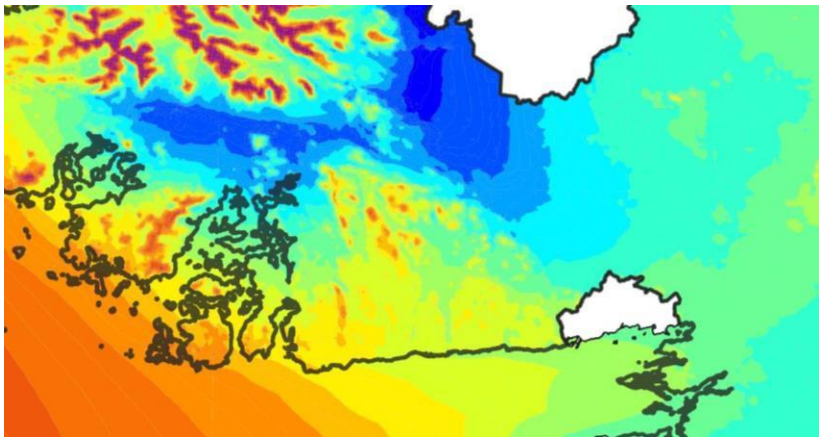

Comhairle Chontae na Gaillimhe
Galway County Council

GALWAY COUNTY COUNCIL LOCAL AUTHORITY RENEWABLE ENERGY STRATEGY JUNE 2022

GALWAY COUNTY COUNCIL LOCAL AUTHORITY RENEWABLE ENERGY STRATEGY

CLIENT, KEYWORDS AND ABSTRACT

Client: Galway County Council

Keywords: Renewable Energy, Local Authority, Strategy, County Galway, Planning, Heritage, Designation, Policy

Abstract: Local Authority Renewable Energy Strategy produced for Galway County Council. It replaces the Wind Energy Strategy of the Galway County Development Plan 2015 (as varied). This Local Authority Renewable Energy Strategy is a key element of the Development Plan Review and will be progressed alongside the review.

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EXECUTIVE SUMMARY

This Local Authority Renewable Energy Strategy ('LARES') outlines the renewable energy resource potential in County Galway. Its vision, consistent with that of the Galway County Development Plan 2022-2028, is to apply energy efficient technologies and harness indigenous renewable energy. It will do this while respecting the need to conserve areas of environmental, cultural and economic value. This will facilitate and encourage renewable energy generation and, ultimately, the transition to a low carbon economy.

This LARES outlines the potential for a range of renewable resources, including bioenergy, micro renewables, wind, geothermal, solar, hydro, energy storage and marine renewable. It acknowledges the significant contribution they can make to County Galway being more energy secure, less reliant on traditional fossil fuels, enabling future energy export and meeting assigned climate change targets.

The LARES also recognises the importance of infrastructure within County Galway including road, electricity, gas and rail networks, and ports. These will support the development of renewables and enable a competitive supply chain economy.

Galway already contributes a disproportionately large share of Ireland's renewable energy. The county generates approximately 11% of national wind energy capacity despite having 8% of Ireland's land area.

The LARES has carried out an assessment of the potential for County Galway to make further renewable energy contributions. This was done by assessing the main types of renewable energy that fall within the legal remit of Galway County Council - these being onshore large-scale renewable energies. [Offshore energy, energy from agriculture (bioenergy) and energy from small-scale individual projects and energy efficiencies, will all provide additional sources of renewable energy. Most of these lie outside of the County Council's jurisdiction for land-use planning or are covered by exempted development regulations].

Table 1: Summary of Wind and Solar renewable energy potential within County Galway.

WIND					
EXISTING			**PROPOSED**		
Wind Deployment Zones 2015	Operational	Permitted	Wind Deployment Zones 2022	2030 New Developed Area Energy Yield @ 7MW/100HA	2030 Additional Yield at repowered existing sites
SUB TOTALS	446MW	124MW	SUB TOTALS	**874MW**	**114MW**
WIND TOTAL	**570MW [385MW†]**		**WIND TOTAL**	**988MW**	
WIND 2030 TOTAL [Modified Existing† plus New]				**1,373MW**	
SOLAR					
EXISTING			**PROPOSED**		
Solar Deployment Zones 2015	Operational	Permitted	Solar Deployment Zones 2022	2030 Developed Area Energy Yield @ 50MW/100HA	2030 Additional Yield at repowered existing sites
SUB TOTALS	0MW	36MW	SUB TOTALS	**180MW**	**0MW**
SOLAR TOTAL	**36MW**		**SOLAR TOTAL**	**180MW**	
SOLAR 2030 TOTAL				**216MW**	
POTENTIAL WIND & SOLAR 2030				**1,589MW (1.5GW)**	
† Assume that, worst case, up to 185MW of existing wind farm permissions will not be renewed due to conflicts with more recent SAC designations					

County Galway Renewable Energy Potential Capacity to 2030 of existing and new larger-scale wind and solar projects (1 Gigawatt (GW) = 1,000 Megawatts (MW))

This new assessment of energy potential has been able to use more up-to-date and detailed mapping analysis of the location of landscape and ecological sensitivities. It has also used more up-to-date mapping of wind speed availability to newer mapping technologies. These maps are used to predict areas of potential availability after the application of greater set-back distances from dwellings.

Notwithstanding this conservative approach, it is estimated that by 2030, Galway will have the capacity to realistically and sustainably deliver over 1.5GW of Renewable Energy (mostly wind), which, if achieved, would make a significant contribution to the Climate Action Plan aims of having 8.2GW of operational onshore wind capacity and 1.5GW of solar PV capacity, nationwide, by 2030.

GLOSSARY OF TERMS

Aspect – *the compass facing of any land with any degree of slope.*

Balance of Payment – *the balance of payments is a statement of all transactions made between entities in one country and the rest of the world over a defined period of time, such as a quarter or a year.*

Biomass – *refers both to "any organic matter that is available on a renewable basis" and the renewable energy industry based on exploiting biomass and its by-products.*

CORINE –*an EU computerised classification mapping system that shows landcover in a standardised format [name is short for Coordination of Information on the Environment Land Cover].*

Energy Grid – *the network of powerlines and substations across the county.*

Environs – *an area that surrounds a specific place, usually having visibility of that place i.e. the environs of the lake, the environs of the town.*

Fossil Fuels – *fuel in the form of hydrocarbons (gas, oil, coal, etc) which are non-renewable.*

Geothermal – *refers to both the process of extracting or dumping heat deep in the ground and the renewable energy industries based off exploiting it.*

Iconic – *an example that is representative of the best of a larger group i.e. Paul Henry's iconic painting of the Wests' cottages, lakes and mountains.*

Infrastructure - *the basic systems and services that a place needs in order to function properly, these typically include roads, railways as well as water and energy services.*

Landcover – *material visible on the surface of the earth – it can include vegetation, both planted and natural, as well as rock, sand or artificial surfaces.*

Landscape – *a place as perceived by people, which evolves through time as a result of being acted upon by natural forces and human beings.*

Landscape Character Assessment [LCA] – *a method for classifying separate places and mapping them as areas of similar character.*

Landscape Features – *visually conspicuous elements such as lakes, rivers, hills, woods or settlements that provide the separate identity to a place.*

Landscape Sensitivity – *the capacity of a place to accommodate development without a noticeable change of appearance or character*.

Landscape Sensitivity Category Definitions

Low:	*Unlikely to be adversely affected by change.*
High:	*High sensitivity to change.*
Special:	*Highest sensitivity to change.*
Iconic:	*Unique landscape with high sensitivity to change.*

Renewable Energy (RE) – *energy form sources that are naturally replenishing but flow-limited.*

Renewable Energy Share (RES) – *the proportion of energy produced nationally which is produced by renewable sources.*

Renewable Energy Share Electricity (RES-E) – *the proportion of national electricity generation which must be from renewable sources.*

Renewable Energy Share Heat (RES-H) – *the proportion of national heating production which must be from renewable sources.*

Renewable Energy Share Transport (RES-T) – *the proportion of national energy consumption by transport which must be from renewable sources.*

Scenery – *landscape that is valued for its appearance.*

Scenic Route – *a road or trail through a landscape that is valued for its appearance.*

Scenic View – *a recognised location from where landscape features are evident and admired on account of exceptionally attractive characteristics.*

Sea Lough – *a body of tidal sea water that is largely surrounded by land.*

Solar Irradiance – *potential power (per unit area) generated from the sun at a discrete point.*

Solar Power – *energy which is captured from the sun by photovoltaic cells.*

Tidal/Wave Power – *kinetic energy which is captured from the sea by underwater tide/wave turbines.*

Urban Fabric – *built-up areas of settlements.*

Unenclosed – *landscapes that have extensive views on account of low or absent filed boundaries.*

Visibility – *the capacity to readily see or notice an object or feature in a landscape.*

Visual Impact – *the degree that a new development changes the appearance or character of a landscape.*

Watershed – *an area or ridge that separates or encloses different parts of a landscape.*

Wind Energy – *kinetic energy from the wind which is captured elevated turbines.*

Wind speed – *refers to the speed of wind (m/s or km/h) at a height relative to the ground (usually 100 meters or higher in the case of wind turbines).*

INTRODUCTION

This document is Galway County Council's Local Authority Renewable Energy Strategy (LARES) 2022. It replaces the Wind Energy Strategy of the Galway County Development Plan 2015 (as varied). This LARES is a key element of the County Development Plan (CDP) which is being reviewed in tandem with the development of this report. The LARES reviews the County's energy strategy and opportunities for both wind and solar energy. It also includes considerations about the other main types of commercial renewable energy technologies. These are used to develop a coherent policy framework that allows for renewable energy to be considered in land-use planning.

The Strategy takes account of new technologies in renewable energy development that may not have been considered in the previous County Development Plan (CDP) and associated strategies such as the Wind Energy Strategy. The Strategy has also been able to use more up-to-date and detailed mapping analysis of the location of landscape and ecological sensitivities as well as more up-to-date mapping of wind energy availability due to newer mapping technologies (improved mapping algorithms, increased sensor/data collection points, etc).

The Strategy has been prepared taking account of relevant European, national, regional and local planning frameworks and guidelines. These include the National Planning Framework, the Northern & Western Regional Spatial and Economic Strategy and the Galway County Development Plan. Consideration is given to all issues raised in the submissions to the non-statutory LARES consultation. This Strategy presents a vision that supports and promotes the development of renewable energy development in a balanced and sustainable manner, in the context of the government's target to transition to a low carbon economy by 2050 and the ambition of the European Union to reach a net zero carbon target by 2050. As a member of the European Union and a signatory of the Paris Climate Agreement 2015, Ireland is committed to reducing its carbon emissions and achieving carbon neutral status by 2050. This Strategy is set out as follows:

Part 1: OVERVIEW AND CONTEXT

Section 1.1	Overview
Section 1.2	Current Renewable Energy in Galway
Section 1.3.	Renewable Energy in adjoining Counties
Section 1.4.	Renewable Energy Strategy Rational
Section 1.5.	Why do we need Renewable Energy?
Section 1.6.	Why prepare a Renewable Energy Strategy?
Section 1.7.	Strategic Aims of Renewable Energy Strategy and Vision
Section 1.8.	Consideration of Alternatives
Section 1.9.	Review of Renewable Energy Technologies
Section 1.10.	Legislation and Policy Context
Section 1.11.	National, Regional & Local Context
Section 1.12.	Sectoral & Other Context
Section 1.13.	Submissions Received

Part 2: RENEWABLE ENERGY STRATEGY FACTORS AND METHODS

Section 2.1.	Introduction
Section 2.2.	Current Capacity
Section 2.3	Renewable Deployment Areas
Section 2.4.	Key Successes and Failures
Section 2.5	Renewable Energy Potential
Section 2.6.	Renewable Energy Potential Contribution

Part 3: COUNTY GALWAY RENEWABLE ENERGY STRATEGY

Section 3.1	Introduction
Section 3.2	Exiting Capacity
Section 3.3	Methodology for determination of Future Capacity
Section 3.4	Opportunities and Challenges
Section 3.5	Mapping of Renewable Energy Factors
Section 3.6	Updated Estimation of Galway's potential Renewable Energy Areas
Section 3.7	Interpretation of Deployment Zone Classification
Section 3.8	Comparison of Previous and Proposed Deployment Zones
Section 3.9	Policy Objectives

Strategic Environmental Assessment (SEA), Strategic Flood Risk Assessment (SFRA) and Appropriate Assessment (AA) are being undertaken iteratively as part of the wider Galway County Development Plan Review which includes this LARES. Environmental considerations have been integrated into the Plan, including this Strategy while associated renewable energy provisions have been integrated into the Plan and other Plan provisions relating to environmental protection and management. Environmental considerations have been used in the identification of areas for renewable energy development, helping to avoid or mitigate impacts on sensitive areas.

PART 1

OVERVIEW AND CONTEXT

Part 1: OVERVIEW AND CONTEXT

1. Overview

Renewable Energy is widely regarded as the future primary source of energy because of the need to reduce carbon emissions to prevent climate change. It is expected, therefore, that investment in renewable energy will continue to grow. To achieve County Galway's renewable energy potential in the coming years, it will be important to develop clear unambiguous policies objectives. These will help to ensure that such developments are suitably located, economical and sustainable in the long term.

Renewable energy is defined by the European Union as *"energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas"*[1]. In recent times, *"The growth in renewable energy has been led by onshore wind (RES-E) and bioenergy in the form of biomass (RES-H) and the biofuel obligation scheme, which requires fuel suppliers to include a level of biofuel in their annual sales of transport fuels (RES-T). Other technologies that have seen some growth in recent years include geothermal (RES-H) and solar (predominantly RES-H)"*[2]. It will therefore be important to consider various types of renewable energy when developing policy objectives for this LARES.

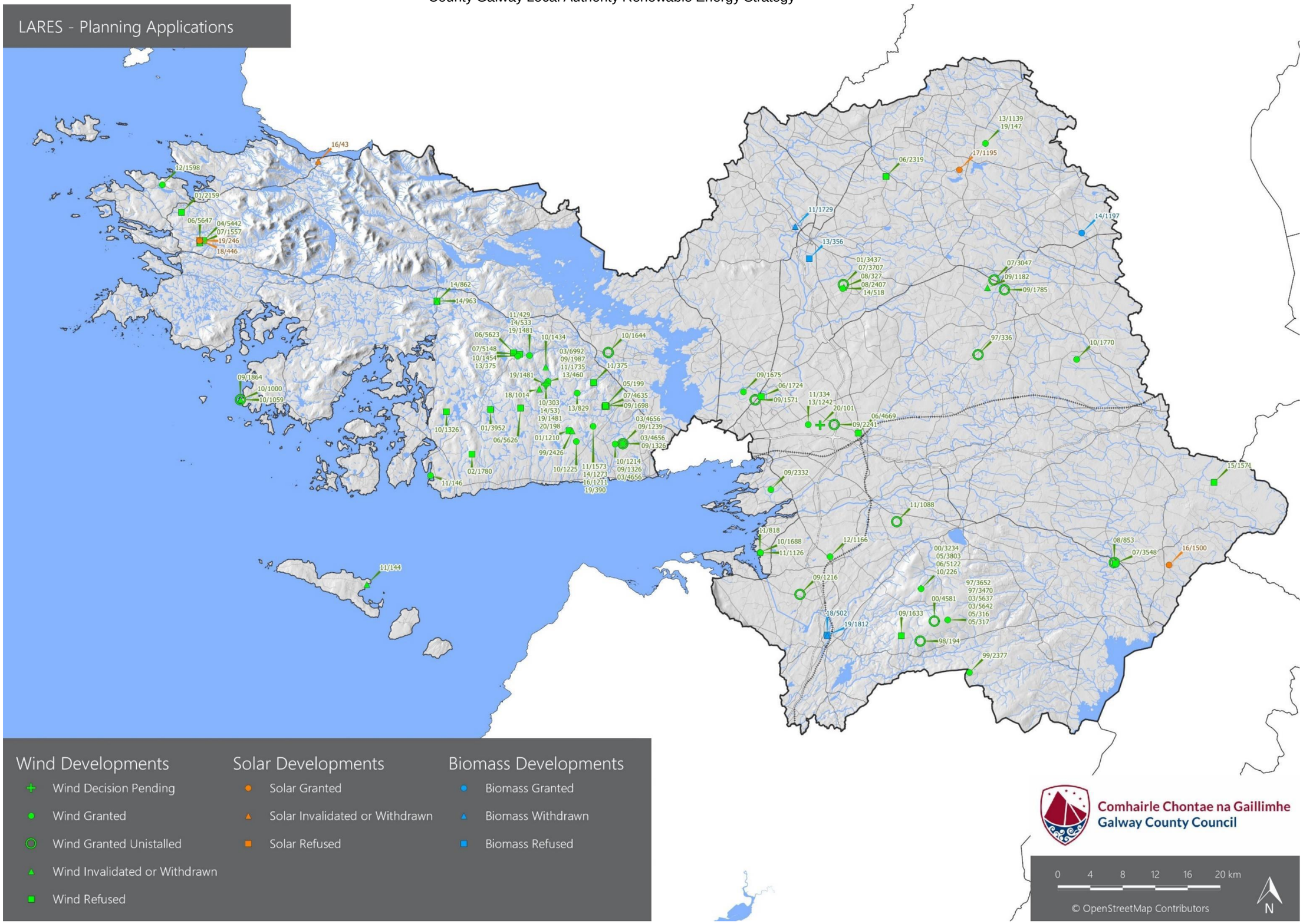
Ireland had the third highest share of wind in electricity generation of International Energy Agency (IEA) member countries in 2017. It has also improved its energy security through an increase in domestic gas production and a reduction of oil's share in energy supply.

The LARES encompasses the entire county of Galway, and comprehensively considers the key sources of renewable energy in the county. The role of non-renewable energy, such as gas, is also incorporated into the LARES to facilitate the transition to a low carbon economy.

It is, however, recognised that renewable energy can be deployed at varying scales which adds a layer of flexibility to its implementation (see Map 1). It can be developed by commercial enterprises, community organisations and individual members of society alike. It will be important, therefore, for policies objectives to be flexible to allow for this.

[1] Article 2(1) of the RECAST Directive (EU) 2018/2001

[2] Text from 2015 White Paper para 125, pg. 52-53



Map 1: Renewable Energy Developments in County Galway

2. Current Renewable Energy in Galway

Wind energy constitutes the largest element of renewable energy generation in County Galway to date. Wind energy generation in the County is characterised by both large and small scale wind energy generation ranging from the largest onshore wind farm in Ireland (Galway Wind Park) to minor research and development turbines (as seen in Part 2, Map 2). This is reflective of the recognised above average wind energy potential that Galway possesses both onshore and offshore.

Offshore wind energy development has not yet come to fruition off the coast of County Galway. However, it is expected that technological developments and the drive to transition to a low carbon economy will result in the development of offshore wind energy, and the LARES will need to examine how terrestrial-based supporting infrastructure is considered in order to facilitate this in the future.

To date, several solar farms have been permitted in Galway, but none are operational. Two solar farms located in County Galway have been successful in the September 2020 RESS 1 auction, one of which is the permitted Ballycrissane Solar Farm with a capacity of 4MW. It is expected that further solar farm developments will proceed in the future, as the cost of technology decreases and return for energy improves with support schemes.

Solar energy development in Galway to date has been limited to domestic installations for solar thermal. Solar energy is set to play an ever-increasing role in the form, appearance and construction of buildings with the use of solar thermal panels at both domestic and commercial scale. It is expected that over the lifetime of the next County Development Plan solar energy will be primarily ground mounted or roof mounted.

Future projections under the National Energy Efficiency Action Plan (NEEAP)/National Renewable Energy Action Plan (NREAP) scenario are targeted to achieve 4000MW of installed wind energy in the Republic of Ireland (RoI). The White Paper: Ireland's Transition to a Low Carbon Energy Future (2015 - 2030), Climate Action Plan 2019 and Programme for Government 2020 extend this growth in renewable energy envisioning Ireland as a leader in renewable energy deployment of large and small-scale renewable energy technologies. As individual renewable energy targets are not set out at the county level it is difficult to identify how much renewable energy power is to be generated in County Galway to meet the NREAP, Climate Action Plan, Programme for Government or subsequent targets. However, it is expected that County Galway will generate a more than proportionate share of renewable energy given the large renewable energy resource in the County.

In addition, there have been significant legislative changes in relation to the requirements for Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Appropriate Assessment (AA) and Flood Risk Assessment (FRA) as well as planning law in the intervening time since the existing strategies were developed. These changes will be reflected in this LARES and the SEA, FRA and AA accompanying the County Development Plan.

3. Renewable Energy in adjoining Counties

The counties adjoining County Galway have varying policy positions regarding different renewable energy types. Most adjoining counties are either in the process of or are commencing reviews of their policy positions as part of the Development Plan review process. These policy positions will be appropriately considered and respected in this LARES, in the interests of maximising the renewable energy resources of the wider Northern and Western region.

LARES Vision

"To facilitate and encourage renewable energy generation and a low carbon energy transition across County Galway, in the interests of future generations, through the application of energy efficient technology and the harnessing of indigenous renewable energy resources, whilst respecting the need to conserve areas of environmental, cultural and economic value."

4. Renewable Energy Strategy Rational

As set out in Section 1 Galway County Council is keen to encourage renewable energy generation across the County to facilitate the transition to a low carbon economy. It is considered that the most effective and sustainable means for doing this is by harnessing renewable energy sources that are indigenous to County Galway. This will need to be supported by clear and unambiguous guidance and policy relating to the applications of renewable energy in County Galway. This will guide renewable energy development to suitable locations at an appropriate scale. Small scale renewable energy developments that benefit from exempted development privileges are also expected to act as a supportive element to this over time.

Notwithstanding the above, the key overarching rational for this LARES is the pressing national and international need to address climate change; In particular, the need to transition to the low carbon economy. In this respect, the National Climate Action Plan sets out several targets relating to renewable energy, and it is through this LARES that County Galway's contribution to these targets will be outlined.

5. Why do we need Renewable Energy?

Renewable energy has become the focus of planning and investment because it reduces dependency on fossil fuels - which contribute to policies and goals for carbon reduction. Renewable energy generally involves the harnessing of naturally renewable energy that can be utilised with minimal to no carbon emissions. As a result of this, climate change adaptation measures worldwide have become centred on the use of renewable energy. This energy has a further benefit for a peripheral island economy like Ireland because it reduces dependency on expensive imported fossil fuels - which are a key factor in the nation's balance of payment calculation.

In this respect, renewable energy will be a key tenet of Ireland's and Galway's response to climate change going forward as it helps in reducing carbon emissions. This is reflected in the government's recent Climate Action Plan and in the current Programme for Government, which both focus heavily on the reduction of carbon emissions and effectively decarbonising the economy.

6. Why prepare a Renewable Energy Strategy?

The Council wishes to consolidate and develop the renewable energies by putting in place a sustainable plan for the long-term development of the sector in County Galway. The LARES will not only review the County's wind energy opportunities but will also expand this to include considerations about the other main types of commercial renewable energy technologies.

Given the high renewable energy potential in County Galway, the Council is supportive of renewable energy, and is keen to facilitate the development of this sector in the context of efforts to address climate change and increasing carbon emissions. This will be achieved by putting in place a planning framework to help reduce reliance on fossil fuels, stimulate local investment in a green economy, and meet energy needs in an affordable and sustainable manner.

The Strategy takes account of new technologies in renewable energy development that may not have been considered in the previous County Development Plan (CDP) and associated strategies such as the Wind Energy Strategy. Central to the Strategy is the application of a plan-led approach to the implementation of renewable energy development across County Galway. This will entail close interaction between the LARES and the Galway County Development Plan, to develop a coherent policy framework that allows for renewable energy to be considered in land-use planning.

In addition to the above, and although the LARES will be focussed on renewable energy, the SEAI methodology requires the consideration of gas infrastructure in the context of renewable energy development, acting as a reserve fuel for heat and power facilities to complement energy provided by renewable resources. Considerations relating to gas (accessibility, availability, location, existing infrastructure etc), will therefore also be incorporated into the LARES although renewable energy will remain as the principle focus.

7. Strategic Aims of Renewable Energy Strategy & Vision

The aim of this Strategy is to build upon current policy to develop an updated, county-wide tool for identifying potentially suitable locations for renewable energy development. This will be used to guide future assessment of renewable energy planning applications in the county and to compliment renewable energy policies in the CDP.

The preparation of the LARES as part of the Galway CDP 2022-2028 is compliant with the principles and requirements outlined in the *Sustainable Energy Authority of Ireland (SEAI) Methodology for Local Authority Renewable Energy Strategies (2013)*, and with any other relevant legislation/guidelines.

The LARES has been prepared in tandem with the updated Landscape Character Assessment (LCA) for Galway. This is an important tool that is used to assess the capacity of the landscape to accommodate development, including different types of renewable energy development.

The key function of the LARES is the identification of the potential of renewable energy resources in Galway. It supports the assessment of how each type of renewable energy may be developed in a sustainable manner within the county. This adds to Galway's ability to meet Ireland's national and international obligations for renewable energy production as set out in the Renewable Energy Action Plan 2013-2020 (NREAP), or any subsequent Plan.

By establishing a comprehensive LARES strategy, the Council is confident of achieving the renewable energy potential of County Galway. This, in turn, will help to attract more economic opportunities to the County whilst respecting the climate change measures that must be implemented to transition to a low carbon economy.

The main high-level objectives in preparing the LARES thus include the following:

- Align the County Development Plan (LARES) strategy with national targets and policies.
- Facilitate a consistent approach to renewable energy.
- Ensure alignment with the Northern & Western Regional Spatial and Economic Strategy.
- Ensure all available resources, constraints and opportunities, are considered.
- Provide an appropriate development management framework for potential renewable projects and renewable energy project developers.
- Facilitate planning and development of electricity infrastructure for renewable energy projects.
- Facilitate greater economic opportunities by harnessing the renewable energy potential of County Galway.

8. Consideration of Alternatives

The Strategy presented here describes how the renewable energy resources of County Galway can be optimised in the future – having regards to the provisions of the Galway County Development Plan and other relevant regional and national standards.

There are a number of alternatives to this strategy that include, but are not limited to;

- **Location of Development**: Locations may be added or removed from the attached mapping as a result of consultation and adoption.

- **Quantity of Development**: The quantity of land, the potential yield by each types of technology may increase or decrease as a result of consultation and adoption.

- **Mix of Development**: The relative contribution of different types of renewable energy developments may increase or decrease as a result of consultation and adoption.

- **Timing of Development**: The phasing and sequencing of the location, extent and types of renewable energy development may increase or decrease as a result of consultation and adoption.

- **Implementation of Strategy**: The final contribution of different types, as well as the phasing and sequencing of the location, extent and types of renewable energy development, may increase or decrease as a result of external forces of market conditions, developer programmes and other drivers of development that cannot be reasonably predicted with any precision. These uncertainties will be captured and assessed by considering high, medium and low levels scenarios of development in the SEA of the Adopted County Development Plan.

The details of all of these matters will emerge following public consultation as well as consideration by Elected Members.

Assessment of the environmental consequences of alternatives will be carried out by the Strategic Environmental Assessment of the Adopted County Development Plan.

9. Review of Renewable Energy Technologies

Most types of renewable energy, except Waste-to-Energy, involve the use of existing natural attributes that are not uniformly distributed. This can often lead to disparate levels of renewable energy potential across a defined area such as Galway County. Constraints such as terrain, environmental designations etc. often further limit the renewable energy potential. However, not all constraints are relevant to all renewable energy types. For example, populated areas may be unsuitable for wind energy development, while the same place may be suitable for solar energy development.

Due to the varying types of renewable energy, with proper consideration of relevant constraints, renewable energy can be considered as a viable source of energy for most needs. This section will outline the varying types of renewable energy sources.

9.1. Onshore Wind

Onshore wind is harnessed with the use of turbines that extract power from the wind and convert it to electricity. Energy from wind can be harnessed both onshore and offshore, with onshore wind energy generation being the most prevalent of the two in Ireland. Wind energy can be harnessed at both commercial and land-user scales. Commercial wind energy developments generally consist of ‘wind farm’ developments that use a number of large individual turbines to supply electricity into the national grid. Micro-renewable scale wind energy developments usually consist of small freestanding wind turbines used to generate energy for local use by dwellings and/or small communities.

Like other renewable energy industries, the technology surrounding onshore wind energy is rapidly developing, to the point that permitted developments are becoming financially obsolete in some cases. This often leads to developers re-applying for permission or applying for alterations to existing permissions to, for example, decrease the number of turbines and increase the length of turbine blades. Increasing the length of turbines also results in an increase in the height of turbines; the benefit of this being that less turbines are required to generate the same or higher levels of energy. However, taller turbines with longer blades do require greater setback distances, and such challenges are usually addressed through micro siting and/or consultation with adjoining landowners. This is considered to be renewing or repowering an existing development in order to increase the

energy generation potential and is becoming increasingly common as existing, older wind farms come to the end of their lifespans. Fáilte Ireland have conducted research assessing the views of tourists about wind farms, and this research found that the majority of tourists favoured a smaller number of wind turbines in certain landscapes (Visitor Attitudes on the Environment – Wind Farms, Fáilte Ireland, 2012[3]). Repowering and/or renewing of wind farms could therefore improve the acceptability of wind farms in the long term.

Opportunities & Challenges of Onshore Wind

Central to the productivity of wind turbine power outputs are the tip height and rotor diameter. These determine the 'swept area' that determines the power yield from each turbine. However, wind speed dictates the ability of wind turbines to generate electricity, therefore, the variability of wind speeds is the chief constraining factor in wind turbine electricity generation. Other common constraints are limits due to noise, shadow flicker and setback distances from homes. These constraints are addressed through the national Wind Energy Guidelines.

Onshore wind is the most heavily utilised renewable energy resource in Ireland (accounting for approximately one third of electricity generated in Ireland[4]), which provides an accepted precedent for such development. Indeed, in some instances, recreation and tourism has been recognised as a by-product of onshore wind energy development where the development has directly funded nature walkways for local communities or has become a tourist attraction. The visual impact of onshore wind developments is often contentious because there are differing opinions as to the appeal of large turbines being incorporated into the landscape, particularly in exposed areas.

The core issue surrounding wind energy is the variable and unpredictable nature of wind. This issue has long been recognised as the chief constraining factor for wind energy and its reliability. However, the emergence of technological advances such as battery storage facilities are expected to increase security of supply from wind energy as they allow for excess energy to be stored for use during periods where wind speeds are lower or reduced.

9.2. Solar Energy

Solar energy can be harnessed from both the light of the sun and the heat of the sun. Energy is harnessed from the light of the sun with solar photovoltaic (PV) panels. Energy harnessed from the heat of the sun is generally done so with solar thermal panels. Solar PVs are used to generate electricity and solar thermals are used to generate heat and hot water. Solar thermal technology is generally utilised for small scale developments such as dwellings, whereas solar PV technology can be and is employed on a larger scale through solar farms, for example. The technology of solar panels has developed quite significantly in recent years to the point that solar panels have become more prevalent in Ireland, despite apparently unfavourable weather patterns. County Galway, in its location along the western coast of Ireland is more susceptible to more overcast weather than other parts of the country. In this respect, the solar energy potential of County Galway is not as high as more southernly located counties. However, this constraint is somewhat diminished by technological advancement in solar technology.

Opportunities & Challenges of Solar Energy

Solar energy is constrained by solar resource, but improvements in solar technology are gradually facilitating the harnessing of smaller levels of solar resource for energy. Potential for overshadowing is a constraint that is most relevant to ground mounted panels due to the higher prevalence of overhanging structures, avoiding areas that are consistently shadowed.

[3] http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf

[4] https://www.iwea.com/latest-news/4126-ireland-now-number-one-in-the-world-for-onshore-wind-energy

Ground-mounted panels are generally suited to flat unobstructed land where sunlight and heat can be maximised. However, a large number of ground-mounted panels can have effects on the local environment due to the lack of penetrable sunlight that reaches the plants and soil beneath. In comparison, roof-mounted panels are considered to be more environmentally friendly as they do not directly impact the local environment.

As with wind energy, opposition to solar energy often relates to the visual impact. Solar farms, in prominent elevated or steeply sloping locations, can present a significant visual impact that cannot be easily hidden due to the need for unobstructed sunlight. This is often mitigated in some countries by, for example, locating solar farms in remote areas such as deserts where solar resource is high and little or no human activity exists. County Galway possesses a large amount of rural terrain, such as bogs, where little to no human activity exists. However, the ecological and landscape importance of some such areas can restrict solar energy capabilities in Galway. Roof-mounted solar panels also have a visual impact; however, the design of such panels has been enhanced to the point that they can now be installed as part of a roofed structure, nullifying the need to mount the panels and therefore reducing their visual impact. Although data on solar farm applications is limited due to the low number of applications submitted, Appendix C shows the need for appropriate siting as a factor in successful applications. It is noted that applications for solar farms are coming forward in other more favourable locations across the country with an estimated contribution of 7GW to the national renewable energy share[5].

Solar panels are generally considered to be most effective and sustainable as the primary source of energy or a contributor to the energy requirements of dwellings and/or commercial buildings. The large-scale deployment of solar panels i.e. solar farms, is less efficient and sustainable when compared to wind energy, for example, because more land is required for an equal amount of energy to be generated. Notwithstanding this, solar energy has a very important role to play in the diversity of energy supply and the transition to a low carbon economy. Development of solar panels on a micro-renewable scale can be an effective means of increasing the carbon neutrality of homes and businesses.

9.3. Bioenergy

Bioenergy is fuelled by biological sources, namely biomass, which can be converted to different forms of energy including heat, power, or liquid biofuels. Facilities may include anaerobic digestion facilities at the medium to large scale, bio-fuel production facilities, district heating projects, combustion and combined heat and power (CHP) facilities etc.

CHP is a technology that uses energy produced in the combustion of fuel to produce both heat, energy and electricity, at both a large scale and small scale. CHP is the simplest form of bioenergy production as it involves direct combustion of typically solid biomass such as willow, miscanthus, tallow etc. to create electricity and heat.

Anaerobic digestion facilities are principally used to produce biogas. Such facilities generally utilise anaerobic processes to produce biogas from biomass. This normally involves the breaking down by micro-organisms of food waste, pig and cattle slurry, grass silage etc. to generate biogas. Anaerobic digestion facilities are therefore characterised by sealed tanks operated under controlled conditions. The biogas produced from this process can then be used to generate heat or electricity, or alternatively the gas can be purified to create biomethane for use as a gas supply.

Bioenergy involves the use of biomass energy crops i.e. willow, miscanthus, sugar beet, oilseed rape etc. for production of energy. It can also involve the use of human waste, waste from food crops, wood or forest residue etc. In this respect, biomass is considered to be both a varied source of energy and a carbon neutral source of energy as the use of biomass to generate

[5] *https://marketresearch.solarmedia.co.uk/products/republic-of-ireland-solar-pv-opportunity-tracker-report*

bioenergy involves the release of carbon emissions that would have normally been released through natural processes associated with the original source.

Opportunities & Challenges of Bioenergy/Biomass

The main advantage that bioenergy has over other forms of renewable energy is the fact that there are many ways in which bioenergy can be produced at varying scales, where it is viable to do so. This flexibility allows for bioenergy to be effectively utilised in several settings. There are, however, some contentious uses of bioenergy such as biofuels produced from food crops in order to fuel the transport industry or to create heat and electricity. This can potentially harm food production and can be avoided by using agricultural residue or waste as an alternative source. Notwithstanding this, to be effectively widely utilised and to be sustained on a large scale, residual biomass needs to be harvested on a commercial scale. Some residual forms of biomass such as agricultural residue, forest thinning and tallow are not yet harvested on such a scale, therefore their ability to sustain energy requirements at a large scale is limited but the potential to harvest such forms of biomass at larger scale remains.

Use of land for harvesting energy crops such as wheat, oilseed rape, sugar beet, maize, willow and miscanthus is not currently implemented on a large scale in Ireland due to concerns surrounding profitability, land use competition and availability. Rather, these energy crops are typically grown for food, fodder or export, which means bioenergy is in direct competition with established and necessary practices in sourcing fuel. The use of land for harvesting energy crops should be considered where suitable land is identified and is not in conflict with food, fodder or exportation production. Notwithstanding this, the remit of the planning process does not generally cover agricultural practices such as planting or harvesting, so energy crop production cannot realistically be guided by this strategy or the wider planning process.

9.4. Micro-renewables

Micro scale solar PVs and wind turbines are generally affixed to the roof of a development or are ground-mounted within a development. Historically, such micro-renewable generation schemes have supported the energy needs of individuals and communities, with any excess energy re-distributed to the national grid subject to financial renumeration. Micro-renewable technologies include, but are not limited to:

- Solar photovoltaic panels (PV);
- Small freestanding wind turbines;
- Micro scale combined heat and power (CHP) plants;
- Micro scale hydroelectric schemes;
- Solar hot water panels;
- Micro scale biomass heating and wood burning stoves;
- Ground source heat pumps; and
- Air source heat pumps.

The government's RESS initiative continues this tradition by allocating up to 30 gigawatt (GW)[6] hours to community-led initiatives generating renewable energy which could include micro-renewable generation. For context, 1 gigawatt hour is enough power to power around one million homes for an hour[7]. Information from a recent SEAI joint Oireachtas briefing indicates that

[6] https://merrionstreet.ie/en/news-room/releases/renewable_technologies_wind_solar_and_community_energy_get_the_green_light_as_ireland_announces_the_provisional_results_of_the_first_renewable_electricity_support_scheme_auction.html

[7] https://www.ofgem.gov.uk/ofgem-publications/76160/13537-elecgenfactsfspdf

anywhere between 2-6GW of energy is expected to be generated from micro-renewables up to 2025[8].

Micro-renewable energy generation may not always result in the generation of excess energy and may simply be used to fulfil or support the energy needs of individual developments. In this instance, such developments would be considered as low carbon or zero carbon due to the use of micro-scale renewable energy to sustain the energy needs of the development, thus reducing or equalizing the carbon emissions of the development.

Opportunities & Challenges of Micro-renewables

There are many variations of micro-renewable energy generation (MREG) which makes it a very adaptable technology that can be used in a wide range of settings. Added to this, often, more than one micro-renewable energy technology (MRET) can be utilised in the same setting, where conditions allow. Furthermore, several planning exemptions apply to some forms of micro-renewable energy development, thus facilitating the instalment of MRET. This provides the opportunity for MREG to be undertaken countywide. However, upfront financial costs are often a barrier to the take-up of MREG and a lack of understanding can often lead to the inefficient implementation of MRET.

In recognition of the limited opportunity for micro-renewable projects to attain funding and support through the RESS, the government have committed to the development of a Micro-generation Support Scheme which will provide a route to market for citizens and communities to generate their own renewable electricity and to receive a fair price when they sell the excess onto the grid. Under this proposed scheme, micro-generation is considered to be micro-generation technologies with a maximum output of 50Kw designed to primarily service the self-consumption needs of the property where it is installed.

9.5. Marine Renewables

Ocean power is at the forefront of renewable energy development and various technologies are currently being developed and investigated. Established terrestrial technology such as onshore wind energy generation is slowly establishing itself offshore, and new marine-specific technologies such as tidal, wave and ocean thermocline energy are being investigated and developed. County Galway, in particular, is considered to have an abundance of potential to develop such marine renewable energies. This is highlighted by the fact that one of the Marine Institute's offices are based in County Galway and that testing sites for wave and tidal energy are located offshore. It is also evidenced by the Offshore Renewable Energy Development Plan 2014 which identifies Area 5 (the area in which County Galway is located) as an area with a marine renewable potential of 18,500-19,500 Megawatts (MW). Given the technological improvements that have occurred in the marine renewables industry since 2014, it is likely that this is an underestimation of the actual marine renewable potential for this area.

Any renewable energy generated in the marine area will inevitably need to make landfall in order to be stored and/or transferred to the national grid. In this respect, the LARES considers land-based infrastructure associated with marine renewables such as transmission substations located in coastal areas and port infrastructure to facilitate maintenance and repair in Ros a Mhíl and the Port of Galway.

A draft national marine planning framework is currently being consulted upon, and is expected to be finalised and published by March 2021 in line with the Marine Spatial Planning Directive, which requires a national marine spatial plan to be in place by March 2021. This will provide the planning

[8] https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/joint_committee_on_communications_climate_action_and_environment/submissions/2019/2019-03-05_opening-statement-jim-gannon-ceo-sustainable-energy-authority-of-ireland-seai_en.pdf

framework within which marine renewables will be considered. It will also provide the platform for the integration of marine and terrestrial planning systems which will be of particular relevance to land based marine renewable infrastructure.

Opportunities & Challenges of Marine Renewables

The Programme for Government[9] has signalled the government's interest in developing and funding marine renewables. It is likely, therefore, that this increased funding could be utilised to enhance land-based renewable energy infrastructure in order to accommodate increased levels of marine renewable energy on the grid, for example.

Offshore wind energy is being rapidly developed to the point that floating wind farms have now become both feasible and economic propositions, and have been deployed successfully off the coast of Scotland[10]. This allows for offshore wind energy to be harnessed in deeper waters due to the elimination of the need to fix the turbines directly to the seafloor. County Galway is already considered to have an abundant resource of offshore wind energy, and technological developments such as this will lead to greater amounts of offshore wind energy being harnessed off the coast of Galway, which will consequently require appropriate supporting land-based infrastructure.

Like onshore wind, offshore wind and wave energy levels are influenced and vary depending on weather patterns. However, greater levels of energy tend to be generated through marine renewables due to the more volatile weather patterns offshore compared to onshore. Battery storage devices can also be used to offset periods of low energy generation. Other forms of marine renewable energy such as tidal and ocean thermocline energy are more constant and predictable allowing for consistent renewable energy generation. In this respect, supporting land-based infrastructure will need to facilitate both variable and consistent forms of marine renewable energy generation.

9.6. Hydroelectric Power

Hydro power involves the generation of energy from falling water. Flowing water is used to drive a turbine which produces mechanical energy. This mechanical energy is usually turned into electrical energy by a generator. Hydropower schemes can be classified as low head schemes or high head schemes based on the geographic characteristics of the site. Plants operating with a head of over 150m are referred to as high head, those in the 20m-150m range are medium and those below 20m are classified as low head. Run of the river schemes are those where water is taken from a river from behind a low weir with no facility for water storage and returned to the same water course after passing through a turbine.

Commercial hydropower development generally consists of upland hydropower facilities to generate electricity from stored water and development of lowland water resources through impoundment or diversion. There are no commercial hydropower schemes and just a small number of community/micro hydropower schemes located in County Galway. Generally commercial scale hydropower is not economically viable, except where certain conditions allow such as suitable terrain and proximity to a large population base and appropriate infrastructure. This is evident with both Poulaphouca Dam's proximity to Dublin City and Ardnacrusha Dam's proximity to Limerick City, both large population base areas with high density development in comparison with other parts of the country. Generation of hydropower from wastewater is another technique that has been applied in places internationally, however it appears as though this technique is only usable and viable in areas of high-density population which is not reflective of the general population patterns of County Galway.

[9] https://static.rasset.ie/documents/news/2020/06/draft-programme-for-govt.pdf

[10] https://www.power-technology.com/projects/hywind-pilot-park-aberdeenshire/

Opportunities & Challenges of Hydroelectric Power

Hydropower is most effective on a local community scale where economies of scale are more manageable and geographical constraints are not as limiting. In this respect micro-hydropower schemes could be of use in County Galway where they are utilised on a community scale. They also have less of an environmental impact then commercial scale hydropower schemes as damming is usually not required, hence why such schemes are regarded as run-of-the-river schemes. However, the scope for energy storage for such schemes can be limited due to the small-scale nature of such schemes and the lack of damming infrastructure.

A limiting factor of hydroelectric power is the variability of the flow of the river. Sufficient flow and head are key enablers of hydroelectric power as the flow of water is the basic resource required to generate energy. Where the flow of water is variable, which can often be the case, a water storage area is normally required to ensure a consistent flow of water, allowing for consistent energy generation. This adds to the visibility of such a scheme and entails further diversion and manipulation of the natural river course.

9.7. Geothermal Energy

Geothermal energy can often be described as energy stored in the form of heat beneath the surface of the earth[11](Article 2 (3), RECAST Directive, 2018). Geothermal energy can be classified as either deep or shallow, depending on the depth of the source. Shallow geothermal energy is the most viable source due to its inherent closeness to the surface of the earth. Ground source heat pumps are commonly used to harness shallow geothermal energy for the purposes of renewable heat generation. Ground source heat resources can be exploited for space heating and cooling, as well as water heating. The technology is applied by pumping heat from a low temperature source and releasing it at a higher temperature.

It is considered that ground source energy has the potential to make a significant contribution to meeting thermal energy targets, particularly in the residential and commercial sectors. Ground source heat collectors can be installed in both urban and rural settings. Given the traditionally dispersed settlement pattern in County Galway, such technology could be implementable across the county.

Opportunities & Challenges of Geothermal Energy

Where geothermal energy reserves are of a suitable nature, which is generally considered to be where shallow ground temperatures are in the range of 5-15C in Ireland[12], ground source heat pumps can be utilised. Geothermal energy reserves are generally easy to quantify as the ground temperature of the earth normally remains stable, making ground source heat pumps a very dependable renewable energy technology.

Ground source heat pumps require additional land in order for the pumps to be installed underground, which also requires drilling to be undertaken. This does not make ground source heat pumps an attractive proposition in built up areas. Conversely, County Galway's dispersed built environment may prove favourable for the application of ground source heat pumps across the county.

9.8. Alternative Technologies

The renewable energy industry is developing at a rapid rate due to the urgent need to address climate change and to transition to a low carbon economy, and it is likely that other technologies not specifically discussed in this LARES will emerge over time. One renewable energy technology

[11] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001&from=EN

[12] https://www.gsi.ie/en-ie/programmes-and-projects/geoenergy/activities/Pages/Geothermal-Energy-and-Ground-Source-Heat.aspx

which is becoming more widely used in recent times relates to battery storage systems. The lack of energy storage capacity has long been a barrier to the efficient use of renewable energy. However, technology in this field has now advanced to the point that utility-scale battery storage systems are being utilised in order to enable more efficient use of renewable energy:

"Utility-scale batteries, for example, can enable a greater feed-in of renewables into the grid by storing excess generation and by firming renewable energy output. Furthermore, particularly when paired with renewable generators, batteries help provide reliable and cheaper electricity in isolated grids and to off-grid communities, which otherwise rely on expensive imported diesel fuel for electricity generation". (International Renewable Energy Agency (IRENA), 26th March 2020)

It is currently estimated that utility-scale batteries dominate the global energy storage market, but it is predicted that by 2030 small-scale battery storage will significantly increase to the point where it compliments utility-scale storage[13]. Small-scale battery storage systems are generally suited for incorporation within individual or residential developments.

Battery Storage – also known as thermal stores, comprises development which allows for the capture of heat or electricity when it is readily available, typically from a renewables system, and save it until a time when it is required to be used. Future energy storage on a national and regional scale is an integral aspect of the renewable energy industry and therefore must be considered in the overall context of planning frameworks for energy. Typical renewable energy storage technologies include:

- Pumped Hydroelectric Energy Storage (PHES) – consists of two large reservoirs located at different elevations and a number of pump/ turbine units. During off-peak electrical demand, water is pumped from the lower reservoir to the higher reservoir where it is stored until it is needed. Once required (i.e. during peak electrical production) the water in the upper reservoir is released through the turbines, which are connected to generators that produce electricity.
- Battery Energy Storage (BES) – can be integrated with renewable energy generation systems in either grid connected or stand-alone applications. There are three important types of large-scale BES; These are Lead-Acid (LA), Nickel-Cadmium (NiCd), SodiumSulphur (NaS). These operate in the same way as conventional batteries, except on a larger scale.
- Heat/Thermal Energy Storage (TES) - involves storing energy in a thermal reservoir so that it can be recovered at a later time. This is a common means to store domestic hot water for later use.
- Electrical Storage heaters - can store electrical energy at night when electricity is available at lower cost, and release the heat during the day as required.
- Heat pumps - Pump heat from a low temperature source and release it at a higher temperature.

Opportunities & Challenges of Alternative Technologies

Any kind of technology that advances energy storage facilitates self-sustaining communities with a reliable source of renewable energy, as any excess energy can be stored and utilised when needed. Although the addition of a battery storage system adds to the upfront cost of installing renewable energy technology, it is offset by the fact that it reduces the cost of energy by creating a reliable and consistent source of energy.

For grid connected BES systems, batteries add value to intermittent renewable sources by facilitating a better match between supply and

[13] https://www.irena.org/newsroom/articles/2020/Mar/Battery-storage-paves-way-for-a-renewable-powered-future

demand. Other benefits of this method of energy storage include; power quality assurance, load levelling and integration of renewable energy generation plants. There are no emissions, solid wastes or effluent produced from these battery storage systems.

Air source heat pumps are another form of renewable energy technology, in that, they use energy from the air outside to heat buildings. They have similar functionalities to ground source heat pumps, in that, they are both renewable heat pumps. However, air source heat pumps are generally more favoured as they are easier to install and are effective in a wider range of climates.

Air source heat pumps, although flexible to install, can present somewhat of an eyesore at times because they involve a large square feature fixed to the side of a building. This can of course be mitigated by locating the air source heat pump in the least visible area. Furthermore, air source heat pumps are most effective where the building they are serving is well insulated with low levels of heat loss[14]. This would mean that air source heat pumps would be less effective in older poorly insulated buildings.

9.9. Energy Efficiency & Conservation

Energy efficiency involves reducing the amount of energy required to provide products and services. Energy conservation involves reducing energy through using less of an energy source.

The transition to a low carbon economy will not solely be facilitated by the advancement of renewable energy technologies. Simple but effective energy efficiency and conservation practices will also have a role to play. The Climate Action Plan recognises this and strongly supports the implementation of energy efficiency and conservation practices to help decarbonise the economy. In this respect, the Climate Action Plan sets out a target of improving the energy efficiency of public buildings by 50%. The Council is supportive of this approach, as a signee of the Climate Action Charter 2019, and will seek to address this through the CDP.

The Building Regulations will require all new builds occupied after the 31st December 2020 (31st December 2018 for public sector buildings) to be in compliance with a Near Zero Energy Building Standard[15], which will help to achieve greater levels of energy efficiency. The challenge, however, will be to encourage retrofitting existing private developments which will need to be supported by appropriate financial mechanisms. This is beyond the scope of this LARES, and is addressed in greater detail in the County Galway CDP 2022-2028.

Opportunities & Challenges of Energy Efficiency & Conservation

The chief constraining factor for the implementation of energy efficiency and conservation practices is the upfront financial cost and the perceived viability issues this entails. The Climate Action Plan seeks to address this through the introduction and imposition of several support schemes going forward.

Energy efficiency and conservation techniques ultimately ensure that the least amount of energy possible is being lost at the point of use. Thus, complimenting sustainable renewable energy production. It will be important, therefore, to implement energy efficiency and conservation practices in tandem with renewable energy development to ensure little or no energy loss at the point of use.

Similar to micro-renewables, energy efficiency and conservation techniques on their own will not be effective in reducing carbon emissions. However, when implemented across a wide range of settings, such techniques can cumulatively reduce carbon emissions significantly; even more so when undertaken in tandem with increased renewable energy development. The National Planning Framework's aim to improve the efficiency of land

[14] https://www.seai.ie/blog/heat-pumps/

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

management will help to drive more compact growth and greater energy efficiencies, as a result.

9.10. Sustainable Transport

It is widely recognised and agreed that significant energy efficiencies can be achieved in the transport sector with the rapid development of hybrid and electric vehicles in recent years, and the recently identified potential of hydrogen as a source of fuel for transport[16]. Considering that the transport sector consumes a large amount of energy in comparison to other sectors and emits high levels of carbon, such developments are not only required but are necessitated by the need to transition to a low carbon economy.

Although the Council does not hold within its remit powers to directly influence travel patterns, the Council can support infrastructural improvements to help facilitate more sustainable travel patterns as well as by planning policies that reduce journey demand. The Council's ambitions to support greater levels of sustainable travel will be outlined in the County Galway CDP 2022-2028, and will be guided by the transport initiatives of the National Planning Framework.

Opportunities & Challenges of Transport

Technological developments over time have dramatically reduced the costs of electric vehicles, greatly improving their functionality and viability. Although further progression is required for the viability of electric vehicles, it is evident that electric vehicle ownership and usage is continually growing[17].

Given Ireland's and County Galway's dispersed settlement patterns and reliance on the private car for daily transport, electric and hybrid vehicles will play a key role in helping to reduce the carbon emissions of County Galway. However, any substantial growth in the use of electric vehicles will need to be supplemented by improvements to capacity on the transmission grid to ensure sufficient availability of energy supply.

10. Legislation and Policy Context

European Union (EU) and Irish Government policies identify the development of renewable energy as a primary strategy in implementing national energy policy and decarbonising the economy.

The Galway LARES Appendix H sets out a detailed section that describes these over-arching energy policies, positions, and related legislation. The focus of which is to summarise policies specifically relevant to renewable energy development in County Galway at the time of writing.

The relevant legislation and policy context includes:

International Context

- Directive on the promotion of the use of energy from renewable sources (RECAST) 2018
- Paris Climate Agreement 2015 & EU Policy Framework for Climate and Energy from 2020 to 2030
- Directive on the promotion of the use of energy from renewable sources 2009
- Kyoto Protocol 1997

National Context

- Draft National Energy & Climate Plan 2021-2030
- Climate Action Plan 2019
- Statement of Strategy 2019 – 2021 (Department of Communications, Climate Action & Environment)
- Draft Wind Energy Guidelines 2019

[16] https://ec.europa.eu/transport/themes/urban/vehicles/road/hydrogen_en

[17] https://www.irishtimes.com/business/transport-and-tourism/electric-and-hybrid-vehicles-now-account-for-over-10-of-irish-car-sales-1.4043776

- Project Ireland 2040 (National Planning Framework 2018 & National Development Plan 2018-2027)
- National Energy Projections to 2030 (SEAI 2018)
- National Adaptation Framework 2018
- Third Report and Recommendations of the Citizens' Assembly How the State can make Ireland a Leader in Tackling Climate Change, (2018)
- National Renewable Energy Action Plan Fourth Progress Report 2018
- National Energy Efficiency Action Plan Fourth Edition (2017-2020)
- National Climate Mitigation Plan 2017
- Ireland's Energy Targets – Progress, Ambition & Impacts (SEAI 2016)
- Draft Renewable Electricity Policy Development Framework SEA Scoping Report 2016
- Climate Action and Low Carbon Development Act 2015
- White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030 (December 2015)
- Strategy for Renewable Energy 2012-2020, Dept. of Communications, Energy & Natural Resources
- Draft National Marine Planning Framework

11. National, Regional & Local Context

Project Ireland 2040 (National Planning Framework 2018 & National Development Plan 2018-2027)

Project Ireland 2040 is the Government's overarching policy initiative to make Ireland a better country, informed by the Programme for a Partnership Government 2016, which recognises that economic and social progress go hand in hand. Project Ireland 2040 comprises of the National Planning Framework to 2040 and the National Development Plan 2018-2027.

The National Planning Framework (NPF) 2018 identifies the importance of climate change in National Strategic Outcome (NSO) 8, which relates to ensuring a 'Transition to a Low Carbon and Climate Resilient Society'.

National Policy Objective (NPO) 55 seeks to 'Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050.' The implementation of carbon pricing and the establishment of a Climate Action Fund are muted as a means of financing this proposed transition to a low carbon economy.

Other NPOs of relevance to this LARES include:

- NPO 3a – Compact Growth.
- NPO 33 – Prioritisation of new homes at locations that can sustainably support them.
- NPO 42 – Offshore Energy.
- NPO 52 – Planning response to environmental challenges.
- NPO 53 – Circular and Bioeconomy.
- NPO 54 – Reduce Carbon Footprint.
- NPO 56 – Sustainably Manage Waste Generation.
- NPO 64 – Improve Air Quality.

In particular, it should be noted that the NPF recognises the important role of rural areas in contributing to the energy needs of the country and energy production. It also highlights the innovative renewable solutions that have been utilised in rural areas and helped to secure a sustainable renewable energy supply. This is of high relevance to County Galway considering the large amount of rural areas within the County.

The associated National Development Plan (NDP) 2018-2027 includes 'climate action' as one of its Strategic Investment Priorities (SIPs). The NPF advises that new energy systems and transmission grids will be necessary for a more distributed, renewables-focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy to the major sources of demand.

Northern and Western Regional Spatial and Economic Strategy (RSES) 2019

This regional strategy was adopted in January 2020 and will heavily influence the wider CDP review encompassing this LARES. This strategy is applicable to the LARES as County Galway is located in the western region.

The RSES recognises the offshore renewable energy potential of Galway and the need to promote and develop renewable energy technologies, in general, in Galway and the wider region. This is characterised by the following regional policy objectives:

- RPO 4.16 – To co-ordinate the identification of potential renewable energy sites of scale in collaboration with Local Authorities and other stakeholders within three years of the adoption of the RSES. The identification of such sites will be based on numerous site selection criteria including environmental matters and potential girds 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 utilisation 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 – To 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 – To 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 – To 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.
- RPO 4.27 – It is an objective to support the National Policy Statement on the Bioeconomy (2018), and the exploration of opportunities in the circular resource-efficient economy, including undertaking a bioeconomy feasibility study for this region. This feasibility study will aim to identify (and map) areas of potential growth to inform the National Transition Agenda, enabling a Low Carbon, resilient nation.
- RPO 4.28 – To support the potential creation of appropriately scaled local multi-feedstock bio-refining hubs across the region as well as potential creation of bio-districts/clusters.
- RPO 4.29 – The Assembly supports the future-proofing of infrastructure planning to allow for the potential upgrading of existing industrial sites to bio-refining plants while also supporting the use of bio-renewable energy for the sustainable production of bio-based products.
- RPO 4.30 – To review, and where necessary amend, the RSES upon adoption of the National Marine Planning Framework (NMPF) to ensure alignment, and consistency between land use and ocean based planning, and to ensure co-ordination which supports the protection of the marine environment and growth of our marine economy.
- RPO 4.33 – To facilitate where possible Marine Renewable Technology Projects off the West and North West coasts of Ireland, and subject to environmental and amenity considerations (feasibility studies), and where applicable, enable National Grid connection.
- RPO 4.37 – To examine the potential of the region's other main ports to expand, and enhance facilities to enable them to become ports with enhanced regional significance in a range of areas, including trade, fisheries, marine tourism and renewables. This will be done in

conjunction with all relevant stakeholders, including the relevant Local Authorities, and within the context of the NMPF.

- RPO 5.5 – Ensure efficient and sustainable use of all our natural resources, including inland waterways, peatlands, and forests in a manner which ensures a healthy society a clean environment and there is no net contribution to biodiversity loss arising from development supported in this strategy. Conserve and protect designated areas and natural heritage area. Conserve and protect European sites and their integrity.
- RPO 5.23 – To establish a Regional Fora that shall prepare an audit of worked out bogs and peatlands within our region and to identify strategic sites and propositions of regional value, including but not limited to areas such as renewable energy, tourism, biodiversity, climate mitigation, education, recreation and amenity.
- RPO 6.14 – Support provision of Smarter Travel infrastructure.
- RPO 6.19 – Reduce dependency on fossil-fuel powered vehicles.
- RPO 6.33 – Reduce dependency on the fossil-fuel powered vehicles and have regard to the National Policy Framework for Alternative Fuels Infrastructure for Transport.
- RPO 6.34 – Promote deployment of targeted, convenient and safe recharging infrastructure across the region to meet the changing needs of the electric vehicle with particular emphasis in public parking areas and employment locations.
- RPO 6.49 – Develop and deliver strategy and infrastructure to enable the adoption and integration of future modes of transport and mobility.
- RPO 8.1 – The Assembly support the development of a safe, secure and reliable electricity network and the transition towards a low carbon economy centred on energy efficiency and the growth projects outlined and described in this strategy.
- RPO 8.2 – Support the reinforcement and strengthening of the electricity transmission network with particular reference to the regionally important projects.
- RPO 8.3 – The Assembly supports the necessary integration of the transmission network requirements to allow linkages with renewable energy proposals at all levels to the electricity transmission grid in a sustainable and timely manner.
- RPO 8.4 – That reinforcements and new electricity transmission infrastructure are put in place and their provision is supported, to ensure the energy needs of future population and economic expansion within designated growth areas and across the region can be delivered in a sustainable and timely manner and that capacity is available at local and regional scale to meet future needs. Ensure that development minimises impacts on designated areas.
- RPO 8.6 – Facilitate the delivery and expansion of natural gas infrastructure throughout the region and have regard to the location of existing gas infrastructure in assessing potential developments.
- RPO 8.7 – Encourage and support innovative partnerships extending the gas network in the region, including the potential for gas to grid injection facilities along with anaerobic digestion facilities.
- RPO 9.4 – Create Resilient Places and Low-Carbon Infrastructure.

Whilst the strategy recognises the abundance of renewable sources of energy, it also recognises the up-front capital investment such sources of energy require in order to be developed at a usable scale. For example, the strategy notes the lack of high capacity 220kv and 400kv transmission infrastructure in the region which will need to be developed if the abundant renewable energy sources in the region are to be realised. Notwithstanding this, the strategy highlights the fact that the region has a huge potential for growth in renewables due to its diverse and growing environmental goods and services sector.

Furthermore, creating resilient places and low carbon infrastructure is identified as a key strategic outcome of the strategy, and it is expected that the wider North West region will be developed as a centre of excellence for renewable energy and innovation in order to facilitate this.

<u>Draft Galway County Council Climate Adaptation Strategy 2019 - 2024</u>

As part of the National Climate Change Action Plan 2019, the County produced and adopted its own County Galway Climate Adaptation Strategy in 2019. This Strategy considers actions to be implemented by the Council in order to arrest the significant issues of climate change at a county level.

The Plan identifies risks and opportunities in relation to key themes and sub-themes, and goals, objectives and actions are developed as a result of this. The key themes addressed are:

- Natural & Cultural Capital.

- Critical Infrastructure (Electricity & Gas Networks).
- Water Resources & Flood Risk Management.
- Public Health.

Of most relevance is Goal 1 which aims to Increase the Resilience of Critical Infrastructure & Buildings to Climate Change by Planning and Implementing Appropriate Adaptation Measures.

Galway County Local Economic and Community Plan (LECP) 2016-2022

This Plan published in 2016 recognises County Galway's renewable energy potential, particularly the wind energy element which it estimates to be a significant portion of the national wind energy potential. Similar to the CDP below, this plan, as part of it's Action Plan, aims to:

- Encourage the location of renewable resource enterprises in rural locations;
- Promote the use of district heating/cooling and combined heat and power; and
- Support the development and expansion of infrastructure for the generation, storage, transmission and distribution of electricity, renewable energy and other renewable energy proposals in suitable locations.

Galway County Development Plan 2015-2021

This is the current Development Plan for County Galway. The County Development Plan (CDP) is in the process of being reviewed and will cover the period of 2022-2028.

Current policies and objectives of relevance in the Galway CDP are:

- Objective DS8 – Climate Change.
- Objective DS9 – Projects/Associated improvements works/infrastructure and Appropriate Assessment.
- Objective EDT11 – Rural Enterprise.
- Objective TI 2 – Sustainable Travel Measures.
- Objective ER 1 – Electricity and Renewable Energy Infrastructure.
- Objective ER 3 – Low Carbon County.
- Objective ER 4 – Renewable Energy.
- Objective ER 5 – Wind Energy Developments.
- Objective ER 6 – Wind Energy Strategy.
- Objective ER 8 – Promoting Energy Hubs.
- Objective ER 9 – Oileáin Árann an Energy Transition Community.
- Policy TI 3 – Sustainable Travel Measure.
- Policy ER 1 – Sustainable Energy Policy and Targets.
- Policy ER 2 – Development of Renewable Energy.
- Policy ER 3 – Security of Supply.
- Policy CC 7 – Local Authority Action Regarding Climate Change.

The Plan also recognises, as a strength, the fact that the County has the potential to be self-sustaining due to the abundance of natural renewable resources. This also presents an opportunity for the growth of the renewable energy sector in the County and to reduce dependency on imported fossil fuels. In this respect, the CDP commits the Council to developing County Galway as a low carbon economy by making provision for renewable energies and reinforcing existing grid infrastructure.

County Galway Wind Energy Strategy

This strategy, in tandem with the CDP, provides strategic direction to encourage renewable energy and, in particular, to guide the siting and designing of wind energy developments. The strategy also aims to promote the economic development of wind energy and other renewables in the County, underpinning the need for energy security, the promotion and establishment of a low carbon economy and the development of green business within the County.

The strategy includes a number of locational strategic wind farm areas;

- Strategic Areas
- Acceptable in Principle
- Open to Consideration
- Not Normally Permissible
- Low Wind Speed

These areas will be re-analysed and appropriately reflected in the Galway LARES.

12. Sectoral & Other Context

Renewable Electricity Support Scheme (RESS)

The RESS has been developed by the government with the primary aim of assisting Ireland in meeting its renewable energy contribution to the EU-wide renewable energy target of 32% by 2030 within a competitive auction based, cost effective framework. The RESS provides financial assistance to the most cost-efficient renewable energy schemes, ensuring value for money.

The first rounds of auction were initiated earlier this year, which saw wind farms and solar farms competing against each other. Of the 2,236-gigawatt hours of energy up for auction, approximately 1,468 hours were secured by wind farms and 767 hours secured by solar farms. This amounts to 479MW for wind and 796MW for solar. [18]A portion of each auction is reserved for community-led projects, ensuring that such projects are appropriately fostered and facilitated. Approximately 7 no. community projects were successful in RESS-1. It remains to be seen how this scheme will incorporate marine renewables as they become more commercially viable.

All Island Generation Capacity Statement 2019-2028

This capacity statement was prepared by EirGrid and SONI, the respective transmission system operators for both the Republic of Ireland and Northern Ireland. Interconnectedness is expected to play a key role in securing Ireland's energy supply in the coming years, and this will be defined by the success of a number a strategic transboundary energy projects such as the North-South interconnector which is proposed to traverse the Ireland and Northern Ireland border.

Although there are no such projects identified in County Galway, renewable energy developments of a regional and local scale will still have a part to play in addressing the identified increasing energy demands across both jurisdictions in this statement. The Capacity Statement projects the following energy demand for Ireland up to 2028 based on a high, medium and low scenario:

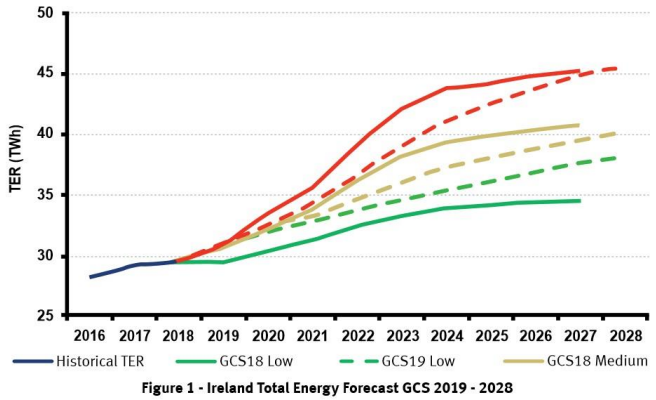


Figure 1: All Island Generation Capacity Statement 2019-2028, Pg.11 (the red line represents the high scenario)

As can be seen, there is a difference of 10TW/h between the high and low scenarios demonstrating the need to generate varying levels of energy. The Capacity Statement identifies the following fuel mix in Ireland, as of 2018:

[18] http://eandemanagement.com/2020/08/green-energy-auction-a-big-step/

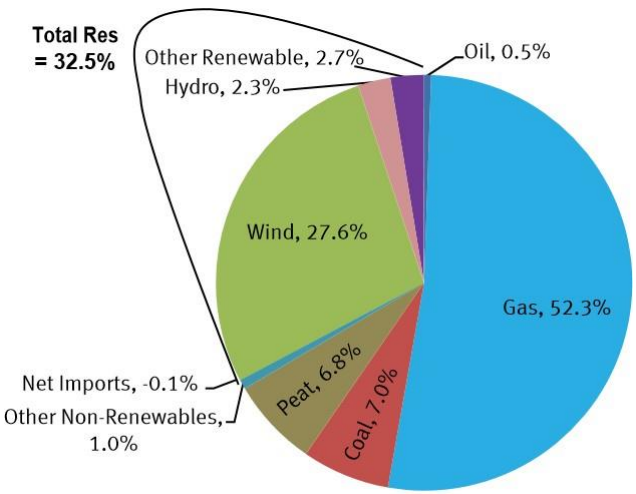


Figure 5 - Fuel mix in Ireland in 2018

Figure 2: All Island Generation Capacity Statement 2019-2028, Pg.14

The total portion of renewable energy in the fuel mix is approximately 32%, which will need to be at least doubled by 2030 in order to reach national renewable energy targets.

Climate Change Advisory Council Annual Review 2019

The Climate Change Advisory Council (CCAC) is independent of government and is charged with reviewing national climate policy, progress on the achievement of the national transition objective and progress towards international targets.

As part of it's annual review the CCAC found, in 2019, that Ireland is not on course to achieve its target to transition to a low carbon economy by 2050, and that a detailed pathway to a low carbon economy needs to be set out. However, it must be noted that the CCAC did not have an opportunity to fully review the newly published Climate Action Plan at the time. Notwithstanding this, the review found that there is a need for additional investment in capacity and technologies in renewable energy in order to reach emissions targets.

Wind Energy Ireland (WEI) – High Level Policy Requests (March 2019)

Considered to be the largest lobbying body for wind energy in the country, WEI often make high level policy requests to government in the interests of wind energy. These policy requests are mainly focussed on supporting onshore wind, offshore wind and community projects. The WEI make a number of recommendations in this respect including:

- Development of a regional approach to wind energy;
- Implementation of the Renewable Electricity Support Scheme (RESS) as soon as possible;
- Greater facilitation of connection to the grid network; and
- Establishment of a body like Local Energy Scotland – possibly under the auspices of the SEAI – to empower and support communities to invest in projects developed by public or private sector companies and to develop renewable energy projects themselves.

Support Scheme for Renewable Heat 2018

This scheme was launched by government in 2018 with the aim of increasing the use of renewable energy in the heat sector by 3%. If successful, a project can be supported by the scheme for up to 15 years, provided the project continues to align with a set of eligibility criteria throughout that timeframe. The scheme is primarily aimed at commercial, industrial, agricultural and other non-domestic heat users to adopt renewable heating systems.

DHPCLG – Interim guidelines for planning authorities on statutory plans, renewable energy and climate change August 2017

These guidelines were issued by the Government in 2017 due to the delay in revising the Wind Energy Guidelines. The guidelines are targeted at Local Planning Authorities reviewing their CDPs or renewable energy strategies. The guidelines highlight the need to have regard to national policy on

renewable energy development and should indicate how the plan or strategy will contribute to national targets for renewable energy.

Tomorrow's Energy Scenarios – Planning our Energy Future (Eirgrid 2017)

This report envisages four different scenarios facing the electricity transmission grid, in which Eirgrid plays a role, looking forward to 2040. The four scenarios are based on expert input and current energy policies and developments. The themes of the scenarios are steady evolution, low carbon living, slow change and consumer action. Each scenario projects different levels of growth and, as such, requires different levels of investment in the grid.

Although the report considers many variables of demand growth, the largest emerging demand growth is identified as large industrial customers such as data centres connecting to the grid. Accounting for over 75% of new demand growth in most scenarios, data centres represent a significant energy intensive use that will need to be carefully considered in the Galway LARES and more broadly in the Galway CDP review.

It is also worth noting that there is a wide variation in renewable generation capacity across the four scenarios due to uncertainties surrounding the build out of renewable generation in the future. Social acceptance of wind energy development is cited as one example of such. However, all scenarios do predict further installed capacity of onshore wind generation; with offshore wind beginning to contribute as and when it becomes more economically feasible.

On the topic of economic feasibility, the report estimates that solar photovoltaic (PV) will become more economically feasible in the short term and will contribute to renewable generation based on how the technology develops. The report also highlights the potential for biomass generation over the next 25 years and for ocean energy generation in the long term.

The National Landscape Strategy for Ireland 2015-2025

This is a high-level policy framework that aims to achieve balance between the protection, management and planning of the landscape by way of supporting actions. It is proposed to produce a National Landscape Character Assessment and a National Landscape Map for Ireland, which will inform, and be informed by, lower tier landscape character assessments, which should in turn be used in planning policy formulation and decision making. The principle objective is to ensure consistency in the categorisation of Landscape types and associated policies across county boundaries.

Offshore Renewable Energy Development Plan 'A Framework for the Sustainable Development of Ireland's Offshore Renewable Energy Resource' (February 2014)

The Offshore Renewable Energy Development Plan (OREDP) was formulated in 2014 to create a vision and high-level goals to help harness the offshore renewable energy of Ireland. In particular, the plan recognises and commits to investigating wave energy potential in Galway which has since been taken forward by the Marine Institute and SEAI in the form of the SmartBay project in Galway Bay.

The prevalence of onshore wind developments and their large contribution to Ireland's renewable energy targets as of 2014 is recognised. Indeed, it was generally considered at the time of the making of the plan that significant development of the onshore wind industry would allow Ireland to reach it's renewable electricity targets by 2020, and as such, government incentives and support schemes such as the Renewable Energy Feed In Tariff (REFIT 2) were focussed on onshore wind. In this respect the plan highlights the need to reinforce the transmission grid network in order to allow for larger amounts of both onshore and offshore renewable energy generation going forward. In particular, the plan notes an EirGrid study from 2011 which recommends that the offshore grid is developed incrementally in a way that would be symbiotic with the onshore grid.

The plan also notes the need to ensure that Ireland develops a supply chain and an export market for renewable energy with our neighbours. However, given that this is a pre-Brexit document the ramifications of the UK leaving the EU have not been considered.

Notwithstanding this, an interim review of the OREDP published in 2018 shows that good progression is being made with offshore renewable energy development and that recent developments such as Brexit aren't expected to hamper further progression.

Draft Bioenergy Plan October 2014

The Draft Bioenergy Plan establishes the broader context for the development of Ireland's bioenergy sector. The Plan sets out the policy areas that must be coordinated to support the development of the biomass sector in Ireland. It identifies 19 measures to support the sustainable development of the sector. It also recognises that meeting the demand for biomass from indigenous sources could deliver significant economic and employment benefits and contains measures to stimulate and support the supply of Irish biomass.

The Plan identifies that an additional bioenergy-focussed measure in the heat sector represents the most cost-effective means of meeting a number of different policy goals and recommends the introduction of an incentive for renewable heat for larger heat users to change to heating solutions that produce heat from renewable sources.

The Plan recommends the continuation of the REFIT schemes and the Biofuels Obligation Scheme, both of which provide a route to market for biomass. The Plan identifies that an additional bioenergy-focussed measure in the heat sector represents the most cost-effective means of meeting a number of different policy goals and recommends, subject to further approvals, the introduction of a support for larger heat users to change to heating solutions that produce heat from renewable sources which will further increase the demand for biomass. This is being realised through the government Support Scheme for Renewable Heat.

SEAI Methodology for Local Authority Renewable Energy Strategies (2013)

In 2013 the SEAI produced a methodology for Local Authority Renewable Energy Strategies (LARES). The objective of this was to establish a structured, consistent and transparent approach to preparing a LARES and to provide information and support for its production. The methodology includes a step-by-step approach to LARES production involving policy review, resource assessment, analysis of constraints and facilitators and finally developing a renewable energy policy. The use of GIS is recommended in the "sieve mapping" stage of resource assessment. Emphasis is also placed on cumulative and transboundary issues.

White Paper on Energy Policy: Delivering a Sustainable Energy Future for Ireland – The Energy Policy Framework 2007-2020

This White Paper was published in 2007 setting out the government's approach to achieving ambitious renewable energy targets and national climate change targets by 2020. The White Paper is informed by public consultation on the government's Green Paper on Energy Policy which preceded this document, and by plans and strategies in place at the time such as the National Development Plan 2007-2013. This White Paper has been superseded by the White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030', which addresses updated renewable energy and climate change targets emerging from the latest EU legislation and international agreements over an extended time period.

13. Submissions Received

6 submissions were received by the Council in response to the dissemination of a briefing note and accompanying letter relating to the preparation of a draft Local Authority Renewable Energy Strategy (LARES) for County Galway. The consultation period ran from 25th May until 24th June 2020. The Council sought submissions from pre-identified stakeholders, Elected Members and prescribed bodies.

The breakdown of the submissions received was as follows:

- Údarás na Gaeltachta (Prescribed Body).
- Eirgrid (Prescribed Body).
- Port of Galway (Stand-alone Economic Entity).
- Irish Wind Energy Association (Representative Body).
- Comharchumann Fuinneamh Oileáin Árann Teoranta (Community Group).
- Coillte (Semi-state Commercial Organisation).

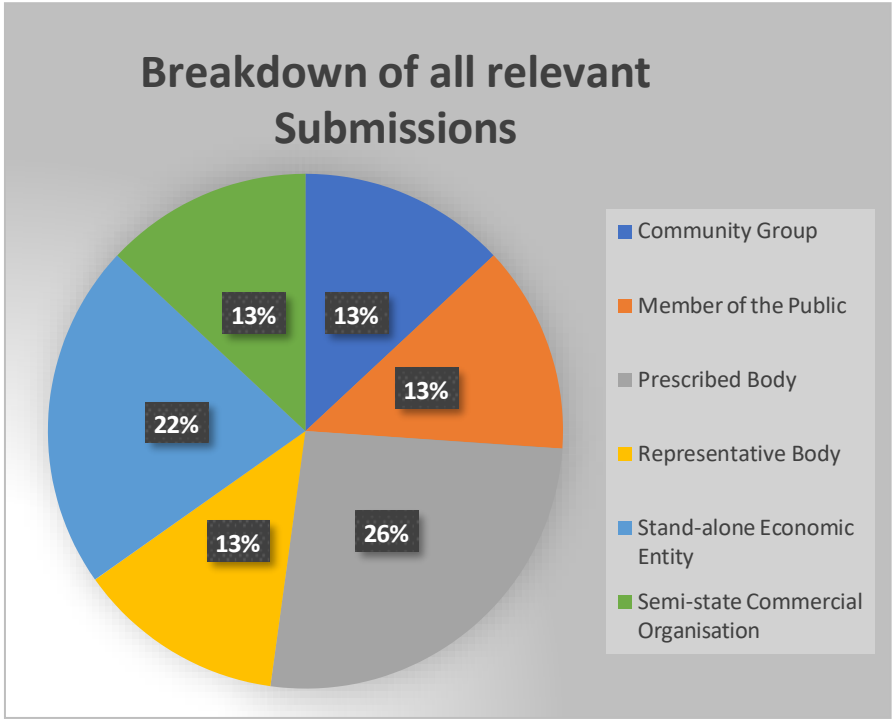


Figure 3: Breakdown of all relevant submissions. A summary of all relevant submissions considered can be found in Appendix B of this LARES

Although the number of submissions received was lower than expected, the range of submissions covers a variety of different bodies and organisations, providing a broad initial indication of the expectations of the wider renewable energy industry in relation to the development of renewable energy across the County of Galway.

In addition to the non-statutory LARES submissions received, a number of submissions relating to the CDP Review were also considered where they addressed renewable energy issues. When considered in combination with the submissions from the non-statutory LARES consultation, prescribed bodies and stand-alone economic entities are shown to be most responsive accounting for approximately 50% of all submissions (see Figure 3). This demonstrates both the economic potential and importance of renewable energy.

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

PART 2

RENEWABLE ENERGY STRATEGY FACTORS AND METHODS

Part 2: RENEWABLE ENERGY STRATEGY FACTORS AND METHODS

1. Introduction

Roadmap

As previously highlighted, County Galway possesses a diverse range of renewable energy potential that can be harnessed over the coming years to drive the transition to a low carbon economy. However, constraints do exist and must be appropriately addressed before realising this potential.

An important factor in realising County Galway's renewable energy potential will be transboundary cooperation and coordination with adjoining counties. County Galway shares energy infrastructure with adjoining counties, and it will be important for the Council to work with them to ensure that this infrastructure is maintained and improved where necessary. There is potential for co-location of renewable energy developments along the County border, which could be considered for regional scale development. This will assist in justifying radical transmission grid improvements in the wider region.

Notwithstanding the wider regional infrastructural advantages in County Galway, there are some local infrastructural advantages that could be utilised and promoted to greater extent in order to fulfil its renewable energy potential. County Galway has access to significant supporting infrastructure such as a comprehensive gas transmission network and an Atlantic port which could facilitate and hasten County Galway's transition to a low carbon economy by increasing and supporting greater renewable energy generation.

2. Current Capacity

2.1. Wind

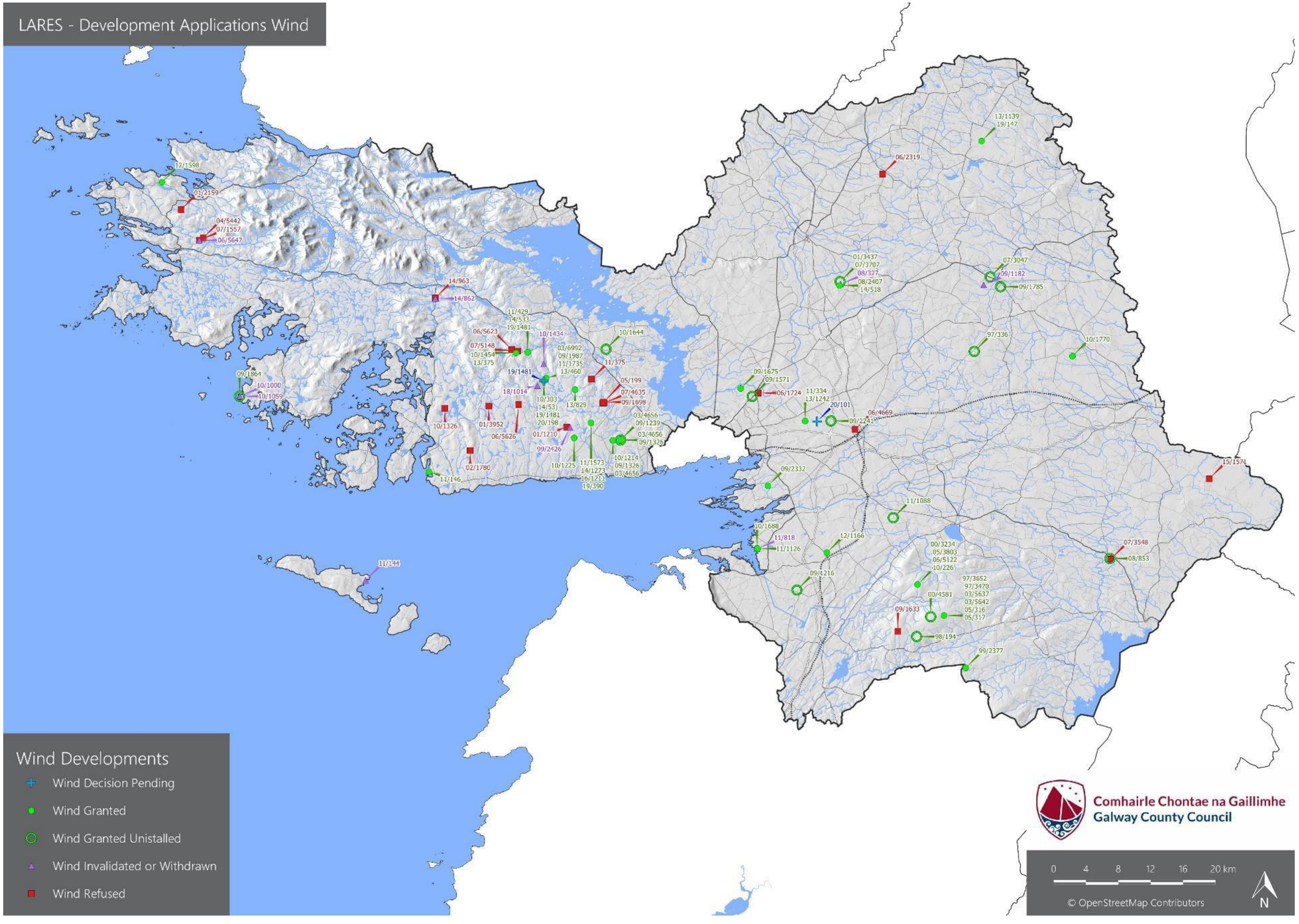
As of the end of 2019, in relation to wind energy alone, Galway has a commissioned capacity of 438 megawatts. This equates to approximately 11% of Ireland's overall wind energy capacity which is currently 4,100 megawatts[19] supplied by 250 onshore wind farms, containing over 2,500 turbines. In comparison, the landmass of County Galway equates to approximately 8% of the national landmass, and when constraints are considered the approximate amount of developable landmass is much less. It is noteworthy that the largest onshore wind farm in Ireland (Galway Wind Park) is in the County, and it is generally recognised that Galway possesses above average wind energy potential both onshore and offshore.

The SEAI/Marine Institute Wave Atlas indicates that the west coast of Ireland has considerable resources in relation to tidal and wave energy, and the LARES will consider how land-based infrastructure can facilitate the harnessing of this energy in County Galway in accordance with national marine renewable policy.

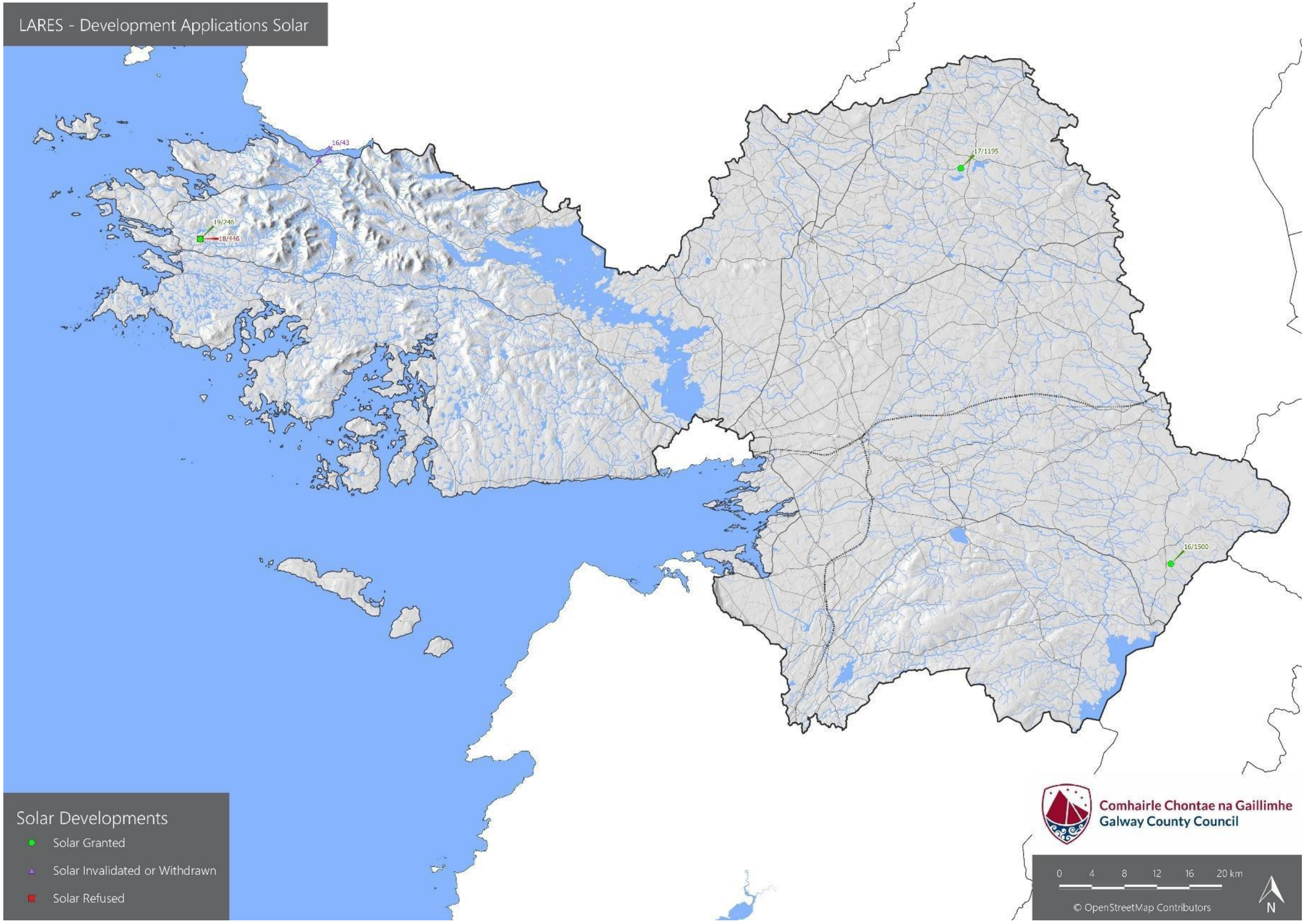
2.2. Solar

To date, a number of solar farms have been permitted in Galway, but none are operational. Although, two solar farms located in County Galway have been successful in the September 2020 RESS 1 auction, one of which is the permitted Ballycrissane Solar Farm with a capacity of 4MW (see Map 3). It is expected that further solar farm developments will proceed and be constructed within the County in the future, as the cost of technology decreases and return for energy improves with support schemes.

[19] WEI submission to non-statutory LARES consultation June 2020



Map 2: Wind Developments within County Galway



Map 3: Solar Developments within County Galway

3. Renewable Energy Development Analysis

3.1. Wind

Analysis of permitted and commissioned commercial scale wind energy developments across County Galway shows that there is an approximate commissioned capacity of 322.65 MW, with a further 124MW of permitted un- commissioned capacity at the time of writing. This demonstrates that there is a combined potential wind energy MW capacity of 446.65 MW from permitted wind energy development across County Galway.

Commissioned (Green) and Permitted (White) Wind Farms in Co. Galway as of December 2020

	Development Description	Planning Reference	MW Capacity
1	Derrybrien Windfarm	97/3652, 97/3470, 98/194, 99/2377, 00/4581, 03/5637, 03/5642, 05/316, 05/317	59.5 MW
2	Sonnagh Windfarm	00/3234, 05/3803, 06/5122, 10/226	7.65
3	Cloonlusk Windfarm	01/3437, 07/3707, 08/327, 08/2407, 14/518	6
4	Galway Wind Park	03/6992, 09/1987, 10/1454, 10/303, 11/429, 11/1735, 13/375, 13/460, 14/533, 19/1481, 20/198	172 MW
5	Inverin Windfarm	96/1684	3.3 MW
6	Lettergunnet Windfarm	03/4656, 09/1326, 10/1214	23
7	Ardderroo Windfarm	SID -ABP – 303086 -18	91
8	Knockranny/Cnoc Raithní Windfarm	13/829	33
9	Knockalough Windfarm	11/1573, 14/1273, 16/1211, 19/390	33
10	Shannagurraun Windfarm	10/1225	18.2
Total: 570MW			

3.2. Solar

Analysis of permitted solar farm development across County Galway shows that there is an approximate permitted capacity of 36.2MW, none of which is commissioned at the time of writing. It is noted that the Ballycrissane Solar Farm was successful in RESS-1, and it is expected that this solar farm will be commissioned with a capacity of 4MW in the near future.

	Development Description	Planning Reference	MW Capacity
1	Ballycrissane Solar Farm	16/1500	5
2	Glenamaddy Solar Farm	17/1195	4.2
3	Clifden Solar Farm	19/246	4
4	Cloonascragh Solar Farm	19/1315	23

Map 1 details all of the renewable energy applications analysed and it represents all submitted renewable energy development applications in County Galway at the time of writing. This map correlates with Appendix C which includes a more detailed analysis of renewable energy development applications.

4. Key Successes and Failures

The success of renewable energy projects in County Galway, as in many other parts of the country, is defined by the renewable energy resources and infrastructure available to them, and the ability of the planning system to facilitate changes in technology over time, to allow for more efficient renewable energy developments.

When permitted and refused renewable energy developments are considered overall over the past 25 years, County Galway achieves a permission rate of 63% with the remaining 37% being refused for various reasons. When the same renewable energy developments are analysed over a period of the last 10 years, County Galway achieves a higher permission rate of 73.5%. This demonstrates a greater acceptance of renewable energy developments in County Galway in recent times, despite there being more renewable energy development applications made in the last 10 years than in the preceding 15 years.

The merits of having a plan led strategy to guide the location and provision of renewable energy projects is evident when the key success and failure factors are examined. A plan led strategy provides greater certainty and clarity to developers and the public. It affords opportunities for public consultation, which engenders a greater sense of ownership of the final adopted strategy. An assessment of the reason for success or failure of renewable energy projects was carried out and reveals the following:

Successful renewable energy projects are generally characterised by:

- Compliance with Development Plan policy and strategies;
- Compliance with regional and national guidelines;
- Engagement in pre planning;
- Early consultation with prescribed bodies;
- Continuous and meaningful community consultation;
- No adverse environmental, traffic, or visual impact;
- Implementation of proposed mitigation measures;
- Broad community support;
- Ease of access to grid;
- Geographical proximity to suppliers/ or end users;
- Protection of residential amenity.

Unsuccessful renewable energy projects may be characterised by:

- Non compliance with Development Plan policy and strategies;
- Non compliance with regional and national guidelines;
- Inadequate or no engagement in pre planning;
- Inadequate or no consultation with prescribed bodies;
- Lack of community consultation;
- Adverse environmental, traffic, or visual impact;
- Non compliance with Habitats Directive;
- Non Implementation of proposed mitigation measures;
- Delay or lack of access to grid;
- Renewable resource remote from potential customers or suppliers;
- Excessive transport costs;
- Inadequate feed in tariffs- economically non-viable;
- Adverse impact on residential amenity

5. Renewable Energy Potential

5.1. Introduction

A number of critical factors - natural, legal and human are important determinants of the general suitability of an area for renewable energy development. More specific attributes for each type of renewable are considered separately under technologies and methodology – Section 9, Part 1. The factors include:

Natural and Cultural Factors

- Landscape Sensitivity
- Ecological and Natural Heritage Designations
- Landslide Susceptibility
- Architectural & Archaeological Heritage & Tourism

Human Factors

- Settlement Patterns & Population Densities
- Network and Grid Connection
- Supporting Infrastructure

Administrative, Legal and Planning Factors

- Renewable Energy in Adjoining Counties
- Planning Case Law
- Cumulative Impacts
- Interactions between LARES and SEA

Each of these is examined in the following sections to provide a context and background for the role of each factor in developing an overall renewable energy strategy.

5.2. Landscape Sensitivity

The Landscape Character Assessment (LCA) for County Galway identifies 4 categories of sensitivity within the county;

1. **Iconic**: Unique landscape with high sensitivity to change
2. **Special**: High sensitivity to change
3. **High**: Elevated sensitivity to change
4. **Low**: Unlikely to be adversely affected by change

Areas of Iconic and Special sensitivity (see page 3, Appendix E) are deemed to be of particular value within County Galway, and have been identified as landscapes that may have elevated constraints when it comes to RE developments.

Renewable Energy developments are generally sited and designed sympathetically to reduce any potential impact on the visual amenity of the surrounding area. During a LCA of a county, sensitivity ratings are assigned to the county's landscapes. A landscapes sensitivity can be described as "A landscape's capacity to absorb new development, without exhibiting a significant alteration of character or change of appearance." As such, landscape sensitivity categories can be used as an indicator to validate deployment zones within a county or maybe influence the final deployment zones. Landscape sensitivities of landscapes bordering counties need also be taken into account to ensure consistency of decision making on county bounds.

Table 2: Areas with "Vulnerable" LCA Sensitivity Ratings

Landscape Unit	Unit Description	Sensitivity Category
Oileáin Árann	Highly distinctive, culturally, historically iconic. Long-settled, man-made landscape with little enclosure, expansive views to and from islands.	**Iconic**
Inisbofin	Long-settled, unenclosed. Extensive rock exposure.	**Special**
Inner Galway Bay	A long-established occupied narrow coastal complex consisting of deep sea-inlets and many smaller islands. Local enclosure afforded by scrub vegetation. The coastal landscape of Inner Galway Bay [Unit 1b] are formed by limestone which gives rise to different features, appearance and character.	**Special**
Cois Fharraige	A long-established, densely occupied, narrow coastal plain - with little shore-line variability. Local enclosure afforded by scrub vegetation.	**Special**
Conamara Sea Lough	Tidal marine water bodies, almost completely enclosed by land. Dominated by exposed rock, low vegetation and high levels of exposure.	**Special**
Soft Shore Coastal	Units where sand, dunes, shingle or glacial till is the dominant shore-forming material resulting in a shallow shore - often featuring a wetland transition zone. Can be prone to occasional flooding and erosion.	**Special**
Hard Shore Coastal	Units where exposed rock is the dominant shore-forming material. Not readily prone to erosion and can feature steep shores and occasional cliffs.	**Special**
Conamara Coastal Islands	Numerous, mostly unoccupied, small islands consisting of a mixture of exposed rock and scrub vegetation.	**Special**
West Conamara	Highly distinctive. A low-lying area between the start of the expanse of the Conamara Bogs and the Sea Lough Complex that contains pockets of development and settlement.	**Special**
Maumturk Mountains	Highly distinctive and iconic, valued for amenity and activity. Unenclosed, unoccupied, elevated, visually prominent peaks.	**Iconic**
Joyce Country	Long-settled, working landscape, topographically enclosed, scenically and historically distinctive.	**Special**
Upper Corrib Environs	Many round-backed, mostly wooded islands throughout lake. Majority of shore is tree-fringed. The hinterlands are a mix of small farms, woodland and bog.	**Iconic**
Lower Corrib Environs	Very complex patterns of shore and water - many islands, shallows, reedbeds and highly indented shores. Extensive wetland areas separate lake from settled hinterlands.	**Special**
Lough Derg Environs	Highly indented shore, usually edged with wetlands and scrub woodland. Large bogs adjoin in places. Natural processes dominate the landscape	**Special**
Slieve Aughty Landscape	Largely un-occupied and un-enclosed. Mosaic of large forestry plantations and residual blanket bog areas. Large windfarms are visually dominant in places.	**Special**
Shannon Environs Landscape	Natural, seasonal processes dominate the landscape. Contains large areas of bog, wetlands and callows. Also supports large parklands and regular fields.	**Special**

5.3. Ecological & Natural Heritage Designations

County Galway is partly characterised by sparsely populated and often uninhabited natural areas such as the Slieve Aughty mountain range and the wider Conamara region. It is in these areas and the unique island terrain of Oileáin Arann and Inisbofin that most ecological and natural heritage designations are located, reflecting the environmental value of these areas (see pages 4-6, Appendix E).

European sites are European designations which include Special Areas of Conservation (SAC) and Special Protection Areas (SPA). These sites and the nationally designated and proposed Natural Heritage Areas (NHA, pNHA) were identified as key policy considerations. Pages 4-6 in Appendix E indicates the distribution of these environmental designated sites in County Galway.

SACs are designed to protect, conserve and, where possible and necessary, to enable the restoration of certain habitats and/or species. SPAs are designated to protect rare or endangered birds and their habitats. Any development in, or near these areas, must be subject to Ireland's obligations under the Habitats Directive (92/43/EEC), the EU (Birds) Directive (2009/147/EC) and the Environmental Impact Assessment Directive (2011/92/EU) as amended by 2014/52/EU).

NHAs are a national designation introduced by the Wildlife (Amendment) Act 2000 to protect natural heritage of national importance. pNHAs were published on a non-statutory basis in 1995, while some have since been statutorily proposed or designated, this is not yet the case for all of them. These sites are of significance to wildlife and habitats. In practice, development proposals within NHAs are typically refused or given consent with specific conditions.

While these designations do not automatically preclude renewable energy development, any development in these areas is subject to the policies and obligations that pertain to these designations. The construction and operation of renewable energy projects can impact the quality and integrity of these ecologically designated areas, as such, so it is vitally important to

consider from the outset any environmental impacts such a proposal may have.

5.4. Water Framework Directive

The EU Council Directive 2000/60/EC (Water Framework Directive) sets out a comprehensive framework for the management of water resources in the European Community. The main principle of the Water Framework Directive (WFD) was to achieve 'good' water status in all waters by 2015 including rivers, lakes, estuaries, coastal waters and groundwater. The WFD expected this to be achieved through the implementation of River Basin Management Plans (RBMP). The 1st Cycle of RBMPs in Ireland ran from 2009-2014. In this cycle, waterbodies that did not achieve the 'good' water status were identified and improvement measures were outlined in order to meet the objectives of the WFD. The 2nd and current cycle of RBMPs covers the period 2018-2021. This cycle sets out actions to improve water quality and achieve 'good' ecological status in Irish water bodies by 2027.

The current cycle consists of one RBMP for the whole country and this is implemented by the Environmental Protection Agency (EPA) who monitor the water status of our water bodies. The current RBMP identifies significant pressures for 'at risk' water bodies. Amongst the identified significant pressures are agriculture, hydromorphology and forestry, all of which can be linked to renewable energy developments depending on the type of renewable energy. The three significant pressures account for three of the four most significant pressures on 'at risk' water bodies. As there are some identified 'at risk' water bodies in County Galway, these significant pressures will need to be considered when choosing the type of renewable energy source for a development.

5.5. Landslide Susceptibility

Landslide susceptibility will be assessed on a case by case scenario in accordance with best practice development control standards.

5.6. Architectural & Archaeological Heritage & Tourism

County Galway is home to many tourist attractions ranging from historical buildings such as Kylemore Abbey as well as natural phenomena such as Dún Aengus and Connemara National Park or cultural areas such as Gaeltacht Conamara. Some of these attractions are captured within the internationally renowned tourism initiative – the Wild Atlantic Way. Supported by Fáilte Ireland and the National Tourism Development Authority, the Wild Atlantic Way covers approximately 2,500 kilometres of coastline, 689 kilometres of which includes parts of the Galway coastline. The unique selling point of this initiative, as with most tourist attractions in County Galway, is the beautiful natural scenery and breath-taking views. The location of renewable developments away from tourist attractions will therefore be imperative to limit any visual impacts. Notwithstanding this, recent wind farm developments such as Galway Wind Park have included walking trails within the site as a community benefit initiative (see Appendix D). Indeed, research shows that there is a tourism interest in both onshore and offshore wind farms which suggests that renewable energy developments can also have a positive impact on tourism[20]. The public discourse, however, appears to remain divided on the visual impact of wind farms. The tourism chapter of the County Galway CDP will list tourism attractions and assets, for further clarity.

Visual impacts on protected structures will need to be limited based on the relative significance of the structure. Impacts must particularly be limited if

20 https://failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf

the protected structure is located within an architectural conservation area, which demonstrates the architectural importance of the wider area as well as the structure itself.

Archaeological heritage such as sites and monuments are protected under the Planning & Development Act, and must be appropriately considered before undertaking any construction works. All known archaeological monuments are recorded on the Record of Monuments and Places (RMPs), which is a national record. The RMP must be consulted in order to ensure if an assessment and/or mitigation measures are required.

5.7. Settlement Pattern & Population Densities

A large part of the population of County Galway resides on the outskirts of Galway City and the main town centres of County Galway (see Map 4). Notwithstanding this, County Galway still retains a predominantly dispersed rural settlement pattern. Population centres of elevated local density in the Conamara region are generally confined to coastal areas due to challenging terrain inland.

Results from the most recent Central Statistics Office (CSO) census, when compared to the preceding census, indicate population growth in areas including and surrounding Maigh Cuilinn, Tuam, Athenry, Kinvara, Kilcolgan and Gort. It is notable that population growth has occurred in the areas surrounding the M17 and M18 traversing centrally through the County from north to south (see Figure 4). This highlights the importance of transport infrastructure in facilitating population growth as it allows for reduced commuting times. However, the necessity of working from home through the recent Covid-19 pandemic may dramatically alter living and settlement patterns going forward, which could result in wider population growth and the renewal of areas experiencing population decline.

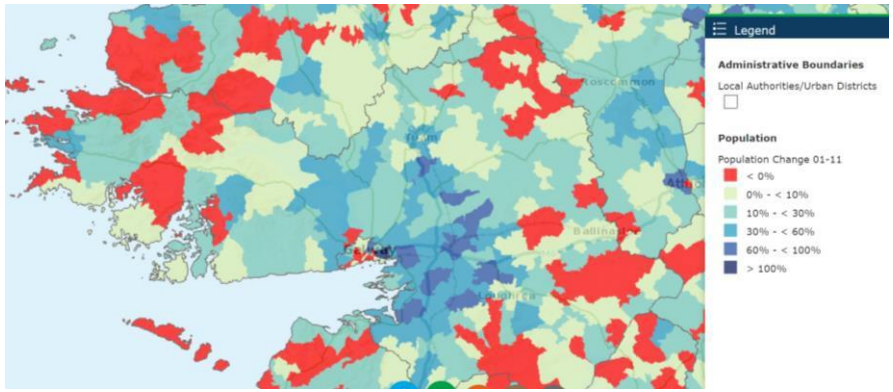


Figure 4: Atlas of Ireland, AIRO (All-Island Research Observatory)

5.8. Network & Grid Connection

Eirgrid is the Transmission System Operator (TSO) for Ireland and, as such, is responsible for the operation, maintenance and development of the transmission network across Ireland. ESB Networks are the main Distribution System Operators (DSO) for Ireland and, as such, are responsible for the construction of the grid infrastructure that supports the transmission network. Both EirGrid and ESB Networks are licensed by the Commission for Regulation of Utilities (CRU).

Where a renewable energy project seeks to connect to the transmission network, an agreement must be entered into with Eirgrid under terms approved by the CRU.

Eirgrid published a Transmission Development Plan (TDP) for the development of the Irish transmission network and interconnection over a ten-year period. The current TDP covers the period 2018-2027 and includes projects that are needed for the operation of the transmission network and future potential projects that could help to drive future needs.

It is worth noting that the TDP notes that many projects relating to this expansion will be located in mainly rural areas where the transmission network is less developed.

In the TDP, County Galway lies within the West Planning Area which is considered to be within the wider Border, Midlands and West Planning Area. Within the wider planning area, the energy generation exceeds the demand, demonstrating the energy exchange potential of this area and County Galway as part of this area.

Due to limited high capacity 400 kv infrastructure in the southern part of the wider planning area, it is recognised that development and reinforcement of this network is mainly required to connect a high level of renewable generation. Added to this, within the West Planning Area the Conamara region is identified as an area of new generation driving network development.

Projects relating to the redevelopment and refurbishment of 110kv infrastructure are identified in Galway in the TDP, in line with the NWRSES. Renewable energy generation is recognised as a driver for these projects.

The TDP identifies several new projects as being required in Galway between 2020 and 2032 – as shown in Figure 5.

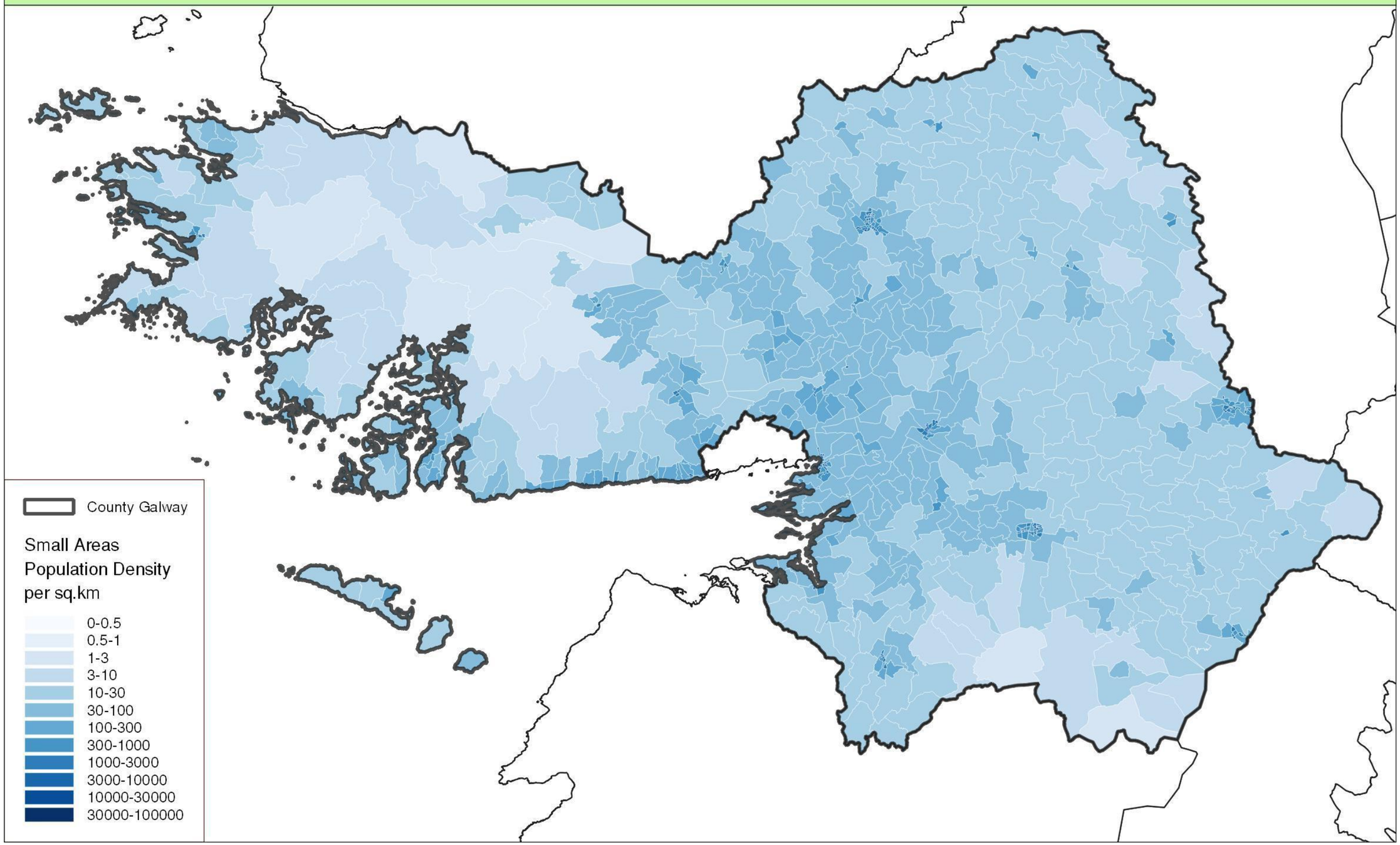
It is recognised that increased uptake of renewables is likely to increase demand for both the quantum and urgency of delivery of these transmission projects and associated upgrades of related supporting transmission infrastructure, such as substations. These pressures are likely to be significant in the northern and western parts of the county.

Much of this infrastructure is likely to be classified as Strategic Infrastructure Development which will mean that development management will be a matter for an Bord Pleanála. Galway County Council will ensure that during scoping and determination all requests for comment and/or advice will be provided as expeditiously as possible.

TABLE 1 PROJECTS IN NORTHERN AND WESTERN REGION	
PROJECT NAME	LOCATION
North Connacht Project	Roscommon, Sligo, Mayo
Regional Solution Project (series compensation on 400 kV network)	Galway
North South 400 kV Interconnector	Meath, Cavan, Monaghan, Armagh, Tyrone
Bellacorick – Castlebar 110 kV Line update	Mayo
North West Project (study area)	Donegal, Leitrim, Sligo
Bellacorick – Moy 110 kV Line update	Mayo
Cashla – Salthill 110 kV Line update	Galway
Galway 110 kV Station Redevelopment	Galway

Figure 5: Transmission Infrastructure Projects identified in the Northern & Western Regional Spatial & Economic Strategy 2020-2032 (Table 1, Pg. 218)

Solar Opportunity - Population Density (2016 Census)



Map 4: Population Density of County Galway

5.9. Supporting Infrastructure

Good quality supporting infrastructure is integral to the proper functioning of renewable energy developments as it provides access for repair and maintenance purposes, for example. Different kinds of renewable energy developments require different kinds of supporting infrastructure. This section examines existing and proposed supporting infrastructure where it is beneficial to renewable energy development.

County Galway's renewable energy supporting infrastructure network consists of roads, electricity, gas, water supply and ports which are influenced by Galway City's strategic economic importance as a key driver of growth in the Northern and Western Region. Key to unlocking growth in County Galway will be the N6 Galway City Ring Road scheme. The scheme, along with the successfully delivered M17/M18 road projects and the Western Rail Corridor, will enable the Galway Metropolitan Area (including areas surrounding Galway City) to continue to be a key driver for effective regional development. Improved road infrastructure such as this will add to the existing road network including the M6 Galway to Dublin motorway, and the M17 Gort to Tuam motorway. As the biomass industry and associated technologies of CHP are highly dependent on good road networks between points of supply and demand, an improved road network will help to attract greater investment in biomass energy generation.

The National Grid is a nationwide electricity transmission network that consists of both overhead and underground high voltage power cables. When electricity is generated at power plants it is transformed to higher voltage levels and fed into the national grid. The electricity is then passed through transformer stations where the voltage is reduced for onward, local distribution. As seen in Map 5, the electricity transmission network in County Galway is mainly characterised by 110 kv infrastructure with a 220 kv transmission line dissecting the County from north to south intersected by a 220 kv substation in Cashla.

It must also be recognised that natural gas, particularly renewable and indigenous gas, will continue to have a role to play in the transition to a low carbon economy. As such, renewable energy developments may require support from such sources in times of high energy demand. Indeed, there are aspects of bioenergy developments that generate renewable gas such as biogas which needs to be appropriately dispersed in the transmission network. Therefore, the gas network plays a key role as part of the supporting infrastructure for renewable energy developments.

The Gas Transmission Network in Ireland is operated by Gas Networks Ireland who, similarly to Eirgird, are required to publish a Network Development Plan (NDP) indicating how the network will be developed over a ten-year period. The current NDP covers the period 2018-2027 and assesses the future demand and supply position of the network. The NDP identifies existing gas pipeline connections serving Galway City, Craughwell, Tuam, Gort, Tynagh, Loughrea, Ballinasloe and Headford (see Map 5). This demonstrates that there is an established gas transmission network in County Galway capable of supporting renewable energy development across various parts of the County.

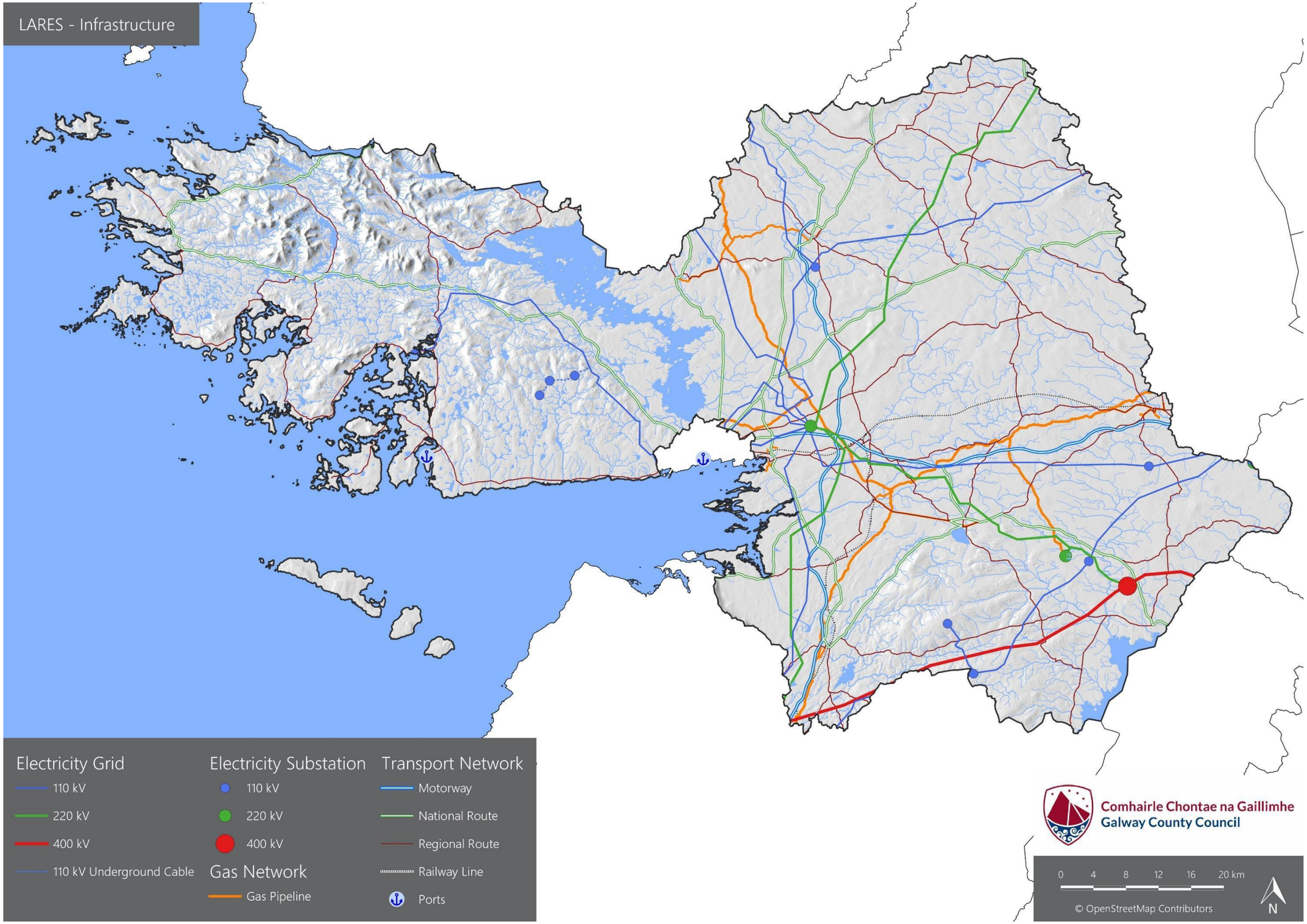
Some renewable energy developments are particularly impacted by water supply such as hydropower. As hydropower relies on a continuous source of water supply to function, a reliable water supply system must be used. In the case of commercial hydropower developments usually a river course or a lake is used as water supply. Due to the ecological importance of lakes and rivers, any environmental effects will undoubtedly need to be assessed. This will be facilitated through the Strategic Environmental Assessment (SEA), Environmental Impact Assessment Report (EIAR) and Appropriate Assessment (AA) processes, where relevant. County Galway is characterised by many large natural reserves of water such as Lough Corrib, Lough Derg and Lough Inagh.

The Port of Galway City is recognised as a port of regional significance that helps to service the County Galway area. This port is complimented by Ros an Mhíl port located in County Galway which functions as both a fishing port and a shipping port. It is the aim of the County Development Plan (CDP) to further develop Ros an Mhíl port as a deep-sea port to allow for the berthing of larger ships. It is also the aim of the CDP to improve interconnectivity between Ros an Mhíl and the Port of Galway City. Port infrastructure will be vital in supporting the marine renewable sector. As this sector evolves, supporting land-based infrastructure such as ports will play a key role in linking marine renewable energy developments to the National Grid.

5.10. Renewable Energy in Adjoining Counties

There are a number of counties bordering County Galway, four of which have Renewable Energy Strategies in place, namely Counties Clare, Roscommon, Tipperary and Mayo. The other neighbouring county of Offaly has renewable energy policies within its Development Plans, and also has a Wind Energy Strategy in place. Galway City Council, which is encircled by Galway County Council, sets out it's renewable energy policy position in the Galway City Council Development Plan 2017-2023.

Notwithstanding this, due to the recent publishing of a National Planning Framework and Regional Spatial and Economic Strategies, a large amount of Local Planning Authorities across Ireland are undertaking a review of their Development Plans. To date, Offaly County Council, Roscommon County Council, Clare County Council, Tipperary County Council, Mayo County Council and Galway City Council have commenced reviews or variations of their respective Development Plans.



Map 5: Energy Infrastructure within County Galway

Mapping Consistency with adjoining Counties

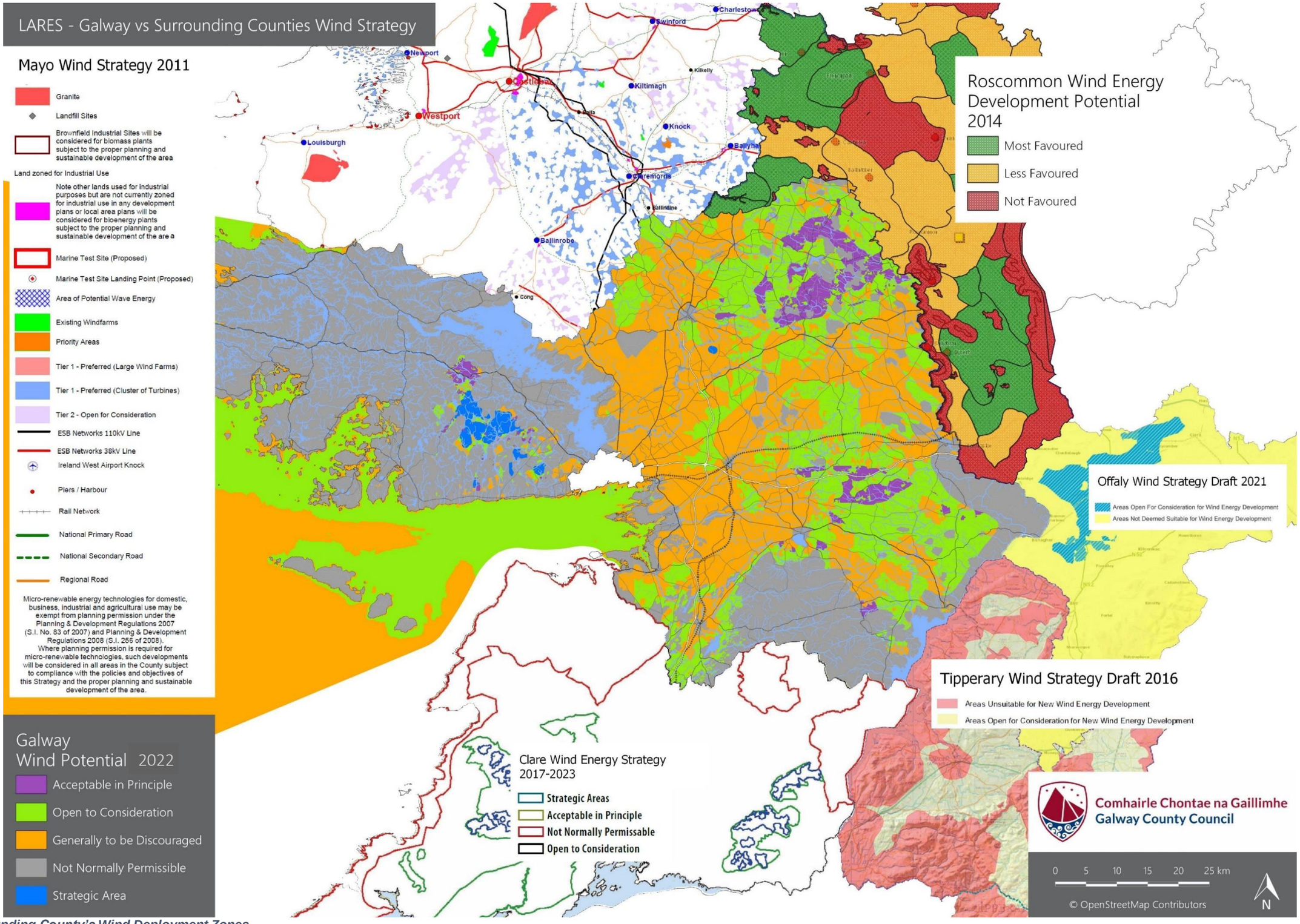
This LARES has evaluated the consistency of renewable energy mapping between adjoining counties and those proposed for County Galway based on the policies in place at the time of writing (see pages 61-65, Appendix F). The analysis has determined a very high degree of consistency across county bounds. Such policy variations as do occur are generally due to the availability of Galway County Council's more detailed Landscape Character Assessment.

From analysis of the renewable energy and wind energy strategies of adjoining counties (see Map 6), it is evident that the following areas along the County boundary are considered to be unsuitable for renewable energy development due to the following varying constraining factors: Page 64 in Appendix E highlights contrasts with areas along the eastern boundary of the County border shared with Roscommon. The LARES has identified areas of both solar and wind potential along this boundary, and development in this area will need to take account of this.

Furthermore, in parallel with the assessment of opportunities and challenges within County Galway, an analysis was also undertaken of renewable energy developments in adjoining counties submitted within the last 10 years and within a 20km buffer of the County boundary (see Map 7 and Map 8).

Table 3: Areas Unsuitable for Renewable Energy Development Adjoining County Galway

County	Area Name	Reason for Sensitivity	Contrast with Galway LARES Areas
Offaly	River Shannon	Environmental Designations and Landscape Sensitivities	-
Clare	Slieve Carran Region	Environmental Designations	-
Clare	Lough Derg	Environmental Designations	-
Clare	Slieve Aughty Region	Environmental Designations	-
Mayo	Conamara Region	Environmental Designations	-
Roscommon	Eastern Boundary Area	Environmental Designations on the Roscommon side of the border	Areas 'Open for Consideration' for solar energy and wind energy are identified along the Eastern Boundary Area.
Tipperary	River Shannon & Lough Derg	Environmental Designations and Landscape Sensitivities	-



Map 6: Surrounding County's Wind Deployment Zones

5.11. Infrastructure Continuity with adjoining Counties

This section highlights infrastructure that supports renewable energy that is located close to the boundaries of adjoining counties. It identifies these as opportunities for a number renewable energy synergies with County Galway. These are summarised below and are identified in mapping and further description in Appendix E & G.

Clare

The County Clare Renewable Energy Strategy 2017-2023 highlights significant supporting infrastructure that traverses the border with Galway such as the M18 motorway, a gas pipeline, a rail line and various transmission powerlines (see page 66, Appendix E). This creates the potential for County Galway to coordinate the use of supporting infrastructure with County Clare.

Tipperary

The Tipperary Renewable Energy Strategy 2016 indicates the presence of a Local Authority Boiler and two anaerobic digesters along the border with Galway to the south east. There are also a number of areas identified as preferred areas for wind energy generation close to the border with Galway on account of a 220kv transmission line running parallel to the Galway border (see page 67, Appendix E). This presents the opportunity for a number of different renewable energy synergies with County Tipperary.

Mayo

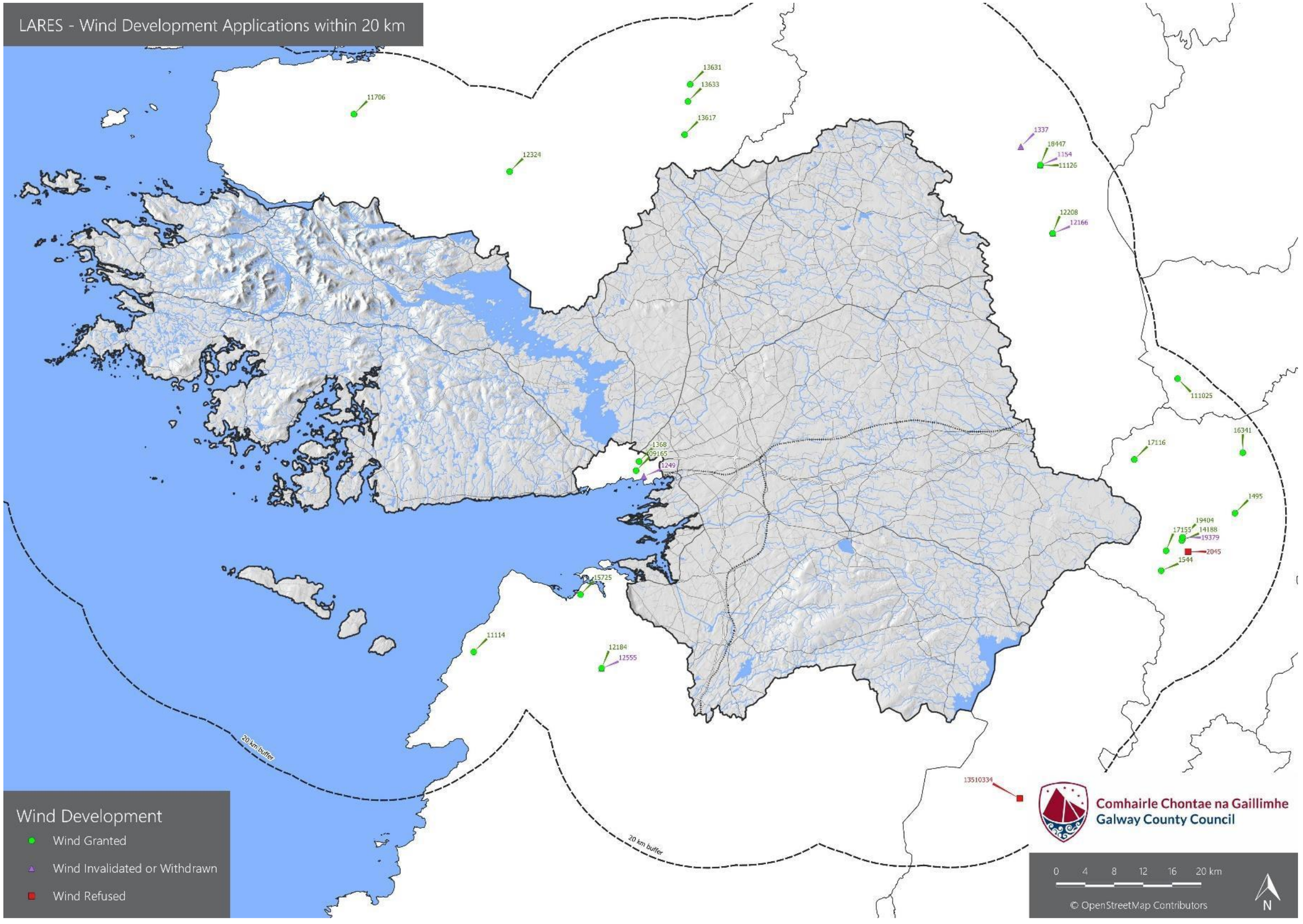
The County Mayo Renewable Energy Strategy 2011-2020 highlights a number of preferred areas and areas open for consideration for wind energy development along the border with Galway. The strategy also identifies supporting infrastructure such as regional roads, a rail line and electricity transmission lines the majority of which traverse the border with Galway in low-lying areas (see page 68, Appendix E). Similar to County Clare, there is a potential to coordinate the use of supporting infrastructure with County Mayo and to co-locate wind energy developments along the border, if considered suitable in Galway.

Offaly

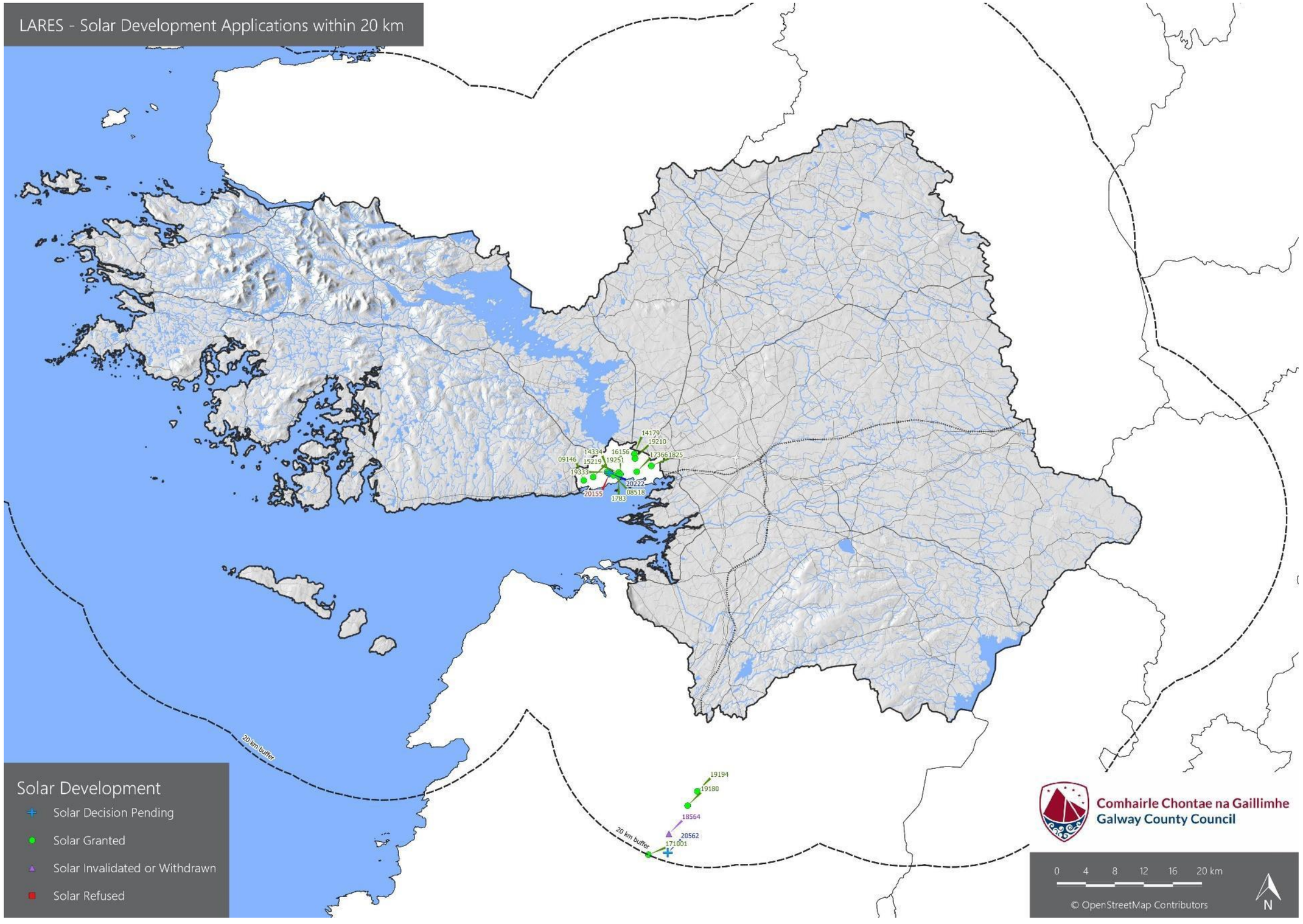
Analysis of the Offaly Wind Energy Strategy 2014-2020 shows that the area bordering County Galway is not considered suitable for wind energy development. However, the supporting transmission infrastructure for the former Shannonbridge power station may offer opportunities for a number renewable energy synergies with County Offaly.

Roscommon

The Roscommon Renewable Energy Strategy 2014-2020 identifies a tract of land that borders the north east of the County as most favoured for wind energy development. This could potentially provide the opportunity for cross-border development of wind energy in this area. Furthermore, the existence of 2 no. transmission lines traversing the border with County Galway between Glenamaddy and Ballygar, one of which directly serves the Cloon 110kv substation outside Tuam creates further opportunity for a synergistic relationship with County Roscommon



Map 7: Wind Energy applications within 20km of County Galway



Map 8: Solar Energy applications within 20km of County Galway

Development Management Consistency with Adjoining Counties

Analysis of wind energy developments within a 20km buffer of the County Boundary identified applications made in each county, including Galway City, within the last 10 years (see Map 7). The most applications were identified in County Offaly which is the sole adjoining county with a Wind Energy Strategy in place, as opposed to a Renewable Energy Strategy. It is noted that there are 2 no. refused applications located in Tipperary and Offaly respectively. The refused application in Offaly was refused on the basis that it was not located in an area identified as suitable for wind energy development in the Council's Wind Energy Strategy. The refused application in Tipperary was refused by the Council on the basis of visual impact and proximity to residential development.

5.12. Planning Case Law

Considering that wind energy is the most prevalent and often the most contentious type of renewable energy development in Ireland, the majority of existing planning case law relates to wind energy.

A ruling that can be applied to most renewable energy developments is the ruling in the case of Kelly vs An Bord Pleanála in April 2019. This ruling made it clear that failure to consider the negative environmental impact of a wind farm project could result in a successful challenge to the planning permission, as two planning permissions were overturned in this case. The Appropriate Assessment was deemed to have failed to adequately demonstrate that the project would not adversely effect the integrity of a protected Natura 2000 site, therefore requiring the judge to overturn the permitted applications.

Another relevant judgement made by the High Court in the case of O'Grianna & Ors v An Bord Pleanála in December 2014 demonstrated the need to assess the cumulative impact of a grid connection as part of the Environmental Impact Assessment (EIA) for a wind farm project. As the EIA for this project was not undertaken on this basis, the permission was overturned.

The O'Grianna & Ors ruling also had a significant effect on a ruling in the case of Daly vs Kilronan Windfarm & Ors in May 2017 relating to underground grid connection works. The ruling in this case prevented the developers (Kilronan Windfarm) from undertaking grid connection works as exempted development based on the O'Grianna ruling which required an EIA to be undertaken for works that are considered to be part of the cumulative impact of the windfarm. As a result of the O'Grianna ruling, the judge in this case found that the works are not considered to be exempted development and must have the benefit of planning permission including an EIA, as the grid connection works are considered to be part of the whole project. Planning regulations have since been updated to account for this.

Planning case law in relation to renewable energies other than wind energy is relatively limited due to the relative lack of legal cases taken against such developments to date. However, two cases and rulings of note relating to solar energy, which are inherently interlinked, are the rulings of Mr. Justice McDonald in the case of Sweetman v. An Bord Pleanála & Ors (2020) and Mr. Justice O'Moore in the case of Kavanagh v. An Bord Pleanála & Ors (2020). Both rulings relate to the misinterpretation by the respective Local Planning Authorities and An Bord Pleanála, who both granted the solar farm developments in question, of the Planning Regulations and the determination that solar farms do not fall within the classes of projects in either Part 1 or Part 2 of Schedule 5 to the Planning and Development Regulations 2001, as amended. The rulings do not determine that an Environmental Impact Assessment will never be required for solar developments based on the Planning Regulations as written at the time of the ruling, they refer to the possibility for such developments to fall within the scope of any of the project classes listed in Annex I or Annex II of the EIA Directive and consequently, Part 1 or Part 2 of Schedule 5 to the Planning and Development Regulations 2001.

In summary, renewable energy developments should be cognisant of potential environmental impacts, including cumulative impacts of any infrastructure associated with the development, and permission for grid connections should be sought where environmental impacts are likely. Interpretation of the Planning Regulations with regard to the requirement for

an Environmental Impact Assessment should also be closely scrutinised in light the legal rulings highlighted above.

5.13. Cumulative Impact

With respect to wind farms, Scottish Natural Heritage (SNH) has produced a guidance document specifically on assessing the cumulative effect of wind farms[21]. It advocates that cumulative effects should be considered both at development control and at strategic planning level. It also recommends that such consideration should not be constrained by administrative boundaries and should cover the whole of a region, straddling more than one planning authority if necessary. Cumulative effects are also considered in Ireland's Wind Energy Development Guidelines 2006 and the 2019 Draft Revised Wind Energy Development Guidelines. Both the SNH document and the version of the Wind Energy Guidelines in place at the time should be considered and complied with, as relevant, as wind energy developments are being progressed.

The SEA provides an assessment of cumulative effects that will need to be undertaken in a more comprehensive manner at individual project-level. Examples of cumulative effects that could arise from implementing the provisions of the Plan relating to the Strategy and renewable energy include:

- Contributions towards reductions in greenhouse gas and other emissions to air and associated achievement of legally binding targets (in combination with plans and programmes from all sectors, including energy, transport and land use planning) as a result of facilitating renewable energy development;
- Contributions towards reductions in consumption from non-renewables and associated achievement of legally binding renewable energy targets, including sectoral targets for electricity (in combination with plans and programmes from all sectors, including energy, transport and land use planning) as a result of facilitating renewable energy development;
- Contributions towards energy security (in combination with plans and programmes from all sectors, including energy, transport and land use planning) as a result of facilitating renewable energy development;
- Potential adverse effects on all environmental components arising from the construction of multiple renewable energy developments, for example:
    - Potential cumulative visual impacts – both within and outside of the County - arising from multiple renewable energy developments.
    - Potential cumulative effects upon bird species arising from multiple wind energy developments.
    - Potential cumulative effects upon ecology and surface and ground water status as a result of pollution arising from multiple renewable energy developments.
- In combination with plans and programmes from all sectors potential adverse effects on all environmental components arising from all development in greenfield and brownfield areas. These plans and programmes from other sectors undergo SEA and AA and comply with environmental legislation while projects are subject to EIA and AA, as relevant.

[21] https://www.nature.scot/sites/default/files/2019-11/Guidance%20-%20Assessing%20the%20cumulative%20impact%20of%20onshore%20wind%20energy%20developments.pdf

5.14. Interaction between the LARES and the Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment (SEA) is being undertaken in relation to the wider Galway County Development Plan Review. Environmental considerations have been integrated into the Plan, including this Strategy, as well as associated renewable energy provisions that have been integrated into the Plan and other Plan provisions relating to environmental protection and management. Environmental considerations have been used in the identification of areas for renewable energy development, helping to avoid or mitigate impacts on sensitive areas.

6. Renewable Energy Potential Contribution

6.1. Introduction

This section examines the main topics and sectors as they relate to County Galway. It provides an overview of each major types of renewable that is relevant to the statutory jurisdiction of Galway County Council. Where relevant, it provides an estimate of the potential contributions that each of the major energy types will be able to contribute.

This section is principally concerned with terrestrial generation of the types that are subject to the planning provisions of the County Development Plan.

Because the County's legal jurisdiction ends at the High Water Mark, ocean energy is largely excluded - except insofar as terrestrial provisions for services and electrical tie-ins are required for wave, tidal and offshore wind energy projects.

Similarly, discussion of matters relating to building standards, industrial processes and transport management are limited to descriptions of their general potential contribution because they are subject to separate and more specific legislation, oversight and planning by separate authorities.

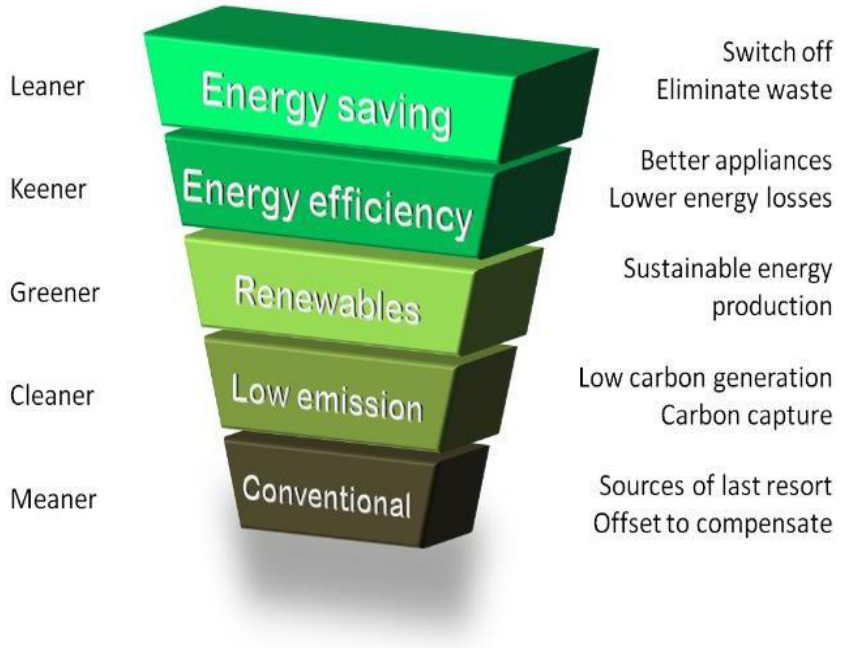


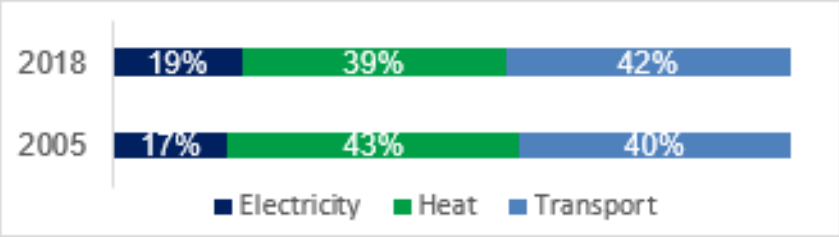
Figure 6: The Energy Hierarchy places savings and efficiency above renewables

6.2. Energy Management

Development planning and management are largely concerned with projects and land-uses for energy generation, transmission, and storage. While these make significant contributions, they must take place within the context of a well-managed holistic energy environment. It is stressed that Energy Management Strategies make the most significant of all contributions to achieving energy targets. Energy conservation measures are estimated to produce a 30-60% return on investment. Such measures include:

- Energy Savings - involves the reduction of energy consumption, by reducing consumption and demand. This is achieved by approaches such as insulation and demand management. It is ranked as the highest priority in the Energy Hierarchy.
- Energy Efficiency and Loss avoidance - by the use of more efficiently designed and operated settlements, buildings and appliances.
- Energy Recovery - by the integration of technology and management systems to recover 'waste' energy from processes and by-products.

Figure 1: Final energy by mode (2005 vs 2018)



Source: SEAI Energy in Ireland

6.3. Energy Conservation and Transport

Description

The avoidance of energy use makes the largest and most effective contribution to reaching energy targets. Most of the instruments and strategies that manage energy use lie outside the remit of a local authority – except for patterns of transport which is one of the largest growing energy uses in Ireland, which is heavily influenced by CDP zoning. Land-use zoning can make significant contribution to the reduction of transport energy demands by providing good adjacency between uses - such as residence, schools, employment and shops.

Requirements

Land-use planning plays a central role in the control and potential reduction of energy use due to transport. Trip demand arises from the separation of functions that require journeys between a point of origin [say a home] and a destination [say a shop]. Land-use planning can make significant contribution to the reduction of transport energy demands by providing good adjacency between uses - such as residence, schools, employment and shops.

Estimation of Capacity

Energy management has the capacity to equal, if not exceed, the contribution of renewable energy projects at significantly lower capital and current costs. It requires an equivalent emphasis and assignment of priorities and resources.

Recommended Strategy

County Development Plan Policy Objectives need to provide for;

- The significant potential that exists to reduce energy demand arising from transportation patterns resulting from land-use planning.
- Local Area Plans to facilitate the reduction of short journey demand - especially by cars - between homes, schools, shops, services and places of employment.
- Compact growth, in line with the National Planning Framework, which focusses energy intensive activities in close proximity to each other and to energy supplies.

6.4. Wind Energy

Description

Wind Energy Projects consist of three types

1. Individual turbines - for landowner use
2. Terrestrial Windfarms - for medium and large-scale commercial generation
3. Off-shore Windfarms - for medium and large-scale commercial generation

For the purpose of developing strategies for Galway County Council - only Terrestrial Windfarms are considered here due to the lack of jurisdiction over offshore windfarm development and the likelihood of individual wind turbines falling within the exempted development provisions.

Requirements
The requirements for identifying the factors required for a viable and environmentally compliant windfarm are well-understood. These factors have been exhaustively mapped and analysed to identify areas of potential for Wind Energy Development - as shown in Appendix E.

- Landscape
- Electricity Grid
- Wind Speed
- Roads
- Coastal Potential
- Population
- Corine Landuse
- Slope
- Flooding
- Landslides
- Protected Areas
- Residential Areas

Estimation of Capacity by 2030
Installed wind capacity in Galway is currently 446MW, with a further 124MW of permitted but uncommissioned capacity. The analysis in Part 3 identifies that there is capacity to develop significantly more wind energy from terrestrial sources by 2030. Estimation for future capacity potential for this sector is the result of a complex mixture of dynamic and interacting factors that include:

- Technology developments - longer blades, bigger, more efficient turbines;
- Repowering of existing permitted windfarms;
- Renewal or extension of permission for existing windfarms - or the loss of existing capacity due to renewal refusals;
- Availability of grid access; and
- Land Power Purchase Agreements.

Mapping of Capacity
Areas for future deployment of Wind Energy Projects are mapped in Part 3.

Recommended Strategy
Policy Objectives for the development of Wind Energy are set out in Part 3 of this report.

6.5. Solar Energy

Description

There are two principle types of solar energy extraction:

1. Large scale photovoltaic installations (exceeding 50 square metres).
2. Small-scale energy and photovoltaic panels - these are described in the section 6.8 on ‘Other Renewable Energy Types’ see following -

Improving technology and falling costs have resulted in the rapid emergence of large arrays of photovoltaic cells - usually referred to as ‘solar farms’ These can vary in size with commercial viability beginning at around 3ha.

These consist of PX cells mounted on low [less than 3m] structures on lands that are free from shade.

Installations should be generally south facing, with an angle of 15-55 degrees.

Requirements

The requirements for identifying the factors required for a viable and environmentally compliant solar farm require consideration of the following factors;

- Landscape
- Electricity Grid
- Wind Speed
- Roads
- Population
- Brownfield Lands
- Corine Landuse
- Slope
- Aspect
- Protected Areas
- Residential Area

Estimation of Capacity by 2030

Currently there is no installed solar capacity in Galway, though there is 36MW of permitted capacity - but none have yet been built. Rates of planning applications in other counties suggest that it would be prudent to expect significantly more applications in County Galway in the near future.

Mapping of Capacity

Areas for future deployment of Solar Energy Projects are mapped in Part 3. However, there are no function solar farms in the county which hinders making a quantitative estimate of prediction of future capacity. For this reason, the strategy limits its estimate of potential future capacity to a qualitative estimate of a 'High' - thus a ten-fold increase of output from this type of energy should be provided for.

Recommended Strategy

Policies Objectives for the development of Solar Energy are set out in Part 3 of this report.

6.6. Bio-energy and Bio-mass

Description

Sources include, biomass, bio-liquids, and biofuels. Fuels principally consist of vegetation and organic waste and their by-products. Sources include agriculture, forestry as well as biodegradable faction of industrial and municipal waste.

Forestry sources consist of roundwood, harvest residues as well as sawmill residues and by-product from wood processing.

Agricultural sources include short rotation coppice willow, miscanthus and other energy grasses such as reed canary grass.

These fuels are used as heat sources in thermal boilers or power plants - either directly or following processing, such as conversion to woodchips or pellets.

This type of energy has application at all scales from domestic heating through meeting heating and occasionally power needs of larger development such as hotels, industries and institutions,

Combined Heat and Power [CHP] are a variant of this technology that combine power generation - often from biofuels - with the recovery of waste heat for local distribution.

Restructuring of agriculture - especially on marginal lands - is leading to an intensification of interest in the conversion of lands from stock-rearing to the cultivation of 'energy crops'. These range from more conventional forestry operations to newer types of short-rotation wood crops, such as willow. On more fertile soils energy crops can include herbaceous and grass species.

Requirements

Crop rotation and selection generally lies outside of the remit of the planning system. Larger forestry-like projects and some types of access roads will require permission and impact assessment.

Larger thermal stations and associated storage areas will require planning permission and assessment. Smaller domestic, industrial and institutional installations will either be conversions of existing equipment or will be an integral part of new developments. Neither are likely to require planning permission. These are classified as 'footloose' development types with such generalised location requirements as to defying any meaningful attempt at predictive mapping.

Estimation of Capacity by 2030

Existing capacity is very difficult to identify on account of the number of small installations as well as the uneven and incomplete reporting on existing larger installations. Best estimates are that there may be as much as 10MW of existing Bio-energy capacity in Galway.

Bio-energy is unlike wind and solar which have a narrower and readily defined set of location factors that restrict the extent and viability of deployment areas. It is not feasible to try to predict the location, extent or likely sources of fuel, the location of generation and the end utilization locations of this form of energy.

More critically, it is not possible to estimate whether, when or how much land could be converted to this type of use.

For this reason, the strategy limits its estimate of potential future capacity to a qualitative estimate of a 'Moderate' - thus a trebling of output from this type of energy could produce up to an additional 30MW of capacity.

Recommended Strategy

Bio-Energy and Bio-Mass should be supported by policy and should be open for consideration in all areas - subject to compliance with all other statutory requirements.

6.7. Hydro Energy

Micro	1 kW to 100 kW
Mini	100 kW to 1 MW
Small	1 MW to 10–30 MW
Large	Above 10–30 MW

Types of Hydro Schemes - Source World Bank

Description

Hydro-power refers to the use of moving water to generate electricity from a turbine. Hydro projects are generally classified into 4 types; These, in turn, can be classified as different types of projects

1. Run-of-the river' Schemes - usually a micro, mini or small project, located on the river - usually with a weir or headrace with a relatively low head.
2. Impoundment Schemes - usually large project that combines significant elevation difference with the storage of large volumes of water gathered from an extensive catchment
3. Energy Storage Schemes - these are similar to Impoundment Schemes - except without the need to gather water from a large catchment. Instead, electricity generated during off-peak hours - usually by renewable or nuclear energy - is pumped to an elevation to be stored and released for generation at periods of peak demand

4. Restoration Schemes - usually involve the repurposing of sites for older water-power projects - such as grain mills - that are restored with modern technology to generate electrical energy

Requirements

Feasibility for Hydro-power is principally determined by a combination of elevational difference ['head'] combined with volume.

For minimum viability, the lowest head [say 2m] requires an average flow rate of least $2m^3/s$ which would typically require a river of around 7m in width and 1m depth at centre. On sites with a much greater head - say 25m+ a smaller river - say 3m in width and 0.5 m in depth could be viable

Estimation of Capacity

The Geological Survey Ireland (GSI) have prepared an estimation of the potential Hydro Capacity that shows County Galway has an unconstrained Potential Annual Energy capacity of 9674 MWh. However, almost all of these sites lie within areas that are excluded on account of both ecological and landscape designations.

For this reason, the strategy limits its estimate of potential future capacity to a qualitative estimate of a 'Negligible' - except for a small number of Restoration Schemes.

For the purpose of estimating future contribution to renewable energy it is assumed that the future capacity will be negligible, though nothing should impede attempts to develop such schemes, providing that they comply with relevant requirements of the Habitats and Water Framework Directives.

Recommended Strategy

Rehabilitation or renewal of existing hydro-power installations should be supported by policy and should be open for consideration in all areas - subject to compliance with all other statutory requirements.

6.8. Other Renewable Energy Types

Introduction

A range of other types of alternative and renewable technologies exist that offer opportunities to reduce dependence on fossil fuels. Most of these are smaller in scale and require little, if any, supporting infrastructure. Most are parts of existing buildings, developments or established land-uses and require little, if any, additional support from planning policy or development management. In many instances, these may be installed as alterations to existing schemes and premises.

Collectively, these technologies, though individually small, have the potential to make significant overall contributions to reducing energy use and emissions.

Strategic Considerations

No specific mapping is required for these technologies. Policy measures to ensure recognition and facilitation during development management is the main strategic contribution.

For comprehensiveness, each of these types of technology are described below to identify the most likely location, application and potential contribution.

Overview of micro-energy technologies

These are technologies that are used on or adjacent to buildings and developments that use natural resources to generate electricity or heat.

These technologies include;

- Heat pumps - ground and air source;
- Solar thermal collectors;
- Wood burning stoves and micro-scale biomass heating;
- Micro Generation Technologies

• Solar photovoltaic panels (PV);

• Small free-standing wind turbines; and

• Hydroelectric schemes.

Heating technologies

- *Heat pumps - ground and air source*

These are increasingly being used for heating homes and small businesses. Heat-pumps are electrical devices which convert energy from the air outside of your home into useful heat, in the same way a fridge extracts heat from its inside. In well insulated houses they are very economical to run. They are an extremely efficient alternative to oil, gas, solid fuel and electric home heating systems.

Different types of heat pump systems draw heat from different sources: air, water or the ground. Heat generated is released via radiators, underfloor heating or warm air. All heat pump systems, excluding those providing warm air to the home, can supply all of the hot water needed for baths, showers and sinks.

Heat pump system types include;

- *Air source*

The most common heat pump systems extract heat from external air, typically using an outside unit. These heat pump systems do not require underground piping to source heat and so can be cheaper and easier to install compared to ground source heat pump systems. The most popular heat pumps are air to water heat pumps.

- *Ground source*

A ground-source heat pump system uses the earth as a source of renewable heat. Heat is removed from the ground through collector pipework and then transferred to the heat pump. The ground collector can be laid out horizontally at a shallow depth below the surface or else vertically to a greater depth.

- *Water source*

Water source heat pump systems use open water, such as lakes, rivers or streams, as a heat source. Heat is removed from the water through collector pipework and then transferred to the heat pump.

Solar thermal collectors

There are a range of technologies which transform the energy from the sun into hot water. In Ireland, the most common technologies are solar thermal collectors, or solar hot water collectors. These devices capture solar energy and transfer it to heat water.

The amount of water supplied by solar thermal collectors depends on the system size and building hot water demand. Typical well-installed systems provide up to 60% of hot water demand over 12 months. Solar thermal collectors can also meet some portion of space heating demand, although typically this is very small. There are two general types of solar thermal collectors.

Flat Plate Collectors

These collectors have a heavy, rigid, and robust, box-like structure. This means you can position them both in-roof and on-roof. They are typically lower in capital cost than evacuated tube collectors, but the hot water produced will generally be at a lower temperature.

Evacuated Tube Collectors

Evacuated tube collectors have a lightweight structure. This usually consists of individual tubes mounted on a frame. Their structure means you can only position them on-roof. Compared to flat plate collectors they:

- Will provide approximately 20% more hot water per m^2 of aperture (surface) area.
- Demonstrate higher efficiencies in low radiation, so typically perform better in cloudy conditions.

- Typically have a higher capital cost.

A total collector area below 12m^2 or 50% of the home's total roof area is generally exempt from planning.

Wood burning stoves and micro-scale biomass heating.

Modern room heating stoves are highly efficient when compared to a traditional open fire as they provide three times the heat and use only a quarter of the fuel, combined Heat and power.

Sustainably produced biomass is a low-carbon fuel, a range of biomass fuels can be used that include;

- Wood - the most commonly used biomass fuel - is supplied either as logs, chips (or shredded wood) or pellets.
- Straw.
- Poultry litter or other animal bedding.
- Energy crops [usually only in larger-scale installations].

Micro Generation Technologies

• Solar photovoltaic panels (PV);

Solar photovoltaic panel systems convert solar radiation into electricity that can be used for lighting, heating and running electrical appliances.

Typical energy yields are;

1 sq. m of silicon solar 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 sq. m (~3kW) and well located would generate around 2,600kWh of electricity a year - over 40% of the average annual electricity demand of an Irish home.

The cost of this technology is falling rapidly and the efficiency is increasing. PV systems are used on a variety of very small-scale applications - including attachments to vehicles, equipment and lights.

A total collector area below 12m^2 or 50% of the home's total roof area is generally exempt from planning.

It is understood that it is the government's intention to put in place a Microgeneration Support Scheme and that this may be accompanied by changes to relevant planning permission exemptions.

Estimation of Capacity by 2030

Existing capacity is very difficult to identify on account of the number of small installations as well as the uneven and incomplete reporting on existing larger installations.

Micro-energy technologies unlike wind and solar which have a narrower and readily defined set of location factors that restrict the extent and viability of deployment areas. It is not feasible to try to predict the location, extent or likely types of generation and the end utilization locations of these forms of energy.

For this reason, the strategy limits its estimate of potential future capacity to a qualitative estimate of a 'Moderate'. This matter can be monitored as part of normal Development Plan Review mechanisms.

Recommended Strategy

Micro-energy technologies should be supported by policy and should be open for consideration in all areas - subject to compliance with all other statutory requirements. Development management will take account of evolving legislation and relevant guidelines in this matter, in order to ensure that planning matters do not inadvertently give rise to delays or obstacles to the implementation of this policy once it is adopted.

It will be important for policies to facilitate and recognise both new community-led micro-renewable energy developments as well as the retrofitting existing developments as effective contributors to the generation of renewable energy in County Galway in accordance with the LARES and the proper planning and sustainable development of the area.

PART 3

COUNTY GALWAY RENEWABLE ENERGY STRATEGY

Part 3: COUNTY GALWAY RENEWABLE ENERGY STRATEGY

1. Introduction

This section draws together the relevant high-level policies objectives as well as data and factors about renewable energy technology. These factors are then combined with planning and environmental data from County Galway to identify the areas of potential for large-scale renewable energy deployment. The methods and assumptions used for making these decisions are described - to facilitate full understanding of the rationale for these determinations. This exercise methodically balances the needs of sustainable development - which protects environmental assets and residential amenity - with the county's patterns of existing renewable energy development and the existing supporting infrastructure. The result is a series of maps that indicate deployment zones where there is potential for future large-scale wind and solar projects that will be technically viable, environmentally sustainable and respectful of social and community amenity.

2. Exiting Capacity

Previous analysis, in Part 2, described approximately 446MW of commissioned wind energy capacity, with a further 124MW of permitted uncommissioned capacity at the time of writing. This demonstrates that there is a combined potential wind energy MW capacity of 570MW from permitted wind energy development across County Galway.

Previous analysis, in Part 2, also identified approximately 36.2MW of uncommissioned solar energy, with an expected 4MW of solar energy capacity to be commissioned in the near future.

In addition, there are a variety of other smaller renewable energy sites that include bio-mass, small scale hydro and many small individual residential and business solar and heat pump installations.

3. Methodology for determination of Future Capacity

The Council has the benefit of an existing Wind Energy Strategy dating back to 2011 which provides a baseline indication of the intricacies involved with renewable energy development in County Galway. Since 2011, a standardised methodology for Local Authority Renewable Energy Strategies (LARES) has been published by the Sustainable Energy Authority of Ireland (SEAI) to facilitate a consistent approach to the development of LARES across the country. Both the standardised methodology and the existing Wind Energy Strategy have been used to inform both the structure and content of this LARES, along with new information and data that has been gathered as part of this LARES exercise. This LARES has been developed using a step-by-step process based on the SEAI LARES Methodology detailed below.

4. Opportunities and Challenges

The challenges, constraints and opportunities of renewable energy differ depending on the renewable energy type. To identify the constraints and opportunities of renewable energy, a comprehensive mapping process was undertaken using the following methodology:

The Draft Revised Wind Energy Development Guidelines December 2019, as recommended by the SEAI Methodology, ['The Guidelines' hereafter] recommend the adoption of an *"ordered approach involves a sieve mapping analysis of the key environmental, landscape and technical criteria which must be balanced in order to identify the most suitable location for wind energy development. In carrying out this exercise, it is advised to consult with neighbouring planning authorities to ensure a consistent approach across county boundaries"*

This section describes how these recommendations have been applied and how the methods have been used to ensure transparency about how mapping was prepared for each type of Renewable Energy. The methods follow the procedure recommended by the Guidelines and adapts these for other types of Renewable Energy to ensure a consistency of approach.

The Guidelines recommend a four-step approach;

1. Assess the areas of wind potential
2. Prepare or utilise an evaluation of the landscape and its sensitivity for wind energy developments
3. Prepare an overlay of the wind energy mapping and the landscape evaluation and sensitivity analysis,
4. Integrate the areas identified in the above steps with information regarding accessibility to electricity transmission and distribution grids

Table 4: Step-by-Step Methodology used to identify Deployment Areas and potential Renewable Energy Yield

SEAI Guidelines Actions	Wind Energy Guidelines Action	GCC LARES Step	Considerations used in GCC LARES
Preliminary Phase Define requirement for LARES. AA and SEA Screening.	AA and SEA considerations are integrated as part of an interpretive process throughout the planning and preparation of LARES	0	Environmental and Ecological considerations are included by mapping of both factors and the intrinsic conditions that give rise to them
Step 1 Review of Renewable Energy Policy in light of understanding Renewable Energy Policy drivers and to gain an understanding of current policy for inclusion in Renewable Energy Strategy.	Identify Relevant Factors	1	Guidelines, submissions, experience and precedent used to identify relevant factors
	Map Factors	2	All factors have been mapped on a common base map using best available data from authoritative sources
	Classify and map individual factors by priority	3	Each factor has been assessed and categorized into opportunities for and sensitivities to each type of RE
Step 2 Assessment of Renewable Energy Resource in light of gaining a greater understanding of available resources within a Planning Authority area and constraints and success factors for utilising such resources.			
Step 3 Analysis of constraints and facilitators, and definition of Galway County area Renewable Energy Resource	Combine all factors to identify opportunities and sensitivities	4	'Sieve Mapping' used to combine weighted factors to identify 'hot spots' of maximum opportunity or concentrations of sensitivities
	Map Areas of Potential	5	Potential mapped as Areas of Opportunity minus areas of sensitivity
	Check against precedent	6	Results checked against existing policies, developments, planning decisions in Galway and in adjoining counties
	Prepare Deployment Map	7	Deployment Maps prepared to indicate a scale of likely acceptability
Step 4 Development of Renewable Energy Policy by providing the following: -Definition of Renewable Energy Policies -Definition of Planning Authority Aims and 'Expectation' of proposed projects. -Definition of Status of Renewable Energy within the		8	LARES Policy and Objectives prepared and coordinated with mapping LARES provides basis for drafting relevant objectives in GCC CDP

Planning Authority area. -Mapping Definition of Planning Authority area Renewable Energy Objectives.			

In this strategy wind energy and landscape evaluation have been mapped along with other critical viability factors such as proximity to electrical grid, road access and other relevant environmental factors, such as ecological designations, elevation, land cover and population density. All of this mapping is contained in Appendix E and the methods for combining and assessing these factors is set out in Appendix F.

The following section describes how these methods have been incorporated along with a wide range of other relevant considerations, to ensure that the mapping of Deployment Areas is:

- As accurate as possible
- Consistent with previous mapping - wherever practicable
- Consistent with planning decisions - wherever practicable
- Consistent with adjoining counties - wherever practicable

5. Mapping of Renewable Energy Factors

The following general description explains why and how each of the mapped factors were used. [More detail on each is provided in Appendix F]

Landscape: Galway County Council have also prepared an updated Landscape Character Assessment that was prepared having regard to the Guidelines by incorporating many of the factors recommended, in particular it includes a mapping of Landscape Sensitivity that identifies, maps and classifies the capacity of each part of the landscape to accommodate change. The mapping of Landscape Character Areas, Units and associated Sensitivity rating already incorporates a significant number of considerations that include factors such as vegetation, soils, slopes, elevation. The categories also incorporate consideration of concentrations of scenic routes as well as protected views. The landscape of the county is divided into four classifications of sensitivity- Unique, Special, High and Low. Unique and Special are used as limiting factors.

Electricity Grid: It is essential that any Renewable Energy project is connected to the energy network. This category is used as an opportunity, because proximity to an existing electrical network reduces the length of purpose-built electrical networks required for the site - and associated environmental effects. Such reductions can increase project viability by reducing costs.

Wind Speed: Wind speed determines the rate/efficiency of energy generated by wind turbines. The higher the average wind speeds, the more suitable an area is for wind energy, and thus this category is used as an opportunity.

Roads: Roads are essential for site access during construction phase and maintenance access. This category is used as an opportunity, because proximity to main roads reduces the length of purpose-built or upgraded roads required for the site.

Coastal Potential: One of the main restrictions to off-shore wind farms is depth to sea bed. The shallower the depth, the easier the construction and the higher the project viability - thus this category is an opportunity.

Population/Setback Distances: Population density was used to help the need to consider setback distances for turbines. It is not feasible to map the setback distances from all dwellings, occupied and unoccupied as well as permitted, but unbuilt. Any such mapping would quickly lose it's validity due to the dynamic nature of housing. Instead, population density is used to indicate areas that have greater or less potential to meet set-back requirements. Population density is slow to change, and so will allow the finished mapping to remain valid and accurate for longer.

Corine Landuse: Landuse types which are deemed more suited for wind RE projects (e.g. types that require little clearance for development) are used as an opportunity, and landuse types which are deemed less suited for wind RE projects (e.g. types with unstable soils) are used as a sensitivity.

Slope: Higher degrees of slope pose engineering and visibility challenges for building windfarms, and so slope is used as a sensitivity.

Flooding: Areas that are likely to flood pose engineering challenges for building windfarms, and so areas with the Catchment Flood Risk Assessment and Management (CFRAMs) mapping are used as a sensitivity.

Landslides: Areas that are susceptible to landslides pose engineering challenges for building windfarms, and so areas of landslide susceptibility are used as a sensitivity.

Protected Areas: SACs and SPAs are used as areas of ecological restriction, and so these areas are omitted from the final heat/band maps.

Mapped Factors (Solar): The following provides the rationale for additional factors that are specific to identifying opportunities for solar energy projects;

- **Residential Areas:** Concentrations of population - especially non-residential structures with large areas of roofing - can offer opportunities for solar energy projects of all types.
- **Aspect:** Any lands that are south facing will be exposed to the most amount of direct light during the day, and thus are used as an opportunity.

Factor Priority				
	Wind	**Solar**	**Hydro**	**Bio**
Energy Network	High	High	High	Low
Road Network	High	Medium	Low	Low
Population Density	High	Medium	Low	Low
Settlements	High	High	High	Medium
Land Use	Medium	High	Low	High
Slope	Medium	High	Low	Low
Elevation	High	Medium	Low	Low
Protected Areas	High	High	High	High
Flooding	Medium	High	High	Low
Landslide	High	Medium	Low	Low
Wind Speed	High			
Aspect		Medium		
Solar Radiation		High		
Crop potential				High

Table 5: General priority of Factors used to determine suitability of an area for different types of Renewable Energy

6. Combining Renewable Energy Factors on Maps

After each factor is classified and mapped as individual factors, they are then assigned a priority that indicates the role of each factor as an opportunity or as a challenge. Prior to combining these factors on a map each is assigned a 'weighted' number to highlight the priority of that factor, so that each can be inserted into opportunities for and sensitivities to each type of Renewable Energy.

The role of each factor is also determined as being an Opportunity, a Sensitivity or as having a neutral role in determining the suitability of an area for each types of development.

Table 6: Factors categorised as opportunities or sensitivities for each type of Renewable Energy

Factor as Opportunity or Sensitivity				
	Wind	**Solar**	**Hydro**	**Bio**
Energy Network	Opportunity	Opportunity	Opportunity	Opportunity
Road Network	Opportunity	Opportunity	Opportunity	Opportunity
Population Density	Sensitivity	Sensitivity	Sensitivity	Sensitivity
Settlements	Sensitivity	Sensitivity	Sensitivity	Sensitivity
Land Use	Opportunity	Opportunity	Neutral	Opportunity
Slope	Sensitivity	Opportunity	Opportunity	Sensitivity
Elevation	Opportunity	Opportunity	Opportunity	Neutral
Protected Areas	Sensitivity	Sensitivity	Sensitivity	Sensitivity
Flooding	Sensitivity	Sensitivity	Opportunity	Sensitivity
Landslide	Sensitivity	Sensitivity	Sensitivity	Sensitivity
Wind Speed	Opportunity	Opportunity	Neutral	Neutral
Aspect	Opportunity	Opportunity	Neutral	Neutral
Solar Radiation	Neutral	Opportunity	Neutral	Neutral
Crop potential	Neutral	Opportunity	Neutral	Opportunity

7. Weighting of Energy Factors

Data from different sources are combined to produce 'heat maps' that indicate the relative densities of opportunities on a map. This method is often described as 'sieve mapping'. The method used for this is to apply each factor as a transparent 'layer'. The degree of opportunity is illustrated by the number of favourable factors that occur in one area. Similarly, a layer of sensitivities can be prepared to identify areas of greatest and least constraint. 'Weighting' refers to the degree of transparency or intensity that is assigned to each layer.

These are used for 'Sieve Mapping' in which factors are combined using weighted factors to identify 'hot spots' of maximum concentrations of opportunities or sensitivities.

8. Mapping Areas of Opportunity and Sensitivity

The data from all of the weighted factors are combined to produce a map showing the areas of opportunity and sensitivity for large-scale Wind and Solar energy developments in County Galway. Note, all maps referred to are provided at a large-scale in Appendix E.

Mapping follows two stages. In the first each factor is assessed to identify whether it should be treated as an opportunity or as a sensitivity.

In the second stage, each factor is first mapped onto a standard map, each such map is then classified as weighted degrees of opportunity or sensitivity. Finally, all individual weighted opportunities and sensitivities are mapped together to produce two maps - one of overall opportunity for each energy type, while the second illustrates the relevant joint sensitivity.

The step-by-step process of mapping factors and the resultant Opportunity and Sensitivity maps are illustrated on the following pages.

Note that the mapping in this strategy is confined to large-scale terrestrial projects that are subject to development management provisions and also subject to the Planning and Development Acts [as amended]. This means that offshore developments as well as developments requiring the growth, harvesting or use of forestry, horticultural or agricultural products are not included in mapping - though they are described and included as policy considerations for coordination of supporting infrastructure provision.

Table 7: Example of Weighting applied to Energy Factors in mapping areas of Potential

Data	Criteria	Renewable Energy	Opportunity / Sensitivity	Sub-Criteria	Value
Landscape	Areas of Low and High Landscape Sensitivity	Windfarm	Opportunity	In/out	9
Roads	Distance (km) from main Roads (National and Regional Routes)	Wind Farm	Opportunity	<=3	6
Roads	Distance (km) from main Roads (National and Regional Routes)	Wind Farm	Opportunity	>3 and <=6	4
Roads	Distance (km) from main Roads (National and Regional Routes)	Wind Farm	Opportunity	>6 and <=9	2
Electricity Grid	Distance (km) from suitable electrical infrastructure	Wind Farm	Opportunity	<=3	9
Electricity Grid	Distance (km) from suitable electrical infrastructure	Wind Farm	Opportunity	>3 and <=6	6
Electricity Grid	Distance (km) from suitable electrical infrastructure	Wind Farm	Opportunity	>6 and <=9	3

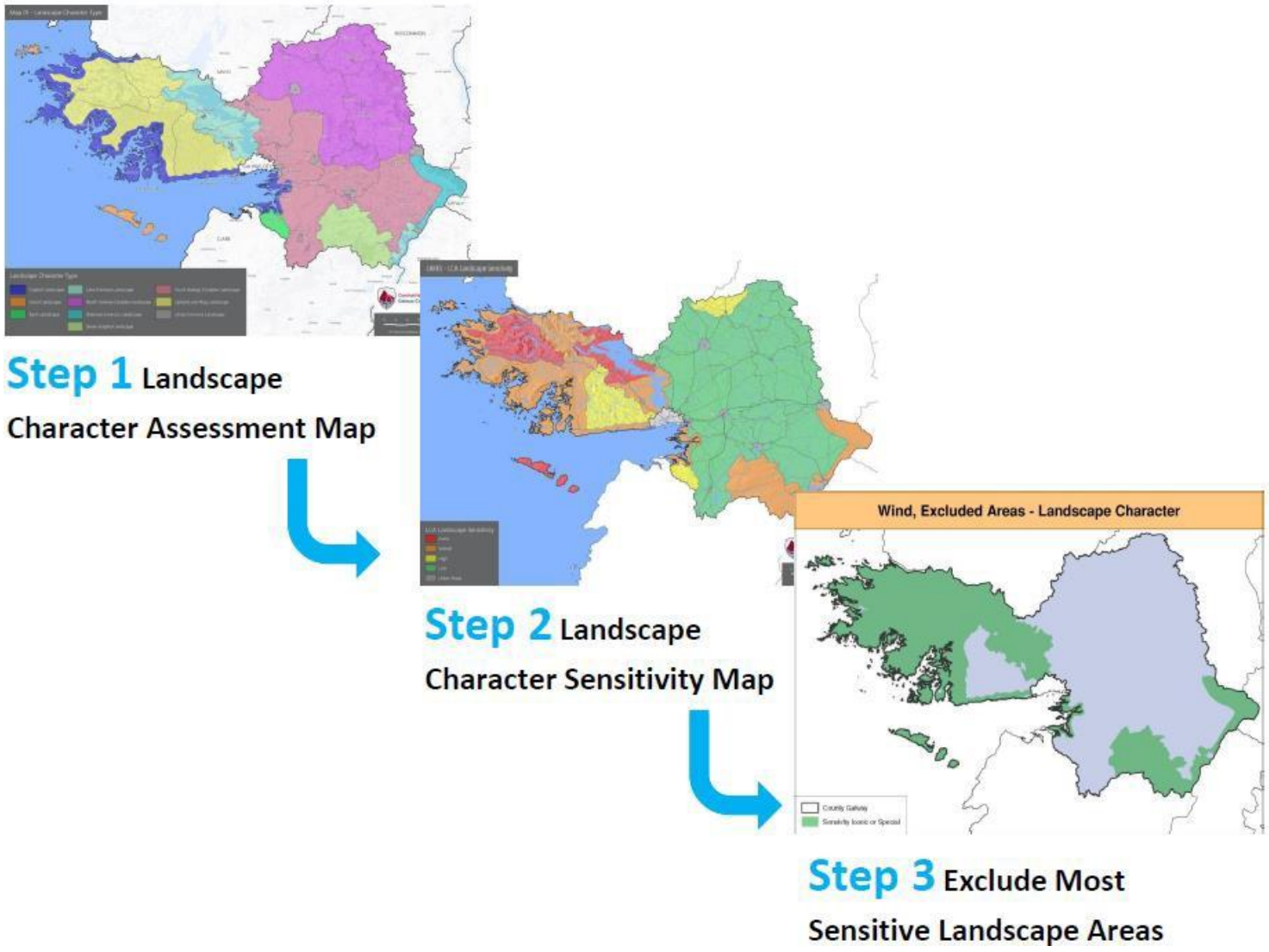


Figure 7: An example of how the Landscape Layer of Wind Sensitivity is mapped

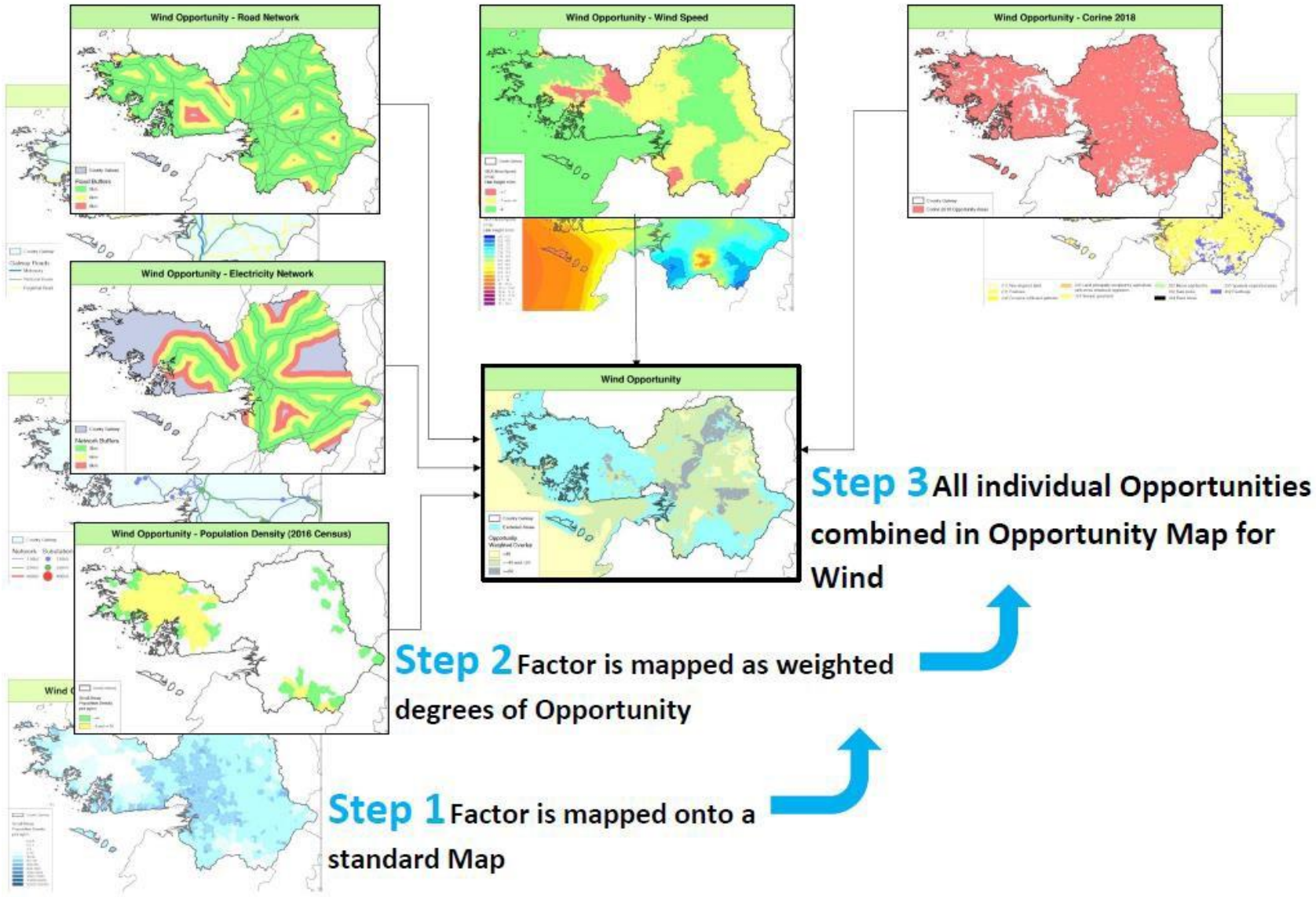
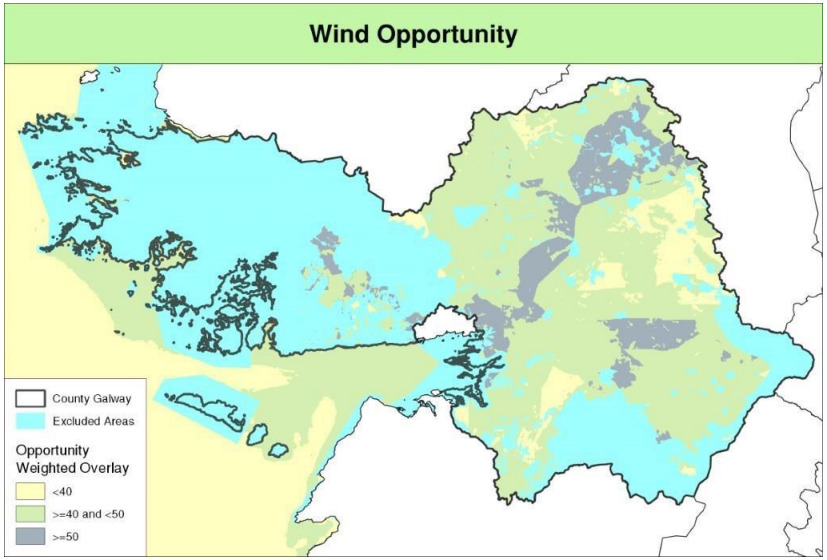
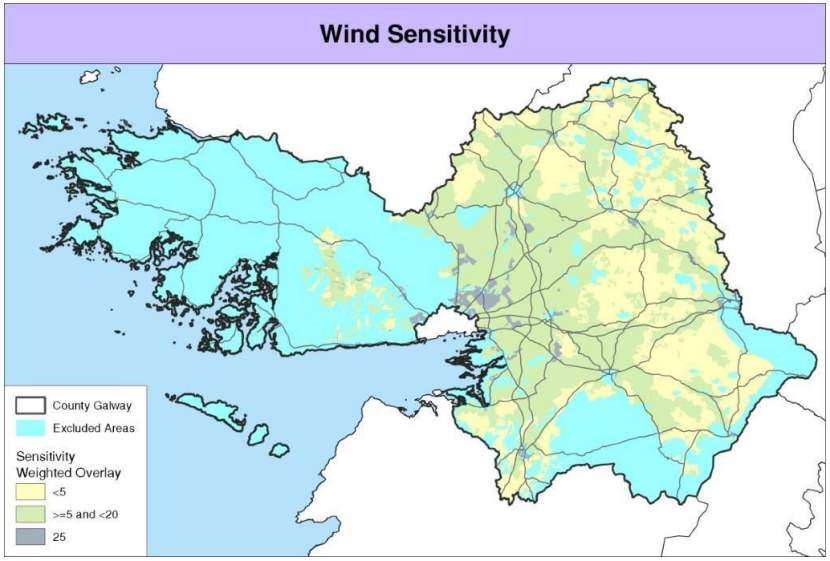


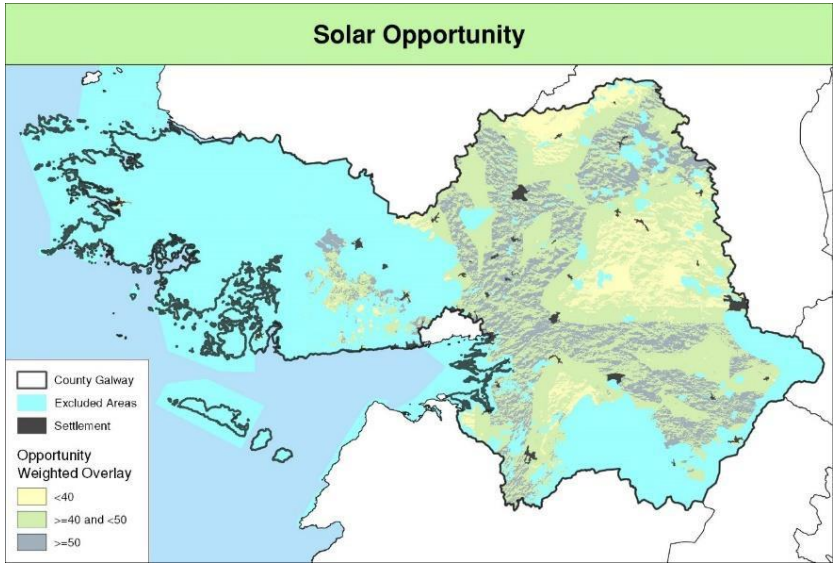
Figure 8: Demonstration of how Wind Opportunity Map is made



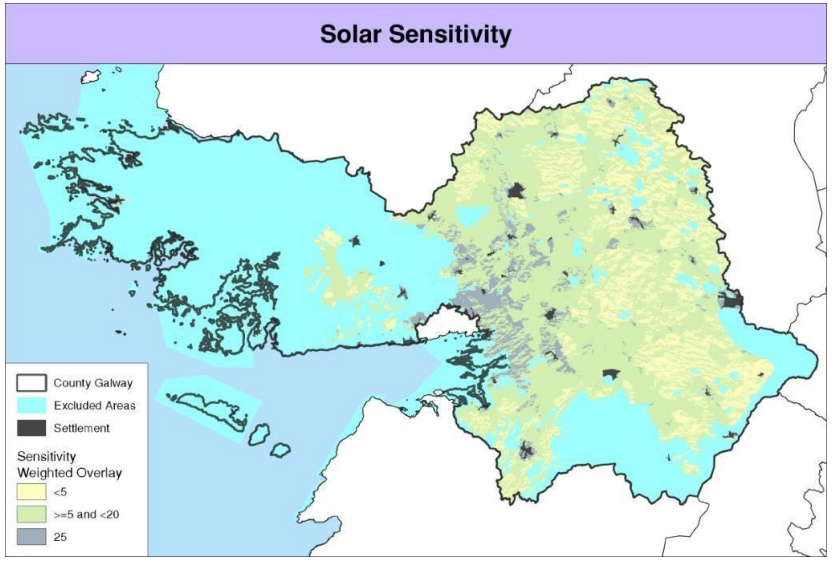
Map 9: Wind Opportunity Map



Map 10: Wind Sensitivity Map

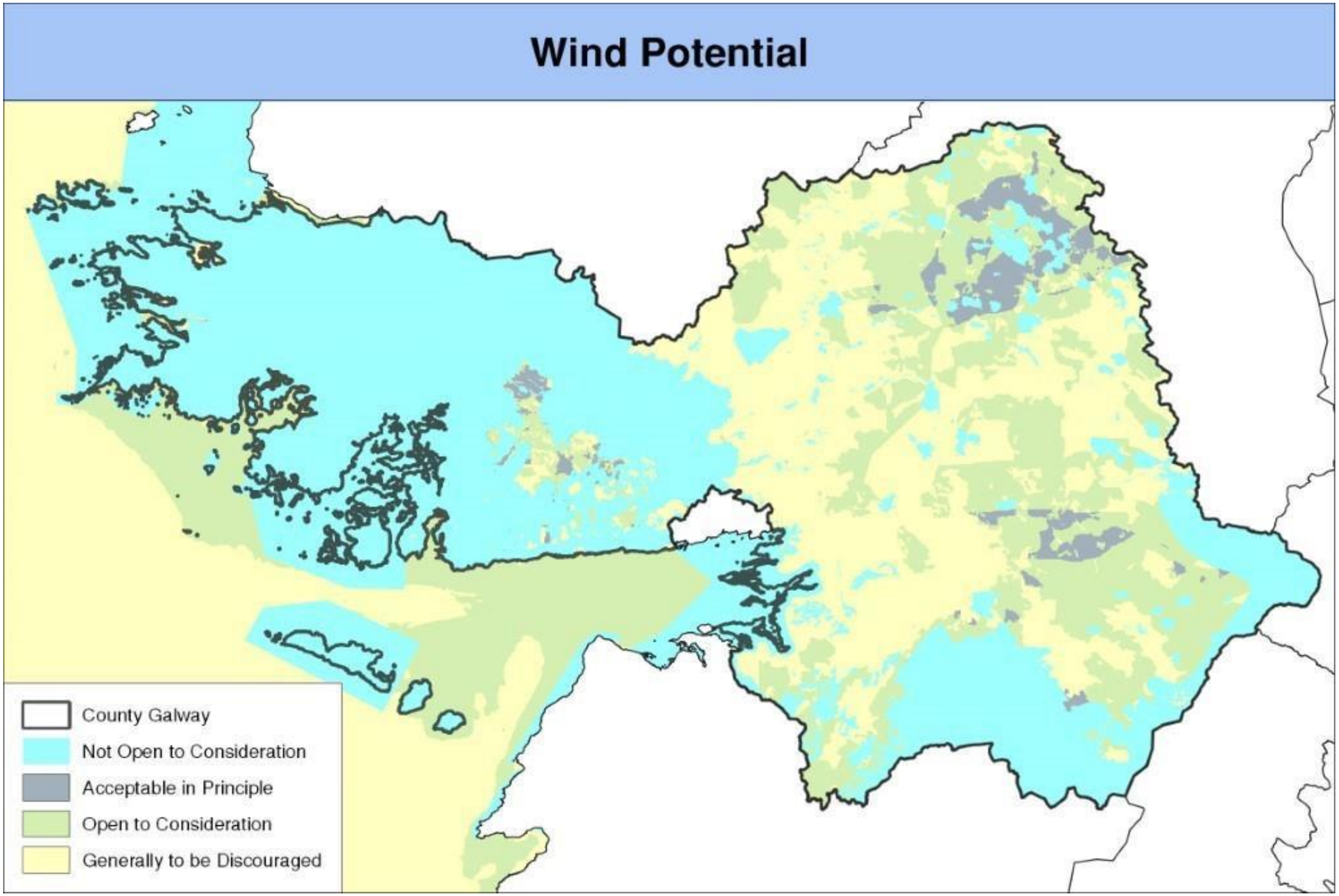


Map 11: Solar Opportunity Map

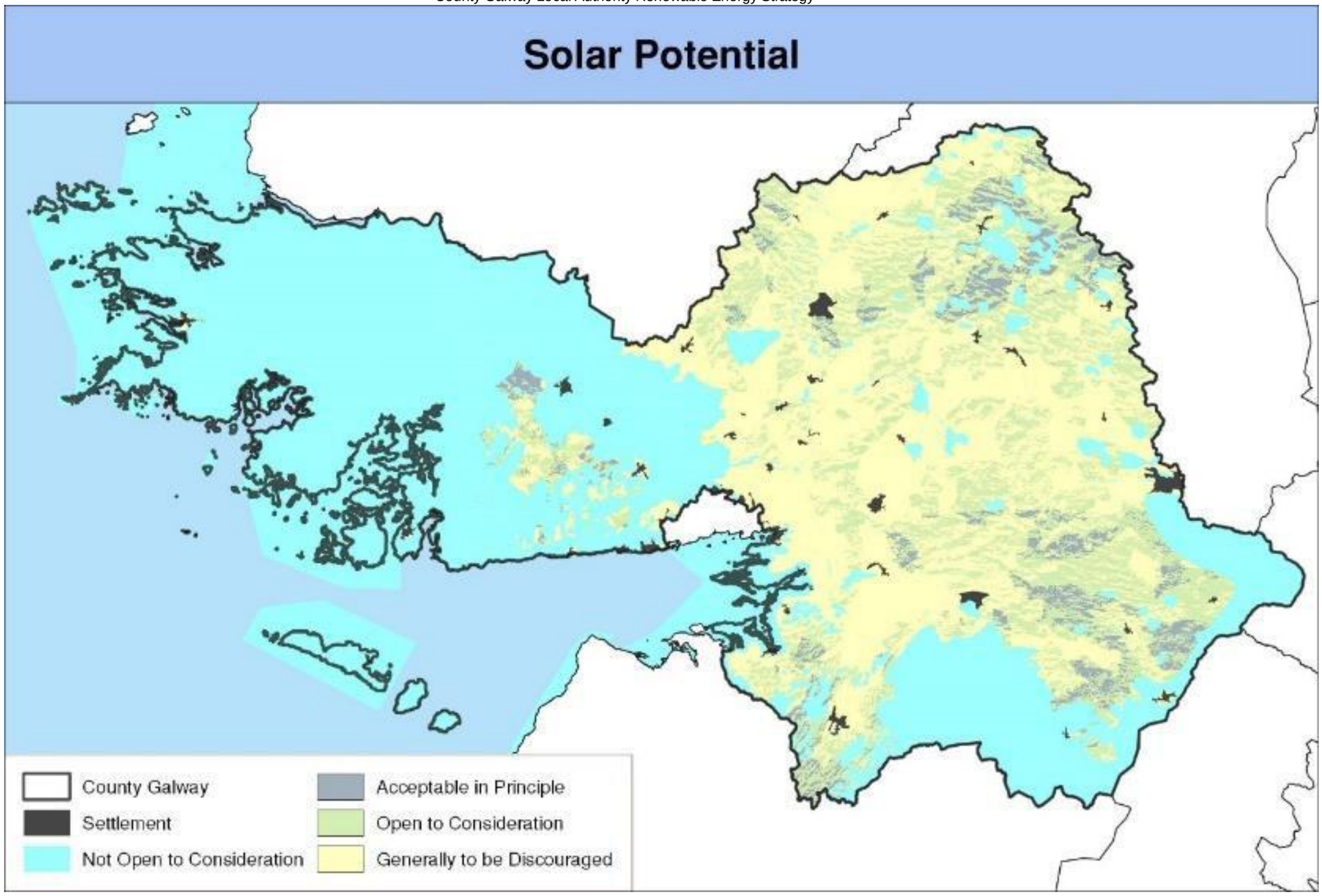


Map 12: Solar Sensitivity Map

9. Maps of Wind and Solar Potential

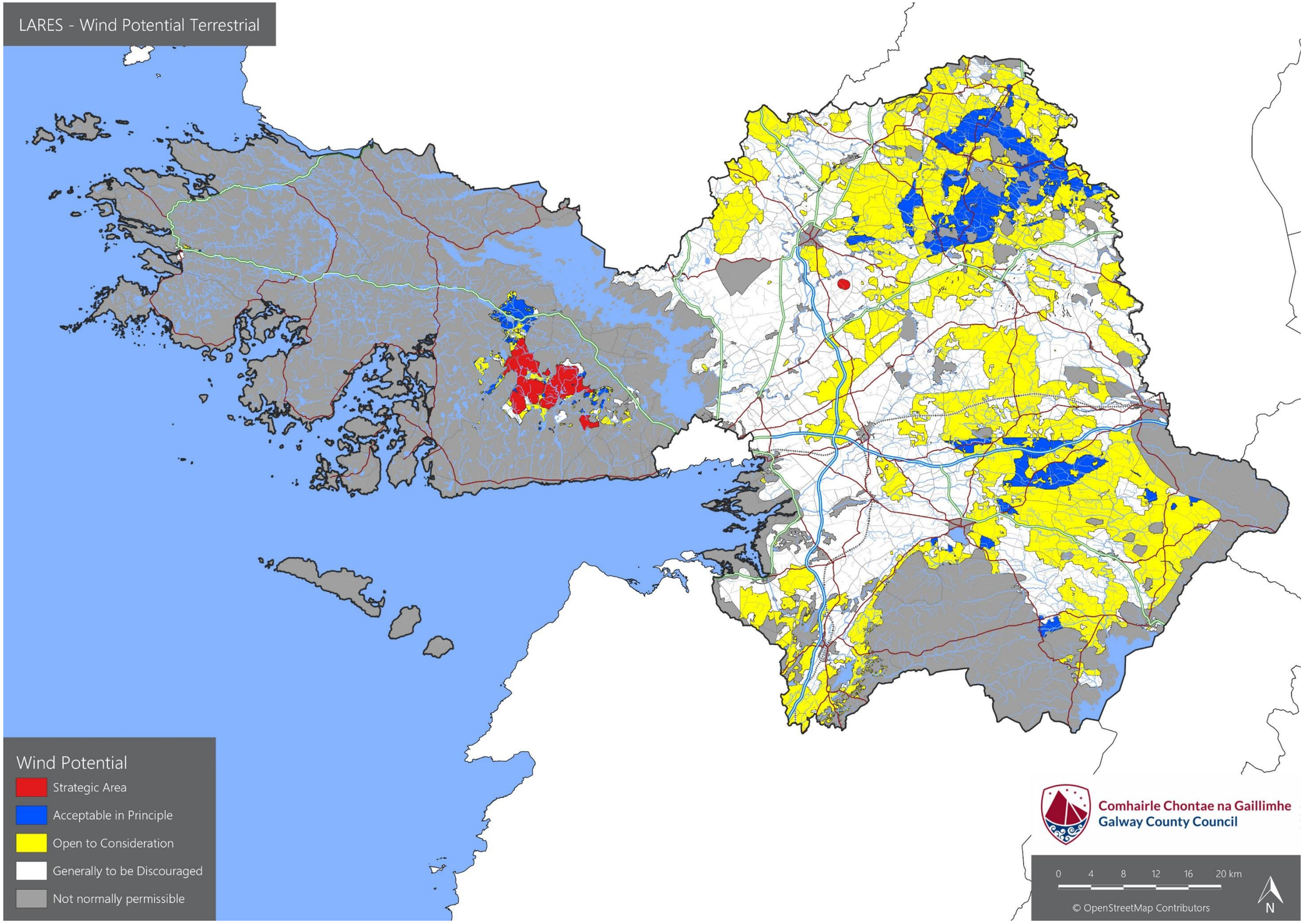


Map 13: Wind Potential Map

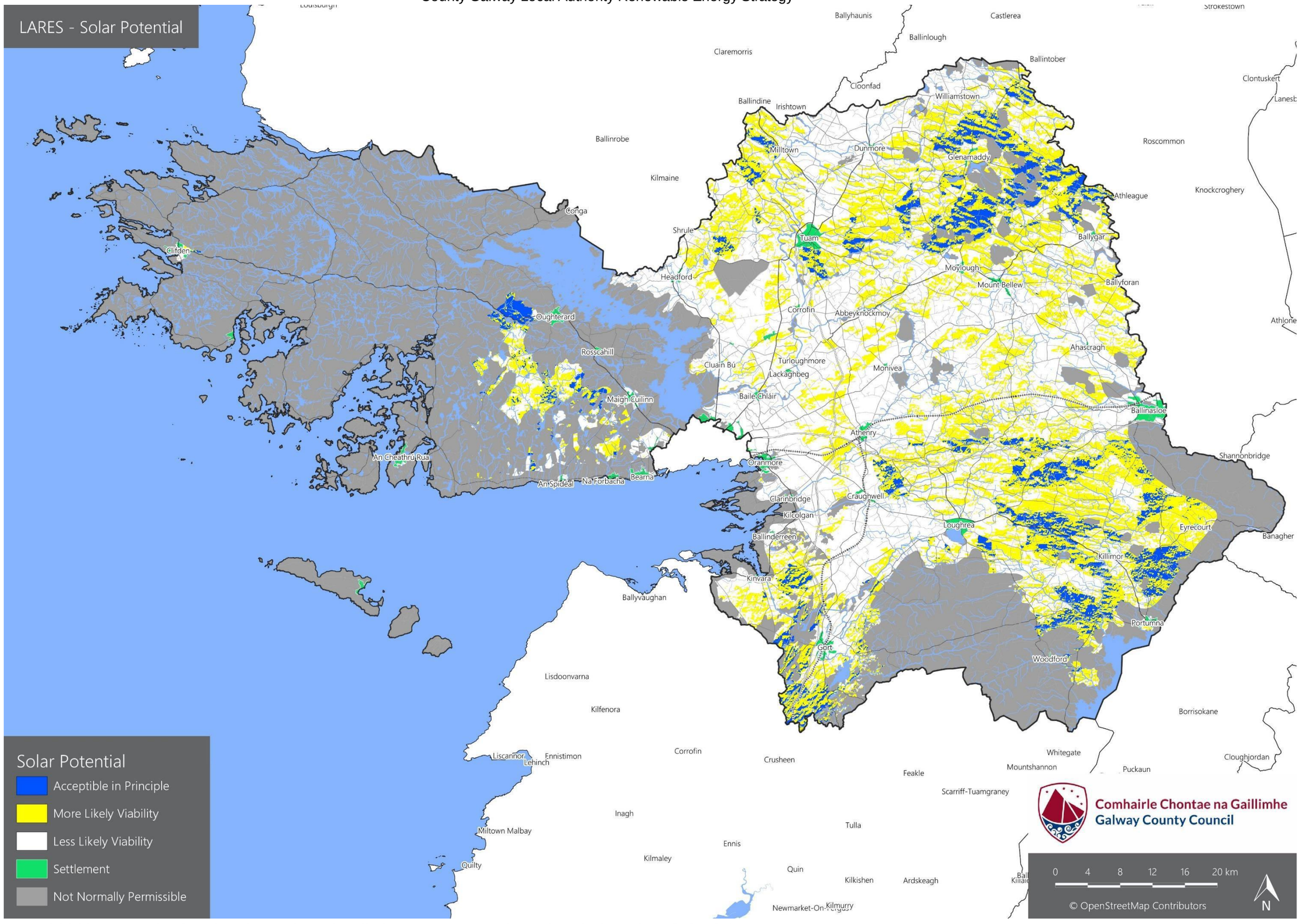


Map 14: Solar Potential Map

10. Maps of Proposed Deployment Zones



Map 15: Wind Potential (This map can be viewed at a larger size on http://galwaycoco.maps.arcgis.com/apps/webappviewer/index.tbc)



Map 16: Solar Potential (This map can be viewed at a larger size on http://galwaycoco.maps.arcgis.com/apps/webappviewer/index.tbc)

11. Updated Estimation of Galway's potential Renewable Energy Areas

Table 8: County Galway Wind & Solar Potential

WIND					
EXISTING			**PROPOSED**		
Wind Deployment Zones 2015	**Area (HA)**	**% of Total Landmass (county)**	**Wind Deployment Zones 2022**	**Area (HA)**	**% of Total Landmass (county)**
SA – Strategic Areas	5,390	1%	Strategic Areas	5,042	0.83%
AP – Acceptable in Principle Areas	6,510	1%	Acceptable in Principle	19,748	3.24%
OC – Open To Consideration Areas	107,965	18%	Open To Consideration	122,701	20.11%
LW – Low Wind Speed Areas	196,403	32%	Generally to be discouraged	169,486	27.78%
NP – Not Normally Permissible Areas	298,125	48%	Not Normally Permissible	293,108	48.04%
SOLAR					
EXISTING			**PROPOSED**		
Solar Deployment Zones 2015	**Area (HA)**	**% of Total Landmass (county)**	**Solar Deployment Zones 2022**	**Area (HA)**	**% of Total Landmass (county)**
0	0	0	Acceptable in Principle	217.50	3.6%
			More Likely Viability	983.23	16.1%
			Less Likely Viability	1977.31	32.4%
			Settlement	62.66	1.0%
			Not Normally Permissible	2868.42	47.0%

12. Interpretation of Deployment Zone Classification

The Key Deployment Zones for each Renewable Energy types are shown on

Map 15 and Map 16. The table below describes the Meaning of each Type along with a note summarising the methodology used to determine each:

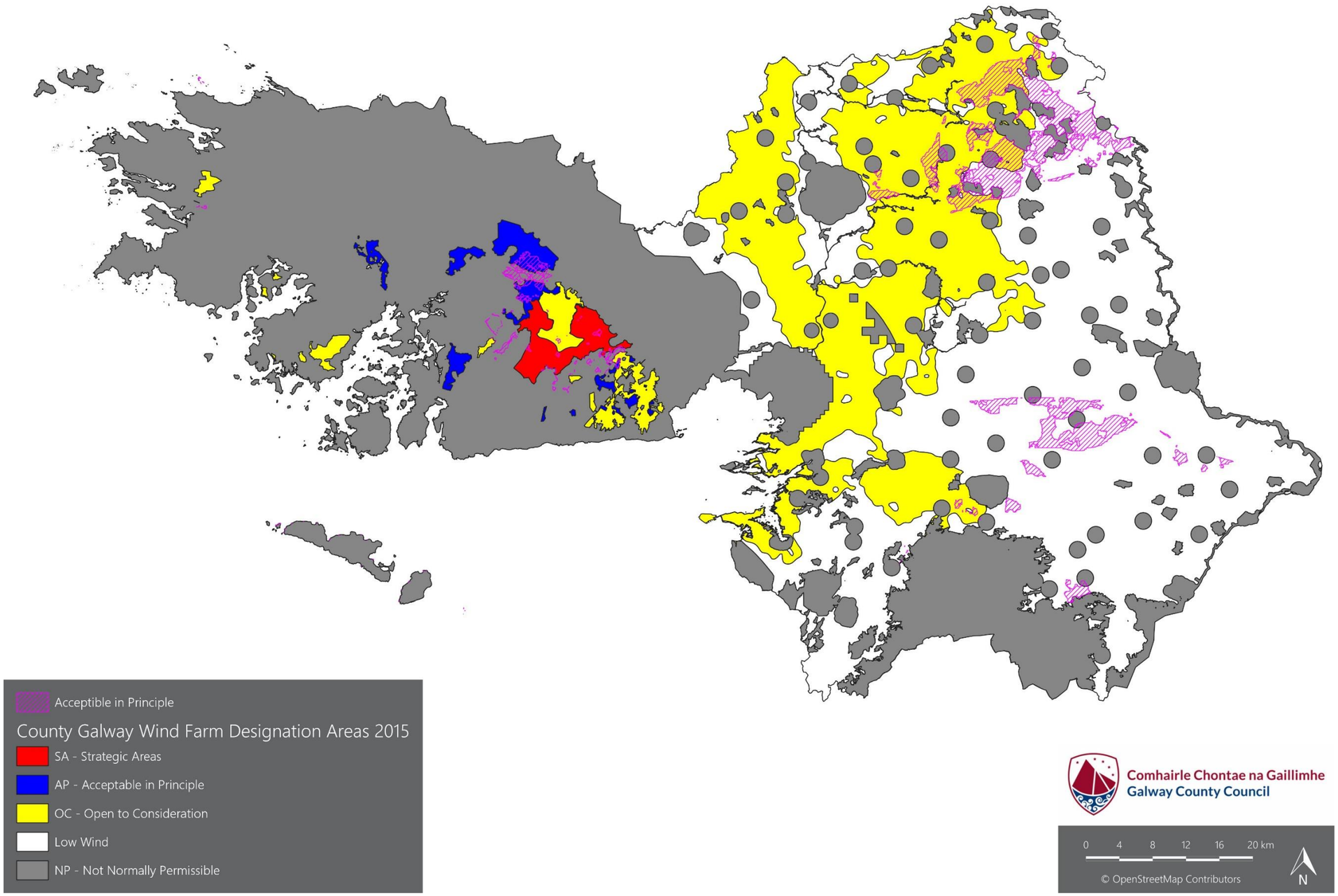
Table 9 Wind Energy Deployment Zones Description

Mapping Key	Meaning [to be read in conjunction with Policies in Section 19]	Method of calculation
Wind Potential		
Strategic Areas	Areas where existing wind developments are situated. These areas have already been subjected to detailed legal and development management processes – both by the local authority – as well as an Bord Pleanala in many cases. Such sites represent important assets that need to be recognised and protected. A further consideration is that many of these sites will be subject of new planning applications for renewal, re-powering or extension.	Areas of existing wind developments with a 600m buffer zone around each.
Acceptable in Principle	Areas where Wind Energy development will be facilitated as an appropriate landuse. Development Management should attempt to control the development of new uses that would reduce the viability of Wind Energy in these areas.	The highest scoring bracket from the combination of wind opportunity and sensitivity weighting scores.
Open to Consideration	Areas where Wind Energy development is likely to be favourable considered - subject to the results of more detailed assessment of polices and potential effects.	The middling scoring bracket from the combination of wind opportunity and sensitivity weighting scores.
Generally to be Discouraged	Areas where Wind Energy development is unlikely to be favourably considered on account of potential to adversely effect protected landscape, water, ecological resources and residential amenity.	The lowest scoring bracket from the combination of wind opportunity and sensitivity weighting scores.
Not Open to Consideration	Areas where Wind Energy Projects, would be likely to conflict with policies of the council to protect landscape, water, ecological resources and residential amenity. Such areas may also include areas and species protected by the Habitats Directive.	Areas excluded due to Natura sites, Iconic and Special Landscape Sensitivity, Geological Heritage sites and Settlements.

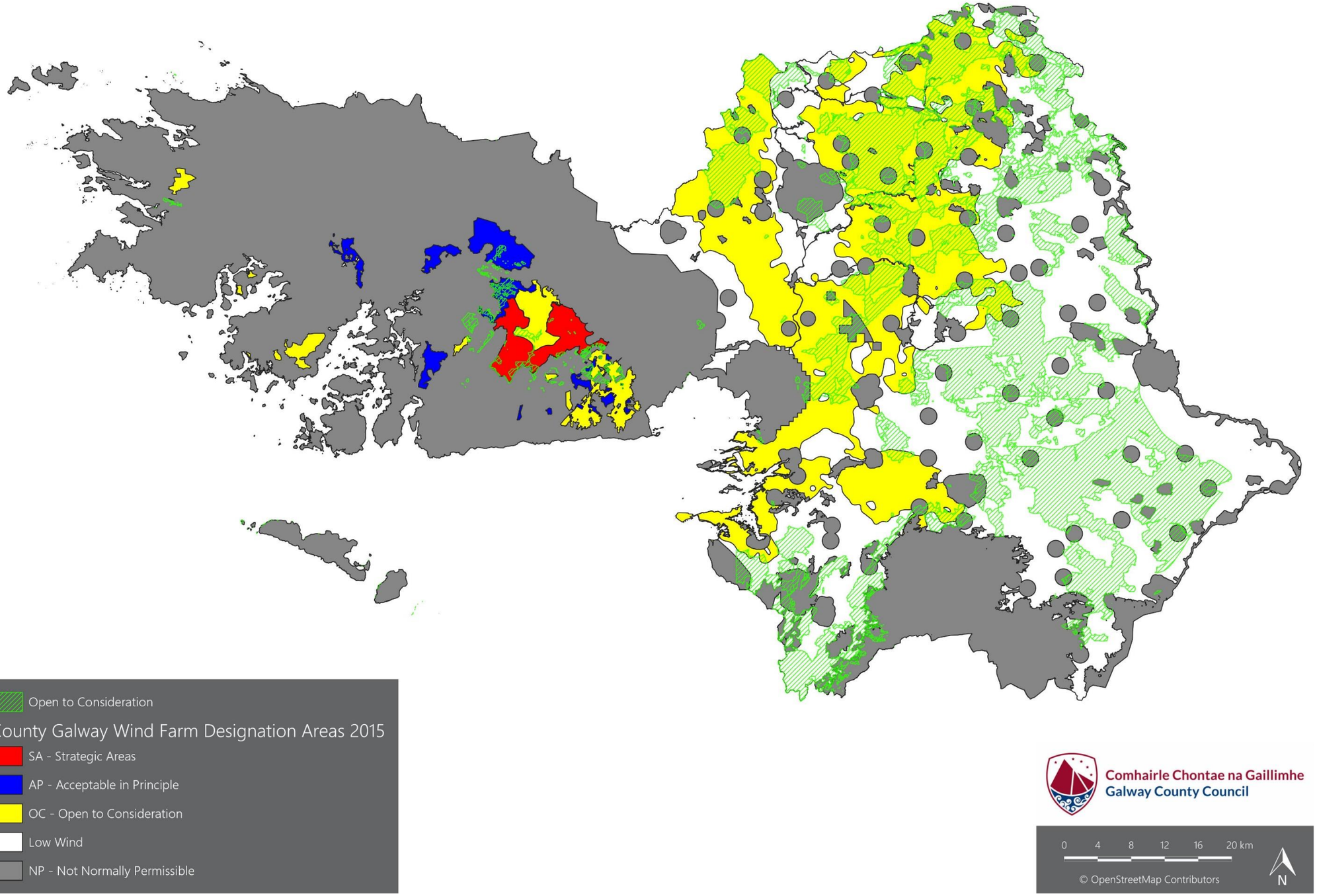
Table 10 Solar Energy Deployment Zones Description

Mapping Key	Meaning [to be read in conjunction with Policies in Section 19]	Method of calculation
Solar Potential		
Acceptable in Principle	Areas where Solar Energy development will be facilitated as an appropriate land use.	The highest scoring bracket from the combination of solar opportunity and sensitivity weighting scores.
More Likely Viability	Areas where Solar Energy development projects are more likely to be proposed by developers on account of superior viability. These are more likely to be favourably considered - subject to the results of more detailed assessment of polices and potential effects. Future additional energy supporting infrastructure is likely be prioritized in large areas where this designation is dominant.	The middling scoring bracket from the combination of solar opportunity and sensitivity weighting scores.
Less Likely Viability	Areas where Solar Energy development projects are less likely to be proposed by developers on account of superior viability. These are likely to be favourably considered - subject to the results of more detailed assessment of polices and potential effects. Future additional energy supporting infrastructure is likely be a lower priority in large areas where this designation is dominant.	The lowest scoring bracket from the combination of solar opportunity and sensitivity weighting scores.
Settlements	Areas where Solar Energy development has a potential to be integrated with buildings, sites and urbanized areas. These are likely to be favourably considered - subject to the results of more detailed assessment of polices and potential effects.	Settlement boundaries are identified from mapping and remote sensing.
Not Open to Consideration	Areas where Solar Energy Projects, would be likely to conflict with policies of the council to protect landscape, water, ecological resources and residential amenity. Such areas may also include areas and species protected by the Habitats Directive.	Areas excluded due to Natura sites, Iconic and Special Landscape Sensitivity and Geological Heritage sites.

13. Comparison of Previous and Proposed Deployment Zones



Map 17: 2015 County Galway Wind Farm Designation Areas overlain with 2022 Acceptable in Principle Areas [purple hatch]



Map 18: 2015 County Galway Wind Farm Designation Areas overlain with 2022 Open to Consideration Areas [green hatch]

14. Reasons for differences between previous and new deployment zones

The more detailed mapping of wind energy resources, together with factors affecting the challenges and opportunities for Wind Energy projects has resulted in changes in the extent of designated areas for Deployment Areas for Wind Energy in County Galway.

The changes have arisen for the following general reasons:

- Lower priority has been given to high wind speeds as a locational factor - to take account of improving technology that makes larger turbines more viable at lower speeds.
- More accurate Landscape Character Assessment allows for more precise definitions of the boundaries of units used for policy formulation.
- Improved understanding of the location and role of supporting utilities and infrastructure has facilitated more precise definition of required proximity to determine feasibility.
- Updated boundaries of ecological sensitivities - especially designations of protected areas - has facilitated more accurate delineation of boundaries of areas of sensitivity.

In summary the changes have resulted in:

- Strategic Areas decreased by 6.4%
- Acceptable in Principle Areas increase by 203% (see Low Wind Speeds).
- Open to Consideration Areas increase by 13.6%.
- Not Normally Permissible areas decrease by 1.6%.
- Low Wind Speeds Area category removed. Most of previous area was incorporated into Acceptable in Principle of Open to Consideration.

15. Estimating Galway's potential Renewable Energy Contribution from Wind

For the purposes of conservatively estimating Galway's potential Renewable Energy Contribution due to wind, an estimate has been prepared based on the potential utilisation of the proposed Wind Deployment Areas contained within this LARES.

The estimation is confined to an evaluation of potential within two types of deployment zones - namely areas that are *Acceptable in Principle* and *Open to Consideration. Strategic Areas* are not considered in this estimation, as it is uncertain as to what percentage of the existing wind farm developments will be renewed/upgraded or not due to conflicts with more recent SAC designations.

Using yields from existing modern projects in County Galway it has been assumed, conservatively, that around 7MW would be produced per 100Ha. By this estimate, County Galway has an 'unconstrained' potential to produce a total energy yield from wind of up to 10GW - though this is unlikely to ever be realised.

More realistically, the estimation examines County Galway's potential contribution in the next 10 years to 2030 - to coincide with government planning horizons as well as anticipating likely maximum grid capacity.

During that time, it examines the scenario of a 15% utilisation of the *Acceptable in Principle* areas - which are likely to contain the most suitable sites and 7.5% of the areas that are zoned *Open to Consideration* - which may yield fewer optimum sites. These estimates are illustrated in Table 9 below.

These more conservative estimates predict that, subject to availability of finance, sites and transmission capacity, wind energy in Galway could increase by 875MW in the next 10 years to contribute a total dispatch of over 1.4 GW of wind to the national grid – contributing over 17% of the entire national target of 8.2GW by 2030.

16. Estimating Galway's potential Renewable Energy Contribution from Solar

For the purposes of conservatively estimating Galway's potential Renewable Energy Contribution due to solar, an estimate has been prepared based on the potential utilisation of the proposed Wind Deployment Areas contained within this LARES.

The estimation is confined to an evaluation of potential within two types of deployment zones - namely areas that are *Acceptable in Principle* and *More Likely Viability*.

Using yields from existing modern projects in County Galway it has been assumed, conservatively, that around 50MW/100HA can plausibly be generated. By this estimate, County Galway has an 'unconstrainted' potential to produce a total energy yield from solar of up to 500MW though this is unlikely to ever be realised.

More realistically, the estimation examines County Galway's potential contribution in the next 10 years to 2030 - to coincide with government planning horizons as well as anticipating likely maximum grid capacity.

During that time, based on an observed reluctance to convert land from agriculture, it examines the scenario of 0.5% of the Solar Acceptable in Principle area used and 0.25% of Solar More Likely Viability. Taking into account existing, but uncommisioned projects plus new developments County Galway could contribute up to 193MW of solar by 2030. These estimates are illustrated in Table 11 below.

17. Potential Yield from Deployment Zones

Table 11 Updating Estimation of Galway's potential Wind & Solar Energy Contribution

WIND													
EXISTING							**PROPOSED**						
Wind Deployment Zones 2015	**Area (HA)**	**% of Total Landmass (county)**	**2015 Potential Total MW Output**	**2015 Target MW by 2020**	**Operational**	**Permitted**	**Wind Deployment Zones 2022**	**Area (HA)**	**% of Total Landmass (county)**	**Area developed by 2030**	**Total New Area Energy Yield @ 7MW/ 100HA**	**2030 New Developed Area Energy Yield @ 7MW/100HA**	**2030 Additional Yield at repowered existing sites††**
SA – Strategic Areas	5,390	1%	600	220	180	124	Strategic Assets	5,042	0.83%		N/A	N/A	61
AP – Acceptable in Principle Areas	6,510	1%	480	100	74.2	0	Acceptable in Principle	19,748	3.24%	2,962HA *	1382MW	207MW	15
OC – Open To Consideration Areas	107,965	18%	480	60	6	0	Open To Consideration	122,701	20.11%	9,202HA **	8,589MW	644MW	0
LW – Low Wind Speed Areas	196,403	32%			0	0	Generally to be discouraged	169,486	27.78%	0	0	0	38
NP – Not Normally Permissible Areas	298,125	48%	120	120	185.95	0	Not Normally Permissible	293,108	48.04%	0	0	0	0
SUB TOTAL			1,680MW	500MW	446MW	124MW						**851MW**	**114MW**
WIND TOTALS					**570MW† [385MW]**		**TOTAL**					**965MW**	
WIND 2030 TOTAL [Modified Existing† plus New]												**1,350MW**	
SOLAR													
EXISTING							**PROPOSED**						
Solar Deployment Zones 2015	**Area (HA)**	**% of Total Landmass (county)**	**Operational**			**Permitted**	**Solar Deployment Zones 2022**	**Area (HA)**	**% of Total Landmass (county)**	**Area developed by 2030**	**Total Area Energy Yield @ 50MW/ 100HA**	**2030 Developed Area Energy Yield @ 50MW/100HA**	**2030 Additional Yield at repowered existing sites**
0	0	0	0MW			36MW	Acceptable in Principle	217.50	3.6%	109HA***	108MW	55MW	na
							More Likely Viability	983.23	16.1%	249HA ****	491MW	125MW	na
							Less Likely Viability	1977.31	32.4%	0	0	0	na
							Settlement	62.66	1.0%	0	0	0	na
							Not Normally Permissible	2868.42	47.0%	0	0	0	na
SUB TOTAL			0MW			36mw						**180MW**	0MW
SOLAR TOTALS			36MW										
SOLAR 2030 TOTAL												**216MW**	
WIND & SOLAR 2030												**1,566MW**	

Notes
Assumed that by 2030
* Assume that 15% of Wind AiP land is used
** Assume that 7.5% of Wind OtC
*** Assume 0.5% of the Solar AiP land is used
**** Assume 0.25% of Solar MLV is used
† Assume that, worst case, up to 185MW of existing wind farm permissions will not be renewed due to conflicts with more recent SAC designations
†† Assume that re-powering and adjustments of existing permissions yields an additional average yield increase of 20%

18. Estimation of Potential Renewable energy Contributions

The following provides a high-level estimate of those aspects of County Galway's energy generation that could be supplied by Renewable Energy by 2030.

Table 12: Estimated Capacity of each Renewable Energy Type

Energy Type	**Existing Capacity**	**Potential Future Capacity**	**Notes**
Energy Conservation and Transport	Unknown	Significant	These cannot be readily calculated or mapped
Wind Energy - Terrestrial	570MW	965MW	
Wind Energy - Off Shore	n/a	n/a	This lies outside the jurisdiction of GCC
Solar Energy	36.2 MW	193MW	
Hydro Energy - on shore	Negligible	Negligible	Environmental sensitivities will preclude further development except refurbishments
Hydro Energy - off shore	n/a	n/a	This lies outside the jurisdiction of GCC
Bio-Energy & Waste To Energy Recovery	10MW	40MW	Existing Capacity is an estimate
Other Renewable Energy Types	Unknown	Moderate	

19. Policy Objectives

Table 13: Key Policy considerations

Policy Consideration	
Relevant Energy Policy Areas of Adjacent Local Authorities	The approach to planning policy for relevant energy technologies in adjoining Local Authority areas was considered.
Planning Application Review	The pattern of current renewable energy development in County Galway and adjacent areas was considered: identifying commissioned, granted, pending and refused applications.
Renewable Energy Potential	Areas where development of renewable energy resources is viable were identified.
Landscape Character Assessment	The outcome of the LCA and how it influences this LARES was considered.
Electricity Transmission/ Distribution Network	The capacity and accessibility to the existing and planned electricity transmission network and distribution grids were analysed in relation to how they might constrain future renewable energy development.
Settlement Pattern and Population Densities	Settlement pattern and population densities were studied in relation to minimising the residential impact of renewable energy development.
Scenic Routes and Landscapes and Amenity Designations.	The impact of renewable energy development on scenic and amenity areas were considered.
Landslide Susceptibility	A preliminary review of landslide risk areas based on slope and soil type was undertaken.
Ecological & Natural Heritage Designations	Consideration was taken of the policy objectives and obligations in relation to any development in these areas.
Architectural & Archaeological Heritage	Consideration of the policy objectives and obligations in relation to any development in these areas.
Water Framework Directive	Consideration of the River Basin Management Plan and the impacts of renewable energy development on water quality. Have consideration of the policy objectives and obligations in relation to Freshwater Pearl Mussel Catchments.
Cumulative Impact	Consider the combined effect of all existing/granted renewable energy developments in conjunction with the proposed renewable energy development areas being considered under this LARES process to determine if any area has an over-concentration of development relative to its sensitivities.

In identifying the key policy considerations which would need to be addressed in developing a Local Authority Renewable Energy Strategy, guidance was taken from the SEAI standardised methodology and national guidelines. In addition, the list of policy considerations was informed by a best practice review of the approach adopted by other Local Authorities and from issues raised in the non-statutory LARES public consultation process undertaken in June 2020.

Policy Consideration	
National & EU Policy Commitments	Evaluate the renewable energy policy commitments for Ireland, and consider the implications of this for renewable energy development in County Galway.
Planning Case Law	The implications of relevant renewable energy planning case law was considered.
Co-location of Renewable Energy	Identify opportunities for areas of co-location of different renewable energy development through analysis of resource potential and existing infrastructure.
Repowering/renewing of existing wind farms	Consider relevant policy and guidance in relation to this issue and best practice approaches to its facilitation.

The preceding sections of this LARES provide a clear background to the current national, regional and sectoral developments in Renewables. These sections are included as precursors to these policy objectives, detailing the narrative behind renewable energy and the needs of County Galway.

Strategic Renewable Energy Policies & Objectives

One of the main aims of the LARES is to set out one integrated, comprehensive suite of policy objectives for renewable energy development in Galway. However, a measured approach must be adopted when developing policy objectives specific to County Galway, as the national and regional renewable energy planning policy approach must also be considered. The National Planning Framework and the Regional Spatial & Economic Strategy for the Northern and Western Region are both key considerations, in this respect, and the policy objectives of this LARES have been formulated in accordance with the policy approach of these policy documents.

This LARES should be considered as part of the Galway County Development Plan in providing a strategic policy steer for renewable energy practices in County Galway. In addition to directing renewable energy developments towards appropriate locations in the County, potential adverse effects arising from renewable energy related developments will be avoided and/or mitigated by various provisions relating to environmental protection and management that have been integrated into the Plan.

Analysis of renewable energy developments refused planning permission in Appendix C shows that the following issues were commonly cited as reasons for refusals:

- Location of developments within or close to protected areas which raised concerns about habitat destruction;
- Landscape and visual impact;
- Location of developments in areas of High Scenic Amenity value;
- Insufficient information to allow for a full and proper assessment of impacts; and
- Non-compliance with the County Development Plan in place at the time.

It is therefore imperative that renewable energy development proposals seek to address the aforementioned issues from the outset, along with the challenges outlined in Section 9 of this LARES.

Renewable Energy Transmission

Given the often rural location of renewable energy proposals, where the transmission grid network is generally not well reinforced, proximity to existing transmission infrastructure will be vital in order to facilitate the targeted reinforcement and upgrading of grid infrastructure, as identified in the Transmission Development Plan[22]. This will increase the resilience of the transmission grid network by facilitating greater levels of renewable

[22] See Part 2, Section 5.7

energy generation and wider renewable energy dispersal across County Galway. As the Transmission Service Operator (TSO[23]) for Ireland, Eirgrid recognises the need to reinforce the transmission grid network in order to accommodate more diverse power flows and this policy is primarily focussed on assisting those efforts in County Galway in order to facilitate the transition to a low carbon economy.

The Council welcomes and supports the inclusion of the Regional Solution Project relating to 400Kv transmission grid infrastructure in the RSES, in light of the identified lack of high-capacity transmission infrastructure but high renewable energy potential in the region.

Renewable Energy Transmission:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 1 - Transmission Grid Network	To support the development of the transmission grid network in order to sustainably accommodate both consistent and variable flows of renewable energy generated in County Galway.
LARES Policy Objective 2- Renewable Energy Transmission	Proposed renewable energy generation projects shall fully consider the capacity of the existing transmission grid network in determining the optimal grid connection for the project, in accordance with the proper planning and sustainable development of the area.

In respect of proposed renewable energy developments, transmission grid capacity should be considered as a constraint where the Transmission Development Plan, or any other equivalent plan of the TSO, does not identify infrastructure reinforcement measures unless transmission grid capacity can be demonstrated.

Notwithstanding ecological and environmental considerations, grid connection routing for development proposals should show all alternative routes that were considered, and should avoid materially impacting the road network, where possible. Undergrounding should be considered where it will significantly negate any identified impacts.

It is important that the necessary transmission and distribution infrastructure is facilitated and put in place in order to maximise the renewable energy potential of County Galway. Liaison with Eirgrid, as the TSO, and alignment with their transmission plans and strategies will be of vital importance in this respect.

Renewable Energy Generation

Considering the provisions of the Climate Action Plan and the EU RECAST Directive have introduced ambitious targets for renewable energy generation, it is vitally important that the most suitable land identified for renewable energy generation is reserved for this function. Notwithstanding this, the Council recognises the needs of rural inhabitants and will continue to appropriately mediate between competing uses, in light of these needs and the national renewable energy ambitions. As such, it is considered that areas identified as 'Strategic Areas' in Map 15 of this LARES should be prioritised for renewable energy development.

Renewable Energy Generation:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 3 - Renewable Energy Generation	To facilitate and support appropriate levels of renewable energy generation in County Galway, in light of the need to transition to a low carbon economy and to reduce dependency on fossil fuels.
LARES Policy Objective 4 - Prioritisation of 'Strategic Areas' for	The areas that are identified as 'Strategic Areas' for renewable energy development will be prioritised for renewable energy uses over other uses, in accordance with the proper

[23] See Section 5.8

renewable energy development	planning and sustainable development of the area.

Any development proposed in areas identified in this LARES as 'Strategic Areas' that is not conducive to substantial renewable energy generation, unless it aligns with policies in the CDP relating to rural needs, should seek to provide evidence as to the siting of the proposal in this area. The evidence should outline the reasons for the selection of the site, and that there are no other suitable and available sites for such a development.

Solar Energy

Solar energy is rapidly developing to the point that most new housing developments are incorporating the use of solar energy in order to satisfy new building standards requiring 70% more energy efficiency than the standards of 2005. Added to this, large commercial companies are investing in solar energy[24] which is seen as a 'quick win' in demonstrating the companies zero carbon ambitions. Although this primarily relates to the demands of customers due to the impending climate crisis, it also shows the effect policy positions can have in conducing change in the business environment and the general public, and this LARES has been framed in the knowledge of this.

Given the solar energy resource potential identified in Map 16 and the ever-increasing use of solar energy in both new and existing developments, the Council is of the view that it is important to highlight areas where solar energy generation is best placed.

Solar Energy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 5 - Solar Energy Generation	To enable improved solar energy generation across County Galway.
LARES Policy Objective 6 - Commercial Solar Energy	Commercial scale solar energy development, where in accordance with the solar energy deployment zones identified in this LARES, will be considered favourably on brownfield sites within industrial and/or commercial settings and on agricultural land suitable for farm diversification.
LARES Policy Objective 7 – Acceptable in Principle	Solar energy development proposals in areas that are identified as 'Acceptable in Principle' will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 8 - More Likely Viability	Solar energy development proposals in areas that are identified as 'More Likely Viability' will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 9 - Less Likely Viability	Solar energy development proposals in areas that are identified as 'Less Likely Viability' will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 10 Solar energy development proposals in Settlements	Solar energy development proposals in areas that are identified as 'Settlements' will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 11 Not Normally Permissible	Solar energy development proposals in areas that are identified as 'Not Normally Permissible' will be considered in accordance with the LARES and the proper planning and sustainable development of the area.

[24] https://www.breakingnews.ie/business/lidl-announce-1-million-contract-with-waterford-solar-energy-company-1015511.html

LARES Policy Objective 12 Small-scale solar energy	Small-scale solar energy development will be considered in accordance with the LARES and the proper planning and sustainable development of the area.

The following table identifies a non-exhaustive list of factors to consider for solar panel installations and larger solar farm developments:

Solar Panel factors to consider	Solar Farm factors to consider
Solar panel installations of a south facing nature should be prioritised.	Shaded areas should be avoided, where possible.
Shaded areas should be avoided, where possible.	Vacant brownfield sites in predominantly industrial areas which have not been developed to date with access to the grid, access by vehicle and with associated transformers and power cables; should be considered for solar energy generation.
Industrial/commercial sites with large amounts of roof space such as offices should also be considered favourably for roof-mounted solar panel installations.	Land diversification should be considered where solar farms can be developed on agricultural land, where proposals include the continued agricultural use of the site or incorporate biodiversity measures within the project.
Existing green roofs could also be complimented by roof-mounted solar panels.	Typically suited to low lying-lands due to the need for level sites.
Impact on protected structures, national monuments and architectural conservation areas.	South facing aspect with either flat terrain or sloping gently.

Prospective developments should demonstrate, where relevant, how they will proportionately contribute to the requirement in the Climate Action Plan to generate 1.5GW of solar PV by 2030.

Prospective developments located in Settlements or built-up areas should generally be of roof-mounted character and should particularly demonstrate how they do not create significant impacts for residential amenity and other relevant policy considerations.

Wind Energy

The Wind Energy Guidelines, as detailed in previous sections, are the national guidelines for wind energy in Ireland and should be the starting point for evaluation of wind energy proposals. This LARES supplements the guidelines by providing locally-specific guidance in identifying the acceptable locations for wind energy development.

The SEAI standardised LARES methodology requires the identification of areas of renewable energy resource and potential across the County in order to guide renewable energy development towards the areas of highest renewable energy generation potential. As detailed in Table 8, a hierarchy of 5 no. area types has been identified in order to appropriately guide renewable energy generation to the areas of most renewable energy potential with the least verifiable constraints.

Wind Energy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 13 Wind Energy Generation	To increase renewable energy generation levels from wind energy developments in County Galway, given the recognised wind energy potential of the County.
LARES Policy Objective 14 National Wind Energy Guidelines	All onshore wind energy developments shall comply with the National Wind Energy Development Guidelines or any subsequent version thereof.
LARES Policy Objective 15 Acceptable in Principle	Wind energy development proposals in the areas that are 'Acceptable in Principle' for renewable energy development will be considered in accordance with the LARES

	and the proper planning and sustainable development of the area.
LARES Policy Objective 16 Open to Consideration	Wind energy development proposals in areas that are identified as 'Open to Consideration' for wind energy development will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 17 Generally to be Discouraged	Wind energy development proposals in areas that are identified as 'Generally to be Discouraged' for wind energy development will be considered in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 18 Not Normally Permissible	Wind energy development proposals in areas that are identified as 'Not Normally Permissible' for wind energy development will be considered in accordance with the LARES and the proper planning and sustainable development of the area.

Wind energy development proposals should consider the constraints and challenges detailed in Sections 5 and 9 of this LARES, and should indicate how these constraints can be addressed where they are not located in an area identified as 'Strategic Areas' or 'Acceptable in Principle'. Although wind energy developments located in areas identified as 'Strategic Areas' or 'Acceptable in Principle' will be considered favourably, they will still need to be assessed against the policies and provisions of the Wind Energy Guidelines, the County Development Plan and any other relevant policy documents.

Prospective developments should demonstrate how they will proportionately contribute to the requirement in the Climate Action Plan to generate 8.2GW of onshore wind by 2030.

Repowering/Renewing Wind Energy Developments

As we approach 30 years since the commissioning of the first commercial scale wind farm in Ireland, many permitted wind farms are nearing the end of their permitted lifespans which has traditionally averaged 25-30 years, based on analysis of permitted renewable energy development applications in Appendix C. However, technological advancements over the last 30 years have increased both the longevity and efficiency of wind farms, resulting in less turbines being required to generate the same amount of energy. Notwithstanding this, the newer turbines are increasing in size which could potentially negate the benefit of requiring less turbines if a similar amount of constraints exist due to the need to seek greater setbacks from nearby dwellings, for example.

Depending on the scale of the proposal and the reasoning for repowering/renewing, there are varying applicable planning processes. These are, namely, seeking an extension of duration of a planning permission, seeking a modification of a planning permission or submitting a Section 146B request to An Bord Pleanála to alter the terms of a Strategic Infrastructure Development. All of the aforementioned processes require an assessment of the likely environmental impacts of renewing/repowering proposals. As such, there may be instances where environmental designations have expanded over time into established wind farms and this will need to be carefully considered in the planning balance when evaluating such developments.

Repowering/Renewing Wind Energy Developments:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 19 Repowering/ Renewing of wind energy	To facilitate and support repowering/renewing of wind energy developments where appropriate, in the context of technological advancements and environmental impacts, along with other relevant constraints, in accordance with the LARES and the proper planning and sustainable development of the area.

In recognition of technological advancements and the variable and lengthening lifespans of wind energy developments, it is considered more appropriate for conditions to reference a period of time where the cessation of onsite operations would trigger the decommissioning of the site.

Constraints and sensitivities identified in Sections 5 and 9 of this LARES should be appropriately considered in relation to renewing/repowering proposals.

Bioenergy

As recognised in previous sections and as reflected in this policy objective, there are a diverse range of technologies that can be utilised to harness bioenergy in a variety of settings. Of particular relevance to County Galway is the potential for agricultural farming areas in the east and south of the County to utilise bioenergy as a renewable energy resource. This potential exists due to the raw bioenergy material created as a result of farming practices, in particular dairy farming where yields are higher in comparison to other farming practices. However, the viability of bioenergy will be limited by the affordability of sourcing the raw material and implementing the technology. In light of this, bioenergy developments that utilise biomass waste as the primary source of fuel should be considered favourably over bioenergy developments that rely on energy crops as the primary source of fuel.

Bioenergy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 20 Bioenergy development	To support and recognise Bioenergy development as a flexible and varied form of renewable energy development that can be implemented in a variety of settings.
LARES Policy Objective 21 Commercial bioenergy	Commercial bioenergy proposals should be encouraged to be located in rural areas both close to the energy source and the point of demand, and served by public roads with sufficient capacity. All bioenergy facilities will be assessed against the ability of the receiving environment to accommodate them in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 22 Brownfield Sites	Brownfield sites in areas zoned for industrial or commercial uses will be considered for commercial scale bioenergy development in accordance with the LARES and the proper planning and sustainable development of the area. All facilities will be assessed against the ability of the receiving environment to accommodate them in accordance with the LARES and the proper planning and sustainable development of the area.

The location of bioenergy proposals should be measured by the sustainability of the proposal having regard to the proximity of the energy source and point of demand, and the sensitivities outlined in Table 5 of this LARES. Where a proposal involves the use of energy crops as the primary source of fuel due to lack of available biomass waste, evidence should be provided as to how the energy crops will be sustainably sourced.

Hydro Energy

In recognition of the unmitigable constraints on commercial scale hydro-energy development in County Galway, this policy objective seeks to encourage small-scale hydro-energy development in County Galway.

Hydro Energy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 23 Hydro-energy development	Hydro-energy development will be supported where appropriate, and in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 24 Small-scale hydro-energy developments	Small-scale hydro-energy developments will be supported as part of the renewable energy mix in County Galway where appropriate, and in accordance with the LARES and the proper

	planning and sustainable development of the area.

Any proposed hydro-energy development will be required to demonstrate how the constraints and sensitivities outlined in Sections 5 and 9 of this LARES can be addressed and justifiably overcome.

Micro-renewable Energy

Micro-renewable energy development is recognised as a key contributor to renewable energy generation targets, particularly where it is community led. This is evidenced by the fact that the government's Renewable Electricity Support Scheme (RESS) apportions funding to such projects, alongside commercial solar and wind energy developments.

Policy Objective	Proposed Policy Objective
LARES Policy Objective 25 Micro-renewable energy developments	To facilitate and recognise micro-renewable energy developments as effective contributors to the generation of renewable energy in County Galway.
LARES Policy Objective 26 Community-led micro-renewable developments and off-grid developments	To favourably consider community-led micro-renewable developments and off-grid developments appropriate, and in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 27 Micro-renewable technologies	To actively promote and encourage the uptake of micro-renewable technologies, with particular focus on retrofitting existing developments where appropriate, and in accordance with the LARES and the proper planning and sustainable development of the area.

Micro-renewable energy development, by its very nature, will be more conducive to community ownership given the reduced level of constraints and challenges involved as opposed to large strategic renewable energy development. As such, it is of upmost importance that these policies are considered alongside the community ownership policies as micro-renewable energy developments are most suited to community ownership.

It will be important to fully consider the cumulative effect of proposed micro-renewable energy developments, as it is likely that a greater number of such developments will come to fruition going forward.

Micro-renewable energy developments proposed in the island areas and in small isolated conurbations across the County should be supported, particularly where they are likely to encourage the uptake of micro-renewables in other such areas.

Auto production

Typical technologies for the auto-production of energy include: Natural gas fuelled CHP, Biomass CHP, Anaerobic digestion CHP, Small hydroelectric installation, Wind turbine, Solar photovoltaic arrays.

In addition to micro-renewables, auto production is also a source of local renewable energy supply. The Commission for Regulation of Utilities (formerly known as the Commission for Electricity Regulation) defines auto producers as *"a natural or legal person who consumes and generates electricity in a Single Premises, where such generation is essentially for its own use in that Single Premises"*[25]. This infers that auto producers will not contribute to the wider energy needs of the County and will serve as a function of their own specific and/or personal needs. Hospitals, universities and enterprises using solar panels or a wind turbine to generate energy for their own uses are examples of such auto producers. Selling of excess renewable energy or storage of renewable energy for later use does not constitute auto production.

[25] https://www.cru.ie/wp-content/uploads/2002/07/cer0237-1.pdf

Auto production:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 28	To recognise, facilitate and favourably consider auto production as a renewable energy contributor, with particular focus on retrofitting/expanding existing developments where appropriate, and in accordance with the LARES and the proper planning and sustainable development of the area.

Auto production development will generally be suited to high energy users with immediate high energy demand. Offsetting this immediate high energy demand through renewable energy is often seen as an effective way for entities to reduce their carbon footprint. This should be supported in locations where the constraints and sensitivities relevant to the renewable energy technology applied can be addressed. Constraints and sensitivities should also be relevant to the scale of production proposed.

Marine Renewables

The LARES cannot actively develop marine renewables as the marine area, beyond the high water mark, is not within the jurisdiction of the Council. However, the LARES can consider infrastructure required to support the development of marine renewables. Given the expectation that a large amount of renewable energy will be generated from marine renewables in Ireland going forward, it is pertinent that this LARES supports the development of infrastructure required to support this. However, the intricate nature of the coastal areas with a wide variety of users and interested parties will require informed and targeted engagement with coastal and marine stakeholders.

Marine Renewables:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 29 Marine Renewable Energy	Support the ambition to harness our ocean wealth in a sustainable manner and to engage with all relevant coastal and marine stakeholders.
LARES Policy Objective 30 Supporting Infrastructure	Strategically located port facilities and land- based supporting infrastructure will be facilitated where appropriate, and in accordance with the LARES and the proper planning and sustainable development of the area.
LARES Policy Objective 31 Protection of Marine Environment	Onshore marine renewable infrastructure will generally be discouraged in areas of high ecological and environmental value in recognition of the ecosystem services derived from such natural capital.

Developments evaluated in light of this policy objective will be required to consider the policies and provisions of the Offshore Renewable Energy Development Plan, the National Marine Planning Framework, the Galway County Development Plan and any other relevant policy documents. The justification for any proposal should be guided by the Offshore Renewable Energy Development Plan.

Perspective developments should demonstrate, where relevant, how they will proportionately contribute to the requirement in the Climate Action Plan to generate 3.5GW of offshore wind by 2030.

Natural Capital and ecosystem services are referred to in this policy objective based on the understanding that natural capital relates *"to the elements of nature that produce value directly and indirectly to people, such as the stock of forests, rivers, land, minerals and oceans",* and that it *"provides ecosystem services, including the provision of food, materials, clean water, clean air, climate regulation, flood prevention, pollination, recreation and wellbeing. Since the flow of services from ecosystems requires that they function as whole systems, the structure and diversity of ecosystems are important components of natural capital. In this regard biodiversity, soil composition, land cover and land use are important*

elements to consider"[26]*.* This aligns with National Policy Objective 52 of the National Planning Framework and with the ecosystem-based approach taken in marine spatial planning and referenced in the National Marine Planning Framework.

Alternative Renewable Energy

In light of ever-improving technological advancements in the renewable energy industry, it is important to recognise and encourage emerging alternative technologies that could demonstrably improve renewable energy generation in the long term and diversify the renewable energy mix. This will improve security of supply, help to reduce reliance on fossil fuels and will facilitate the transition to a low carbon economy.

Alternative renewable energy technologies, as opposed to traditional renewable energy technologies, are primarily characterised by battery storage technologies, ground source heat pumps and air source heat pumps.

Alternative Renewable Energy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 32 Diversification of Renewable Energy Mix	To recognise and encourage the deployment of alternative renewable energy devices where they add demonstrable capacity and efficiencies to existing renewable energy developments and/or diversify the renewable energy mix of County Galway.
LARES Policy Objective 33 Alternative Renewable Energy	Alternative renewable energy developments will be supported where they are not likely to have significant impacts on the built and natural environment and can be evidently accommodated on the transmission grid network in accordance with the proper planning and sustainable development of the area.

Proposed developments should demonstrate how they will proportionately contribute to the requirement in the Climate Action Plan to generate 70% of electricity from renewable energy by 2030 and the EU requirement to generate 32% of energy from renewable sources by 2030.

Given the emphasis in these policy objectives on renewable energy transmission and renewable energy generation, it will be important to consider them in tandem with the renewable energy generation and transmission policy objectives when evaluating a proposal.

Renewable Energy Co-Location

Co-location of renewable energy in areas identified as suitable for renewable energy generation, is the most sustainable use of land for renewable energy purposes. However, if an area is identified as suitable for one type of renewable energy technology, it does not necessarily mean it is suitable for other renewable energy technologies as different sensitivities may apply. It will be important to closely consider this in light of the opportunities and challenges identified in Section 9 of this LARES.

Renewable Energy Co-Location:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 34 Co-location	To advocate for the co-location of renewable energy developments and technologies to ensure the most efficient use of land identified as suitable for renewable energy generation in this LARES.
LARES Policy Objective 35	Co-location of renewable energy development is strongly encouraged where

26 https://www.epa.ie/researchandeducation/research/researchpillars/sustainability/sustainabilitytheme3/

Co-location of complimentary renewable energy development	the developments are complimentary of each other in terms of infrastructure requirements, energy generation and spatial optimisation, in accordance with the proper planning and sustainable development of the area.

The co-location of renewable energy developments that are not complimentary of each other should be avoided.

Environmental & Ecological Assessments

Legislation requires an assessment of the likely significant environmental effects of a development before it can be permitted. Environmental & ecological assessments such as Appropriate Assessments (AA) and Environmental Impact Assessment Reports (EIAR) are the legally accepted methods for environmentally assessing developments. However, some developments will not require such assessments. An EIAR and/or AA 'screening' exercise determines the requirement for an EIAR and/or AA, providing a general overview of the likely effects and detailing the relevant thresholds that may trigger an EIAR or AA.

Analysis of planning case law in Section 5.12 shows that certain intricacies exist as to the interpretation of planning legislation relating to the environmental and ecological assessments of renewable energy developments. In particular, the analysis identifies key considerations to take into account with regard to the assessment of supporting infrastructure for renewable energy developments and the cumulative impact of renewable energy developments.

Environmental & Ecological Assessments:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 36 Environmental and Ecological assessments of renewable energy	To ensure that all renewable energy proposals/projects are appropriately assessed with relevant environmental and ecological assessments under the Habitats Directive (92/43/EEC, as amended), the Environmental Impact Assessment Directive (2011/92/EU, as amended by (2014/52/EC), the Birds Directive, the Water Framework Directive, all other relevant EU Directives and transposing legislation.

Indigenous Renewable Energy

Indigenous renewable energy is considered to be energy generated from natural resources within the boundary of County Galway.

Action 209 of the Government's White Paper 'Ireland's Transition to a Low Carbon Energy Future' 2015-2030 specifically references the need to further develop indigenous renewable energy supplies, which it identifies as 'plentiful'. This is corroborated by Section 6 of this LARES which clearly identifies renewable energy potential across County Galway. This demonstrates the ability of County Galway to develop its own indigenous renewable energy supply within the County. In light of this, and the need to transition to a low carbon economy; it is considered both prudent and necessary to prioritise developments that utilise indigenous renewable energy as the primary source of energy. Concurrently, this will help to reduce reliance on imported fossil fuels as a source of energy and will allow County Galway, and the country as a whole, to become more energy independent and self-sustaining.

Indigenous Renewable Energy:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 37 Indigenous renewable energy	To prioritise and actively encourage the generation of indigenous renewable energy in developments throughout County Galway. Proposals involving indigenous renewable energy as the primary source of energy will be considered favourably, in accordance with the LARES and the proper planning and sustainable development of the area.

Community Ownership

In their submission to the non-statutory LARES consultation, communities highlighted the need to change the role of the local community as passive consumers to active participants in the renewable energy generation and development process. The government's Renewable Electricity Support Scheme (RESS) helps to realise this ambition, with the first round of auction results in 2020 awarding funding to approximately seven renewable energy schemes involving community ownership.

The Council fully supports this ambition which requires a realignment of traditional viewpoints relating to renewable energy providers, and empowers the community at the core of renewable energy development.

Community Ownership:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 38 Community Ownership	To encourage the local community to become active participants in renewable energy generation to help drive an energy transition from the bottom up. To consider favourably renewable energy proposals involving Community Ownership, subject to the requirements of the Habitats, Birds, Water Framework, Floods and EIA Directives.

Development proposals considered under this policy objective need not be fully within community ownership, rather variable levels of community ownership should be considered acceptable. However, the larger the community ownership element, the more favourable a proposal should be considered, subject to the provision of evidence of community ownership.

In light of a government announcement in February 2021 requiring all community-led projects seeking to apply for RESS funding to be 100% community owned, community-led projects considered against this policy objective will, at first, be expected to be 100% community owned. Proposals that do not involve 100% community ownership, but rather partial community ownership, will be considered favourably relative to the level of community ownership involved.

Community benefits pertaining to renewable energy proposals should be shown to have considered and aligned with the relevant elements of the Wind Energy Guidelines and the RESS Good Practice Principles Handbook for Community Benefit Funds, once adopted.

Regional Renewable Energy Development

In recognition of the wider transboundary efforts to accommodate renewable energy in adjoining counties and beyond, this policy objective provides direction for the application of regional renewable energy policies for renewable energy developments that are either at a strategic scale, located adjacent to the County Boundary or are directly justified based on large demand growth centres outside of County Galway.

Regional Renewable Energy Development:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 39 Regional Renewable Energy Development	Renewable energy developments of either a regional or county boundary significance will be considered in accordance with Regional Policy Objectives of the RSES and of adjoining Local Planning Authorities.

Such proposals should be considered in consultation with the Northern & Western Regional Assembly and the adjoining Local Planning Authorities. The RSES, County Development Plans of adjoining counties and Renewable Energy Strategies or equivalent strategies of adjoining counties should be consulted in this respect.

For clarity, demand growth centres are considered to be energy intensive developments such as data centres or manufacturing plants, for example.

Renewable Energy Research & Development

Analysis of renewable energy development applications has shown that numerous applications have been submitted over the past 25 years for research purposes, see Appendix C of this LARES. This is reflected by the fact that the Marine Institute, GMIT and NUIG are all located in the general locality of County Galway and are actively conducting research relating to renewable energy development. The Council recognises the importance of this research in advancing renewable energy and will seek to facilitate development in relation to this, where acceptable. The Council encourages close interaction between higher education, state agencies, and enterprise to position the Region as a leader in Research and Development.

Renewable Energy Research & Development:

Policy Objective	Proposed Policy Objective
LARES Policy Objective 40 Renewable Energy Research & Development	To facilitate and support collaboration between research stakeholders and investment in renewable energy research. Renewable Energy Research & Development Proposals should be considered favourably where clear justification is provided for the proposal, in accordance with the LARES and the proper planning and sustainable development of the area.

In recognition of the short-term nature of research and development proposals, consideration should be given to permitting such developments in areas not considered suitable for renewable energy development on a strictly short-term basis, subject to the provision of a clear justification for the research to be undertaken in said location. The justification should include evidence clearly demonstrating the requirement for the research and the exceptionality of this.

Conclusion

This strategy has comprehensively identified County Galway's potential to contribute to national targets for renewable energy generation. This new assessment of energy potential has been able to use more up-to-date and detailed mapping and analysis of landscape and ecological sensitivities as well as more up-to-date mapping of wind energy availability to newer technology.

This assessment in greater detail has enabled the identification of increased areas with development potential for both wind and solar energy. It has also clarified the location and rational for those areas where such areas will not normally be permissible. These activities will provide greater clarity for developers and greater certainty for other land-uses.

Using this approach, it has been estimated that by 2030, County Galway will have the capacity to realistically and sustainably deliver over 1.5GW of renewable energy.

If achieved, this amount of energy production would make a significant contribution to the Climate Action Plan target of having 8.2GW of additional capacity by 2030.