: Is your home a holiday home? Yes ☐ No ☐

Q3: The building's Address (or Eircode, if you know it)

____

Q4: When was your home built (a guess is fine)?

Pre 1919 ☐ 1919-45 ☐ 1946-60 ☐ 1961-70 ☐ 1971-80 ☐ 1981-90 ☐ 1991-2000 ☐ 2001-2010 ☐

After 2010 ☐

Q5: Is your home:

Owned Outright ☐ Owned with Mortgage or Loan ☐ Privately Rented ☐ Rented from Local Authority ☐

Q6: For Central Heating Does You Home Mainly Use

Oil ☐ Coal/Anthracite ☐ Electricity ☐ Turf ☐ Other ☐

Q7: Your email ____

Q8: Your Phone Number ____________________________________

I accept this survey's terms and conditions Yes ☐ No ☐

Please be aware, that we are looking for a sample of homes and so your home may not be chosen. **Anonymized** information on homes selected will be published as part of the Energy Master Plan produced

Figure 22: Homeowner Survey Questionnaire

We received twelve responses to the questionnaire which represented a cross-section of homes across categories of age, fuel type, and ownership type. We selected seven of the entrant homes (randomly) across the categories to ensure we had a representative sample of the homes on the island. These homes were surveyed by our BER Auditors 2Eva Energy Consultants, and full BER certs and Energy Uplift reports produced. These were supplied directly to the homeowners but are contained in anonymised form in the Register of Opportunities Workbook that accompanies this report.

Our researchers also carried out an exterior visual inspection of all homes on the island to gauge: building type, year of construction, and building area. This enabled us to cross reference with the surveyed homes so as to get an accurate building census and energy use estimate for the homes on the island.

8.3.2 Energy Use Data: CSO, SEAI and Survey

There are 28 dwellings on Inishturk[65] seven of these are holiday homes, giving a total of 21 permanently occupied homes. Seven permanent homes on the island were recruited for a BER and Energy Upgrade Audit Survey Report. Thus, our energy audit survey examined 33% of the permanently occupied homes on the island (we only requested applicants from non-holiday homes). We were therefore in a position to take a much more focussed, real-world observation approach than for other SECs. However, we were not certain of how representative of the homes our sample was. This is because it is likely that some of the homes not sampled already had BERs done. This could happen because of retrofitting works done requiring certification. In that case the non-sampled homes in our survey would have better BERs and lower energy consumption than the sampled homes. This would skew the results and not give a clear picture as to the actual energy efficiency and use of the domestic sector on Inishturk. However, Inishturk is unlike other SECs in that is comprises only part of a CSO Small Area with Clare Island as the remainder. There are therefore no disaggregated data available for Inishturk from the census or from the SEAI BER published information[66] on building types, occupancy, average BER etc. A statistical workaround is required to give the best possible image of the energy use in the domestic sector on Inishturk.

We adopted an approach which balanced the survey data with the existing Small Area data. The number of homes not in the survey is 14. We applied an assumed BER for these homes based on the SEAI SA data and then combined these estimates with the known BERs for the survey. This is seen in Table 16 below.

[65] In person visual Survey by authors
[66] https://ndber.seai.ie/BERResearchTool/ber/search.aspx

Table 16: Inishturk adjusted BERs from sampled homes and existing data

	Small Area n=	Small Area %	Inishturk Survey n=	Inishturk Survey %	Inishturk Plus Small Area	Inishturk Adjusted
A	2	11.1%	0	0.00%	2	7.4%
B1 rated		0.0%	0	0.00%	0	0.0%
B2 rated		0.0%	0	0.00%	0	0.0%
B3 rated	3	16.7%	0	0.00%	2	11.1%
C1 rated	1	5.6%	1	14.29%	1	8.5%
C2 rated		0.0%	0	0.00%	0	0.0%
C3 rated	5	27.8%	2	28.57%	4	28.0%
D1 rated	1	5.6%	1	14.29%	1	8.5%
D2 rated	2	11.1%	1	14.29%	2	12.2%
E1 rated		0.0%	1	14.29%	0	4.8%
E2 rated	1	5.6%	0	0.00%	1	3.7%
F rated	3	16.7%	0	0.00%	2	11.1%
G rated		0.0%	1	14.29%	0	4.8%
	18		7	100.00%	14	100.0%
Total	23.7%		33.3%		66.7%	

Combining the Small area data and the Inishturk survey data enables us to bring in additional variables and comparisons from CSO data, such as home heating fuel types, average building area etc. We feel that this greatly assists the energy baseline methodology.

To convert the BER ratings into energy use we need two additional pieces of information: the average energy consumption per meter squared for each BER category, and the average area for the homes in the SA.

We took the energy consumption for each home as the mean value of the BER category (Column 4, Table 17). We estimated the average aera for each home as that of the national average for detached homes as published by the CSO[67] (Column 5, Table 17)

Table 17: Inishturk Homes Energy Use

Homes in Inishturk			Energy Use kWh/yr/m2	Total Area Est from CSO Areas Detached[68]	total est kwh/yr
BERs form SEAI and Survey	% of homes	Number of homes			

[67] Average home area in m^2 for detached homes is $162m^2$, from: https://www.cso.ie/en/media/csoie/releasespublications/documents/ep/domesticbuildingenergyratings/q42022/P-DBER2022Q4TBL12.xlsx
[68] $162m^2$ X Number of homes in category.

A	7.4%	2	37.5	252.0	9,450
B1 rated	0.0%	0	87.5	0.0	0
B2 rated	0.0%	0	112.5	0.0	0
B3 rated	11.1%	2	137.5	378.0	51,975
C1 rated	8.5%	2	162.5	288.0	46,800
C2 rated	0.0%	0	187.5	0.0	0
C3 rated	28.0%	6	212.5	954.0	202,725
D1 rated	8.5%	2	242.5	288.0	69,840
D2 rated	12.2%	3	280	414.0	115,920
E1 rated	4.8%	1	320	162.0	51,840
E2 rated	3.7%	1	360	126.0	45,360
F rated	11.1%	2	405	378.0	153,090
G rated	4.8%	1	500	162.0	81,000
Total	100%	21	-		828,000

This enables us to calculate the total energy consumption of the homes on the island used in Section 5.1 above.

9 Appendix II Register of Opportunities Supporting Documentation

9.1 Individual Level Behaviour Changes for homeowners

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

Step 1: Do Your Own Audit:

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

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

- Turn everything off – don't leave on standby (2%)
- Use a clothes line when possible - no tumble dryer (7%)
- Wash clothes @ 30 degrees (1%)
- Turn off lights when not in a room, replace bulbs with CFLs at least, or with LEDs if possible (2%).
- Use oil to heat water – not electric immersion or electric shower (24%)

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

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

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

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

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

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

9.2 SEAI Supports for Individual Homeowner Applicants

There are three categories of applicants to the SEAI Home Energy Grant Scheme[69] of which this is a brief summary. These are:

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

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

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

Table 18: Grants for Detached Private Homes not qualifying for extra supports

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

9.3 Incentives for Battery Electric Vehicles from the SEAI

List Price of Approved BEV	Level of Grant
€14,000 to €15,000	€2,000
€15,000 to €16,000	€2,500
€16,000 to €17,000	€3,000
€17,000 to €18,000	€3,500

List Price of Approved BEV	Level of Grant
€18,000 to €19,000	€4,000
€19,000 to €20,000	€4,500
€20,000 to €60,000	€5,000

*Note: The maximum grant for a private M1 (passenger car) will change to €3,500 from the 1st July 2023.

Grant Eligibility: to qualify for SEAI grant assistance, the purchased vehicle must be new and one of the approved car models. The full list of car models (illustrated in Figure 23) is available at this link.

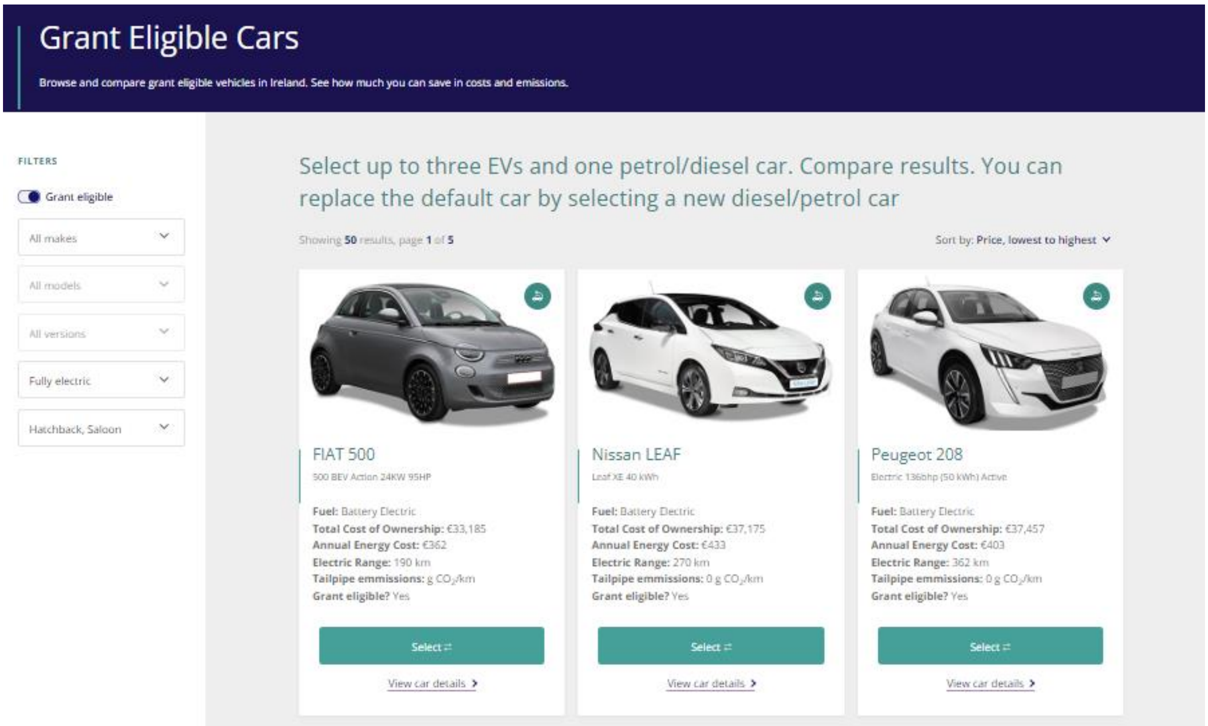


Figure 23: Grant Eligible Cars

9.4 SME Supports

9.4.1 SEAI Energy Academy

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

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

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

LINK HERE

9.4.2 Climate Toolkit 4 Business

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

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

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

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

Waste and Water Usage is also tracked

LINK HERE

9.4.3 SME Energy Audits

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

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

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

Businesses applying to the scheme must be:

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

Non-obligated parties (that is those who are eligible for the scheme) are: small and medium enterprises (SMEs), or public sector bodies with a useful floor area less than 500m2 and spending less than €35,000 per year on energy

9.4.4 SEAI SME Guide to Energy Efficiency

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

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

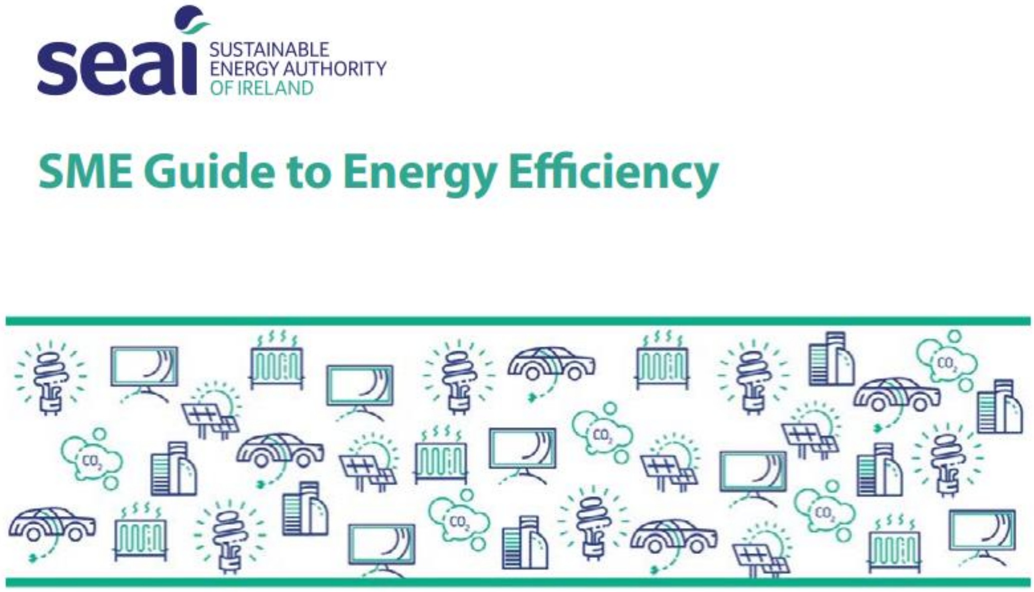


Figure 24: SEAI SME Guide to Energy Efficiency: LINK HERE

9.5 Sustainability Technologies

This is a brief description of Renewable Energy Technologies that are relevant to this Energy Master Plan

9.5.1 PV

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

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

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

9.5.2 BEVs

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

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

BEVs are Cheaper than Petrol Hybrids

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

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

9.5.3 Biofuel

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

Hydrotreated Vegetable Oil (HVO) is a type of renewable diesel fuel that is produced by hydrotreating vegetable oil. It is a high-quality, low-emission fuel that can be used as a direct replacement for fossil diesel in diesel engines. In Ireland HVO is commonly produced using feedstocks such as rapeseed oil, waste fats, and oils.

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

HVO is considered a transitional sustainable fuel option as it is made from renewable feedstocks and produces lower emissions compared to fossil diesel. It has also been found to be compatible with existing diesel engines and infrastructure, making it a viable alternative to fossil diesel for transportation and industrial applications in the short and medium terms.

HVO Fuel Suppliers Online

lassoil.ie/

inverenergy.ie/

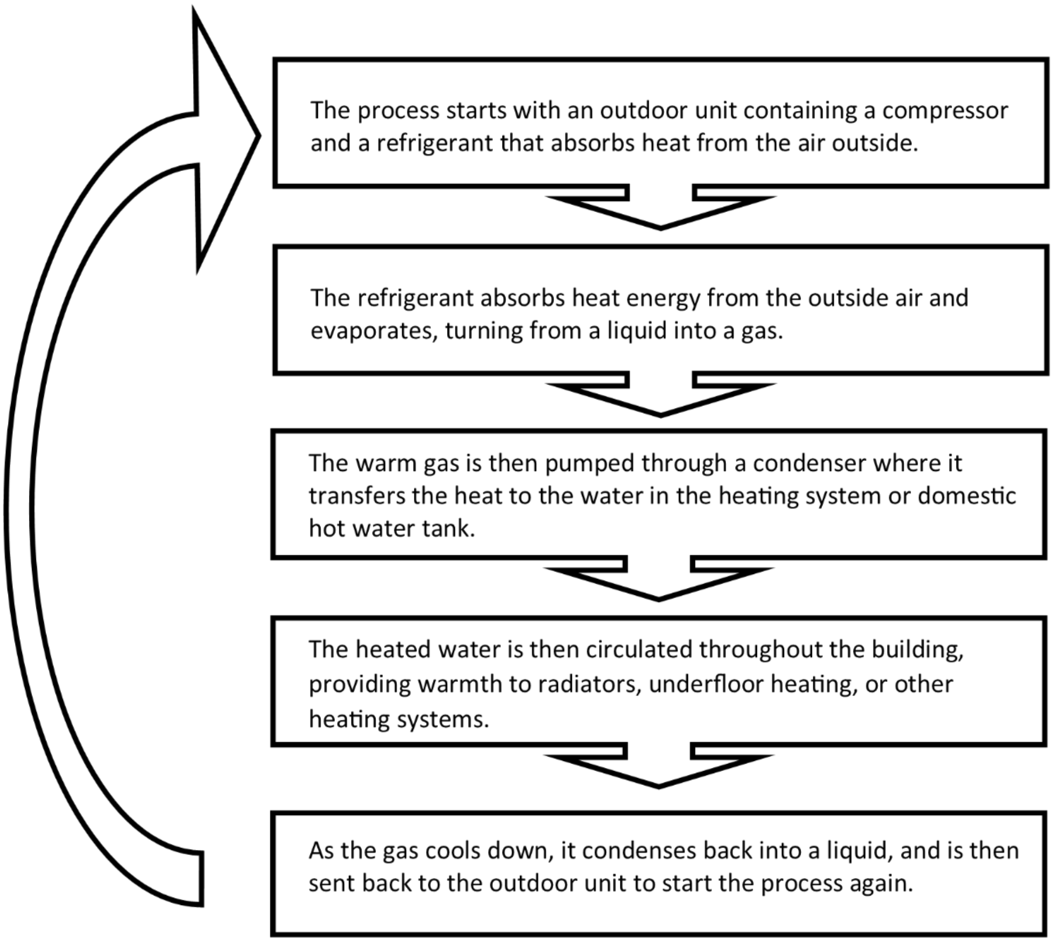
Certaireland.ie

Eurooil.ie

We understand that the marine users on Inishturk have built up a relationship and practice with their current oil suppliers. A more efficient approach to fuel switching may be to engage with these suppliers as intermediaries with HVO suppliers.

9.5.4 Heat Pumps

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



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

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

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

9.6 Levelized cost of electricity

The Levelized Cost of Electricity (LCOE) is a measure used to estimate the average cost of producing electricity over the lifetime of a power-generating asset or facility. It takes into account all of the costs associated with building, operating, and maintaining a power plant, including the cost of fuel, financing, capital expenditures, and any other expenses.

The LCOE is typically expressed as the cost per unit of electricity generated (e.g. euros per kilowatt-hour or cents per kilowatt-hour), and it allows for the comparison of different types of power generation technologies on a level playing field. This is because it takes into account the total cost of ownership of a power plant over its lifetime, rather than just the upfront capital costs or the cost of generating electricity at a single point in time.

The LCOE is an important metric for energy decisionmakers and investors because it helps to determine the cost-effectiveness of different types of power generation technologies and the most efficient use of resources for electricity production.

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

I_t = Investment expenditures in year t (including financing)
M_t = Operations and maintenance expenditures in year t
F_t = Fuel expenditures in year t
E_t = Electricity generation in year t
r = Discount rate
n = Life of the system

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