Monaghan Integrated Development

County Monaghan Sustainable Energy Community

Energy Master Plan 2022

Supported by

County Monaghan
Sustainable Energy
Community

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1.0 Executive Summary

The purpose of this project is to develop an Energy Master Plan (EMP) for County Monaghan on behalf of the County Monaghan Sustainable Energy Community (SEC). This will assist the community understand its energy needs and sources and identify opportunities through which the community can achieve energy savings in the short, medium and long term. The EMP will identify specific energy initiatives which can be developed during the next two years through the support of SEAI and other sources of funding to build a sustainable, resilient energy system.

This report focuses on the opportunities within the residential and agricultural sectors. A Register of Opportunities (RoO) is provided as a separate document (in MS Excel format).

1.1 Recommendations for residential sector

Ireland's 2019 Climate Action Plan state two residential energy targets for the 2030 year:

- Upgrade of 500,000 existing homes to a B2 BER rating
- Installation of heat pumps in 400,000 existing homes

Latest statistics from SEAI show that approximately 20% of Monaghan's Private Housing Stock have had home energy upgrades through the Home Energy Grants and Free Energy Upgrades These upgrades can range from very minimal to deep retrofits and therefore some of the 20% may require further upgrades to raise their BER rating. The following recommendations have been made to increase the uptake of energy efficiency retrofits in Monaghan.

- Development of an action plan for the ongoing management of the online resource and social media platforms
- Plan and schedule future Webinars
- Increase community engagement with the SEC through presence of SEC members at community events, printed flyers, clinics and fairs
- Engage with homeowners in the identified small areas through a marketing campaign to assess their willingness to participate in any potential community applications for home upgrades
- Identify a suitable property/homeowner to serve as a Passivhaus "EnerPHit" standard demonstration within the county which can be promoted on the online resource
- Explore the feasibility of developing a one-stop-shop model within the SEC

1.2 Recommendations for agriculture sector

The Department for Agriculture, Food and Marine (DAFM) published its report "A Roadmap towards Climate Neutrality" in December 2020, detailing the national energy efficiency targets within the agricultural sector. The two main greenhouse gases that drive the majority agricultural emissions are methane and nitrous oxide however there are targets which include the emissions through energy use:

1. Generate at least 20% reduction in agricultural energy use by 2030 across all farms
2. Generate at least 20% deployment of renewable energy technologies focusing primarily on energy intensive farming systems
3. Double the sustainable production of biomass from forests by 2030 and ensure biomass mobilisation for heat production

4. Engage with stakeholders to maximise the potential opportunities from AD for the agricultural sector

Opportunities have been highlighted in relation to the first two targets of reduction in agricultural energy use and deployment of renewable technologies. The baseline energy analysis for Monaghan highlighted the following farms and processes as most energy intensive and therefore prioritised these for energy improvements:

Poultry

- Improvement in the energy efficiency of heating, lighting and ventilation equipment within broiler houses – supported through the Dept. of Agriculture, Food and Marine (DAFM) Pig and Poultry Investment Scheme.
- Reduction of the costs and CO_2 emissions associated with traditional heating systems in broiler houses with the installation of biomass renewable heating system– supported through the Support Scheme for Renewable Heat (SSRH)

Mushroom

- Reduction of energy costs and CO_2 emissions associated with traditional heating systems (used for sterilising mushrooms and heating growing rooms) by replacing with biomass renewable heating systems - supported through the Support Scheme for Renewable Heat (SSRH).

Dairy

- Improvement in the energy efficiency of equipment used for water heating, milk cooling and vacuum pumping – supported by the DAFM Dairy Equipment Scheme.

Pigs

- Improvement in the energy efficiency of heating, lighting and ventilation requirements within the pig houses – supported through the DAFM Pig and Poultry Investment Scheme.
- Reduction of the costs and CO_2 emissions associated with traditional heating systems in pig houses with the installation of biomass renewable heating system– supported through the Support Scheme for Renewable Heat (SSRH)

1.2.1 Agricultural diversification

Section 9 of the report identifies energy production diversification opportunities. In County Monaghan, 69% of the land area is used for agriculture, and the county has significant poultry and mushroom industries. Investigation into agricultural diversification focussed on 3 potential areas as follows:

- **Growing short rotation coppice (SRC)** willow which can be used by farmers as a renewable fuel for biomass heating systems for poultry houses. The heat energy produced is eligible to receive support under the Support Scheme for Renewable Heat (SSRH). A co-operative approach could be used in terms of rotational harvesting and centralised drying and storage. There is potential for funding of such a facility under the Climate Action Fund.
- **Solar PV installation** on roofs is an opportunity due to the large amount of farm buildings with large roof areas. Smaller scale installations (<11kW) can be installed without grid connection permission. Farmers with available land could consider the development of a solar 'farm' (or lease the land to a developer) which would create a stable long term income from sale of exported electricity / lease payments.

- **An Anaerobic Digestion Plant** breaks down organic materials and wastes such as chicken litter and slurry, and produces 'biogas' which can be upgraded to biomethane and used in heating boilers or injected into the natural gas grid. County Monaghan has a significant amount of poultry litter waste which is being transported out of the county. The opportunity is for a farm, or multiple farms to collaborate to build, own and operate an AD plant to produce renewable gas for grid injection or transport, or to generate renewable electricity through a CHP engine. This opportunity is dependent on having a secure feedstock and onward market for the gas produced.

A full list of opportunities for each sector and from the residential, farm and community audits is detailed in the Register of Opportunities.

2.0 Introduction

2.1 SEAI's Sustainable Energy Communities (SEC) Network

SEAI created the Sustainable Energy Communities (SEC) programme to enable and encourage communities to change how energy is used at a community level. A Sustainable Energy Community (SEC) is a community that works together to develop a sustainable energy system. To do so, they aim to:

- Be energy efficient
- Use renewable energy
- Consider smart energy solutions

A SEC can include a range of different energy users in the community such as homes, sports clubs, community centres, churches, and businesses. In this way, an SEC connects sustainable energy, local economic development, and public wellbeing.[1] There are currently over 200 SECs across Ireland.

Monaghan Integrated Development (MID) is the local Development Company for county Monaghan. Through their role of working with communities and facilitating bottom-up development, MID is supporting the establishment of SECs in county Monaghan. MID was the animator behind the formation of the County Monaghan SEC which was formed on 11th September 2020. County Monaghan SEC currently has 12 members representing a variety of interests including domestic, community, agriculture, education, and the public sector. The vision of County Monaghan SEC is for a county where every household, business and organisation are aware of their carbon footprint and supported to take measures to reduce it.

2.2 Objectives of the Energy Master Plan

The objective of the Energy Master Plan (EMP) is to enable the community to develop an understanding of how energy is used locally. The EMP will consider energy usage in the domestic, private transport, agriculture and agri-food sectors and will identify opportunities to allow these sectors and the community to become more energy efficient. It is intended that specific energy initiatives identified in this plan will be developed in the next two years in Monaghan with the support of SEAI and other sources of funding.

A Register of Opportunities (RoO) also forms part of the Energy Master Plan and lists all the appropriate energy efficiency and renewable energy opportunities identified both for the county and for specific buildings e.g., community buildings which had energy audits carried out. The RoO includes behavioural/awareness opportunities such as events and use of digital communication in addition to capital investment projects.

The EMP will be used to inform/support initiatives to address fuel poverty and the Just Transition to a low carbon economy.

[1] https://www.seai.ie/resources/publications/Sustainable%20Energy%20Communities%20Handbook.pdf

3.0 Legislation and policy context

Ireland acknowledges climate change as one of the biggest challenges in the coming years and as such is party to the Kyoto Protocol, the United Nations Framework Convention on Climate change (UNFCC) and the Paris agreement. These international frameworks together provide a basis for addressing climate change on a global scale and allow for European, National and Local policies and frameworks to be developed in line with these targets.

3.1 EU level

2030 Climate and Energy Framework

The Paris Agreement sets out Nationally Determined Contributions for each member state to achieve a 40% EU-wide emissions reduction target by 2030 compared to 1990 levels. This 40% reduction is broken down into the following 2030 targets:

- At least 40% GHG emission reductions (binding)
- At least 32% share for renewable energy (binding)
- At least 32.5% improvement in energy efficiency (endorsed)

Energy performance of buildings directive

The building sector in the EU is responsible for approximately 40% of energy consumption and 36% of greenhouse gas emissions. The EU developed a legislative framework including the Energy performance of Buildings Directive in 2010 and the Energy Efficiency Directive in 2012.
Both directives were then revised in 2018 and 2019 to include strategies and objectives aiming to address the challenge of decarbonising the building stock, create economic opportunities in the construction industry and alleviate energy poverty. These new objectives include:

- Implementing national roadmap to decarbonise buildings with a view to the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95% compared to 1990
- Smarter buildings - encouraging more automation and control systems to make them operate more efficiently
- A smart readiness indicator that will measure a building's capacity to use new technologies and electronic systems to adapt to the needs of the consumer, optimise its operation and interact with the grid
- E-mobility in buildings - supporting the rollout of e-mobility infrastructure such as e-charging points in buildings

3.2 National Level

3.2.1 The 2012 National Climate Change Adaptation Framework (NCCAF)

Irelands first step in developing a national policy on adaptation actions to combat the impacts of climate change.

3.2.2 National Policy: Climate Action and Low Carbon Development 2014

Restated the policy position of the NCCAF, 2012. Greenhouse gas mitigation and adaption to the impacts of climate change were to be addressed in parallel national plans under an evolving climate policy to 2050.

3.2.3 Climate Action and Low Carbon Development Act 2015

This is the first ever climate legislation in Ireland and provides a statutory basis for the national objective of transitioning to a low carbon economy by 2050. It enshrines the commitment of the State to GHG mitigation and adaptation measures as well as providing approval for the plans underpinning this transition, namely the National Mitigation Plan and National Adaptation Framework.

3.2.4 National Mitigation Plan 2017

This first whole-of-government plan sets out the multiple measures requires across several Government Departments to enable the required transition "to a low carbon, climate resilient and environmentally sustainable economy by 2050". It sets out measures to facilitate the decarbonisation of electricity generation, built environment, transport and agriculture/ forestry/land use.

3.2.5 Project Ireland 2040: National Development Plan 2018-2027

Project Ireland 2040 is the Government's long-term strategy to make Ireland a better country for all its people. The National Development Plan and the National Planning Framework combine to form Project Ireland 2040. The National Development Plan (NDP) 2018-2027 sets out investment priorities that will underpin the successful implementation of the National Planning Framework (NPF). The NDP will guide national, regional, and local planning and investment decisions in Ireland over the next two decades. Within the NDP the National Strategic Outcome 8: Transition to a Low-Carbon and Climate Resilient Society highlights investment priorities building upon the approach of the Government's National Mitigation Plan. These investments have the potential to represent a step change in Ireland's performance in relation to climate objectives through delivering significant reductions in carbon emissions over the period to 2030.

Investment actions highlighted within the NDP include:

- Investment in energy efficiency to assist homes to achieve a minimum BER rating 'B'
- Establishment of a Renewable Electricity Support Scheme to support additional renewable electricity generation by 2030
- At least 500,000 electric vehicles on the road by 2030
- New Support Scheme for Renewable Heat

Under the Strategic Investment Priorities 2018-2027: Transition to a Low-Carbon and Climate-Resilient Society, will receive €21.8 billion of funding. Investment in the measures listed within the NDP are made through the Climate Action Fund (CAF) which was established to provide financial support and assistance to projects which will help Ireland achieve climate and energy targets. The targets of the NDP are different to the climate action plan as it was published before the climate action plan to identify areas which requires investment.

3.2.6 Climate Action Plan 2019

The Plan published by government contains 183 actions, broken down into 619 individual measures, which Ireland needs to implement to meet our EU 2030 targets and to achieve net zero emissions by 2050. The actions identified will be implemented by 13 Government Departments and 40 agencies under the remit of those Departments, requiring a deep level of collaboration across Government. The Department of Communications, Climate Action and Environment also

entered into a five-year financial commitment to establish four Local Authority Climate Action Regional Offices (CARO's). CARO's will assist local authorities in building their capacity to engage effectively with climate change. The following section sets out a number of the objectives included in the plan:

Electricity

- Increase share of renewable electricity from 30% to 70%, with peat and coal plants closing
- Support scheme for micro-generation

Buildings

- Introduce stricter requirements for new buildings and major renovations
- 500,000 homes to be upgraded to B2 (BER)
- Heat pumps to be fitted to 400,000 existing homes
- Increase attention to Energy and Carbon ratings in all aspects of managing property assets

Transport

- Target of 950,000 EV's on road by 2030
- Make the economy less transport-intensive
- Increase biofuel content for motor fuels
- Conversion of public transport fleet to zero carbon alternatives

Agriculture

- Deliver verifiable GHG abatement through improved farming practices
- Carbon abatement through increased forestry planting and soil management

3.2.7 Climate Action and Low Carbon Development (Amendment) Bill 2021

The Climate Action and Low Carbon Development (Amendment) Bill 2021 was passed by the Seanad on 16th July 2021 and will be signed into law by President Michael D. Higgins. The Bill will support Ireland's transition through the establishment of a legally binding framework, which will decide clear targets and commitments to ensure Ireland's national, EU and international climate goals and obligations are achieved. The Climate Action and Low Carbon Development (Amendment) Bill 2021 has been developed to support Ireland's transition to Net Zero and achieve a climate neutral economy no later than 2050.

The Bill includes some of the following key elements:

- Embeds the process of carbon budgeting into law
- Requires the Government to adopt a series of economy-wide five-year carbon budgets, including sectoral targets for each relevant sector, on a rolling 15-year basis, starting in 2021.
- Targets will be detailed in the Climate Action Plan and updated annually.
- A National Long Term Climate Action Strategy will be prepared every five years
- Government ministers are responsible for achieving the legally binding targets for their own sectoral area with each Minister accounting for their performance towards sectoral targets and actions before the Oireachtas Committee each year
- Strengthens the role of the Climate Change Advisory Council (CCAC), tasking it with proposing carbon budgets to the Minister. The Bill has also seen the expansion of the

CCAC from eleven to fourteen members, and provides that future appointments to the CCAC provide for a greater range of relevant expertise
- Provides that the first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% emissions over the period to 2030, in line with the Programme for Government commitment
- Introduces a requirement for each local authority to prepare a Climate Action Plan, which will include both mitigation and adaptation measures and be updated every five years. Local authority Development Plans will also align with their Climate Action Plan.

3.3 Local level

3.3.1 Monaghan County Council Climate Change Adaptation Strategy 2019-2024

The Monaghan County Council Climate Change Adaptation Strategy 2019-2024 forms part of the National Adaptation Framework (NAF) which was given statutory authority by the provisions of the Climate Action and Low Carbon Development Act 2015.

Local authorities are required to undertake an annual programme with measurable impact with actions to focus on for example:

- Reducing emissions by 30% and improve energy efficiency of public sector buildings by 50% under the guidance of a new Public Sector Decarbonisation Strategy.
- Setting a target to demonstrate leadership in the adoption of low emission transport options
- Public buildings (all) to reach BER 'B' Rating

Monaghan County Council Mitigation Activities

The strategy emphasises Monaghan County Council commitment to mitigating the causes of climate change and to decreasing the organisations dependency on fossil fuels and reduce energy consumption. This goal is defined in supporting strategy 2.4 of the Monaghan County Council Corporate Plan 2015-2019 as follows:

2.4 Promote the sustainable use of energy by assisting Monaghan County Council and local communities in reducing their energy consumption in line with national targets.

3.3.2 Monaghan County Development Plan 2019 – 2025

The Monaghan County Development Plan provides an overall strategy for the proper planning and sustainable development of County Monaghan over the timescale of the Plan. Chapter 8 of the Development plan covers objectives within Environment, Energy and Climate Change. The strategic objective within this sector is stated as follows:

- *To afford a high level of environmental protection in County Monaghan through the provision of quality environmental services which adhere to the precautionary principle, to provide for sustainable development through the promotion of energy efficiency and renewable energy to deliver a low carbon future for County Monaghan, to implement measures to reduce the human causes of climate change and to consider its effects when formulating development plan policies.*

3.3.3 Monaghan Decarbonisation Zone

Within the Climate Action Plan: Action 165 – *Extend flagship low-carbon projects to other towns and villages*. The Climate Action Plan has established an obligation for each local authority in Ireland, to identify and develop one Decarbonising Zone. The implementation of this action is led by the Department of Housing, Local Government and Heritage (DHLGH), together with the Sustainable Energy Authority of Ireland (SEAI) and local authorities.

A Decarbonising Zone (DZ) is defined as an area which is spatially identified by a local authority, in which a range of climate mitigation measures can co-exist to address local low carbon energy, greenhouse gas emissions and climate needs. The range of policies and projects developed are specific to the energy and climate characteristics of the spatial area covered by the DZ. This can include a range of technologies and measures addressing electricity, heat, transport, building energy efficiency, carbon sequestration, energy storage, grid frequency/inertia etc.

Monaghan County Council has put forward a proposal for Monaghan Town as the first DZ within County Monaghan. The council have identified Monaghan Town as it is the only town within the county which has a population significantly greater than 5,000 persons and it is also likely to be the area with the highest carbon footprint within the county. The 2020 CO_2 emissions for the proposed Monaghan DZ have been estimated by IHER Energy Services Ltd through a baseline analysis as 129,200 tonnes across residential, commercial, public buildings/large energy users and car transport. Monaghan County Council believe that establishing Monaghan Town as the counties first DZ will provide a wide range of opportunities for identification of carbon savings initiatives across a wide range of sectors which includes, retail, leisure, industry, residential, education and health.

Furthermore, there are a significant number of key stakeholders including government agencies are located within the proposed DZ all of whom are responsible for achieving national climate change targets. The proposed zone therefore contains many buildings, properties and infrastructure which are under the ownership/control of the local authority and other government departments/agencies which provides substantial opportunities for establishing decarbonisation projects.

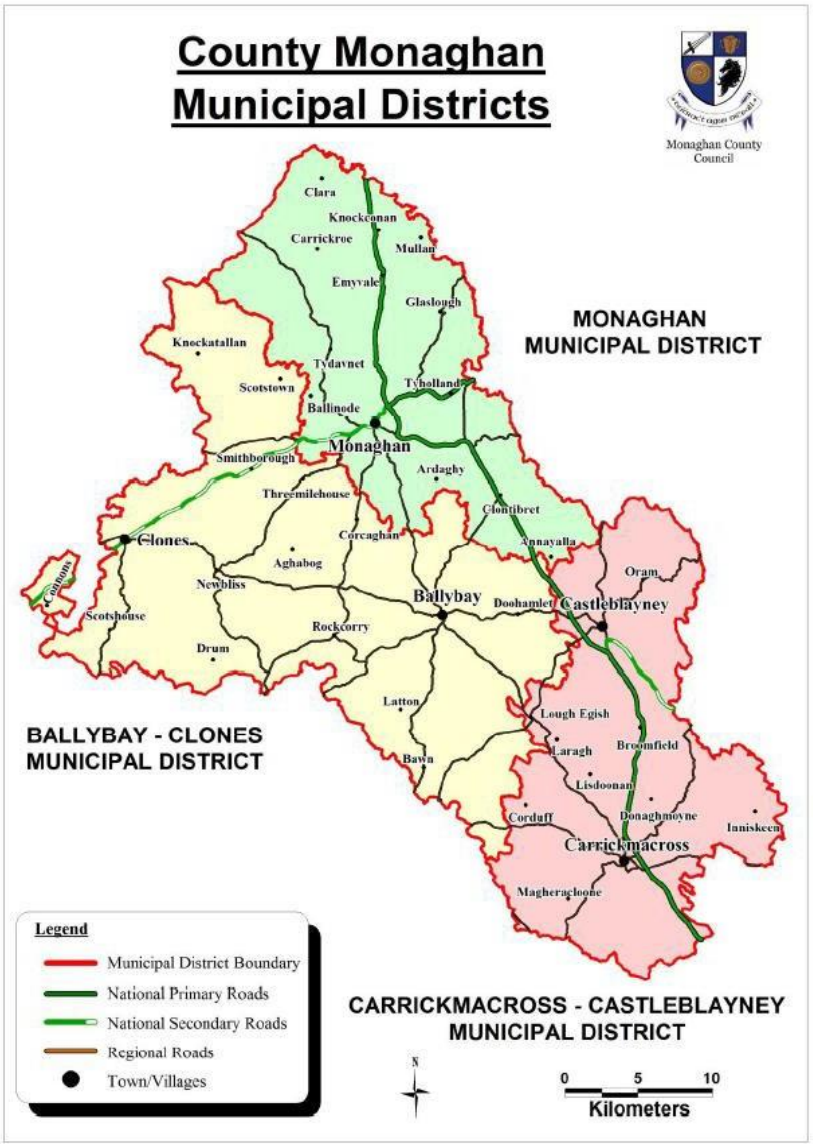
4.0 Characterisation of the community

4.1 Overview

Monaghan is a relatively small county of approximately 1295km^2 representing 1.9% of the total area of the Republic of Ireland. A landlocked county, Monaghan is bounded by counties Cavan, Meath, Louth, Fermanagh, Tyrone, and Armagh. It shares 108 miles of border with Northern Ireland giving the county the longest share of border between Northern Ireland and the Republic of Ireland counties. There is 2,408.97 km of public road in county Monaghan of which 107 km is national road[2].

There is a strong agricultural tradition in the county with 69% of the county area is dedicated to agriculture. The county comprises of 3 municipal districts, namely, Monaghan MD, Ballybay-Clones MD, and Carrickmacross-Castleblayney MD as shown in Figure 1: Municipal districts in County Monaghan (Source: Monaghan County Development Plan 2019-2025)

Figure 2: Map showing the 2016 Pobal Deprivation index of IrelandFigure 3 below. The 5 towns in the county are also shown: Monaghan, Castleblayney, Carrickmacross, Ballybay, and Clones.



[2] https://monaghan.ie/roadtransport/about-us/

Figure 1: Municipal districts in County Monaghan (Source: Monaghan County Development Plan 2019-2025)

Figure 2: Map showing the 2016 Pobal Deprivation index of IrelandFigure 3: Municipal districts in County Monaghan (Source: Monaghan County Development Plan 2019-2025)

4.2 Population

Monaghan is a predominantly rural county with only 37% of the County's population living within an urban area which is considerably lower than the national figure of 62%. The population is quite evenly spread throughout the Municipal Districts. Census 2016 results indicate that the population of Monaghan has only grown modestly since the previous census of 2011 increasing to 61,386 persons, an increase of 906 persons. Based on an assumption of approximately 1.04% growth per annum, the population of County Monaghan is expected to reach 67,253 by the year 2025.

Central Statistics Office (CSO) data has been used to create a population age profile as shown in Figure 4 below. The graph displays a breakdown of the county's population as of 2016, compared to Ireland as a whole.

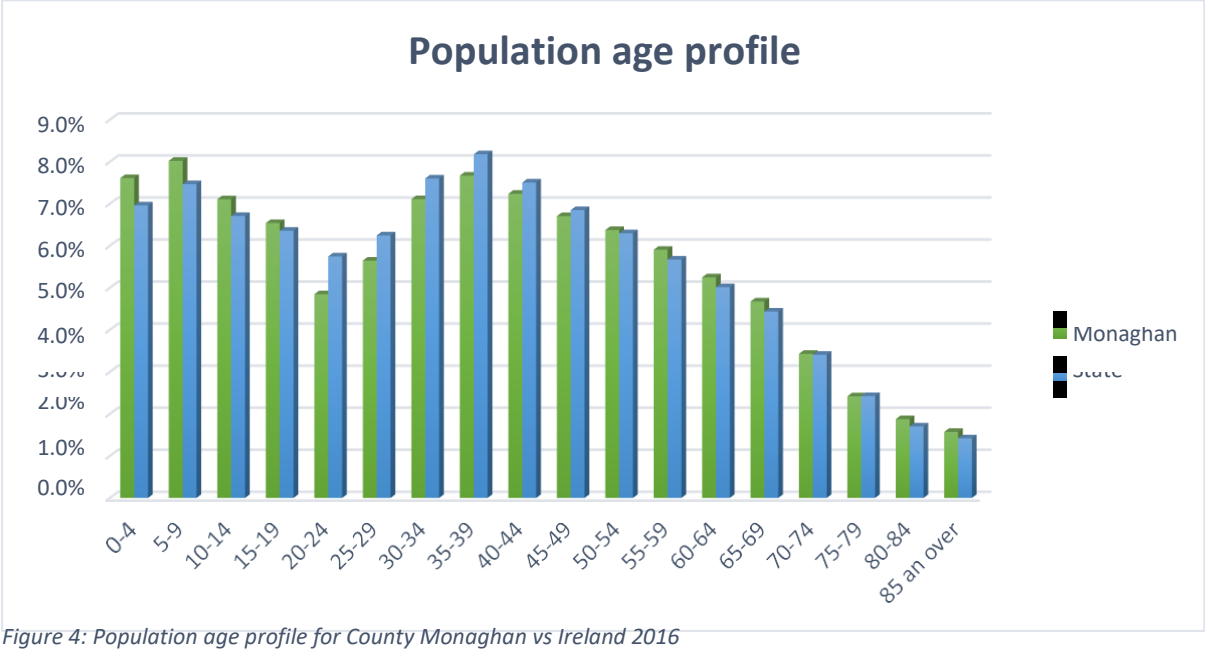


Figure 4: Population age profile for County Monaghan vs Ireland 2016

The profile shows that approximately a quarter of the population are families with young children as 23% of the total population fall in the age range of 0-14 years old. Those aged ≥65 account for 14% of the population. The adult age group with the highest proportion of the population is the 35-39 category.

4.2.1 Electoral Divisions

There are 70 electoral divisions within County Monaghan, as listed in Table 1. Census data for these electoral divisions is used later in the EMP to analyse heating fuel type, year of construction and indicative Building Energy Ratings (BERs).

Table 1: List of electoral divisions in County Monaghan

Electoral Divisions in County Monaghan						
Aghabog	Bragan	Church Hill	Currin	Drumsnat	Killynenagh	Newbliss
Anketell Grove	Broomfield	Clones	Dawsongrove	Emyvale	Kilmore	Rackwallace
Annayalla	Caddagh	Clones Rural	Derrygorry	Enagh	Kilmurry	Raferagh
Anny	Carrickaslane	Clones Urban	Donaghmoyne	Enagh	Kiltybegs	Scotstown
Ballybay Rural	Carrickatee	Clontibret	Drum	Figullar	Laragh	Shanmullagh
Ballybay Urban	Carrickmacross Rural	Cormeen	Drumboory	Glaslough	Lisnaveane	Sheskin
Ballymackney	Carrickmacross Urban	Corracharra	Drumcarrow	Greagh	Loughfea	St. Tierney
Bellanode	Castleblayney Rural	Creeve	Drumgurra	Inishkeen	Monaghan Rural	Tedavnet
Bellatrain	Castleblayney Urban	Cremartin	Drumhillagh	Killeevan	Monaghan Urban	Tehallan
Bocks	Castleshane	Crossalare	Drummully	Killylough	Mullyash	Tullycorbet

4.2.2 Deprivation Index

The Pobal Deprivation Index has also been used to identify areas where householders may require assistance in home energy improvements. Pobal are an organisation that work on behalf of Government to support local communities in achieving social inclusion and development. Their interactive map tool shows the various levels of deprivation across the whole of Ireland. The tool uses data from Ireland's census, such as employment, age profile and educational attainment, to calculate and classify each area as the following:

- Very affluent
- Affluent
- Marginally above average
- Marginally below average
- Disadvantaged
- Very disadvantaged
- Extremely disadvantaged

Figure 5 below shows the Pobal Deprivation index map for all counties within Ireland for the 2016 year. The County has an average Pobal index of -3.23 for the year 2016 which is classed as marginally below average. 20 other counties within the state also lie within this classification.

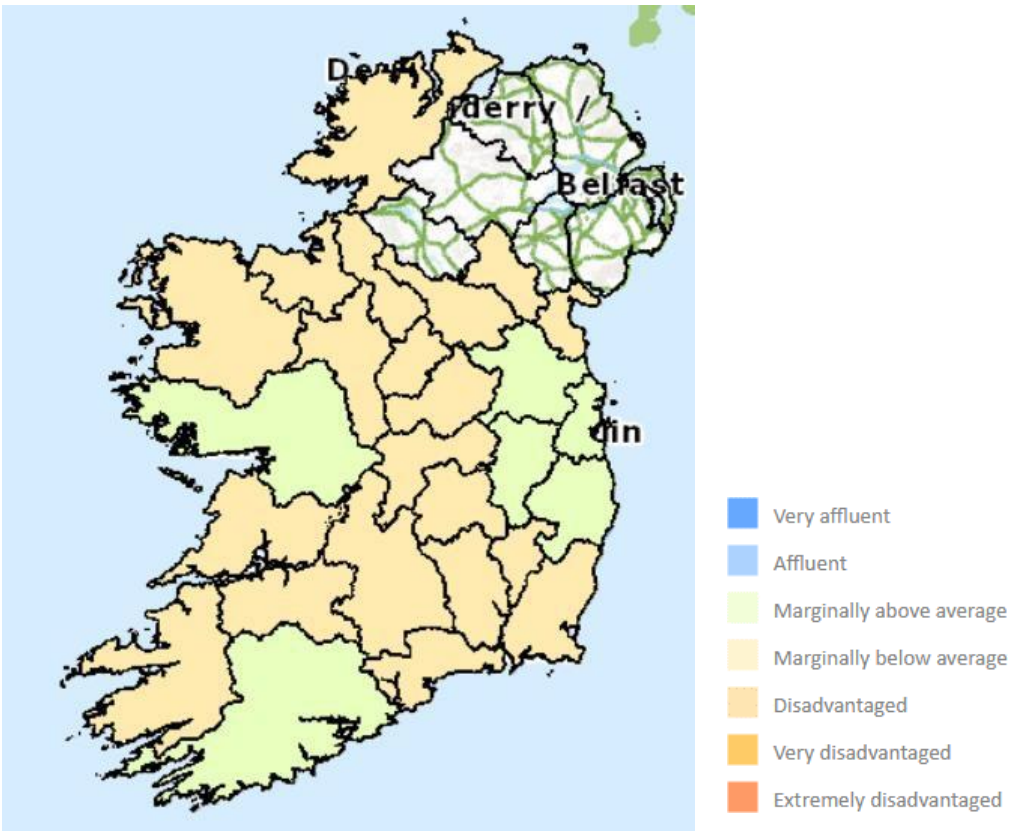


Figure 5: Map showing the 2016 Pobal Deprivation index of Ireland

Figure 6 below shows the Pobal deprivation index map for County Monaghan for the year 2016 for all small areas. Small Areas are defined by CSO as the lowest level of geographical division for compiling statistics and will typically contain between 50 and 200 dwellings.

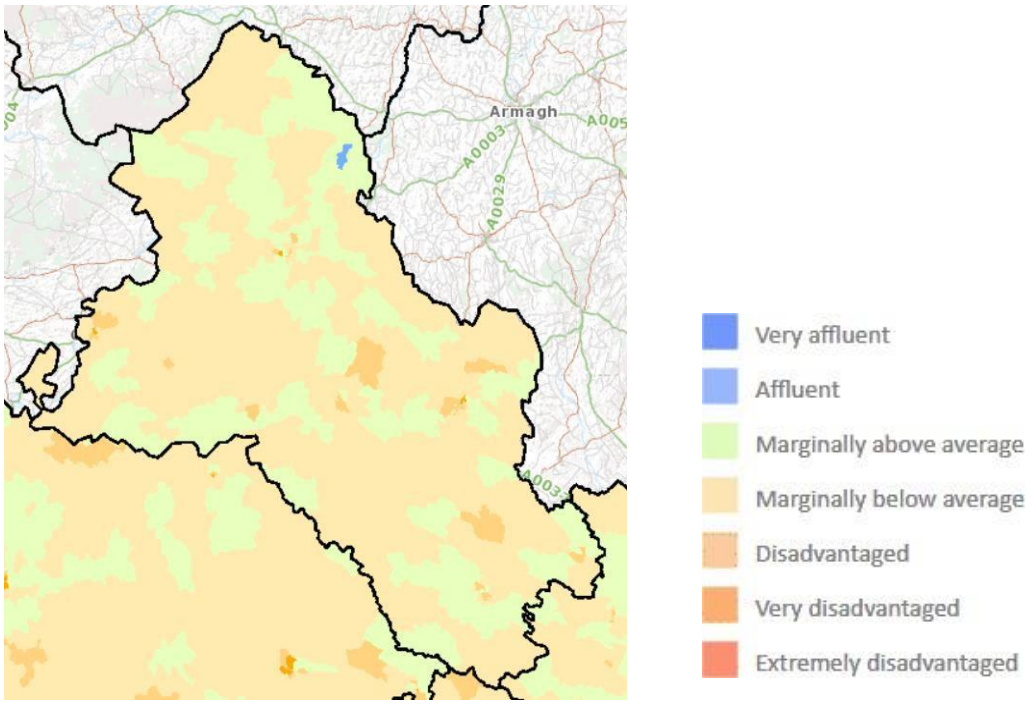


Figure 6: Map showing the 2016 Pobal deprivation index for small areas within County Monaghan

Areas that are classified as “Very disadvantaged” have been taken from the map and are shown in Table 2 below.

Table 2: Small areas in County Monaghan which are classified as "Very disadvantaged" from 2016 Pobal index

Small area ID	Electoral division	Pobal HP index 2016
177024004	Clones Urban	-27.59
177058010	Monaghan Rural	-24.67
177017003	Carrickmacross Urban	-14.84
177032003	Dawsongrove	-14.42
177059003	Monaghan Urban	-14.32
177061004	Newbliss	-14.18
177019014	Castleblayney Rural	-14.04
177023006	Clones Rural	-13.10
177070002	Tullycorbet	-12.27
177048004	Inishkeen	-12.25
177021002	Church hill	-12.13
177016011	Carrickmacross Rural	-10.82
177030001	Crossalare	-10.49

Further analysis of the electoral divisions and deprived areas is presented in section 6.4.2.

4.3 Housing

The 2016 census recorded that a total of 25,311 housing units exist in County Monaghan. Figures 5, 6 and 7 below show the predominant private dwelling type in the County is ‘house/bungalow’ (93.9%) with the largest proportion (27.0%) built between 2001 and 2010. Most domestic properties use oil as their main heat source (76.3%) reflecting the rural nature of settlement.

The Monaghan County Development Plan has estimated the need to provide housing for a total 5,979 persons between 2019 and 2025, and that 1,935 housing units will be required to accommodate this estimated population increase. The Council is both the Housing Authority and the Planning Authority for County Monaghan.

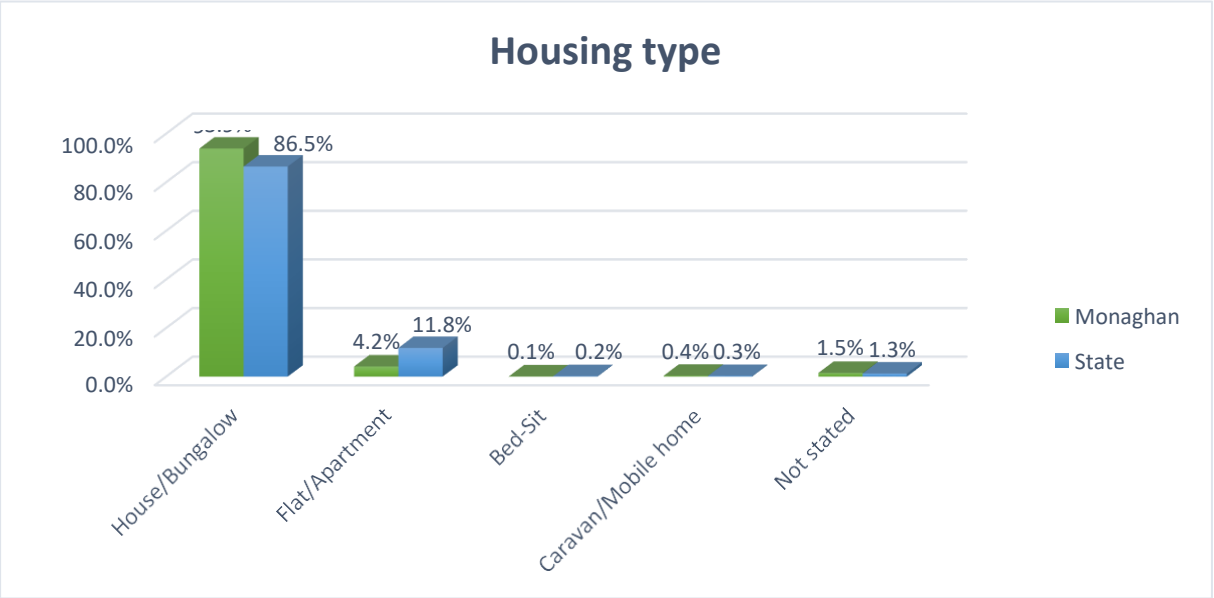


Figure 7: CSO data showing type of private housing County Monaghan vs Ireland 2016

Figure 7 illustrates that most domestic properties in the county are houses and bungalows, with only 4.2% being apartments.

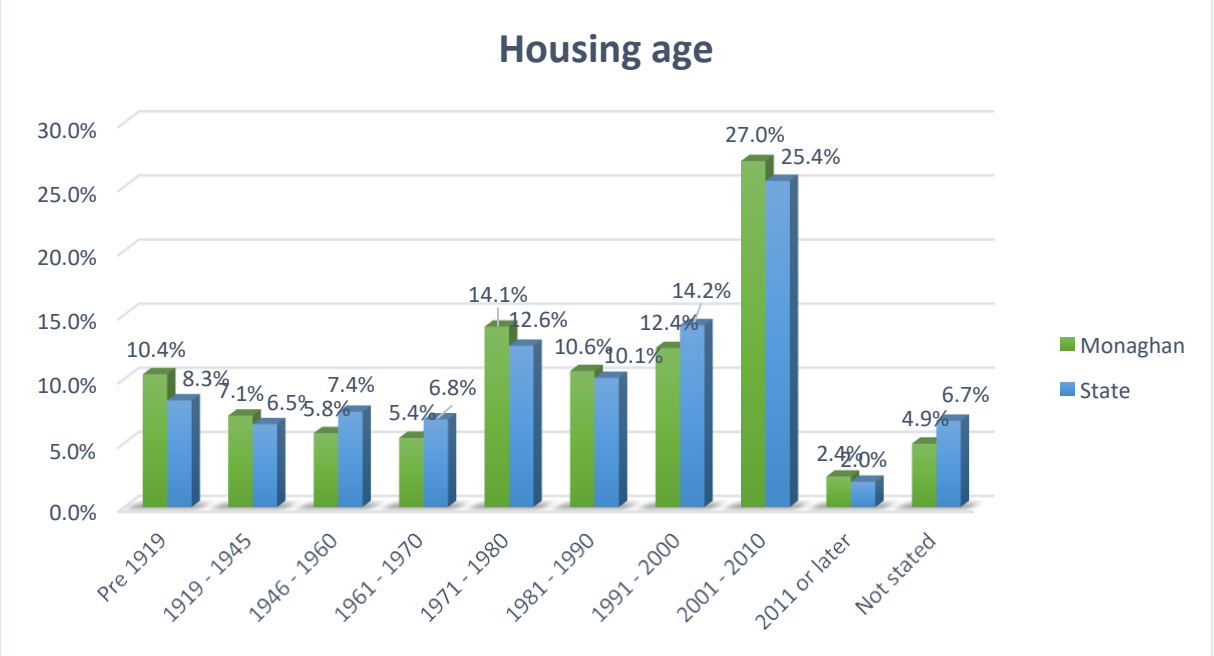


Figure 8: CSO data showing period of construction private dwellings County Monaghan vs Ireland 2016

Figure 8 shows the housing age within County Monaghan to follow a similar trend to that of the state. 53% of houses within County Monaghan were built before 1990, this is very similar to the state figure of 51%. The largest number of houses were built in the 2001-2010 period.

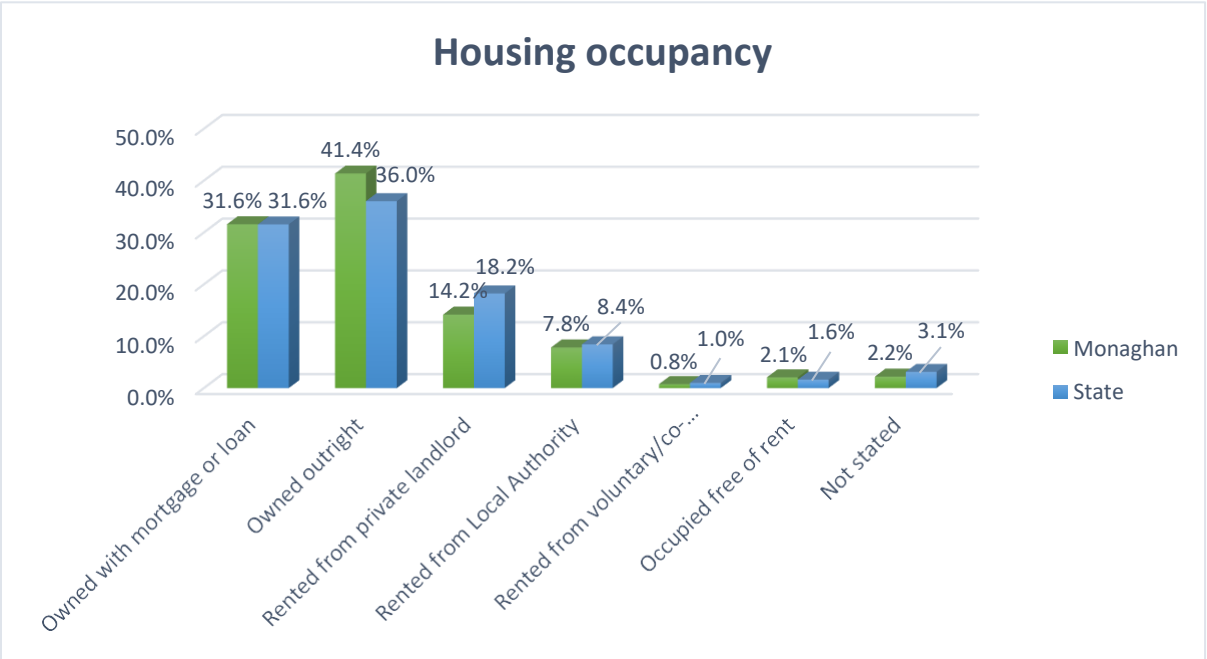


Figure 9: CSO date showing housing occupancy County Monaghan vs Ireland 2016

Figure 9 above shows that there is a high number of properties (41%) owned outright, higher than the national average of 36%. A similar number of properties are mortgaged.

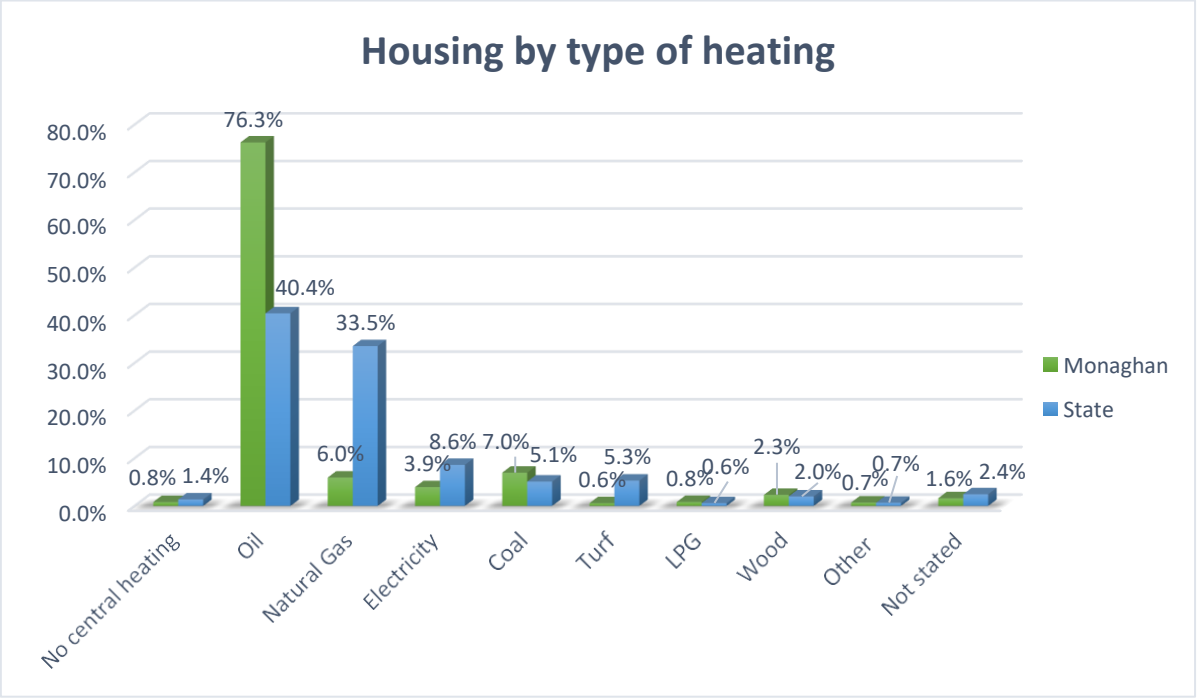


Figure 10: CSO data showing central heating type private dwellings County Monaghan vs Ireland 2016

Figure 10 shows the higher dependency of oil for central heating within Monaghan at 76.3% compared to 40.4% for the state. This coincides with a disparity in uptake of gas within the County as 6% compared to 33.5% for the state.

4.4 Employment

Traditionally agriculture has been the backbone of the economy and food production is still a very important sector. Other important sectors have been the furniture and engineering business and in recent years much of the work force is employed in the poultry sector, mushroom production, and transportation.

Figure 11 shows the proportion of people working within different industries within Monaghan compared to Ireland for 2016. The data reflects the dominance of the agriculture sector within the county with 11.2% of people working within this sector compared to the state's 4.4% average.

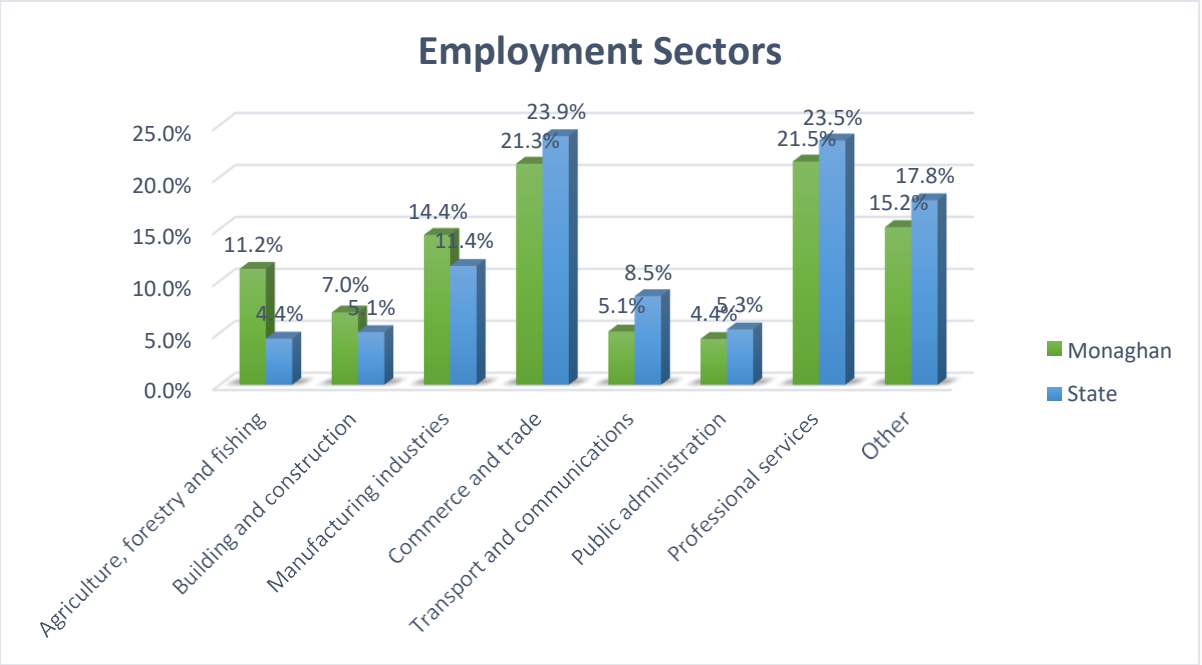


Figure 11: CSO data showing persons at work by industry County Monaghan 2016 vs Ireland

4.5 Transport

Road transport is the only form of transport available in County Monaghan. Car ownership is high with 63% of the county's population live in a rural area. There is a limited amount of public transport available within the county. In County Monaghan, towns which are in close proximity to the N2 National Primary Route are well serviced by the National bus routes. East – West routes and village routes are not well serviced by public transport. Bus Eireann provides limited services from Monaghan to Galway, Cavan, and Dundalk, while Ulster Bus operates routes to Belfast City.

There are several private bus operators which provide services to other towns in the region, however this is largely for students attending third level institutions. In 2017, two new commuter services were developed: 'M1 Tydavnet, Scotstown, Ballinode to Monaghan' and 'M2 Ballybay to Monaghan' which provide an up to nine times per day timetabled option for passengers to access employment, education, health, or social needs in Monaghan town. There are no rail services within the county.

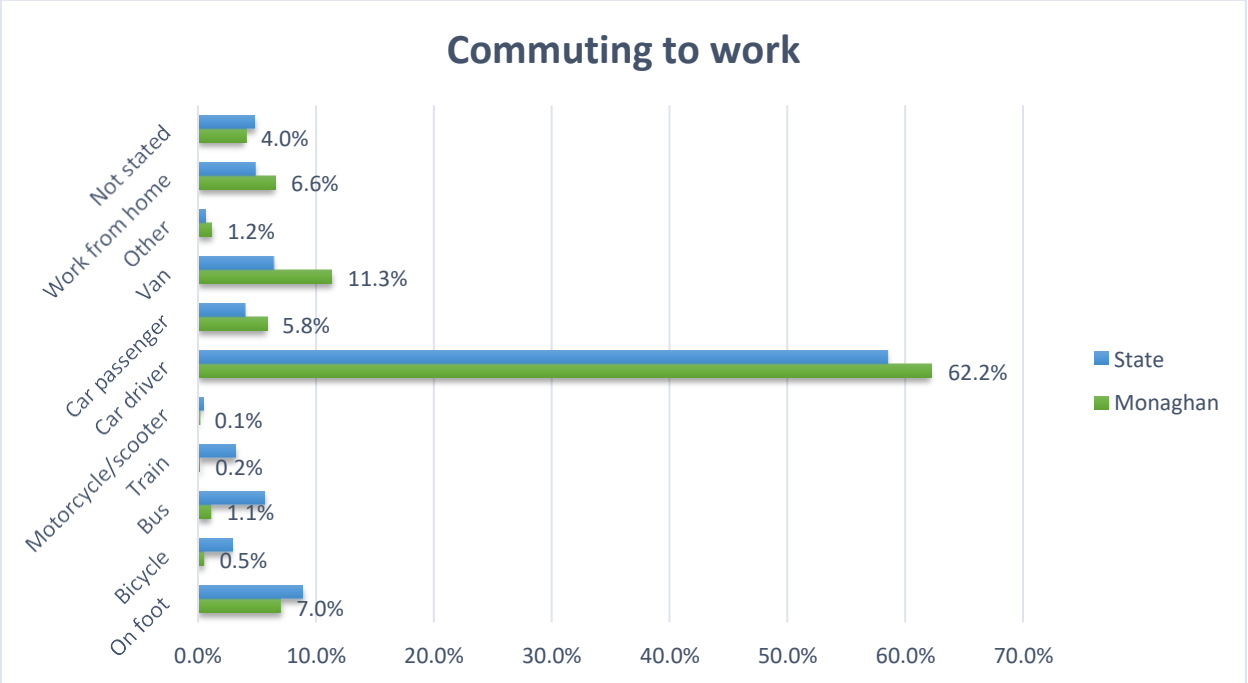


Figure 12: CSO data showing commute to work County Monaghan 2016 vs Ireland

The 2016 census shows an increase of 10% on the number of taxed vehicles since 2011. The average national commute to work is estimated to be 28 minutes which is longer than Monaghan's average commute to work of 25 minutes. Figure 12 and Figure 13 show CSO data on forms of commuting to work and school within the County for the 2016 baseline year compared to Ireland as a whole.

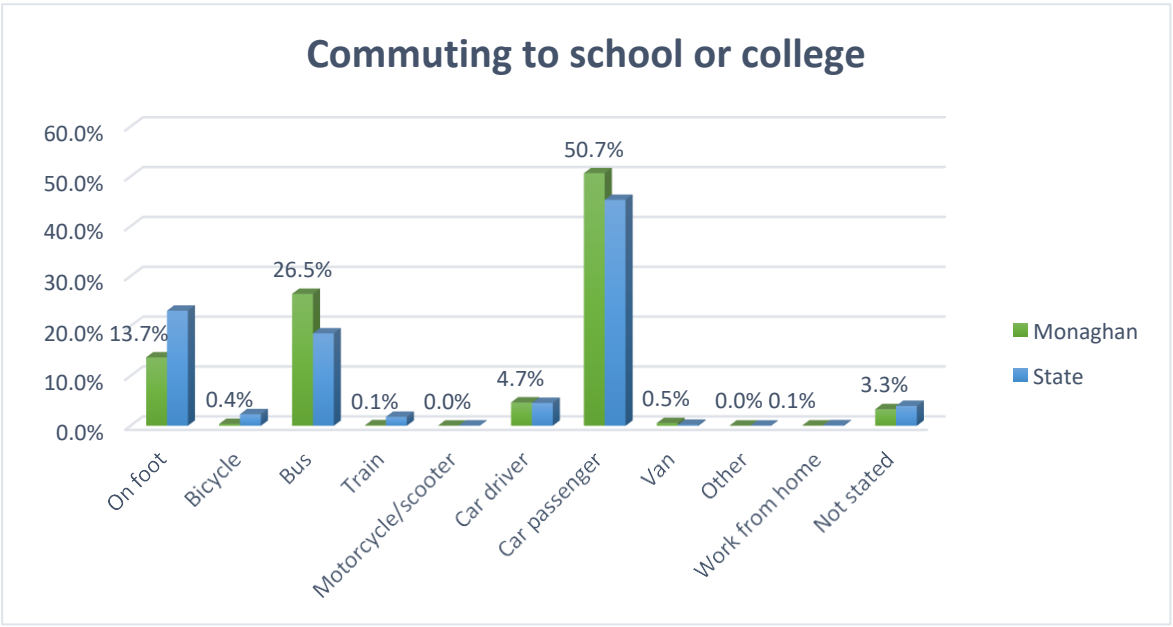


Figure 13: CSO data showing commute to school or college County Monaghan 2016 vs Ireland

In 2016, a total of 39,310 people in the county travelled to work, school, or college each day. Of this 71% travelled by private motor car/van. While 9.4% of people commuted to work, school or college on foot and 0.4% made their journey by bicycle. The CSO National Travel Survey 2016, shows that nationally the number of commuters travelling by foot was 14.6% and 1.7% by bicycle, therefore the county is below the national averages. Monaghan County Council is currently developing the county's first 'Walking & Cycling Strategy[3]' to help the council to identify the needs of the county in relation to walking and cycling infrastructure. The strategy will enable council departments to identify areas where their existing programmes of work can contribute to the promotion of walking and cycling throughout the county. The publication date of the final 'Walking and Cycling Strategy' is not publicly available.

Figure 14 shows the number of cars owned by private dwellings within the County compared to Ireland for 2016. Homes with 2 cars are higher than the national average.

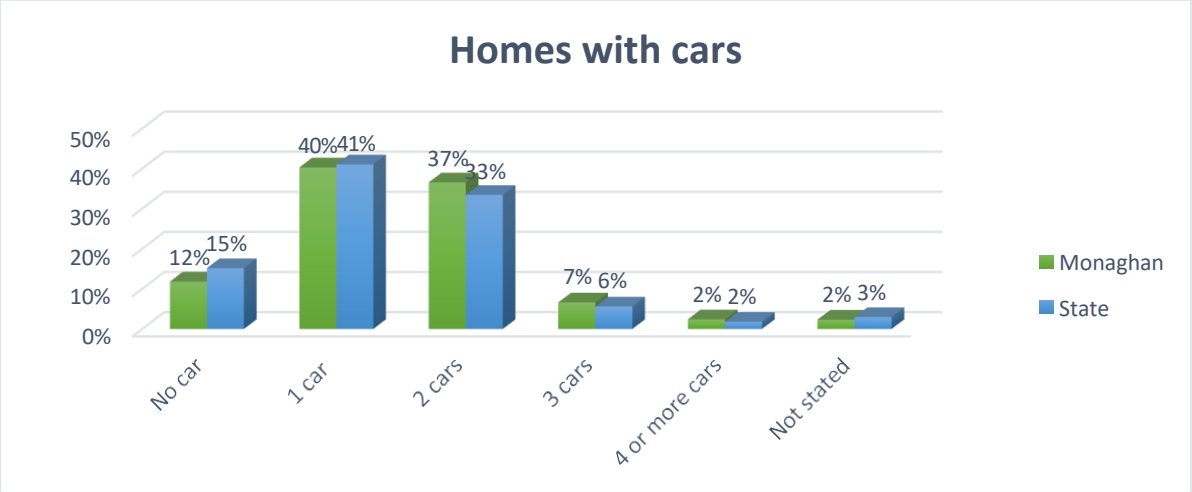


Figure 14: CSO data showing the number of cars owned per private household County Monaghan 2016 vs Ireland

4.6 Road Haulage

Road haulage is a significant sector in County Monaghan with 147 licensed haulage contractors as of September 2021[4], as shown in Table 3. 20 of these 147 companies operate 10 or more trucks.

Monaghan is ranked 9th out of the 26 counties in terms of number of licensed haulage contractors. The total number of licensed HGVs operated by the companies in Monaghan is 854.

Table 3: Number of licensed hauliers in each County

County	No. of licensed hauliers	County	No. of licensed hauliers
Dublin	566	Kerry	119
Cork	407	Wicklow	117
Kildare	225	Kilkenny	110
Meath	223	Cavan	94
Wexford	204	Clare	81
Tipperary	195	Carlow	80
Galway	162	Roscommon	74
Donegal	161	Westmeath	74
Monaghan	147	Offaly	65
Louth	140	Sligo	57
Limerick	137	Waterford	55
Mayo	125	Longford	38
Laois	123	Leitrim	29

[3] https://activetravelmonaghan.files.wordpress.com/2021/03/draft-monaghan-walking-cycling-strategy-for-public-consultation-april-2021.pdf

[4] Information provided by Department of Transport - only vehicles that are being operated for hire or reward, and in excess of 3.5 tonnes, are required to be licensed. Vehicles that are operated for 'own account' work are not required to be licensed.

4.7 Business and agri-food Monaghan

Agriculture in Co. Monaghan is of huge importance with the County being a leader in poultry production and mushroom growing. The agricultural sector in the county is well supported by a strong agri-food sector with major companies operating locally such as Monaghan Mushrooms, Lacpatrick, Greenfield Foods Ltd, Silverhill Foods, Allied Beef Processors and Kerry Group. Together the agricultural sector and the agri-food sector make up 60% of the total employment in the County.

The County Monaghan Food Strategy[5] 2017-2020 outlines the importance of the agri-foodsector within the County with agriculture providing 12.5% of employment compared to the national average of 5.06%. These figures show an increase from the 2016 census data stated in section 3.4 due to the report having been published after 2016. Food manufacturing alongside agriculture accounts for 60% of employment within the County with 9 out of the top 10 employers being food companies[6]. These food companies include the provision and production of the following:

- Dairy and infant formula
- Poultry and eggs
- Red meat
- Mushrooms
- Water
- Value Added and Convenience Foods
- Meal Feedstuffs
- Food Laboratories
- Food Services – transport, distribution and temperature controlled warehousing

The county has also seen the successful development of a significant number of Small and Medium Enterprises (SMEs) in key sectors including engineering, ICT, tourism, culture, and business support services.

As mentioned, information on active enterprises on a County Level are available from the CSO Business Demography databases. The CSO data available for the 2016 baseline year shows types of enterprises that have been classified using the European classification of economic activities[7]. Table 4 shows a breakdown of the number of enterprises within each classification as set out by CSO for the County for the 2016 baseline year and shows the comparison with the state. A letter is used to represent each type of activity as set out by the European classification system.

[5] https://www.localenterprise.ie/Monaghan/Enterprise-Development/Supports%20for%20Food%20Business/Agri-Food-Strategy.pdf

[6] https://www.monaghanbusiness.com/our-businesses/key-sectors/key-sectors/

[7] https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF

Table 4: CSO data on type of enterprises in County Monaghan vs Ireland for 2016

Activity	Monaghan		Ireland
	Number	%	%
Wholesale and retail trade, repair of motor vehicles and motorcycles (G)	804	22.0%	14.3%
Construction (F)	774	21.2%	15.8%
Manufacturing (C)	303	8.3%	4.8%
Professional, scientific, and technical activities (M)	268	7.3%	12.4%
Other Service Activities (S)	251	6.9%	6.0%
Transportation and storage (H)	241	6.6%	7.6%
Human Health and Social Work Activities (Q)	197	5.4%	6.1%
Accommodation and food service activities (I)	191	5.2%	5.6%
Administrative and support service activities (N)	166	4.5%	5.1%
Real estate activities (L)	149	4.1%	4.1%
Education (P)	134	3.7%	4.2%
Arts, Entertainment and Recreation (R)	78	2.1%	3.3%
Information and communication (J)	42	1.1%	4.5%
Financial and insurance activities excluding activities of holding companies (K-642)	29	0.8%	2.0%
Water supply, sewerage, waste management and remediation activities (E)	27	0.7%	0.3%
Mining and quarrying (B)	-	0.0%	0.1%
Electricity, gas, steam, and air conditioning supply (D)	-	0.0%	0.2%

The number of manufacturing and construction enterprises is higher in Monaghan than the Ireland average. Manufacturing activity is defined as also including the production of food such as poultry, meat, fish, and dairy. This classification would therefore include food manufacturers in the county such as beef, poultry, eggs, and dairy products. These sectors would be considered energy intensive. The table also shows that the percentage number of vehicle trade and repairs is higher in Monaghan than Ireland, this is likely to be due to border location and a high car dependency in the county.

As of 2019 Small to medium sized enterprises (SME's) accounted for 99% of active enterprises in Ireland[9]. This translates to 65% of total employees in the country. The EU defines SMEs as companies with less than 250 employees and an annual turnover below €43m.

A report on the SME sector in Ireland was published by the Seanad Public Consultation Committee in May of 2019[8]. The committee's goals of the report included an assessment of the business environment in Ireland, the identification of key challenges faced by SMEs and the creation of a recommendation report aimed to guide national policy in the support of the SME sector in the Country. The report included a breakdown of different sized businesses on a county level. This quantification came from both primary research through consultations and interviews and secondary research from sources such as Central Statistics Office (CSO), Department of Business,

[8] https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/seanad_public_consultation_committee/reports/2019/2019-05-16_small-and-medium-sized-businesses-in-ireland_en.pdf

Enterprise and Innovation and European Commission Small Business Act Factsheets. Table 5 shows the report's assessment of different sized businesses in County Monaghan for the 2016 baseline year.

Table 5: Summary of size of enterprises within County Monaghan for 2016

Size of enterprise	Enterprises		Employees	
	Number	%	Number	%
Micro enterprises (<10 employees)	2718	90.4%	5395	33.9%
Small enterprises (10- 49 employees)	242	8.1%	4672	29.4%
Medium enterprises (50- 249 employees)	41	1%	3796	23.9%
Large enterprises (250+ employees)	4	0.1%	2048	12.9%

The report includes a comparison of the above breakdown of different sized enterprises across all counties within the state, which is shown in Figure 15. The graph shows Monaghan to have a similar break down of different sized enterprises as other counties in the Country. An average was calculated for each type of enterprise:

- Micro enterprise- Country average: 36.9%
- Small enterprise- Country average: 26.9%
- Medium enterprise- Country average: 20.1%
- Large enterprise- Country average: 18.3%

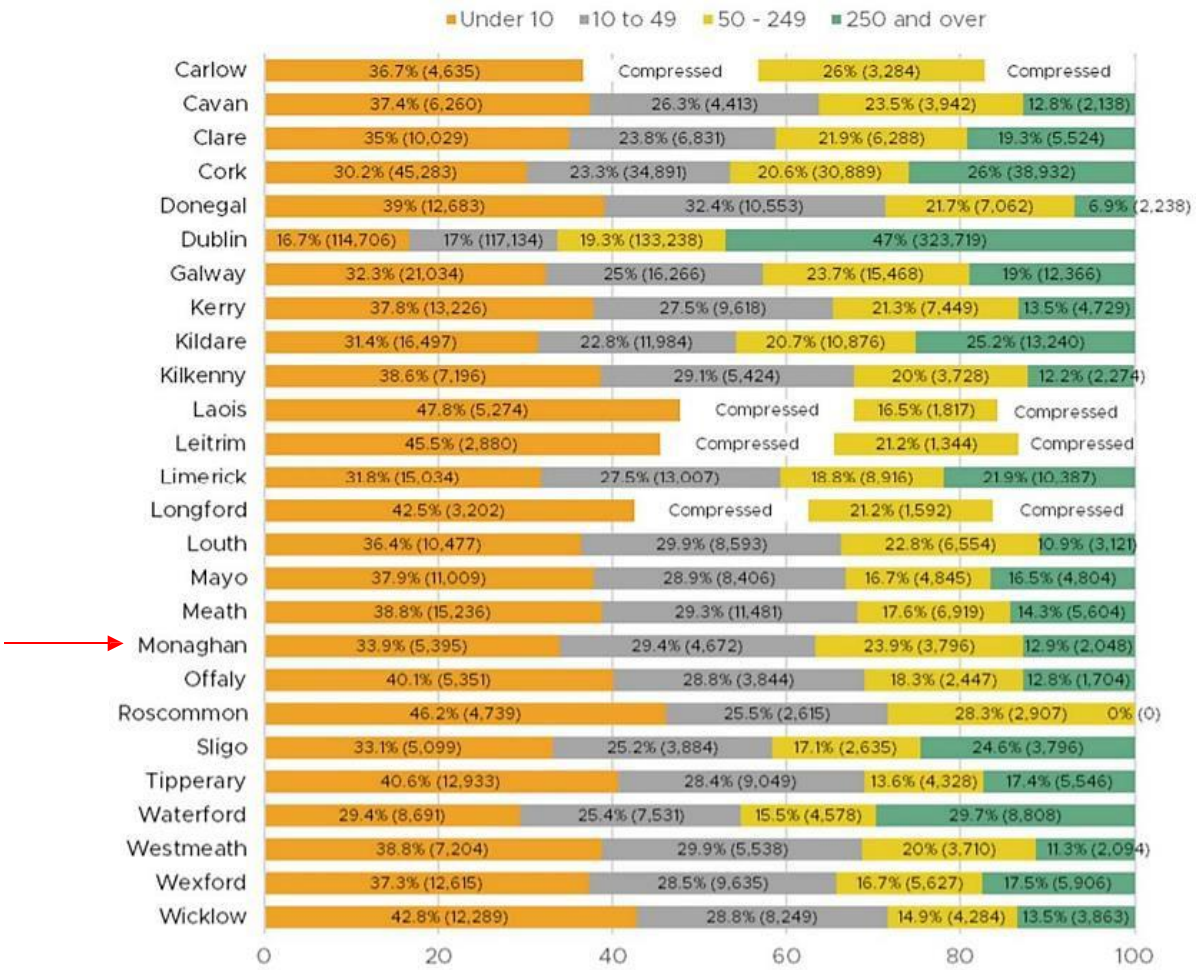


Figure 15: Graph showing the comparison of different sized enterprises across Irish Counties for 2016. (Source: Seanad Public Consultation Committee Report on Small and Medium Sized Businesses in Ireland)

5.0 Energy Baseline

The baseline energy use for the county is detailed throughout this section of the report and covers key sectors including the residential sector, agriculture sector and business sector. A mixture of published sources has been used for calculations including CSO, SEAI, Teagasc and Department for Agriculture Food and Marine (DAFM). A baseline year of 2016 has been used as this is the latest CSO census publication.

Energy usage detailed throughout this section for each sector will be presented in the units Megawatt Hours (MWh) regardless of fuel type to maintain consistency. As reference, a typical Irish home consumed 18MWh of energy (electricity and heating) per year in 2019. Where the units Kilowatt hours (kWh) have been referenced this will be due to the source of data (1,000kWh equates to 1MWh). Alongside energy usage, associated carbon emissions have been calculated and will be presented in tonnes. Carbon (CO_2) emissions are calculated using SEAI conversion factors which are stated in kilograms or tonnes of carbon per unit of energy (MWh). For example, SEAI states that the carbon conversion factor for grid supplied electricity for Ireland in 2016 was 0.480kg of CO_2 per MWh of electricity. This factor would be multiplied by the total electricity consumption to calculate associated carbon emissions.

5.1 Residential sector

5.1.1 Domestic electricity baseline

Central Statistics Office (CSO) data for the county show that there are 21,689 private dwellings in the county for the 2016 baseline year. This figure has been used to calculate electricity demand within the residential sector. SEAI statistics for energy use per dwelling[9] and carbon conversion factors[10] have also been used to calculate energy spend on residential electricity and associated carbon emissions. These conversion factors correspond to the year 2016 to retain consistency with the CSO data year. The price of electricity was taken from SEAI's statistics on average price of electricity to Irish households for the year 2016[11]. Table 6 below shows a summary of this consumption, spend and CO_2 emissions. From the 8 residential audits carried out an average electricity demand of 4.453MWh was calculated which correlates to SEAI's latest national statistics which state an average electricity demand for residential households as 4.544MWh for 2019.

Table 6: Residential electricity baseline for County Monaghan for baseline year

Residential electricity baseline		
Total electricity demand (MWh)	Total electricity spend (€)	CO_2 emissions (tonnes)
100,594	€22,497,755	48,285

[9] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/residential/
[10] https://www.seai.ie/publications/Energy-in-Ireland-2018.pdf
[11] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/prices/

5.1.2 *Domestic heat baseline*

SEAI statistics for the year 2016 gives an average heat demand per dwelling[12] of 13.753MWh, however, to use figures more representative of County Monaghan specifically the SEAI BER database has been used alongside 2016 census data.

The BER database contains data on over 8,900 dwellings in County Monaghan which have been carried out between 2009-2020. Energy ratings range from A1 which indicates the highest energy efficient rating through to a G rating indicating the least energy efficient properties. Table 7 shows a comparison of BER ratings within County Monaghan with BER ratings for the whole of Ireland. This is based on approximately 8,900 BER ratings in Monaghan and 920,000 BER ratings in Ireland. It should be noted that the energy consumption per dwelling column includes both heat and electricity. These figures show that County Monaghan's BER ratings are close to those of Ireland in all categories.

Table 7: Comparison of BERs within County Monaghan vs Ireland CSO BER database

BER rating	Energy consumption per dwelling (kWh/m^2)	Monaghan BER database (comparison to Ireland)	Ireland BER database
A	<75	5%	5%
B1	>75	2% **(+1%)**	1%
B2	>100	3%	3%
B3	>125	8% **(+1%)**	7%
C1	>150	12%	12%
C2	>175	11% **(-2%)**	13%
C3	>200	11% **(-2%)**	13%
D1	>225	13% **(+1%)**	12%
D2	>260	11% **(-1%)**	10%
E1	>300	6%	6%
E2	>340	5%	5%
F	>380	5%	5%
G	>450	8%	8%

SEAI have published a guide[13] on indicative BER's based on a dwelling's year of construction and central heating fuel type. Table 8 shows a comparison of central heating fuel type within County Monaghan and the whole of Ireland from 2016 census data. The table shows a higher dependency on oil fuel and smaller proportion of households having gas as their heating fuel type. Residential heating through natural gas is mostly limited to Carrickmacross within the County. The table also shows County Monaghan having a smaller proportion of households using electricity and solid fuels for central heating compared to the rest of Ireland.

[12] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/residential/
[13] https://www.seai.ie/publications/Your-Guide-to-Building-Energy-Rating.pdf

Table 8: Comparison of central heating fuel type within Ireland vs County Monaghan 2016

	2016 Census	
	Ireland	**Monaghan (comparison to Ireland)**
Oil	41%	76% (+35%)
Natural gas	34%	6% (-28%)
Solid fuel	13%	9% (-4%)
Electricity	9%	4% (-5%)
Other central heating	1%	2% (+1%)
No central heating	1%	1%

Census data on central heating fuel type and year of construction was used to calculate indicative BERs for 20,544 residential dwellings in the County. 1,068 dwellings did not state their year of construction within the 2016 CSO census and so these dwellings could not be accounted for. The BER database for Monaghan was then used to calculate the heat demand per m^2 for each BER rating. The database gave an average floor space of 125m^2. This figure was used alongside SEAI domestic fuel cost prices[14] and SEAI carbon conversion factors[15] for various central heating fuels to calculate the heat baseline, as summarised in Table 9. Using the total heat demand from the table and the number of residential dwellings in the County gives an average heat demand of 19.73 MWh per dwelling, compared to the SEAI 2019 national figure of 14.204 MWh per dwelling. Results from the 8 residential audits showed oil as the central heating fuel type for 7 households which correlates with the county as a whole. An average heat demand of 15.645 MWh per annum was calculated for the 7 households.

Table 9: Residential heat demand for County Monaghan for the baseline year

Residential heat baseline		
Total heat demand (MWh)	Total heat spend (€)	CO_2 emissions (tonnes)
405,465	€29,105,359	103,761

5.1.3 Domestic transport energy baseline

To calculate the annual transport fuel demand and spend of the residential sector for the county, a combination of Census data and SEAI transport statistics were used.

According to SEAI, transport (both commercial and domestic) has continued to be the largest energy-consuming sector, contributing to 42% of the nation's final energy demand and 41% of energy emissions in 2019[16]. In the same year private car energy use was the largest energy demand within the transport sector contributing to 39.7% of the total transport energy use.

[14] https://www.seai.ie/publications/Domestic-Fuel-Cost-Comparison.pdf
[15] https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/
[16] https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf

Census data for County Monaghan shows the number of cars in each household for the year 2016. Transport statistics from SEAI's 2014 Transport report[17] were used to find the annual average milage for diesel and petrol cars as well as the split of cars by the two fuel types (Diesel 36% vs Petrol 63%). The age of a car will also affect the CO_2 emissions per kilometre travelled, as well as the energy efficiency of the fuel used.

The transport report gives an average private car age of approximately 8 years old. This age was incorporated into calculations to estimate the fuel consumption, fuel spend and associated CO_2 emissions. Table 10 gives a breakdown of the findings.

Table 10: Private transport energy baseline for County Monaghan for the baseline year

Private transport baseline		
Energy Consumption (MWh)	Fuel spend (€)	CO_2 emissions (tonnes)
336,021	€42,053,014	86,340

5.1.4 Residential Summary

According to Sustainable Energy Authority Ireland (SEAI)[18] the residential sector accounted for approximately a quarter of total energy consumption and energy related carbon emissions in Ireland in 2016. SEAI states that energy use within Irish homes is distributed between space heating (61%), water heating (19%), lighting and appliances (17%) and cooking (3%). This means that heating within a home accounts for approximately 80% of total energy consumption. This correlates with data analysed for County Monaghan with residential electricity accounting for 20% and space and water heating accounting for 80% of total energy consumption within homes.

Through analysis of energy consumption in households in County Monaghan, final energy use by different fuel types has been calculated and compared to Irish household data for the year 2016, as shown in Figure 16. This final energy use includes electricity use and heating within a home. The chart shows County Monaghan having a greater dependency on oil fuel at 64% compared to 37% in Ireland. This could be attributed to the lack of gas network pipeline within some areas of the County.

[17] https://www.seai.ie/publications/Energy-in-Transport-2014-report.pdf

[18] https://www.seai.ie/publications/Energy-in-the-Residential-Sector-2018-Final.pdf

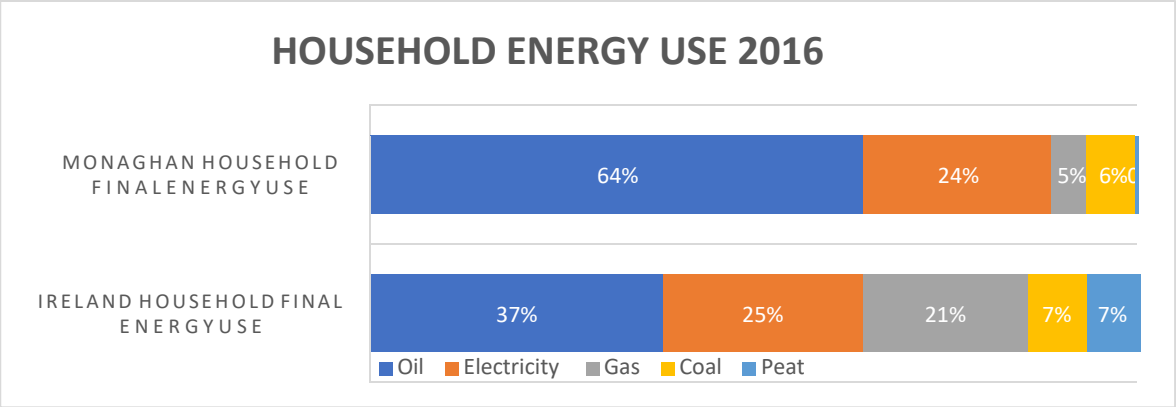


Figure 16: Comparison of household energy usage for County Monaghan and Ireland in 2016

The CSO census specifies that there were 21,689 private dwellings in County Monaghan in the 2016 baseline year. The above analysis on electricity and heating within the residential sector would translate to 7 tonnes of CO_2 per dwelling per annum compared to 5.7 tonnes per dwelling per annum stated by SEAI for an average Irish dwelling. This increase in carbon per dwelling comes from the higher carbon intensity of heating consumption per dwelling as shown in Figure 17. This could be due to the larger dependency on oil as central heating fuel as oil emits 26% more carbon per kWh used compared to natural gas. It should be noted that the heating figure includes heating through electricity.

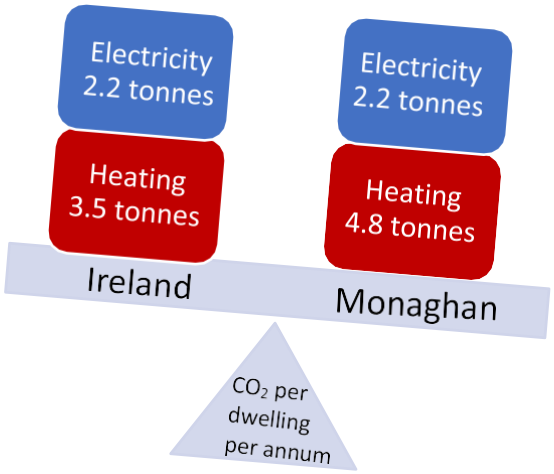


Figure 17: Comparison of tonnes of carbon emissions per dwelling per annum Ireland vs Monaghan 2016

Table 11 shows the comparison of electricity and heating demand, expenditure and associated emissions per dwelling compared with the state[19] for the baseline year. This excludes residential transport.

Table 11: Electricity and heating per dwelling Monaghan vs Ireland 2016

Per dwelling (excluding transport)	Monaghan	Ireland
Energy demand (MWh)	23.3	18.5
Energy cost	€2,375	€1,990
CO_2 emissions (tonnes)	7.0	5.7

[19] https://www.seai.ie/publications/Energy-in-the-Residential-Sector-2018-Final.pdf

Private transport within the County was analysed and collated into a final energy baseline for the residential sector. A summary of the County's residential total energy consumption, energy spend and associated CO_2 emissions for the 2016 baseline year is summarised in Table 12, in order of highest energy demand.

Table 12: Summary of energy baseline within the residential sector County Monaghan for the baseline year

	Energy demand / MWh	Energy spend / €	CO_2 Emissions / Tonnes
Residential heat	405,465	€29,017,876	103,761
Residential transport	336,021	€42,053,014	86,340
Residential electricity	100,594	€22,497,755	48,285
Total	**842,080**	**€93,568,644**	**238,386**

Figure 18 shows a breakdown of the different fuel types that make up the residential heat and transport sectors in the County for the baseline year. Proportioning of fuel types within the residential heat sector were calculated using 2016 census data for the County for central heating fuel type. No County level data regarding private transport fuel types was available therefore the most recent published data on the national ratio (Diesel 36% vs Petrol 63%) was used. The methodology used for each sector is detailed throughout this section of this report.

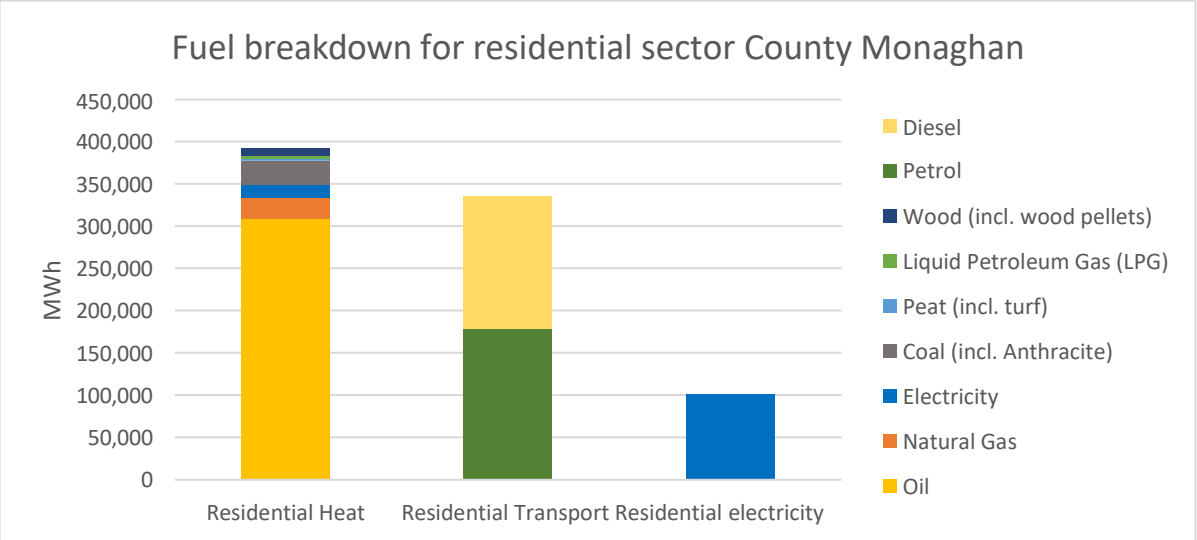


Figure 18: Breakdown of fuel types within Residential Heat & Transport for County Monaghan for baseline year

Figure 19 shows the contribution of electricity, heating and transport make within the residential sector for the County for consumption, spend and CO_2 emissions. Heat is the largest contributor to the residential energy demand (48%) and CO_2 emissions (44%), while transport is the largest contributor to the residential energy spend (45%). This would suggest that the most effective energy reduction opportunities within the residential sector would involve heat use and heat loss within a home.

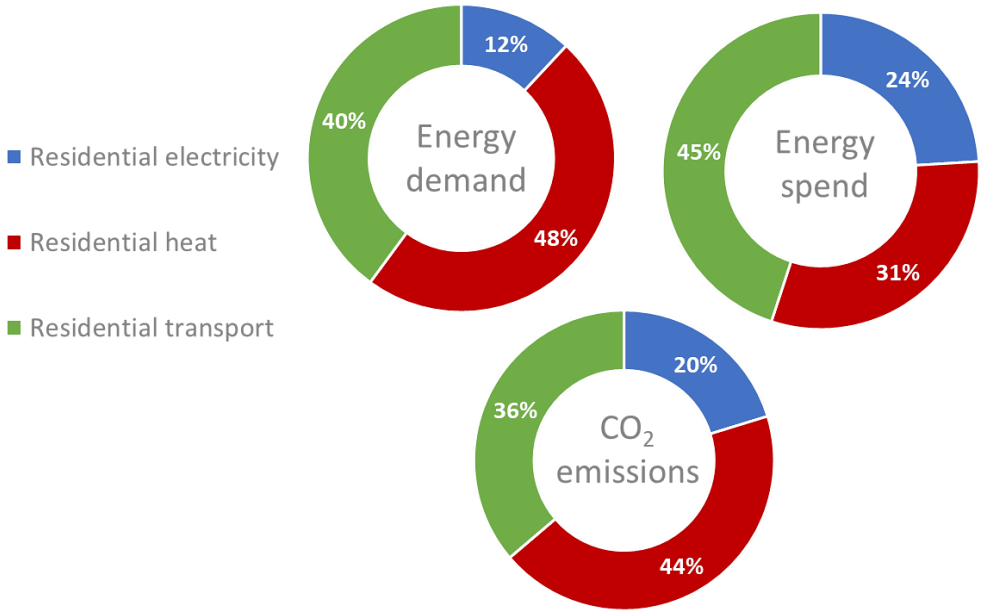


Figure 19: Breakdown of energy baseline for Residential sector of County Monaghan for baseline year

5.2 Business sector

5.2.1 Business energy baseline

The energy baseline for businesses within the industry and services sector has been calculated for the County using the available data from CSO's Business Energy Use survey. The Business Energy Use (BEU) survey was first carried out in 2009 and has become compulsory since 2018 however data has only been published up to the year 2017. The survey provides estimates on costs and quantities of energy consumption used by enterprises within the Industry and Services sector to carry out their operations. The business activities that have been included within this data are economic activities that fall under the European NACE 2 classification. These activities are listed in Table 13. This data set will include the prominent food companies within the County due to the inclusion of the manufacture of food within the NACE 2 classification[20]. A full list of food production activities that are included in the data can be found within Appendix 6 - *Business Energy Use Survey- NACE Rev 2 Sector: Manufacture of Food, Beverages and Tobacco (10-12)*. Energy use by enterprises and family farms in NACE Divisions 01-03 (Agriculture, forestry, and fishing) are not included in the results.

Table 13: Summary of economic activities included within the CSO Business Energy Use data

Mining and Quarrying (05-09)
Manufacture of Food, Beverages and Tobacco (10-12)
Manufacture of Wood and Paper (16-18)
Manufacture of Chemicals (20)
Manufacture of Pharmaceuticals (21)
Manufacture of Rubber, Plastic and Non-metallic Mineral Products (22-23)
Manufacture of Basic Metals and Metal Products (24-25)
Manufacture of Electronic and Electrical Equipment (26-27)
Other Manufacturing
Electricity and Gas (35)
Water Supply, Sewerage, and Waste Management (36-39)
Construction (41-43)
Wholesale, Retail, and Vehicle Repair (45-47)
Transportation and Storage (49-53)
Accommodation and Food Services (55-56)
Information and Communication (58-63)
Financial, Insurance and Real Estate Activities (64-68)
Public Administration (84)
Education (85)
Health, Residential Care and Social Work Activities (86-88)
Other Services Sectors

Data collected for the Survey in 2016 included enterprises with 10 or more employees. To give better representation of smaller companies, the 2017 survey[21] included enterprises with less than 10 employees (3-9). Given the prominence of SMEs within the County, data for the 2017 year will be used for the baseline. The BEU survey gives total energy consumption per County which

[20] https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF
[21] https://www.cso.ie/en/releasesandpublications/er/beu/businessenergyuse2017/

includes energy used for electricity, heat, and transport. The survey also states an associated total energy spend per county. Table 14 below shows the total energy consumption, spend and associated emissions for businesses within the County included in the NACE 2 sector listed in table 13. Data for 2016 is also included to show a comparison between the two years.

The table shows a significant increase the energy consumption and spend from 2016-2017, however it is not possible to differentiate between the increase attributed to the inclusion of the smaller sized businesses from the 2017 survey and a general increase in new SMEs or energy consumption.

Table 14: Energy baseline for Industry and Services Businesses in County Monaghan 2016-2017 from CSO BEU survey

	Industry and services sector		
	Energy consumption (MWh)	**Energy spend (€)**	**CO_2 emissions (tonnes)**
2016	407,050	€35,753,000	115,885
2017	**546,610**	**€52,580,000**	**154,529**
% increase	34%	47%	33%

Figure 20 shows the breakdown of fuel types for total energy consumption of businesses within Ireland for the year 2016. This breakdown was used to estimate the CO_2 emissions stated in Table 14 above.

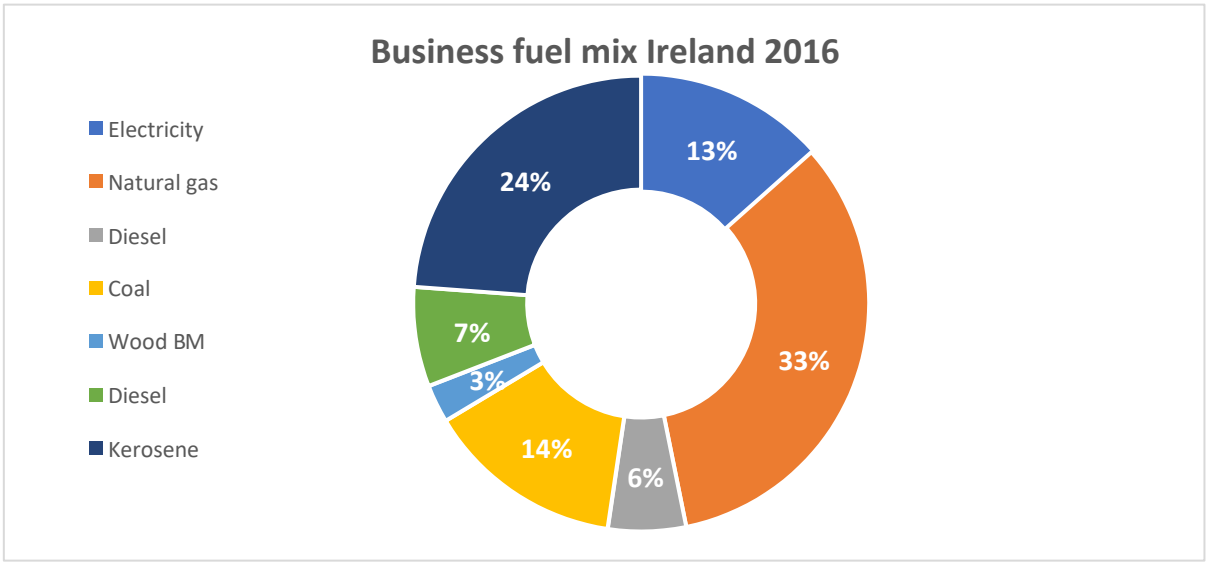


Figure 20: Fuel mix for businesses in Ireland 2016

As the graph above shows, the main energy source is from gas, however a quarter of businesses are using oil (kerosene) and 14% of businesses in Ireland are using coal for fuel both of which could be attributed to Irelands gas network. This presents an opportunity for businesses to decarbonise by converting to either a renewable fuel source such as biomass for heating requirements or switching to gas for those businesses located on the gas network. Although not a renewable fuel, burning natural gas results in lower CO_2 emissions than kerosene and will enable businesses to use renewable gas blends in the future.

5.3 Agriculture sector

5.3.1 Agriculture baseline

Information on different farm types within County Monaghan was gathered using CSO statistics and from consultation with Teagasc specialists. This data alongside figures published by The Department of Agriculture, Food and Marine (DAFM) were then used to estimate the number of livestock and amount of produce for the various farms on a yearly basis. Energy use from electricity, heating and agricultural equipment fuel was then quantified for all farms.

The most recent agricultural census which shows a breakdown of farm type on a county level was carried out by CSO in 2010[22], as shown in **Error! Reference source not found.** CSO defines the "Other" f arm category as farms specialising in horticulture, fruit, pig or poultry production, mixed crops, mixed livestock, and a small number of unclassified farms. This census data has been used as a basis from which growth rates of various farm types have been calculated through desk-based research and guidance from Teagasc research officers. Figure 21 shows the most prominent farm type within County Monaghan in 2010 is Specialist beef, followed by specialist dairying.

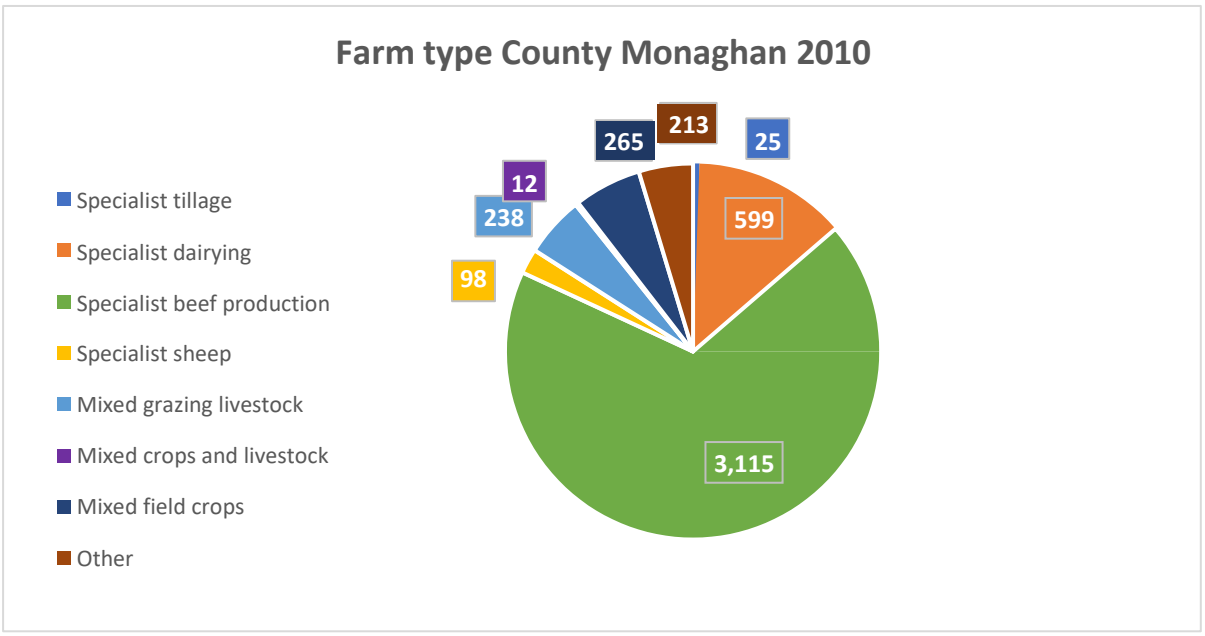


Figure 21: Farm types within County Monaghan CSO farm census 2010

Table 15 shows a comparison of farm types within County Monaghan and Ireland in 2010. The table shows specialist beef farms as being the most prominent farm in Ireland as well as in Monaghan. Monaghan shows a greater % of "Other" farms compared to the national 0.96%, this would be due to the prominence of poultry and mushroom farming within the County.

[22] https://www.cso.ie/en/media/csoie/releasespublications/documents/agriculture/2010/full2010.pdf

Table 15: Comparison of farm types within County Monaghan and Ireland from CSO 2010 census

Farm type	Monaghan	Ireland
Specialist beef production	68.24%	55.58%
Specialist dairying	13.12%	11.19%
Mixed field crops	5.81%	6.89%
Mixed grazing livestock	5.21%	10.51%
Other	4.67%	0.96%
Specialist sheep	2.15%	9.69%
Specialist tillage	0.55%	3.43%
Mixed crops and livestock	0.26%	1.75%

It has not been possible to quantify energy consumption within farm categories that have a mixture of livestock and or crops as varying factors from farm to farm including farm size, herd size and this would lead to inaccuracies. Therefore, to estimate energy consumption on farms within the county, the most relevant farm animals and products have been quantified separately.

The Agricultural Development and Advisory Service (ADAS), one of the leading independent environmental and agricultural consultancies in the UK, carried out energy audits on approximately 1000 farms between 1993-1995 within the UK. The figures from these audits[23] have since been used as benchmarks for energy use on farms for various European projects such as SustainFarm[24] which aims to enhance agronomic, environmental, and economic performance of traditional and innovative farming systems that integrate food and non-food production. The energy data from ADAS is split into the following farm types: dairy, beef and sheep, pig, and broilers. Energy consumption for each farm type includes electricity consumed for farm operations, diesel fuel used for farm vehicles and kerosene fuel use in heating and hot water demand. These figures per head of livestock have been included within the Appendix 5 - ADAS farm data

SEAI conversion factors have been used to convert litres of fuel into energy consumption in MWh for both diesel and kerosene[25]. Energy spend for each farm type has been calculated by using SEAI figures for the price of commercial electricity in Ireland for the baseline year 2016[26] and Irish Farmer's Association's national average figures for the price of diesel and kerosene for the same year[27]. Associated carbon emissions have been calculated using SEAI figures for carbon intensity of electricity in Ireland for 2016 and UK government conversion factors for diesel and kerosene. Teagasc specialist knowledge has been incorporated into the above data source and will be detailed for each farm type. It is important to note that the cumulative energy consumption for each farm type will depend greatly on the prominence of that farm type within the County. The

[23] http://www.calu.bangor.ac.uk/Technical%20leaflets/Energyauditmanual.pdf
[24] http://www.sustainfarm.eu/en/
[25] https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/
[26] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/prices/
[27] https://www.ifa.ie/policy-areas/quartely-ifa-fuel-survey-shows-continued-price-increases/

farm types in the following section are presented from highest to lowest energy intensity per farm.

Poultry

A baseline study on the poultry sector in County Monaghan[28] was published in June 2021 with the intent of highlighting the scale of the sector within the County and identifying the associated environmental impacts. The study states that from analysis of CSO survey data between 2013-2016, 70% of poultry farms within Ireland are broiler farms and County Monaghan account for 59% of broiler birds in the state. For this reason, broiler farms will be analysed for the energy baseline.

Broiler farms will typically go through 6-7 cycles of birds within a given year. The baseline study states an estimated broiler capacity of 4,575,393 birds within County Monaghan within a given cycle. Therefore, to estimate the total broiler birds produced within a year, this capacity was multiplied by 6 cycles to give the total throughput of broiler birds within the County. This total throughput was used alongside ADAS data and Teagasc figures[29] to estimate energy consumption on broiler farms. A Teagasc specialist advised that there were approximately 240 poultry farms within the County, the majority of which being broiler.

Table 16 below summarises the energy consumption, spend and associated CO_2 emissions for poultry farms within the County for the baseline year.

Table 16: Energy baseline for broiler farms in County Monaghan for baseline year

Total broiler birds per year	Poultry farms	Energy consumption (MWh)	Energy spend (€)	CO_2 emissions (tonnes)
27,452,358	240	280,240	€17,909,207	80,051

The 2010 census gives an average flock size for poultry farms in County Monaghan of between 915-16,613 birds per farm. An average of this range was used to estimate the energy consumption for one farm for a given year. This energy consumption and associated expenditure and emissions are summarised in Table 17.

Table 17: Energy baseline per broiler farm County Monaghan for baseline year

Energy consumption per farm (MWh)	Energy spend per farm (€)	CO_2 emissions per farm (tonnes)
169.59	€34,304	153

[28] https://monaghan.ie/monaghan-county-council-has-published-a-baseline-study-report-on-the-poultry-sector/

[29] https://www.teagasc.ie/media/website/publications/2018/Teagasc-A4-Energy-Fact-Sheet-No.-06-Energy-Efficiency-on-Poultry-Farms_2pp.pdf

Mushrooms

A Teagasc mushroom specialist advised that County Monaghan is responsible for producing approximately 35% of Ireland's total mushroom production. This share was used to calculate total mushroom production for the 2016 baseline year using Teagasc figures of Ireland's total production[30]. An average heating demand of 0.85kWh/kg of mushroom produced was taken from Teagasc research[31]and used to calculate the energy consumption for the County for the baseline year. Associated energy spend and emissions for this consumption on all mushroom farms is summarised in Table 18. It should be noted that electricity consumption on mushroom farms also plays an important role for cooling and lighting within the tunnels however, there is no published data available that would be deemed accurate enough for Ireland's climate.

Table 18: Mushroom energy baseline for County Monaghan for baseline year

Total mushroom production per year (tonnes)	Mushroom farms	Energy consumption (MWh)	Energy spend (€)	CO_2 emissions (tonnes)
24,798	12	21,078	€ 1,152,047	5,425

Mushroom yields vary depending on many factors such as grower capability, air handling facilities, and number of batches taken therefore an estimate of energy consumption per farm was not possible. However, given the number of farms and high production rate, it can be assumed that mushroom farming will have a high energy intensity.

Dairy cattle

A Teagasc dairy specialist advised that there were approximately 37,315 dairy cattle in the County spread over 707 farms for the 2016 baseline year. ADAS figures for electricity and diesel were used to calculate total energy consumption. Table 19 summarises the energy consumption, spend and associated CO_2 emissions for dairy cattle in the County.

Table 19: Dairy cattle energy baseline for County Monaghan for the baseline year

Total dairy cattle	Farms with dairy cattle	Energy consumption (MWh)	Energy spend (€)	CO_2 emissions (tonnes)
37,315	707	38,615	€ 4,356,549	12,609

Using the figures from the Teagasc specialist, an average herd size of 52 dairy cattle was calculated per farm. This figure was used to calculate the energy consumption, expenditure, and carbon emissions per herd, as shown in Table 20.

[30] https://www.teagasc.ie/crops/horticulture/mushrooms/

[31] Teagasc, 2019. Heat energy requirements in commercial mushroom production in Ireland.

Table 20: Energy baseline per dairy herd County Monaghan for baseline year

Annual energy consumption per dairy farm/ MWh	Annual energy spend per dairy farm/€	Annual CO2 emissions per dairy farm/ tonnes
53.81	€6,071	17.57

Pigs

An estimate for the number of pigs in the County for the baseline year was calculated using the CSO 2010 farm census and the DAFM national pig census of 2020[32]. The number of pigs increased by 17.8% between 2010 and 2016 to give a total of 28,925 pigs in the County spread over 33 farms. Energy consumption figures published by Teagasc[33] were used to calculate the fuel split and usage per pig for the County. Table 21 summarises the energy consumption, spend and associated CO_2 emissions for pigs within the County.

Table 21: Pig energy baseline for County Monaghan for baseline year

Total pigs	Farms with pigs	Energy consumption (MWh)	Energy spend (€)	CO_2 emissions (tonnes)
28,925	33	1,079	€ 100,827	401

The number of pigs in each herd increased by 12.9% since 2010 to give an average herd size of 954 for 2016. This figure was used to calculate the energy consumption, expenditure, and carbon emissions per herd, as shown in Table 22.

Table 22: Energy baseline per pig herd County Monaghan for baseline year

Annual energy consumption per pig farm/ MWh	Annual energy spend per pig farm/€	Annual CO2 emissions per pig farm/ tonnes
35.58	€3,325	13.22

Cereals

Teagasc highlight that electricity use on crop farms is minimal and the most significant energy consumption comes from the fuel used for crop drying, crop storage and field cultivations[34]. The energy consumption within each arable farm will vary widely depending on the business i.e., within one farm most of the energy might be used within field cultivation whereas on another farm where grain drying takes place, energy consumption will be split between the two operations.

The energy consumption on cereal farms was calculated by using ADAS figures for electricity and fuel consumption for farm operations based on per hectare of farm and per tonne of grain. Cereal

[32] https://www.gov.ie/en/publication/5b140b-national-pig-census-2019/

[33] http://tea.ie/wp-content/uploads/2012/05/Energy_Use_in_Agriculture.pdf

[34] https://www.teagasc.ie/media/website/publications/2018/Teagasc-A4-Energy-Fact-Sheet-No.-01-Energy-Use-On-Tillage-Farms_4pp.pdf

farms in this calculation include wheat, oats barley and "Other cereals" as classified by CSO. The total area of cereal farms within the County was calculated as 333 hectares based on the CSO 2010 farm census. This total area gave an estimated total production of 2,788 tonnes of grain for cereal farms in the area using Teagasc figures for average yield of crop farms in 2016[35]. Table 23 below summarises the energy consumption on cereal farms and the associated energy spend and CO_2 emissions for the baseline year.

Table 23: Cereal Farms energy baseline County Monaghan

Cereal farm area (hectares)	Farms with cereal crops	Grain production (tonnes)	Energy consumption (MWh)	Energy spend (€)	CO_2 emissions (tonnes)
333	40	2,788	1,172	€85,812	357

An average cereal farm size of 8.25 hectares was calculated using the figures in table 21. This figure was used to calculate the energy consumption, expenditure, and carbon emissions per farm and is shown in Table 24 below.

Table 24: Energy baseline per cereal farm County Monaghan for baseline year

Annual energy consumption per cereal farm/ MWh	Annual energy spend per cereal farm/€	Annual CO2 emissions per cereal farm/ tonnes
29.31	€2,145	8.93

Sheep

An estimate for the number of sheep within the County was calculated using the CSO 2010 farm census and the Department of Agriculture, Food and Marine (DAFM) National Sheep and Goat census of 2019. This gave a total number of sheep within the County as 48,543 spread over 447 farms. Table 25 summarises the energy consumption for sheep within the County. Teagasc advised that sheep and cattle farms use very little energy with the exception of tractor diesel for day to day activities.

Table 25: Sheep energy baseline for County Monaghan for the baseline year

Total Sheep	Farms with sheep	Annual energy consumption (MWh)	Annual energy spend (€)	Annual CO_2 emissions (tonnes)
48,543	447	12,847	€891,726	3,782

Using DAFM and CSO figures an average herd size for sheep in the county for the baseline year was calculated as 109. This is a decrease of 13% compared to sheep herd sizes from the 2010 census. This figure was used to calculate the energy consumption, expenditure, and carbon emissions per herd, as shown in Table 26.

[35] https://www.teagasc.ie/media/website/publications/2018/E-Profit-Monitor-Analysis-2016.pdf

Table 26: Energy baseline per sheep herd County Monaghan for baseline year

Annual energy consumption per sheep flock/ MWh	Annual energy spend per sheep flock/€	Annual CO_2 emissions per sheep flock/ tonnes
28.74	€1,995	8.46

Non-dairy cattle (including specialised beef)

An estimate of the number of cattle within the County for the baseline year was calculated by using CSO farm census data that compares the numbers of cattle within the County between 1916 and 2010[36]. This increase in cattle per year gave an estimated number of cattle within the County as 214,120 spread over 4,922 farms for 2016. This would include farms that are specialist beef and farms that have other livestock and or crops alongside the cattle. Table 27 summarises the energy consumption for farms with non-dairy cattle which includes fuel used for farm vehicles in addition to electricity and heating which may be used for various purposes. This can include heating of water for washing handling/transport equipment, heating for young calves in winter months and the property associated with the farm.

Table 27: Non-dairy cattle energy baseline County Monaghan for baseline year

Non-dairy cattle	Farms with non-dairy cattle	Annual energy consumption (MWh)	Annual energy spend (€)	Annual CO_2 emissions (tonnes)
214,120	4,922	56,668	€ 3,933,369	16,682

The 2010 census gives an average herd size of 44 cattle per farm within County Monaghan. This figure was used to calculate the energy consumption, expenditure, and carbon emissions per herd, as shown in Table 28 .

Table 28: Energy baseline per cattle herd County Monaghan for baseline year

Annual energy consumption per cattle herd/ MWh	Annual energy spend per cattle herd/ €	Annual CO_2 emissions per cattle herd / tonnes
11.51	€799	3.39

5.3.2 Agriculture summary

A summary of the results from the agriculture analysis is shown in Table 29 . The table shows that non-dairy cattle farms are the largest contributor to energy consumption within this sector, however as noted previously this will be due to the prominence of cattle farming in the County. To identify farm types for energy reduction and improved energy efficiency, it is more beneficial to look at energy intensity i.e., energy use per farm.

[36] https://www.cso.ie/en/releasesandpublications/ep/p-1916/1916irl/economy/ag/

Table 29: Summary of energy baseline of agriculture sector County Monaghan for baseline year

Farm/animal type	Energy Consumption (MWh)	Energy spend	CO_2 emissions (tonnes)
Non-dairy cattle	56,668	€3,933,369	16,682
Poultry	46,707	€2,984,868	13,342
Dairy cattle	38,615	€4,356,549	12,609
Mushrooms	21,078	€1,152,047	5,425
Sheep	12,847	€891,726	3,782
Tillage/cereal	1,172	€85,812	357
Pigs	1,079	€100,827	401
Total	**178,166**	**€13,505,197**	**52,598**

Table 30 shows energy consumption, spend and emissions per farm type. The table shows poultry, dairy, and pig farms to be the most energy intensive. Average figures per mushroom farm are not shown as Teagasc advised that each farm would vary widely depending on the farm configuration, however it was confirmed that mushroom farms are energy intensive. Opportunities for energy efficiency should therefore be prioritised on these farm types due to the greater potential of energy reduction and efficiency on these farms.

Table 30: Summary of energy baseline per farm County Monaghan for baseline year

Farm type	Energy consumption per farm (MWh)	Energy spend per farm (€)	CO_2 per farm (tonnes)
Poultry	169.59	€10,837	48.4
Dairy	53.81	€6,071	17.6
Pigs	35.58	€3,325	13.2
Cereal	29.31	€2,145	8.9
Sheep	28.74	€1,994	8.5
Cattle	11.51	€799	3.4

A breakdown of fuel type used on farms within the county for the baseline year is shown in Figure 22. The graph shows heating fuel as the largest contributor within the fuel mix as 49% which would correlate to the high heating requirement used within poultry farming alongside heating demand on mushroom farming and pig farming. Figure 23 shows a more detailed breakdown of fuels used on each type of farm.

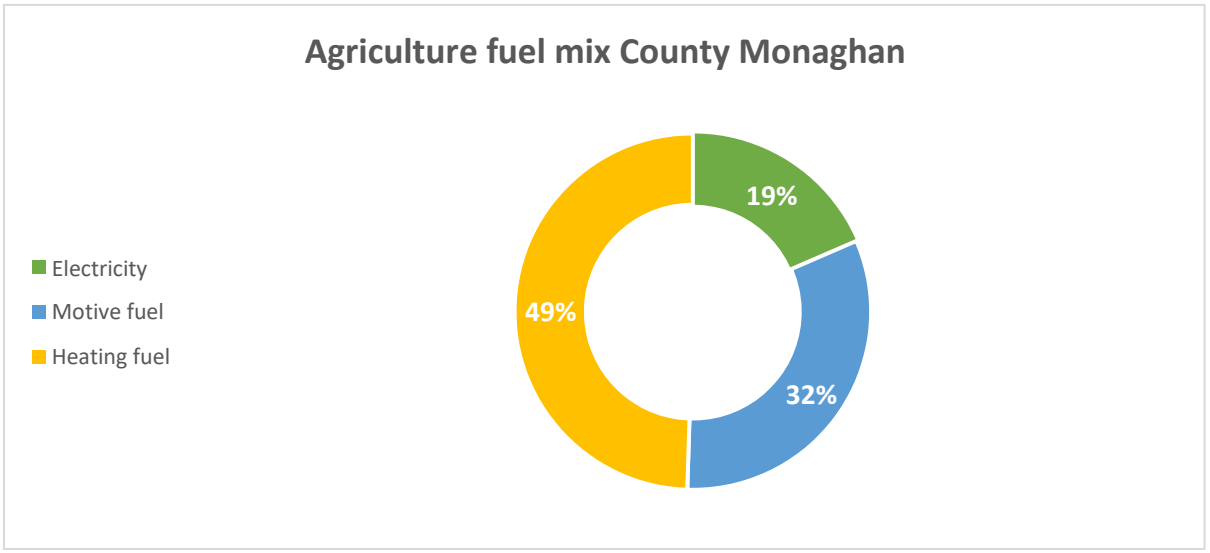


Figure 22: Fuel breakdown for agriculture sector County Monaghan for baseline year

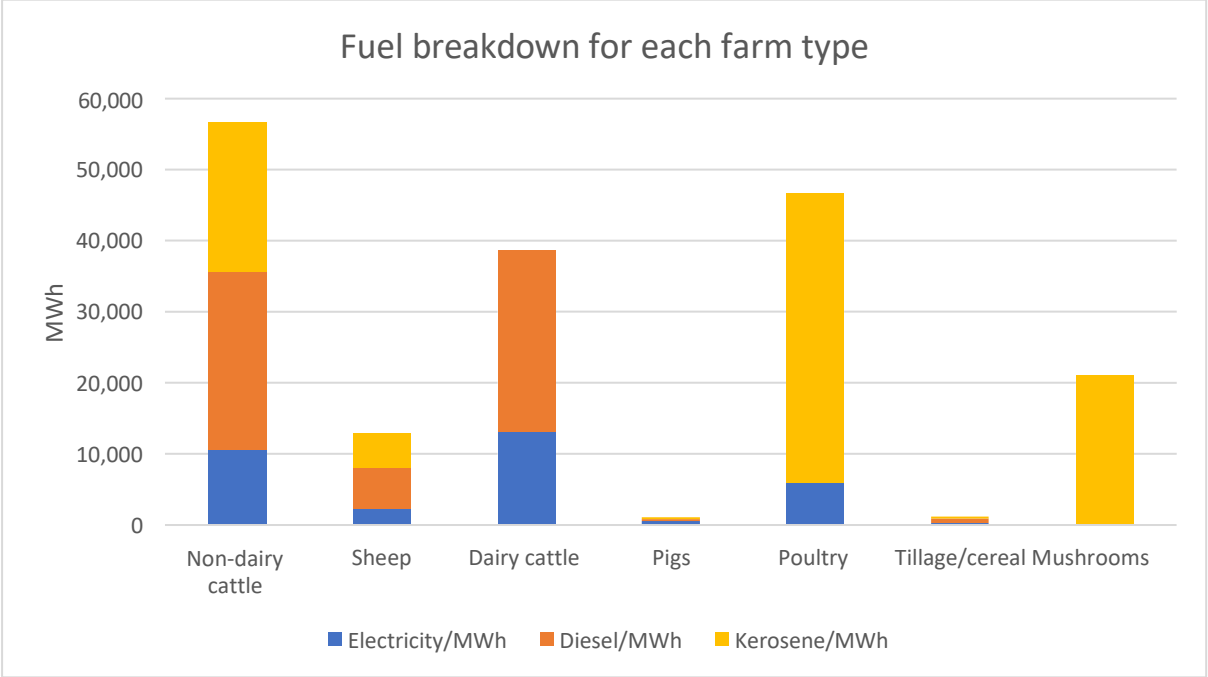


Figure 23: Fuel breakdown for each farm type County Monaghan for the baseline year

5.4 Energy baseline overview

The energy consumption analysis for the sectors covered in this report are summarised in this section to give a complete energy balance for the County. This balance will assist the Register of Opportunities in helping to identify and prioritise areas for energy reduction. Table 31 gives an overview of the energy consumption, spend and associated CO_2 emissions per annum for the residential sector, agriculture sector and industry and services sector for the baseline year.

The table shows a total energy consumption for the study area as 1,566,856 MWh or 1,566 Gigawatt hours (GWh) for the baseline year. The residential sector is the largest contributor representing 53.7% of this total energy demand. The industry and services sector accounts for 34.9% and the agriculture sector accounts for 11.37% of the County's energy demand. Similarly with the energy expenditure and CO_2 emissions, the residential sector dominates representing 58.61% and 53.54% respectively.

Table 31: Overview of energy baseline by sector for County Monaghan for baseline year

Sector	Energy consumption /annum (MWh)	Energy spend/ annum (€)	CO_2 emissions/annum (tonnes)
Residential	842,080	€93,568,644	238,386
Industry and Services	546,610	€52,580,000	154,529
Agriculture	178,166	€13,505,197	52,598
Total per annum	**1,566,856**	**€159,653,841**	**445,513**

Figure 24 gives a breakdown of energy consumption by fuel type for the three sectors. The graph shows kerosene as the largest single contributor for residential (37.3%) and agricultural (49.5%) sectors. It should be noted that kerosene within the industry and services sector is less commonly used for heating. Given that kerosene is heavily depended on within the residential and agricultural sectors, opportunities for energy reduction within heating for both sectors may hold the greatest potential in reaching national targets.

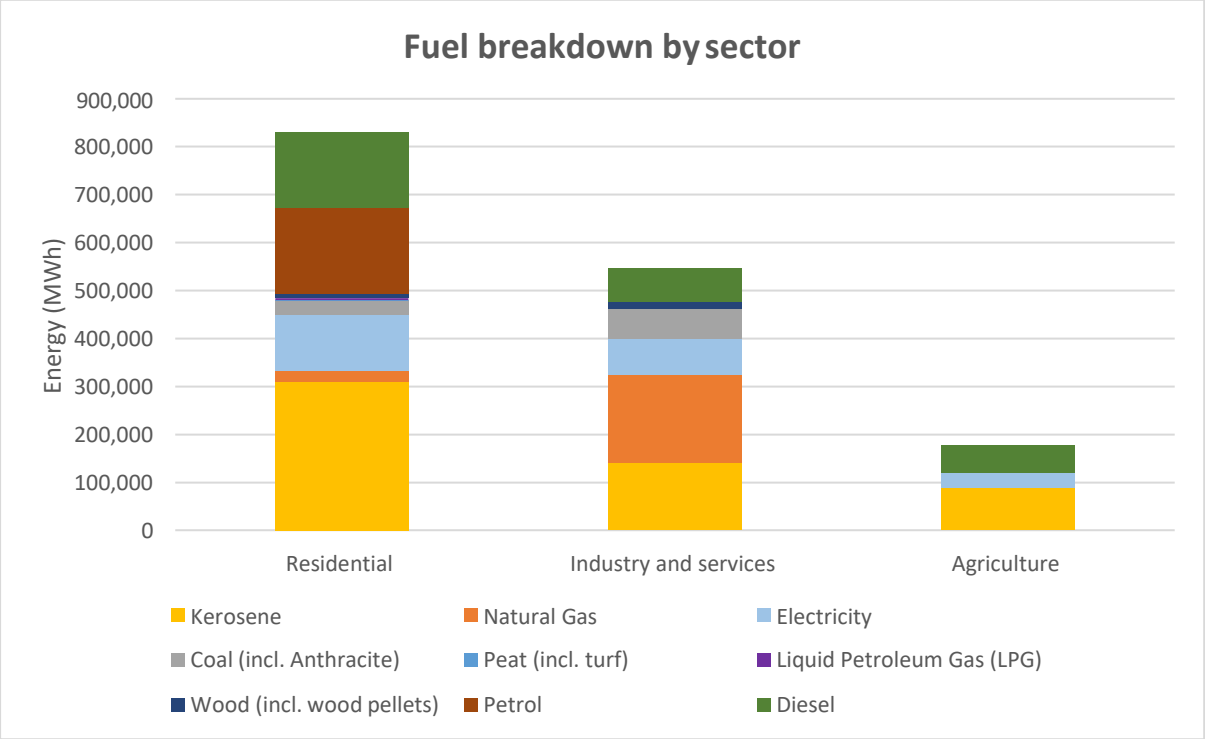


Figure 24: Fuel breakdown by sector County Monaghan for baseline year

6.0 Low carbon transport

6.1 Electric Vehicles

The Climate Action Plan committed Ireland to a target of 936,000 electric vehicles in Ireland by 2030. SEAI state that there are currently over 35,000 electric vehicles on the roads in 2021. The Monaghan County Development Plan 2019-2025 recognises that electric vehicle ownership is likely to increase significantly over the plan period. The government has increased the incentives available to electric vehicle owners which includes grants to support the purchase of electric vehicles as well as grants to provide support homeowners install a home charging point. The county development plan highlighted the need for provision of charging infrastructure to facilitate this transition to electric vehicles in the county.

The County Monaghan Electric Vehicles Policy highlights the following priorities for the county:

1. New residential development with communal parking areas should provide a minimum of one car parking space equipped with an EV charging point.
2. New non-residential development should accommodate at least one car parking space equipped with an EV charging point for every ten car parking spaces being provided for the associated development.
3. Car charging spaces should be clearly demarcated with appropriate signage

We have assessed the County's progress against the priorities set out in the Monaghan Electric Vehicle Policy. The County Council Planning section confirmed that communal parking for residential developments is not favoured by the section due to historical issues surrounding parking of non-residents. This has led to issues of non-availability of legitimate parking space for residents. The strong preference for provision of parking space for residential developments within the county has been to have dedicated parking spaces (1-2) per dwelling unit. In recent times, most if not all, non-residential planning applications that have been submitted to the section have included EV charge points on the original application. Monaghan County Council has requested changes to such applications where the one to ten requirement was not being met. In relation to marking of car charging spaces, the planning section has advised that they have not imposed any such requirements as this is typically carried out as part of the requirements of car-parking space layout and marking.

6.2 Charging Infrastructure

Based on the most recent survey conducted by Monaghan County Council there are 8 charging stations equipped with 13 charging points located throughout County Monaghan. The locations of these public charging points can be seen in

Table 32 and Figure 25. Public charge points are no longer free to use and can be paid for using a downloadable app or reloadable card.

Town	Location	No.	Size/Type	Provider	Tariff
Clones	Town Centre Car Park	2	22kW Type 2	E-Cars	€0.268/kWh
Monaghan	Rooskey Vale	2	22kW Type 2	E-Cars	€0.268/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	43kW AC43	E-Cars	€0.305/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	50kW CHADEMO	E-Cars	€0.305/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	50kW Combo CCS	E-Cars	€0.305/kWh
Castleblayney	Off Thomas Street	2	22kW Type 2	E-Cars	€0.268/kWh
Carrickmacross	Market Street	2	22kW Type 2	E-Cars	€0.268/kWh
Carrickmacross	Louis Convent, Castle Street	2	22kW Type 2	E-Cars	€0.268/kWh

Table 32: Public electric vehicle charging points in County Monaghan

Town	Location	No.	Size/Type	Provider	Tariff
Clones	Town Centre Car Park	2	22kW Type 2	E-Cars	€0.268/kWh
Monaghan	Rooskey Vale	2	22kW Type 2	E-Cars	€0.268/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	43kW AC43	E-Cars	€0.305/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	50kW CHADEMO	E-Cars	€0.305/kWh
Monaghan	Circle K / Topaz, Emyvale Road	1	50kW Combo CCS	E-Cars	€0.305/kWh
Castleblayney	Off Thomas Street	2	22kW Type 2	E-Cars	€0.268/kWh
Carrickmacross	Market Street	2	22kW Type 2	E-Cars	€0.268/kWh
Carrickmacross	Louis Convent, Castle Street	2	22kW Type 2	E-Cars	€0.268/kWh

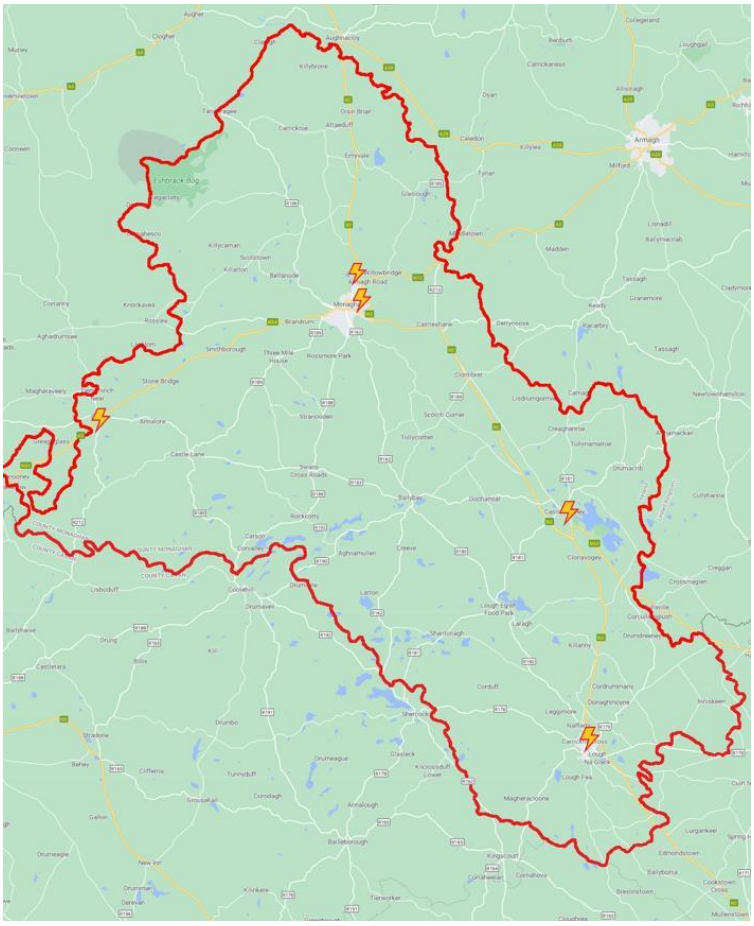


Figure 25: EV charging point locations throughout County Monaghan

Most EV charging points are in Monaghan Town with 5 charging points available for public use, other towns with charging facilities available include Carrickmacross, Castleblayney and Clones.

Monaghan County Council also has two 22kW EVCP's installed at its Glen Road head offices for council vehicle use. There are also home charging facilities throughout the county however this data is not publicly available. Ensuring that there the infrastructure in place is sufficient to improve the accessibility of electric vehicle is critical for the uptake of electric vehicles to be a success.

6.3 Policy and support

The County Monaghan Climate Adaptation Strategy 2019-2024 actively encourages policy to support and develop electric vehicle infrastructure particularly on sites owned by Monaghan County Council. Through consultation with council members, we have learnt that the roads department in the county have placed an order for two electric vans which are expected to be delivered by 2022. The department is also currently progressing a tender to have two EV charging points installed in the Council Machinery Yard which is expected to be delivered in 2022.

The government is actively supporting the roll out of Electric Vehicle public charge points across Ireland with the Electric Vehicle Public Charge Point Grant initiative. Local authorities and county councils can apply to install charging points on public streets or car parks which provide overnight parking for residents. The initiative will support up to 1,000 on-street public charge points for EV's over the next 5 years with the aim of supporting the uptake of EV's. The scheme supports the following charger types:

1. Charging posts (typically supply AC power at 230V via two plug sockets each supplying 22kW of power)
2. Lamppost chargers (usually fit within a lamppost and supply AC power at 230V via one plug socket at 3-7kW of power).

For each charge point (a single EV plug socket) a total of 75% of the capital costs will be provided under the initiative and has been capped at €5,000 per single charge point. A charging post would contain two charge points which means it would be eligible to receive up to €10,000 per post. To date Monaghan County Council has not availed of this grant support.

The County and City Management Association, Local Government Management Agency and Local Authorities Ireland have recently published a Local Authority "Electrification of Fleet and EV Charging Guidance"[37] which Monaghan County Council should consult going forward.

6.4 FASTER (Facilitating a Sustainable Transition to EV's in the Region)

The FASTER project is an EU INTERREG VA funded project which has been set up to encourage the uptake of EV's across the border region of Ireland, Northern Ireland, and Western Scotland. The FASTER project recognises that one of the main barriers to EV uptake is the lack of charging infrastructure in comparison to the availability of fuel stations. The FASTER project aims to ensure that going forward, the availability of charging stations is not a major issue to the growth of the EV market. The FASTER project is currently working with Monaghan County Council to identify suitable locations in the county for this vital infrastructure which will be installed on a rolling basis over the next 6 to 18 months. The project is set to result in one or two rapid charge points being installed in the county.

[37] https://www.caro.ie/getattachment/5da7713a-b50a-4156-95ac-a946b1ca6574/LA-electrification-of-fleet-and-ev-charging-guidance.pdf.aspx?lang=en-GB

6.5 Alternatively Fuelled Heavy Duty Vehicle Purchase Grant Scheme

In addition to supporting the electrification of vehicles, Transport Infrastructure Ireland (TII) have opened the 'Alternatively Fuelled Heavy Duty Vehicle Purchase Grant Scheme'[38] (AFHDV). The scheme has been implemented to assist with the purchase of heavy-duty vehicles (HDVs) that are alternatively fuelled and would not have otherwise been purchased without the schemes support. The scheme offers to pay up to 60% of the difference between an alternative fuelled vehicle and a diesel equivalent model for N2 category (medium van with a gross weight of between 3.5 – 5 tonnes). The funds for 2021 have been allocated however applications are still being accepted as an expression of interest which will be held on a waiting list. If more funding becomes available under the scheme, new qualifying applicants on the waiting list will be contacted directly.

The scheme supports the following fuel types: compressed natural gas (CNG), liquified natural gas, battery electric vehicles, plug in hybrid electric vehicles and fuel cell electric vehicles.

6.5.1 Opportunities for haulage sector

As mentioned in section 4.6, Monaghan has a significant haulage sector which is currently almost all diesel fuelled. This provides an opportunity for decarbonisation of the sector. An example of a local haulage business which has incorporated alternative fuels is Virginia International Logistics in County Cavan, also a border county. This company has partnered with Gas Networks Ireland and has developed a compressed natural gas (CNG) station at its premises in Virginia. Another example is McCulla Transport based in Lisburn, Northern Ireland. This company is using biomethane to run 10 (IVECO S-WAY) CNG vehicles for Lidl (NI). McCulla Transport is currently taking food waste from 41 Lidl (NI) stores to use as digestate for its anaerobic digestion processing plant. The plant processes 450m^3 of biogas per hour, resulting in enough biomethane to fuel 10 CNG HGVs which cover 2,300 miles each day. This reduces carbon emissions by 95% and the vehicles are also quieter for use in built up areas and for driver comfort.

CNG is natural gas which has been compressed to fit into a Natural Gas Vehicle's (NGV) tank and is particularly suitable for use in commercial vehicles. It is a proven alternative to diesel or petrol and reduces transport costs by up to 25% and carbon emissions by over a fifth.[39] In the future, these vehicles can achieve zero carbon transport when operating on renewable gas.

CNG for transport is one of the key gas technologies set out in Gas Networks Ireland's Vision 2050. Their ambition is to develop, in partnership with others, a 170-station CNG refuelling network including 40 public access forecourts, on major routes, and/or close to urban centres. The organisation is leading a project called the Causeway Study, funded by the Commission for Regulation of Utilities (CRU) and the Connecting Europe Facility (CEF) Transport Fund. This project will deliver 14 high capacity fast fill CNG stations and a single renewable gas network injection point. To date the project has developed the gas injection facility, deployed of a fleet of CNG vehicles and opened 4 CNG stations at Circle K Dublin Port, Circle K Cashel Co. Tipperary, Circle K Ballysimon Road, Limerick and Circle K Clonshaugh, Co. Dublin.

In 2017 Gas Networks Ireland launched its CNG Vehicle Fund, funding up to €20,000 to businesses purchasing a new CNG vehicle. This fund is open for applications until 31st January 2022.

[38] https://www.tii.ie/roads-tolling/tolling-information/afhdv-scheme/

[39] Gas Networks Ireland supports Virginia International Logistics to fuel Compressed Natural Gas fleet

7.0 Energy Efficiency Potential

This section of the EMP discusses the current situation in relation to residential and agricultural energy efficiency upgrades and interventions, funding available, targets and how these translate to County Monaghan. Recommendations have been made to increase the uptake of energy efficiency upgrades (and renewable energy) which are also listed in the Register of Opportunities with specific actions.

7.1 Residential Energy Efficiency

Local Authority Housing

Monaghan County Council have undertaken various activities in line with their Climate Change Mitigation strategy for example phase 1 energy efficiency upgrades have been completed on 1890 houses which is 100% of the council housing stock. These upgrades included heating controls, attic insulation, cavity wall insulation and ventilation.

Due to varying construction types within the housing stock 200 properties could not have cavity wall insulation installed (12%). These properties required Deep Retrofit Works including heat systems, external insulation, internal insulation, windows, and doors. This work is being completed on a priority basis and depending on funding. Under the Energy Efficiency retrofit programme, in 2020 Monaghan County Council installed external insulation, new windows and doors and energy efficient heat pumps to 6 properties. In 2021 Monaghan County Council will complete deep retrofit works to a further 22 properties. Of these 22 properties, 10 will be receiving external insulation or drylining. Information provided by Monaghan County Council Housing Division shows the breakdown of BER ratings among the council housing stock as shown in Figure 26. The Clones/Ballybay district has the highest number of properties with both C-D and E-G BER ratings and the lowest number of properties with an A or B rating.

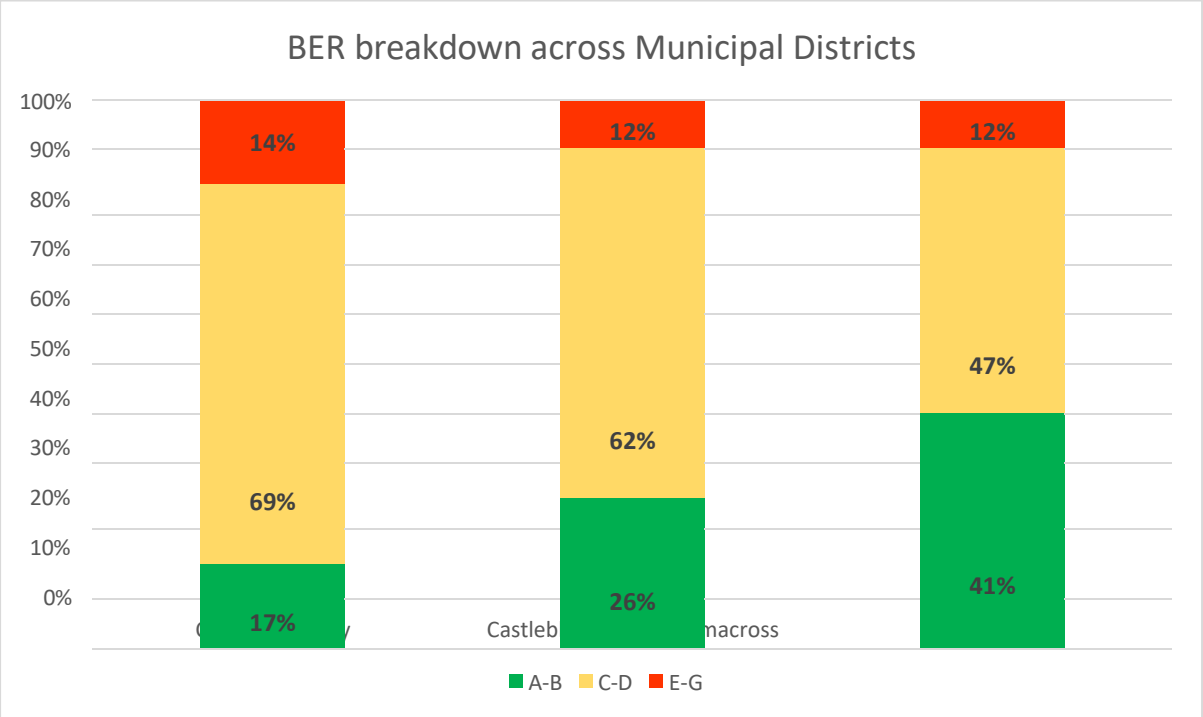


Figure 26: Breakdown of BER ratings across municipal districts in County Monaghan

Properties are targeted for upgrades based on both technical and social factors and may be across a range of BERs. The council targets for property retrofits depend on the funding provided by the Department of Housing, Local Government and Heritage each year. Monaghan County Council have been proactive in implementing energy efficiency works and have not encountered any resistance from tenants. There are 180 houses owned by Respond Housing Association in County Monaghan. Respond have upgraded 78 houses in 2020 under SEAI programme, however none of these have been in County Monaghan.

7.1.1 Private Housing

Latest statistics from SEAI show that within County Monaghan there has been a total of 5,163 home energy upgrades to date. This includes 3,296 'Home Energy Grants' (from the year 2006) and 1,867 (from the year 2000) 'Free Energy Upgrades' for eligible homes. The Home Energy Grants include support for insulation, heating controls and renewable energy upgrades such as solar photovoltaics and heat pump systems. The Free Energy Upgrades are available to eligible homeowners who are categorised as vulnerable or at risk of energy poverty. This means that approximately 20% of the county's housing stock have had some form of energy upgrades works within their homes. These upgrades can range from very minimal to deep retrofits and therefore some of the 20% may require further upgrades to raise their BER rating.

A comparison of how many home energy upgrades have been completed to date, based on the total housing stock on a county level within Ireland[40] is shown in Figure 27. The map shows that County Monaghan, along with most other Counties falls into the 16-24% range meaning that 16-24% of a county's housing stock have had energy upgrades within their home.

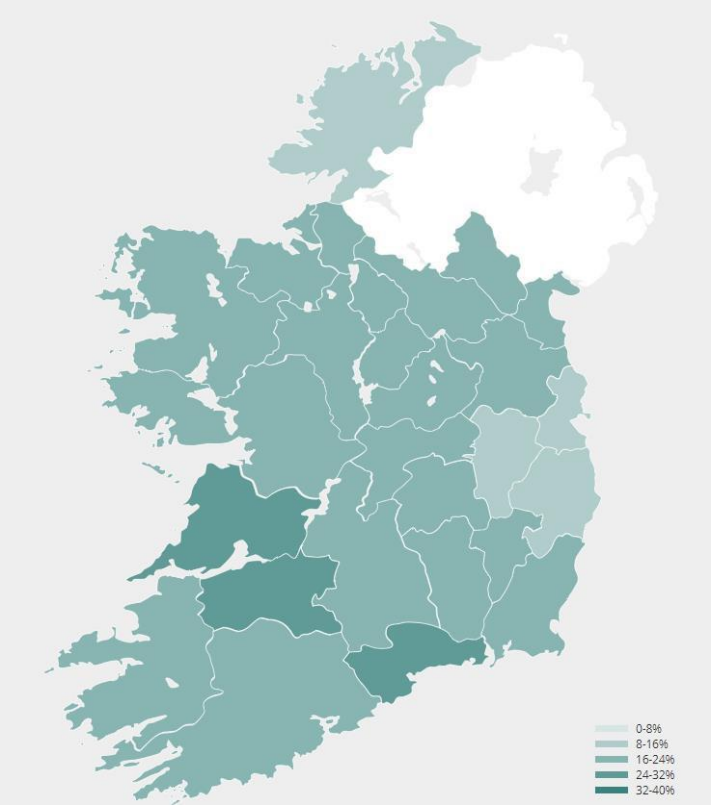


Figure 27: Map showing home energy upgrade uptake by County for Ireland (Source: SEAI)

[40] https://www.seai.ie/grants/home-energy-grants/home-upgrades/

Grants

There are currently various grants are available including:

- **National Home Retrofit Scheme[41] (SEAI)-** new government scheme designed to encourage the development of One-Stop-Shops and engage groups of private households, registered Housing Associations and Local Authorities who wish to participate in delivering home energy upgrades, specifically in domestic buildings.
- **Home Energy Grants (SEAI)** – Grants are available to eligible homes for a wide range of energy efficiency upgrades including insulation, heating controls, solar PV, solar water heating and heat pump systems.
- **Better Energy Warmer Homes scheme (SEAI)** – free energy efficiency upgrades are available to homeowners in receipt of certain welfare payments.
- **Better Energy Communities (SEAI)** – a national retrofit initiative which supports new approaches to achieving energy efficiency in Irish communities. The BEC initiative offers community grant support through capital funding, partnerships, and technical support.
- **Electric Ireland Energy Efficiency Incentive Scheme** – Provides credit on the electricity bill of the homeowner if energy efficiency measures are carried out through their approved partners.
- **Energia Cosy Homes Deeper Retrofit Project** – Energia is currently offering a contribution for energy efficiency works to their customers' homes.

Green Finance

'Green finance' is also available through An Post, Bank of Ireland, AIB and Ulster Bank.

- **An Post** – competitive loan rates in conjunction with SEAI grant. 50% of loan value must be used to complete the energy upgrade work. Package approach promoted as 'The Green Hub'.
- **Bank of Ireland's 'Sustainable Finance Fund'** – discounted rates are offered to fund energy efficiency upgrades.
- **AIB's 'Green Personal Loan'** – offers a lower rate providing 50% or more of the loan is spent on energy/sustainability upgrades.
- **Ulster Bank's 'Green Mortgage'** – provides a 4-year fixed rate lower than standard 4-year rate.

Barriers

SEAI's report 'Financing Energy Efficiency in Ireland' Dec 2020 cited research into barriers to retrofitting homes[42].

- Energy efficiency projects are relatively low on homeowners' personal spending priorities (e.g., car or kitchen purchase)
- Disruption and inconvenience factors throughout the retrofit process
- The length of time that a homeowner intends to stay in the property
- Lack of information – or confusing information – on everything from costs to technology
- Lack of access to a trusted and independent adviser, together with a mistrust of contractors
- Mistrust in the potential savings from retrofit measures
- Hidden costs, e.g., researching suitable solutions, unplanned maintenance

[41] https://www.seai.ie/grants/national-home-retrofit/

[42] https://www.seai.ie/documents/research-projects/RDD-000503.pdf

- Split incentives (landlord/tenant)
- The upfront capital investment required

SEAI research from 2016 also showed the reasons why homeowners who had already considered retrofitting their homes had not yet acted upon this. (Most relevant to least relevant 1-6):

1. "I don't have sufficient funds" (most relevant)
2. "I thought it was too costly for the expected benefits"
3. "I have not had the time to organise it yet"
4. "I do not have enough information/don't know where to get it"
5. "I decided it was not worth the inconvenience"
6. "The landlord (where relevant) did not agree" (least relevant)

SEAI research and analysis to identify what the Irish market would regard as attractive, effectively provides us with a 'wish list' for residential finance[43] as shown in Figure 28.

Criteria	Detail
Lower-cost	5% or lower[65]
Longer term	Preferably in line with payback – or else as long-term as possible
Ease of application	Limited paperwork/bureaucracy
One stop shop approach	Integrated technical and financial solution
Ease/flexibility of repayment	On-bill or on-tax schemes
Grants	Continuing to be underpinned by grants

Figure 28: Summary of Irish Research on residential retrofit finance

There are clearly barriers to residential upgrades especially for the 'able to pay' category. This presents several opportunities in relation to raising awareness, access to independent advisors and demonstration projects. There is also the 'split incentive' problem in relation to privately rented properties – this occurs when the benefits do not primarily accrue to the person who pays for the transaction. In the case of rented properties where landlords meet the cost of improvements, the tenants would reap most of the benefits. Tenants do not control the property and have little incentive to invest. Therefore, neither party is motivated to upgrade the building. This problem results in poorer energy efficiency outcomes in both the rented residential and commercial sectors.

A Government consultation on Removing Barriers to Energy Efficiency in the Rental Sector by Addressing the 'Split-Incentive Problem' was completed in January 2020 which presented a number of options. The consultation is currently being reviewed.

7.1.2 Targeting specific areas within County Monaghan

CSO census data relating to central heating type and year of construction was reviewed for the 'small areas' that had been identified as "very disadvantaged" from the 2016 Pobal deprivation index, as mentioned in section 4.2.2. Figure 29 shows the small areas identified from the Pobal deprivation index.

[43] https://www.seai.ie/documents/research-projects/RDD-000503.pdf

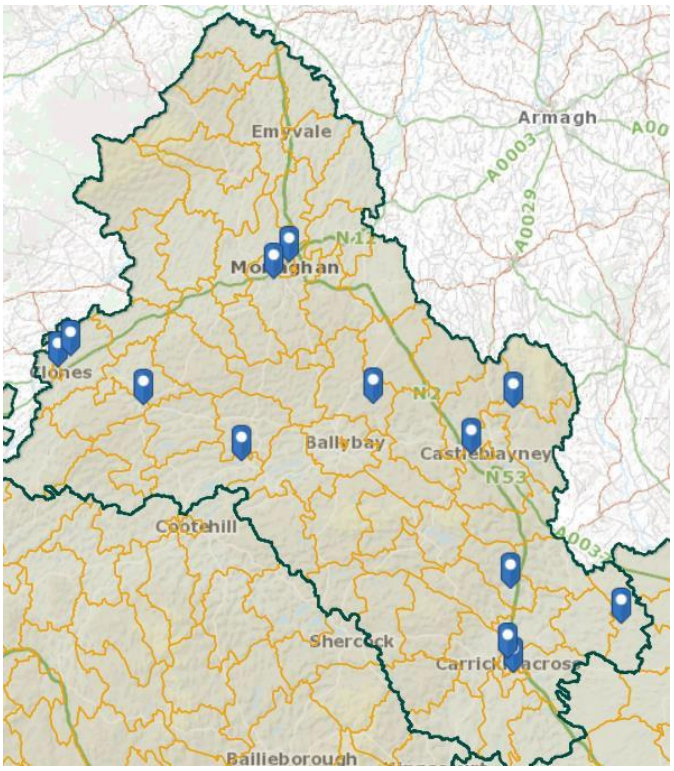


Figure 29: CSO SAPMAP showing small areas highlighted for Pobal index score

SEAI guidelines allow for indicative BER ratings to be calculated for houses based on year of construction and type of central heating. Houses built before 1980 display the lowest BER ratings. Census data was used to calculate the proportion of houses within each small area that were built pre-1980. The County average of houses built before 1980 was calculated as 46%. The proportion of coal central heating was also analysed for each small area, and this was compared to the County average of 6.8%. This analysis was cross referenced with the type of house ownership for each small area and is summarised in Table 33. Small areas are listed in the table from highest deprivation first.

The table highlights various areas which should be focussed on by the SEC to promote retrofitting opportunities and funding, for example:

- Mullaghmatt has the second highest deprivation score and 89% of houses built before 1980. It also has a high share of coal heating. 38 houses in this small area are owner occupied.
- Castleblayney: Drumillard, The Crescent & Bree, has a high share of pre 1980s houses and 85 homes are owner occupied.
- Innishkeen has a high percentage of pre-1980s houses, and 84 houses are owner occupied.
- Tullycorbett has an above average percentage of pre 1980s homes and an above average percentage of homes with coal heating. There are 64 owner occupied homes in this small area.

There is a total of 271 owner occupied houses in these small areas alone which represent an significant opportunity for the SEC to influence the uptake of energy upgrades.

Table 33: Cross reference of CSO data and Pobal index for disadvantaged small areas in County Monaghan

Main areas of deprivation in Co Monaghan along with housing types and energy poverty indicator for these areas											
Small area ID	Location	Pobal HP Deprivation Index 2016	County average		No of dwellings	No of dwellings by main types of occupancy					No of owner occupied
			46.00% Share of Pre 1980 houses	*6.80%* Share of coal heating		Rented from Local Authority	Rented from Private Landlord	Owner Occupied with Mortgage	Owner Occupied no Mortgage	Rented from Voluntary Body	
177024004	Clones Urban (part of town centre)	-27.59	57.45%	4.00%	47	21	11	2	9	0	11
177058010	Monaghan Urban: Mullaghmatt	-24.67	89.32%	47.57%	103	55	7	18	20	0	38
177017003	C'macross Urban (Ardross Ave & Inver Park)	-14.84	59.30%	2.33%	86	15	17	14	37	0	51
177032003	Rockcorry: Dawsongrove	-14.42	45.45%	29.29%	99	26	6	25	39	0	64
177059003	Monaghan Urban: Roosky	-14.32	63.79%	6.03%	116	7	47	12	42	0	54
177061004	Newbliss	-14.18	35.19%	20.37%	54	8	11	15	18	0	33
177019014	C'blayney (Drumillard, The Crescent & Bree)	-14.04	72.41%	8.62%	116	17	9	22	63	0	85
177023006	Clones Urban : North	-13.1	55.26%	2.63%	76	13	0	21	35	3	56
177070002	Tullycorbett	-12.27	46.27%	7.46%	66	0	0	23	41	0	64
177048004	Inishkeen	-12.25	73.98%	6.50%	123	22	8	32	52	0	84
177021002	Oram	-12.13	25.29%	12.64%	87	25	13	17	23	0	40
177016011	C'macross Rural: Drummond	-10.82	4.40%	2.20%	91	38		14	3	30	17
177030001	Tullyvaragh (between C'macross & C'blayney along N2)	-10.49	28.95%	8.77%	114	6	12	41	43	8	84

7.1.3 National targets for energy efficiency within the residential sector

The Climate action plan (2019) states **a national 2030 target** of:

- **BER of B2** - Upgrading 500,000 existing homes to B2 BER rating (MACC[44] proposes that the majority of these retrofit upgrades will involve insulation rather boiler upgrades
- **Heat Pump Target** - Installing heat pumps in 400,000 existing residential homes (MACC proposes that the heat pumps be installed in existing dwellings that currently have oil or solid fuel fired heating systems)

How this translates to County Monaghan

BER of **B2**- The 2016 census counted a total of 2,003,645 houses and apartments in the State. County Monaghan holds approximately 1% of the States' housing stock. Applying this 1% to the national BER target equates to 6,316 homes in the county which require upgrading by 2030 (or 25% of Monaghan's housing stock). This gives an indicative figure of **700 homes requiring an upgrade to B2 rating year on year from 2021 - 2030.**

Heat Pump Target – With reference to the census data above, this equates to 5,053 homes installing a heat pump by 2030. This is approximately 20% of the County's housing stock as of the baseline year. Therefore **561 homes that use oil fired boilers would require the installation of a heat pump year on year from 2021 - 2030**.

This is undoubtedly a difficult target to meet, and it should be recognised that there are significant challenges involved in the retrofit installation of heat pumps which include:

- Costs of remedial work required before heat pump can be installed
- Delays on grant payments to householders
- Perception of heat pumps being expensive to run (electricity costs)

The SEC can play a role in accelerating the uptake of heat pump installation through the measures indicated below, in particular the one-stop-shop model. However, with the existing barriers evident in SEAI's retrofitting research (section 7.1.1 above), it is difficult to predict the impact this will make on the target.

7.2 Increasing the uptake of energy efficiency retrofits in County Monaghan

Marketing and online engagement – marketing is key to making householders aware of energy retrofit opportunities and funding. County Monaghan SEC has developed a comprehensive web resource specifically for the county which provides information and advice on retrofitting along with case studies and how to apply for grants. The SEC has also set up social media accounts which should be utilised to drive traffic to the website. Recommendations for improving online engagement have been provided to the SEC, an action plan for developing engaging content should be drawn up with specific pieces planned and scheduled. The outcomes of successful local projects should also be promoted in conjunction with local contractors, housing bodies e.g., Monaghan County Council, Respond Housing, to build acceptance of the retrofit installations / technology among all of these key stakeholders. Marketing efforts should focus on emphasising the economic savings, comfort benefits, and environmental benefits of heat pumps.

[44] Marginal Abatement Cost Curve (MACC) has been developed to provide a solid analytical foundation on the most cost-effective pathway to reduce emissions in line with Ireland's decarbonisation targets.

Recommendation 1: Develop an action plan for the ongoing management of the online resource and social media platforms.

Educational webinar - The first Monaghan SEC webinar was very successful and served as an introduction to the SEC. The webinar was held on the 20th of May 2021 and had approximately 40 attendees. The webinar covered an introduction to home retrofitting and was delivered successfully by a range of speakers including Monaghan Integrated Development, County Monaghan SEC, an SEAI Regional Coordinator as well as a Communities Retrofit Programme Lead from Dunleer SEC. A second webinar was held on the 12th October 2021 to continue the momentum and align with the start of the heating season. Inviting a homeowner who has gone through the retrofit process would also be beneficial in addition to an installer of one of the energy efficiency / renewable energy measures, which are grant funded.

Community Events -Although it has been difficult to engage with communities in Monaghan during the Covid19 pandemic, as organisations and events start to reopen, these should be utilised in conjunction with online marketing to raise awareness. This can be done by for example:

- SEC presentation at local community meetings and events taking place in regional towns. These may also be related to events held by other SECs in County Monaghan (Railway View, Castleblayney Sustainable Energy Group, Sicín, Glaslough, Knockatallon Development Co CLG, Tydavnet Group Water Scheme)
- Provision of printed literature / flyers promoting the online resource / email signups for events such as above.
- Energy efficiency funding clinic – planned events in the five county towns over a period of 6 months Monaghan, Castleblayney, Carrickmacross, Clones, Ballybay. The format would involve 2-3 representatives from the SEC and / or a local installer to provide technical advice.
- Gauge interest in a sustainable living / green fair event to be held in summer 2022 – invite energy efficiency measure installers, SEAI representatives, other SECs.

Recommendation 3: Increase community engagement with the County Monaghan SEC through presence of SEC members at community events, printed flyers, clinics, and fairs to engage with local community groups.

Target specific small areas – The small areas listed in table 30 have been identified as the most deprived in the county. Three small areas have been highlighted as having a high percentage share of pre-1980s houses and an above average percentage share of coal heating. These also have a high number of owner-occupied homes and could be targeted with a collective approach for example submitting an application for several homes under the SEAI Community Grants (Better Energy Communities) for installation of various measures across a several homes. To engage homeowners in these areas a direct marketing campaign should be carried out (using methods detailed in the point above). A basic online energy survey with a prize incentive can be created which would generate a mailing list of interested householders.

Recommendation 4: Engage with homeowners in the identified small areas through a marketing campaign to assess their willingness to participate in any potential community applications for home upgrades.

Develop a demonstration home to Passivhaus 'enerPHit' standard. EnerPHit is the standard issued by the Passivhaus Institute that focuses on retrofit projects as it is not always possible to achieve Passivhaus standard when refurbishing old buildings. It sets a slightly different standard

requirement and provides a 'quality approved energy retrofit with Passivhaus components' certificate. The SEC should work to identify a suitable property and home owner who is willing to engage in marketing and case study promotion and to have various monitoring carried out before and after the retrofit work. Housing association – might be more willing to invest in their stock, interested in the CO_2 savings and green credentials

Recommendation 5: Identify a suitable property/homeowner to serve as a Passivhaus 'enerPHit' standard demonstration within the county. To be promoted on the online resource.

Development of a 'one-stop-shop' model – A streamlined one-stop-shop approach to energy retrofitting significantly reduces the administrative burden on householders. One example of this model is Energy Team developed by Dunleer SEC. Energy Team representatives provide bespoke advice and manage the process from end to end including provision of engineer's assessment, selecting approved contractors and handling paperwork involved in the grant process. Energy Team have assisted 30-40 householders, community buildings and businesses per year using this approach. Energy Team partner with a local Project Co-ordinator specified on the SEAI list. This model would require at least a part time role to provide administration and co-ordination however this can be funded through a project management fee on the delivery of the installation work. It is recommended that Monaghan SEC procure local expertise to investigate the most suitable finance model and develop a business plan in addition to availing of the shared learning from other SECs such as Dunleer. The SEC website (detailed above) is also a platform that can be utilised in future as a hub for a one-stop-shop resource with minimal structural changes.

Recommendation 6: Explore the feasibility of developing a one-stop-shop model within the County Monaghan SEC.

7.3 Agricultural sector

7.3.1 Agricultural Energy Efficiency

The Department for Agriculture, Food and Marine (DAFM) published a report in December 2020 entitled "A roadmap towards Climate Neutrality" which details national energy efficiency targets within the agriculture sector. Whilst the two key greenhouse gases that drive agricultural emissions are methane and nitrous oxide, it is carbon emissions that are associated with the use of energy. Three actions are listed within the sustainable energy section of the report:

- Generate at least a 20% reduction in agricultural energy use by 2030 across all farms. In addition, generate at least 20% deployment of renewable energy technologies focusing primarily on energy intensive farming systems
- Double the sustainable production of biomass from forests by 2030 and ensure biomass mobilisation for heat production
- Engage with stakeholders to maximise the potential opportunities from AD for the agricultural sector

7.3.2 How these targets translate to County Monaghan

The first two interlinked targets of 20% reduction in energy use and 20% deployment of renewable energy should therefore be prioritised on energy intensive farms. The baseline energy analysis for the County's agriculture sector shows the most energy intensive farms as poultry, mushroom, dairy, and pig farms. These farm types should be prioritised in terms of identifying opportunities due to the greater potential for energy reduction and energy efficiency.

These two targets would translate to a year-on-year target of:

- 2.2% reduction in agricultural energy use year on year with a focus on poultry, mushroom, dairy, and pig farms
- 2.2% deployment of renewable energy technology on farms, year on year with a focus on poultry, mushroom, dairy, and pig farms.

Opportunities to increase energy efficiency on the highlighted energy intensive farms will be reviewed in the following sections with available funding highlighted.

7.3.3 Increasing agricultural energy efficiency / opportunities for renewable energy

Energy efficiency on Poultry farms

Teagasc research highlights that the lighting, heating, and ventilation equipment required for the broiler houses are the biggest energy consumers within poultry farming. These areas would therefore offer the highest potential for energy saving opportunities. Analysis of energy use on poultry farms[45] has identified space heating to account for over 80% of total energy consumption. Lighting ventilation and fans account for over 80% of total electricity consumption. Figure 30 shows the total energy breakdown on poultry farms in Ireland.

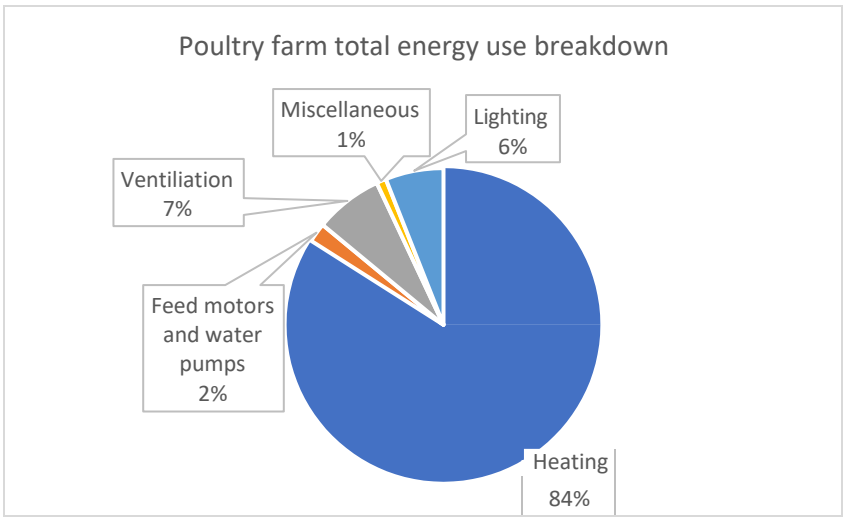


Figure 30: Breakdown of total energy use on poultry farms in Ireland. (Source: Teagasc 2011)

The Teagasc factsheet on energy efficiency on poultry farms[46] states that a typical 73m x 18m 27,000 broiler bird house will consume on average 240-266MWh of heat energy and 35MWh of electrical energy within a given year. This works out as approximately 1.78kWh of total energy per bird based on 6 cycles per year. This figure can be used as an energy performance indicator or benchmark figure for assessing a poultry farm's energy efficiency. Teagasc published benchmark figures for energy consumption per bird for Irish farmers in 2011 and compared this to best practice figures from poultry farmers in England and Wales. A summary of this comparison is shown in Table 34. It is noted that these figures are from 2011, however it shows that there is scope to reduce energy consumption by up to 50% by using best practice measures.

[45] http://tea.ie/wp-content/uploads/2012/05/Energy_Use_in_Agriculture.pdf

[46] https://www.teagasc.ie/media/website/publications/2018/Teagasc-A4-Energy-Fact-Sheet-No.-06-Energy-Efficiency-on-Poultry-Farms_2pp.pdf

Table 34: Comparison of actual energy use on Irish poultry farms vs Typical and Best practice poultry farms in UK. (Source: Teagasc 2011)

Total energy per annum consumption poultry farms			**Potential savings**		
Unit size	Irish actual energy use (kWh/ bird)	Typical UK energy use (kWh/ bird)	Best practice (kWh/ bird)	Typical	Best practice
Over 200,000 birds	0.71	0.39	0.33	45%	54%

Teagasc list several recommendations for heating, lighting, and ventilation operations on poultry farms to increase energy efficiency. These include:

Boiler and space heating

- Replace aging boilers with energy efficient models or renewable energy systems. High efficiency condensing boilers will have up to 95% operating efficiency as opposed to 80% or lower for older boilers. Ensure regular servicing of burners and cleaning of heat transfer services, this basic maintenance could achieve up to energy savings of 10%-15%.
- Consider radiant heating for space heating as opposed to direct air heating systems. Radiant heaters are fired with propane or natural gas- potential fuel savings can be achieved due to manufacturers usually installing 15% less heating capacity than that for direct air heating systems. Another advantage of radiant heating is that the heat is transferred directly to the floor of the broiler house which ensures that birds body heat is not being lost to the floor and this in turn results in warmer birds and drier litter.
- Position thermostats carefully to avoid overheating sheds

Ventilation

- Replace old fans with energy efficiency models. New belt driven fans will consume 33% less energy than older fans.
- Seal gaps around doors, walls, and windows to reduce air leakage. This raises static pressure and improves ventilation efficiency and natural air mixing.
- Fit proprietary “bell-mouths” to fans or “cones” to outlet fans, this can increase aerodynamic efficiency by 10%
- Use of recirculation fans improves heat distribution, especially with the use of direct acting heating systems.
- Use heat recovery to pre-heat incoming air with warm extract air. Savings of 10-25% are achievable.

Lighting

- Reduce lighting within regulation, current minimum is 20 Lux over 75% of floor area of broiler shed.
- Replace old incandescent and tungsten halogen lights with energy efficient fluorescent systems indoors and high-pressure sodium or metal halide lamps outside.
- LED lights are dimmable and can fit existing sockets. Higher cost to standard lightbulbs (€11 per bulb vs €0.75 per bulb) however, lifespan is longer (50,000 hours vs 1,000 hours) and use less energy to produce twice as much light

Energy efficiency on mushroom farms

Mushrooms are typically grown on a shelf system in purpose-built growing rooms. These rooms are temperature controlled to stay within the range of 18°C-25°C, and 90-95% relative humidity. Heating requirements on mushrooms farms are used for maintaining this optimum temperature range and for steam sterilising the mushrooms once the growth cycle has been completed. During this steam "cook out" temperatures are kept between 60°C-70°C for at least 8 hours. Electricity is used on mushroom farms for lighting within the growing tunnels and for ventilation and fans for cooling purposes.

Total energy costs are estimated to contribute to 5-6% of the production of mushrooms per kg[47]. The all-Ireland and UK mushroom conference of 2013 concluded that energy costs on mushroom farms could be reduced by 50% using energy efficiency measures and the adoption of renewable energy technology such as biomass boilers. Mushroom growers from the 2013 conference noted that their heating costs had been reduced by 40%-70% using biomass heating on their farms. A case study carried out by Teagasc compared heating requirements on two commercial mushroom farms to investigate the benefits of using a solid fuel boiler (wood pellet) instead of an oil boiler. The study found the solid fuel boiler to achieve a 65% reduction in energy cost per tonne of compost filled[48]. Solid fuel boilers are approximately twice the cost of an oil boiler however Teagasc state payback periods of between 2-3 years due to energy savings each year. Other measures that could be implemented to increase energy efficiency include:

- Upgrade lighting system to LED lighting. This could reduce electricity use by up to 60%
- Increasing heating and cooling radiator size from $1m^2$ to $1.2m^2$ alongside an increased air distribution duct from 600mm to 800mm diameter can increase air volume flow by 60% using the same amount of energy. Due to fans operating on a near 24/7 basis this could offer a potential energy saving of €400 per growing room per year[47].
- Insulation of the hot water distribution pipework to reduce heat loss and therefore heat consumption
- Change electricity tariff to benefit from cheaper night rate
- Installation of an integrated environmental control system

Energy efficiency on dairy farms

Teagasc highlight that milk cooling, water heating and vacuum pumping account for the largest proportion of energy consumption on dairy farms, with each operation accounting for 20-30% of electricity consumption on a typical dairy farm. These areas would therefore offer the greatest amount of scope for energy savings. Figure 31 shows a breakdown of total energy use on a typical Irish dairy farm.

[47] https://www.teagasc.ie/media/website/publications/2013/Mushroom_-Conference_-Proceedings_web.pdf

[48] http://tea.ie/wp-content/uploads/2012/05/Energy_Use_in_Agriculture.pdf

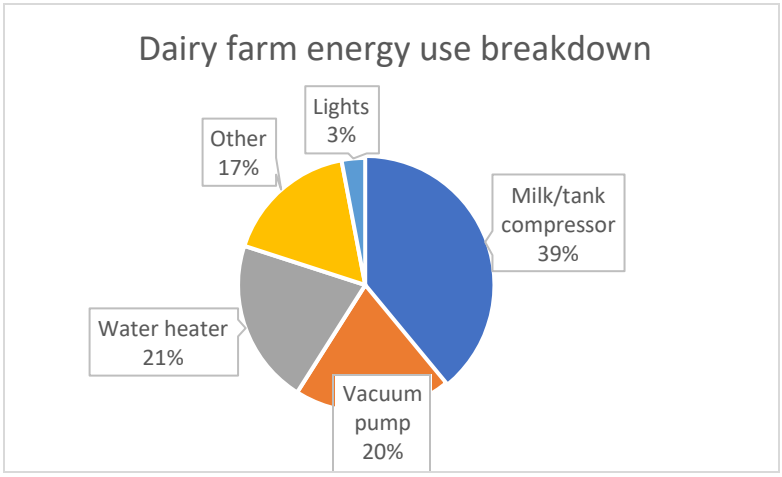


Figure 31: Breakdown of energy consumption on Irish Dairy farms based on 21 farms. (Source: Teagasc 2011)

Teagasc have indicated that in Ireland electricity costs on dairy farms vary from €15 to €45 per cow per year. These figures could be used by the dairy farmers in the area to compare their own energy use. The closer towards €45 per cow per year (as indicated Table 35) the more likely the scale of opportunities for energy and costs savings.

Table 35: Dairy farm energy cost scale

€15	€20	€25	€30	€35	€40	€45

Table 36: Energy saving measure on dairy farms. Source: Teagasc 2018

Action	Cost of action	Annual saving	Simple payback
Move to cheapest supplier	None	€ 500	Immediate
Milk pre-cooling (installing a plate cooler)	€ 3,200	€ 1,000	Three years
Install night rate electricity	None	€ 1,000	Immediate
Synchronise water heater with night rate	€ 50	€ 170	< 1 year
Variable speed drive (VSD) on the vacuum pumps	€ 3,300	€ 460	7 years
Solar thermal heating	€ 4,000	€ 350	> 10 years
Heat recovery system (in addition to pre-cooling)	€ 3,500	€ 500	7 years
Micro photovoltaic system	€ 6,000	€ 700	8.5 years
Wind turbine	€ 25,000	€ 800	> 30 years

Teagasc have also identified average costs, savings and payback associated with implementing the following energy/ cost saving measures on dairy farms in Ireland.[49] Which can be seen in the above table.However, to calculate farm specific savings and payback, the 'Dairy Energy Decision Support Tool' developed by Cork Institute of Technology (CIT), SEAI and Teagasc could be used. This tool predicts specific dairy farm electricity consumption, CO_2 emissions and cost, both in real-world and hypothetical scenarios which allows for the calculation of potential payback periods and cost savings attributed to the installation of energy technologies such as

[49] https://www.teagasc.ie/media/website/publications/2018/Teagasc-A4-Energy-Fact-Sheet-No.-04-Dairy-Farm-Energy_2pp.pdf

variable speed drives (VSD) for milking machines, solar PV panels, solar thermal, heat recovery and wind turbines, on a farm-to-farm basis. This tool could be introduced to dairy farmers at dairy farm workshops as this tool can be used by individual farmers to work out specific paybacks for technologies at their own farms.

This online tool can be accessed at the following link: https://messo.shinyapps.io/dairy/

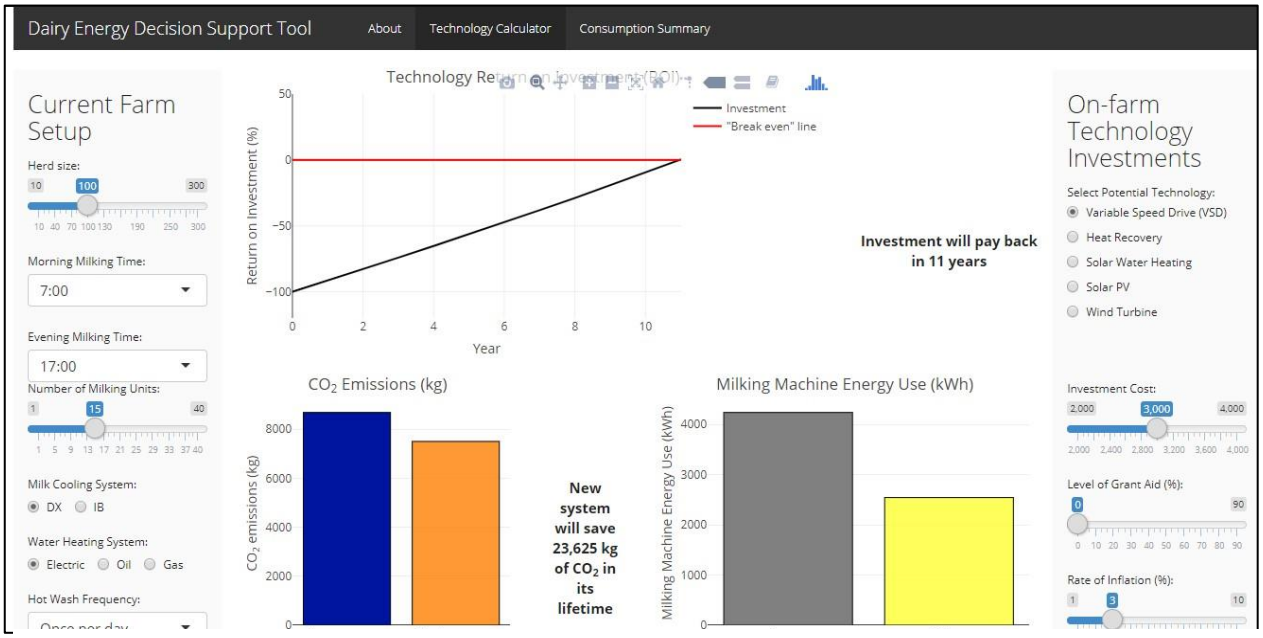


Figure 32: Dairy farm energy support tool

Energy efficiency on pig farms

Teagasc highlight that the three largest energy consumers on pig farms are the heating, lighting and ventilation required within the houses which hold piglets and young pigs. Fuel is also needed for feeding systems and manure handling on site. There are three main stages within the pig farming process which include:

- Farrowing: piglets who have just been born are kept for 115 days with temperatures being kept at 24° initially before decreasing as the piglets grow. This stage is estimated to consume approximately 20%-25% of overall electricity demand.
- Weaning: piglets weighing 6kg-17kg are kept within a room with temperatures being kept at 28°C-29°C initially before temperatures are decreased over time. This stage is estimated to consume 25% of overall energy demand on the farm.
- Finishing: Pigs are kept in this room for the remaining time on the farm before being sent to the abattoir. It is estimated that 33% of overall electricity demand is used in this stage, mainly for ventilation and feeding systems.

The Carbon Trust published data on energy usage on pig farms in the UK. Table 37 shows typical and good practice energy usage per pig produced for each stage of the farming process. The figures show that there is scope within each section to improve energy efficiency.

Table 37: Energy usage in each section of pig production. (Source: Carbon Trust)

Stage/section	Energy technology	Typical per pig produced	Good practice per pig produced	Main influence
Farrowing	Heating, lighting, and ventilation	8kWh	4kWh	Use of box creeps with thermostatic control gives the lowest running cost. Under-floor heating pads are generally more efficient than infra-red bulbs
Weaning	Heating, lighting, and ventilation	9kWh	3kWh	Major issues are the insulation of buildings (or kennels) and most importantly the control of ventilation
Finishing	Ventilation and lighting	10kWh	6kWh	Efficient fan selection, good design of inlets and outlets and system cleaning are the key points to minimising energy use
Feeding system	Motive power, pumping, conveying	3kWh	1kWh	Dry feeding systems use a small amount of energy for conveying. Wet feeding is generally more energy intensive because of the need to mix pump feed and pressurise pipework
Manure handling	Motive power, pumping, scraping	6kWh	2kWh	Selection of high efficiency pumps, aerators, and separators
Total		**36kWh**	**16kWh**	

The Teagasc Energy factsheet on pig farms[50] lists several recommendations for reducing energy consumption on pig farms. These include:

- Installation of heating controls within creeps which could save up to 45% in energy
- Fitting dimmer switches on heater lamps within creeps are a cost-effective way of significantly reducing heating costs. Savings up to 30% can be achieved with this measure
- Full insulation around creeps could save a further 13% if enclosure is well sealed
- Ensuring that insulation material is kept dry is vital for heat retention to be maintained. This simple step could achieve energy savings of 5%-10%
- Installation of fluorescent lighting and low energy lamps can significantly reduce energy costs with savings of up to 80%
- Reviewing fan and ventilation design to ensure air inlets, outlets, fan chimneys and other fittings are correctly sized to match output of fans
- Ensuring thermostats are correctly situated in houses to be representative of livestock temperatures and that controller read outs are accurate with actual thermometer reading

[50] https://www.teagasc.ie/rural-economy/rural-development/diversification/energy-use-on-pig-farms/

7.3.4 Funding Schemes

Teagasc Smart Farming programme

Over the past 8 years, 229 farmers have volunteered to participate in the Smart Farming resource efficiency programme. The Smart Farming programme also engaged with over 5000 farmers through discussion groups. 40 farmers have volunteered to take the Smart Farming challenge in 2021, an annual programme where the farm is visited, assessed, and given advice and recommendations which includes energy saving advice.

Targeted Agricultural Modernisation Scheme (TAMS)

This grant scheme provides grants to farmers to build and/or improve a specified range of farm buildings and equipment on their holding. There are seven schemes under TAMS, however those which fund energy related measures are as follows:

Pig and Poultry Investment Scheme - Open to farmers who generate a minimum of 20 production units. The scheme provides grant support for various equipment to enable farms to comply with animal welfare standards, in addition to energy efficiency equipment such as water meters, solar panels and boilers. Grants of 40% up to maximum investment of €80,000 per holding are available.

Young Farmers' Capital Investment Scheme – Helps young farmers to meet capital costs associated with the establishment of their enterprises through funding equipment and building work such as dairy equipment and energy efficiency measures. Grants of up to 60% are available to a maximum of €80,000 per holding.

Dairy Equipment Scheme – Provides financial help to farmers in milk production to upgrade technology and compete in the modern dairy sector. Open to farmers with a minimum of 5 hectares of eligible land in the basic payment scheme. Equipment funded includes water heating, milking machine equipment and milk storage and cooling equipment. Grants of 40% up to maximum investment of €80,000 per holding are available.

Support Scheme for Renewable Heat (SSRH)

The SSRH is a government funded initiative designed to increase the energy generated from renewable sources in the heat sector. The scheme is open to commercial, industrial, agricultural, district heating, public sector, and other non-domestic heat users. The scheme will provide an installation grant (for air/ground/water source heat pump systems only) and on-going operational support (a tariff) for a period of 15 years based on useable heat output in renewable heating systems, in new installations or installations that currently use a fossil fuel heating system and convert to using the following technologies:

- Biomass boiler or biomass HE CHP heating systems
- Biogas (Anaerobic Digestion) boiler or biogas HE CHP heating systems

Participants are required to install approved meters and submit readings on a quarterly basis confirming the amount of renewable heat energy used for eligible purposes. The SSRH support tariffs are shown in the Figure 33 below. A practical example can be seen in section 8.3.4.

Tier	Lower Limit (MWh/yr)	Upper Limit (MWh/yr)	Biomass Heating Systems Tariff (c/kWh)	Anaerobic Digestion Heating Systems (c/kWh)
1	0	300	5.66	2.95
2	300	1,000	3.02	2.95
3	1,000	2,400	0.50	0.50
4	2,400	10,000	0.50	0.00
5	10,000	50,000	0.37	0.00
6	50,000	N/A	0.00	0.00

Figure 33: Tariffs available under the Support Scheme for Renewable Heat

The SSRH offers operational support through a tiered tariff system which is shown in Figure 33. . Each tier has a lower and upper limit which gives a range. The total heat output of a biomass or AD system is split into each tier range which has a corresponding tariff. For example, a biomass system which has an annual heat output of 1,100MWh per year will be split into the first 3 tiers as follows;

- The first 300MWh will fall into tier one
- The next 700MWh will fall into tier two
- The remaining 100MWh will then fall into tier three

The SSRH has been gaining momentum since its introduction in 2019 and remains in its early stages as renewable heat is becoming a more attractive option particularly in the agricultural sector in Ireland. According to SEAI records[51], 11 installations were granted operational support under the SSRH in 2019 increasing to 40 installations in 2020 and to date only one installation in 2021. The most up to date records provided by SEAI show that a total of 52 renewable heat installations throughout Ireland are receiving operational support under the SSRH of which 15 are in County Monaghan. SSRH eligible installations within the county are predominantly in the poultry sector with 13 installations registered at poultry businesses while there are only 2 eligible installations to date are in the mushroom sector within the county.

[51] https://www.seai.ie/publications/SSRH-tariff-scheme-information-.pdf

8.0 Energy audit summaries

8.1 Domestic

Residential energy audits were conducted on 8 properties located within Co. Monaghan. A summary of the properties audited can be seen in Table 38 which highlights the properties which have a higher annual electricity usage than the national average for 2019 and a higher direct fuel consumption than the national average for 2019. Property 2 which has been highlighted green has an air source heat pump (ASHP) installed so it has no heating bills and a higher electricity consumption it has therefore been excluded from this analysis.

Table 38: Summary of residential properties audited including electricity use, heating use, and CO_2 emissions

Property number	Construction date	Property type	Electricity usage (kWh)	Heating usage (kWh)	CO_2 emissions ($kgCO_2$)
Property 1	1965	Mid-terrace	3883	15,581	5264
Property 2	Pre 1978	Detached farmhouse	7741	N/A	2512
Property 3	Pre 1978	Detached	3206	23,414	7058
Property 4	1978 – 1993	Bungalow	3089	25,450	7543
Property 5	1980s	Detached cottage	5141	14,732	5454
Property 6	2005 – 2007	Detached	5329	14,732	5515
Property 7	2005 – 2007	Detached	4062	11,198	4196
Property 8	2008 – 2009	Detached	3276	20,360	6296
National average (2019)			4544	14,204	5,700

Two of the audited properties had an annual electricity consumption which was greater than the national average for 2019. The rest of the properties were below average for electricity consumption. As shown in table 31, six out of seven properties which have an oil-fired central heating system have a higher direct fuel consumption than the national average for 2019. The results of the residential energy audits have shown that the residential properties are consuming on average 34% more fuel than the national average. Annual CO_2 emissions for each of the properties was also calculated, property 2 had the lowest CO_2 emissions associated with energy use in their home as they have an energy efficient air source heat pump installed.

Based on the information above, several electricity and heating opportunities were identified for each of the properties which would reduce energy consumption and associated carbon emissions. Electricity opportunities included: using energy efficient appliances, replacing older lighting with efficient alternatives, reviewing their electricity tariff with their supplier and, where feasible, renewable electricity generation. Heating opportunities included upgrading of insulation, draught-proofing, heating controls, improving the energy performance of existing doors and windows as well as renewable heating options such as air source heat pumps. The reports also outlined the grants available to homeowners for each of the opportunities identified and guidance on where to find more information.

8.2 Non-domestic

Energy audits were conducted at Blackwater Valley Learning Centre and St. Michaels Community Centre which were identified by the SEC. There is a significant difference in the energy use between the audited buildings due to their size, occupancy, and usage.

Blackwater Valley Learning Centre is used predominantly for education and childcare as it houses the Knockconan National School and Tru Beginnings childcare. Truagh Development Association and a Parish office are also located within the Learning Centre. Through consultation with the site representatives it is understood that the building typically operates between the hours of 9:00a.m. to 17:00p.m. Monday to Friday. The average daily occupancy levels are 244 persons. Energy usage on site is associated with lighting, AV equipment, kitchen equipment, water heaters and space heating**.**

St Michaels Community Centre is used predominantly for childcare services - St. Michael's Little Scholars Community Childcare. The centre is open 5 days a week typically Monday – Friday for playgroup and childcare services between the hours of 08:00a.m. – 18:00p.m. The average daily occupancy levels are 26 persons. The site representative has indicated that the facilities are typically open for up to 12 hours per day. In normal circumstances, the community centre is also used on average 2-3 nights per week for evening classes and activities. Energy usage on site is associated with lighting, AV equipment, kitchen equipment, electric heaters, water heating and space heating. Table 39 below shows the annual electricity and heating use of these buildings based on analysis of energy bills for a one-year period.

Table 39: Overview of heating and electricity usage of community audits

Community building	Estimated Floor Area (m^2)	Average daily occupancy	Electricity usage (kWh)	Heat energy usage (kWh)	CO_2 emissions (tCO_2)
Blackwater Valley Learning Centre	1700	244	58,923	96,854.97	43.16
St. Michael's Community Centre	403	26	6,520	39,048.30	12.15

Based on the information above several electricity and heating opportunities were identified for each building these are listed below in relation to each of the community buildings.

Blackwater Valley Learning Centre: Opportunities in relation to electricity consumption for the centre included monitoring electricity consumption, reviewing their electricity tariff and lighting upgrades throughout the building. At present, electricity is billed for the whole building and each business pays a proportion of the bill. The operation of a building with multiple tenants through one electricity meter makes it difficult for businesses to monitor their own energy usage. It is difficult for the organisation to implement effective measures to use energy more efficiently if they do not have visibility on their actual energy usage.

A recommendation has been made for the building to introduce submetering. Submetering will allow each business to monitor their electricity use, this will give business the opportunity to monitor and adapt the ways in which they are using energy. Regarding heating, it has been recommended that the building has their insulation levels assessed by a registered installer as it not known if this is compliant with current standard of 300mm rockwool or equivalent. The buildings current heating system is complex with three distinct heating systems operating within

the building. The building could benefit from better heating controls which allow heating to be zoned reducing energy wastage in areas such as hallways. A recommendation has been made for the two heating systems which operate on oil to upgrade to a natural gas system in line with the other tenant. As part of the analysis the suitability of a Solar Photovoltaics (PV) installation was assessed for the building to meet electricity demand through renewable electricity generation. We have concluded that an area of the building is suitably orientated and could generate an estimated annual output of 9,341 kWh.

St. Michael's Community Centre: Opportunities in relation to electricity consumption for the centre included monitoring electricity consumption, reviewing their electricity tariff and lighting upgrades throughout the building. Regarding heating, the site representative expressed concern regarding the heat loss of the building. It has been recommended that the site representative has the heat loss of the building assessed by a registered installer this should include an assessment of the performance of existing windows which are 25 years old. As part of the analysis the suitability of a Solar Photovoltaics (PV) installation was assessed for the building to meet electricity demand through renewable electricity generation. We have concluded that the building is suitably orientated and could generate an estimated annual output of 7,357 kWh. However, we have also acknowledged that the building holds a heritage conservation status. Therefore, before any installation of Solar PV can take place, the building representative should engage with the local planning department to determine if development is permitted.

8.3 Farms

Audits were conducted at two poultry farms as indicated by the SEC. The Council's baseline study on the poultry sector within the County states that most poultry farms in Monaghan are sub licensed which denotes a bird capacity of less than 40,000 birds (per cycle). However, the licensed farms hold the greatest proportion of birds overall. Both the Shanmullagh and Doogary poultry farms are licensed due to having a bird capacity of over 40,000 birds- 106,000 and 193,000 respectively. Information assessed on each farm has been summarised and is shown in Table 40.

Table 40: Overview of poultry farms audited

	Shanmullagh	**Doogary**
Type of enterprise	Poultry meat production	Poultry meat production
Number of buildings	5 broiler sheds	5 broiler sheds
Year of construction	2 x 1990 (completely refurbished in 2010), other 3 2000	1987, 1994, 2007, 2015, 2017
Energy types	Electricity and Gas	Electricity and Gas
Lighting	4 houses have LEDs, other house has fluorescent tubing- all have dimming control	Timer set fluorescent tube lighting in all houses
Heating & Insulation	No boilers- each house has 2 naked flat heaters each. All houses draft sealed. Roofs insulated to standard level (200mm) and walls have Kingspan insulation. 2 houses have extra 100mm insulation.	2 gas boilers used to heat houses through heated pipes and underfloor heating. Older houses have 100mm insulation while newer houses have 120mm insulation.

Ventilation	2 houses are naturally ventilated. Other houses are computer controlled. Draught shutters fixed, linked with heating	Computer controlled, draught shutters fitted, linked with heating
Operating hours	Equipment running 24/7 for the 6 weeks of each cycle	Equipment running 24/7 for the 6 weeks of each cycle
Bird capacity (per cycle)	106,000	193,000
Birds per year	636,000	1,158,000

Table 41 shows the annual electricity and heating usage at both farms based on analysis of energy bills.

Table 41: Overview of heating and electricity usage of farm audits

Farm	Birds per year	Estimated Electricity Usage (kWh)	Estimated Heat Energy Usage (kWh)
Shanmullagh	636,000	113,381	147,259
Doogary	1,158,000	151,000	1,204,109

The energy consumption per bird per cycle has been analysed for both farms and compared to Teagasc figures from their poultry energy factsheet which gives average Irish figures and benchmark figures published by Teagasc in 2011 which gave best practice figures for poultry farms within England and Wales. This comparison is shown in Table 42. The table shows both farms as having an energy consumption per bird that is below the average figure from Teagasc and that the Shanmullagh farm has a figure close to best practice. Many of the recommendations outlined by Teagasc to increase energy efficiency on poultry farms has been implemented on both farms regarding heating, ventilation and lighting. These figures show that the measures implemented by the farmers has had a significant impact on their energy consumption as they are using less energy than the latest Teagasc figures.

Table 42: Comparison of energy consumption figures per bird per cycle

	Energy per bird per cycle (kWh)		
Farm	**Actual farm usage**	**Teagasc 2018**	**UK Best Practice 2011**
Shanmullagh	0.409	1.78	0.330
Doogary	1.17		

8.3.1 Shanmullagh Poultry Farm

One of the main opportunities on this farm relates to monitoring of energy use at a more detailed level. As the farmer has made some very efficient changes to each of his poultry houses over the past few years the integration of sub metering for each house would allow a complete understanding of the way energy is used on through the entire broiler process.

Renewable energy opportunities have also been highlighted such as solar panel installation, on poultry houses 4 & 5 which would be considered as most suitable as they are south easterly facing. This has been detailed further in the farm audit report and also referenced in section 7.4.4 of this EMP.

The farm owner also expressed interest in small scale onsite Anaerobic Digestion of poultry manure. The starting aim of the project would be to displace the amount of propane gas used onsite and instead to replace it with biogas from the digestion process. This would result in utilising chicken litter already on farm as a by-product of the poultry process. This would also eliminate transportation off the farm by HGV equipment and instead be used to create a more useful product as heating fuel for the farm's poultry operation. It would be useful to use this farm as a pilot / demonstration site to assess the viability of small scale on farm AD for this purpose.

8.3.2 Doogary Poultry Farm

Improved monitoring of energy use was also the main recommendation at this farm. As the farmer has several poultry houses, some of which are of a newer design, the integration of sub metering for each house would allow a complete understanding of the energy use throughout the entire broiler process. Renewable energy opportunities have also been highlighted such as solar panel installation, on the two newer poultry houses 4&5. These would be considered as most suitable for PV installation as they are south westerly facing. The estimated output of a 20kW PV system has been calculated and presented in the energy audit report and summarised in the register of opportunities.

Similar to the previous farm, AD for producing biogas to replace the propane usage may also be viable pending further analysis and consultation with industry experts.

9.0 Farm Diversification

9.1 Introduction

County Monaghan is a unique county where 69% of the land area within the county is dedicated to agriculture. The county has become renowned for poultry production and mushroom cultivation and has a vibrant agri-food industry. Landowners and farmers within the county are becoming increasingly interested in diversification of their business e.g., expanding their businesses beyond traditional farming into an additional income generating activity. There are many sectors which farmers and landowners can diversify into, such as tourism, organic farming, food production, forestry, and energy production.

This section of the EMP focuses on diversification opportunities available in relation to energy production. It is important to note that the most successful diversification opportunities are those which complement the existing business by improving cashflow, adding profit and reducing

volatility. For the purposes of the EMP, farm diversification is an additional activity which will result in income or cost saving for the farm business, however, it must relate to a renewable energy project in which the farm business participates.

The table below shows five farm diversification activities and opportunities which have been considered. Those numbered 1-3 have been appraised for the purposes of the EMP in sections 8.3 – 8.5 below.

9.2 Potential Farm Diversification Opportunities

Potential opportunity	Details
1. Willow growing and centralised drying/storage facility	• Potential for poultry (or other) farms to diversify into growing willow. • Willow chip used for biomass heating to heat individual poultry houses. • Willow fuel must be dried to certain standard for burning in biomass boilers • There are currently few drying facilities in the county • Centralised drying facility would enable local processing and storage of the wood chip • SSRH payments would be applicable to willow biomass combustion (e.g., to heat poultry houses).
2. PV installation on farm roofs	• Farms often have large sheds with low roof angles which are suitable for solar PV installation • Suitable for farms with daytime electrical demand e.g., ventilation, lighting, refrigeration, cooling • Particularly suitable for farms with a high electricity load such as poultry farms and dairy farms • Potential funding available under CAP •
3. Solar PV on non-productive land	• Non-productive farmland could also be utilised in larger scale 'PV farms' providing electricity for onsite processes in addition to exporting to the grid
4. Anaerobic digestion (AD) Plant to produce biogas for grid injection / transport and generating renewable electricity, using local chicken litter waste and potentially waste from local food manufacturing companies.	• Poultry litter currently transported out of the county for disposal • Potential to treat locally at an AD plant • Resulting biogas could be used to fuel on site farm and other local poultry farms (pipeline or transported by road) for use for heat of poultry houses. • AD could be extended in future to process waste from food manufacturing businesses operating in Monaghan • Potential for renewable electricity generation from combustion of excess biogas
5. Biomethane production for use in transport by agricultural /haulage sector	• If AD plant is viable, gas produced could be upgraded for use in transport. • There are several food manufacturing businesses in the county which would be potential users in addition to other hauliers e.g., Virginia transport.
6. Biomethane injection to gas grid	• As above if AD is feasible, biogas could be upgraded and injected into the local gas network • The gas runs through the county from Kingscourt in the south, through Carrickmacross, finishing at Lough Egish. If it was possible for an AD site to be located adjacent to the current gas pipeline, upgraded gas could be supplied into the network. • Lakelands Dairies have a milk processing facility at Lough Egish which would generate significant food waste, providing a fuel for an AD plant.

9.3 Willow growing and centralised drying/storage facility

9.3.1 Current situation

The suitability of land within County Monaghan for growing Short Rotation Coppice (SRC) Willow was assessed in the EU funded ANSWER (Agricultural Need for Sustainable Willow Effluent Recycling) Project which ran between 2010 – 2014[52]. Figure 34 illustrates that a large quantity of land in County Monaghan is considered to have a high – medium suitability for growing SRC willow.

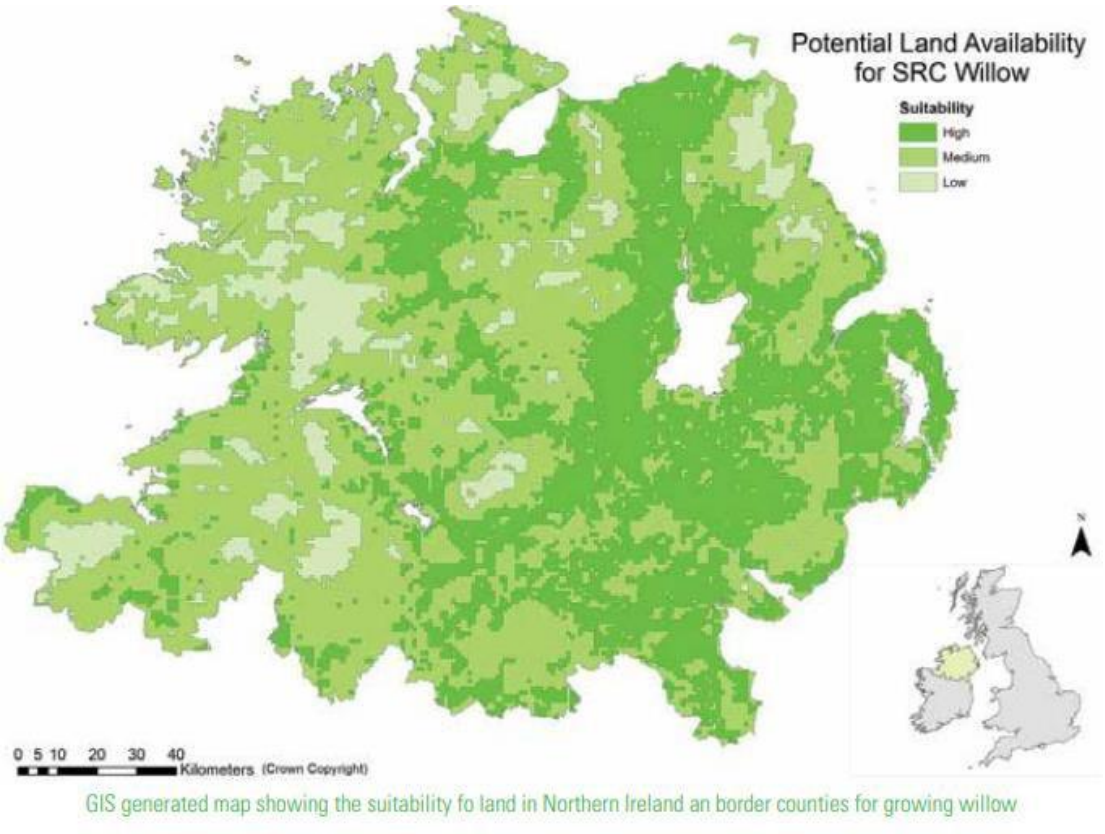


Figure 34: Suitability of land in Northern Ireland and border counties for growing willow (Source ANSWER Project)

9.3.2 SRC Willow

A report published by Teagasc and AFBI states that in the context of climate and soils, willow is the most suitable woody biomass crop for Ireland[53]. Willow yields a fuel that can be stored for long periods and can be used to produce heat and electricity. Energy crops such as willow are high yielding and carbon neutral as during photosynthesis the crop captures carbon dioxide from the atmosphere to grow and locks CO_2 within its structure. SRC willow is capable of re-sprouting from the stool that remains after harvest. Therefore, a willow coppice may be harvested six to eight times on a three-year cycle giving a plantation a lifespan of between 19 – 25 years allowing for the establishment year. The yield which would be expected from one hectare of SRC willow for one year would be between 7 – 12 tonnes of dry matter. This would translate to between 21 – 36 tonnes of dry matter on a three-year harvest cycle.

[52] Answer project report.pdf (afbini.gov.uk)
[53] Best-Practice-SRC-Willow.pdf (geraghtyconsulting.ie)

9.3.3 Opportunity for farm diversification

Considering the suitability of land in the county for growing SRC willow an opportunity has been identified which can diversify farm and landowners' income. Farmers and land owners within the county could diversify their income by using a proportion of their available land to grow SRC willow which can be used by farmers as a renewable fuel for their farm buildings such as poultry houses. The heat energy produced using a biomass renewable heating system would be eligible to receive support under the Support Scheme for Renewable Heat (SSRH), a government funded initiative which has been designed to increase the uptake of renewable heating technologies. This would create an additional source of income for farmers in the county while also reducing carbon emissions. We have been unable to identify any community led projects which have grown SRC willow in a cooperative approach for renewable heating on farms which makes this opportunity unique to the county.

9.3.4 Considerations

There are several areas which would require further consideration to assess the feasibility of growing SRC willow for biomass heating within the county and these have been listed below.

Biomass fuel requirement for one poultry shed

Figures published by Teagasc in 2018 states that a standard 73m x 18m bird broiler house with a capacity of 27,000 broiler birds would require a heat input of 253 MWh per year. Based on the heat energy requirements of one broiler shed for one year the amount of willow required to meet the energy demand has been estimated and can be seen presented below in Table 43.

Table 43: Estimated annual willow requirements for one broiler shed

Average yield one-hectare SRC Willow (tonnes)	28.5
Annual broiler shed energy demand (MWh)	253
Dry Willow energy content (MJ/kg)	16
Dry Willow energy content (kWh/kg)	4.444
Willow harvested to meet broiler shed energy demand (tonnes)	57
Willow grown to meet boiler shed energy demand (hectares)	2
Estimated cost of establishment	€ 5,460

The biomass fuel required for each farm will need to be established to determine how much SRC willow will need to be established and harvested. A 99kW biomass boiler for a poultry shed will cost in the region of €64,000 however, this will be unique to each poultry shed and the equipment required. If the installation receives support from the SSRH, the possible annual income from a biomass heating system based on the annual broiler shed energy demand detailed in Table 43 above has been estimated as €14,320. This would have an associated payback period of 4.5 years with support under the SSRH.

Costs

Farmers should consider the costs associated with establishment, harvesting and drying SRC willow before investment. SRC Willow is expensive to establish with costs in the region of €2,730 per hectare which includes operational and material costs[46]. Average costs provided by Teagasc and AFBINI have been presented below in relation to cut back, harvesting, chipping, and drying of SRC willow.

Activity	Cost
Cut back of willow	€30 per hectare
Whole stem harvesting	€30 per dry tonne
Chipping	€10 per fresh tonne
Direct chip harvesting	€25 per dry tonne
Force drying	€30 per dry tonne

Harvesting

SRC willow is harvested on three-year cycle. Collaboration between farmers is required to establish willow on a rotational basis ensuring that willow is harvested annually, and fuel supply is maintained. Harvesting SRC willow can be difficult in Ireland due to wet conditions in winter it is therefore advised that all farmers should have a backup fuel supplier.

Drying

As fuel supply is required continuously throughout the year a drying and storage facility will be required. Long term storage will require moisture levels of below 20%. Ventilated grain floors have been used successfully to dry SRC willow wood chip and can achieve the required moisture content within 3-6 weeks. There is potential to develop a centralised drying and storage facility in the county which could be operated on a cooperative basis between farmers. The facility should be fuelled using renewable energy where possible. The development of such a facility may be supported under the Climate Action Fund (CAF)[54]. The Climate Action Fund (CAF) was established on a statutory basis, with effect from 1 August 2020, to provide assistance and financial support to projects which help Ireland achieve its climate and energy targets. The CAF will provide at least €500 million in government funding up to 2027. The fund will allow for the development of innovative initiatives which, without this support, may not otherwise be possible to achieve.

A centralised drying facility meets the criteria of the types of projects which the Department of the Environment, Climate and Communications (DECC) states may be funded under the CAF as it would support the decarbonisation of farm buildings. The date for the next call for applications has not been made publicly available. It is worth noting that the DECC is currently developing proposals to provide further support from the CAF through the development of a community Climate Action Programme. The SEC can become involved in this process through providing feedback to the 'climate conversation'[55]. The feedback received through these conversations will be used to identify where financial support is required.

[54] https://www.gov.ie/en/publication/de5d3-climate-action-fund/

[55] https://www.gov.ie/en/campaigns/f6197-climate-conversations/

9.3.5 Recommendations

1. The SEC should explore funding opportunities such as the LEADER Programme[56] which helps rural communities across the EU engage in local development of their area through community-led local development. The LEADER Programme supports projects which improve renewable energy Farm diversification projects have been funded by the LEADER Programme recently include a project in Co. Kerry receiving €28,619 of funding in January 2020 to purchase equipment to produce ice cream on site on the farm. The programme has also provided funding for feasibility studies.

2. A feasibility study will be required for this farm diversification opportunity to be assessed in more detail including an assessment of land classification, economic assessments and return on investment once a group of farmers willing to participate has been established.

Two micro case studies have been presented below to demonstrate the benefits farmers have experienced through the use of a biomass heating system on poultry farms.

Ballymoney, Northern Ireland
Project cost: £330,000
ROI: 4 – 6 years
A broiler poultry farm located in Ballymoney introduced a biomass heating system (6 x 99kW) within their six poultry sheds. The benefits of using a dry heating system were significant with carbon dioxide, carbon monoxide and water levels in the shed being significantly reduced. This reduced the levels of ammonia in the sheds providing a much healthier environment for the chickens. Before the introduction of the biomass heating system, it took on average 35 days to achieve a target weight of 1.85kgs and pododermatitis (foot lesions) were an issue. Since installation of the biomass system there is a very low incidence of pododermatitis and hock burn. The average age of birds achieving 1.85kgs has been reduced to 33 days. Overall, the biomass heating system has improved the profitability of the farm, reduced the carbon emissions, and generated additional income from the Renewable Heat Incentive (RHI).

Tiverton, Devon
Project cost: £300,000
ROI: 5 – 6 years
A free-range poultry farm located in Tiverton introduced a biomass heating system (4 x 100kW) within their six poultry sheds. Previously the farm used LPG, which was expensive, inefficient and was detrimental to poultry health due to increased humidity, CO_2 and ammonia levels within the sheds. The biomass heating system generated dry heat in a more efficient manner enabling air quality to be maintained. The biomass system which uses locally sourced wood chips has led to improved bird welfare and performance and has lowered input costs by between 50-80%. As well as reducing the cost of heating on the farm the boilers were eligible to receive support through an RHI payment which they will receive for the next 20 years creating an additional source of income which will help payback the cost of the project.

[56] gov.ie - LEADER Programme Funding (www.gov.ie)

9.4 PV installation on farm roofs / non-productive land

9.4.1 Current situation

The abundance of agricultural land and farm buildings within the county presents an opportunity for the diversification of landowners/farmers' incomes. Landowners and farmers could create an additional source of income through the production of renewable electricity.

9.4.2 Solar PV

Solar photovoltaic (PV) systems convert solar radiation into electricity. Solar PV is a well adopted renewable energy technology that will play an important role in the decarbonisation of energy in Ireland. Solar PV is a well-established technology which can be deployed as roof-mounted or ground-mounted systems. Solar PV is an excellent opportunity for the agricultural sector in the county as landowners and farmers who can generate their own electricity can reduce energy costs on site reduce carbon emissions and create an additional source of income through export of electricity to the grid.

9.4.3 Opportunity for farm diversification

The abundance of agricultural land and farm buildings within the county has been identified as an opportunity to diversify landowner and farmers' incomes. Land owners/farmers could consider leasing an area of their grazing land to developers for the development of a Solar PV farm. This would allow a stable long-term income for the landowner to be created. In addition, existing farm buildings could be used to develop roof-mounted Solar PV systems which would reduce the farms reliance on imported grid electricity reducing costs and carbon emissions and can create an additional income source from exported excess electricity when the Micro-generation Support Scheme becomes available.

9.4.4 Considerations

Solar PV siting

The angle and orientation of the solar array is important generally a PV installation requires a large south facing roof or accessible land for ground mounting. For roof mounted systems a pitch angle of 35° is best for optimal PV output. Farmers with buildings which are suitably orientated and have a structure which is sufficient to support the weight of Solar PV panels should explore the opportunity to produce their own electricity on site.

Planning permission

Before installation of solar panels, the landowner/farmer should consider planning permission requirements associated with the proposed installation. Generally, solar PV installation on agricultural structures, or within the curtilage of an agricultural holding; is considered exempted development subject to the conditions set out in schedule 2, Part 3, Class 18(c) of the Planning and Development Regulations (2001). The exemption conditions for both ground-mounted and roof-mounted solar have been detailed in Table 44.

Table 44: Exemption conditions for Solar PV development on agricultural structures or within the curtilage of an agricultural holding

Exemption conditions	
Ground mounted	**Roof mounted**
the array shall not exceed 25m^2	the array should not exceed 50m^2 or 50% of the total roof area, whichever is lesser
the height of the free-standing solar array should not exceed two meters	solar panels should be a minimum of 50cm from the edge of the wall or roof on which they are mounted

Larger rooftop and ground mounted installations will require planning permission which should be discussed with a local planning officer within Monaghan County Council.

Grid connection

Renewable energy technologies up to 3.68kW (single phase) and 11.04kW (three phase) also termed Micro-Generators do not need prior permission to connect to the national grid from the national network operator ESB Networks. For micro-generators ESB operate an "inform and fit" policy. The generator should complete an NC6 form and email to ESB Networks and fit in 20 days if no objections are received. For larger installations which will export to grid pre-approval is required an application for a new connection (NC5 form) should be submitted for consideration. The ESBN Generation Capacity Heatmap can be used to get an indication of transformer capacity in the area planned for Solar PV installation.[57] For larger installations applications can be made to ESBN for a budget estimate it will cost a generator €1,200 to apply for this estimate from ESBN.

Basic Farm Payment

If the landowner is considering leasing their land for the purposes of a larger solar development (or solar 'farm'), they should ensure that leased land can continue to be used for grazing of small livestock such as sheep and calves. This should be agreed by the developer and landowner before development commences to ensure the farmer is still entitled to their basic farm payment.

Estimated Solar PV generation: Farm audit

A Solar PV feasibility study has been completed on a Monaghan poultry farm as part of the EMP to give a practical example of the energy savings which can be achieved. The study has considered the planning exemption, that no more than 50m^2 of each roof can be taken up by the PV panels. This would give a total area of 100m^2 which would fit a 20kW system with the two roofs combined. The most suitable location for Solar PV installation at this farm was identified as broiler sheds 4 & 5 which can be seen presented in Figure 35. These roofs are South-Easterly facing and do not have any nearby vegetation or buildings that would cause any shading. The slope of the roofs is approximately 22°. However, an installer can position the panels at the optimum incline e.g., 35° using a rack if the roof is deemed to be robust enough for this extra equipment.

[57] https://www.esbnetworks.ie/network-capacity-map

Figure 35: Satellite image showing the most suitable locations for PV installation on the farm

Table 45 presents the key information required when assessing the potential output of the PV system on the identified roof i.e., the orientation of the roof, the approximate roof slope (incline), the approximate roof area available and the resulting PV system size (based on a standard 335W Solarwatt PV panel of 1.69m^2). A 20kW PV system would require 59 panels. This PV system would give an estimated annual generation of 15,976 kWh. Based on an average price of €1,750 per kW installed, the proposed 20kW PV system would cost €35,000 excluding VAT.

Table 45: Inputs and outputs from Solar PV software for proposed installation on the most suitable roofs

Roof slope	Roof orientation (degrees east or west from south)	Roof area needed	Approximate solar PV system size (kW)	Estimated output (kWh)	CO_2 savings ($kgCO_2$)
22°	-27° (South-East)	100m^2	20	15,976	5,416

The annual electricity demand for a 12-month period was 113,381kWh. The PV system above would therefore contribute to a maximum of 14% of the annual electricity. Given an average electricity import price of €0.19/kWh for the site, this would equate to a maximum annual saving of €3,035. Based on this annual costs saving the estimated payback period for the proposed 20kW PV system would be 11.5 years without any financial support.

9.4.5 Financial Support

Targeted Agricultural Modernisation Scheme[58]

Farmers if eligible may receive grant support of up to 40% on Solar PV investment, through the Targeted Agricultural Modernisation Scheme (TAMS). Young, qualified farmers may receive up to 60% in grant aid. TAMS support is currently available for up to 11kW Solar PV on dairy, beef, tillage, and sheep farms. If a farmer planned to install a 20kW system as detailed above TAMS would only fund up to 11kW and the farmer must fund the additional capacity. PV installers must

[58] https://www.gov.ie/en/service/targeted-agriculture-modernisation-schemes/

be on the SEAI register of installers or the Department of Agriculture, Food and Marine (DAFM) approved list.

Pig and Poultry Investment Scheme[59]

The scheme is open to farmers who generate a minimum of 20 production units. The scheme provides grant support for specific types of equipment and includes grant support for energy efficiency measures such as solar panels up to maximum of 11kW. Grant support is paid at the rate of 40% up to a maximum investment ceiling of €80,000 per holding. In the case of Solar PV, 100% of the electricity generated from the panels must be consumed on the applicants holding for farming purposes.

Accelerated Capital Allowance[60]

Accelerated Capital Allowance (ACA) is a tax incentive scheme which promotes investment in energy efficient products and equipment. The ACA scheme allows farmers who pay corporation tax in Ireland to deduct the full cost of equipment such as a Solar PV installation from their profits in the year of purchase. The installation must be on the Triple E Products Register[61] and has meet the eligibility criteria. The minimum expenditure to receive the ACA incentive for Solar PV is €1,000.

Micro-generation Support Scheme (MSS)[62]

At present, there is no feed-in tariff support for electricity exported to the grid in Ireland. Action 30 of the Climate Action Plan states that a support payment should be made available for **excess** electricity which is generated on site and exported to the grid for all microgenerators in Ireland by late 2021. Micro-generation is the general term that refers to the generation of electricity from renewable technologies including solar photovoltaic (PV), micro-wind, micro-hydro and micro-renewable combined heat and power (CHP). The Clean Export Guarantee (CEG) will be made available to all renewable generators that spill a capped amount of excess electricity to the grid, regardless of what energy provider they have a supply contract with. It is important to note that the Micro-generation Support Scheme has been designed to improve the commercial case for **self-consumption** by providing a small payment for any excess electricity spilled to the grid not to improve the commercial case for exporting electricity to the grid. The pricing regime for the CEG has not be published at the time of writing.

It should be noted that the high-level design for the MSS proposes to phase out or discontinue the current investment subsidy schemes such as SEAI PV grants and the solar PV aspect of the TAMS II funding[63]

9.4.6 Recommendations

1. The SEC should establish a working group with local farmers to determine if this is a diversification opportunity, which they would be willing to pursue.
2. The SEC should encourage the dissemination of information relating to the financial support mechanisms in place as well as upcoming support such as the Micro-generation Support Scheme (MSS) to encourage farmers to invest in renewable energy technologies.

[59] https://www.gov.ie/en/service/406a9b-pig-and-poultry-investment-scheme/
[60] Accelerated Capital Allowance | Business Grants | SEAI
[61] https://triplee.seai.ie/AcaProducts/Search.aspx
[62] https://www.gov.ie/en/publication/b1fbe-micro-generation/
[63] gov.ie - Public Consultation on a Micro-generation Support Scheme (MSS) in Ireland (www.gov.ie)

3. The roll out of solar PV on agricultural buildings could also be considered in the SEC's plans to avail of the Better Energy Communities grant application in the future.

9.5 Anaerobic Digestion (AD) Plant

9.5.1 Current situation

It is understood that poultry farms currently pay for farm waste to be removed from site. This waste is predominantly spent chicken litter and often travels long distances for disposal. The removal of chicken litter costs farmers in Monaghan approximately €16 per tonne. Some farms already transport their waste to anaerobic digestion (AD) plants in other counties in Ireland or Northern Ireland.

9.5.2 Anaerobic Digestion

AD plants take organic materials and/or by-products and use them in a process, using bacteria to naturally break down organic matter and produce biogas. The resulting biogas can be used at the point of production to power a combined heat and power (CHP) engine to produce electricity. This electricity can be used on site or exported into the electricity grid, subject to permissions and an economic assessment. Biogas produced can also be upgraded to biomethane, a higher grade gas which shares the same characteristics as natural gas. Biomethane can therefore be used in a natural gas boiler or injected into the gas grid. Likewise this can be used on site or injected into the natural gas grid, subject to permissions and an economic assessment. The sizing of AD plants varies and will be dependant upon the feedstocks available.

9.5.3 Opportunity for farm diversification

The farm diversification opportunity is for a farm, or multiple farms to collaborate to build, own and operate an AD plant to produce renewable gas for grid injection or transport, or to generate renewable electricity through a CHP engine. Critical to this opportunity is a secure supply or organic materials, referred to as the 'feedstock'. This will include local chicken litter waste, other farm wastes such as manure and waste from local food processing companies, reducing the cost of disposal of farm waste to feedstock suppliers. An additional benefit is that the by-products of undigested waste from an AD plants make useful fertiliser material for local farms such as the mushroom producing farms, closing the loop of the circular economy.

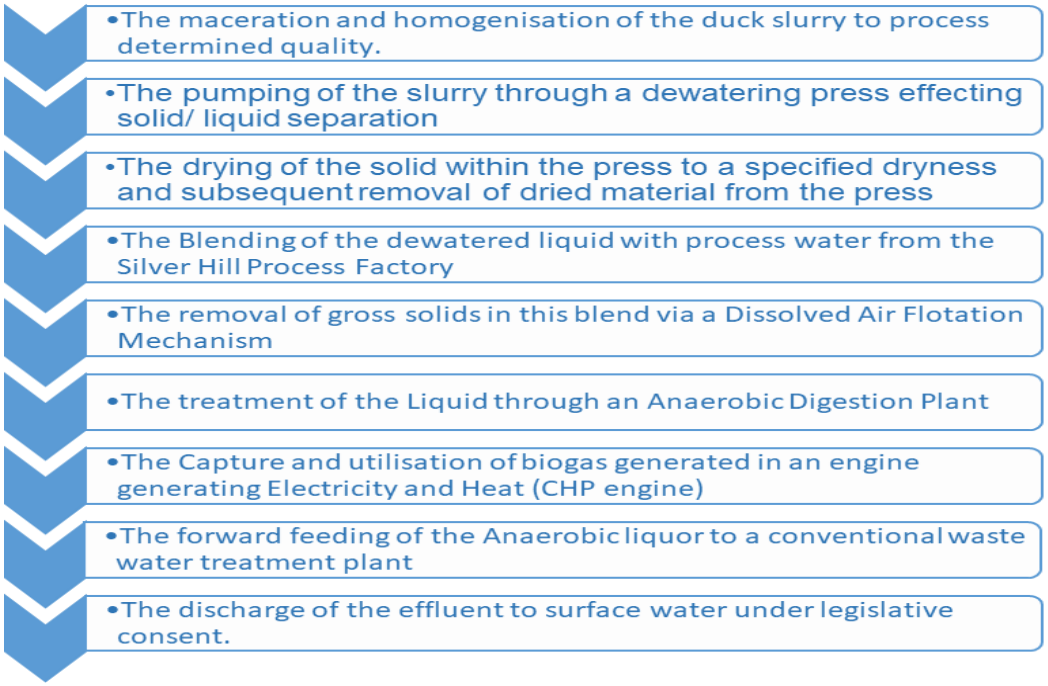
In 2005 a local duck farming enterprise, Silver Hill Foods, developed an AD plant with assistance from the EU LIFE programme. The objective of the project was to deal with duck slurry waste in light of tighter restrictions on land spreading imposed by the Nitrates Directive. In the north east of County Monaghan the land has a poor capacity for sustainable application of animal slurries and also has a high concentration of intensive farming, which had resulted in low quality of waterways in the region.

The aims of the project were to

- Develop a sustainable, cost-effective mechanism for the processing of duck slurry into a solid fertiliser
- Eliminate the potential problem of diffuse water contamination from existing land spreading operations.
- Demonstrate a full-scale working model of the application of new technology to the management of animal wastes.

- Reduce the emissions of greenhouse gases from storage and transport of duck slurry and, indirectly, from manufacture of artificial fertiliser[1]

The process involved the following stages:



The drying stage of the project encountered problems and did not achieve the required dryness of the solid fraction of the waste. It was planned that this dried material could be treated further resulting in a fertiliser product, however this was not possible. Various different approaches were taken to try and resolve this issue without success. The ammonia levels resulting in the dewatered liquid were also discovered to be above the threshold concentrations acceptable in the AD plant and would have caused inhibition of the anaerobic digestion process. This therefore prevented the generation of biogas and subsequent use to generate heat and electricity. At the time of the operation of the plant, there was no suitable ammonia removing technology available, therefore the company reverted back to land spreading of the manure under regulatory controls. The plant has now been decommissioned.

It is important to note that Silverhill no longer has any flocks on site and instead has a network of 21 growers from across Ireland. 12 of these farms are located in County Monaghan, and must dispose of their duck slurry waste by land spreading, as regulated under the Nitrates Directive.

It is understood that Silver Hill Foods and another poultry company have engaged with an AD consultant on the feasibility of an AD plant located in County Monaghan as it is recognised that this is required by growers in the county. Monaghan County Council have also engaged with the consultants.

The learning from this project should be investigated further and contact made with stakeholders mentioned above, with the view to inputting to an AD working group for County Monaghan.

[1] LIFE 3.0 - LIFE Project Public Page (europa.eu)

9.5.4 Considerations

This opportunity is dependent on a secure feedstock and an onward market for the gas or electricity produced. Additionally contractual agreements between all parties are important in any shared ownership arrangement.

The economics will depend on the scale of the digester and the availability of feedstocks being digested. AD requires a high capital cost, estimated at €6-€8 million depending on whether the use if for electricity or gas. This estimate is based on enquiries with AD operators for the cost of an AD plant of a scale which would produce the gas equivalent of 500kWp of electricity. Payback will therefore be determined by the price received for the renewable electricity or gas produced.

There is currently no Renewable Energy Feed-in Tariff (REFIT) supporting AD in the Republic of Ireland. Economics are not favourable for digesting energy crops/grasses and these are not a sustainable use of high quality cereal crops. However, with access to food wastes and operating a site gate fee for waste disposal, the projects' viability may become favourable. This would require a detailed feasibility study to justify investment.

The level of investment required means that a project of this type is normally investor or developer led and as such may not appeal to landowners. Such a project becomes third party led and therefore there is a risk that farmers could become client stakeholders rather than operators which makes it less of a farm diversification opportunity. A 'Co-Operative' arrangement would be a possible solution.

9.5.5 Recommendations

1. A working group should be established to commission a feasibility study. In order to progress this option, it is suggested that a commercial enterprise / promoter such as a local agri-food business should be involved, in addition to stakeholders from the Silver Hill Food AD project in the working group.

2. A pilot sized project could be considered similar to that discussed in Section 0 for a proof of concept.

10.0 Case studies

10.1 Egni Solar Co-Op, Wales

10.1.1 Background

Egni is a cooperative which was set up by Awel Aman Tawe (with support from Renew Wales) a community energy charity working to make a difference to the lives of people at the top of the Swansea and Amman Valleys. Egni is registered with the Financial Conduct Authority.

First Egni approached Newport Council and Swansea Council to secure their cooperation in the scheme. The two councils then put forward suggested sites to develop under the scheme. The Co-op then secured a loan in order to finance the construction of the solar installations. In addition to this loan, the Co-op also ran a scheme where people would buy shares in to survey and design the systems.

The Phoenix Centre

Townhill, Swansea SA1 6PH

Live since: *October 2016*

Size: *30 kW*

Est. Annual Generation: *25,500 kWh*

Installer: *SolaRFIT*

10.1.2 What is an energy co-operative?

The co-op gathers lots of people together to invest collectively in rooftop solar PV systems. Once the solar systems are installed, the electricity generated qualifies for a government subsidy called the Feed in Tariff (FiT) additionally Egni is paid for any excess electricity exported to the grid and the sites get electricity at a 20% discount. The revenue raised flows back into the co-op and is used to pay interest to members in addition to funding maintenance and development of future projects.

The co-operative aims to install 250 PV systems and has over 1000 members.

10.1.3 Financial benefits to members

Members purchase shares at £1 each, with the minimum investment being £50 and the maximum being £100,000. Owning shares means a member can participate in the operation of the co-op through a 'one member, one vote principle'. Members also elect a board of directors on a 3 year rotation. The co-op offers a projected return of 4% to all members over the 20 year lifetime of the scheme. This income is inflation – protected since the sources of revenue (feed in tariffs and exported electricity) increase in line with the retail price index.

Egni members own the solar panels and associated equipment. The board of directors manages the installation of the solar PV systems and deals with contractors and maintenance. The revenue from the generation and export is used to:

- pay any maintenance & repairs required for the panels and associated equipment
- pay for the running costs of Egni
- payments into a repair fund for replacement of the inverters
- fund annual interest payments to investors and capital repayments
- fund an educational and awareness raising programme

Awel Aman Tawe also owns and runs two 2.35 MW Enercon wind turbines on Mynydd Gwyrhyd, near Swansea, and is in the process of developing a 2.23MW solar farm adjacent to the turbines. The 4 hectare site on which the turbines are located has grid connection capacity for 4.7MW and therefore the co-op wanted to make full use of capacity available. They also intend to install 5MW of battery storage at the site, to enable storage of energy from the renewables which can be exported at times of peak demand.

Although the Feed-in-tariff (FiT) is not a mechanism currently available in Ireland, the Egni Solar Co-op is a good example of community ownership. A similar community ownership model could be applied in County Monaghan for the development of e.g. a community solar farm or wind turbine/ wind farm. Community renewable electricity projects over 500kW are eligible under the Renewable Electricity Support Scheme (RESS) and would provide an income to investors. (see 10.3.1 below)

10.2 Drumlin Wind Energy Co-Operative (DWEC) Limited, Northern Ireland

10.2.1 Background

Drumlin Wind Energy Co-operative was established in 2012 with the aim to generate clean, green electricity and reduce reliance on energy sources which have a negative environmental impact in Northern Ireland. DWEC enabled individuals and organisations to become members and invest for a reasonable financial return in the local enterprise.

DWEC supported by Energy4All raised £2.7 million in 2012, through a public share offering enabling local people in Northern Ireland and beyond to become members of the co-op by purchasing shares. The DWEC also secured a loan of £340,000 from Ulster Community Investment Trust to meet the total capital cost of £3.1 million. The funds from this were used to deploy four 250kW wind turbines across Northern Ireland at the following locations: Cavanoneill, Aghafad, Ballyboley and Parkgate. In the 2014 the DWEC raised an additional £1.2 million to support the deployment of two additional 250kW wind turbines (Cavanakill, Ballyrobert) bringing their total community owned and managed wind turbines to six 250kW Vestas turbines. All six turbines are now generating clean, green energy and is supported by the local community. The turbines themselves are designed to have a life span of 25 years and produced 2266MWh of power in 2017 alone. This was enough energy to supply the electricity needed for 600 homes.

Figure 36: 250kW Vestas wind turbine located at Ballyboley, Northern Ireland being erected

10.2.2 How does the DWEC work?

The electricity which is generated by the wind turbines owned by the DWEC is sold to the electricity markets through a Power Purchase Agreement (PPA). Following payment of operation, maintenance, rent, insurance, and administration costs the surplus profits will be made available and distributed as a share interest payment to members of the DWEC. In addition, each wind turbine within the DWEC has committed £2000 per year to the local community. The community fund can be used to support local environmental and social projects in the areas local to each wind turbine. DWEC engages with the local community to educate them on the benefits of renewable energy. The DWEC provides lessons for children in local schools through the Drumlin Energy School Programme. The aim of this programme is to raise awareness of renewable energy sources amongst children and increase their knowledge on how wind turbines work. The DWEC want to engage children in the energy transition that is occurring.

10.3 Potential for community energy schemes in County Monaghan

The community projects detailed above represent potential Renewable Energy Co-operative models which could be developed in County Monaghan. To progress this idea, the SEC should engage with Energy Co-operatives Ireland, a co-operative renewable energy consultancy promoting community access to the benefits of renewable energy in Ireland. They provide support to community-based renewable energy co-operatives at each stage of development, including the legal process of setting up a cooperative. They provide advice on dealing with state agencies and introduce new co-operatives to a network of co-operatives where they can learn from the best practice examples and communicate their message locally and nationally.

Benefits of locally owned renewable energy

- **Local ownership results in more renewables**
  In countries with a legal and financial environment that enables local renewable developments, local investment has played a major role. In Denmark, for example, 86% of all wind turbines are owned by local investors.
- **Local ownership creates local dialogue and acceptance**
  Through dialogue with different interest groups, energy co-ops generate a widespread understanding for and social acceptance of renewables.
- **Local ownership raises public awareness**
  The local development of renewables allows people to engage with the technology. Electricity becomes something that does not simply appear from the socket.
- **Community investment promotes cheaper and better technologies**
  Co-ops often pay more attention to detail for projects since, for utilities and big companies, renewables are only a small part of their business.
- **Local renewables are democratic**
  With local investment in power production, local people take decisions on planning and implementation of the power supply. This brings more responsibility to the local level.
- **Local production makes sustainable development understandable**
  Egni Coop is a local and clear example of how people can contribute to sustainable development. It illustrates our use of resources and enable us to see the consequences of their use.
- **Local ownership gives people opportunity to act for sustainable development.**
  Egni is engaging people in practical and sustainable action.
  Source:https://egni.coop/

10.3.1 Renewable Electricity Support Scheme (RESS)

The community commitments of RESS seek to support sustainable community energy projects, particularly in rural Ireland, delivering on national policy goals of climate action, rural regeneration, social cohesion, capacity building and community development as well as ensuring local communities' benefit from RESS projects.

The Programme for Government, Our Shared Future underlines the importance of community participation in energy projects. Community energy can play an important role in reaching the at least 70% renewable electricity target by 2030.

The community features within RESS include a separate community category within the RESS auction to give a route to market for community led generation projects. This resulted in seven community projects gaining support in the RESS-1 auction in 2020.

The RESS contains an enabling framework of measures to support communities to develop renewable electricity projects to feed the category including trusted intermediaries, trusted advisors, financial supports, and information guides. SEAI offers support to communities interested in developing their own renewable electricity generation projects and wish to bid in the Community Category of RESS auctions. In addition, a mandatory community benefit fund set at €2/MWh for all generation projects to be used for wider economic, environmental, social, and cultural well-being of the local community. The community benefit fund under the first RESS auction will deliver close to €4 million a year to sustainable community initiatives targeted at those communities living near the RESS-1 Projects.

Community-led projects can apply for RESS if they meet the following criteria:

- Application must be made in conjunction with a Sustainable Energy Community (SEC)
- Project size must be between 0.5 and 5MW
- Fully (100%) owned by a Renewable Energy Community (REC) – a legal entity, whose primary purpose is community benefit (environmental, economic, or social) rather than financial profit
- Community group must be based on open and voluntary participation
- Participation based on local domicile (within proximity to the RESS project)

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Appendix 3 - Methodology

Baseline Energy Use

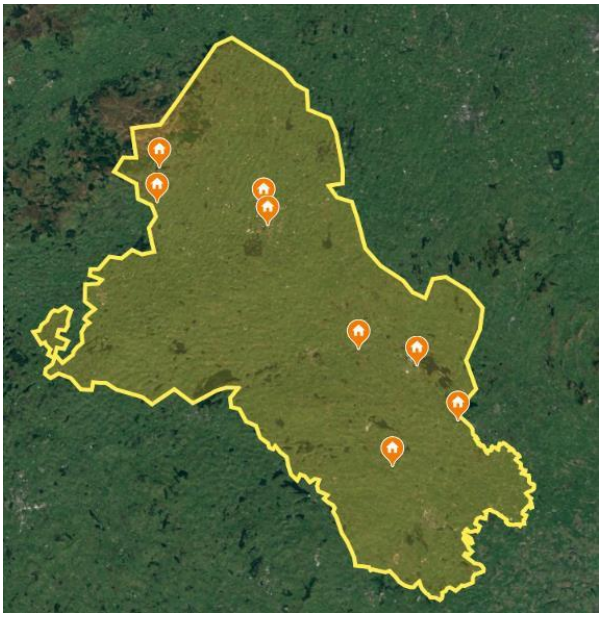
The baseline energy use for County Monaghan was calculated for the year 2016 as the most useful data sources, such as the most recent CSO census, had been collected in this year. The baseline includes key sectors within the area such as the residential electricity, heat and transport and agricultural sectors. All sectors analysed include a breakdown of both electricity and fuel usage with associated energy spend and carbon emissions. Where possible, bottom-up data has been used to inform calculations within the baseline but where this has been unavailable, published data on a County level has been gathered and collated from sources such as SEAI, CSO, Teagasc and the National BER database.

Energy Audits

Energy audits were conducted on eight residential properties, two poultry farms and two community buildings.

Residential energy audits

The residential properties chosen for audit were selected from a list of volunteers who expressed interest in having their homes energy efficiency assessed. The location of each of the residential properties audited can be seen in the figure below. The housing types were predominantly detached houses or bungalows, which represents to main dwelling type in the county, with only one being a mid-terraced property. Construction dates ranged from 1965 – 2009. Energy audits were conducted remotely through circulation of an energy audit questionnaire as well as telephone and email communication to obtain additional information.



Location of residential energy audit properties

The questionnaire was used to gather key information such as building fabrics (insulation levels), BER's, electricity and heating usage and energy saving measures currently in place within each of the residential properties. Electricity and heating consumption was compared with the national average for 2019 to determine if the property has above or below average energy usage.

Electricity and heating bills were taken for the 2019 period where available to reflect normal energy consumption pre-covid. Each report outlines a list of measures aimed at reducing energy consumption associated with electricity and heating, renewable energy opportunities and information on grant support where appropriate.

Poultry farm audits

Two poultry farms identified by the SEC were chosen for audit, located in Clontibret and Doogary. Energy audits were conducted both remotely, through circulation of a farm energy audit questionnaire to each of the farm owners, in addition to telephone communications and site visits conducted in July 2021. Key information was gathered such as current energy sources, annual energy consumption & spend and existing technology/equipment. Each report outlines the farms potential for energy efficiency improvements and scope for installing renewable energy technologies. (Site visits to be carried out)

Community building audits

Two community buildings identified by the SEC were chosen for audit, Blackwater Learning Centre and St. Michael's Community Development. Energy audits were conducted both remotely, through circulation of a community building energy audit questionnaire to each of the site representatives, and in person in July 2021. The questionnaire was used to gather key information such as building occupancy, building fabrics (insulation), BER's, electricity and heating usage as well as energy saving measures currently in place within each of the community buildings. Each report outlines energy saving measures which can be implemented within community buildings to reduce electricity and heating usage.

Stakeholder consultation

Consultation with various stakeholders was conducted during the project as follows:

- Irish farmers association
- Teagasc farm advisors – poultry, beef, sheep, dairy, pig, mushroom, crop
- Environmental Protection Agency
- CSO departments: Environment, Agriculture, Business
- Agricultural Development and Advisory Service
- Local Enterprise Office Monaghan
- SEAI Business Support
- Dunleer SEC / Energy Team
- Monaghan County Council - Housing Division
- Monaghan County Council - Enterprise Development
- Monaghan County Council - Communications & Marketing
- Monaghan County Council – Environment Department
- Respond Housing
- Doohamlet Community Centre
- Monaghan Local Enterprise office
- Monaghan Mushrooms
- Eurotech Renewables

Register of Opportunities

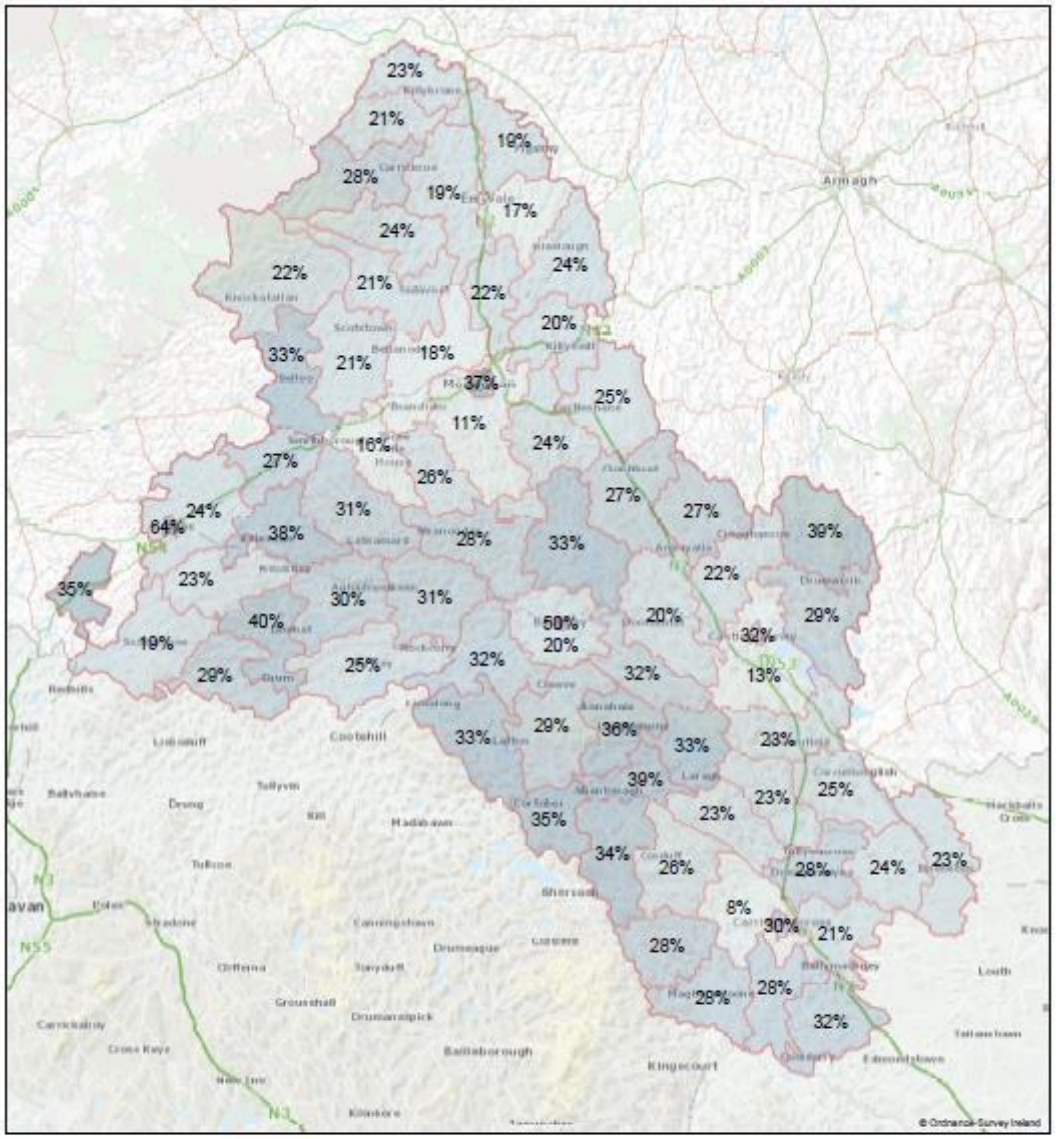
The Register of Opportunities is an Excel spreadsheet which is intended to be used as a live document and updated regularly by the SEC group. It records all opportunities which have been identified as part of this study including, where appropriate, costs and savings. The register also includes opportunities identified during the energy audits of the two community centres, two poultry farms and generic opportunities from the 8 residential audits.

Each opportunity is categorised under Type (behavioural, process, building upgrade), Cost (low, medium, high) Impact in terms of energy, CO_2 & cost reduction (low, medium, high) and Ease of Implementation (easy, moderate, difficult).

An extract of the Register of Opportunities is shown below:

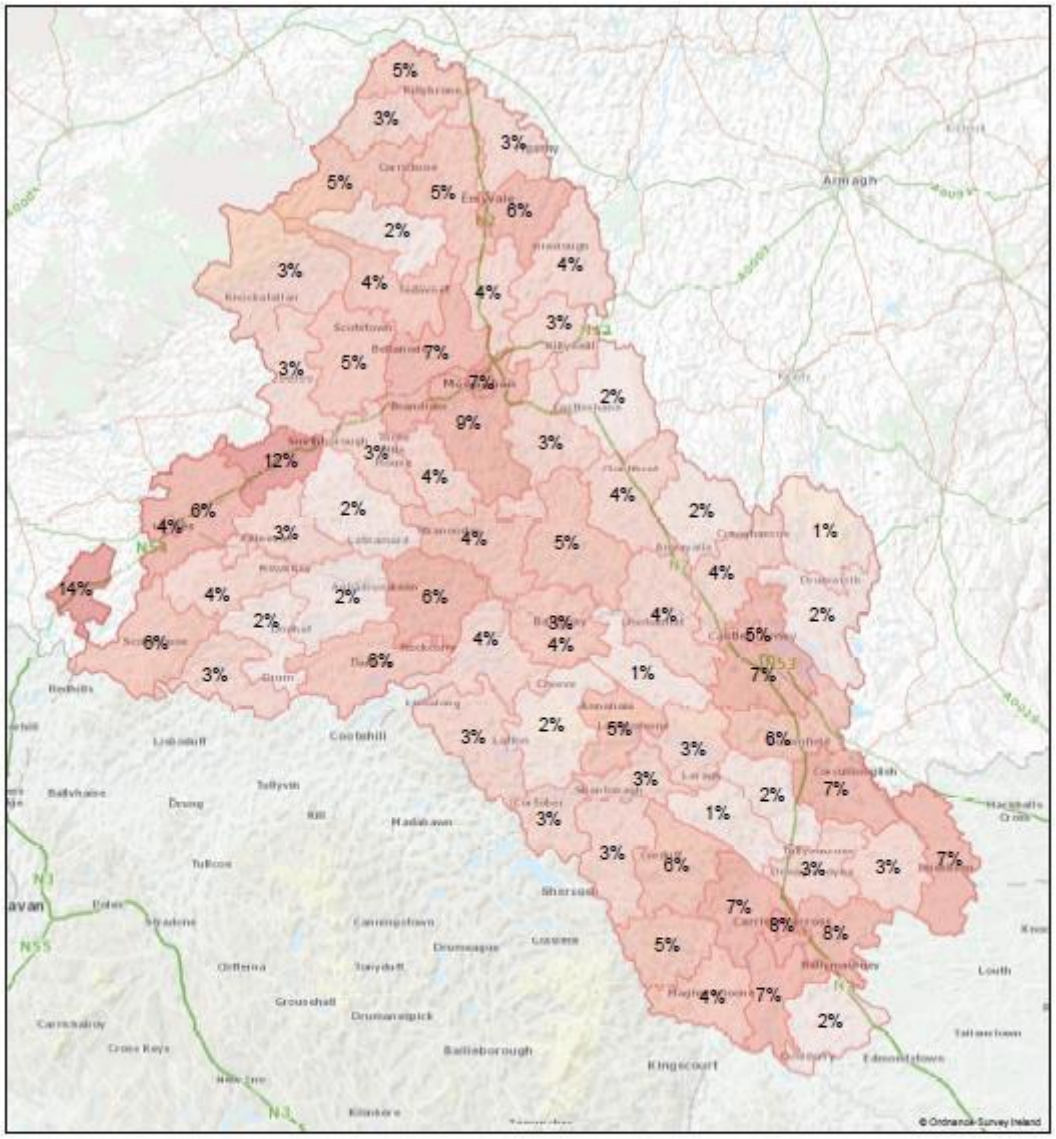
Measure	Specific Actions	Type	Cost	Impact – energy, CO2 & cost reduction	Ease of Implementation	Investment	Saving €/yr	Saving kWh/yr	CO2 emission savings (tonnes/yr)
Residential Opportunities									
Development of one-stop-shop model	Request for quotation to be issued to suitable consultants regarding development of 'One-stop-shop' business case model	Process	Medium	High	Difficult	Up to €3800 (remaining SEAI budget)			
	Liaise with Energy Team in relation to their experience in setting up 'One-stop-shop' (Potentially include in action above)					SEC members' time			
	Liase with other SECs in County Monaghan with view to combined approach to funding application under SEAI Community grant (Railway View, Castleblayney Sustainable Energy Group, Sicín, Glaslough, Knockatallon Development Co CLG, Tydavnet Group Water Scheme)					Unknown at present			
	Contact local SEAI Project Co-Ordinator to partner with.					SEC members' time			
	Use Monaghan SEC website to promote service and update as required					<€500			
	Plan and implement the set-up/initial phase.	Process	Medium	High	Moderate				
Small area Mullaghmatt - increase BER rating to B2 (from assumed average of C3) for 50% of homes (19 homes)	Highest deprivation index, highest coal heating , highest pre 1980s houses target these areas with a leaflet campaign - flyer with SEC details and link to an online suvey with an incentive i.e. local shopping voucher. Target community events in Monaghan town centre	Building upgrade	High	High	Moderate	€285,000 - €380,000	€ 49,941	237,500	61.87
Small area Castleblayney: Drumillard, The Crescent & Bree - increase BER to a B2 (from assumed average of C3) for 50% of homes (17 homes)	This small area has a high proportion of pre 1980s houses	Building upgrade	High	High	Moderate	€255,000 - €340,000	€ 111,710	531,250	138.40
Residential energy audits - Potential group of 7 homes with oil heating which can be put forward for an SEAI Community grant application (Better Energy Communities) for heat pump upgrade.	N/A	Process	Low	High	Moderate	€105,000 - 140,000			
Farm Opportunities									
Investment in energy efficiency in 50% of dairy farms (353 farms)	Install Teagasc recommended dairy farm energy savings actions i.e. milk pre-cooling, night rate electricity, synchronise water heater with night rate, VSDs, solar thermal heating, heat recovery system (total €11,200 per farm)	Process	High	High	Moderate	€ 3,957,130	£ 2,354,510		
Poultry farm opportunities- Shanemullagh									
Install 20kW Solar PV system spread over 2 roofs on Broiler sheds 4 and 5. This could contribute to a maximum of 14% of site electricity demand per year.		Building upgrade	High	Medium	Moderate	€ 34,000	€ 3,035	15,976	5.42
Community Building Opportunities - Blackwater Learning Centre									
Replace existing lighting with LED alternatives throughout the building	N/A	Building upgrade	Medium	High	Moderate	£ 1,700.00	€ 1,139	7909	2.6

Appendix 4 - CSO mapping



Homes - Pre 1960

- 8% - 18%
- 19% - 26%
- 27% - 32%
- 33% - 40%
- 41% - 64%



Homes - 1960s

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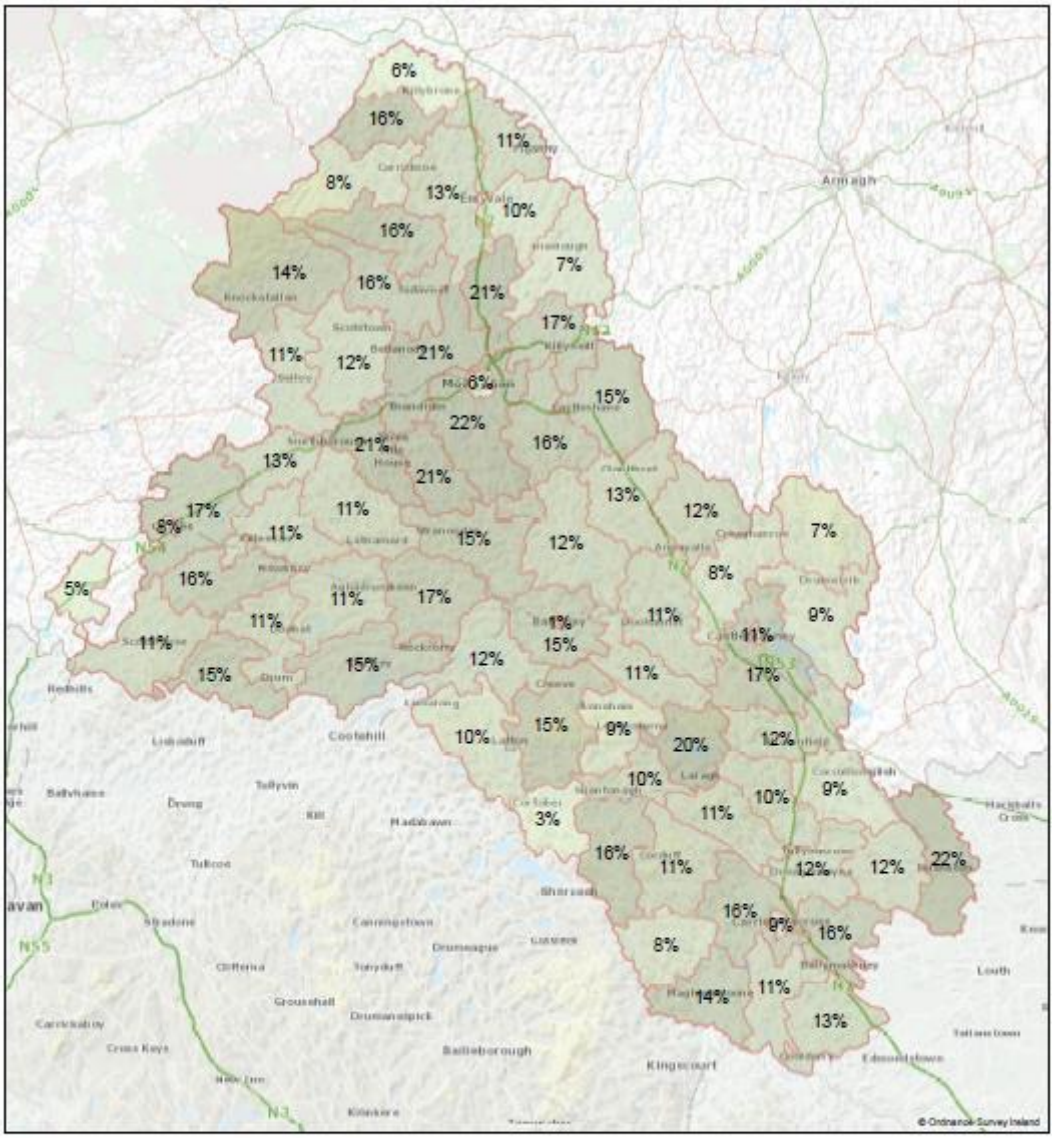
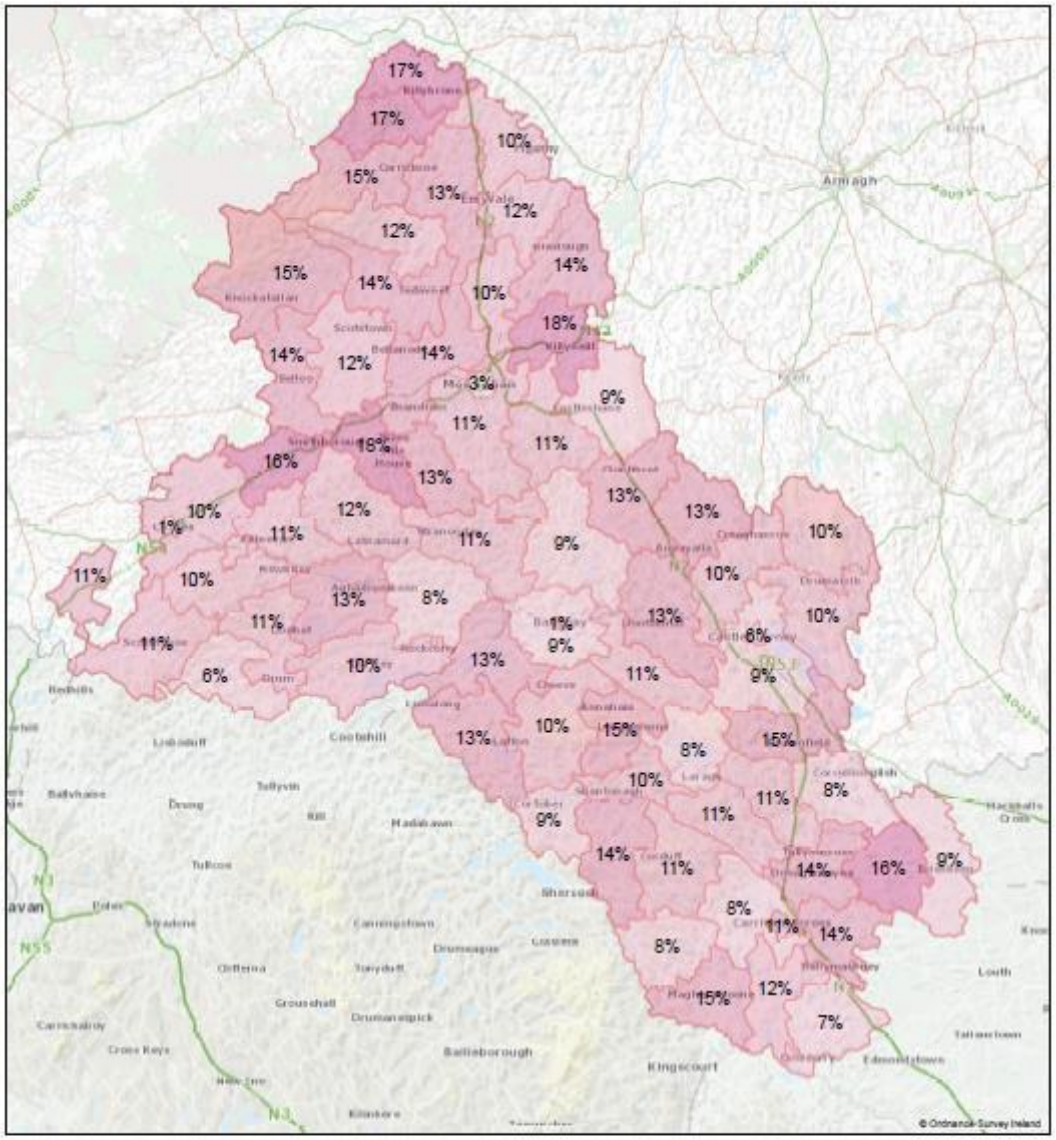
- 3% - 4%
- 5% - 6%
- 7% - 9%
- 10% - 14%



Homes - 1970s

- 1% - 6%
- 7% - 10%
- 11% - 13%
- 14% - 17%
- 18% - 22%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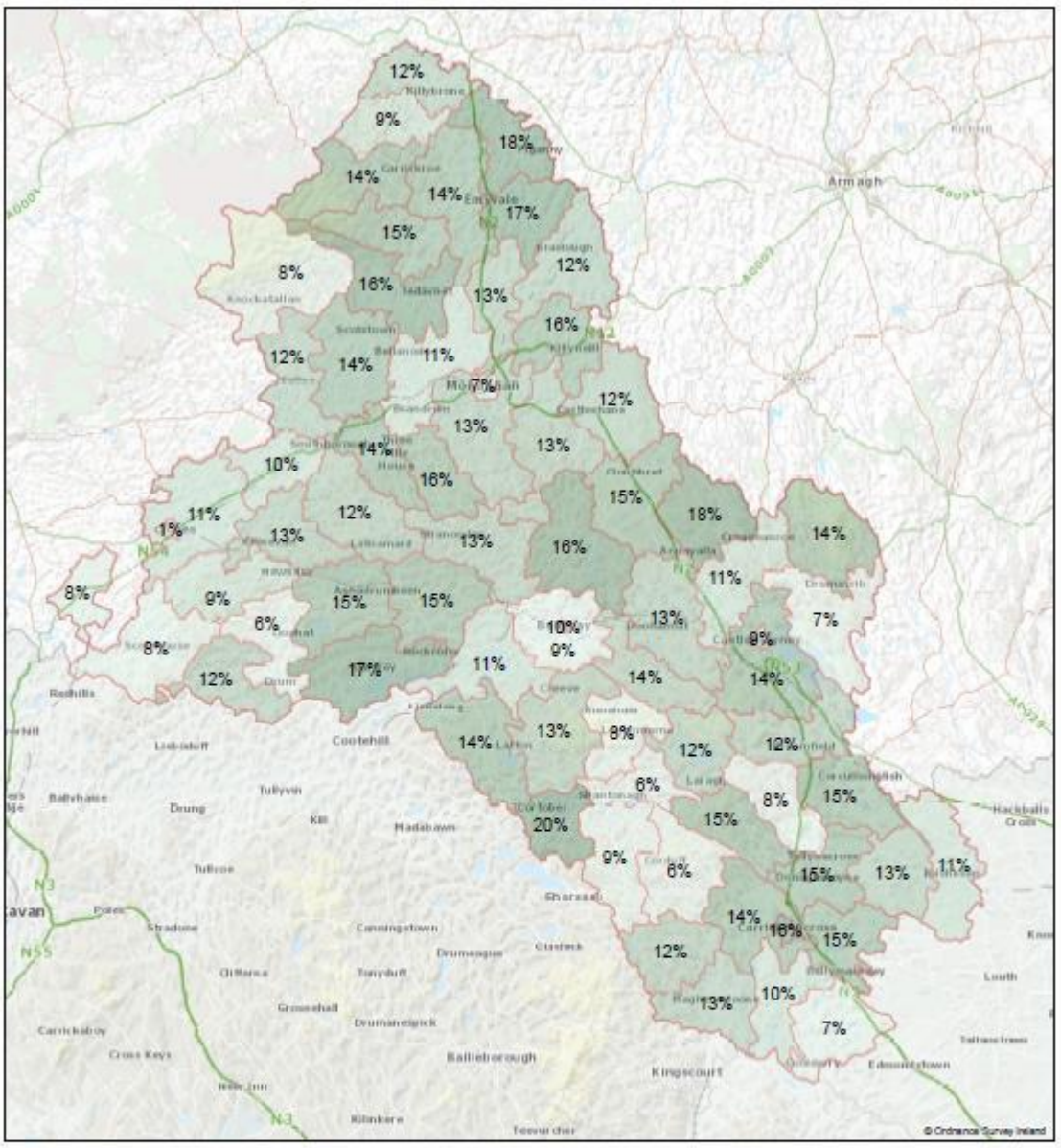
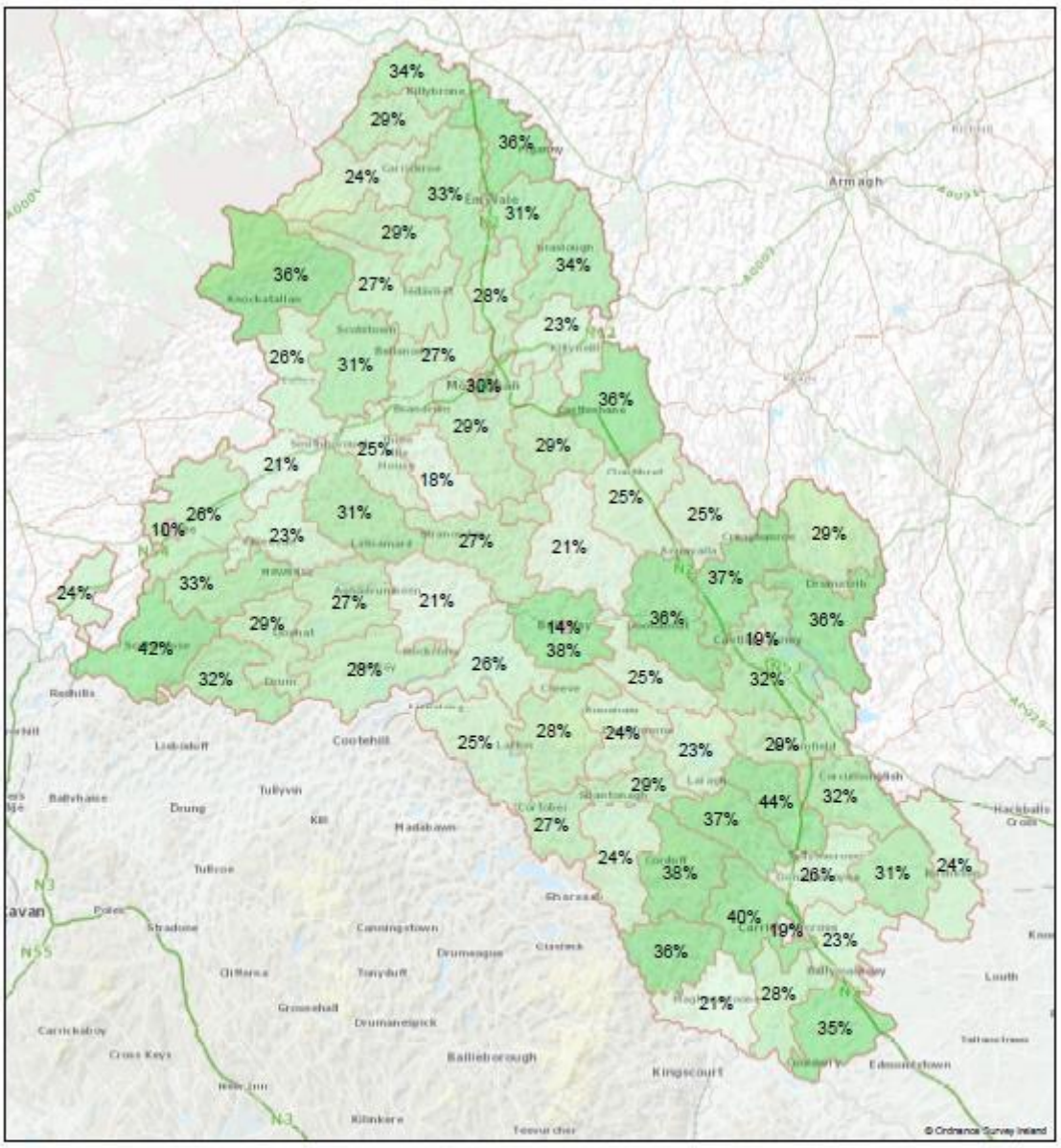
Carrickmore
Emyvale
Scotstown
Knockatallon
Belleek
Monaghan
Castleblayney
Keadue
Ballybay
Crossmaglen
Newtownhamilton
Cootehill
Ballyhaise
Tullyvin
Drung
Redhills
Lisdoonvarna
Tullow
Shercock
Carrickmacross
Inniskeen
Castleblayney
Ballybay
Clones
Scotstown
Glaslough
Ballinamallard
Oldtown
Ballinamallard
Omeath
Ballybay
Castleblayney
Carrickmacross
Inniskeen
Dundalk
Louth
Ardee
Kingscourt
Ballieborough
Cross Keys
Kilnaleck
Oldcastle
Virginia
Navan
Kells
Athboy
Trim
Enfield
Edenderry
Tullamore
Portlaoise
Mountmellick
Ballybrittas
Clonaslee
Mountrath
Abbeyleix
Durrow
Castletown
Ballacolla
Stradbally
Ballinakill
Portarlington
Rathdowney
Borris-in-Ossory
Roscrea
Birr
Banagher
Shannonbridge
Ferbane
Clara
Tullamore
Edenderry
Rathangan
Kilcock
Maynooth
Celbridge
Leixlip
Lucan
Clondalkin
Tallaght
Dublin
Swords
Malahide
Howth
Balbriggan
Skerries
Rush
Lusk
Donabate
Portrane
Ashbourne
Dunshaughlin
Ratoath
Kells
Navan
Slane
Drogheda
Termonfeckin
Castlebellingham
Dunleer
Ardee
Collon
Louth
Carlingford
Omeath
Newry
Kilkeel
Warrenpoint
Rostrevor
Hilltown
Castlewellan
Dundrum
Newcastle
Downpatrick
Ballynahinch
Saintfield
Crossgar
Killyleagh
Strangford
Portaferry
Kircubbin
Newtownards
Comber
Donaghadee
Bangor
Holywood
Belfast
Lisburn
Dromore
Banbridge
Rathfriland
Kilkeel
Newry
Crossmaglen
Keady
Armagh
Portadown
Lurgan
Craigavon
Moira
Hillsborough
Dromara
Ballynahinch
Castlewellan
Newcastle
Kilkeel
Warrenpoint
Rostrevor



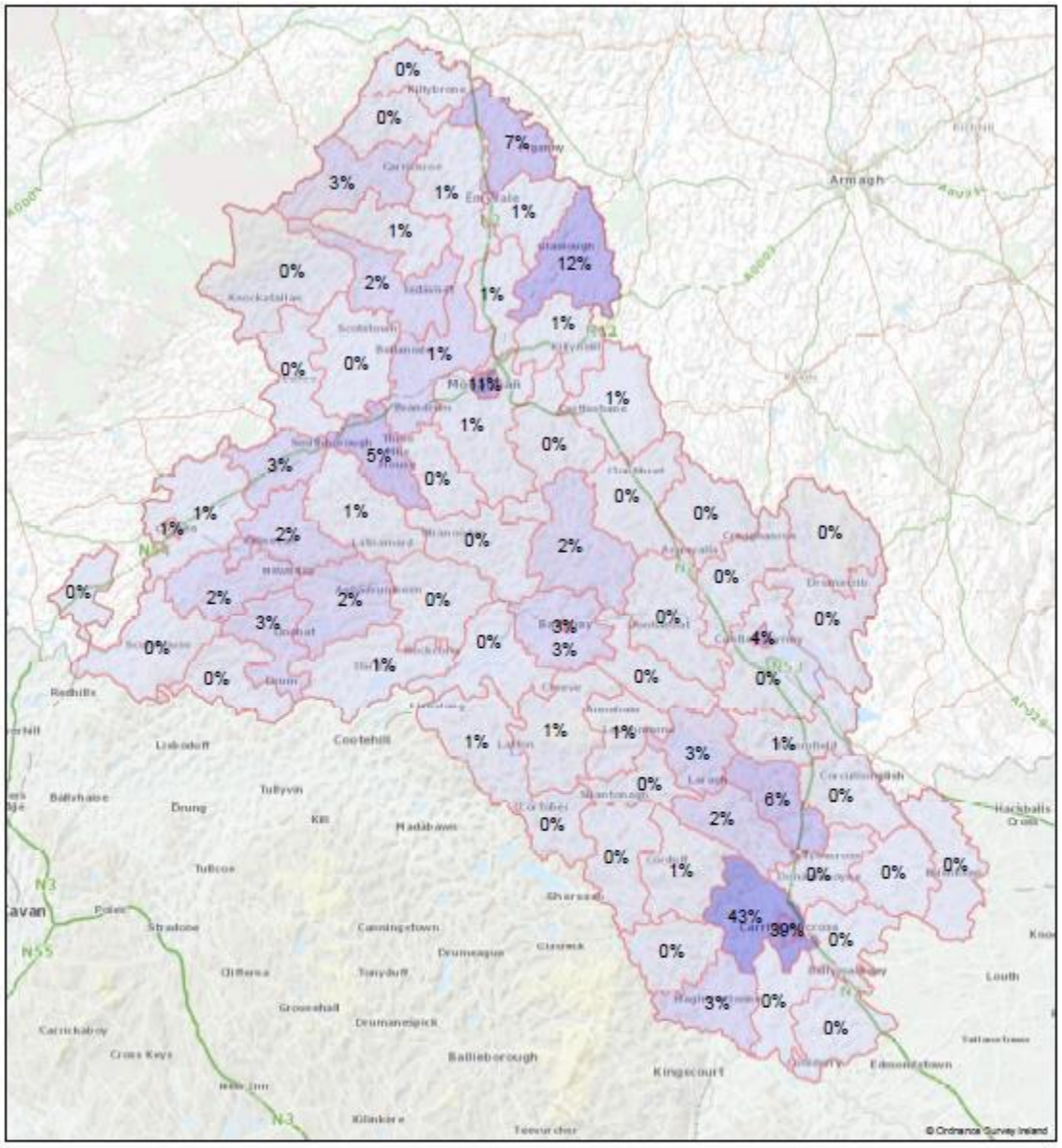
Homes - 1990s

- 1% - 9%
- 10% - 11%
- 12% - 14%
- 15% - 16%
- 17% - 20%



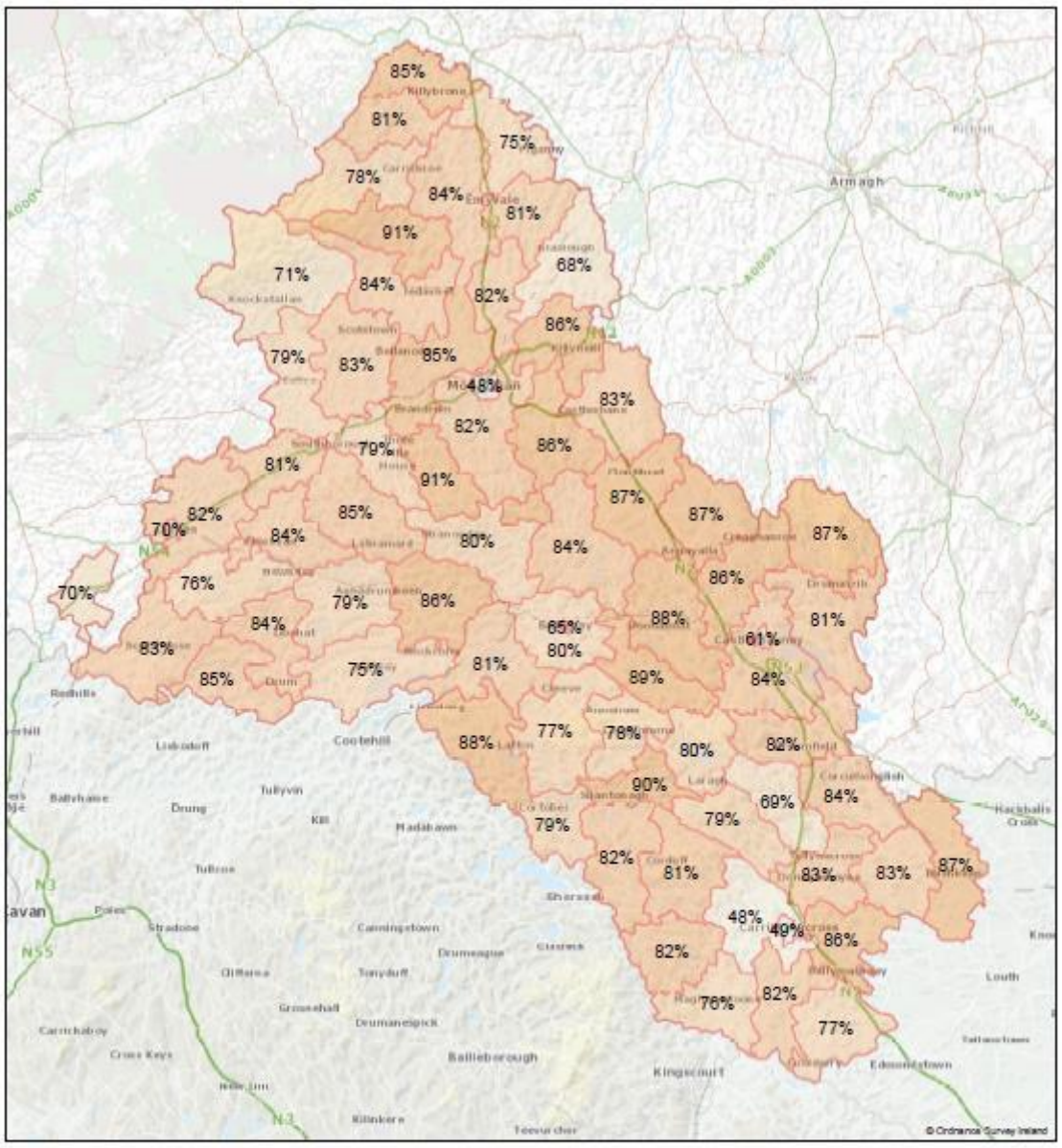
Homes - Post 2001

- 10% - 21%
- 22% - 26%
- 27% - 29%
- 30% - 34%
- 35% - 44%



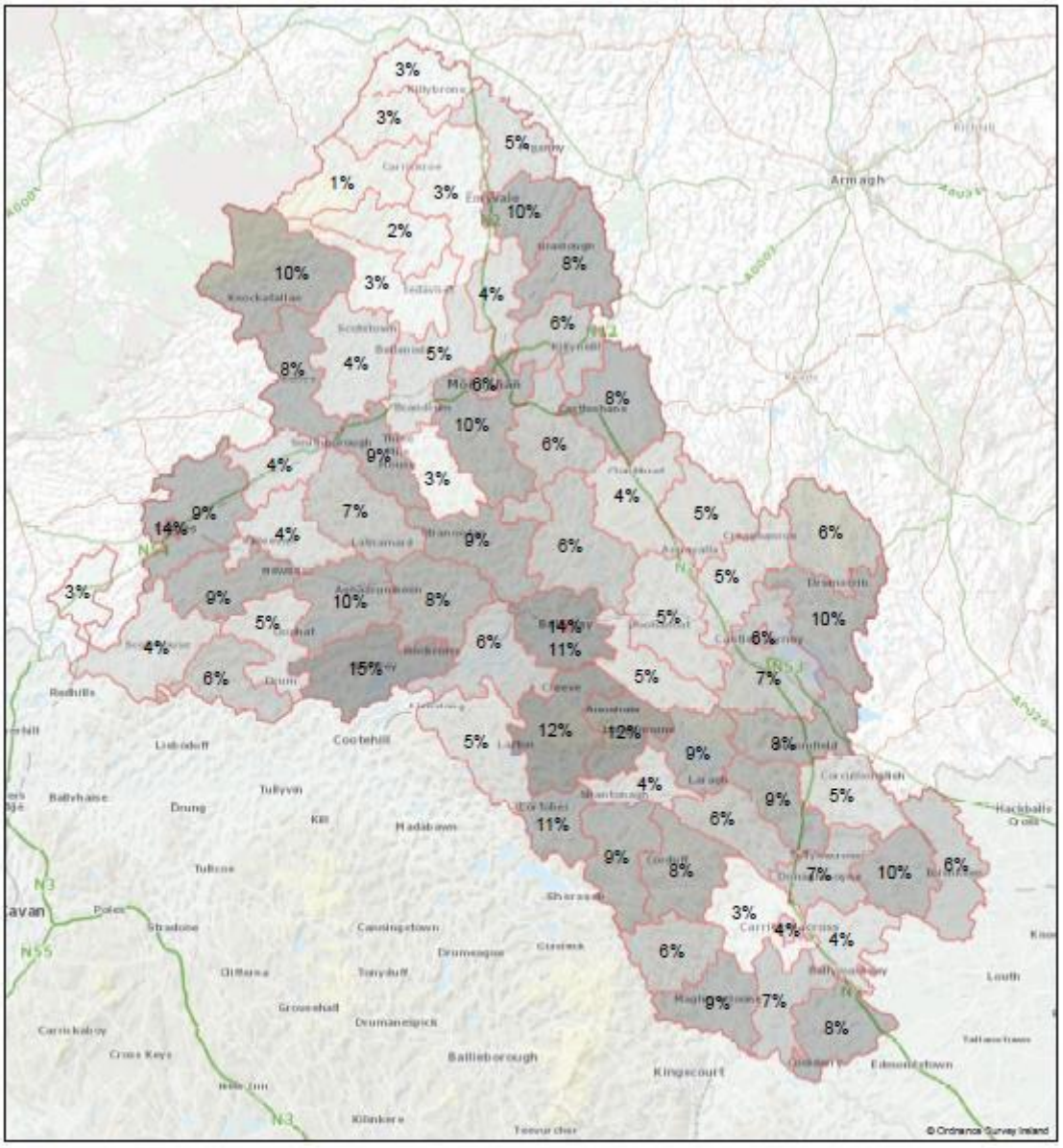
Home heating - Natural Gas

- 0% - 1%
- 2% - 3%
- 4% - 7%
- 8% - 12%
- 13% - 43%



Home heating - Oil

- 48% - 49%
- 50% - 71%
- 72% - 80%
- 81% - 85%
- 86% - 91%



Home heating - Coal

- 1% - 3%
- 4% - 5%
- 6% - 7%
- 8% - 11%
- 12% - 15%

Appendix 5 - ADAS farm data

Electricity consumption			
Enterprise and assessment unit	**Average range (kwh per year)**		**Average/ kwh per year**
	Lower	*Higher*	
Dairy (per cow)	273	434	354
Arable (per ha)	66	225	146
Pig (per head)	41	447	244
Beef & sheep (per head)	36	63	50
Broilers (per 1000 birds)	330	2200	1265
Layers (per 1000 birds)	2270	3900	3085
Grain drying (per tonne)	41	123	82
Potato storage (per tonne)	55	123	89

Fuel consumption			
Enterprise and assessment unit	**Average range (L per year)**		**Average/ L per year**
	Lower	*Higher*	
Dairy farm vehicle (fuel per cow)	44	90	67
Arable farm vehicle (fuel per ha)	123	236	180
Grain drying by 3% (fuel/tonne)	9	12	11
Beef and sheep (fuel per head)	8	15	12
Beef and sheep heating (per head) including farmhouse	8	12	10
Greenhouse heating oil (per ha)	123582	297858	210720

Appendix 6 - Business Energy Use Survey- NACE Rev 2 Sector: Manufacture of Food, Beverages and Tobacco (10-12)

n.e.c. : not elsewhere classified				* part of
Division	Group	Class		ISIC Rev. 4
			SECTION C — MANUFACTURING	
10			Manufacture of food products	
	10.1		Processing and preserving of meat and production of meat products	
		10.11	Processing and preserving of meat	1010*
		10.12	Processing and preserving of poultry meat	1010*
		10.13	Production of meat and poultry meat products	1010*
	10.2		Processing and preserving of fish, crustaceans and molluscs	
		10.20	Processing and preserving of fish, crustaceans and molluscs	1020
	10.3		Processing and preserving of fruit and vegetables	
		10.31	Processing and preserving of potatoes	1030*
		10.32	Manufacture of fruit and vegetable juice	1030*
		10.39	Other processing and preserving of fruit and vegetables	1030*
	10.4		Manufacture of vegetable and animal oils and fats	
		10.41	Manufacture of oils and fats	1040*
		10.42	Manufacture of margarine and similar edible fats	1040*
	10.5		Manufacture of dairy products	
		10.51	Operation of dairies and cheese making	1050*
		10.52	Manufacture of ice cream	1050*
	10.6		Manufacture of grain mill products, starches and starch products	
		10.61	Manufacture of grain mill products	1061
		10.62	Manufacture of starches and starch products	1062
	10.7		Manufacture of bakery and farinaceous products	
		10.71	Manufacture of bread; manufacture of fresh pastrygoods and cakes	1071*
		10.72	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes	1071*
		10.73	Manufacture of macaroni, noodles, couscous and similar farinaceous products	1074
	10.8		Manufacture of other food products	
		10.81	Manufacture of sugar	1072
		10.82	Manufacture of cocoa, chocolate and sugar confectionery	1073
		10.83	Processing of tea and coffee	1079*
		10.84	Manufacture of condiments and seasonings	1079*
		10.85	Manufacture of prepared meals and dishes	1075
		10.86	Manufacture of homogenised food preparations and dietetic food	1079*
		10.89	Manufacture of other food products n.e.c.	1079*
	10.9		Manufacture of prepared animal feeds	
		10.91	Manufacture of prepared feeds for farm animals	1080*
		10.92	Manufacture of prepared pet foods	1080*
11			Manufacture of beverages	
	11.0		Manufacture of beverages	
		11.01	Distilling, rectifying and blending of spirits	1101
		11.02	Manufacture of wine from grape	1102*
		11.03	Manufacture of cider and other fruit wines	1102*
		11.04	Manufacture of other non-distilled fermented beverages	1102*
		11.05	Manufacture of beer	1103*
		11.06	Manufacture of malt	1103*
		11.07	Manufacture of soft drinks;production of mineral waters and other bottled waters	1104
12			Manufacture of tobacco products	
	12.0		Manufacture of tobacco products	
		12.00	Manufacture of tobacco products	1200