Leitrim County Development Plan 2023-2029

APPENDIX X

Part A – Leitrim County Renewable Energy Strategy

Comhairle Chontae Liatroma | Leitrim County Council

LEITRIM COUNTY RENEWABLE ENERGY STRATEGY

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1 INTRODUCTION

The demand for energy at a global, national and local level is constantly increasing. There is a challenge to not only meet and manage this growing demand, but to do so in a secure, sustainable and efficient manner. It is widely acknowledged that, due to global warming and resource depletion, this cannot be achieved through the use of conventional fossil fuels alone, such as coal, oil and gas. In light of this, emphasis is being placed on energy conservation, energy efficiency and the development of alternative sources of energy, namely renewable energy.

Renewable energy developments can bring economic, social and environmental benefits, such as job creation, decreased import dependency and reduced greenhouse gas emissions. However, there are also challenges associated, such as landscape and visual impacts, the availability of supporting infrastructure and competition for land-use. As a result, it is vital that clear policies and objectives are in place for renewable energy developments to ensure that they are suitably located, economical and sustainable.

1.1 What is Renewable Energy?

Renewable energy (RE) is that which is derived from natural resources that are constantly being replenished. Where sufficient quantities of these resources exist, technologies can be employed for their exploitation, producing electricity, heat or transport fuel. The processes in which these resources are converted to usable forms of energy do not release harmful pollutants or greenhouse gases, such as carbon dioxide (CO_2).

Leitrim has an abundance of natural resources that can be harnessed in a sustainable manner, without negatively impacting the environment. The potential within the county for a range of renewable energy technologies has been assessed, including:

- Wind energy;
- Solar energy;
- Bioenergy (biomass, biogas, biofuel);
- Geothermal energy;
- Hydropower;
- Wave energy;
- Tidal energy; and
- Waste-to-energy.

The potential for each renewable energy type in Leitrim is dependent on the abundance of the natural resource available, along with the environmental and infrastructural constraints and facilitators. The scale of developments can range from micro to large-scale, providing energy for a single dwelling, a commercial property or being exported to the electricity grid for distribution. Renewable energy development decreases reliance on fossil fuels and imports, reducing greenhouse gas emissions and improving security of supply.

Carbon neutrality is the concept of achieving net zero CO_2 emissions by balancing carbon emissions of a system with carbon removal or carbon offsetting measures to mitigate any effects on the climate.

1.2 Why Prepare a Renewable Energy Strategy?

A Renewable Energy Strategy (RES) for Leitrim is vital to enable the county to fully harness its natural resources in a way that is both economical and sustainable. The overall aim of the strategy is to provide a plan-led approach to renewable energy development in Leitrim, which when integrated into the County Development Plan (CDP) 2023 – 2029 allows renewable energy to be considered in land-use planning. A RES provides a comprehensive assessment of the area to identify the most suitable locations for developments, considering the natural resource, the environmental considerations and the impact on local communities and quality of life. The strategy is tailored to the specific objectives of the county, developed to achieve the overall strategic aims and vision.

A RES contains clear planning policies that can be applied to development proposals to ensure they are in line with the objectives of the county. The clear policies, combined with the information regarding available resources and spatial evaluation of suitable locations, provides a robust policy position for the county in relation to renewable energy. The strategy is also beneficial to other stakeholders, such as residents and businesses, as it provides concise information on the potential for renewable energy in the county.

Ireland is working towards both national and EU renewable energy and efficiency targets. A RES will allow Leitrim to maximise its contribution to achieving these targets through optimum use of resources.

1.3 Vision for Renewable Energy

To encourage and support the transition of Leitrim to a carbon neutral county through community engagement, energy efficiency and the sustainable development of renewable energy, whilst providing environmental and economic benefit at a local and national level and preserving the cultural heritage and visual amenity of the county.

1.4 Existing Energy Profile

The existing energy profile of Leitrim compared to the national baseline is outlined in Table 1-1. This is based on calculations from the Sustainable Energy Authority of Ireland (SEAI) and CSO data, with further details provided in **Appendix A**. At the time of preparation of this RES, full statistical data is available for 2016 (full census completed), and therefore this was the base year for calculations. National data on energy consumption was available from SEAI for 2018 – prior to the Covid-19 Pandemic. An energy profile for Leitrim for 2018 is presented at the end of this chapter using a pro rata calculation based on Leitrim's share of national energy consumption in 2016.

Leitrim's total energy consumption in 2016 was 75.64 ktoe)[1] or 880 GWh.[2] This accounts for 0.64% of national energy consumption in 2016. In 2016 Leitrim's population accounted for 0.67% of the total population, meaning Leitrim's average energy consumption per head of population is less than the national average of 2.48 toe, calculated as 2.36 toe (Table 1-2). This results in the average energy consumption per person in Leitrim being 5% less than the national average energy use per person despite it being the most rural county in Ireland.

Transport is the largest consumer of energy both in Leitrim and nationally. The transport sector accounts for 40% of Leitrim's total final energy consumption. Consumption by sector is lower than the national average. Despite private car energy consumption being 13% higher than the national average, the percentage of energy consumed by transport in Leitrim is lower than the national

[1] Kilotonne of oil equivalent (ktoe), and tonne of oil equivalent (toe). Eurostat defines ktoe as: "*A normalized unit of energy. By convention it is equivalent to the approximate amount of energy that can be extracted from one tonne of crude oil. It is a standardized unit, assigned a net calorific value of 41 868 kilojoules/kg and may be used to compare the energy from different sources*." https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Tonnes_of_oil_equivalent_%28toe%29

[2] Gigawatt Hour (GWh). Eurostat defines GWh as: "*A unit of energy representing one billion (1 000 000 000) watt hours and is equivalent to one million kilowatt hours. Gigawatt hours are often used as a measure of the output of large electricity power stations. A kilowatt hour is equivalent to a steady power of one kilowatt running for one hour and is equivalent to 3.6 million joules or 3.6 megajoules*." https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:GWh

average due to the fact that energy for aviation and navigation was not considered to be consumed in Leitrim. Use of rail transport in Leitrim is limited, with the Sligo to Dublin InterCity line passing through Carrick on Shannon (with the railway station in Cortober, on the Co. Roscommon side), and also Dromod.

The residential sector is the second largest consumer of energy in Leitrim, making up 27% of the total energy consumption. Average energy consumption by dwelling in Leitrim is 3% higher than the national average, as dwellings in Leitrim are older than average, are less well insulated, are highly reliant on oil as a fuel source and have lower BER ratings. This explains the larger percentage of energy consumed by the residential sector in Leitrim compared to 24% consumed by the sector nationally.

Industry and services consume 16% and 11% of energy respectively in Leitrim. Nationally industry and services consume 21% and 11%, however this is reflective of the lack of a significant industrial base in Leitrim. The agriculture sector in Leitrim consumes 6% of energy, higher than the 2% consumed by this sector nationally. This difference is due to Leitrim's rural landscape and the higher proportion of land devoted to agriculture.

Table 1-1: Summary of Leitrim and National final energy consumption by sector

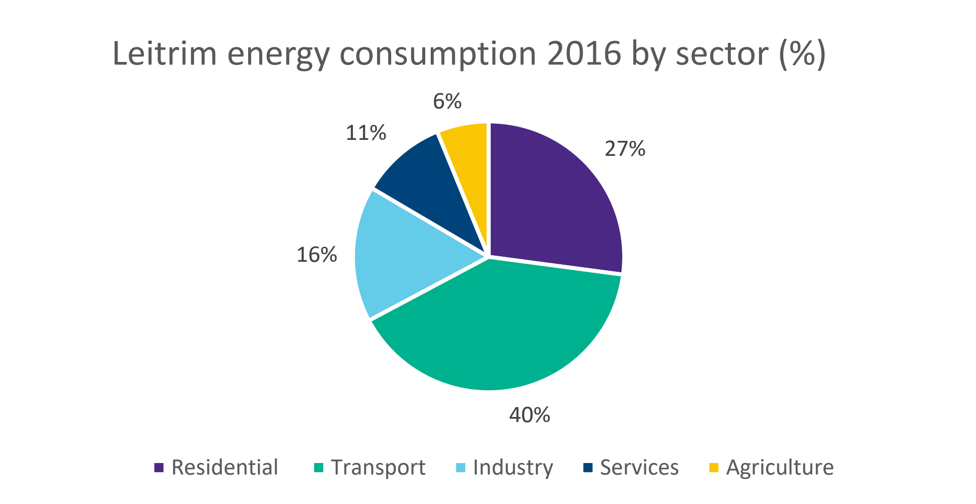
Sector	Leitrim energy consumption 2016		Leitrim sector as % of Total	National energy consumption 2016		National Sector % of Total	Leitrim % of national, by sector
	ktoe	GWh	%	ktoe	GWh	%	%
Residential	20.50	238.41	27.10	2860	33261.80	24.18	0.72
Transport	30.34	352.88	40.11	4970	57801.10	42.01	0.61
Industry	12.31	143.12	16.27	2430	28260.90	20.54	0.51
Services	7.81	90.87	10.33	1340	15584.20	11.33	0.58
Agriculture	4.68	54.47	6.19	230	2674.90	1.94	2.04
Total	**75.64**	**879.75**	–	**11830**	**137582.90**	–	–

Source: CSO & SEAI

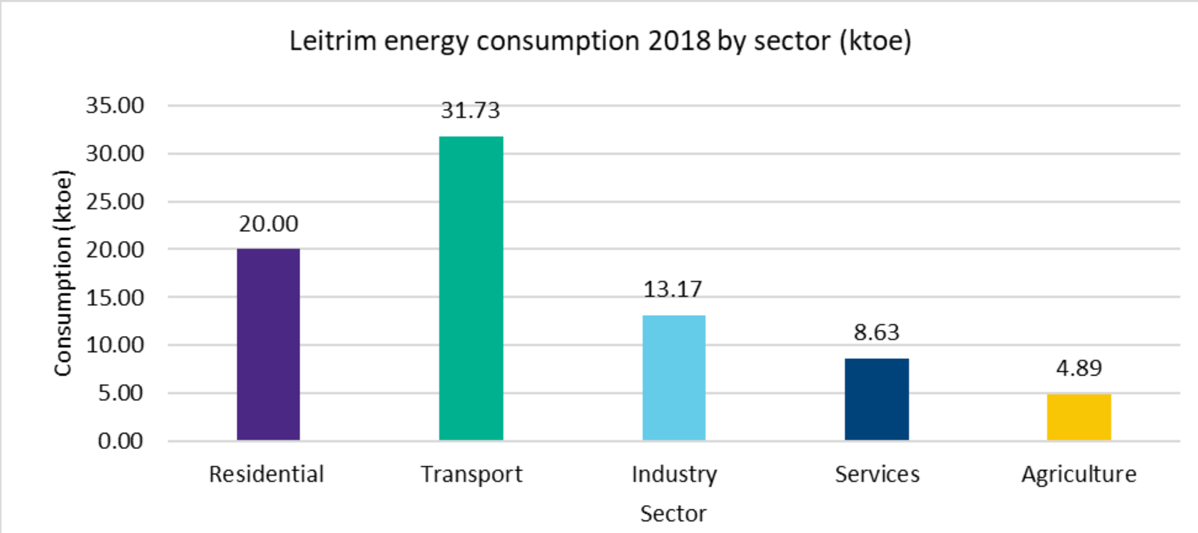
Table 1-2: Leitrim and National Energy consumption per person (2016)

Energy Consumption (2016)	ktoe/person
National average energy consumption per person 2016	0.002484321
Leitrim average energy consumption per person 2016	0.002360675
Ratio Leitrim to National average energy consumption per person	**0.95**

Source: CSO & SEAI



National energy consumption increased slightly between 2016 and 2018. The estimated total consumption for Leitrim in 2018 is 78.41 ktoe, and the breakdown is presented below.



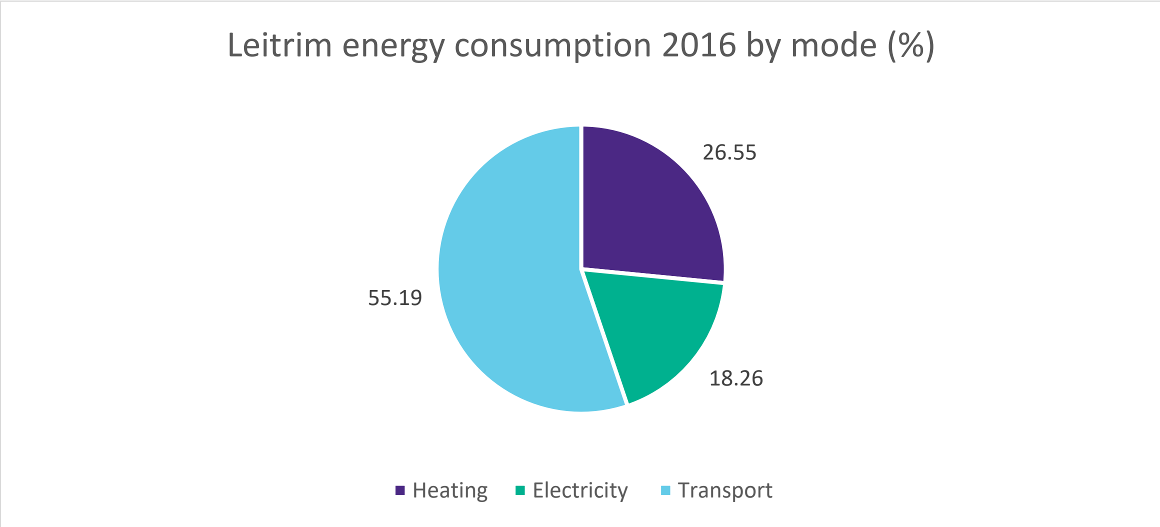
1.5 Energy Consumption by Mode

Energy consumption by mode categorises energy use based on the mode of application, namely electricity, transport and heating. The calculation aggregates energy usage across sectors and reflects the application within those sectors. For example, transport energy usage relating to Agriculture and Services sectors will be calculated in Transport for the modal split and energy use associated with EV's is included in Electricity rather than Transport under the consumption by mode analysis.

Table 1-3 shows that transport accounts for the largest consumption of energy by mode, both in Leitrim and nationally. Around 55% of energy is used in transport applications, which is higher than the national average. Approximately 27% of energy is used in heating applications in Leitrim, the majority of which is in the residential sector. Approximately 18% of energy is used in electrical applications in Leitrim, which is slightly less than the national figure. These differences are explained by the lower industrial and commercial employment in Leitrim in comparison to the national average.

Table 1-3: Breakdown of energy use by mode (2016)

Sector	Energy ktoe	Leitrim %	National %
Heating	20.08	26.55	37.45
Electricity	13.81	18.26	21.18%
Transport	41.75	55.19	41.37
Total	**75.64**	**100**	**100**



Using the national energy use by sector for 2018, the estimated energy modal split for County Leitrim in 2018 is presented below based on equivalent modal shares from 2016 data.

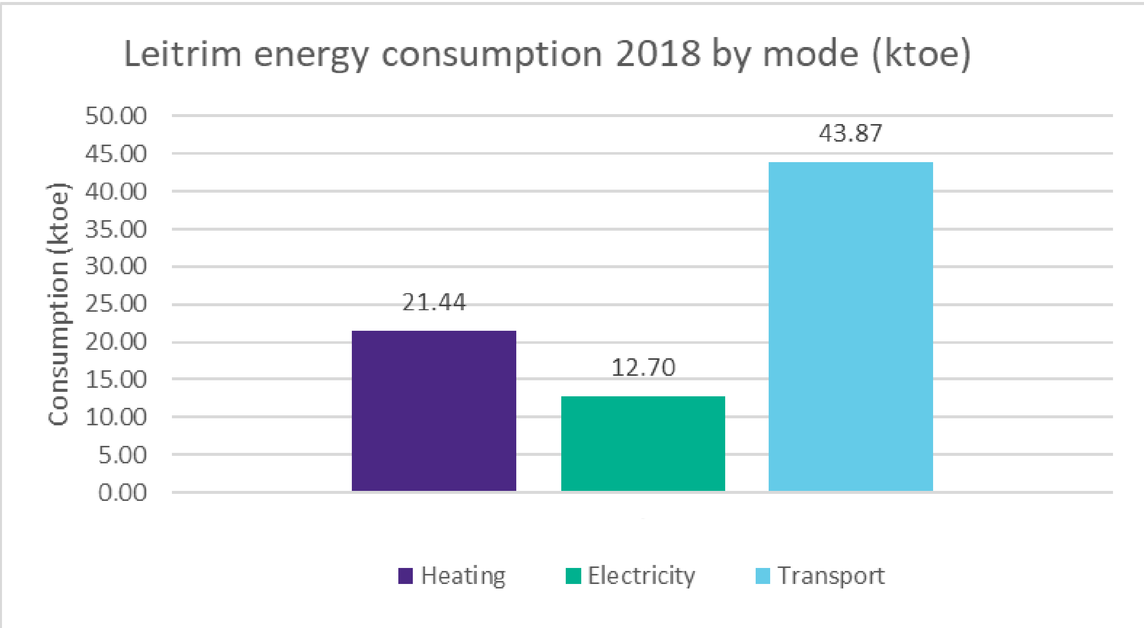


Table 1-4 below gives a summary of the available capacity of the greatest potential resources for the county, with further details of each resource given in the relevant sections of **Chapter 6**. The figures for total available capacity have been calculated in **Sections 6.1** (Wind), **6.2** (Solar) and **6.4** (Micro Hydroelectric Power).

Table 1-4: Available Capacity of Renewable Energy Resources within County Leitrim

Renewable Energy Resource	Total Available Capacity	Capacity Available at Assumed Delivery Rate of 10%[3]
Onshore Wind	594MW	59 MW
Solar Photovoltaic	61,588 MW	6,159 MW
Hydroelectric	1.178 MW	0.12 MW

1.6 Methodology for Local Authority Renewable Energy Strategies

A key guidance document, which has informed the development of this RES, is the SEAI's **Methodology for Local Authority Renewable Energy Strategies [LARES] 2013**. This is a comprehensive document designed to provide local authorities with guidance, templates and reference points for the preparation of a LARES and also to facilitate consistency in their approach that is taken to these strategies across Ireland. This approach is based upon a four-step process, as follows:

1. **Policy Context** – A review of the local, regional, national and European policy context to ensure that a concrete set of assumptions is developed for the strategy and to ensure the validity of the strategy in the context of local, national and European obligations.
2. **Identify and Assess the Renewable Energy Resources and Potential** – An assessment of the RE resources and potential in the local authority area, which includes the above policy review, an examination of current, consented, and planned RE projects, and a review of available information on the RE resource in the local authority area so that the RE resources availability can be spatially mapped and quantified.
3. **Constraints and Facilitators Review** – Consideration of the infrastructural constraints, environmental considerations and any limiting or restrictive factors that may need to be taken into account. The outcome of undertaking this review is to determine what renewable resources are viable for future development.
4. **Development of Renewable Energy Policy and Implementation** - To develop RE policy and provide detail on its implementation. This will be informed by the information obtained from the previous steps and culminates in the production of the LARES document.

1.7 Structure of this document

The remainder of the document is set out below:

- Section 2: Legislative and Policy Context
- Section 3: Constraints and Facilitators
- Section 4: Economic Benefits of Renewable Energy
- Section 5: Energy Efficiency and Conservation
- Section 6: Overview of Renewable Energy Types
- Section 7: Conclusion

[3] The 10% is an assumption referring to the planning success rate. This figure comes from a previous analysis undertaken by RPS for the SEAI (RPS, 2015. Wind Turbine Noise Modelling).

2 LEGISLATIVE AND POLICY CONTEXT

The context for the Leitrim Renewable Energy Strategy is set within a hierarchy of other plans, programmes and policies which are set at international, European, national and regional levels. The following sections outline the key policies and plans of relevance to the RES. This discussion is not exhaustive and additional key relevant legislative context is set out in **Appendix B**.

2.1 International Context

The **Kyoto Protocol** was a landmark international agreement to which 192 countries including Ireland agreed to limit worldwide greenhouse gas emissions. The protocol was adopted and ratified in 1997 under the **United Nation Framework Convention on Climate Change (UNFCCC)**.

Building on this, the United Nations Climate Change Conference of the Parties (COP) serves as the formal meeting of the UNFCCC. The 12th December 2015, at COP21 in Paris, marked the date that a legally-binding global agreement on climate change was agreed under the **Paris Agreement**. On this day, all governments agreed to a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels, and to aim to limit the temperate increase to 1.5°C. The Paris Agreement does not set a date for a peak in emissions, nor for the achievement of carbon neutrality. These targets are binding at global level but there is nothing binding for countries involved and countries can use ‘sinks’ such as forests to achieve these targets. The key points from COP21 include:

- Aim to peak in emissions as soon as possible and a long-term global goal for net zero emissions in the second half of the century. Countries can use ‘sinks’ such as forests to do this.
- Introduction of a review mechanism to take stock of country efforts every five years. Each pledge must be ‘a progression’ and ‘as ambitious as possible’.
- Introduction of a mechanism to recognise and address the financial losses vulnerable countries face from climate change.
- Legal obligation on developed countries to continue to provide climate finance to help developing countries adapt to climate change and transition to clean energy.
- A “facilitative, non-intransitive and non-punitive” system of review will track countries progress.
- Establishment of a “global goal” on adaptation of “enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.

Additionally, *inter alia*, the Paris Agreement aims to increase the ability of countries to deal with the impacts of climate change and provides for an enhanced transparency framework for action and support. At COP24 in Katowice, countries agreed on most of the elements of the ‘rulebook’ for implementing the Paris Agreement into practice, which includes how countries will measure and report on emission reductions efforts according to internationally agreed standards. A key horizon is 2020, when countries will show how they have met targets and when new, stricter targets will be set.

2.2 European Context

The **EU Climate and Energy Package 2020** resulted in a set of binding legislation which aims to ensure the EU meets its ambitious climate and energy targets for 2020 which include the following key objectives:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels;
- Raising the share of EU energy consumption produced from renewable resources to 20%;
- A 20% improvement in the EU's energy efficiency.

The **2020 EU Effort Sharing target** commits Ireland to reducing emissions from those sectors that are not covered by the **EU's Emissions Trading Scheme (ETS)** (e.g. agriculture, transport, residential, non-energy intensive industry, commercial services and waste) to 20% below 2005 levels. Ireland's 2020 emissions are anticipated to be only 8% below those in 2005 with final results to be released in late 2021.

Directive 2009/28/EC on the promotion of the use of energy from renewable sources (the "RES" Directive) established the basis for the achievement of the EU's 20% renewable energy target. Each Member State is set a binding renewable energy target, which will contribute to the achievement of the overall EU goal. Ireland's overall target was to achieve 16% of gross final consumption from renewable sources by 2020. In 2020, renewable energy in Ireland represented 13.6% of gross final consumption.[4]

Beyond 2020, the EU has set further targets through policies as part of the **2030 Climate and Energy Framework** which were agreed by EU leaders in July 2018. These targets seek a 40% reduction in EU greenhouse gas emissions from 1990 levels and a greater contribution from renewable energy under key policy pillars covering renewable energy, energy efficiency and emissions trading. Under the **revised ETS Directive (EU) 2018/410**, which will apply from 2021-2030, the target for Ireland has been set at a 30% reduction in ETS sector emissions on 2005 levels by 2030. The **revised Renewable Energy Directive (EU) 2018/2001 (recast)**, sets a target of at least 32% for renewable energy by 2030, at EU-wide level, with a review clause for 2023 to examine the potential for an upward revision of the EU level target, while the **revised Energy Efficiency Directive (EU) 2018/2002**[5] also sets a target of at least 32.5% for energy efficiency EU-wide.

The European Commission launched the European Green Deal in late 2019. The framework includes ambitious targets for reducing net emissions by at least 55% by 2030 compared to 1990 and for being the first climate neutral continent by 2050. The Fit for 55 legislative proposals, adopted by the EU Commission in July 2021, cover a wide range of policy areas including climate, energy, transport and taxation, setting out the ways in which the Commission will reach its updated 2030 target in real terms.

The **EU Governance of the Energy Union and Climate Action Regulation (EU) 2018/1999**[6] sets the overall framework for the achievement of the EU climate and energy 2030 targets. This regulation requires Member States to develop a **National Energy and Climate Plan (NECP)**. The (NECP) replaces the National Energy Efficiency Action Plan (NEEAP) from the Energy Efficiency Directive (EED) and the National Renewable Energy Action Plan (NREAP) through the Re-cast Renewable Energy Directive (RES) of 2018. The Directives and Regulations, however, still set out the requirements for climate objectives (e.g. energy efficiency, renewable energy) and specific sectoral framework.

Ireland's draft NECP was submitted to the European Commission in December 2018. The aim of the NECPs is to provide an integrated policy framework for the period up to 2030 to ensure regulatory certainty and a coordinated approach among Member States. In March 2019, the Joint Oireachtas Committee on Climate Change recommended a more ambitious target be set for RES-E than was

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[4] SEAI (October 2021) Renewable Energy in Ireland 2020 https://www.seai.ie/publications/Renewable-Energy-in-Ireland-2020-Short-Note-FINAL.pdf

[5] Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency

[6] Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council.

proposed in the first draft NECP – from 55% to 70% RES-E by 2030.[7] Table 2-1 presents the latest performance data for 2020 and an indicative set of targets for 2030 across electricity, heat and transport sectors, following the 'With Additional Measures' projection set out in the (NECP).

Table 2-1: Renewable Energy Performance and Targets

RES Target	Ireland Performance in 2020 (%)	Target for 2020 (%)	Target for 2030 (%)[8]
Overall RES Target	13.6	16	34.1
RES-E	39.1	40	70
RES-H	6.3	12	24
RES-T	10.2	10	13.4

Progress to date as reported by the SEAI[9] indicates that the RES-E share in 2009 of 13.7% has risen to 39.1% in 2020, just short of the 40% target. The RES-H share was 6.3% in 2020, compared to the 12% target, while the RES-T share was 10.2%% in 2020 compared to the 10% target. Based on these achievements to date, Ireland's overall renewable energy contribution was 13.6% in 2020, indicating a shortfall compared to the overall 16% target.

The **land use, land use change and forestry (LULUCF)** sector is also increasingly being recognised as playing a large role in how GHG emissions are reported; this sector considers emissions and removals from six categories including forest land, cropland, grassland, wetland, settlements and other land. The LULUCF sector is a net carbon sink within the EU but increasing anthropogenic activities in this sector can contribute to both emissions and removals of carbon dioxide (CO_2). Due to the complexities on emissions reporting for this sector, emissions and removals from LULUCF were not counted towards the EU's 20% by 2020 GHG emissions reduction target but count in part towards the EU's Kyoto Protocol and UNFCCC limitation of emissions and reduction commitments. The **EU Regulation on the inclusion of GHG emissions and removals from LULUCF** was therefore adopted in May 2018 as part of the 2030 Climate and Energy Framework.[10] Under the regulation, Member States must ensure that GHG emissions from LULUCF are offset by at least an equivalent removal of CO_2 from the atmosphere in the period 2021-2030.

2.3 National Context

Project Ireland 2040 – National Planning Framework (NPF) and the National Development Plan (NDP) are at the top of the spatial planning hierarchy in Ireland and are the Government's high-level plan for the future development of Ireland, with a particular focus on strategic growth and infrastructure; together they make up "Project Ireland 2040". Number eight of the ten National Strategic Outcomes (NSO's) is to facilitate a *Transition to a Low Carbon and Climate Resilient Society*. The capital investment priorities arising from this strategy represent a major change in Ireland's delivery of climate-action objectives to achieve sufficient reductions in carbon emissions during the period to 2030. Investment priorities include:

- Upgrading of 45,000 homes a year from 2021;
- An additional 3,000-4,500 MW of renewable energy;

[7] Houses of the Oireachtas (March 2019) Report of the Joint Committee on Climate Action. *Climate Change: A Cross-Party Consensus for Action*.

[8] National Energy and Climate Plan 2021-2030 . Table 5. [Accessed 14/10/2021]

[9] SEAI (October 2021) Renewable Energy in Ireland 2020 https://www.seai.ie/publications/Renewable-Energy-in-Ireland-2020-Short-Note-FINAL.pdf

[10] Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU.

- Full rollout of the Renewable Heat Support Scheme;
- Transition to low-emission (including electric) buses for the urban bus fleet; and
- A target of 500,000 electric cars by 2030.

The RES will need to be cognisant of these targets set out under Project Ireland 2040. In particular, decarbonising the various sectors i.e. electrification of transport, can only be achieved if there is a proportional increase in electricity generated from renewable sources to offset increased demands on the sector. This will include new offshore wind farms but also increased penetration of on-shore wind and solar energy.

Ireland's **Climate Action Plan** (2021)[11] outlines the current challenges across key sectors including electricity, transport, built environment, industry and agriculture and outlines a co-ordinated approach towards ambitious decarbonisation targets. The objective of the Plan is to enable Ireland to meet its EU targets to reduce its carbon emissions by 51 percent by 2030 and lay the foundations for achieving net zero carbon emissions by 2050. The Plan sets out 493 actions that need to be taken and extends to all sectors of the economy. These targets are to be underpinned by governance arrangements including carbon-proofing our policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas.

Alongside this, there is the investment strategy, **Investing in the Transition to a Low-Carbon and Climate-Resilient Society 2018-2027** (June 2018), outlining the Government's commitment to achieving a low carbon and climate resilient future by 2050. To achieve this, actions must be undertaken to reduce GHG emissions, and resilience entails reducing vulnerability to climate change impacts which are happening now, and what might occur in the future. Project Ireland has committed to an investment of €22 billion towards climate action over the coming decade, with the National Development Plan allocating a further €8.6 billion for investments in sustainable mobility.

The **Climate Action Fund** was also launched in 2018, with €500 million supporting the delivery of projects necessary to achieve the low carbon, climate-resilient transition. Chapter 4 of the accompanying report concerns 'decarbonising electricity', which sets out the contribution of the NDP to Ireland's decarbonisation objectives. The report sets out the key electricity sector investments applicable to Leitrim as follows:

Decarbonising electricity generation through the Renewable Electricity Support Scheme [to support up to 4,500 megawatts of additional renewable electricity by 2030

- Roll-out of the National Smart Energy Metering programme;
- Ongoing reinforcement of existing power grid; and
- Use of energy research funding to accelerate diversification away from fossil fuels to green energy, including, wind, wave, solar, biomass, biofuels, biogas and hydrogen.

The Climate Action and Low Carbon Development (Amendment) Act 2021 was signed into law by the government in July 2021, binding Ireland to achieve the GHG emissions reduction targets of 51% by 2030 and net zero emissions by 2050 (The National Climate Objective)[12]. The Act provides the legislative and governance framework with which the many measures outlined in **the Climate Action Plan (2019)** and **the Programme for Government: Our Shared Future (2020)** will be implemented. This includes:

- The strengthening of the role of the Climate Change Advisory Council
- The preparation of five-year Carbon Budgets by sector

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[11] DECC (2021) Climate Action Plan: https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

[12] https://www.oireachtas.ie/en/bills/bill/2021/39/

- Yearly National Climate Action Plans with sectoral updates
- The preparation of Local Authority Climate Action Plans every 5 years
- Public Bodies will be obliged to take account of Climate Action Plans in the performance of their functions

The new **Renewable Electricity Support Scheme (RESS)** is a key deliverable on Ireland's transition to its low carbon future. The RESS will provide support to renewable electricity projects in Ireland with a focus on cost-effectiveness, and targets the delivery of a broader range of policy objectives, including:

- An Enabling Framework for Community Participation through the provision of pathways and support for communities to participate in renewable energy projects;
- Increasing Technology Diversity by broadening the renewable electricity technology mix (the diversity of technologies);
- Delivering an ambitious renewable electricity policy to 2030; and
- Increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy.

The first RESS auction took place in June 2020 adding 479MW of onshore wind and 796MW of solar to the grid. A further four auctions are expected to take place throughout the lifetime of the scheme which will last until 2025.The scheme will provide for a renewable electricity (RES-E) ambition of up to a maximum of 70% by 2030, subject to determining the cost-effective level which are set out in the **National Energy and Climate Plan (NECP) 2021-2030**. RESS auctions have been designed in line with trajectory targets identified in Ireland's NECP. It aims to deliver 'shovel ready' projects and to assist in the early delivery of targets for Ireland's trajectory to 2030.[13]

Similarly, for renewable heat, the government funds an initiative called the **Support Scheme for Renewable Heat (SSRH)**[14] with the goal of increasing the share of renewable sources in the heat and thermal sector by:

- Bridging the gap between the installation and operating costs of renewable heating systems and the conventional fossil fuel alternatives; and
- Incentivising the development and supply of renewable heat.

The SSRH is open to commercial, industrial, agricultural, district heating, public sector and other non-domestic heat users not covered under the ETS. The scheme opened for applications relating to installation grants for air source heat pumps, ground source heat pumps and water source heat pumps in September 2018. The operational support component of the scheme, including support for biomass boiler/biomass HE CHP heating systems and biogas (anaerobic digestion) boiler/biogas HE CHP heating systems, opened in 2019, and is subject to receipt of state aid approval from the European Commission.[15] The first SSRH project under this scheme was completed in January 2020.[16]

In 2015 the Government enacted the **Climate Action and Low Carbon Development Act (2015)** which provides for the approval of plans by the Government in relation to climate change for the purposes of pursuing the transition to a low carbon, climate resilient and environmentally sustainable economy, and to establish the Climate Change Advisory Council. The act also sets the statutory basis for the establishment of a **National Mitigation Plan (NMP)**, the first of which was published in

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[13] DCCAE Renewable Electricity Support Scheme (RESS): https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/renewable-electricity-supports/ress/Pages/default.aspx

[14] SEAI: https://www.seai.ie/sustainable-solutions/support-scheme-renewable-/

[15] DCCAE (2018) Draft National Energy and Climate Plan.

[16] https://www.biomassengineering.ie/2020/01/07/first-ssrh-project-completed/

2017. The aim of the NMP is a whole of Government approach to setting Ireland on the pathway to achieving decarbonisation across various sectors (electricity generation; agriculture and forestry; transport; and the built environment). The first NMP was quashed by the Supreme Court due to lack of specificity and a replacement plan is being developed.

In 2018, the Government published the statutory **National Adaptation Framework (NAF)** which sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. Under the Framework, Government Departments are required to prepare Sectoral Adaptation Plans for key sectors. Local Authorities will also be preparing Adaptation Strategies and the Framework provides a basis for local authorities and key sectors to assess their key climate risks and vulnerabilities while enabling climate resilience actions to be mainstreamed into all local, regional and national policy-making. The **Climate Change Adaptation Plan for the Electricity and Gas Networks Sector** was published by DCCAE in February 2018. It is a high-level plan which outlines the initial research and analysis on the likely effects of climate change on these sectors and sets out possible actions to develop resilience.

The **National Policy on Alternative Fuels Infrastructure for Transport 2017-2030** was published by DTTAS reiterating the cornerstones of Irish transport policy which includes key goals such as reducing reliance on fossil fuels and reducing transport emissions. Utilising alternative fuels is a key aspect of this and for contributing to decarbonisation of the electricity sector. It outlines the main fuel options that could provide alternatives to oil in transport namely: electricity, hydrogen, biofuels, and natural gas, in the forms of compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG). Ireland set an initial target in 2008 of converting 10% of its passenger and light commercial vehicle stock to electric vehicles by 2020 (roughly equivalent to 230,000 vehicles).

As the uptake of EVs was lower than anticipated, this target was revised to 50,000 in Ireland's **third National Energy Efficiency Action Plan (NEEAP)** published in 2014. The target for EV uptake was revised to 20,000 electric vehicles by 2020 by this framework, which is reflected in **NEEAP 4**.

The use and specification of biofuels in the transport sector is dictated by the Renewable Energy Directive (2009/28/EC) and the **Fuel Quality Directive (2009/30/EC).** Under Article 3(4) of the Renewable Energy Directive, Ireland is committed to ensuring that at least 10% of energy consumption in the transport sector is achieved from renewable sources by 2020. The national **Biofuel Obligation Scheme** (BOS) which as of 2020 requires 11% of biofuels in the road transport fuel mix is a key mechanism for delivering on the RES-T target.[17]

The **Draft Wind Energy Development Guidelines (DCCAE, December 2019)**, issued under Section 28 of the **Planning and Development Act 2000 (as amended) (PDA)** set out advice to planning authorities on planning for wind energy through the development plan process and in assessing applications for planning permission. The guidelines ensure consistency of approach throughout the country in the identification of suitable locations for wind energy development. The 2019 draft guidelines have been published following a focused review to establish clearer guidance to facilitate the achievement of wider renewable energy targets, while also considering community, spatial planning, energy policy, environmental, technological and industry issues that all need to be balanced. Pending finalisation of the draft, the existing 2006 Wind Energy Guidelines remain in force with material consideration to be given to the interim guidelines which were issued by (DHPCLG) in 2017[18].

The draft 2019 guidelines focus on addressing several key considerations including: sound/ noise; visual amenity setback distances; shadow flicker; consultation obligations; community dividend; and

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[17] https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf

[18] DHPCLG, 2017) https://www.gov.ie/en/publication/5ecd0-planning-circular-letter-pl-52017-interim-guidelines-for-planning-authorities-on-statutory-plans-renewable-energy-and-climate-change-and-wind-energy-development-guidelines-2006-update-on-review/

grid connections. Planning authorities and An Bord Pleanála must have regard to these guidelines and are required to apply the specific planning policy requirements (SPPR's) of the guidelines when carrying out their functions under section 28(1C) of the PDA. These guidelines are of direct relevance to the RES in terms of the key environmental aspects to be considered as part of wind energy development, such as noise and shadow flicker considerations, as well as setback distances. Among the key criteria set out in the December 2019 draft are:[19]

- **New noise standards:** The proposed new standards have been brought up to date in line with the 2018 World Health Organization (WHO) Environmental Noise Guidelines for the European Region, including a maximum noise level of 43 dB(A).[20] A robust new noise monitoring framework is also proposed.
- **Setback distances:** This is required for the purposes of visual amenity and comprise a distance of four-times the tip height between a wind turbine and nearest point of the curtilage of any residential property in the vicinity of the proposed development, subject to a minimum mandatory setback distance of 500 metres. This setback distance must also comply with the proposed noise limits.
- **Shadow flicker:** Automatic control mechanisms for shadow flicker will be required during the operational phase of a wind energy development.
- **Community engagement:** Developers will be required to undertake mandatory and active consultation with the public and the local community at an early stage in project development. There is also a requirement for the preparation of a 'Community Report' to be submitted as part of the planning application.
- **Community dividend:** Wind energy developers must provide an opportunity for the local community to receive social or economic benefit from the project (e.g. community investment, ownership etc.)
- **Grid connections:** Updated advice has been included concerning the requirements of EIA as they relate to wind energy development and associated grid connections, as informed by relevant case law.

2.4 Regional & Local Context

A **Regional Spatial and Economic Strategy (RSES)** has been prepared by each of the three Regional Assemblies, namely the **Eastern and Midland,** the **Southern,** and the **Northern and Western**. One of the principal functions of the RSES's is to practically support and advance the delivery of the national policy objectives contained in the NPF at the regional level, and to inform lower-level planning (such as County Development Plans). The three regional assemblies will bring forward the NPF in a manner which best reflects the challenges and opportunities of their respective regions. Leitrim is part of the Northern and Western Region and falls under the **Northern and Western RSES** (January 2020). It contains the following key relevant Regional Policy Objectives (RPOs):

- *RPO 4.16: The NWRA shall co-ordinate the identification of potential renewable energy sites of scale in collaboration with Local Authorities and other stakeholders within 3 years of the adoption of the RSES. The identification of such sites (which may extend to include energy storage*

[19] DCCAE (December 2019): https://www.dccae.gov.ie/en-ie/news-and-media/press-releases/Pages/Ministers-Murphy-and-Bruton-publish-draft-Wind-Energy-Development-Guidelines-for-public-consultation.aspx

[20] A-weighted decibel, or dB(A). The EEA defines a decibel as: "*A logarithmic scale used to denote the intensity, or pressure level, of a sound relative to the threshold of human hearing. A step of 10 dB is a 10-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.*" https://www.eea.europa.eu/help/glossary/eea-glossary/decibel. The A-weighting corrects unweighted decibels for audio frequency and represents the relative loudness of sound in air as it is perceived by the human ear.

solutions) will be based on numerous site selection criteria including environmental matters, and potential grid connections.

- *RPO 4.17: To position the region to avail of the emerging global market in renewable energy by:*
  - *Stimulating the development and deployment of the most advantageous renewable energy systems.*
  - *Supporting research and innovation.*
  - *Encouraging skills development and transferability.*
  - *Raising awareness and public understanding of renewable energy/ encourage market opportunities for the renewable energy industry to promote the development and growth of renewable energy businesses.*
  - *Encourage the development of the transmission and distribution grids to facilitate the development of renewable energy projects and the effective utilization of the energy generated from renewable sources having regard to the future potential of the region over the lifetime of the Strategy and beyond.*
- *RPO 4.18: Support the development of secure, reliable and safe supplies of renewable energy, to maximise their value, maintain the inward investment, support indigenous industry and create jobs.*
- *RPO 4.19: Support the appropriate development of offshore wind energy production through the adequate provision of land-based infrastructure and services, in line with national policy and in a manner that is compatible with environmental, ecological and landscape considerations.*
- *RPO 4.20: Support and encourage the development of the bio-economy sector, and facilitate its development for energy production, heat, and storage distribution, in particular advocating Combined Heat and Power Units integrated into District Heating networks, in combination with Pyrogenic, Carbon Capture and Storage (PyCCS) or Bio-Energy Carbon capture and storage (BECCS).*
- *RPO 4.21: Promote innovative new building design and retrofitting of existing buildings, both private properties, and publicly owned, to improve building energy efficiency, energy conservation and the use of renewable energy sources following National Regulations, and Policy.*
- *RPO 4.22: Safeguard and support the strategic role and function of existing test and development sites, for example, the Atlantic Marine Energy Test Site (AMETS). The test site forms part of Ireland's Ocean Energy Strategy and is being developed following the Offshore Renewable Energy Development Plan.*

The three **Regional Waste Management Plans (RWMP) 2015-2021 (Eastern-Midlands; Southern; and Connaught-Ulster)** were published in 2015 to provide a framework for the prevention and management of wastes for the three defined regional areas. Leitrim falls under the **Connacht-Ulster RWMP** which sets policies for waste management, including growth of the biological treatment sector as well as supporting the development of thermal recovery in the region.

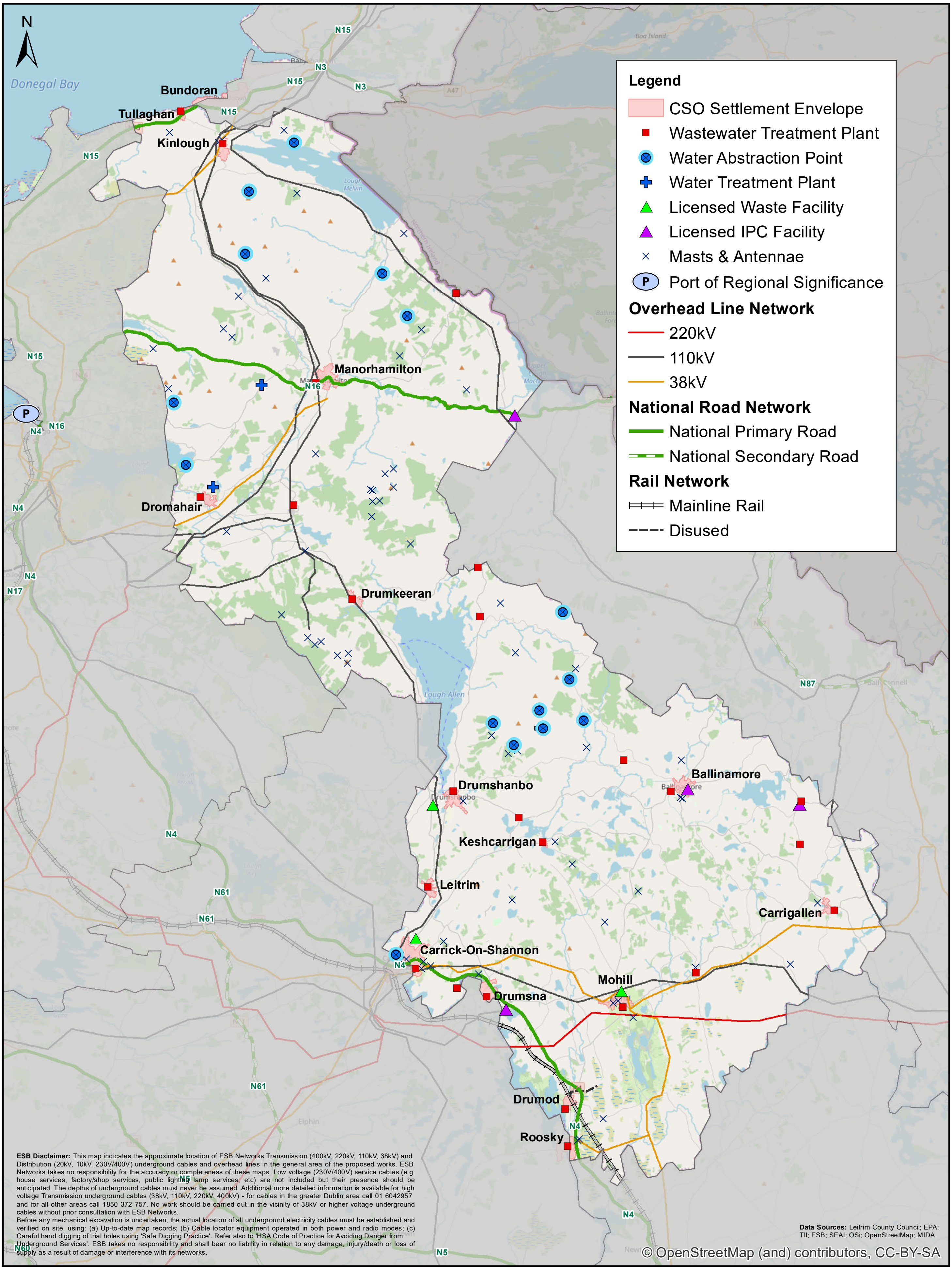
Leitrim Climate Adaptation Strategy 2019-2024

Adopted in 2019, this Strategy is the start of the process of adaptation planning in County Leitrim. It will help develop resilience within Leitrim County Council and the county as a whole and will enable effective responses to the threats posed by climate change. These include extreme weather events leading to effects such as flooding, storm damage (high winds), snow and ice, drought and also sea-level rise. The Strategy includes seven high level goals for climate adaptation and includes a series of actions under each goal. One of the relevant themes for the renewable energy strategy is the potential to find synergy between climate mitigation and climate adaptation. Equally, measures to increase renewable energy should not undermine adaptation or increase climate related risks.

3 CONSTRAINTS AND FACILITATORS

The availability of supporting infrastructure can facilitate or constrain renewable energy developments. The type, scale and location of installations will depend on the proximity to the required infrastructure and the available capacity. Key supports include the National Grid, gas infrastructure, water supply and wastewater facilities, ports, transport and energy storage. Preferred locations for developments will be in proximity to the required infrastructure. Where necessary, infrastructure may need to be upgraded or constructed, however, this increases the complexity, cost and duration of projects.

There is existing infrastructure in Leitrim that presents opportunities for future renewable energy developments, shown in Figure 3-1. However, infrastructural upgrades or new installations would greatly enhance the renewable capacity of the county and maximise the potential of the different natural resources.



Title

Figure 3.1

Key Infrastructure and Material Assets within County Leitrim

Project

Leitrim Renewable Energy Strategy

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3.1 National Grid

Renewable energy developments can be used for on-site generation or can export electricity to the National Grid, depending on their scale. The transmission system on the island, operated by EirGrid and the System Operator for Northern Ireland (SONI), transports electricity from generation stations to demand centres, using high-voltage lines at 110 kV, 220 kV and 400 kV in the Republic of Ireland and 110 kV and 275 kV in Northern Ireland. Electricity is transported to consumers through the distribution network, operated by ESB in the Republic of Ireland, and SONI in Northern Ireland. The distribution network operates with low voltage, 10 kV, 20 kV, 38 kV and 110 kV lines.[21]

Leitrim is connected to the grid through predominantly 110 kV lines, with some at 38 kV and a 220-kV line through the south of the county. Renewable energy developments that require a grid connection, such as wind farms and solar farms, must consider the proximity of the proposed site to the existing transmission network. When new generation capacity is connected, it alters the power flow in the network and reinforcements may be needed.

EirGrid have released details of their plans for transmission network development to 2027.[22] Leitrim is included in the Border planning area, grouped with the West and Midlands. These are areas of lower demand and higher generation, which is expected to increase as more renewables are introduced. There is an opportunity for Leitrim to become exporters of electricity, providing for higher demand locations in the east. There are planned network reinforcements for the area that would assist in achieving this goal. Updates and redevelopments are planned for lines and stations in Leitrim and the surrounding area. The North Connacht 110 kV Project is planned to significantly improve the network around Leitrim, particularly in Sligo, Roscommon and Mayo, accommodating for the transfer of electricity across the country.[23]

3.2 Gas Infrastructure

The natural gas network in Ireland provides much of the country with a cleaner, more sustainable alternative to coal, peat and oil for heat and power. Natural gas can assist in the connection of variable renewable generation to the grid, acting as a back-up fuel. Leitrim is not connected to the gas transmission network in Ireland.

Gas Networks Ireland are working to introduce renewable gas to Ireland through the construction of injection facilities along the existing network. Although the network does not extend into Leitrim, there is potential to produce biogas within the county using on-site or off-site anaerobic digestion (AD) at farms or industrial facilities. The intention would be that the biogas would be purified to natural gas standard at the AD site and collection logistics would be in place to transport the renewable gas to Central Grid Injection (CGI) facilities along the network.[24]

The viability of this opportunity should be fully assessed when the exact injection and processing plant locations and collection logistics are known. An alternative use for the biogas is on-site heat and electricity generation using a Combined Heat and Power (CHP) plant.

3.3 Water Supply and Wastewater

Water supply and wastewater treatment infrastructure is vital for the economic and social development of the county, while also protecting the environment from pollution and contamination. There are multiple wastewater treatment plants, water abstraction points and water treatment plants

[21] https://www.esbnetworks.ie/who-we-are/our-networks [Accessed: 04/04/2019]

[22] EirGrid Transmission Development Plan 2017-2027 [Accessed: 04/04/2019]

[23] http://www.eirgridgroup.com/the-grid/projects/north-connacht/related-documents/ [Accessed: 04/04/2019]

[24] https://www.gasnetworks.ie/corporate/company/our-commitment/environment/renewable-gas/ [Accessed: 25/04/2019]

throughout the county. It is important that watercourses involved in the generation of hydroelectric power, for example, are protected from pollution and managed in a sustainable manner.

3.4 Waste

Infrastructure supporting the management and disposal of waste is required for development. There are licensed waste facilities in Carrick-on-Shannon, Mohill and Drumshanbo.[25] Carrick-on-Shannon and Mohill are inactive landfills; both of which have been capped, with no remaining capacity for waste disposal.[26,27] The facility in Drumshanbo, Barna Waste Disposal Limited, is a waste transfer station and recycling facility. It is licensed to accept a maximum of 24,990 tonnes of waste per annum, with the most recent reporting period reaching 20,072 tonnes per annum. The facility accepts non-hazardous waste, with specific waste types including municipal solid waste, mixed dry recyclables kerbside, packaging waste, C&D waste and scrap metal.[28] There are four licensed Integrated Pollution Control (IPC) facilities.[29]

3.5 Ports, Harbours and Piers

Infrastructure such as ports and harbours are particularly important for the development of offshore renewables, such as offshore wind, wave and tidal energy. Clear access to the marine environment is required for construction and decommissioning of the development and for its ongoing operation and maintenance. Ports are also required for the importation of renewable energy technologies that are not produced domestically, for example large-scale wind turbine components. Leitrim has a limited coastline with no access to ports or harbours within the county. Sligo is the nearest neighbouring port of regional significance, and it may meet the importation and access needs of the county.

3.6 Transport

Transport infrastructure is an important consideration for the development of renewable energy technologies. Access roads capable of accommodating heavy duty vehicles are required for the construction, operation and decommissioning phases of developments. The Leitrim County Development Plan 2015-2021 identified three national roads acting as strategic links in Leitrim; the N4 (Dublin – Sligo), the N15 (Letterkenny – Sligo) and the N16 (Enniskillen – Sligo). The R280 regional road is also considered to be a strategic link connecting the north of the county.

Infrastructure is also required to accommodate and promote renewable transport. Leitrim has a limited public transport network. The south-west of the county contains a small portion of a rail network with the InterCity rail line running through Carrick on Shannon and Dromod, while the rest of the county is served by local buses. There are also regional buses in the form of a Bus Éireann Dublin-Sligo Expressway service and an Ulsterbus Derry-Cork service. Therefore, for local transport, Leitrim may benefit from encouraging alternative modes of transport, such as walking or cycling, or the uptake of alternatively fuelled vehicles. However, given the dispersed distribution of the population in Leitrim, the provision of public transport outside of the larger urban centres is acknowledged as a significant challenge.

Electric vehicles offer an opportunity for Leitrim to contribute to Ireland's renewable transport targets, provided there is sufficient supporting infrastructure. There are a limited number of ESB public charging points in Leitrim which are primarily located in the south of the county. For electric vehicles

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[25] https://gis.epa.ie/EPAMaps/default [Accessed: 08/04/2019]

[26] http://www.epa.ie/licences/lic_eDMS/090151b2806a7491.pdf [Accessed: 25/02/2019]

[27] http://www.epa.ie/licences/lic_eDMS/090151b2806a7492.pdf [Accessed: 25/04/2019]

[28] http://www.epa.ie/licences/lic_eDMS/090151b2806e6855.pdf [Accessed: 25/04/2019]

[29] Note, the four licensed IPC facilities are located in Glenfarne, Ballinamore, Newtowngore and Carrick-on-Shannon.

to achieve higher penetration in the Leitrim vehicle fleet, installation of more public charging points will be required. See also **Section 6.6 - Renewable Transport** for further details.

3.7 Energy Storage

Heat and power demand vary constantly and must be matched with sufficient generation. While methods of conventional generation using fossil fuels can be scaled to match demand, renewable energy technologies typically have more variable outputs, dependent on the availability of resources. As more renewable energy is introduced to the network, grid stability becomes a challenge. If generation from renewables is low during a period of higher demand, fossil fuel plants must be scaled up to compensate. In contrast, during times of high renewable energy production, there may be insufficient demand to allow for full exploitation of the resource, leading to a wasted opportunity to generate more clean energy.

One solution to the challenges faced due to the variability of renewable energy is energy storage. This involves storing the excess energy produced during times of low demand to be used at a later stage when demand is higher. The electrical energy is typically converted to a more easily and economically stored form, such as potential or thermal energy, and converted back to electrical energy as required. Emphasis is being placed on the development of energy storage technologies, with some viable options available. Developing energy storage in Leitrim would allow the county to maximise the potential of its natural resources.

3.7.1 Battery Storage

Battery storage involves converting the electrical energy to chemical energy. ESB offer an opportunity for large businesses to install battery storage on-site, a method of demand-side storage. This provides a back-up power supply and reduces costs by charging the battery during periods of low electricity prices. Batteries can also be employed on the generation side of the network, creating hybrid systems with renewable energy technologies to store excess generation.

The increased uptake of electric vehicles has sparked research into their potential as energy storage devices. By keeping the vehicle connected to the grid when not in use, the battery could be charged at times of low demand and could send electricity back to the grid when required to meet higher demands. However, the degradation of the battery with extra charging and discharging is a limitation.

3.7.2 Thermal Storage

Electrical energy can also be converted to thermal energy for storage. For example, excess electricity can be used to freeze or chill water, which can be stored in a tank and later used to cool the building. Solar thermal technology can be combined with a storage tower or trough to store the heat collected until it is required.

3.8 Environmental Considerations

It is vital that renewable energy development is sustainable and appropriate for the area. There are a number of key environmental considerations that must be taken into account during all stages of the development.

3.8.1 Biodiversity

The potential impact of proposed renewable energy developments on flora and fauna in the immediate and surrounding area must be assessed to ensure that there are no adverse effects on nature and wildlife. The designated areas for protection in Leitrim have been mapped, including Special Protection Areas (SPAs) and Special Areas of Conversation (SACs), which make up the Natura 2000 network across the European Union, incorporating both terrestrial and marine areas. The SPAs are designated under the Birds Directive and protect migratory birds and threatened species.

The SACs are conservation areas protecting wildlife habitats and species outlined in the Habitats Directive. Within Leitrim, there is one designated SPA (Sligo/Leitrim Uplands SPA) and eight designated SACs (Arroo Mountains; Ben Bulben, Gleniff and Glenade Complex; Boleybrack Mountain; Bunduff Lough and Machair/Trawalua/Mullaghmore: Cuilcagh – Anierin Uplands; Glenade Lough; Lough Gill; and Lough Melvin).

National Heritage Areas (NHAs) are areas of conversation designated at a national level from the Wildlife Act 2000. These areas are considered important for the habitats and species of plants and animals present. There are also non-statutory areas of significance called Proposed NHAs. Wetland sites of international importance are classified as Ramsar Sites.

In all cases, the potential impact of proposed developments on these areas should be assessed and mitigation measures put in place where necessary. Where measures cannot be implemented to eliminate or significantly reduce impacts, developments should consider alternative siting. In Leitrim, there is a higher concentration of protected areas in the north of the county, particularly Special Areas of Conservation. Protected areas for biodiversity are outlined in **Figure 3-2**.

3.8.2 Noise

There is potential for noise impacts during the construction, operation and decommissioning stages of renewable energy developments. Receptors in the surrounding area, particularly sensitive receptors such as schools and hospitals, should be identified and assessed for their susceptibility to environmental noise. Measures can then be put in place to prevent or reduce noise emissions and their impact on receptors.

3.8.3 Landscape and Visual

Preservation of landscape character and visual amenity should be considered when planning renewable energy developments, as specified in the Planning and Development Act 2000. Leitrim has been divided into Landscape Character Areas that have been assessed for their character, value and sensitivity. Throughout the county there are designated Areas of Outstanding Natural Beauty and Areas of High Visual Amenity. It is important for local communities, the wider society and for the tourism industry that Leitrim preserves the character of the landscape and the available views. Proposed renewable energy developments should be assessed for their impact on sensitive landscapes and measures put in place to minimise the impact on visual amenities within the county.

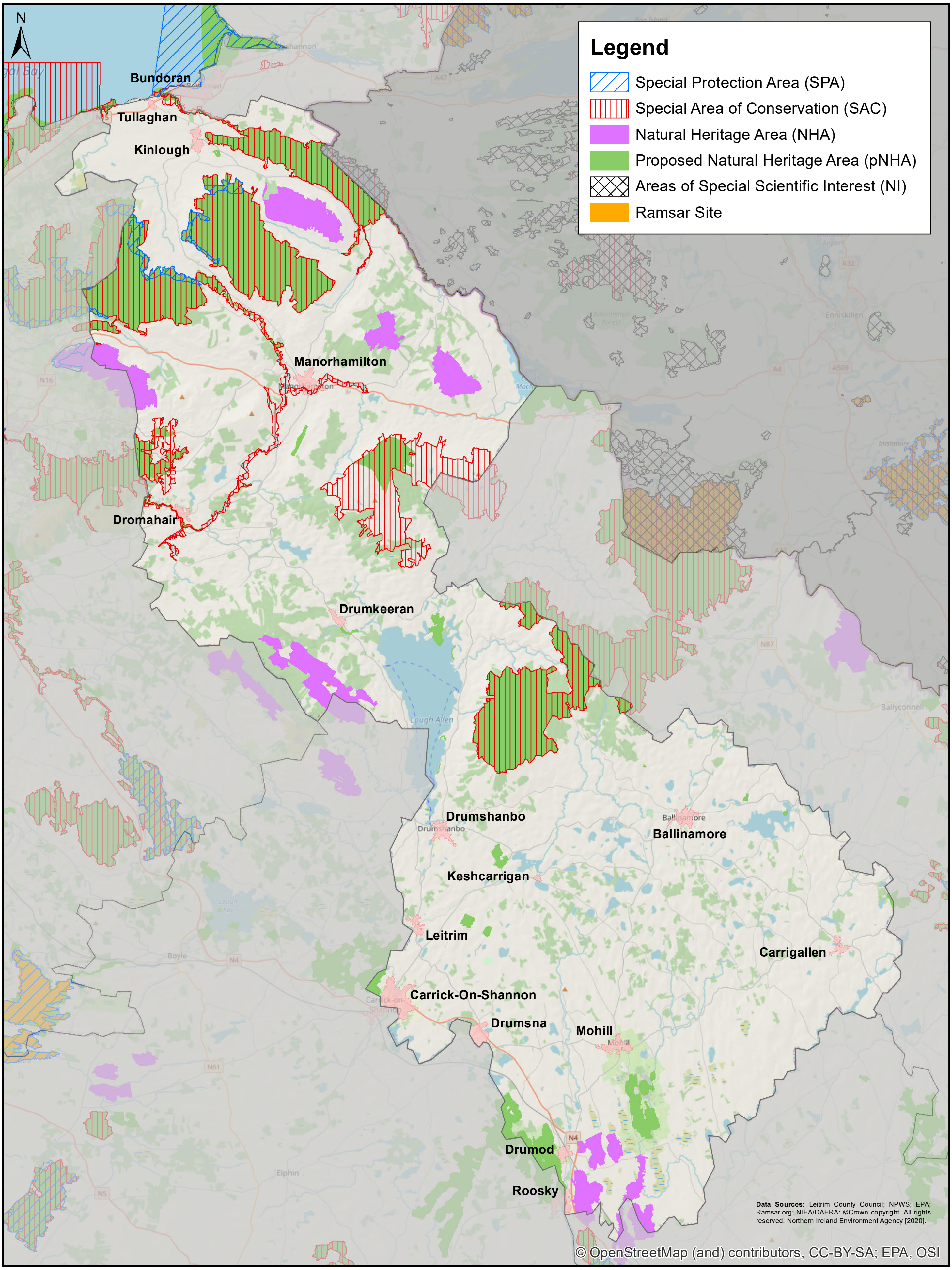
3.8.4 Cultural Heritage

Whilst the sieve mapping undertaken as part of this Renewable Energy Strategy does not incorporate features of cultural or built heritage as part of the suite of environmental constraints in its analysis, the potential impact of proposed renewable energy projects on such features should be assessed at project level. Renewable energy developments should avoid adversely impacting the cultural heritage in the county. The architectural and archaeological protected structures, sites and areas within Leitrim have been identified and mapped. The National Monuments Act established a list of Recorded Monuments and Places (RMP) that are of historical and archaeological significance. These sites are scattered throughout the county, with higher concentrations in the larger urban areas. A number of buildings in Leitrim are included in the Register of Protected Structures (RPS) as being of special interest for historical, artistic or other cultural reasons. Buildings constructed after 1700 are included in the National Inventory of Architectural Heritage (NIAH). In all cases, consent must be obtained to carry out works on or near these sites and limitations may apply to the extent of retrofit possible for protected structures.

Development within townlands may be constrained by designated Architectural Conservation Areas (ACAs) and the Zone of Architectural Potential surrounding recorded monuments. Where necessary, an Archaeological Assessment can be undertaken to determine the type and extent of impacts of a development on protected structures or monuments. The aim is to harness the renewable energy potential of the area while preserving the architectural and archaeological heritage.

3.8.5 Air Quality and Climate

Renewable energy provides a cleaner alternative to conventional generation in terms of reduced impact on air quality and climate. Although the renewable energy generation itself does not produce harmful emissions or CO_2, there is potential for such during the operating life cycle of the development. The construction, operation and decommissioning stages must be considered when assessing the impact of the development on air quality and climate, with projects aiming to minimise the release of CO_2. Elements such as vehicle emissions, material supply and reuse and disposal of waste offer opportunities for carbon savings to be made.



Title

Figure 3.2

Designated Nature Sites

Project

Leitrim Renewable Energy Strategy

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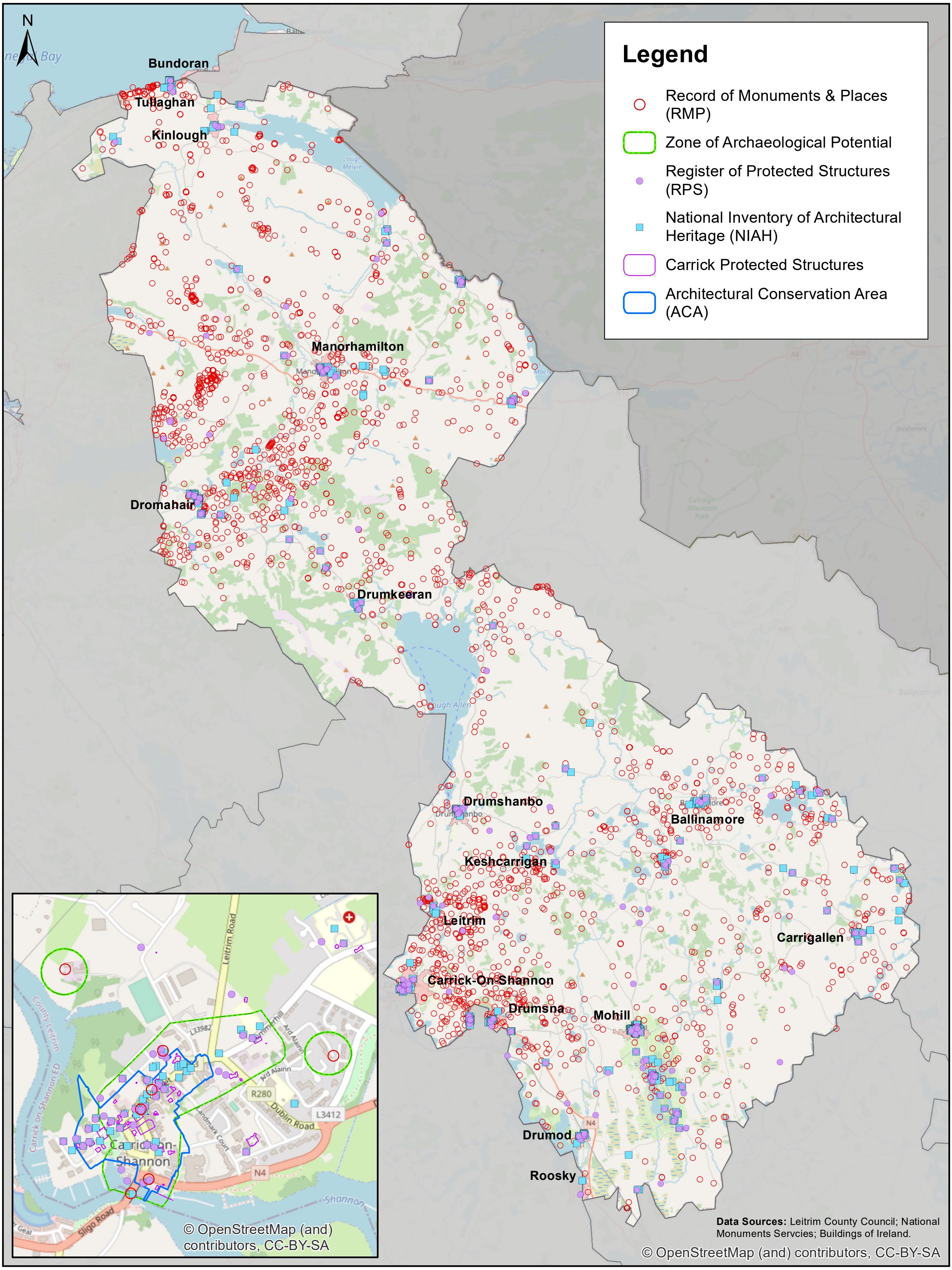

Title

Figure 3.3

Cultural Heritage Features

Project
Leitrim Renewable Energy Strategy

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4 ECONOMIC BENEFITS OF RENEWABLE ENERGY

4.1 Introduction

The uptake of renewable energy technologies offers economic as well as environmental benefits for the local community and the wider area. Renewable energy adds to the indigenous energy supply in Ireland, improving trade balances and Gross Domestic Product (GDP) by reducing reliance on imports. Wind energy alone is estimated to have displaced €200 million of fossil fuel imports in Ireland in 2017.[30] Renewable energy offers opportunities for both domestic and foreign direct investment in the country.

4.2 National Context

One of the main economic benefits to the local community is job creation. Renewable energy developments can lead to increased employment on three levels: direct, indirect and induced employment. Direct jobs are those involved in the manufacturing, construction, installation, operation, maintenance and decommissioning of the technologies, while indirect jobs are those associated with the supply chain. Although more difficult to quantify, renewable energy developments also create induced jobs in the wider economy as a result of increased consumption.

As of 2018 renewable energy is estimated to be responsible for 6,988 (combined direct and indirect) jobs in Ireland. On average, across all technologies, this equates to approximately 1.8 jobs created per megawatt (MW) of installed capacity. Wind energy accounted for 4,200 of those jobs, a share of approximately 60%. Solid biofuels resulted in the highest rate of employment per unit installed capacity, with 37.8 jobs created per megawatt output. This is due to the more labour-intensive nature of the sector and the required feedstock production. With solar photovoltaic (PV) expected to grow in Ireland, the current rate of 3.4 jobs created per megawatt of installed capacity presents an opportunity for substantial economic benefit. Consideration of induced employment would increase these rates further.

As illustrated in **Table 4-1** and **Table 4-2**, most of the jobs created from renewable energy come from fuel supply, namely bioenergy feedstocks, manufacturing, and installation. Solar PV has created the most employment worldwide to date, over 32% of the direct and indirect jobs from renewable energy. It has been reported that solar PV creates at least twice the number of jobs per unit electricity generated compared to coal or natural gas[31].The International Renewable Energy Agency (IRENA) reported that the shift towards renewable energy has resulted in job creation in the renewable sector that more than offsets the accompanying job loss in the fossil fuel industry[32].

[30] IEA Wind TCP Annual Report (2017)

[31] IRENA Renewable Energy Benefits: Measuring the Economics (2016)

[32] IRENA Renewable Energy Benefits: Understanding the Socio-Economics

Table 4-1: Direct and Indirect Job Creation from Renewable Energy in Ireland 2018

Technology	Installed Capacity 2018 (MW)	Number of Jobs (Direct & Indirect)	Number of Jobs/ MW Installed
All Renewable Energy	3,890	6,988	1.796
All Wind Energy	3,518	4,200	1.194
All Bioenergy	106	2,100	19.811
Solid Biofuels	45	1,700	37.778
Biogas	62	300	4.839
Renewable Hydropower	237	200	0.844
Geothermal Energy	–	188	–
Renewable Municipal & Industrial Waste	39	100	2.564
Solar PV	29	100	3.448

Source: IRENA

Table 4-2: Direct and Indirect Job Creation from Renewable Energy Worldwide 2018

Technology	Installed Capacity 2018 (MW)	Number of Jobs (Direct & Indirect)	Number of Jobs/ MW Installed
All Renewable Energy	2,350,755	10,343,200	4.400
All Wind Energy	563,726	1,148,161	2.034
All Biofuels	115,731	3,090,192	26.702
Solid Biofuels	95,687	779,502	8.146
Biogas	17,692	344,253	19.458
Renewable Hydropower	1,171,612	1,803,748	1.540
Geothermal Energy	13,329	93,297	7.000
Renewable Municipal & Industrial Waste	12,624	27,840	2.205
Solar PV	480,356	3,365,294	7.006

Source: IRENA

A typical 50 MW solar PV development is estimated to require 229,055 person-days from planning through to decommissioning. Aside from the manufacturing of the panels, 22% of the required person-days, the remaining work can be sourced within Ireland. Installation of the solar PV panels account for 17% of the direct employment required, while operation and maintenance make up 56%. A wind farm of the same capacity requires 144,420 person-days, with 30% for installation and 43% for operation and maintenance, which can be sourced internally.[30] Other opportunities for local employment exist during planning, transport, and decommissioning. Community benefit can be maximised through localisation of the value chain where possible, ensuring that a portion of the revenue flows to the host areas.

5 ENERGY EFFICIENCY AND CONSERVATION

5.1 Introduction

Renewable energy development will allow Leitrim to generate cleaner, more sustainable energy, contributing to national and European targets. However, renewable energy alone cannot fully combat the issues of climate change and depleting fossil fuel supplies. Energy efficiency and conservation are of equal importance and are vital if Leitrim is to achieve a carbon neutral future. Generating energy through renewable energy sources must be complimented by efforts to reduce energy demand and waste.

Energy efficiency involves using less energy to perform the same task. Although less energy is consumed, the same standard of product or service is achieved, thus it is the energy waste that is reduced. Ireland has a target of 20% energy savings through efficiency by 2030 and a more ambitious target of 33% in the public sector alone.[33] [34] By the end of 2016, 12% of the overall target had been met and energy efficiency in the public sector had improved by 21% at the end of 2015.[34]

Energy efficiency is typically improved through technology advancements and design improvements. It is then the responsibility of residents, business and industries to invest in these technologies, which typically result in financial savings following an initial investment. The SEAI have identified measures that have the potential to provide energy efficiency savings of almost 25% of Ireland's 2013 demand. Of these measures, both technical and behavioural, 75% will bring net financial savings in the long term.[35] The remaining measures can be implemented with appropriate support and financial incentives. The sector with the greatest potential for energy efficiency savings is the residential buildings sector, followed by transport, commercial buildings and industry.

The main opportunities in buildings are LED lighting, roof and solid wall insulation, efficient glazing, efficient appliances and heating systems such as heat pumps or efficient boilers with heating controls. Industry can benefit in the long term from investing in the installation of Combined Heat and Power (CHP). Energy efficiency in the transport sector is driven by EU regulations and modal shifts.[35]

Energy conservation is behaviour that results in the use of less energy. Conservation is usually reliant on changes in human behaviour and increased awareness or smart monitoring and control technology. There are measures that can be taken to conserve energy whilst maintaining a satisfactory standard of living. For example, installing timers or smart heating controls, turning the temperature down by 1°C, switching off lights, appliances and devices when not in use and maximising natural daylight. Once implemented, these measures can provide financial savings on the next energy bill, while also contributing to Leitrim and Ireland's targets. Although retrofit and energy efficient installations are vital if targets are to be achieved, it has been reported that to date, most of the savings have come from lower cost energy conservation measures.[36]

5.2 National Context

The Department of Communications, Climate Action and Environment have published a National Energy Efficiency Action Plan (NEEAP) #4 2017-2020. This plan sets out Ireland's progress to achieving our energy efficiency targets and details the measures that could be implemented to maximise savings. Achieving the 20% target would equate to 31,925 GWh of primary energy saved. The plan explores the residential, commercial, transport and public sector, detailing the strategies and policies in place to improve energy efficiency.

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[33] https://www.seai.ie/about/irelands-energy-targets/ [Accessed: 25/04/2019]

[34] DCCAE National Energy Efficiency Action Plan for Ireland #4 2017-2020

[35] https://www.seai.ie/resources/publications/Unlocking-the-Energy-Efficiency-Opportunity-Summary-for-Policymakers.pdf [Accessed 26/04/2019]

[36] DCCAE National Energy Efficiency Action Plan for Ireland #4 2017-2020

For the period from 2021-2030, the DCCAE is required to draw up a 10-year integrated national energy & climate plan (NECP) outlining how it intends to meet the different targets for 2030. This will include energy efficiency measures previously required under the (NEEAP).

A Public Sector Energy Efficiency Strategy was published in 2017 detailing how the target of 33% energy efficiency savings could be met by 2020. Achieving this target would see the public sector save €246 million on energy spend and avoid 5.9 million tonnes of CO_2 emissions between 2009 and 2020. The strategy highlights that most of the savings to date have been from behavioural changes, smarter energy use and some equipment upgrades. For the target to be met, progress must be made on a larger scale, such as the deep retrofit and renovation of buildings. The aim of the strategy is to promote greater effort in energy efficiency and energy management in the public sector, providing an example for other sectors to follow suit.

The Climate Action Plan (2021) requires an even more ambitious target of 50% improvement in energy efficiency to be achieved by 2030 in the public sector and individual targets for each public sector body to be put in place to deliver 51% emissions reduction by 2030 and to develop a roadmap to carbon neutrality by 2050.[37]

SEAI Programmes

The SEAI have programmes in place to support energy efficiency in homes, communities and businesses. The Home Energy Grants programme is designed to assist homeowners in reducing their energy consumption and achieving energy cost savings through financial incentives. Grants are available for measures including attic and wall insulation, upgrading heating controls, solar thermal, heat pump systems and Building Energy Rating (BER). As of March 2021, the scheme has supported the upgrade a total of over 402,000 homes in Ireland, about 20% of the housing stock. In Leitrim 3,043 homes have been upgraded representing 17% of the county's housing stock.

For those in receipt of welfare payments, the SEAI offer a range of free energy efficiency upgrades for eligible homes. Rather than providing a cash grant, measures such as attic and wall insulation, draught proofing, lagging jackets and energy efficient lighting are provided free of charge. As of 2021 over 143,000 homes have been upgraded using the 'Free energy upgrade Grant'. In Leitrim the Free energy upgrade grant represented 58% of the total upgrades listed above.

The SEAI Community Energy Grant Scheme is the national retrofit initiative which provides grant support for communities looking to achieve energy efficiency and reduce energy use by using a cross-sectoral approach throughout the community. The programme aims to combine buildings into one retrofit programme, making the process more efficient and cost effective. The project can involve residential housing, private and public sector non-residential buildings and commercial, voluntary and community organisations. There is a limit of €1 million funding for each project, with a yearly budget of €28 million in total.[38] As of 2020, nearly 19,000 homes and 2,800 non-residential buildings were retrofitted as a part of this scheme. Communities participating in this programme are encouraged to become a Sustainable Energy Community (SEC), a network supported by the SEAI that is focused on reducing energy consumption, improving energy efficiency and generating cleaner energy.

There are twelve SECs in Leitrim, namely, Mohill Community Development Association Ltd., North Leitrim SEC, Drumshanbo SEC, Ballinamore Area Community Council Ltd., Upper Shannon Erne Sustainable Region, Ballinaglera SEC, Dromahair Development Association, W8 Centre, Empower Community Project, Carrick on Shannon Community Solar, Carrigallen Sustainable Energy Community and Leitrim Integrated Development Company.[39]

Business Grants are also available from the SEAI, including Project Assistance Grants and the EXEED Certified Grant, which provide funding for businesses to implement measures to reduce

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

[38] https://www.seai.ie/grants/community-grants/ [Accessed: 15/09/2021]

[39] https://www.seai.ie/community-energy/sustainable-energy-communities/sec-map/?z=10&lat=54.11414554643288&lng=-7.971592282904383 [Accessed: 15/09/21]

energy use and improve efficiency.[40] The Lighting Support Scheme for SMEs (Small to Medium Enterprises) assists business in upgrading their lighting to more energy efficient alternatives, reducing energy use and achieving financial savings on energy bills. The SEAI have also collaborated with Teagasc to deliver a Dairy Farm Grant, allowing farmers to reduce costs and increase profitability through investing in energy efficient technology.

5.3 County Context

Leitrim is participating in initiatives to contribute to the energy efficiency and conservation goals of the county and country. The SECURE Project operated between 2016 and 2019 to assist in the deployment of energy efficiency and renewable energy technologies within the county. The project was co-funded by the EU's Northern Periphery and Arctic (NPA) Programme and consisted of a partnership of eight participants across the region sharing their experience and expertise in energy efficiency and generation. The innovative project aims to trial new technologies and raise awareness throughout the county about the need for these measures and the best practice in implementation in Leitrim.[41] Leitrim introduced energy efficiency lighting solutions in three public buildings through the SECURE projects achieving annual cost savings of €7,864 and reducing annual carbon emissions by 5720 t/Co2.

The Local Community Development Committee (LCDC) have developed a LEADER funding programme in County Leitrim, focused on community-led rural development. It aims to promote social inclusion, poverty reduction and economic development by delivering funding to rural businesses and communities.[42] Leitrim benefited from almost €6 million of support over the lifetime of the project, 2014 to 2020. The next LEADER programme framework is not expected to be implemented until 2023. In order to bridge the gap, a transitional fund was announced in 2021 which allocated €1.7 million in funding to Leitrim. The development of renewable energy is considered eligible under the rural environment theme, including small scale and community energy projects.

The policies and objectives for energy efficiency and conservation for the county are outlined in Table 5-1. The indicative timeframes quoted include for the short (1 to 2 years), medium (2 to 6 years), and long term (6 to 10 years).

5.3.1 Policies and Objectives

Table 5-1: Recommended Energy Efficiency & Conservation Objectives and Polices

Name	Description	Short-term	Medium-term	Long-term
Objective EE1	To support the implementation of national energy efficiency standards and to support and facilitate energy conservation and efficiency, including through: • Improved building design; • Promoting smarter travel; and • Raising awareness / benefits of energy conservation.	✓	✓	✓
Policy EE1.1	Increase awareness of the environmental, financial, social and practical benefits of being energy efficient	✓	✓	✓
Policy EE1.2	Encourage consideration of energy efficiency and low-carbon design solutions when carrying out pre-planning discussions for major residential, commercial and industrial development.		✓	✓
Policy EE1.3	Support energy efficiency and conservation education in partnership with local, regional, and national organisations	✓	✓	✓

[40] https://www.seai.ie/grants/business-grants/ [Accessed: 26/04/2019]
[41] http://leitrimcoco.ie/eng/Business/Secure-Smarter-Energy-Communities/ [Accessed: 26/04/2019]
[42] http://www.ldco.ie/assets/uploads/EOI_Booklet_compress.pdf [Accessed: 26/04/2019]

Case Study – LCC Social Housing Energy Efficiency Upgrades

Name of the energy practice:

Mohill Better Energy Communities Project

Region where the practice is active:

Mohill, County Leitrim

Short description about the function or background of the product or service:

The project involved working with the local community in the town of Mohill in County Leitrim. Mohill has a population of approximately 1,000 people. The Local Authority owns and runs a local library there as well as being responsible for public housing in the town. The Local Authority and Local Enterprise Office combined to apply for a package of supports from the Sustainable Energy Authority of Ireland, SEAI to increase the energy efficiency of housing and public buildings. Scheme included works to:

- Knocklongford - energy upgrades to 26 homes
- Cappagh – 16 homes (+ 4 private homes)
- Mohill Public Library – insulation, heating and lighting upgrade
- Mohill Fire Station – insulation, heating and lighting upgrade
- Hyde Terrace – insulation, storage heating and lighting upgrade

Energy upgrade works to homes included the installation of cavity wall insulation, attic insulation, oil boiler replacement with condensing boilers, and new front door to homes in some cases.

The works to Mohill library and Fire station included an internal lighting upgrade to LED lighting, cavity wall/external wall insulation upgrade and also oil boiler replacements to a more efficient condensing boilers. Heating control upgrades were also installed.

At Hyde Terrace the works included a lighting upgrade, attic insulation, ventilation upgrade

Works also included replacement of the existing storage heaters with more energy efficient storage heaters.

Innovativeness or relevance of the practice:

The project is part of a programme of works rolled out in a number of local authorities in Ireland with funding from the SEAI. Leitrim has undertaken work in Mohill, Carrick on Shannon and Manorhamilton. Works in Mohill (including replacement of 50 public lights with LED lanterns) were done in line with LCC Climate Change Plan.

It is estimated that a **total of 690,150 kWh** (kilowatt hours) will be **saved annually** from the energy upgrade works in Mohill. This is equivalent to an annual **saving of 19,985 kg CO_2**.

Other information
https://www.seai.ie/grants/community-grants/
https://www.ernact.eu/BestPractice.aspx?BPID=105

6 OVERVIEW OF RENEWABLE ENERGY TYPES

This chapter presents the renewable energy types with the greatest potential for realisation throughout County Leitrim. To assess the different types of renewable energy resources, a “sieve analysis” was carried out starting with the maximum theoretical resource possible, which is then refined to the current accessible resource for the county, as shown **Figure 6-1**. Full details of this approach can be found in the SEAI’s ‘*Methodology-for-Local-Authority-Renewable-Energy-Strategies*’ (2013).

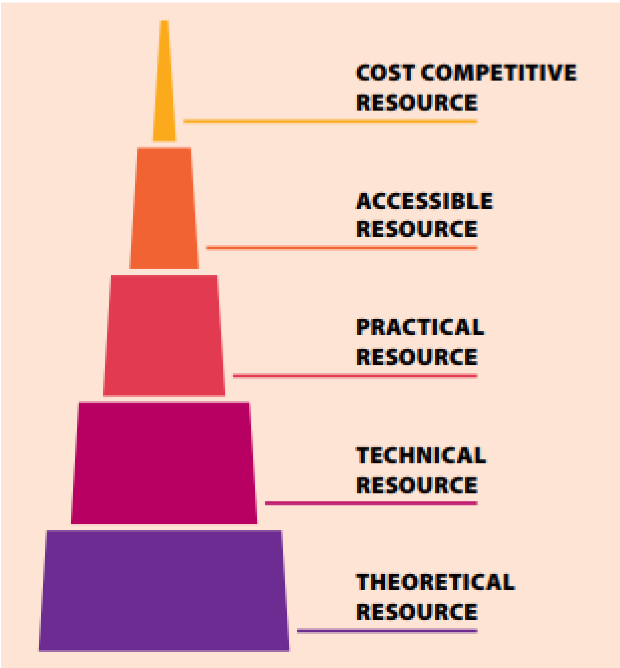

Figure 6-1: Graphical representation of ‘sieve analysis’ approach

From this analysis, the most viable resources have been identified and presented here, showing the current, planned and contracted developments within the county, the key success factors for each, and, where possible, areas within the county for future consideration.

The full analysis of each renewable energy resource considered is presented in **Appendix A**.

6.1 Wind Energy

6.1.1 Introduction

This section considers onshore wind in County Leitrim, defining the resource and the associated energy conversion technologies, identifying potential development, and setting out policy and objectives to support wind energy developments, which can make a contribution to our renewable energy targets while minimising any adverse impact on the environment.

6.1.2 Overview

Wind energy arises due to the uneven heating of the earth which creates thermal air currents. Wind turbines can be used to extract the power in the wind and convert it to mechanical power, which can then be transformed into electricity. Wind turbines can be constructed onshore or offshore, the dominating classification in Ireland being onshore.

The total installed capacity of wind in Ireland reached 4,175 MW in 2019 with all but 25.2 MW being from onshore wind. In 2019, wind energy provided 32% of Ireland's electricity demand, producing 9.4 TWh (terawatt hours).[43].[44]

The tip height and rotor diameter of a wind turbine influence its power output. Increasing the tip height increases the productivity of the turbine as it can access higher wind speeds. Since power output is dependent on wind speed, a large degree of variability can be associated with wind turbine electricity generation. The challenges to the development of onshore wind include the local wind speed resource, noise limits, specifications for shadow flicker and spatial requirements relating to setback distances. The 2006 Wind Energy Development Guidelines (WEDGs) are, at the time of writing, under review with the publication of the Draft Wind Energy Development Guidelines (DCCAE, December 2019). The draft guidelines propose a setback distance from residential properties of four times the turbine tip height, with a minimum requirement of 500 metres.[45]

6.1.3 Current, Planned, and Contracted Developments

Onshore wind energy is the largest contributor to total renewable energy generation in Leitrim, which reflects the national status of wind energy contribution. There is an installed capacity of c. 92.9 MW of onshore wind power in the county.[46] [47] [48]

Table 6-1 outlines the existing, planned and contracted wind energy developments in Leitrim.

[43] 2019 IEA Wind TCP Annual Report

[44] SEAI (April 2020) Renewable Energy in Ireland 2020 Update. https://www.seai.ie/publications/2020-Renewable-Energy-in-Ireland-Report.pdf

[45] https://www.housing.gov.ie/planning/guidelines/wind-energy/coveney-and-naughten-announce-key-development-review-wind-energy-development-guidelines [Accessed: 12/03/2019]

[46] https://www.esbnetworks.ie/docs/default-source/publications/dso-connected-energised-wind-generators-q4-2018.pdf?sfvrsn=e18b05f0_0 [Accessed: 12/03/2019]

[47] http://www.eirgridgroup.com/site-files/library/EirGrid/TSO-Connected-Renewable-Generation.pdf

[48] https://www.thewindpower.net/windfarms_list_en.php [Accessed: 12/03/2019]

Table 6-1: Current and planned onshore wind developments, date and capacity.

Name	Status	Date of Connection	Maximum Export Capacity (MW)
Tullynamoyle Wind Farm (2)	Operational	17/11/2017	10.225
Tullynamoyle Wind Farm (3)	Operational	18/09/2017	11.98
Tullynamoyle Wind Farm (3)	Operational	18/09/2017	1.598
Faughary Wind Farm	Operational	12/12/2014	6
Carrickeeny Wind Farm	Operational	28/02/2014	7.65
Tullynamoyle Wind Farm (1)	Operational	17/11/2011	9
Moneenatieve Wind Farm (2)	Operational	15/10/2011	0.29
Garvagh-Glebe Wind Farm (1a)	Operational	01/06/2010	26
Moneenatieve Wind Farm (1)	Operational	23/09/2005	3.96
Black Banks Wind Farm (2)	Operational	08/09/2005	6.8
Black Banks Wind Farm (1)	Operational	01/09/2001	3.4
Spion Kop Wind Farm	Operational	01/12/1997	1.2
Corrie Mt Wind Farm	Operational	01/03/1997	4.8
Tullynamoyle Wind Farm (5)	Planning Granted 28/05/2020.	–	16 (Projected)
Greaghnaslieve	Granted by ABP 27/11/2020-		2 Projected
Croagh Wind Farm	On appeal to ABP (Sept. 2021)		38.4 (Projected)
Tullynamoyle Wind Farm (5) Extension	Planning Application under consideration by LCC (Sept.2021)		20 (Projected)

6.1.4 Key Supporting and Constraining Factors

Whereas the above table shows a significant number of operational wind farms in the county, many other planning applications have not been successful. Notwithstanding the availability of excellent wind resources and enabling grid infrastructure, the county contains a number of sensitive ecological sites, as well as a rich cultural heritage and high quality landscapes. A number of proposed wind energy development have been refused on the basis of their potential to give rise to adverse impacts on these features. Single turbine plans have also been rejected in the absence of an overall strategic approach to the development of wind, where in some cases the relatively limited energy output does not justify the local environmental impacts.

6.1.5 Potential Resource

Methodology

The approach to identifying the wind energy potential is summarised in Figure 6-2 below.

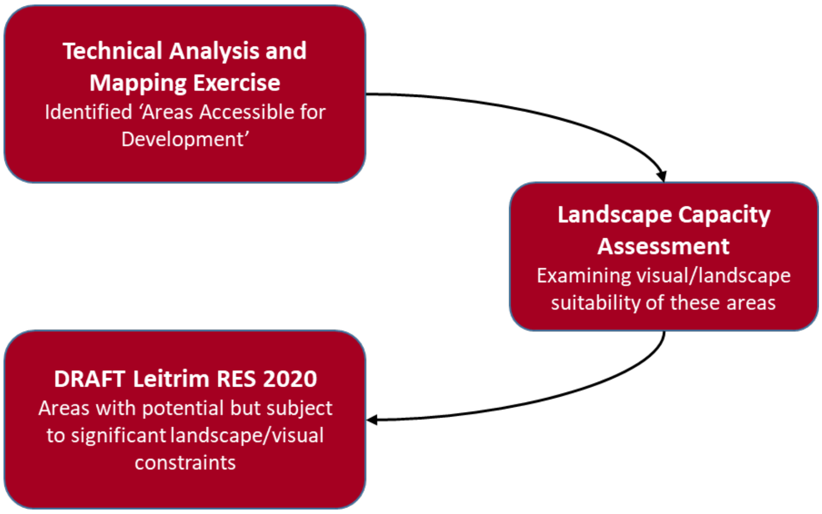

Figure 6-2: Methodology for Identifying Wind Energy Potential

Step 1- Technical Analysis and Mapping Exercise

The calculation of available wind resource for Leitrim has been undertaken having regard to 2006 Wind Energy Guidelines. Furthermore, the technical requirements of the draft WEDGs 2019 were also included. In the first instance, if only areas which have a viable wind speed greater than 7.6 m/s are considered (related to a typical turbine with a tip height of 175m), the maximum theoretical wind capacity potential for Leitrim would be 5,376 MW using a Wind Capacity Intensity of 7 MW per 100ha[49]. Then, in having regard to Section 3.4 of the WEDGs, and the SPPR contained within the 2017 *Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change*, a sieve analysis was undertaken to identify those areas which are potentially accessible for wind development having regard to environmental, heritage and amenity features, but excluding landscape and visual amenity. **Figure 6-3** shows those areas in dark blue that are available, taking into account constraints posed by features such as European and Ramsar protected sites (also including waterbodies), heritage and monuments, settlements and existing infrastructure/ material assets, as discussed in **Section 3**. The findings presented in **Figure 6-3** also take into account a setback distance of 500m from all sensitive receptors consistent with the Wind Energy Guidelines of 2006 and the draft 2019 WEDGs. This figure also illustrates the proximity of the available areas to the transmission network and therefore possible grid connections.

A further technical/mapping exercise was carried out to examine risk factors within these potentially available areas, this is presented in **Figure 6-4.** The colour ramp displaying risk level in available areas has been defined by adding up the risk levels (5 for High, 3 for medium and 1 for Low) at certain distances from material assets, sensitive receptors, European Sites and from natural physical attributes (such as groundwater vulnerability, geological heritage sites, soil drainage, landslide and flooding susceptibility). The risk levels are aggregated and displayed on a scale ranging from High (maximum risk) to Low (minimum risk). However, the presence of a risk category in and of itself does not support nor preclude wind energy development. It is a tool which flags areas of having a higher or lower concentration/distance from various sensitive receptors.

The total available capacity for onshore wind energy development for Leitrim from these identified areas is therefore estimated to be 594 MW. The capacity that is available at an assumed delivery rate of 10% is 59 MW.[50]

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[49] As used in the Draft Galway County Council Local Authority Renewable Energy Strategy May 2021: https://consult.galway.ie/system/files/materials/17/Appendix%201%20Renewable%20Energy%20Strategy%20LARES.pdf

[50] Based on the following assumptions: Mandatory setback distance of 500m imposed on wind turbines from domestic dwellings; then All Risk areas Excluding SPA, SAC, RAMSAR, gives the available area as 59 km^2. This is multiplied by a Wind Capacity Intensity (7 MW per km^2), giving the available capacity of 594 MW. The 10% delivery rate is a figure based on the planning success rate of previous applications, also agreed with the SEAI as part of RPS's Noise Modelling work.

Step 2 – Landscape and Visual Capacity Study

A Landscape and Visual Capacity Study has been prepared which focuses on the areas of search identified from the constraints exercise referred to above. This is presented in a separate report entitled*, Leitrim County Renewable Energy Strategy – Landscape and Visual Capacity Study for Wind Farms and Wind Turbines*. The areas of search comprise upland and lowland landscapes located within six of the county's Landscape Character Areas (LCAs).

The capacity study concludes that there is very limited capacity to absorb future proposed development in the form of wind turbines and wind farms. This is due to a number of factors relating to landscape quality and scenic quality as follows:

- Scenic quality and expansive nature of these landscapes;
- Remote, tranquil and wild quality where the absence of man-made influences is a key characteristic;
- Intervisibility and relationship with adjacent landscapes for which the uplands are important to setting and present as a distinctive skyline or mountain backdrop;
- Presence of complex, distinctive and rugged landform;
- Landscape scale, at locations where field patterns defined by hedgerows convey a sense of a small scale landscape in which the presence or visibility of wind turbines would dominate; and
- Proximity of settlements for which upland moorland and mountain areas are an important setting, which would be adversely affected by future wind turbines or wind farms.

Figure 6-5 sets out out the (LCAs in question, and further details of the analysis for each of these LCAs can be found in the Landscape and Visual Capacity Study Report.

The capacity study concludes that although scope for future wind energy development would be limited, each planning application for proposed development of this kind would have to be judged individually on its own merits with reference to a landscape and visual impact assessment (LVIA) report undertaken in line with current good practice guidance by an appropriately qualified landscape architect. The LVIA would also demonstrate that the design of the proposed development, in terms of turbine number, hub height, tip height and siting of individual wind turbines has regard for the baseline landscape character and visual amenity of the study area in which the development would be located.

Sensitivity Analysis on Available Areas

A further technical assessment was carried out of potentially available areas (Step 1 above), using a search criterion for land parcels of greater than 100 hectares in area. This would potentially be suitable for smaller wind farm configurations of say 3 to 5 turbines. This is presented in **Figure 6.3 (b),** see Appendix B**.**

The sensitivity analysis had the effect of increasing slightly the scale of identified areas in the north of the county, by bringing some additional parcels of land into the 'available' category.

The analysis also identified two further areas in South Leitrim with land parcels >100 hectares and sufficiently separated from dwellings. Both sites are part of bogland that adjoins and spans into County Longford. This forms part of the South Leitrim Drumlin and Shannon Basis landscape character area.

The westernmost site (beside the village of Rooskey) is close to the River Shannon corridor, and is part of the Aghnamóna Bog, which is designated as a Natural Heritage Area because it forms part of a raised or 'high bog' complex. The easternmost area is part of Cloonageeher bog, which is also a designated NHA because it forms part of a raised or 'high bog' complex. Given the environmental sensitivity of the area, the potential for wind energy development is considered low.

The 'available areas' layer that considers areas >100ha has an overall area in Leitrim of 9,641 ha, this converts to 675MW available capacity (or 67MW at 10% delivery rate). No further landscape capacity analysis was carried out in relation to the sensitivity analysis in **Figure 6.3(b)**.

Extensions to existing wind farms

One way to further avail of the wind energy resource in the county is to extend existing wind farms by adding new turbines. A site by site analysis of potential for extensions has not been carried out for this RES. If this approach is to be followed, regard should be had to the risk mapping set out above (Figure 6-4) and to the Landscape and Visual Capacity Study, which assesses the sensitivity of the landscapes to development.

Repowering existing wind farms

In addition to potential for new wind farms, Repowering is also a concept which will become more relevant as the national wind turbine fleet matures. Most wind turbines have an operational life of 20-25 years. Rather than decommissioning a wind farm in its entirety, repowering offers an opportunity to replace some or all turbines thereby extending the operating life of the wind farm. Repowering can result in a smaller number of higher-output turbines as the technology continues to advance. This potentially contributes to less environmental and economic impact, as improvements are made to an existing installation and are cheaper than new-builds.[51] Repowering is also a key strategy in the SEAI's Wind Energy Roadmap 2011-2050 for driving onshore wind capacity growth from 2030 onwards.[52]

To date, not much analysis has been undertaken to determine what volume of repowering potential is possible for Ireland. The 2019 IWEA repower report [51] has outlined the potential for Leitrim; see **Table 6-2**. The age of an existing wind farm indicates the degree to which aged wind farms will potentially repower. IWEA also notes that the degree to which the repowering potential will be realised in Ireland will be highly dependent on regulatory frameworks and addressing current barriers (e.g. lack of an enabling framework, different definitions of repower, planning restrictions etc.).

Table 6-2: Repower Potential for Leitrim - Capacity Aged 15 years-plus in 2020, 2025 & 2030 (IWEA, 2019)

Year	2020 (MW)			2025 (MW)			2030 (MW)		
Wind Farm Age	**15-19**	**20-24**	**25+**	**15-19**	**20-24**	**25+**	**15-19**	**20-24**	**25+**
Leitrim	**14**	**6**	**0**	**26**	**14**	**6**	**23**	**26**	**20**
National Total (MW)	*307*	*109*	*6*	*974*	*307*	*115*	*1,040*	*974*	*422*
National % Capacity	*8%*	*3%*	*0%*	*26%*	*8%*	*3%*	*28%*	*26%*	*11%*

Source: Adapted from Table 1, IWEA (October 2019) More Power to You: A Guide to Repowering in Ireland.

If repowering is being considered, regard should be had to the risk mapping set out in Figure 6-4 and to the Landscape and Visual Capacity Study, which assesses sensitivity to development and sets out the proper approach to assessing landscape and visual impacts.

Potential Wind Resource Summary

Having combined the technical and mapping analysis (Step 1) and the Landscape and Visual Capacity Assessment (Step 2), opportunities for new wind farm are limited. There are no areas where new wind turbines would be considered 'acceptable in principle'.

Opportunites for repowering of existng wind farms or extensions to existing wind farms may be considered, but the environental constraints and visual and landscape sensitivity need to be carefully considered on a case by case basis.

Wind Energy Potential - Relationship with adjoining counties

[51] IWEA (October 2019). More Power to You: A Guide to Repowering in Ireland. https://www.iwea.com/images/files/repoweringes.pdf

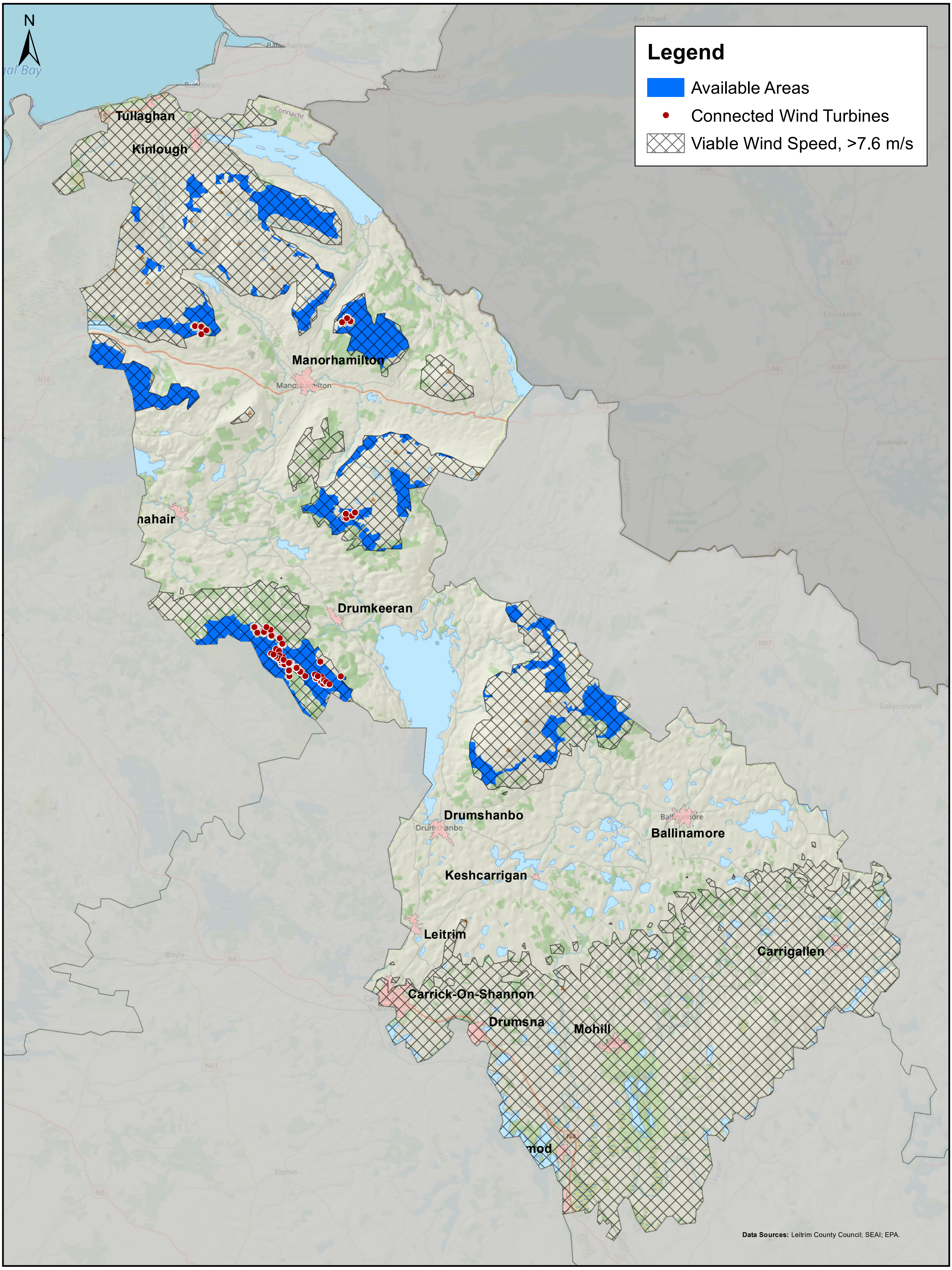
[52] SEAI Wind Energy Roadmap 2011-2050. https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf

A mapping exercise has been carried out in relation to adjoining local authorities to enable the wind energy policies to be examined side by side with the emerging wind energy availability in County Leitrim. As of September 2021, the most recent available wind energy strategy for adjoining counties - or landscape strategy in the case where no wind energy strategy is available - is shown on **Figure 6-6** below.

It should be borne in mind that the 'available areas' shown in Leitrim do not correspond with 'acceptable in principle' status for wind energy. Reference should be had to the report *Leitrim County Renewable Energy Strategy – landscape and visual capacity study for wind farms and wind turbines*.

Some observations on the map featured in Figure 6-6 are as follows:

- Many of the 'available areas' in Leitrim are not contiguous with the border of the county, so the potential for conflict with other county policies is limited.
- There are some areas of potential in East Leitrim that border County Cavan. This corresponds with both LCA 8 (Boleybrack Uplands) and LCA 10 (Slieve Anierin) in the accompanying *Leitrim County Renewable Energy Strategy – Landscape and Visual Capacity Study for Wind Farms and Wind Turbines*. Within Cavan, the adjoining areas are designated as 'High Landscape Areas'.
- In mid-west Leitrim, the available areas in Leitrim are contiguous with both Roscommon and Sligo. This corresponds with LCA 11 (Corry Mountain) in the accompanying Leitrim Landscape and Wind Turbine Study. The northern tip of Roscommon is designated as 'most favoured' for wind turbines. In Sligo the area is shown in yellow as a 'sensitive rural landscape', although it is noted that this designation covers a significant part of the county. A red line denoting 'visually vulnerable landscape' is also show, presumable corresponding with a ridgeline. No wind energy strategy is available for County Sligo.
- In north-west Leitrim – the 'available areas' are contiguous with County Sligo in two places. Typically, this corresponds with both 'sensitive rural landscape', and 'visually vulnerable landscape' in Sligo.
- Wind energy mapping and landscape mapping for the Fermanagh and Omagh District Council area for their Draft Development Plan is available on their website, but not available to reproduce at the time of completion of this draft RES (November 2021). While there is one designated Area of Outstanding Natural Beauty (AONB) with the District Council's functional area, Sperrin AONB, this is not within County Fermanagh.



Title

Figure 6.3

Wind Opportunities & Constraints

Project

Leitrim Renewable Energy Strategy

Client

Comhairle Chontae Liatroma
Leitrim County Council

rps

West Pier Business Campus,
Dun Laoghaire,
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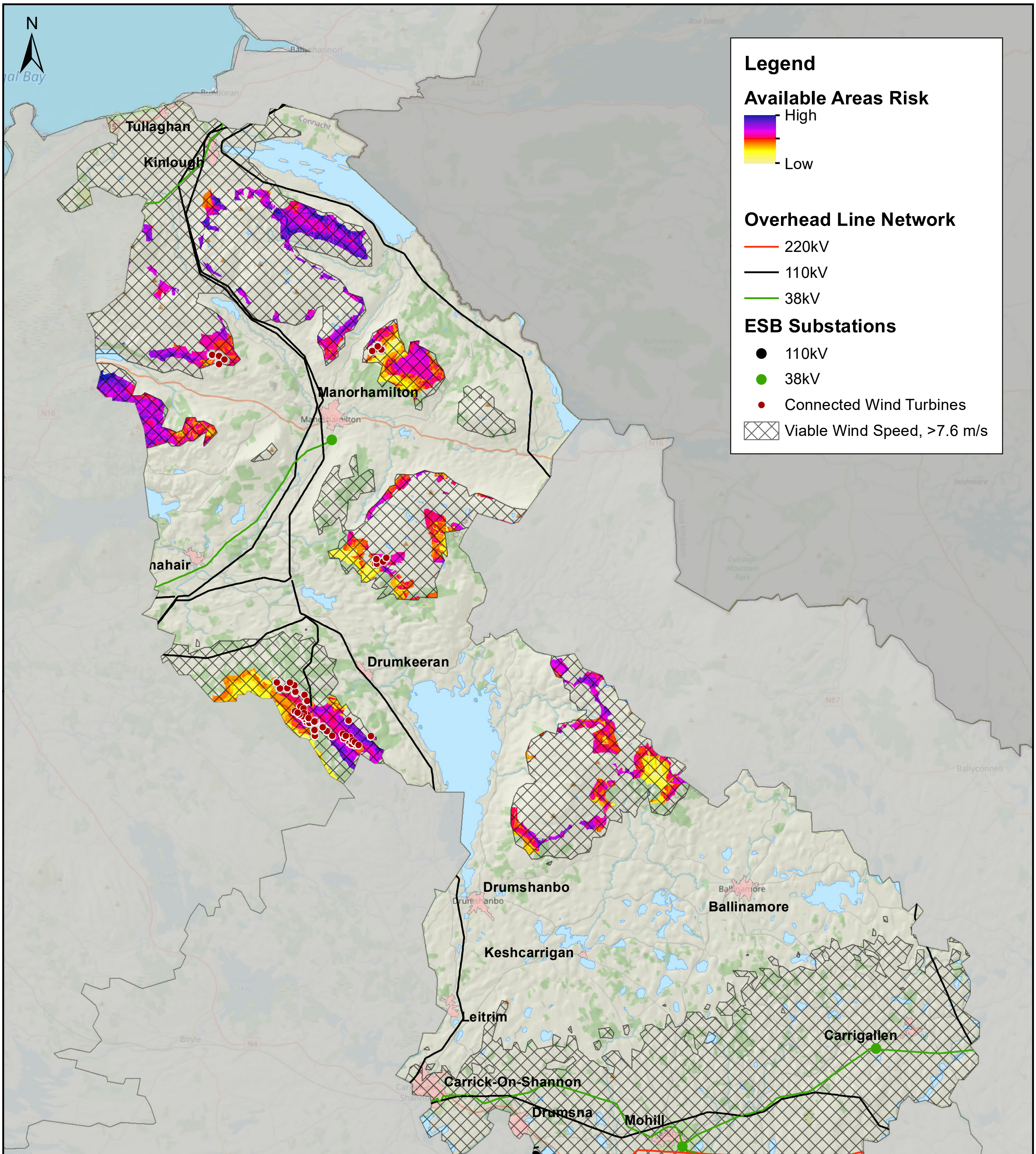
Issue Details			
Drawn By:	NO'N	Project No.	MDR1528
Checked By:	SK	Date:	18/05/2020
Approved By:	CB	File Ref:	
Scale:	1:320,001 @ A4	MDR1528Arc0023A01	



ESB Data Disclaimer
This map indicates the approximate location of ESB Networks Transmission (400kV, 220kV, 110kV, 38kV) and Distribution (20kV, 10kV, 230V/400V) underground cables and overhead lines in the general area of the proposed works. ESB Networks takes no responsibility for the accuracy or completeness of these maps. Low voltage (230V/400V) service cables (e.g. house services, factory/shop services, public lighting lamp services, etc) are not included but their presence should be anticipated. The depths of underground cables must never be assumed. Additional more detailed information is available for high voltage Transmission underground cables (38kV, 110kV, 220kV, 400kV) - for cables in the greater Dublin area call 01 6042957 and for all other areas call 1850 372 757. No work should be carried out in the vicinity of 38kV or higher voltage underground cables without prior consultation with ESB Networks.
Before any mechanical excavation is undertaken, the actual location of all underground electricity cables must be established and verified on site, using: (a) Up-to-date map records; (b) Cable locator equipment operated in both power and radio modes; (c) Careful hand digging of trial holes using 'Safe Digging Practice'. Refer also to 'HSA Code of Practice for Avoiding Danger from Underground Services'.
ESB takes no responsibility and shall bear no liability in relation to any damage, injury/death or loss of supply as a result of damage or interference with its networks.

Title

Figure 6.4

Wind Opportunities & Constraints – Risk Rating of the Available Areas

Project

Leitrim Renewable Energy Strategy

Client

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Drawn By: NO'N	Project No. MDR1528
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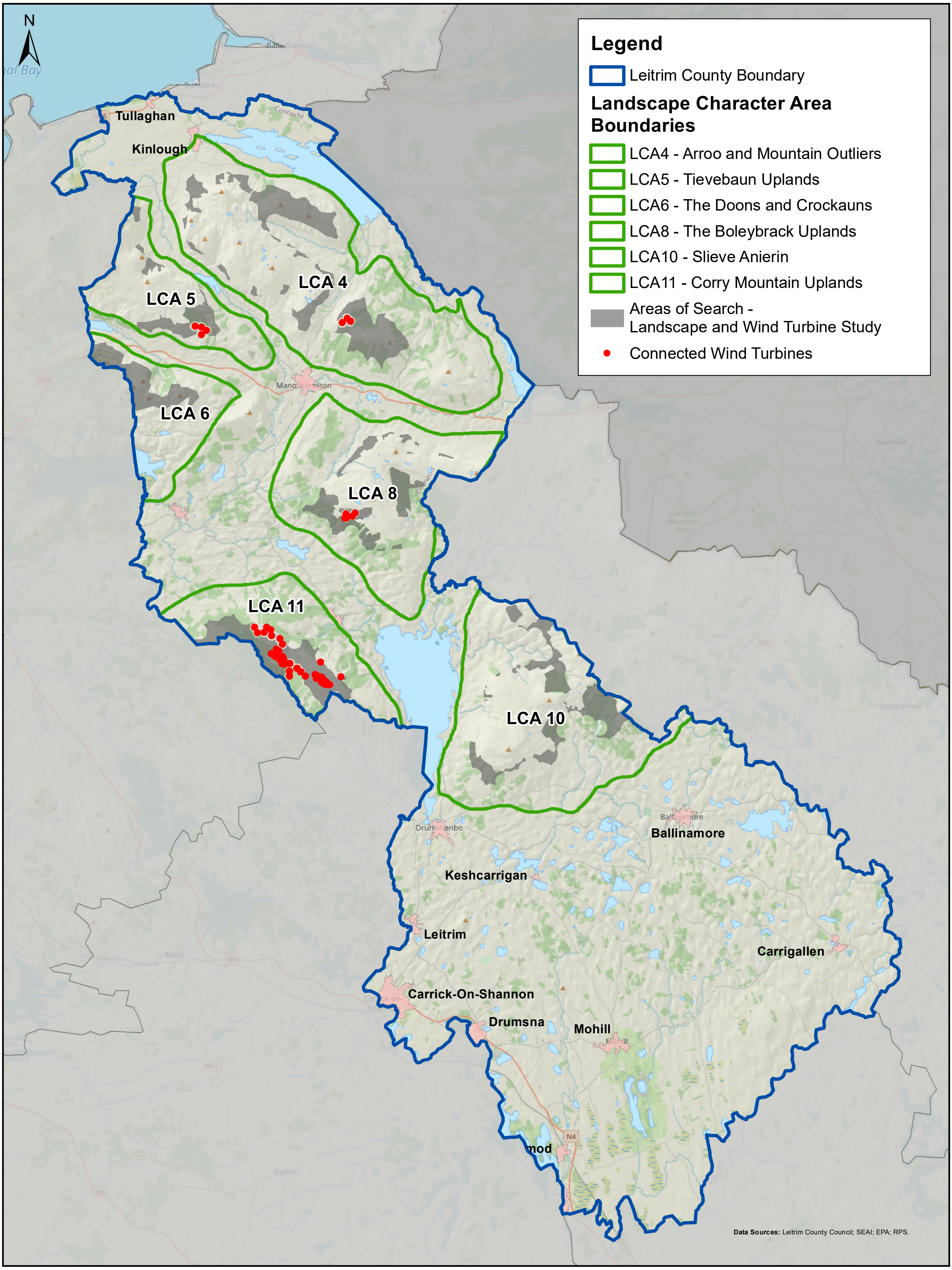
Scale: 1:320,000 @ A4	



Title	Project		Issue Details	
Figure 6.5	Leitrim Renewable Energy Strategy	rps	Drawn By: NO'N	Project No. MDR1528
Landscape Capacity for Wind Turbines	Client: Comhairle Chontae Liatroma / Leitrim County Council	West Pier Business Campus, Dun Laoghaire, Co Dublin, Ireland. Tel: +353 (0) 1 488 2900 Email: ireland@rpsgroup.com Web Page: rpsgroup.com/ireland	Checked By: SK	Date: 18/05/2020
			Approved By: CB	File Ref: MDR1528Arc0030A01
			Scale: 1:320,001 @ A4	

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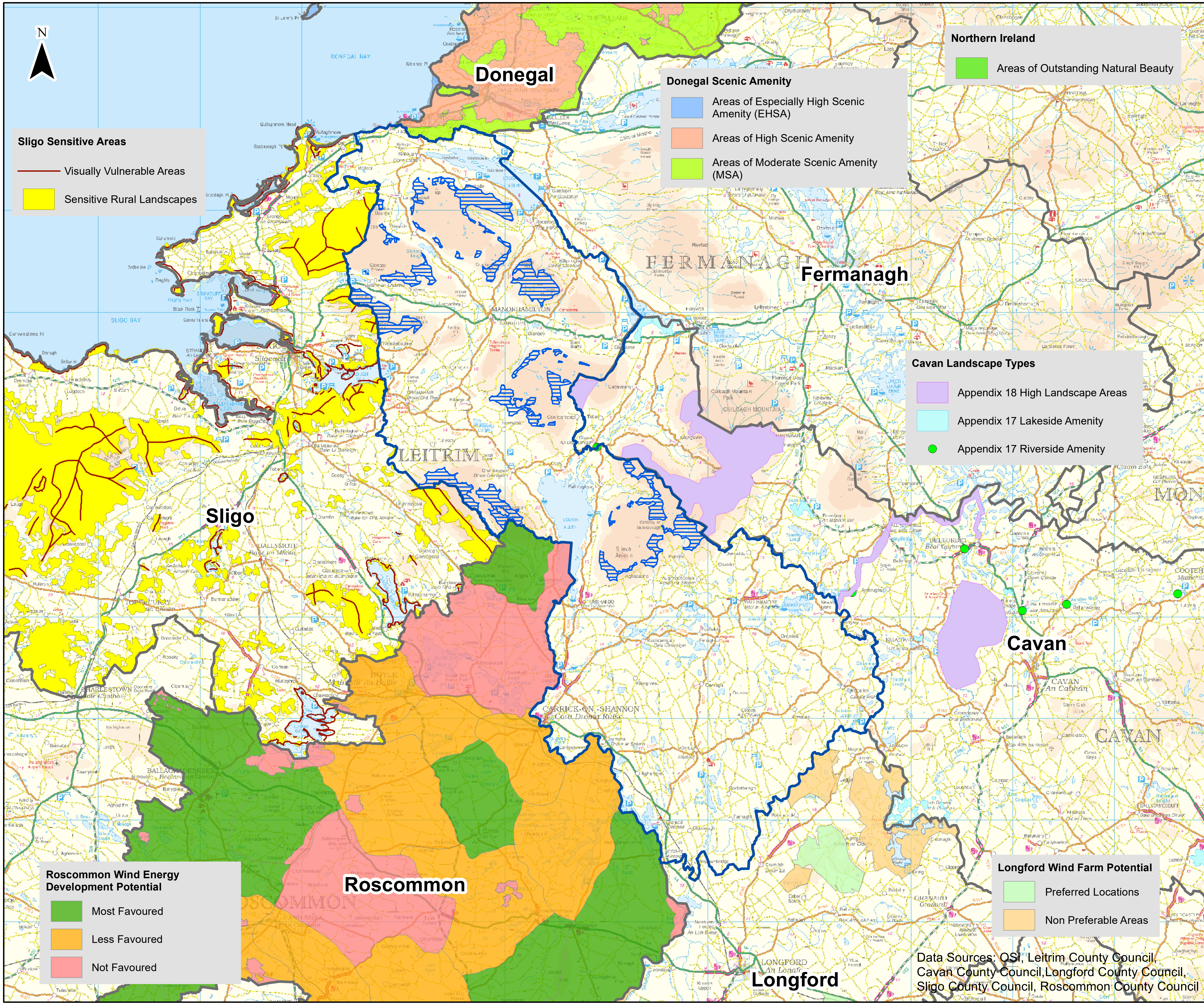

Legend

Leitrim Wind Landscape Capacity Study

Available Areas

0 4.5 9 18 km

Client

Comhairle Chontae Liatroma
Leitrim County Council

Leitrim County Council Renewable Energy Strategy

Title

Figure 6.6

Wind (or Landscape) Strategies in Neighbouring Counties

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Issue Details

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Status: Draft	**Rev:** A01
Model File Identifier: N/A	
Drawn: NR	**Date:** 24/09/2021
Checked: IP	**Scale:** 1:350,000 (A3)
Approved: CB	**Projection:** ITM

NOTE:

6.1.6 Recommended Policy and Objectives

Table 6-3 below outlines the objectives and supporting polices in relation to wind energy over the short (1 – 2 years), medium (2 – 6 years), and long term (6 – 10 years).

Table 6-3: Wind Energy Objectives and Polices

Name	Description	Short-term	Medium-term	Long-term
Objective W1	Promote appropriate wind energy development in Leitrim.	✓	✓	✓
Policy W1.1	Proposals for on-shore wind farm developments will be determined in accordance with the Wind Energy Development Guidelines and County Development Plan policy framework.	✓	✓	✓
Policy W1.2	Preference for re-power of existing wind farms when they come to the end of their operational life.		✓	✓
Policy W1.3	Support community led wind energy developments or developments with innovative models for community ownership.	✓	✓	✓

Leitrim's Contribution to National Targets for Wind Energy

The 'Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change (July 2017)' contain a specific planning policy requirement (SPPR) requiring the Development Plan to indicate how the wind energy policies for the county align with national targets.

The National Climate Action Plan (2021) includes a target to expand on-shore wind energy generation to 8,200 MW by 2030 (approximately doubling current installed capacity which sits at around 4,000 MW). An assessment of Leitrim's potential contribution to this target is set out in **Table 6-4** below.

Table 6-4: Wind Capacity/ Potential Included in the RES

Repowering of Existing Wind Turbines	As set out in Table 6.2 by the year 2025, the existing wind farms in Leitrim will be in their 'middle age': 14 MW capacity will be > 20 years old, and a further 26 MW will be >15 years old. Using a ratio of 65% increased capacity when repowering takes place (IWEA, 2019), this 40MW might be repowered to yield **a further 26MW by 2030**.
Extensions of Existing Wind Farms	There are four upland areas identified in Figure 6.3 where existing wind farms sit within 'available areas'. Extensions of these may prove viable (possibly in tandem with repowering proposals). Total operational capacity in Leitrim stands at 92MW in 2021. If extensions were to deliver an addition 30% capacity, this would equate to **a further 27 MW by 2030.**
New Turbines/ Wind Farms	A theoretical capacity of 594 MW has been identified for Leitrim following the SEAI LARES methodology. Industry experience suggests that a delivery rate of 10% of the theoretical capacity is a realistic benchmark, equating to 59 MW for Leitrim. A Landscape and Visual Capacity Assessment of the available areas found that opportunities for new wind farms are constrained by the need to protect the natural amenities of the county. No areas have been identified as 'acceptable in principle'. As of September 2021, a further 18MW has been granted planning permission. Two planning applications for a total of 58MW have been made. There is no guarantee that success in planning will lead to a completed wind farm. A **conservative estimate of 30 MW** is therefore assigned for new wind farms for the purpose of this RES.

As summarised in **Table 6-5** below, the RES has identified the potential for Leitrim to increase its wind energy operational capacity **by 90% in the period up to 2030**, through a combination of repowering and extending existing windfarms and new wind farms. This aligns well with the national target for growth in onshore wind energy.

Table 6-5: Leitrim's Wind Potential to 2030 – Possible Scenario.

Existing Connected Wind Energy (2021)	92 MW
Additional indicative/ potential capacity included in the RES up to 2030.	83 MW (90% increase)
Total 2030 Operational	175 MW

6.2 Solar Energy

6.2.1 Introduction

This section considers the solar energy resource in County Leitrim, describing the resource and the associated energy conversion technologies, how it can be harnessed, and setting out policy and objectives to support solar energy developments, which can make a contribution to our renewable energy targets while minimising any adverse impact on the environment.

6.2.2 Overview

Solar energy technology harnesses the energy radiated from the sun that reaches the earth as visible light. This light can be categorised as direct and indirect depending on cloud cover and location. Solar energy can be used to produce electricity, heat or hot water. There are two main categories of technologies that are suitable for installation in Ireland, solar thermal and solar photovoltaic (PV). In 2019 solar PV energy provided 2.7% of Ireland's electricity generated, producing 21 GWh.[53] In Ireland, solar thermal is generally considered to be suitable for smaller scale applications such as domestic hot water or to meet part of the demand in larger buildings.

6.2.3 Solar Photovoltaic

Solar photovoltaic (PV) technology exploits solar energy to produce electricity. This technology is typically deployed as panels made from a semiconductor, such as crystalline silicon, which absorb the light energy and produce electricity. The panels can work with both direct and indirect light, meaning that they will continue to generate electricity on overcast days. Solar PV panels can be rooftop-mounted for building applications or ground-mounted, such as those in solar farms.

Rooftop applications are typical in both domestic and non-domestic settings. The amount of electricity generated also depends on the solar resource, the location, orientation and tilt of the panels and the area covered. The maximum output will be achieved when facing due south, away from shading and at a tilt of 30°. The most common type of silicon solar panel, on a clear, sunny day, will produce approximately 150 W per square metre. Strategically placed solar PV panels can provide over 40% of the electricity requirements of a typical domestic dwelling.[54] There are also opportunities for the use of Building-integrated solar PV, where solar PV technology is built into materials such as roof tiles and windows.

[53] SEAI Energy in Ireland 2020 Report

[54] https://www.seai.ie/resources/publications/FAQs_on_Solar_PV.pdf [Accessed: 19/03/2019]

Ground-mounted solar arrays, or solar farms, can deploy solar PV technology on a small, medium or large scale. Solar PV panels are installed on rows of mounting systems, orientated and tilted to access the best resource possible. Each megawatt (MW) installed requires approximately 5 to 6 acres of land and 4,000 individual panels.[54] Solar farms export the generated electricity to the grid and therefore the proximity to the required infrastructure must be considered. Other factors contributing to the suitability of a site include the solar resource, slope of the land, accessibility and the potential for over shading. There are no connected solar farms in Ireland.

6.2.4 Current, Planned, and Contracted Developments

As of April 2020, no commercial scale solar projects are in operation within County Leitrim. There is, however, one contracted development, the Maximum Export Capacity (MEC) and other details of which are provided in **Table 6-6** below. Additionally, a feasibility study is being undertaken for North Leitrim SEC for a 5MW and 15MW solar farm to provide energy to the local community (see **6.5 – Micro Energy Generation**).

Table 6-6 : Contracted Solar Developments for Leitrim County

Ref.	System	Solar Farm Name	Status	MEC (MW)	Company	110 kV Node	Date of Application Completion
DG1169	DSO	Lisdadnan SF	Contracted	4	Elgin Energy	Carrick-on-Shannon	18/01/2016

6.2.5 Key Supporting and Constraining Factors

The potential for the use of commercial or industrial brown field sites, which are currently idle but have the grid and road connection infrastructure, should be considered as viable locations within the County.

Installations should be generally south facing, with an angle between 15 and 55 degrees, with some systems having the ability to automatically adjust in response to the position of the sun and therefore maximise energy production. However, seasonality is a big factor that needs to be taken into account with significantly shorter winter days meaning much lower yields. Shadows from existing structures, trees etc. may have an impact on the performance of PV's, and inversely, the impact of glint and glare from PV infrastructure on the surrounding receptors are further factors that may need to be considered and adjusted for in potential developments.

6.2.6 Potential Resource

Following a sieve analysis, **Figure 6.7** shows those areas identified as accessible for solar development following removal of European protected sites, heritage and monuments, settlements and existing infrastructure as discussed in **Section 3**. The risk level outside the excluded areas is defined by adding up the risk levels (5 for High, 3 for medium and 1 for Low) at certain distances from material assets, sensitive receptors, European Sites and from natural physical attributes (such as groundwater vulnerability, geological heritage sites, soil drainage, landslide and flooding susceptibility). The summed risk levels are displayed on a scale ranging from High (maximum risk) to Low (minimum risk). However the presence of a risk category in and of itself does not support nor preclude solar development; it is a tool which flags areas of having a higher or lower concentration/ distance from various sensitive receptors. A proposed solar energy development would be subject to detailed siting and environmental considerations and the outcomes of the planning process.

The total available capacity for solar energy development for Leitrim is therefore estimated as 61,588 MW using a Solar Capacity Intensity factor of 50MW per 100ha. If 1% of this capacity was availed of, that would equate to 616MW. These figures are very large. A recent study by the Energy Association of Ireland suggests that up to 3,300 MW of solar capacity will be installed by 2030, playing a significant role in meeting our 70% renewable electricity target.

In reality, the number of solar farms will be constrained by external factors such as grid capacity availability and the competitive RESS Auction process. In the RESS Auction process, projects compete on a level playing field across the country, and the most efficient projects will be successful. In the RESS 1 auction (2020), solar farms ranging from about 4MW up to 120MW capacity were successful. None of these were in Leitrim, although further rounds of RESS auctions may enable Leitrim projects to be successful. Proposed utility scale solar projects in Leitrim will be in competition with other parts of the country such as in the south east, where land parcels are bigger and solar irradiation levels marginally better. Taking into account existing levels of activity in project development in Leitrim, **a target of 30MW installed solar capacity in Leitrim** (approximately 1% of the projected national total) by 2030 is selected.

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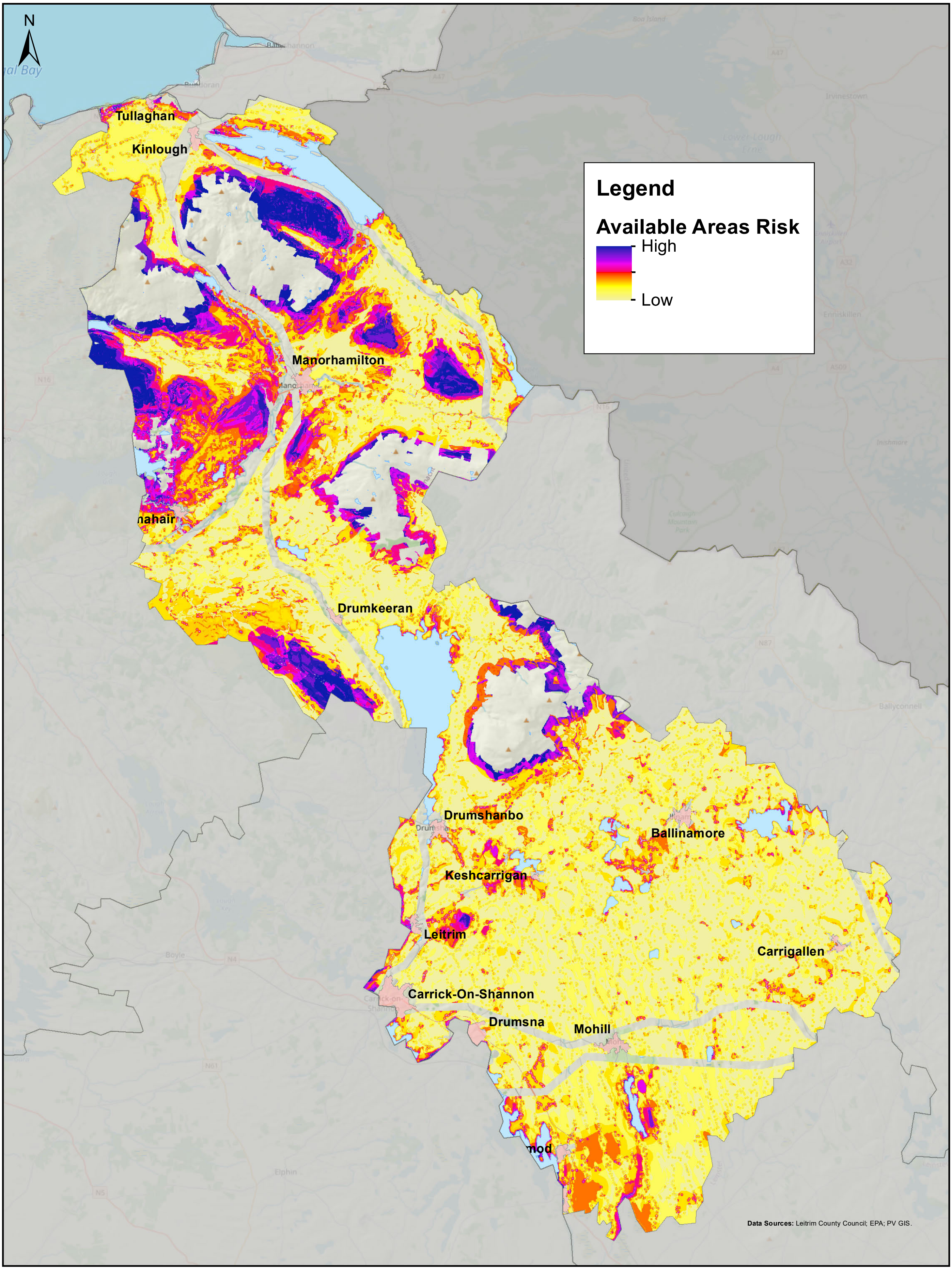

Title

Figure 6.7

Solar Opportunities & Constraints

Project

Leitrim Renewable Energy Strategy

Client

Comhairle Chontae Liatroma
Leitrim County Council

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6.2.7 Recommended Policy and Objectives

Table 6-7 below outlines the objectives and supporting polices in relation to solar energy over the short (1 – 2 years), medium (2 – 6 years), and long term (6 – 10 years).

Table 6-7: Recommended Solar Energy Objectives and Polices

Name	Description	Short-term	Medium-term	Long-term
Objective S1	To promote commercial scale solar energy development in appropriate locations	✓	✓	✓
Policy S1.1	To favourably consider the redevelopment of brown field sites in predominantly industrial/ commercial areas for large solar PV projects	✓	✓	✓
Policy S1.2	To favourably consider the development of solar farms on agricultural lands which allow for farm diversification and multipurpose land use		✓	✓
Policy S1.3	Consider impacts of overshadowing on the efficiency of existing solar technologies when assessing planning applications.		✓	✓
Objective S2	To promote the integration of solar energy into existing and planned developments	✓	✓	✓
Policy S2.1	An evaluation of the potential to incorporate thermal solar or solar PV should be carried out as part of the design and planning process	✓	✓	✓
Policy S2.2	To promote and facilitate the use of solar technology across County Leitrim including schools, public offices and for infrastructure, e.g. traffic lights, street lights, road information signage etc	✓	✓	✓
Policy S2.3	The Planning Authority will support and facilitate the development of passive solar design proposals for the development of houses in rural and urban areas		✓	✓

6.3 Bioenergy

6.3.1 Introduction

This section considers the bioenergy resource in County Leitrim, describing the resource and the associated energy conversion technologies, how it can be harnessed, and setting out policy and objectives to support bioenergy developments, which can make a contribution to our renewable energy targets while minimising any adverse impact on the environment.

6.3.2 Overview

Bioenergy is energy derived from biological sources, typically organic matter from plants and animals and their by-products. It can be categorised as biomass, biogas and biofuels. Biomass refers to land and aquatic vegetation, organic waste and photosynthetic organisms. Depending on the conversion technology employed, biomass can be converted directly to heat and electricity, or used to make biogas or biofuel. Solid biomass tends to be converted directly to heat and electricity by combustion, while wet biomass is digested to form biogas or fermented to produce biofuel. The main types of solid biomass used in Ireland for direct combustion are forest thinnings, sawmill residues, waste wood, willow, miscanthus, straw, residual municipal solid waste (MSW) and tallow. [55]

[55] SEAI, Bioenergy Supply in Ireland 2015 - 2035 https://www.seai.ie/resources/publications/Bioenergy-Supply-in-Ireland-2015-2035.pdf [Accessed: 19/03/2019]

Biomass is currently co-fired in one peat-fired power station in Edenderry, Co. Offaly. This is supported under REFIT 3, up to a level of 30% average co-firing and 125 MW in total.[56] According to the SEAI, approximately 3.5% of the energy used in Ireland comes from Irish grown biomass, and by 2035 the bioenergy potential will be close to 30% of 2015 energy demand.[57]

Biogas, formed from biomass, can be combusted in boilers to produce heat, or in combined heat and power plants, typically gas engines, to provide both heat and electricity. Alternatively, the biogas can undergo further upgrading to remove the CO_2, to produce an almost pure stream of biomethane. There are plans in place to allow for this biomethane to be injected into the natural gas network at appropriate points and transported to consumers.

Biomass can also be used to produce biofuels, which serve as a renewable alternative to fossil fuels for transport. Biofuels produced from food crops, called first generation biofuels, are contentious as they compete with food production. Second generation biofuels do not use food crops as their feedstock. They use lignocellulosic biomass or woody crops, agricultural residues or waste, as well as dedicated non-food energy crops grown on marginal land unsuitable for crop production. Second generation biofuels are not produced commercially as of yet, however research is ongoing.[58] [59]

In 2019 there were 97 micro CHP units in Ireland with an operating capacity of 0.7 MWe. A report on *Biomass District Heating Options in Carrick-on-Shannon*[60] has identified a cluster of buildings; Áras an Chontae County Buildings, proposed extension to Áras an Chontae, Dock Arts Centre, ETB Building and boat companies opposite the LCC County Buildings that have potential for a biomass DH scheme. Such a scheme is feasible as the heat loads are concentrated. The cost of the biomass DH scheme is estimated at €333,000 and the carbon savings by the biomass scheme over BAU oil are estimated to be 125 tonnes, which represents a saving of 3.5% of LCC's total carbon emissions.

6.3.3 Feedstock Sources

Forest Thinnings

Forest thinnings and residues are a source of biomass that can be used to produce heat, electricity and potentially, biofuels. This resource includes the thinnings from forest maintenance and residuals from harvesting. The wood, after a period of drying, can be used directly as logs in domestic boilers and stoves or processed to form chips or pellets to be used in combustion power stations, combined heat and power plants (CHP) or industrial boilers. This material is also a feedstock for the advancing production of second-generation biofuels. Forestry has the largest potential to expand at current market prices for energy. Leitrim, which has the highest percentage of forest cover (18.9%) in the country, offers large potential for bioenergy from forest residue.[61] Similar material can be obtained from sawmill residue or waste wood sources.

Energy Crops

Energy crops act as a bioenergy feedstock, including wheat and oilseed rape (OSR) which are used in biofuel production. Wheat can be used to produce bioethanol, while biodiesel can be formed from OSR. Both crops are currently grown in Ireland but are not used for domestic biofuel production as refineries must be quite large to achieve economies of scale and the availability of the resource is limited. Sugar beet and maize can both act as feedstock for biogas production, with sugar beet also being used to

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[56] Department of Communications, Energy and Natural Resources, Ireland's Transition to a Low Carbon Energy Future 2015-2030 https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf [Accessed: 20/03/2019]

[57] https://www.seai.ie/sustainable-solutions/renewable-energy/bioenergy/ [Accessed: 19/03/2019]

[58] SEAI, Bioenergy Supply in Ireland 2015 - 2035 https://www.seai.ie/resources/publications/Bioenergy-Supply-in-Ireland-2015-2035.pdf [Accessed: 19/03/2019]

[59] IEA, Sustainable Production of Second -Generation Biofuels https://www.iea.org/publications/freepublications/publication/second_generation_biofuels.pdf [Accessed: 19/03/2019]

[60] S Luker (date), A report on: Biomass District Heating Options in Carrick-on-Shannon

[61] Department of Agriculture, Food and the Marine, Ireland's National Forest Inventory 2017 Main Findings https://www.agriculture.gov.ie/media/migration/forestry/forestservicegeneralinformation/MainFindings301018.pdf [Accessed: 19/03/2019]

produce bioethanol.[62] Ireland also has the potential to grow miscanthus and willow, forms of solid biomass for direct combustion. Crops are typically grown in Ireland for food, fodder or exportation. The potential for expansion into the energy market faces the challenges of land-use competition, availability of land and profitability. Grass silage in Ireland offers a large resource for biogas production, albeit at a greater cost.[63]

Agricultural Waste and Residues

Agricultural waste and residues, such as straw, pig manure and cattle manure, can be used to produce biogas at little to no cost. Straw produced as a by-product in crop production can be combusted to produce electricity and heat and is a potential resource for second-generation biofuels. The slurry and manure from cattle and pigs can be used to produce biogas, which can then be combusted or further transformed into biomethane for gas network distribution.

Other By-Products and Residues

Other process by-products and residues that can act as a feedstock for bioenergy production include tallow, used cooking oil (UCO), food waste and residual municipal solid waste (MSW). Tallow, produced during meat processing, can be converted to biodiesel or used as a heating fuel. Used cooking oil is currently collected from food services and industries and used in the production of biodiesel. Food waste has the potential to be used for biogas production and residual MSW can be burned in a waste-to-energy process to produce heat and electricity.

6.3.4 Conversion Technologies

Biomass Combustion and Combined Heat and Power

Direct combustion is the simplest method of bioenergy production. This is typical of solid biomass, which is converted to heat through combustion. Forest thinnings, sawmill residues, waste wood, willow, miscanthus, straw, residual MSW and tallow are the main types of solid biomass used for direct combustion in Ireland.[64] Combined heat and power (CHP) is the process by which electricity and heat can be produced from biomass.

Anaerobic Digestion

Anaerobic digestion (AD) is the process used to produce biogas. Grass silage, domestic and industrial food waste, and pig and cattle slurry provide the feedstock for the process. The biomass is broken down anaerobically in biodigester plants to produce the biogas. Biogas is composed primarily of methane (CH_4) and carbon dioxide (CO_2), and may have small amounts of hydrogen sulphide (H_2S), moisture and siloxanes.

Micro-organisms break down the organic material in the absence of oxygen. The process is operated under controlled conditions in sealed tanks. In this anaerobic environment, biochemical reactions occur that convert organic polymers from the feedstock into methane rich biogas and nutrient rich digestate. Anaerobic digestion works best at temperatures of 30°C to 60°C and typically takes anything between 14 and 40 days to complete.[65]

The biogas produced can be combusted to create heat or used to generate electricity. The electricity can be used in the facility or be exported to the grid while the digestate can be pasteurised at high temperatures to remove pathogens, and then used as a fertilizer. Biogas can also be upgraded to biomethane by removing impurities such as CO_2 and H_2S.

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[62] https://www.seai.ie/resources/publications/Bioenergy-Supply-in-Ireland-2015-2035.pdf [Accessed: 29/04/2019]

[63] SEAI, Assessment of Cost and Benefits of Biogas and Biomethane in Ireland https://www.seai.ie/resources/publications/Assessment-of-Cost-and-Benefits-of-Biogas-and-Biomethane-in-Ireland.pdf [Accessed: 19/03/2019]

[64] SEAI, Bioenergy Supply in Ireland 2015 - 2035 https://www.seai.ie/resources/publications/Bioenergy-Supply-in-Ireland-2015-2035.pdf [Accessed: 19/03/2019]

[65] https://envirocare.org/anaerobic-digestion-process-from-waste-to-energy/ [Accessed: 21/03/2019]

The energy output from an anaerobic digestion plant greatly depends on the biomethane potential of the feedstock. High-energy feedstocks such as glucose or kitchen waste will have much higher energy yields than feedstocks such as grass cuttings. Those organic feedstocks with the highest biomethane potential contain 10 times more energy than the lowest biomethane potential feedstocks, such as sewage sludge.

Anaerobic digestion can be undertaken on a scale ranging from small farm-based AD plants to large industrial AD plants, with a range of technology from simple to very sophisticated and highly mechanised and automated systems. There is potential for the deployment of micro anaerobic-digestors in Leitrim, due to the wastes produced by the agriculture and forestry sectors.

Gasification

Biomass can also undergo gasification, a process by which a mixture of carbon monoxide, carbon dioxide and hydrogen, called syngas, is produced. This syngas can then be used to generate electricity. The gasification process involves the incomplete combustion of solid biomass, such that the resulting gas still has combustion potential.

6.3.5 Current, Planned & Contracted Developments

Table 6-8 outlines the existing bioenergy developments in Leitrim

Table 6-8: Current Bioenergy Developments in Leitrim

Name	Type	MEC (MW)
Health Service Executive – Arus Breffini Nursing Unit	Biomass Boiler	0.3
Aura Leitrim Leisure Centre	Biomass Boiler	0.32
Garadice Country House Ltd.	Biomass Boiler	0.18
McCauley Wood Fuels Ltd.	Solid Biofuel Supplier	–

6.3.6 Key Supporting and Constraining Factors

The success of bioenergy projects is heavily dependent on the availability of the resources. Leitrim's large forestry and agricultural industries present opportunities for the provision of forest thinnings and residues, straw and animal manure and silage. A common failure factor for bioenergy plans is competition for land use, particularly food crop production. There is reluctance to use edible plants or good quality arable land for energy crop production. Therefore, success is more likely when harnessing residue from existing industries, such as forest materials and animal by-products. The price of conventional fuels also plays an important role in the success or failure of bioenergy projects. The cost of feedstock production, transportation and processing must be compared to that of other energy sources to determine if it is economical.

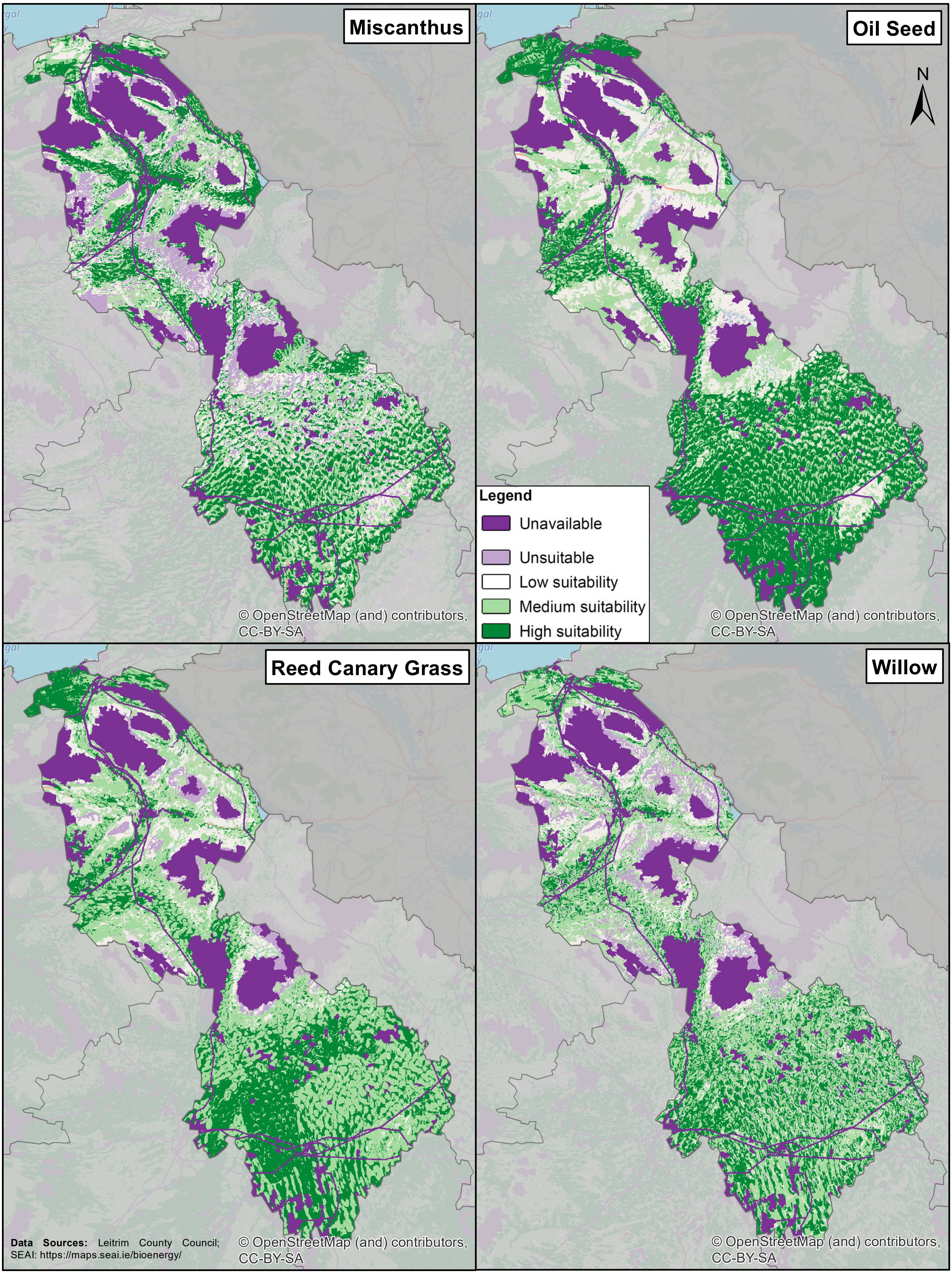
6.3.7 Potential Resource

The SEAI have quantified the bioenergy potential in Leitrim on a 50m by 50m grid for miscanthus, oilseed rape, reed canary grass and willow. Each grid square has been assigned a category of bioenergy suitability (high, medium, low, unsuitable, unavailable). This suitability assessment undertaken by the SEAI has taken into account existing land use, existing agriculture and forestry, soils, topography, average annual and seasonal rainfall. Designated conservation areas, archaeological areas and residences have also been considered. It should be noted this data is provided by the SEAI as *indicative suitability* only, and there may be competing land uses which could affect the viability of bioenergy crop usage. Any planned or future developments in relation to use of crops for bioenergy would need to be assessed in detail on a project by project basis, and subject to feasibility/technical studies and appropriate environmental assessments in the first instance.

Table 6-9: Suitability for Miscanthus, Oilseed Rape, Canary Grass and Willow in County Leitrim

Crop Type	Area (ha)	Suitability tonne/ha	Toe/ tonne	Total Energy (toe)	Total Value (€)
Miscanthus High Suitability	39,595.57	16	0.33	209,064.6	41,179,390
Miscanthus Low Suitability	36,141.17	9	0.33	107,339.3	21,142,580
Miscanthus Medium Suitability	36,134	12.5	0.33	149,052.8	29,358,880
Miscanthus Unavailable	9,175.1	0	0.33	0	0
Miscanthus Unsuitable	12,850.22	0	0.33	0	0
Miscanthus Total				***465,456.7***	
Oilseed Rape High Suitability	54,003.48	6	0.59	191,172.3	92,345,950
Oilseed Rape Low Suitability	36,001.71	2	0.59	42,482.02	20,520,970
Oilseed Rape Medium Suitability	33,800.82	4.5	0.59	89,741.18	43,349,550
Oilseed Rape Unavailable	9,175.1	0	0.59	0	0
Oilseed Rape Unsuitable	9,14.95	0	0.59	0	0
Oilseed Rape Total				***323,395.5***	
Reed Canary Grass High Suitability	40,733.09	10	0.33	134,419.2	28,513,160
Reed Canary Grass Low Suitability	19,472.82	2.5	0.33	16,065.08	3,407,744
Reed Canary Grass Medium Suitability	60,577.97	6	0.33	119,944.4	25,442,750
Reed Canary Grass Unavailable	9,175.1	0	0.33	0	0
Reed Canary Grass Unsuitable	3,937.08	0	0.33	0	0
Reed Canary Grass Total				***270,428.68***	
Willow High Suitability	31,229.32	28	0.21	183,628.4	83,069,990
Willow Low Suitability	26,652.82	20	0.21	111,941.8	50,640,360
Willow Medium Suitability	54,185	24	0.21	273,092.4	123,541,800
Willow Unavailable	9,175.1	0	0.21	0	0
Willow Unsuitable	12,653.82	0	0.21	0	0
Willow Total				***568,662.6***	

Source: SEAI Bioenergy System and Mapping Tool: https://www.seai.ie/technologies/seai-maps/bioenergy-map/



Title

Figure 6.8

Mapped potential bioenergy resource suitability

Project

Leitrim Renewable Energy Strategy

Client

Comhairle Chontae Liatroma
Leitrim County Council

West Pier Business Campus,
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Issue Details

Drawn By:	NO'N	**Project No.**	MDR1528
Checked By:	DC	**Date:**	24/04/2020
Approved By:	CB	**File Ref:**	MDR1528Arc0013A02
Scale:	1:630,000 @ A4		

6.3.8 Recommended Policy and Objectives

Table 6-10 below outlines the objectives and supporting polices in relation to bioenergy over the short (1 – 2 years), medium (2 – 6 years), and long term (6 – 10 years).

Table 6-10: Recommended Bioenergy Objectives and Polices

Name	Description	Short-term	Medium-term	Long-term
Objective B1	To support and encourage the development of bioenergy opportunities, facilities and associated enterprises in Leitrim	✓	✓	✓
Policy B1.1	To allow proposals for commercial bioenergy plants on brownfield sites adjacent to industrial / enterprise areas or on lands which are in industrial / enterprise use or zoned for such purposes	✓	✓	✓
Policy B1.2	To promote the installation of district heating schemes powered by biomass fuel sources		✓	✓
Policy B1.3	To ensure that any commercial bioenergy plant is close to the point of demand and is served by public roads with sufficient capacity	✓	✓	✓

6.4 Micro Hydroelectric Power

6.4.1 Overview

Hydroelectric power is the generation of electricity through harnessing the energy in the flowing water of a stream or river. A turbine is used to convert the kinetic energy in falling water to mechanical energy, which is further converted to electrical energy by a generator. The amount of electricity produced depends on the amount of water, the flow, and how far the water falls to reach the turbine, the head. The greater the flow and the head, the more power produced. In 2019, hydropower accounted for 2.8% of Ireland's electricity generation, producing 889 GWh[66].

Micro hydroelectric power refers to hydropower installations below 100 kW.[67] Installations of this size are typically run-of-river systems, which exploit the natural flow and slope of a river or stream to generate electricity. A portion of the water is diverted to power the turbine before being returned unchanged further downstream. These systems typically operate without a water storage mechanism, such as a dam, therefore limiting their environmental impact. This leaves the electricity generation subject to seasonal variations as the flow changes and offers no opportunity for energy storage. Some installations may have a small water storage area, or pondage, to regulate the flow, while still being considered run-of-river due to their limited impact on the river.

6.4.2 Current, Planned & Contracted Developments

Currently there are no hydroelectric power sites existing in County Leitrim, however, a feasibility study for a 55kW micro hydro project along the Owenmore River has been carried out for North Leitrim SEC (see Section 6.5 Micro Energy Generation and Community Energy).

6.4.3 Key Supporting and Constraining Factors

The key factor for success or failure of micro hydroelectric power is site selection. Site selection must consider the environmental impact, the resource availability and the proximity to the required infrastructure.

[66] Energy in Ireland 2020 Report

[67] https://www.energy.gov/energysaver/buying-and-making-electricity/microhydropower-systems [Accessed: 19/03/2019]

In terms of the required resource, the availability and variability must be considered. Sufficient flow and head must be present in the water to generate electricity. Furthermore, where there is no water storage area, the variability of the water flow will determine whether it can be easily integrated into the grid.

One of the key failure factors for hydropower development plans is the environmental and landscape impact during construction and operation. Hydropower installations operate by disrupting the flow of the watercourse, which may impact on biodiversity in the area. The visual amenity of the area is also impacted during construction, and to a lesser extent during operation.

The transmission and distribution network, along with the road network, are important supporting infrastructure for hydropower construction and operation. Success will depend on the availability of these supports near the proposed site.

6.4.4 Potential Resource

Potential locations within Leitrim were identified by the SEAI for micro hydroelectric power installations. There is theoretical potential for a total installed capacity of 1.178 MW throughout the county, outlined in **Table 6-11** and **Figure 6-9**.

This resource was mapped by the SEAI from comprehensive information identified in the then Department of Energy's 1985 report "Small Scale Hydro Electric Potential of Ireland."[68] As such, this map and the identified sites in Leitrim outlined in Table 6-11 are indicative of micro-hydropower potential only. It is noted that some sites may also be located in or in proximity to European sites. For instance, due to the slow level of flow in the Shannon, hydro-power was not considered suitable. As such, any proposal for hydro-power development would need to be subject to a feasibility or technical study, as well as detailed environmental assessment and subject to the outcomes of the planning process at the project level.

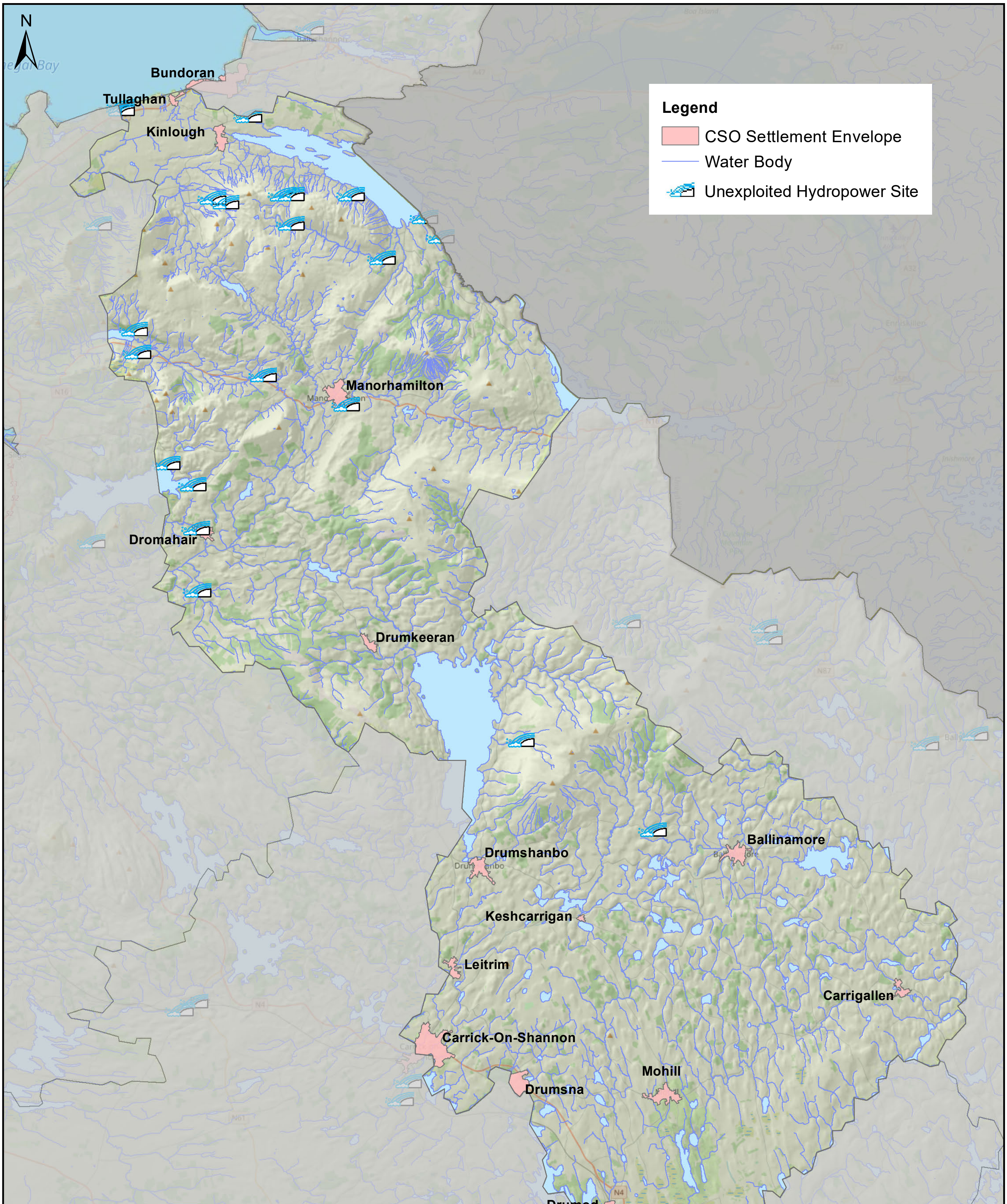
Table 6-11: Potential Locations for Micro-Hydropower Generation in Leitrim

Site No. on SEAI Map	River	National Grid Reference	Potential Inst. Cap. (kW)	Potential Annual Energy (MWh)
1	Duff	G754 574	76	340
3	Duff	G754 572	161	724
4	Drowes	G832 568	46	305
16	*Un-named*	G810 518	12	55
17	*Un-named*	G818 515	27	119
19	*Un-named*	G853 520	29	130
20	*Un-named*	G858 520	55	247
24	*Un-named*	G895 520	22	110
27	*Un-named*	G858 502	45	202
35	*Un-named*	G940 506	39	173
37	County	G950 494	30	148
38	Glenaniff	G914 481	82	368
43	*Un-named*	G762 437	32	145
48	*Un-named*	G764 423	15	68
61	*Un-named*	G841 409	11	51
83	*Un-named*	G798 342	20	90
85	Owenmore	G892 391	37	162
93	Bonet	G800 315	302	1597
94	*Un-named*	G801 277	18	129

[68] SEAI HydroMap: http://maps.seai.ie/hydro/

Site No. on SEAI Map	River	National Grid Reference	Potential Inst. Cap. (kW)	Potential Annual Energy (MWh)
147	Yellow	H080 137	17	95
H1	Stony	G999 185	38	197
H2	*Un-named*	G782 355	64	323

Source: SEAI Hydropower Potential Mapping: http://maps.seai.ie/hydro/



Title

Figure 6.9

Mapped potential of the micro-hydro resource

Project: Leitrim Renewable Energy Strategy

Client: Comhairle Chontae Liatroma / Leitrim County Council

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Issue Details			
Drawn By:	NO'N	Project No.	MDR1528
Checked By:	DC	Date:	24/04/2020
Approved By:	CB	File Ref:	
Scale:	1:320,000 @ A4		MDR1528Arc0004A02

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6.4.5 Recommended Policy and Objectives

Table 6-12 below outlines the objectives and supporting polices in micro-hydro energy over the short (1 – 2 years), medium (2 – 6 years), and long term (6 – 10 years).

Table 6-12: Recommended Micro-hydro Objectives and Polices

Name	Description	Short Term	Medium Term	Long Term
Objective MH1	To promote and support hydroelectric power at the identified unexploited sites	✓	✓	✓
Policy MH1.1	To favourably consider micro hydro developments which minimise impact on biodiversity and fisheries	✓	✓	✓
Policy MH1.2	To favourably consider community led micro hydro developments and off-grid developments		✓	✓

6.5 Micro Energy Generation and Community Energy

6.5.1 Introduction

Micro energy generation is the domestic and community use of small-scale solar PV and solar thermal, wind, Combined Heat and Power (CHP) and Heat Pump (HP) technologies to generate heat and electric power in a domestic, commercial or agricultural setting. Micro energy generation can be used to meet all the energy needs of a home, business or community, or can be a supplement to grid connected energy. Micro generation allows homes, business and communities to lower their carbon footprint and to reduce the cost of energy imported from the grid. Micro generation technologies can be combined to form a hybrid power solution that can offer superior performance and lower cost than a system based on one generator. Energy storage can be combined with micro generation technologies to allow for the supply of energy during periods of low generation.

6.5.2 Overview

Micro Wind

Wind energy micro generation involves the installation of small capacity wind turbines on the site of a domestic dwelling, commercial facility or agricultural site for electricity production. A free-standing wind turbine with a total hub height limited to 10 m, a total structure height no greater than 13 m and a maximum rotor diameter of 6 m can usually be erected at a domestic dwelling without planning permission. Larger turbines, with a total structure height of 20 m and a maximum rotor diameter of 8 m usually constitute exempted development from planning requirements at industrial or agricultural properties. In all cases, there must be sufficient clearance and setback distances from roads, dwellings and overhead lines.[69].

Solar PV

Solar PV rooftop applications are typical in both domestic and non-domestic settings. The amount of electricity generated depends on the solar resource, the location, orientation and tilt of the panels and the area covered. The maximum output will be achieved when facing due south, away from shading and at a tilt of 30°. Typically, a1 m^2 of silicon solar panels will generate ~150W of power on a clear sunny day. A home solar PV system sized at 20 sq. m (~3kW) and well located would generate around 2,600kWh of electricity a year.

Solar Thermal

Solar thermal technology can provide space and water heating in residential, commercial or industrial applications. Solar collectors are installed to capture the energy from the sun and convert it to heat,

[69] Planning and Development Regulations 2007 https://www.housing.gov.ie/sites/default/files/migrated-files/en/Legislation/DevelopmentandHousing/Planning/FileDownLoad%2C1486%2Cen.pdf [Accessed 12/03/2019]

which can then be stored in a hot water storage cylinder for future use. The solar collectors can take the form of flat panels or evacuated tubes and are typically installed on the roof of a building. Solar thermal technology is most commonly employed in the residential sector in Ireland for water heating. In applications where the total collector area exceeds 50% of the total roof area, or 12 m^2 in domestic applications and 50 m^2 in non-domestic settings, planning is required. Where space is limited, evacuated tube collectors may be more suited, as they produce more hot water per square metre.[70]

Micro Combined Heat and Power (CHP)

CHP is the generation of usable heat and electricity in a single process. It is also referred to as cogeneration. Electricity generation from fossil fuels and renewable sources such as biomass involves much of the input energy being lost as waste heat. This may be released to the atmosphere or river systems. CHP systems put this heat to useful purposes such as industrial processes or heating buildings. CHP has an overall efficiency of 80%, with electrical output accounting for 30% of the total output. Of the total output, 50% is in the form of heat, while 20% of energy is lost.[71] Leitrim has a large supply of biomass from forestry, which can be used in small scale CHP plants throughout the county. The **European Union CHP Directive**[72] defines micro CHP as having an electrical capacity size range of <50 kWe (electrical Kilowatts).

Ground Source Heat Pump (GSHP)

Ground-source heat pumps (GSHPs) exploit geothermal energy to provide space heating and cooling. Ground-source heat pumps utilise the low temperature geothermal resources closer to the surface, which act as a heat source during heating and a sink into which excess heat is released during cooling. Geothermal energy offers a reliable resource as the temperature of the earth below a certain depth, typically ten metres, is relatively stable. Ground-source heat pumps are potential replacements for conventional oil, coal or gas boilers and can be used in both domestic and non-domestic applications

The system typically consists of a collector loop, a heat pump and a distribution system. Ground-source heat pumps require electricity during heating and cooling operations; however, the heat pump produces three to four units of heat for each unit of electricity consumed. GSHPs can be categorised based on their collector types; closed-loop systems and open-loop systems.

A closed-loop system consists of a closed loop of pipes buried in the ground, through which a heat transfer fluid circulates. The fluid extracts heat from, or releases heat to, the ground as required. The pipes can have a horizontal or vertical configuration, depending on the availability of land and cost requirements. A horizontal system is installed in a shallow trench, typically 1.5 m below the surface, while vertical systems access more stable temperatures between 6 m and 120 m through installing collectors in drilled boreholes or wells.[73] The horizontal configuration requires a larger availability of land, however, the lack of drilling required makes it a lower cost installation. A closed loop system can also be installed in ponds or lakes.

An open-loop system extracts groundwater from a well or borehole through a vertical configuration and transfers it to a heat exchanger for energy extraction. The water is then re-injected to the source or discharged elsewhere. The limitations of an open-loop system include the proximity to a groundwater source, the potential for water contamination and pipe corrosion.

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[70] SEAI, A Homeowner's Guide to Solar Thermal for Hot Water https://www.seai.ie/resources/publications/Homeowners-Guide-To-Solar-Thermal.pdf [Accessed: 19/03/2019]

[71] SEAI. Combined Heat and Power in Ireland. https://www.seai.ie/publications/CHP-Update-2018.pdf

[72] European Union, 2004. Directive 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02004L0008-20090420&qid=1409052593848&from=EN

[73] Lucia, U., Simonetti, M., Chiesa, G. and Grisolia, G. (2017). Ground-source pump system for heating and cooling: Review and thermodynamic approach. *Renewable and Sustainable Energy Reviews,* Volume 70, p. 867-874. Available at: https://www-sciencedirectcom.ucd.idm.oclc.org/science/article/pii/S1364032116310504 [Accessed 19/03/2019].

Air Source Heat Pump

SEAI estimate that 90% of heat pumps installed in Ireland are air source heat pumps (SEAI 2020). The most common form of air source heat pumps, Air to Water, gather heat from the outdoor air and distribute the heat through water-based systems such as underfloor heating and radiators. They can also be used to heat water in a storage tank for the bathroom or kitchen. Air-to-air systems typically use fans to circulate warm air around the home and cannot be used to heat water.

6.5.3 Micro-hydroelectric

Micro-hydroelectric power is discussed in detail in **Section 6.4** above.

6.5.4 Existing Initiatives

The SEAI[74] offers **homeowners a rebate of €900** for each kW of solar PV installed up to 2 kW to support the installation of Solar PV panels and battery energy storage systems. The support is extended to 4 kW if a battery storage system is also installed and is capped at €2,400 for the Solar PV and €600 for battery storage. The rebate is available to all owners of dwellings built and occupied before 2011. A **solar water heating grant** is available for up to €1200. A **heat pump system grant** of up to €3500 is available for a variety of heat pump systems.

The **Electric Ireland Micro-Generation Pilot Scheme**[75] supports existing domestic customers in installing domestic micro-generators, and offers an export payment rate of 9.0 cent per kWh. This scheme was closed to new customers in 2014. ESB Networks accepts new applications to connect micro-generators to the electricity network. Surplus electricity exported to the ESB Networks Low Voltage (LV) System is subject to a rated maximum output of 6 kW when the connection is single phase and 11 kW when the system is three-phase. When the generator and import/export meter have been installed, the customer must contact their electricity supplier regarding payment arrangements for any electricity exported to the grid. There is no charge to connect a micro-generator to the ESB network. There is a charge of €340 to install an import/export meter.

The **Microgeneration Support Scheme Bill 2017**[76] was presented to Dáil Éireann in December 2017 and is at Dáil Third Stage. It is an Act to "provide for the growth of electricity production from micro-generators through a supplier obligation to provide a tariff for electricity exported to the grid". It is also a key provision of the EU's clean energy package and, in particular, the recast renewable energy directive. The Climate Action Plan (2021) proposed timelines and a framework for the micro-generation support scheme to deliver a route to market for citizens and communities to generate their own renewable electricity and receive payment from energy suppliers for the electricity exported to the grid. The payment or Clean Export Guarantee (CEG), will be available to all renewable generators that export to the grid, regardless of what energy provider they have a supply contract with, including citizens, small communities, clubs. The Micro-generation Support Scheme framework is expected to be finalised by the end of 2021.

6.5.5 Key Supporting and Constraining Factors

Micro generation and the introduction of new renewable technologies conflicts with the traditional use of coal and peat and this is a major behavioural change that needs to be tackled throughout Ireland. Education and awareness initiatives need to be improved to provide more information to the general public about micro-generation technologies and their benefits. Another key barrier that will need to be addressed is the perceived high initial cost of capital, high installation costs, long pay-back periods and lack of Feed-in Tariffs for auto-producers and micro-generators in Ireland. This will be addressed with the introduction of the Micro-Generation Support Scheme mentioned above. The large proportion

[74] https://www.seai.ie/grants/home-energy-grants/solar-electricity-grant/

[75] https://www.electricireland.ie/residential/help/micro-generation/electric-ireland-micro-generation-pilot-scheme

[76] Microgeneration Support Scheme Bill 2017

of agricultural land and one-off housing within the county means there is suitable space for small-scale wind turbines, ground and/or roof mounted solar PV panels or small-scale CHP plants.

There is also a well-established SEC network within Leitrim. These SECs promote and raise awareness of micro generation technologies in Leitrim. SECs can continue to develop as they learn from each other and network across other counties.

6.5.6 Potential Opportunities

Micro Wind

In general, there is a very good wind resource in Leitrim. However, due to differences in local climate conditions, wind speeds and directions, along with ground conditions and obstructions, can vary from site to site. Sites must therefore be assessed individually for wind energy micro-generation suitability. Generally speaking, the ideal location is on top of a high tower on a south westerly facing hill with gently sloping sides surrounded by clear countryside which is free from obstructions such as trees, houses or other buildings. Here the wind flows relatively smoothly and steadily enabling it to drive wind turbines with greater efficiency. Wind Energy Ireland recommends carrying out a detailed assessment of the wind resource of a potential site, including erecting a wind monitoring mast at turbine height for at least 12 months. This will give more accurate information on the wind resource on the site in terms of both wind speed and direction, distribution and levels of turbulence and will indicate the varying level of annual energy production.

The **SEAI Wind Map**[77] shows the wind speed at different heights across the country. The wind resource in Leitrim is better in the northern half of the county. The top of Corry Mountain Bog reaches wind speeds of 6.7 m/s at a height of 20 m. North of Tawnylea and Coollegreane has wind speeds of 6.2 m/s, as does the raised land to the north and north-west of Manorhamilton. The highest wind speeds in the County are located at the top of Kings Mountain in the north of the county, with speeds reaching 12.6 m/s at a height of 20 m. The output of a turbine is greatly affected by the wind speed as the power developed in wind is proportional to the speed of the wind cubed; a turbine at 20 m with a rotor diameter of 8 m, assuming a power coefficient of 35 %, will generate approximately 9 MW at a wind speed of 6 m/s and 73 MW at a wind speed of 12 m/s.

Solar PV

With the most common silicon solar panels typically 1 sq. m of panels will generate ~150W of power on a clear sunny day, enough to power a laptop computer. A home solar PV system sized at 20 m^2 (~3kW) would generate around 2,600kWh of electricity a year if well-located, over 40% of the typical annual electricity demand of an Irish home.[78] The suitability of a site for solar depends on the solar resource, slope of the land, accessibility and the potential for over shading.

The average solar resource in Leitrim is 80 - 100 W/m^2.[79] There are 11,850 detached, semi-detached and terraced houses in Leitrim (of which 3,083 are vacant[80]). Assuming a third of the total dwellings are suitable for PV installations sized at 20 m^2, the electricity generated would be 7110 kW. Assuming 1,400 annual sunshine hours in Leitrim[81], the total electrical energy produced by domestic PV in Leitrim is 9,954 MWh, or an average of 2.5 MWh per suitable dwelling. The total electrical energy requirements of a dwelling in Leitrim is 5.72 MWh. The energy supplied by a 20 m^2 domestic PV system can provide 44% of this requirement on a per suitable dwelling basis. Installing 20 m^2 domestic PV system on a third of dwellings in Leitrim can provide 14% of the total electrical residential energy demand.[82]

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77 http://maps.seai.ie/wind/

78 SEAI. Frequently Asked Questions on Solar Photovoltaics. Available at: https://www.seai.ie/resources/publications/FAQs_on_Solar_PV.pdf

79 MDR1528Arc0019A01_Solar Irradiation Potential

80 CSO Census 2016: Vacant Dwellings. https://www.cso.ie/en/releasesandpublications/ep/p-cp1hii/cp1hii/vac/

81 https://www.met.ie/climate/what-we-measure/sunshine

82 Leitrim Energy Model

Solar Thermal

The level of heating provided by solar thermal collectors depends on the solar resource, the efficiency of the technology and the area covered by the solar collectors. The preferred location for solar collectors is on a south-facing roof with a tilt angle of 30° to 45°. Southeast and southwest facing installations are also viable, with only a 5% reduction in the output.[83] In domestic applications, the systems can typically provide 50% to 60% of the annual hot water requirement. Water heating accounts for 19% of residential energy use nationally.[84] A solar thermal collector system installed on a dwelling in Leitrim has potential to reduce the energy consumption of that dwelling by 0.16 toe. Assuming that a third of dwellings in Leitrim are suitably located for the installation of solar thermal collector system, there is potential to reduce energy consumption in Leitrim by 0.65 ktoe (0.8% of the county's total final energy consumption).

Micro Combined Heat and Power (CHP)

In 2019 the national operational capacity of biomass fired CHP plants was 6.6 MWe (Megawatt electrical), accounting for 2% of the total capacity. Nationally, hotels and leisure centres account for 42% of CHP units in the services sector and the hospital sub-sector accounts for 11.7%[85]. These sub-sectors benefit from having close to relatively consistent demand for heat and electricity. Due to the dispersed rural population in Leitrim, district heating is only potentially viable in towns such as Carrick-on-Shannon and Manorhamilton. Micro CHP plants allow domestic users to generate their own electrical energy onsite using locally available woodchips. Heat generated can be used to heat the dwelling, displacing oil heating systems.

Ground Source Heat Pump (GSHP)

The SEAI Geothermal Mapping System[86] has classified the area north-west of Manorhamilton as "suitable" for vertical closed loop GSHPs. The majority of the remainder of the county is classified as "probably" or "possibly" suitable, with assessments specific to each site required. The coastline, stretching down to Tawney and Kinlough, is classified as "highly suitable" for domestic and smaller commercial open loop GSHPs, as is a section at the south of the county. The majority of land in the middle third of the county is classified as "generally unsuitable", while the remainder varies between "suitable" and "probably suitable".

Air Source Heat Pump

At domestic level or for individual commercial properties Air Source Heath Pumps are a viable option for micro-generation. See references above.

6.5.7 Micro-hydroelectric

North Leitrim SEC carried out a feasibility study in 2014 to determine if a 55kW scheme along the Owenmore River in Manorhamilton would be viable. The study looked at available water flow, turbine options and site characteristics, and determined that a system could be viable. From an estimated cost of €326,235 and predicted generation worth €22,649 per year, there would be a payback period of 15.2 years and a return on investment of 6.6%. With the number of unexploited sites identified in **Section 6.4** above, there is the possibility for a number of similar schemes throughout the county,

6.5.8 Recommended Policy and Objectives

Table 6-13 below outlines the objectives and supporting polices in relation to microgeneration and community energy over the short (1 – 2 years), medium (2 – 6 years), and long term (6 – 10 years).

[83] SEAI, A Homeowner's Guide to Solar Thermal for Hot Water https://www.seai.ie/resources/publications/Homeowners-Guide-To-Solar-Thermal.pdf [Accessed: 15/03/2019]

[84] In domestic applications, the systems can typically provide 50% to 60% of the annual hot water requirement.

[85] https://www.seai.ie/publications/CHP-Update-2020.pdf

[86] http://maps.seai.ie/geothermal/

Table 6-13: Recommended Microgeneration and Community Energy Objectives and Polices

Name	Description	Short Term	Medium Term	Long Term
Objective MG1	To facilitate micro-renewable energy installations	✓	✓	✓
Policy MG1.1	To encourage the retro fit of domestic and commercial buildings with micro generation technologies and improve the environmental performance of buildings	✓	✓	✓
Policy MG1.2	To actively promote the use of micro-renewable technologies throughout the County for all redevelopment / extension / expansion projects.	✓	✓	✓
Policy MG1.3	To promote the uptake of incentives, schemes, grants and other available funding to improve energy efficiency.	✓	✓	✓

6.6 Renewable Transport

6.6.1 Overview

It is estimated that 43.8 ktoe of energy was consumed by transport in Leitrim in 2018. This accounts for 55% of total energy consumption, more than both heat and electricity.[87] Leitrim's rural landscape, dispersed population and lack of public transport have led to high levels of private car ownership. According to the 2016 Census[88] 86.2% of households in Leitrim were in possession of one or more motor cars, compared to 81.95 nationally. It is estimated that private car energy consumption accounted for 43.5% of total energy consumed in the transport sector in Leitrim in 2016, compared to 41% nationally. [89] A total of 285 million kilometres were driven by private cars in Leitrim in 2016, accounting for 0.78% of the total kilometres driven nationally.

Ireland was obliged to achieve a minimum target of 10% renewable energy in the transport sector by 2020 under the EU Renewable Energy Directive 2009/28/EC[90]. Ireland's transport sector is currently dependent on imported oil. In 2019 renewable transport in Ireland stood at 8.9%, 99% of which came from bioenergy, including biodiesel and biomethane. Data for 2020 shows a rate of 10.2% achieved. Based on indicative trajectories proposed in the NECP 2021-2030 and as part of the recast Renewable Energy Directive 2018/2001/EU, the RES-T target will increase to about 13.4% by 2030. Reducing reliance on traditional fossil fuels is of utmost importance for Leitrim to meet the 10% RES-T target and to move towards carbon neutrality. This can be achieved through the adoption of electric vehicles and the use of alternative transport fuels, primarily biofuels.

6.6.2 Existing initiatives

On a national level, the National Renewable Energy Action Plan (NREAP)[91] specifies a two-pronged strategy that combines increased use of biofuels with the accelerated development and use of electric vehicles (EVs) in Ireland. The national Biofuel Obligation Scheme 2010 obliges all road transport fuel suppliers to use biofuel in the fuel mix and is set at 11%. The Government has set a national target of 840,000 electric vehicles by 2030 and for Leitrim this will represent a target of 5,777 private e-vehicles.

The ESB is responsible for the rollout of EV charging points across the county. The ecars Charge Point Map[92] shows the locations of these charging points. Of a total of 1,100 public, standard and fast charging points in the country, only four standard charging points are located in Leitrim; see **Table 6-14**.

[87] Leitrim Energy Model.

[88]https://www.cso.ie/px/pxeirestat/Database/eirestat/Summary%20Results%20Part%202/Summary%20Results%20Part%202_statbank.asp?SP=Summary Results Part 2&Planguage=0

[89] https://www.seai.ie/resources/seai-statistics/key-statistics/transport/

[90] https://www.seai.ie/resources/publications/Renewable-Energy-in-Ireland-2019-Infographic-.pdf

[91] DCCAE. National Renewable Energy Action Plan

[92] https://www.esb.ie/our-businesses/ecars/charge-point-map

Table 6-14: Location of charging points in Leitrim

Location	Type	Details
St. Georges Terrace, Carrick-on-Shannon	Type-2 AC Socket 22kW	2 x AC charge points, free to use
Bush Hotel, Main Street, Carrick-on-Shannon	Type-2 AC Socket 3.7kW	1 x AC charge point, 24 hour access
Glebe Street, Mohill	Type-2 AC Socket 22kW	2 x AC charge points, free to use
Lough Rynn Castle Hotel, Mohill	Type-2 AC Socket 3.7kW	1 x AC charge point, 24 hour access, free to use (not part of ESB network)

There is an additional charging facility located in Carrick-on-Shannon but within County Roscommon. This charging location includes 2 AC charging points (Type-2 AC Socket 22kW) and 1 DC charging point (CHAdeMO DC Socket 50kW). There are also a number of other charging points located in towns in surrounding counties, namely; Drumcliff, Sligo Town, Boyle, Longford Town and Cavan Town.

The SEAI[93] offers a number of benefits for EV customers, including a government incentive of up to €5,000 grant per vehicle and up to €5,000 Vehicle Registration Tax relief, €120 motor tax band for electric vehicles and a government grant of up to €600 towards home charging point.

6.6.3 Potential Opportunities

In 2009 the government published **Smarter Travel - A Sustainable Transport Future: A new Transport Policy for Ireland 2009- 2020.[94]** This document outlined a number of energy efficiency and conservation measures that can be adopted in Leitrim to reduce the transport energy use in the county. Such measures include the use and improvement of rural/urban public transport services, promotion and prioritisation of walking and cycling, promotion of car sharing, and reduction in overall travel demand.

Due to the high level of private car use, there is potential to reduce transport energy consumption in Leitrim by switching from conventional internal combustion engine vehicles to electric vehicles. According to the ESB ecars Cost Calculator,[95] switching to a Nissan Leaf from a petrol car equivalent saves €0.10 in fuel costs and 67 grams CO_2 per kilometre driven. Switching to a Nissan Leaf from a diesel car equivalent saves €0.07 in fuel costs and 40 grams CO_2 per kilometre driven. It is estimated that switching the entire private car fleet from petrol and diesel to electric vehicles can save approximately 11.5 ktoe of energy. This equates to 87% of the total private car energy use and 31% of the total transport energy use in 2016. 65% of the population in Leitrim who travel to work or school have a travel time of less than half an hour. Applying the more realistic assumption that only the population that have a travel time of less than half an hour switch to electric vehicles, the total final energy consumption savings are estimated to be 7.5 ktoe.

In Leitrim, 96% of dwellings are detached, semi-detached and terraced houses, making them suitable for EV ownership as the majority them would be capable of charging an EV from the house. However, more public charging points are required to allow for the widespread uptake of EVs. Nationally there is an average of one charge point for 4,000 people, while in Leitrim there is one charge point for 8,000 people. An additional four charge points are needed to bring Leitrim on par with the national average. These charge points should be located in Manorhamilton, Kinlough, Ballinamore and Drumshanbo as these are the largest towns in Leitrim that do not have existing charge points. In addition to this, charge points should be located along major roads in the county such as the N4 and the N16. This will allow for the use of EVs to travel from Leitrim to Dublin along the N4, and to access other locations in the west and the north of Ireland along the N16.

[93] https://www.seai.ie/grants/electric-vehicle-grants/grant-amounts/

[94] http://www.smartertravel.ie/sites/default/files/uploads/2012_12_27_Smarter_Travel_english_PN_WEB%5B1%5D.pdf

[95] https://www.esb.ie/our-businesses/ecars/ecars-cost-calculator

The national target for EVs is 845,000 cars by 2030[96]. 5,777 EVs are required in Leitrim to meet this national target. According to the EU directive 2014/94/EU the appropriate average number of recharging points should be equivalent to at least one recharging point per 10 cars, meaning that an additional nine charging points are required in Leitrim. However, the **Alternative Fuels Framework**[97] states this recommendation is disproportionate to the needs of the market as more than 80% of charging occurs at home, and the number of recharging points needed to support 20,000 EVs would not differ significantly from the level that would be required to support 50,000 EVs. Applying this reasoning, one charge point is needed for 25 cars, resulting in a need for only two additional charge points in Leitrim to meet the national target.

There are no biofuel refineries in Leitrim. Biofuel refineries must be quite large to achieve economies of scale, and so are rare in Ireland. Biofuels are produced from crops such as wheat and oil seed rape. The SEAI bioenergy map[98] estimates the total potential energy content of oilseed rape to be 323.4 ktoe, if all land of high, medium and low suitability for the growth of oilseed rape were dedicated to the growth of the crop.

6.6.4 Key Supporting and Constraining Factors

Success Factors:

- Large area of land suitable for growing biomass for biofuel production; and
- Large proportion of detached, semi-detached and terraced housing are suitable for EV home charging.

Failure Factors:

- Rural, dispersed population has resulted in a poor public transport system and a heavy reliance on private cars; and
- Lack of charging points in the county have hindered the uptake of EVs. Charging points nationally are to be located along motorways and large urban centres, meaning little investment in Leitrim.

6.6.5 Recommended Policy and Objectives

Table 6-15 below outlines the objectives and supporting polices in relation to renewable transport over the short (1-2 years), medium (2-6 years), and long term (6 to 10 years).

Table 6-15: Recommended Renewable Transport Objectives and Polices

Name	Description	Short Term	Medium Term	Long Term
Objective T1	To promote alternative transport options in Leitrim	✓	✓	✓
Policy T1.1	To facilitate the installation of charging points for Electric Vehicles at suitable public locations	✓	✓	✓
Policy T1.2	To promote and facilitate the provision of cycling lanes		✓	✓
Policy T1.3	To investigate the establishment of a Transport Forum to oversee transport policy of the county	✓	✓	✓

[96] Climate Action Plan 2021 https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

[97] DTTAS. Alternative Fuels Framework

[98] http://maps.seai.ie/bioenergy/

6.7 Renewable Heat

6.7.1 Overview

21.44 ktoe of energy were consumed as heat energy in Leitrim in 2018, accounting for 24.26% of total energy consumption in the county. 71.5% of this consumption took place in the residential sector, with the rest occurring in industry and services.[99] Leitrim's residential sector is highly dependent on oil, with 66% of dwellings using oil for space and water heating in 2016. 12% of dwellings used solid fuels.[100] The heating sector in Leitrim is influenced by a dispersed rural population, lack of natural gas infrastructure, and reluctance to depart from the traditional use of turf and peat. Ireland failed to achieve a minimum target of 12% of heat to come from renewable sources by 2020 under the EU Renewable Energy Directive 2009/28/EC.[101] According SEAI this figure stood at 6.3% in 2020[102]. Biomass made up the largest proportion representing 58%, with most generation and consumption of this energy occurring in the industry sector. The capture and use of ambient heat energy using ground- or air-source heat-pumps and related technology represented 19% of renewable heat energy. Under the **Renewable Energy Directive (EU) 2018/2001 (recast)**, the renewable heat target for 2030 will likely be 24% as outlined in Table 2-1. This represents a significant challenge.

The **Support Scheme for Renewable Heat**[103] has been designed to replace fossil fuel heating systems with renewable energy technologies. The Scheme will contribute to meeting Ireland's 2030 renewable energy and emission reduction targets. It will focus on heat users in the Non Emissions Trading (non-ETS) sector. This includes commercial, industrial, agricultural, district heating, public sector and other non-domestic heat users. The Scheme is made up of two support mechanisms – an on-going operational support for biomass boiler and anaerobic digestion heating systems and an installation grant for electric heat pumps. The Scheme is now open for applications for heat pump installation grants.

The **Afforestation Grant and Premium Scheme 2014 - 2020**[104] aims to increase the area under forest in Ireland to 18% of total land cover. In doing so, the scheme aims to contribute towards climate change mitigation and to produce biomass for energy production. Support will take the form of grants and annual premiums towards the costs of agricultural income foregone, establishment, and maintenance. A further native Woodland Conservation Scheme has been introduced in 2020 to supplement the above scheme, and to encourage native woodlands and biodiversity, including conversion of non-native forests to native woodland.

6.7.2 Potential Opportunities

Heat energy is difficult to transport over a significant distance in an efficient way. As a result, heat energy tends to be generated from a diverse range of technologies, using a diverse range of fuels, installed close to each individual demand site. Renewable heat technologies include solar thermal for water heating and ground source heat pumps for space and water heating. The potential for the uptake of these technologies at a domestic or commercial scale in Leitrim is discussed in **Section6.5**. The use of small-scale CHP is also discussed in **Section 6.5**.

District Heating (DH) are thermal energy networks that distribute hot water or steam through insulated dual (supply and return) pipe lines to serve commercial, residential, institutional and industrial energy needs for space heating, hot water, space cooling and industrial purposes. DH systems allow heat energy as distinguished from fuel to be bought and sold as a commodity. Ireland has one of the

[99] Leitrim Energy Model

[100] CSO. https://www.cso.ie/en/releasesandpublications/er/dber/domesticbuildingenergyratingsquarter42016/

[101] https://www.seai.ie/resources/publications/Renewable-Energy-in-Ireland-2019-Infographic-.pdf

[102] SEAI 2021 https://www.seai.ie/publications/Renewable-Energy-in-Ireland-2020-Short-Note-FINAL.pdf

[103] https://www.seai.ie/sustainable-solutions/support-scheme-renewable-/

[104] Department of Agriculture, Food and the Marine. Afforestation Grant and Premium Scheme 2014 - 2020. Accessed at: https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2015/AfforestationSchemeEd2190315.pdf

lowest shares of DH in Europe at less than 1% of the heat market. DH systems that use sources such as biomass and waste heat from electricity production and industry are considered renewable heat systems. Once a DH system is established, it is possible to connect many sources of heat. High levels of recycled heat and renewable sources serve to lower the emissions from a DH system and the cost of heat to the end consumer. When CHP is added to the DH system there are significant improvements in energy conversion efficiency as low value heat resources, which would otherwise go to waste, are captured.

The economic feasibility of a DH system in a region depends on the heat density of the region, baseline heating costs and heat supply price. The majority of Leitrim's dwellings are dispersed in rural locations with low heat density, rendering them unsuitable for DH development. Towns such as Carrick-on-Shannon and Manorhamilton offer potential for DH due to their higher heat densities. The **SEAI Heat Map**[105] estimates the heat demand and linear heat density for each county by electoral division. Table 6.16 below shows the heat demand in 2015, the linear heat density using the water mains as proxy for district heating pipe length (water heat demand) and the linear heat density using road network as proxy for district heating pipe length (road heat demand) for the total county and for a number of towns. The largest heat demand is in Carrick-on-Shannon, making up 12% of the total heat demand of the county. The next largest heat demand is in Mohill. In each town except for Kinlough and Manorhamilton, the linear heat density is greater along the road network than along water mains. Carrick-on-Shannon and Manorhamilton have the highest linear heat densities of 1082 kWh/m and 660 kWh/m respectively along the road network, offering the greatest potential for DH development in Leitrim.

Table 6-16: Heat Demand for Leitrim [Source: SEAI Heat Map]

	Heat demand 2015 (MWh)	Water heat demand 2015 (kWh/m)	Road heat demand 2015 (kWh/m)
County	203,713	338	348
Carrick on Shannon	24,287	667	1,082
Mohill	8,931	379	426
Manorhamilton	8,626	728	660
Drumshanbo	7,934	309	394
Kinlough	4,721	341	257

Leitrim's large biomass resource is an excellent resource to provide low carbon, cost attractive fuel for a DH system. The biomass can be harvested close to the system, resulting in low transport costs. Large industries in Leitrim, such as Masonite in Drumsna, Vista Med in Carrick-on-Shannon, Modular Panel Systems Ltd. in Mohill, Elastometall Engstler GMBH, Mirror Controls International and Merenda all in Manorhamilton and Glenfarne Wood Products in Glenfarne potentially have waste heat from industry that could be used in individual DH systems or incorporated into a larger DH system.

6.7.3 Key Supporting and Constraining Factors

Public bodies are identified as key enablers of DH, particularly where larger scale co-ordination of projects is required among diverse stakeholders. The development of DH will require coordinated, local-level action to effectively plan for successful wide-spread DH implementation. Most barriers to development of DH are non-technical, as the technologies used are themselves not new or innovative. With the large domestic biomass resources in Leitrim and suitability of the major towns such as Carrick-on-Shannon and Manorhamilton with relatively high heat densities, DH has the potential to integrate more renewables into the heating system and reduce Leitrim's dependency on oil. However, there are no guidelines, regulations, policies, frameworks or standards for DH in Ireland. A national policy framework to encourage the development of DH is planned, as outlined in the national level energy

[105] http://maps.seai.ie/heatdemand/

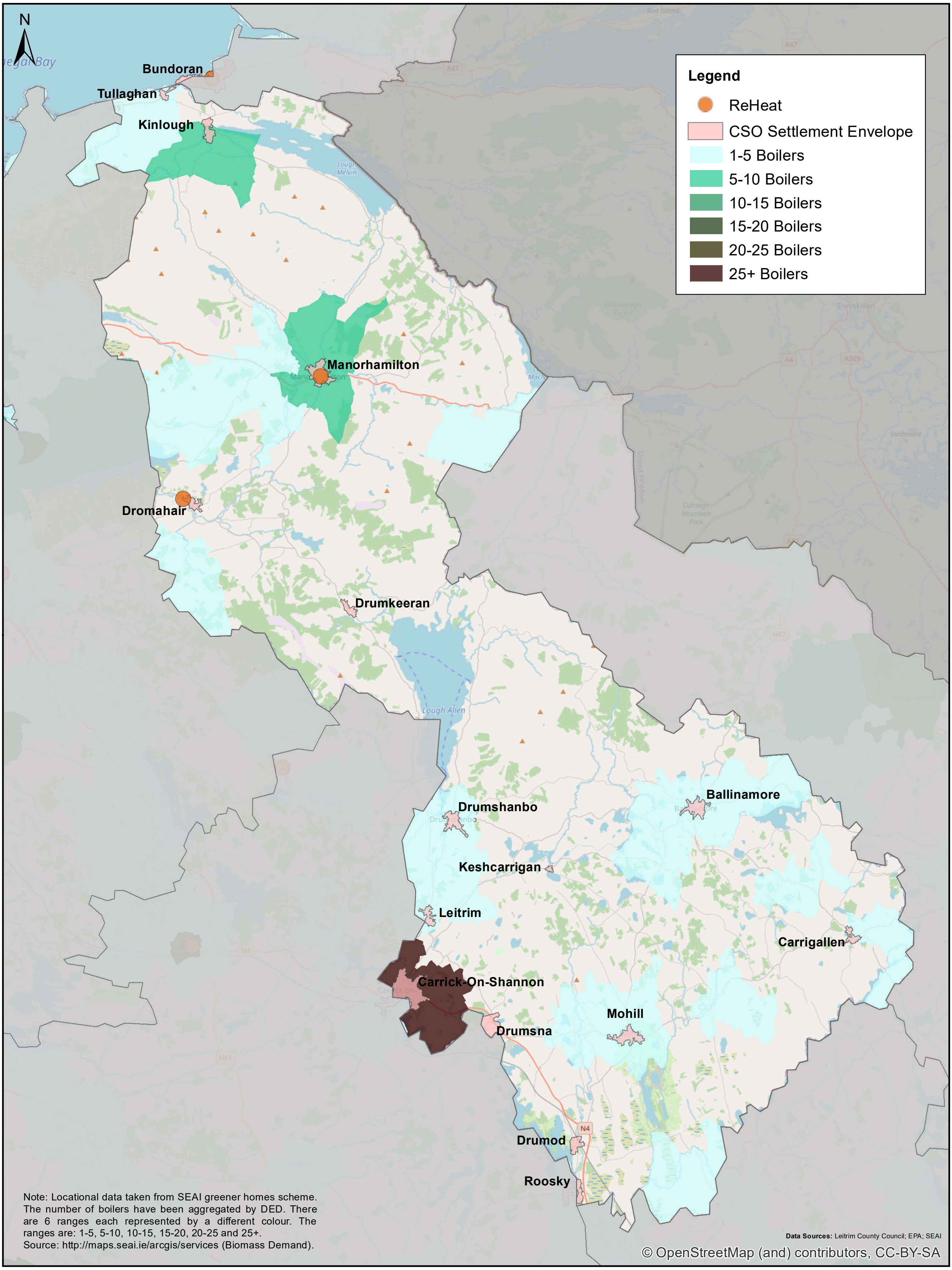
white paper Ireland's Transition to a Low-Carbon Energy Future, but since this paper was published, there has been no announcement on the timeline of this framework. Also, heat energy is required and created at an individual building level and is therefore fundamentally a local level issue. The role of local authorities is crucial in the development of DH. There is a need for integrated land-use, energy and infrastructural planning in order to progress DH development, and the local authorities are ideally placed to oversee that this integration occurs. Most local authorities in cities with DH have used planning policy and local regulations to promote and develop DH. The local authorities in Ireland are not obliged from a national level to implement such energy plans and are not given the equivalent resources.

6.7.4 Recommended Policy and Objectives

Table 6-17 below outlines the objectives and supporting polices in relation to renewable heat over the short (1-2 years), medium (2-6 years), and long term (6 to 10 years).

Table 6-17: Recommended Renewable Heat Objectives and Polices

Name	Description	Short Term	Medium Term	Long Term
Objective H1	To reduce dependency on fossil fuels for domestic and commercial heating	✓	✓	✓
Policy H1.1	To support and facilitate the installation DH technologies in new developments	✓	✓	✓
Policy H1.2	To facilitate the development of CHP plants for DH in industrial zoned areas		✓	✓



Note: Locational data taken from SEAI greener homes scheme. The number of boilers have been aggregated by DED. There are 6 ranges each represented by a different colour. The ranges are: 1-5, 5-10, 10-15, 15-20, 20-25 and 25+.
Source: http://maps.seai.ie/arcgis/services (Biomass Demand).

Title

Figure 6.10
Heat Demand Map

Project
Leitrim Renewable Energy Strategy

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Issue Details

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CASE STUDY:

Biomass District Heating Options in Carrick-on-Shannon, March 2017[106]

This study was carried out by ReHeat for Leitrim County Council and the Western Development Commission. It examines options for a biomass DH network in Carrick-on-Shannon, its initial extent and potential for incremental development. It identifies two distinct clusters of buildings that have potential for a DH scheme.

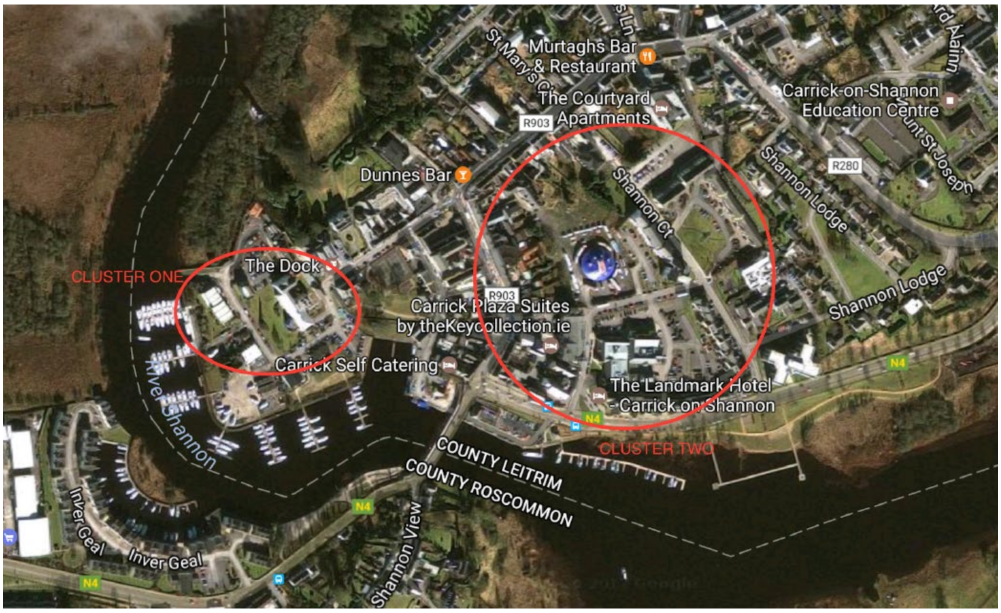


Figure 6-11: Clusters in Carrick-on-Shannon

Cluster One:

- Áras an Chontae County Buildings
- Proposed extension to Áras an Chontae
- Dock Arts Centre
- ETB Building
- Boat companies opposite the LCC County Buildings

Cluster Two:

- St George's Terrace Restaurant
- Market Yard
- Landmark Hotel
- Bush Hotel
- Court House
- Social Work Office
- Murtaghs Bar

The report found that it would make most sense to undertake a district heating scheme initially in cluster one, as this represents the most concentrated set heat loads and involves the fewest number of different heat customers. That makes it more deliverable and more financially attractive than cluster two.

The cost of the biomass DH scheme is estimated at € 333,000

The carbon savings by the biomass scheme over BAU oil are estimated to be 125 tonnes, which represents a saving of 3.5% of LCC's total carbon emissions. Heating oils contributed 334 tonnes CO_2 and saving 125 tonnes CO_2 probably represents the single largest measure LCC could take to reduce its carbon emissions from oil.

[106] ReHeat. Report on: Biomass District Heating Options in Carrick-on-Shannon (2017)

CASE STUDY 2

RASLRES District Heating as an Enabling Technology for Biomass in the Western Region[107]

RASLRES (Regional Approaches to Stimulating Renewable Energy Solutions) is an EU bioenergy project led by the WDC and funded under the Northern Periphery Programme of INTERREG IVB. In 2011 RASLRES carried out an appraisal of the Aras an Chontae and surrounding buildings in the Dock Area with a view to servicing them from a central District Heating biomass boiler. This initial analysis showed that, including costs for connection of each building, only the Aras and the Dock building have high enough consumption to provide an attractive payback from switching to biomass, 6 and 5 years respectively.

Main energy users:

There is one large contract consumer in Carrick on Shannon, Masonite. Masonite is 9km from Carrick on Shannon along the N4. It is a biomass processor, so the concept of a biomass boiler and a CHP plant at Masonite supplying heat to Carrick is of interest. There are also 9 large, 47 medium and 213 small I/C loads in the town.

Table 6-18: Potential DH Clusters in Carrick Energy profile

Potential DH Cluster	MWh/yr heat used	kW load estimate
Dock area cluster	723	615
Town hotels cluster	5,006	1,921
Schools cluster	2,853	1,804
Retail/Office/IDS Cluster	2,214	1,134
Subtotals	**10,796**	**5,473**

Outline Solution:

a. Town DH Network

This option involves installing the infrastructure required to service the largest energy users in Carrick. It is based on a provisional location adjacent to the Aura leisure centre and other large users nearby. This is the optimum solution to allow DH to be delivered as a public service through the main parts of Carrick.

The overall cost of the piping would be about € 500,000. This excludes heat generator costs and also excludes customer end connection and investments. Boiler capacity of circa 6 MW would need to be installed.

This analysis has shown that the town hotel cluster is likely to be the cluster with the highest utilization rates of DH piping, delivering approximately 8.3 MWh/year per m of installed network.

b. Cluster-Based Development

This approach differs from the town-wide approach in that not all of the heat capacity is installed at once. This would entail initially servicing anchor loads within the identified clusters, which is the most pragmatic approach where capital or other constraints prevent implementing DH on a wide scale.

Advantages: the capital cost is incurred on incremental basis, easier to target anchor loads and obtain their commitment to participate, ultimately can reduce DH pipe sizes required and associated costs, as the heat is distributed on a more local basis.

Disadvantage: by beginning with the ad hoc addition of boilers, it becomes very difficult to centralise the DH service later, the economies of scale of operating a central unit are not available, the smaller

[107] RASLRES. Biomass District Heating Options in Carrick-on-Shannon, March 2017. Accessed at: http://www.raslres.eu/wp-content/uploads/2011/06/RASLRES-District-Heating-Public-Sector-WR.pdf

disperse units will incur higher maintenance, fuel and administration costs. If the network is broken up into smaller projects, it also becomes quite difficult to finance as a utility package.

From a public service point of view, the smaller clusters in the town without anchor loads would be deemed unviable as DH is not cross supported by the larger clusters with an anchor load.

c. Masonite Option – Remote Heat Supply

To deliver 6MW of heat from an external plant at a single source 9km distant would require a new transmission line (DN200 insulated steel piping8) providing MPHW9 at 120 °C. This would have to be stepped down to LPHW10 (circa 90 °C) for local distribution

Barriers to DH in Practice

The additional cost of this transmission line would be approximately €330/m or about €3m. Local main lines and distribution line costs are not included in this. The cost-benefit of such an investment has not been quantified as yet and would depend entirely on the energy cost advantages of the site. In this case preliminary assessment indicates that this approach is not financially viable.

Disadvantages: 9,000m pipe run would also entail additional system losses of up to 360kW (at 40W/m), large piping is required for remote heat delivery – a biomass system located close to the larger users would mean that a maximum of about 2,600 kW would need to be distributed from the central plant in radial piping rather than having to serve the whole DH network via a single 9km line.

Advantages: Large biomass heating plant already exists which would make up a significant part of the overall investment cost, economies of scale possible, logistics and transport issues already resolved, possibility of combined heat and power or other technologies become technically possible due to scale of operation and space available at the rural location**.**

7 CONCLUSION

7.1 Overview of Targets and Actions

This Renewable Energy Strategy has been developed to help enable the vision for Leitrim of encouraging and supporting the transition to a carbon neutral county through community engagement, energy efficiency and the sustainable development of renewable energy.

To achieve this there is a clear need to increase the share of renewable energy generation, improve efficiency and conservation measures, and to raise awareness and the level of information among the general public as well as interested parties. Having considered the current state of the various renewable energy resources and taken into account the environmental and infrastructural considerations, the analysis carried out has identified what is accessible and which resources have the greatest potential.

To further the development of renewable generated electricity, the potential for greater wind energy capture has been assessed. The need to conserve landscape character and visual amenity will limit the opportunities for new wind farm development. Opportunities to extend or to re-power existing wind farms may arise, but subject to careful consideration of the landscape capacity. There are also opportunities for community-led and owned wind energy developments on a smaller scale.

The redevelopment of industrial/ commercial brown field sites for large solar PV projects are encouraged, with opportunity for co-existence with agricultural land use. In terms of buildings, key opportunities exist around encouraging building retrofit with micro generation technologies, improving the energy efficiency of buildings, and actively promoting the use of micro-renewable technologies throughout the County.

In terms of Renewable Heat, there is a major opportunity for the utilisation of the vast biomass resources in the county and for highly efficient district heating systems in the larger urban areas, such as Carrick-on-Shannon and Manorhamilton, to reduce oil dependency.

Given the rural, dispersed nature of the county, Renewable Transport is the most challenging sector to make improvements in the short term. However, there are still opportunities that can be targeted for the county, such as promotion of alternative transport options, and with the large areas of land suitable for biomass there is the opportunity to further the production of biofuels.

There is already a high level of support for renewable energy throughout county Leitrim, from the existing onshore wind farm developments to the various Sustainable Energy Community projects and widespread microgeneration installations. However, it is key that support is maintained and the uptake of incentives, schemes, grants and other available funding to improve energy efficiency are continually promoted.

Table 7-1: Summary of Targets and Actions

Sector	Target to 2030	Delivery Actions
Energy Efficiency	Improve energy efficiency by 50% by 2030 with a view to achieving carbon neutrality by 2050	Building awareness and motivating behavioural change. Engaging with SEAI and government programmes for energy efficiency. Investing in efficiency improvements such as insultation, lighting upgrades and low-energy appliances. Switching to low-carbon transport modes such as walking, cycling and public transport.
Climate Change	Reduce CO_2 equivalent emissions from public sector by 50%	Building awareness and motivating behavioural change across all sectors of society.

Sector	Target to 2030	Delivery Actions
	Ambition to reduce greenhouse gases by 7% per year to 2030, with a view to achieving carbon neutrality by 2050	Investing in efficiency improvements such as insulation, lighting upgrades and low-energy appliances Switching to low-carbon transport modes such as walking, cycling and public transport. Developing plans to achieve full decarbonisation by 2050 (Net Zero Carbon)
Renewable Electricity	Contribute to national target of 70% renewable electricity by 2030	Enabling an increase in wind energy generation by 83 MW through wind farm extensions, repowering existing wind farms and additional wind farms (taking the total capacity in the county to 175MW). Enabling solar farm development with a target of 30 MW installed capacity in solar farms. Enabling micro-generation including rooftop solar, wind, hydro-electric and bioenergy CHP.
Renewable Heat	Achieve 24% heat from renewable sources.	Support and facilitate the installation of DH technologies in new developments. Facilitate the development of CHP plants for DH in industrial zoned areas. **Commercial/Industrial sector:** Greater use of bioenergy (biomass boilers, biogas and CHP), District Heating systems, and other low-carbon fuel sources. Greater use of electrical heat pumps in place of fossil-fuel based systems. **Household sector:** Retrofitting of dwellings from oil/ coal/ peat to electrical heat pumps. Greater use of bioenergy (biomass) for domestic heating.
Renewable Transport	Achieve 13.4% of transport energy from renewable sources	Facilitate the installation of charging points for Electric Vehicles at suitable public locations Promote and facilitate the provision of cycling lanes Gradual switch from petrol and diesel cars to EVs. Greater use of blended biofuels in petrol and diesel. For commercial vehicles and public transport: conversion to low-carbon alternative fuels (such as biodiesel, biogas, CNG, and hydrogen). In commercial transport, gradual switch to EVs where feasible (e.g. light commercial vehicles).

7.2 Roles and Responsibilities

Implementing the Renewable Energy Strategy calls on all sectors of society in Leitrim to make changes. A lot of work is needed in the next 10 years to move away from fossil-fuels and enable the renewable energy potential of the county to be achieved. The roles of various stakeholders are summarised below.

7.2.1 Role of Leitrim County Council

- Provide leadership on energy efficiency and renewable energy.
- Continue to implement energy efficiency across County Council buildings and activities to reach new target of 50% energy efficiency improvements for the public sector by 2030.
- Develop a Decarbonisation Zone within County Leitrim, as a living laboratory to demonstrate how carbon reduction can be achieved, including energy efficiency, renewable energy and sustainable transport systems.
- Support community energy initiatives throughout County Leitrim.

- Use the planning system to encourage energy efficiency and use of renewable energy in new developments and refurbishments. Build energy sustainability into the planning of new residential and employment areas.
- Enable more public EV charging points to be developed at strategic locations in the County.
- Develop partnerships with business, industry and agriculture to enable innovation.

7.2.2 Role of Community Sector

- Implement sustainable energy initiatives within their own communities, by building awareness of energy efficiency and developing projects that showcase good practice.
- Engage with SEAI Better Energy Community scheme.
- Incorporate energy efficiency and renewable energy into community projects and facilities.
- Develop community owned and operated renewable energy projects such as solar farms and wind farms.

7.2.3 Role of Householders

- Implement energy efficiency measures such as home insultation and choosing energy efficient lighting and appliances.
- Make sustainable transport choices – walking, cycling, taking public transport, and car-sharing to reduce fossil-fuel based transport.
- Installing domestic renewable energy systems such as rooftop solar panels.
- Replace fossil-fuel boilers with renewable heat systems, such as electrical heat pumps.
- Make the switch to EVs instead of petrol or diesel cars.
- Use smart meters – a roll-out of which is underway across Ireland - to better manage household energy and enable revenue from micro-renewable generation.

7.2.4 Role of Business and Industry

- Engage with SEAI programmes in support of energy efficiency.
- Develop awareness and behavioural change to reduce energy consumption.
- Upgrade buildings and energy systems to achieve more efficiency and incorporate renewable energy.
- Develop partnerships to enable solutions like district heating to be achieved.
- Use investment in sustainable energy to reduce operational costs and drive efficiency.
- Support sustainable transport modes (walking, cycling, public transport) for staff, and EV charging.

7.2.5 Role of the Agricultural Sector

- Implement energy efficiency around the farmyard, for example by using low-energy lighting, appliances and equipment.
- Install rooftop solar PV systems on farm buildings to generate renewable electricity.
- Explore the potential to use biofuels or other renewable fuels in agricultural machinery.
- Explore the potential to generate biogas (biomethane) generation using agricultural slurry and residues, for use in transport, heating, or for injection into the natural gas grid.
- Consider growing bioenergy crops and using agricultural residues for bioenergy, as a source of heat or transport fuel, whilst minimising the impact on land use change.
- Explore bio-economy opportunities for farm residues.

Appendix A

Existing Energy Profile Calculations

Energy Use by Sector

Residential

- CSO Census 2016 data (*number of dwellings in Ireland*, *national average floor area* and *national average primary energy use*) was used to calculate the residential energy use in Ireland by type of dwelling and period of construction.
- CSO data was used for the *number of dwellings in Leitrim*. *BER ratings* in Leitrim were used to calculate the average floor area and average primary energy use. The Leitrim average floor area and primary energy use were compared to national averages to obtain local factors for floor area and average primary energy use.The Leitrim residential energy use was calculated by type of dwelling and period of construction.
- The average primary energy use per dwelling was obtained for Leitrim. The national average primary energy use per dwelling was obtained using SEAI Final Energy by Sector data. The ratio of energy use per dwelling in Leitrim to energy use per dwelling in Ireland was obtained. The ratio was applied to national average primary energy use per dwelling to obtain the total residential final energy use in Leitrim.

Residential Assumptions

- *The primary energy consumption values calculated for Ireland and Leitrim could be considered accurate relative to each other considering the same method and data sources were used, and that the ratio of primary energy consumptions for Leitrim and Ireland could be applied to final energy consumption data.*
- *BER data was limited to the period of construction 2001 - 2010. The local factors obtained were calculated based on these years. It was assumed that these local factors were representative of average primary energy use and average floor area across all periods of construction.*

Transport

- CSO Census 2016 data (Private car vehicle population number and average kilometres travelled by private car, by type of fuel and year of registration for Leitrim and Ireland) was used to calculate the total kilometres driven by private cars in Leitrim and in Ireland, by type of fuel. The total energy consumption by private cars in Leitrim and Ireland was calculated.
- Private car energy consumption in Leitrim was found as a ratio of national private car energy consumption.
- This ratio was applied to SEAI national energy consumption data by mode of transport, to determine the total transport energy consumption in Leitrim.

Transport Assumptions

- *The CSO data included three fuel types; petrol, diesel and “other fuels”. It was assumed that the calorific value of “other fuels” consumed per car is the average of the calorific value of petrol and diesel consumed per km.*
- *Rail, aviation or navigation energy consumption in Leitrim is zero as the train is not re-fuelled in Leitrim and as there are no airports or ports in Leitrim.*
- *The ratio found for private car energy consumption could also be applied to national data for energy consumption by road freight, LGV, public passenger, fuel tourism and unspecified.*

Industry

- CSO Census 2016 data (*Population Aged 15 Years and Over in the Labour Force 2011 to 2016 (Number) by Detailed Industrial Group and Census Year* for Leitrim and Ireland) was used to determine the ratio of number of people employed in industry in Leitrim to Ireland.
- This ratio was applied to SEAI national final energy consumption data for the industry sector to determine the total industrial energy use in Leitrim.

Industry Assumptions

- *The national industrial energy consumption is representative of energy consumption in Leitrim.*
- *Figures given for number of people employed in agriculture activities were not included as agriculture energy use is accounted for separately.*

Services

- CSO Census 2016 data (*Population Aged 15 Years and Over in the Labour Force 2011 to 2016 (Number) by Detailed Industrial Group and Census Year* for Leitrim and Ireland) was used to determine the ratio of number of people employed in services in Leitrim to Ireland.
- This ratio was applied to SEAI national final energy consumption data for the services sector to determine the total industrial energy use in Leitrim.

Industry Assumptions

- *The national services energy consumption is representative of energy consumption in Leitrim.*
- *Figures given for number of people employed in transport activities were not included as transport energy use is accounted for separately.*

Agriculture

- CSO Census 2010 data (*Agricultural Holdings (Number) by Size of Holding, Census Year and County* for Leitrim and Ireland) was used to determine the ratio of total farmland in Leitrim to total farmland in Ireland**.**
- This ratio was applied to SEAI national final energy consumption data for the agriculture and fisheries sector to determine the total agricultural energy use in Leitrim**.**

Agriculture Assumptions

- *The ratio of farmland in Leitrim to Ireland in 2010 is the same as 2016, allowing the 2010 ratio to be applied to 2016 energy consumption data.*
- *The national agriculture and fisheries energy consumption is representative of energy consumption in Leitrim.*

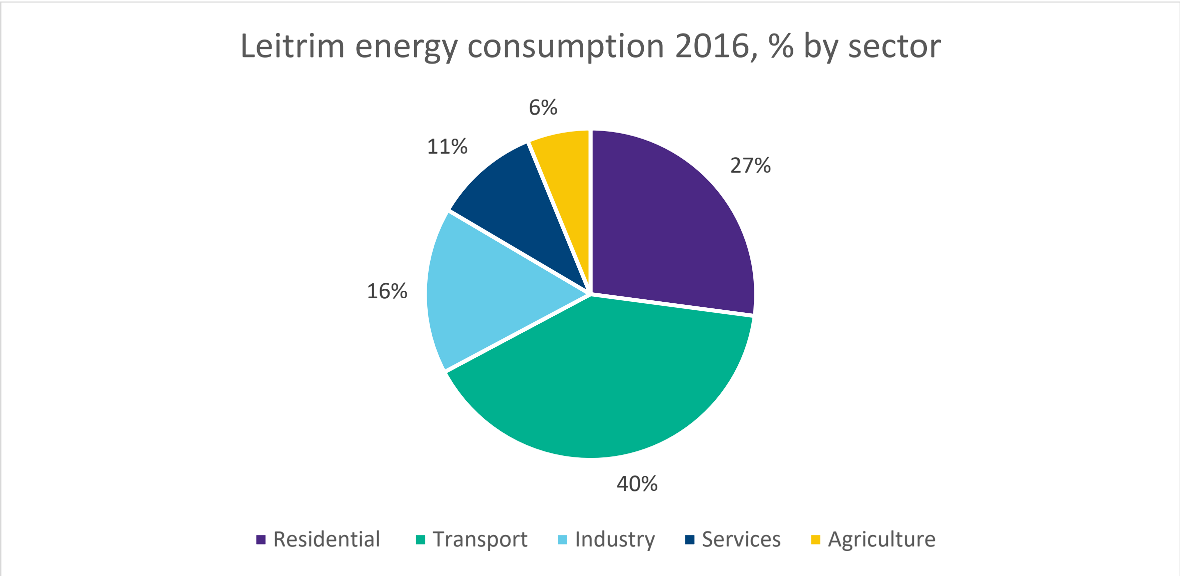
Results

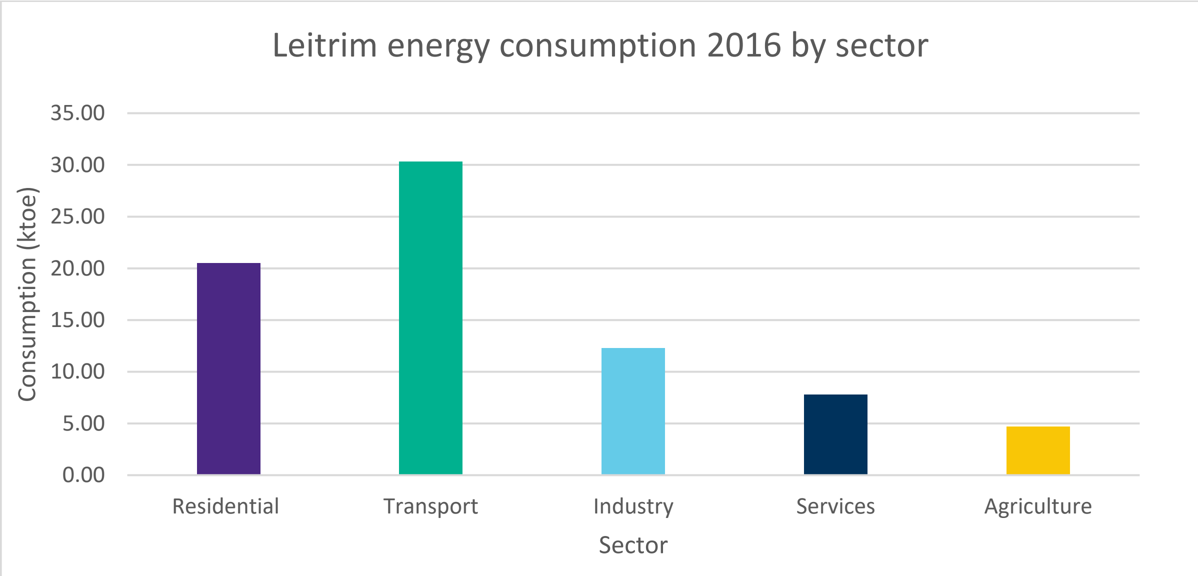
Energy consumption by sector

Summary of Leitrim and National final energy consumption by sector

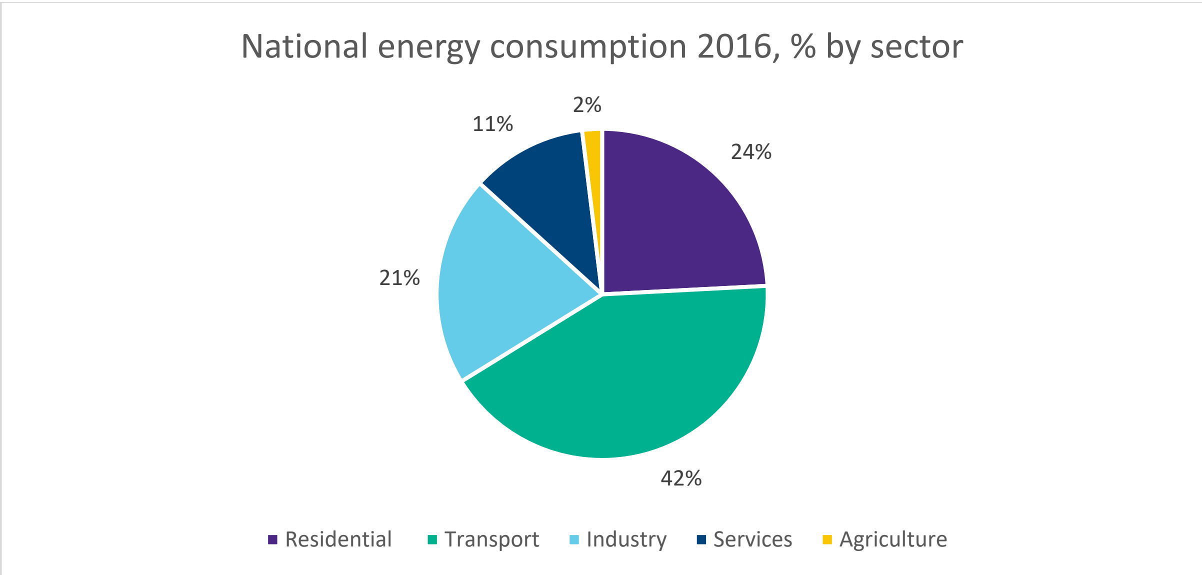
	Leitrim energy consumption 2016		Leitrim Sector Consumption as % of Total	National energy consumption 2016		National Sector Consumption as % of Total	Leitrim consumption as % of national, by sector
	ktoe	MWh	%	ktoe	MWh	%	%
Residential	20.50	238,414.19	27.10	2,860	33,261,800	24.18	0.72
Transport	30.34	352,878.48	40.11	4,970	57,801,100	42.01	0.61
Industry	12.31	143,124.36	16.27	2,430	28,260,900	20.54	0.51
Services	7.81	90,865.76	10.33	1,340	15,584,200	11.33	0.58
Agriculture	4.68	544,73.95	6.19	230	2,674,900	1.94	2.04
Total	***75.64***	***879,756.74***	***100***	***11,830***	***137,582,900***	***100***	***0.64***

Leitrim and National Energy consumption per person 2016	
National average energy consumption per person 2016 (ktoe/person)	0.002484321
Leitrim average energy consumption per person 2016 (ktoe/person)	0.002360675
Ratio Leitrim to National average energy consumption per person	0.950229479

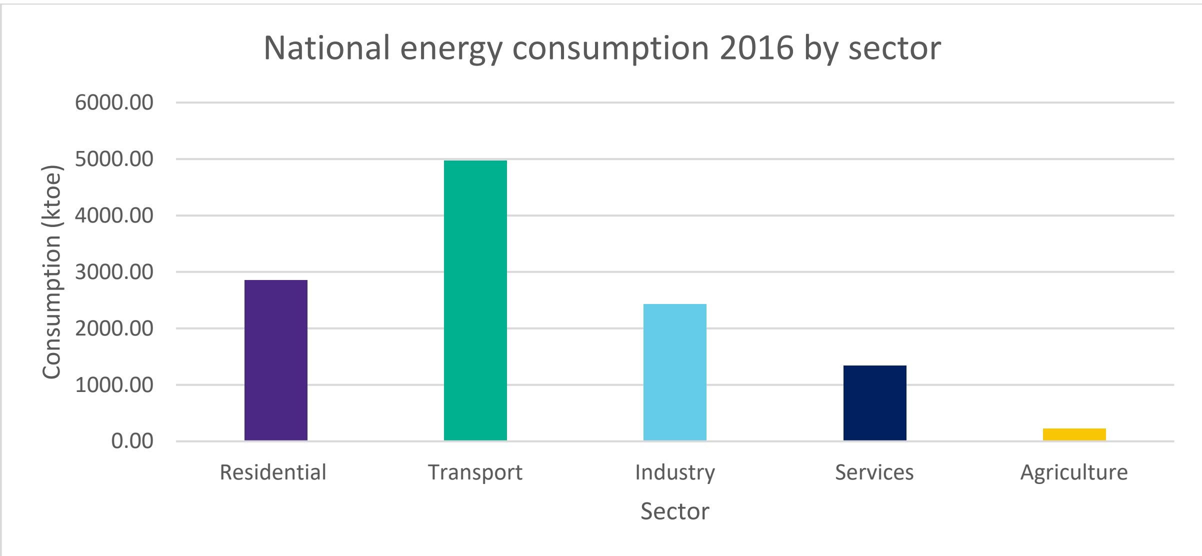




Leitrim energy consumption 2016 by sector
Consumption (ktoe)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Residential
Transport
Industry
Services
Agriculture
Sector



National energy consumption 2016, % by sector
2%
11%
24%
21%
42%
Residential
Transport
Industry
Services
Agriculture



National energy consumption 2016 by sector
Consumption (ktoe)
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
Residential
Transport
Industry
Services
Agriculture
Sector

Energy Use by Mode

"*Energy use can be categorised by its mode of application: whether it is used for mobility (transport), power applications (electricity) or for thermal uses (space, water or process heating). These modes also represent three distinct energy markets. Where thermal or transport energy is provided by electricity (e.g. electric heaters and electric vehicles) this energy is considered under electricity, and not under thermal or transport, so that double counting is avoided.*" – SEAI Energy in Ireland 2018 Report.

Residential

- SEAI data that gives the breakdown of energy used in space heating, water heating, lighting and appliances and cooking in an average Irish home was used with CSO data that gives the main space heating fuel in Leitrim to determine the residential energy use by mode.
- It was assumed that all water heating is heating.
- It was assumed that all lighting and appliances and cooking is electricity.

Transport

- It was assumed that all energy consumed in the transport sector is transport, no electricity.

Industry

- A ratio for electricity energy use in industry from a regional energy balance was applied**.**
- It was assumed that the remaining energy the remaining energy consumption was split 70% transport and 30% heat**.**

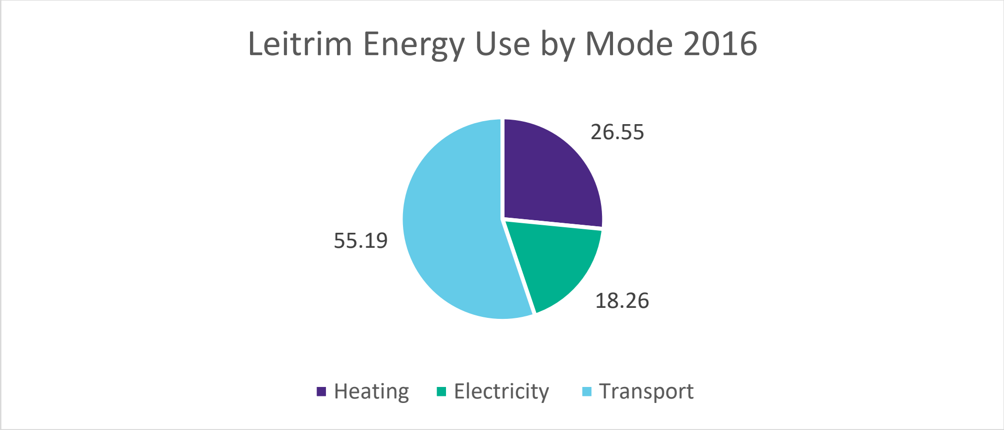
Services

- The SEAI Energy in Ireland 1990 - 2016 report states that 44% of energy in the services sector is consumed by electricity nationally. This figure was applied to Leitrim service's sector consumption.
- It was assumed that the remaining energy consumption was split 30% transport and 70% heat**.**

Agriculture

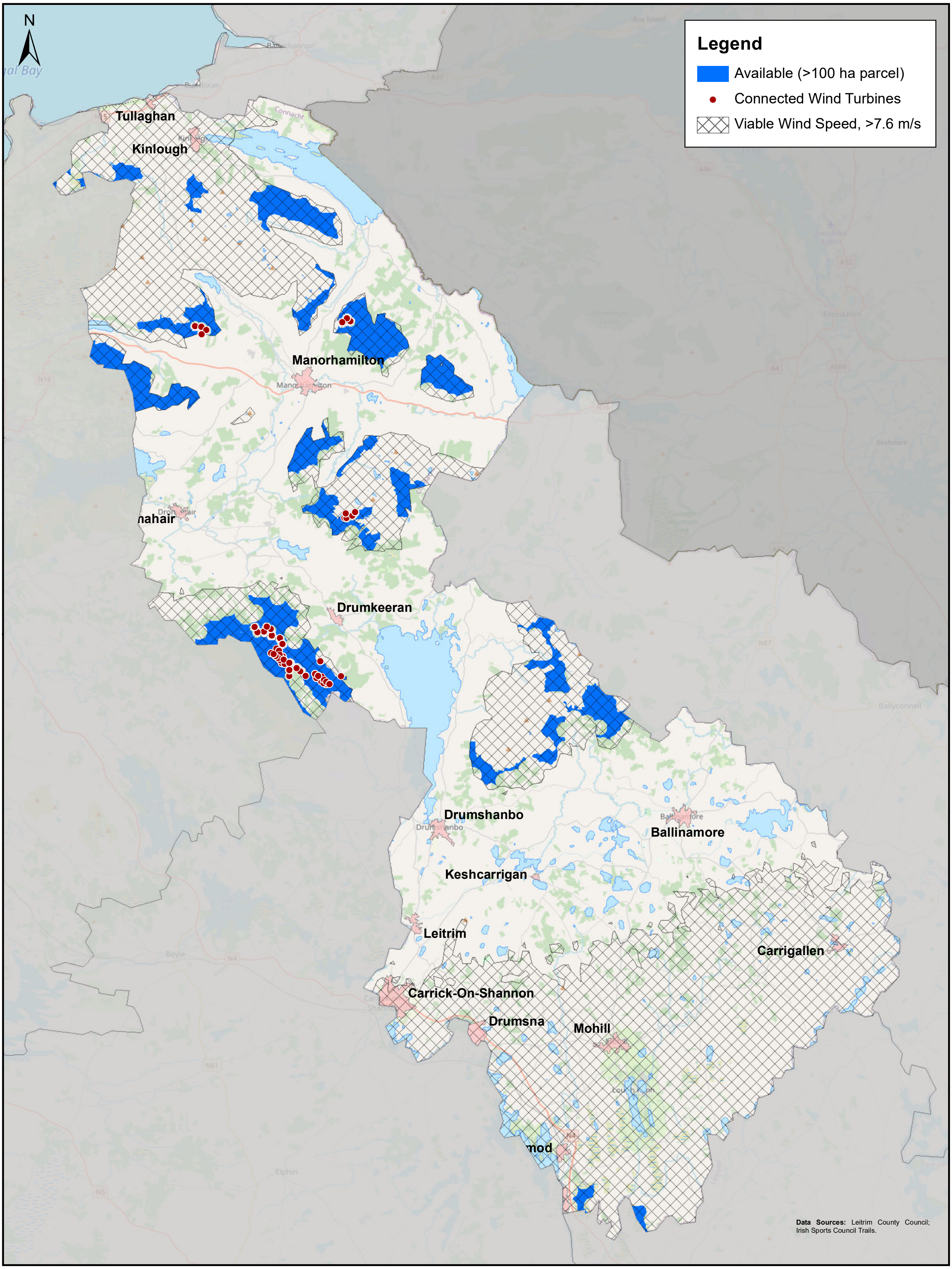
- A ratio for electricity energy use in industry from a regional energy balance was applied**.**
- It was assumed that all energy consumed in the agriculture sector is electricity and transport, no heat. The remaining energy consumption was therefore allocated to transport.

Results


Leitrim Energy Use by Mode 2016
26.55
55.19
18.26
Heating
Electricity
Transport

Appendix B

Figure 6.3(b): Onshore Wind – Sensitivity Analysis – Available Areas



Title

Figure 6.3 (b) Wind Opportunities and Constraints (Parcels > 100ha)

Project

Leitrim Renewable Energy Strategy

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Leitrim County Development Plan 2023-2029

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