SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Methodology for LOCAL AUTHORITY RENEWABLE ENERGY STRATEGIES

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Prepared by RPS

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1.0 INTRODUCTION, BACKGROUND & PROCEDURAL CONSIDERATIONS

1.1 Background

The Sustainable Energy Authority of Ireland (SEAI), formerly the Irish Energy Centre, was set up by the Government in 2002 as Ireland's national energy authority. Its mission is to play a leading role in transforming Ireland into a society based on sustainable energy structures, technologies and practices. SEAI has a key role in implementing measures to enable the achievement of Ireland's ambitious 2020 renewable energy target of 16% of energy consumption. Achieving this target will involve a transformation of many sectors of the energy industry and will require coordinated action from a diverse set of organisations and stakeholders.

At regional wind energy workshops which SEAI hosted in 2010, a number of local authority stakeholders stated that they would welcome assistance in the preparation of more comprehensive renewable energy strategies for their areas. In this regard, SEAI initiated a project to prepare a methodology or template to act as a guide to assist local authorities in the preparation of their Local Authority Renewable Energy Strategy (LARES) and appointed RPS to assist in this process.

To guide the development of the methodology, SEAI convened a steering group with representation from the main groups that would be directly involved with the delivery and execution of LARES. The organisations represented on the steering group were:

- The Department of Communications, Energy and Natural Resources
- The Department of Environment, Community and Local Government
- The County and City Managers Association
- The Irish Planning Institute
- The Regional Planning Authorities
- The Commission for Energy Regulation
- The National Parks and Wildlife Service
- EirGrid
- ESB Networks
- Dublin Institute of Technology, School of Planning
- The Sustainable Energy Authority of Ireland

The individual steering group members are identified in Appendix A1. SEAI would like to acknowledge and thank the steering group members for dedicating their time and efforts to participating in the LARES initiative. Seven meetings of the steering group were held during the development of the LARES template. The diverse competences of the steering group members contributed to the development of a robust and comprehensive methodology. SEAI would also like to thank the stakeholders who participated in LARES events and responded to the consultations on the draft methodology. Their contribution also improved and refined the methodology.

1.1.1 Renewable Energy Strategies for Local Authorities

Directive 2009/28/EC on the promotion of the use of energy from renewable sources establishes the basis for achieving the EU's 20% renewable energy target by 2020. Ireland's *National Renewable Energy Action Plan* (NREAP) sets out how Ireland intends to achieve our individually binding national renewable energy (RE) target of 16% of energy demand by 2020: through 40% of electricity consumption, 10% of transport energy and 12% of heat energy being obtained from renewable sources. To achieve these agreed European targets, the delivery of RE infrastructure will have to undergo substantial transformation.

In energy planning terms, 2020 is rapidly approaching. However, the Government is also looking beyond 2020 in terms of the opportunities to develop Ireland's extensive offshore RE resources, including offshore wind, wave and tidal energy, recognising that these offer rich potential over the coming decades.[1]

This methodology aims to facilitate consistency of approach in the preparation of LARES, and to assist local authorities in developing robust, co-ordinated and sustainable strategies in accordance with national and European obligations.

The methodology also aims to address the most common issues regarding RE technologies and projects. However, issues discussed are not exhaustive; local authorities should always analyse and amend in the context of their own jurisdiction and setting. It should also be noted that, while local authorities have a responsibility for their own organisational energy performance, this is not the primary focus of this methodology.

1 National Renewable Energy Action Plan 2010 (pg 6)

Local authorities increasingly deliver wind-energy strategies in response to the statutory requirement to have regard to the *Wind Energy Development Guidelines* and the increased development of windfarms across the country. The Department of the Environment, Community and Local Government (DECLG) published the *Wind Energy Development Guidelines* in 2006 for the purpose of guiding local authorities in the delivery of these plans or strategies and to facilitate the delivery of a plan-led approach to the sensitive siting of these developments. In parallel to the development of these local authority wind-energy development plans, there is a growing trend whereby some authorities are considering the development of RE strategies with a broader focus than solely wind energy. Thus, while there is no obligation to prepare a LARES, SEAI has responded to this trend by developing this methodology to support local authorities in their efforts.

It may be useful for local authorities to develop LARES when preparing County Development Plans (CDPs) and in association with wind-energy strategies, and to incorporate the strategy in part into the CDP.

There are various options in producing a LARES; these are entirely at the discretion of each local authority. The project Steering Group, however, recommends that any policies and objectives arising from the development of the LARES be incorporated into the CDP. Another option is that the LARES be produced as a standalone strategy publication. A third option is to incorporate the LARES entirely into the CDP. The extent to which a strategic environmental assessment is carried out, or required to be carried out, will be affected by the decision taken in this regard.

1.1.2 Objectives and End Users

The key objectives of this methodology were established in response to consultation at regional SEAI planning workshops and an initial inception workshop for the project held on 21st June 2011. They may be summarised as follows:

- to provide a structured approach to preparing a Local Authority Renewable Energy Strategy (LARES)
- to provide information and support to local authorities wishing to create a LARES
- to facilitate consistency in the generation of local authority renewable energy strategies
- to support local authorities in the development of specific policies and objectives in their development plans
- to assist local authorities in providing transparent information to the public and prospective developers on the future development of renewable energy within a local authority area
- to facilitate a consistent identification of key renewable energy resources and development areas by local authorities

While development management is not a primary focus or objective of this document, such guidelines could be developed as a result of the LARES development exercise and would likely prove a useful resource for local authorities, developers and the wider public.

1.1.3 Stakeholder Consultation to Date

On 21st June 2011, a Joint Steering Group and Local Authority Officers Workshop was held in Dublin. Further meetings were held and feedback was provided by the Steering Group, which includes a CCMA representative. The comments, consensus points and discussions were considered by the project team in the production of this draft document.

A formal consultation with planning authorities was then conducted, and in December 2011 the draft strategy was forwarded to local and regional authorities for review and comment. This updated draft results from the feedback received from local authority respondents and advice received from the Steering Group.

A second workshop was held in Dublin on 3rd July 2012. It coincided with the official launch of the Public Consultation on the Draft Methodology for Local Authority Renewable Energy Strategies (LARES). Consultation closed on 5th October 2012. Feedback was welcomed from affected organisations, stakeholders and individuals, and comments received were discussed by the Steering Group and Project Team, and adopted where appropriate.

1.1.4 Strategy Promotion

Following the finalisation of this report, SEAI will promote the LARES methodology with the appropriate institutions to ensure that it is communicated to and promoted with stakeholders, industry participants and the general public.

Subsequent sections of the methodology describe mechanisms through which local authorities may engage in LARES promotion and consultation, through engagement with the public, developers and other stakeholder organisations.

Local authorities may choose to initiate a consultation process similar to the CDP process. The guidance on consultation contained in the *Wind Energy Development Guidelines – DECLG (2006)* could also contribute to a consultation strategy developed for a LARES document.

1.1.5 Structure of Document

The structure of this document is presented in the graphic below:

Figure 1: Structure of document

SECTION 1

Introduction & Background

Procedural Considerations

SECTION 2

Overview of Methodology & Renewable Energy Types

SECTION 3

Steps for Preparation of Renewable Energy Strategy

– Assess Resources & Potential
– Constraints Review
– Development & Implementation of Renewable Energy Policy

APPENDICES

Glossary, Renewable Energy Types, Suggested Structure of a Renewable Energy Strategy, Renewable Energy/Land Use Interactions and Mitigation, Relevant Consultation Bodies

Section 1 – Introduction, Background & Procedural Considerations

Section 1 provides a brief introduction and overview of a proposed renewable energy strategy and the document structure. It also provides information to local authorities on the procedures and processes that may need to be followed during the development of the LARES.

Section 2 – Overview of Renewable Energy Types

Section 2 provides an overview of the most common types of renewable energy (RE) project likely to be developed in Ireland. It is intended that this initial walk-through of RE project types will enable better understanding of later sections. A brief reading list is also provided.

Section 3 – Steps for Preparation of Renewable Energy Strategy

Section 3 sets out how local authorities can prepare a LARES. It outlines the four-step methodology of compiling a LARES. It is essential that this core part of the document receive due attention during the consultation phase.

Appendices

The appendices contain a comprehensive glossary, give detailed information on RE types and consultation bodies, and provide a suggested structure for a LARES document.

1.2 Procedural Considerations

The preparation of a Local Authority Renewable Energy Strategy (LARES) involves a number of associated procedural matters which need consideration at the outset.

1.2.1 Consultation and Promotion

Consultation during the preparation of a LARES (as per Development Plan review and variation to Development Plan route) could be carried out as:

- **Public consultation** as part of a County Development Plan Review (or variation)
- In conjunction with **Strategic Environmental Assessment (SEA)** and **Habitats Directive Assessment (HDA) (Scoping) Consultation**

A non-exhaustive list of bodies suggested for consultation is provided in Appendix A.5.

The value of a LARES will be dictated by the use it is put to by project developers and other participants in the energy industry. With this in mind, it is important that there be a high level of awareness of the LARES both during the consultation phase and following its adoption. The LARES can be used as a vehicle to attract development within the local authority administrative area. Ideally, the LARES would be consulted by developers prior to any major investment in land or project development, such that the strategy forms an early and fundamental project assessment and development input.

The consultees identified in Appendix A.5, particularly the representative bodies such as the Irish Bioenergy Association and Irish Wind Energy Association, should be given notification that the strategy has been adopted so they can disseminate this information to their members.

While the extent of public consultation undertaken with the LARES is at the discretion of the local authority, it may be considered appropriate to use a consultation format similar to that of a County Development Plan; that is, public consultation may be undertaken (a) as part of the preliminary preparation for the LARES, (b) on preparation of a draft LARES and (c) on delivery of the final document. In addition, it may be considered appropriate to pursue some or all of the following activities on adoption of the LARES:

- Formal launch, with workshop
- Advertisement/publicity in local media
- Notification of adoption/highlighted coverage on local authority website
- Notification (with/without workshop) to RE industry representative bodies

1.2.2 Strategic Environmental Assessment

Strategic Environmental Assessment is the process by which environmental considerations are required to be fully integrated into the preparation and adoption of certain plans and programmes. The LARES is *not* a statutory requirement and thus a SEA is not automatically required. It is advised, however, that screening for SEA be completed in relation to the LARES as a best-practice exercise.

Where a LARES is being developed in tandem with or as a part of the development of a statutory CDP or in line with a statutory Wind Energy Strategy, this could facilitate the delivery of a SEA encompassing the Renewable Energy Strategy (the RES) within the same SEA process. This could save time, cost and effort in a local authority's delivery of the RES.

The legislation relating to SEA in the Irish context may be found in: *S.I. 435 of 2004, European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004* and *S.I. 436 of 2004 Planning and Development (Strategic Environmental Assessment) Regulations 2004*, as amended by *S.I. No. 200 of 2011, European Communities (Environmental Assessment of Certain Plans and Programmes) Amendment Regulations 2011*, and *S.I. No. 201 of 2011, Planning and Development (Strategic Environmental Assessment) Amendment Regulations 2011.*

During this process the local authority must consult with a range of designated statutory bodies. The DECLG has published guidance on the SEA Directive.[2]

The EPA ENVision atlas is also a useful tool when compiling a map of SEA constraints.

Where the SEA process is being applied to the development of a LARES, the LARES should provide information on how the SEA informed the LARES vis-a-vis options and alternatives, and also how areas were identified or excluded for the purposes of renewable energy. The SEA process allows for the identification of potential environmental impacts at an early stage of developing the LARES and can enable early mitigation of potential environmental impacts.

1.2.3 Habitats Directive and Appropriate Assessment

The Habitats Directive (Council Directive 92/43/EEC as amended) and the Birds Directive (Council Directive 79/409/EEC as amended) form the cornerstone of Europe's nature conservation policy.

Appropriate Assessment is a process that requires the competent authority to assess the possible nature conservation implications of any plan or project, alone and in combination with other plans or projects that might affect any Natura 2000 site. The requirement to undertake an Appropriate Assessment is derived

2 http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,1616,en.pdf

from Articles 6(3) and 6(4) of the Habitats Directive and Section 5 of S.I. No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011.

'Plan' and 'project' are not defined in the Habitats Directive but European Court of Justice (ECJ) case law indicates that both should be given a very broad interpretation. 'Plans' include all statutory and non-statutory land-use and framework and sectoral plans and strategies to the extent that they have the potential to have significant effects on a Natura 2000 site.

Article 6(3) requires that any plan or project that is not directly connected with or necessary to the management of the Natura 2000 site concerned but is likely to have a significant effect on it, on its own or in combination with other plans and projects, is to be authorised only if it will not adversely affect the integrity of that site.

With regard to the delivery of a LARES, the Appropriate Assessment (AA) process must be completed by the competent authority, *prior to the adoption of the strategy.* This begins with screening for AA, which should determine if significant impacts on Natura sites may occur as a result of implementation of the LARES, either on its own or in combination with other plans or projects. If screening cannot exclude, on the basis of scientific information, such significant effects, a full Appropriate Assessment, informed by the production of a Natura Impact Statement, must be carried out. Both the assessment and its conclusions should be recorded to ensure that existing and future plans or projects are not authorised if they are likely to adversely affect the integrity of a Natura site.

To assist planning authorities, the Department of the Environment, Community and Local Government (DECLG) published *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities* (2009). The European Commission also provides guidance on this topic (*Wind Energy Guidance and Natura 2000*).

While the Appropriate Assessment of a LARES should outline mitigation measures to preclude direct and indirect effects on any Natura 2000 sites from proposed RE developments outside designated areas, AA screening is necessary for individual RE projects, and a Natura Impact Statement is required, where appropriate. The LARES should provide information on how the AA screening and further processes (where applicable) informed the LARES. As discussed above, consultation is also required as part of the AA procedure, including consultation with relevant experts.

Should both an AA and SEA be required for the LARES, or where the LARES is being delivered in the context of an AA and SEA (as part of a CDP or in tandem with a Wind Energy Strategy), the local authority may consider aligning the two processes and combining the consultation activities.

1.2.4 Flood Risk Assessment

Local authorities should incorporate into the strategy guidelines on flood-risk assessments for RE developments. RE projects must be carried out in accordance with flood-risk management guidelines. Reference should be made to *The Planning System and Flood Risk Management: Guidelines for Planning Authorities, 2009* as set out by the DECLG and the Office of Public Works (OPW).

Developments should avoid flood risk areas, but where exploitable resources are present in a high-risk flood zone, e.g. on a floodplain, mitigation measures and testing should be carried out according to the flood-risk guidelines to reduce flooding potential and influence. Reference should be made to the Preliminary Flood Risk Assessments (PFRA) of each area as compiled by the OPW, the Environmental Protection Agency (EPA) and local authorities. Local authorities should be certain that the benefits from the development are justified. RE developments should only be carried out where risk can be managed and where there will not be subsequent flood risk for other areas, either upstream or downstream of the development.

Activities and requirements relating to Areas for Further Assessment (AFAs) and the outputs and activities relating to Catchment Flood Risk Assessment and Management Studies (CFRAMS) should also be given due consideration during the production of the LARES.

Local authorities may also wish to provide guidance regarding surface water drainage and storm-water management systems. It may be beneficial to consider the approaches and techniques of a sustainable urban drainage system (SUDS), to prevent runoff and pollution, whether on site or within the drainage network.

2.0 OVERVIEW OF RENEWABLE ENERGY TYPES

A brief description of the range of resource types available in Ireland is provided below, as an introduction. The purpose of this overview is to assist local authorities in the identification of future and potential renewable energy (RE) resources within their administrative area. For more detailed information on the typical environmental and land-use considerations relating to these technologies and project types, in tabular form, see Appendix A.4.

Energy contributes to three sectors: electricity, heating and transport. Ireland's National Renewable Energy Action Plan sets out the envisaged contribution from RE in each of the three sectors. The electricity sector plays the most significant role. Our overall RE target of 16% will be met from approximately 40% RE in electricity consumption, 12% in the heat sector and 10% in the transport sector. National RE targets, the NREAP and sources where up-to-date information can be accessed on these are considered in detail in section 3.1.1.3.

The various forms of RE technologies outlined below contribute to the different sectors.

In summary, wind (onshore and offshore), hydropower and solar photovoltaic are used to generate electricity, and wave and tidal have potential to do so in the future. Geothermal and biomass energy can be harnessed to contribute to both heat and electricity. Solar thermal energy is generally used for water and space-heating. Biomass is particularly useful for the heat sector (e.g. biomass-based district heating, wood chip boilers, etc), but can also be used to generate electricity. Liquid biofuels currently contribute to the transport sector, while gaseous biofuel (in the form of biomethane) may contribute to the transport sector in the future.

RE technologies are supported by government schemes and initiatives such as the Renewable Energy Feed-In Tariff (REFIT) administered by the Department of Communications, Energy & Natural Resources (DCENR) to support renewable electricity (see section 3.1 for details on RE support schemes).

2.1 Wind Energy

Onshore wind energy

Onshore windfarms currently represent the greatest contribution to the amount of RE generated in Ireland. As of September 2012, Ireland has 1,696 MW of wind connected on both the distribution and transmission systems.[3] It is envisaged that, in 2020, wind energy will contribute a substantial proportion of Ireland's renewable electricity target. According to the NREAP First Progress Report (January 2012) 3,521 MW of wind capacity will need to be installed onshore in Ireland if we are to meet 40% renewable electricity, as set out in the NREAP. This will mean an extra 1,825 MW of capacity in the next eight years.

Most of this energy generation will be from onshore wind.

Offshore wind energy

Developers and planners are increasingly considering the siting of windfarms offshore. Offshore wind generally has a higher capacity factor than onshore wind (e.g. around 40% for offshore versus 31% average onshore). Typically, offshore wind parks are considerably larger than onshore windfarms. This is to make them financially viable as the cost of manufacture, construction and maintenance of offshore windfarms is currently much higher than for onshore windfarms.

Offshore windfarms typically require higher support scheme payments than onshore wind. There is currently no domestic support scheme available for offshore wind. REFIT is available for onshore wind only. The rationale for this is outlined in the First Progress Report on the NREAP (2012) (available on DCENR's website). Currently only one offshore windfarm – at Arklow Bank (25 MW) – operates in Irish waters. This is supported under AER (Alternative Energy Requirement), a support scheme that preceded REFIT. Three offshore windfarm projects (totalling 800 MW) have received grid connection offers under the Gate 3 process. EirGrid has been examining infrastructure requirements for their connection to the grid. These projects would require development consent (foreshore licence and onshore planning) prior to commencing construction.

3 787 Maximum Export Capacity (MEC) – EirGrid TSO figures (14/12/2012); **view document**.
Plus 909 MEC – ESB Networks DSO figures (19/09/2012); **view document**.

Permitting of offshore windfarms falls under the remit of the Department of Environment, Community and Local Government for the foreshore area (out to 12 nautical miles, approx. 23km). At present there is no consenting regime for offshore wind developments beyond 12 nautical miles. Local authorities will be primarily concerned with onshore elements of offshore windfarms such as cable landfall and the onshore grid connection infrastructure to facilitate this type of project. Local authorities may also be involved as consultees during the consenting process for offshore windfarms. Local authorities may consult the *Draft Offshore Renewable Energy Development Plan* (OREDP)[4] for information on potential marine energy resources within their jurisdiction.

The DECLG is reforming the foreshore licence process under its remit and is expected to publish the general scheme of a Bill shortly. In the anticipated new regime, offshore RE processes are expected to be integrated with the consenting regime for onshore developments, with offshore renewable development of a certain size requiring consent under the Planning and Development (Strategic Infrastructure) Act 2006 (as is currently the case with onshore developments).

As set out in the NREAP, the offshore RE area, including offshore wind, potentially offers renewable electricity export opportunities for Ireland. This potential is being explored at present in the context of the Memorandum of Understanding between the Minister for Communications, Energy and Natural Resources of Ireland and the Department of Energy and Climate Change of the United Kingdom on cooperation in the energy sector as signed on January 24th 2013. The cooperation mechanisms provided for in Articles 6-11 of the Renewable Energy Directive 2009/28/EC are the only means whereby RE that contributes to member-state targets may be traded. Any export regime agreed with another country would fall under these articles and would require a legal treaty. If it is decided to pursue an export regime and negotiate a bilateral treaty, information on the treaty and export regime would be made publicly available.

2.2 Bioenergy

Bioenergy may be defined as the energy derived from biomass. The bioenergy sector will play a key role in the delivery of our renewable heat and renewable transport targets. The RE Directive categorises bioenergy into three sub-groups: biomass, bioliquids and biofuels.

Bioenergy technologies may be broken down into three sub-groups:

- Combustion – both using biomass solely, and the co-firing of biomass with a fossil fuel (most commonly used for 'dry' resources)
- Biochemical processes – including anaerobic digestion of organic residues and also fermentation and esterification in the production of biofuels
- Thermochemical processes still being developed: gasification and pyrolysis (these technologies are still maturing and may not contribute much to reaching energy targets in the short term)

The NREAP First Progress Report (January 2012) envisages that bioenergy could contribute 274 MW to our renewable electricity consumption by 2020. The REFIT 3 scheme to support 310 MW of electricity from biomass technologies opened in February 2012. Bioenergy is also estimated to contribute a further 345 ktoe[5] towards the renewable transport (RES-T) target.

Biomass

Biomass is defined in the RE Directive as the biodegradable proportion of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, including fisheries and aquaculture, and the biodegradable fraction of industrial and municipal waste.

Energy from biomass, including organic waste, is referred to as bioenergy. When plant material is burned for energy purposes, carbon dioxide is released. However, because new plant growth absorbs the amount of carbon dioxide released on combustion, bioenergy is considered to be 'carbon neutral'.

4 At time of print, the OREDP was in draft format: www.dcenr.gov.ie/

5 NREAP Ireland, First Progress Report (January 2012)

Projects involving the combustion of biomass can range in size from a domestic boiler to commercial and industrial installations. The main feedstocks are dry organic residues (e.g. wood chip and wood pellets), energy crops and the combustion of municipal solid waste in waste-to-energy facilities. The most efficient combustion processes use both the heat and electricity generated in a high-efficiency CHP (combined heat and power) process.

The anaerobic digestion of biomass can result in two end uses: the generation of heat and/or electricity, or the production of biomethane as a transport fuel or for grid injection. Multiple feedstock anaerobic digestion facilities vary from on-farm digesters to larger centralised digesters, using various agricultural and food wastes as feedstocks. Examples include: grass, slurry, food waste and the organic fraction of municipal solid wastes. Municipal sewage and landfill gas can also be used to produce heat and/or electricity. Biomethane as a biofuel is discussed further below.

REFIT 3, for up to 310 MW, for biomass technologies was introduced in 2012 following state-aid clearance. This secures REFIT rates for specified biomass technologies of certain sizes, including high-efficiency anaerobic digestion CHP and biomass CHP.

Biofuels

Biofuels may be defined as liquid or gaseous fuels for transport produced from biomass. A number of conversion techniques are used to produce biodiesel, bioethanol and biomethane. Bioliquid sources include vegetable oils (rapeseed, soya and palm), animal fats and used cooking oils. The liquids may be used to produce heating, cooling and electrical energy.

Liquid biofuels can be incorporated as blends with petrol/diesel fuels or used on their own as a replacement fuel. As set out in the NREAP, biofuels will be critical to the delivery of our renewable transport target. Under the RE Directive, every European member state must at a minimum have 10% of its transport-sector consumption from renewable sources by 2020.

The Biofuels Obligation Scheme was initiated in July 2010 under new legislation. Under this scheme, suppliers of petrol and diesel to the transport sector in Ireland must ensure that in any given year a set percentage of their supply is composed of biofuel that complies with the sustainability criteria set out in Article 17 of the RE Directive. The percentage under the obligation is currently set at 6% by volume. This rate of obligation will remain in place for 2013 and 2014 but will subsequently be increased on a sustainable basis to 2020 (in a manner which takes due account of any revision to Directive 2009/28/EC, currently under negotiation in the European Union), to meet the Renewable energy in transport (RES-T) target of 10% in 2020 and with due regard to the requirements of the Fuel Quality Directive.

Biofuels that are produced and consumed in Ireland under Article 21(2) of the RE Directive (so called second-generation biofuels) include those derived from used cooking oil (UCO), category 1 tallow (to produce biodiesel) and whey (residue from dairy products production used for bioethanol production). Biodiesel production and use from UCO and tallow has increased significantly since 2009.

Biogas

Biomethane is a biofuel which can be injected into the natural gas grid to complement or substitute natural gas and can also be compressed and used for a transport fuel. Biomethane is derived from biogas produced through anaerobic digestion (e.g. in a reactor or at a landfill). Prior to injection into the natural gas grid or to use as vehicle fuel, biogas must undergo an upgrading process, where all contaminants as well as carbon dioxide are removed and the percentage of methane is increased from the usual 50-75% to more than 95%.

Research on the production of biomethane from various biomass sources such as grasses, crop residues and municipal solid waste is ongoing. Consideration is also increasingly being given to the potential for injection of upgraded biogas directly into the natural gas grid. As set out in 3.3.1.3, the CER is planning to initiate a consultation on biogas, with regard to the technical and regulatory aspects. It is envisaged that this application of biogas has the potential to be developed further in Ireland.

2.3 Hydropower

Hydroelectricity is electricity derived from the power harnessed from the flow of falling water, typically from fast-flowing streams and rivers. The Ardnacrusha hydroelectric station is the largest hydropower facility in Ireland. The NREAP envisages 234 MW of hydroelectricity contributing to our RE 2020 target,[6] mostly from the existing large hydro plants. There are also many smaller hydroelectric plants in operation across the country. A 1985 report by the Department of Energy identified potential for further small hydroelectric developments.[7] [8] A REFIT tariff is available for hydro plants of 5 MW or less, and a number of such plants have joined the original scheme.

There are also a number of ongoing initiatives to examine the possibility of 'pumped storage' schemes to provide reserve and responsive power when required. The pumped-storage scheme at Turlough Hill, Co Wicklow is an example of this type of project. However, under the RE Directive, pumped storage is not considered an RE technology and is not counted towards our national target.

2.4 Solar Energy

Solar energy uses the sun's energy for power or heat production. There are two main forms of solar energy extraction: thermal solar energy (passive and active) and photovoltaic. The 2010 NREAP does not envisage solar power making a contribution to Ireland's 2020 renewable electricity targets, and it is estimated that solar power will contribute just over 20 ktoe towards our renewable heat target. However, market trends suggest that we may see increased solar energy installations in the period to 2020. Much of this will arise from the ongoing use of solar thermal panels in the domestic and commercial sector. More information on microgeneration is provided in Section 2.8 below.

Solar energy is not a resource that is currently supported under the REFIT scheme. However, should the technology become more cost-competitive in the future, it may be included at a later date, subject to government decision and state-aid clearance. Electric Ireland's microgeneration tariff for the domestic sector has supported solar power for the last number of years, while previous grant schemes run by SEAI for the heating sector have to date supported thermal solar energy.

Solar thermal energy

Solar panels transform solar energy into heat. A solar thermal energy system can provide both water and space heating, although it is predominantly used for water heating at present. Solar water heating is currently the most common application of active solar thermal in Europe.

'Passive' solar heating is a method of building design to maximise solar gains and minimise heat losses. 'Active' solar heating is one of the primary ways for buildings to use solar energy.

Photovoltaic

Photovoltaic (PV) solar energy is the generation of electricity from solar radiation. In essence, photovoltaic systems use daylight (not necessarily direct sunlight) to convert solar radiation into electricity. The light that shines on the semiconductor or the PV cells creates an electric charge. Silicon is the most common semiconductor material used in PV cells. PVs respond to both direct radiation (i.e. direct sunlight) and diffuse radiation (i.e. through cloud cover), and their output increases with increasing irradiance.

2.5 Ocean Energy

Ocean energy generally refers to electricity extracted from the waves and tides (tidal current or tidal barrage). Wave and tidal technologies are not yet commercially viable and are still at the RD&D stage worldwide. Ireland has operated an ocean-energy programme since 2008, through an ocean-energy unit established in SEAI. The programme has provided research, development and demonstration funding for this sector through a Prototype Development Fund and has provided funding for the wave-tank facility in University College Cork, the Galway Bay quarter-scale prototype test site for wave energy

6 NREAP Ireland First Progress Report (January 2012)

7 Small-Scale Hydro-Electric Potential of Ireland; Department of Energy: www.seai.ie/

8 ESBI/ETSU (1997), Total Renewable Energy Resource in Ireland, Final Report, March 1997. European Union ALTENER Programme, Report No. PA598-R2-001.

operated by the Marine Institute, Co Galway, and pre-planning work for the development of a full-scale wave-energy test site at Belmullet, Co Mayo.

The NREAP has factored 75 MW[9] of ocean energy into the modelled scenario for 2020. This is in expectation that the technology will be commercially and technologically viable by that stage. Should the technology be developed to effectively harness wave and tidal energy, Ireland has a strong natural advantage and could capitalise on this. State-aid clearance has not yet been sought for a REFIT for wave and tidal energy.

Wave energy

The kinetic energy contained in waves can be extracted and converted into electricity. The average wave height off the coast of Ireland is 2.5 to 3 metres. The power generated is a function of the wave height, length, speed and water density. Many different prototype devices for the capture of wave energy have been developed by companies. The European Commission has included ESBI's Westwave project in the NER 300 scheme.[10]

Tidal energy

Tidal energy in an appropriate location can provide a reliable and predictable energy resource due to the predictability of tidal streams. The two main types of tidal energy extraction are tidal barrage systems and tidal stream-flow turbines. Barrages, usually located across a tidal inlet, capture the energy of the tidal movement by creating a barrier and channelling it through turbines. Tidal stream-flow turbines are located beneath the ocean surface and can be submerged so they are not seen or heard. They operate on the same principle as wind turbines but, as water is a great deal denser than air, tidal turbines generate more energy for a given rotor size. Similarly to wave devices, there is a broad and diverse range of technologies under development for harnessing tidal energy. A 1.2 MW tidal device has been successfully operating since 2008 in Strangford Lough in Northern Ireland.

9 NREAP Ireland First Progress Report (January 2012)

10 http://ec.europa.eu/clima/news/articles/news_2012121801_en.htm

Offshore wind, wave and tidal energy

The DCENR has developed a Draft Offshore Renewable Energy Development Plan which describes the policy context for development of offshore wind, wave and tidal stream energy in Irish waters for the period to 2030. In accordance with EU Directive 2001/42/EC of the European Parliament and of the Council on the Assessment of the Effects of Certain Plans and Programmes on the Environment ('the SEA Directive'), a Strategic Environmental Assessment has been prepared to evaluate the likely environmental effects of implementing the plans to develop offshore renewable (offshore wind, wave and tidal) energy in Irish waters. A Natura Impact Assessment has also been prepared. These documents represent excellent reference material for further information on offshore RE development.

2.6 Geothermal Energy

Geothermal energy means energy stored in the form of heat beneath the surface of solid earth. It is generally classified as either 'deep' or 'shallow' depending on the depths involved. Several studies are being carried out at present to assess the resource potential of renewable energy, such as the *Play Fairway Analysis of the Geothermal Potential of Ireland*, which provides a ranked risk assessment of exploration of geothermal energy resources on a regional scale, based on assessing the presence of an energy source, a reservoir and insulator layers as pre-requisites for a developing a successful geothermal system.

IRETHERM and the Geological Survey of Ireland Shallow Geothermal Energy Project are other sources of information on geothermal energy that may be of use to local authorities.

Deep geothermal energy

Deep geothermal energy (typically classified as being greater than 400m in depth,[11] but generally installed on a 'kilometre depth' scale) may be used for both thermal and electricity generation. The centre of the earth has a temperature of around 4,200 degrees Celsius. Most of this heat arrives at the

11 Geothermal legislation is in preparation in Ireland – http://www.dcenr.gov.ie/Natural/Exploration+and+Mining+Division/Geothermal+Energy+Legislation/ Under the proposed legislation, the Minister will be able to introduce regulations setting out the criteria to apply e.g which types of geothermal development might be exempted etc.

surface of the earth at too low a temperature to be used for heating or power generation activities, so drilling is required to harness this resource.

There is currently no deep geothermal electricity generation in Ireland and REFIT is not currently available for geothermal power. Recent tests have indicated that depths of up to 4km might be required in Ireland to harness deep geothermal power. This is far deeper than geothermal power harnessed in Iceland or the better sites on mainland Europe, and is likely to be expensive to access. The indicative depths required for development of deep geothermal electricity in Ireland would affect the viability of such projects, unless a substantial grant or much higher feed-in-tariff than is provided to other renewable technologies were made available, or unless the development were built beside a substantial heat demand that could make the project commercially viable, without substantial support schemes. Technology for electricity generation from lower temperatures is being researched; thus, although a depth of 4km is estimated as necessary for electricity generation in Ireland at present, this depth may reduce as technology evolves.

The modelled electricity scenario in the NREAP does not envisage electricity from deep geothermal sources contributing to our 2020 target.

Shallow or ground-source geothermal energy

Shallow geothermal (also known as ground-source) energy can be harnessed by either 'closed' or 'open' loop systems and is most frequently used for providing heat. It can also be used for cooling purposes.

Closed-loop geothermal systems operate by circulating a heat transfer fluid around a sealed pipe network which is buried in the ground in either a vertical or horizontal configuration. Closed loops may be installed into purpose-drilled boreholes, structural foundations, ponds or purpose-dug trenches.

Open-loop geothermal systems typically operate by pumping water into and out of an aquifer. Geothermal energy is extracted through heat pumps, typically gaining between 2.5 and 4 times as much energy (in the form of heat) as is used (in the form of electricity).

Shallow geothermal energy can be found virtually anywhere and has been successfully harnessed by homes and commercial and recreational buildings in Ireland for heating purposes. There are now more than 6,500 ground-source energy systems in Ireland.

A current project at the Geological Survey of Ireland partly involves the development of a national geothermal energy installations database. More information can be found on the GSI website (**http://www.gsi.ie/**). Over 250 MW of installed capacity already exists and there is considerable potential for further development.

Geothermal energy may also be used for renewable heat in district heating systems. Local authorities could consider the potential for district heating systems from renewable sources (including biomass and geothermal) when considering new developments or retrofitting existing developments.

2.7 Combined Heat and Power

Combined heat and power (CHP) is a technology that uses the energy produced in the combustion of fuel to produce both useful heat energy and electricity. CHP can refer to gas-fired CHP or biomass CHP. Biomass CHP is a form of RE.

In many scenarios, CHP increases the total amount of useful energy that is produced from a fuel when it is burned. However, the ratio of production of heat and electricity from a CHP unit is often fixed – i.e. when you turn the unit up or down to get more of one type of energy, you automatically get more of the other. For this reason, it is important that, with CHP units, careful consideration is given to the 'demand' for energy that the unit is trying to satisfy in terms of both electricity and heat.

While the development of CHP units is often associated with industries and commercial entities that have constant or predictable heat and electricity demand, the application of CHP is now becoming more widespread across a broader range of uses.

New REFIT tariffs for biomass technologies specifically reserve a set number of MW for biomass high-efficiency CHP.[12] The first progress report on the NREAP (January 2012) envisages a

12 The CER is responsible for certification of HECHP. Further information is available at www.cer.ie

change in the contribution in biomass (now expected to be 274 MW, up from 153 MW in the original NREAP) due to the inclusion of additional high efficiency biomass CHP, in view of the introduction of the new REFIT scheme for biomass technologies.

2.8 Microgeneration & Autoproduction

A range of small- and micro-scale energy generation technologies – including wind, solar thermal, solar photovoltaic (PV), geothermal, air-source heat pumps and hydroelectric generators that can contribute to the sustainability and security of energy supply have emerged in recent years. Such generators can be suitable for directly serving the electricity and heat needs of consumers on scales ranging from individual residences to small business or industrial premises.

Electric Ireland, on a commercial basis, operates a limited domestic feed-in-tariff for microgeneration under specified conditions. No other electricity suppliers have opted to enter the microgeneration market to date and there is no other support scheme available at present. The DCENR and SEAI are currently examining policy options around the microgeneration sector and how it might be taken forward. Those wishing to connect microgeneration may do so by complying with the conditions for connecting microgeneration set out by ESB Networks on their website.

Depending on their cost-effectiveness and user appeal, certain types of these technologies may see rapid market uptake in the coming years and contribute to energy and environmental policy objectives. SEAI implemented the Small- and Micro-Scale Generation Programme and pilot field trials to assess the potential of some of these generators to contribute to energy supply, and to monitor their performance.

There is no universally agreed definition of microgeneration, but it is generally accepted to apply to very small-scale electricity generators with an electrical output of less than 50 kWe. The definition has also been extended to renewable heat energy-generating technologies; for example, in the UK, microgeneration is defined, in section 82 of the Energy Act 2004, as the small-scale production of heat and/or electricity from a low-carbon source. There are some provisions in legislation and standards adopted in Ireland, key among these being:

- The European CHP Directive (2004/8/EC), was brought into law in Ireland in S.I. 298 of 2009, which brought Section 6 of the Energy (Miscellaneous Provisions) Act 2006 into operation. It applies to micro-CHP plants with a maximum capacity of less than 50 kWe, and thus would cover domestic and small commercial and industrial applications.
- The CENELEC Standard EN50438 was adopted by the CER in a decision paper for microgeneration in Ireland.[13] It applies to equipment rated up to 16A per phase for three-phase (11 kWe), or up to 25A for single-phase (6 kWe), which covers primarily domestic and very small commercial applications.

For electricity generation, a number of microgeneration technologies may be used; for example, a wind turbine, photovoltaic panels, micro-hydro (scaled-down version of hydro-electricity station), micro-CHP (fuelled by biofuels), or a combination of these. In general, there are two key types of these microgenerators that produce electricity:

1. Stand-alone systems – designed to operate in conjunction with a battery bank and/or other backup generation to supply on-site demand only

2. Grid-connected systems – where excess generation can be sent to the grid and in times of low generation electricity can be drawn from the grid

For heat generation, a range of technologies – including geothermal, solar thermal, small-scale biomass and air-source heat pumps – are in common use across the country. These are most often implemented on a building-scale basis, without reference to a larger heat distribution grid, although in certain cases a heat distribution system may be connected to renewable heat generation.

The microgeneration of RE does not necessarily fall under the same planning process as larger-scale projects, and the terms can vary between domestic, agricultural and industrial installations. Local authorities should be aware of the exemptions for microgeneration set out in S.I. 83 of 2007 and S.I.

13 Arrangements for Micro Generation: Decision and Response to Comments Received, 20th November 2007, CER/07/208 (http://www.cer.ie/)

235 of 2008, and the restrictions on these exemptions as per S.I. 600 of 2001. Projects that do not fall under the exemptions must seek planning permission.

A thorough description of micro and small-scale generation technologies is available, alongside a detailed review of relevant planning exemptions, on the SEAI website: **www.seai.ie/Renewables/Microgeneration/**

Local authorities with a greater proportion of urban environment could facilitate the use of RE through promoting microgeneration in their area. Part L (Conservation of Fuel and Energy) of the Second Schedule to the Building Regulations includes requirements on sourcing a reasonable proportion of energy in new buildings from RE sources. There is some precedent in this regard where local authorities have requested that developments incorporate a defined level of energy and carbon intensity performance over and above the Building Regulations. It is recommended that any local authority following this approach consult both the SEAI website and the Draft Building Regulations in order to understand fully the technological, planning and regulatory context for small-scale renewable.

The Triple-E product register, available through the SEAI website, is a benchmark register of energy-efficient products. The register provides a great resource for identification of products that meet a minimum set of stringent efficiency criteria and typically will be of a best-in-class efficiency standard.

S.I. 201 of 2012 provides, inter alia, for the refund of VAT paid by farmers on qualifying equipment, purchased from 1st January 2012, for the purposes of micro-generation of electricity for use in a farm business.

Generators with an installed capacity of 1 MW or less are deemed to be automatically authorised and licensed by the energy regulator (CER) under the terms of S.I. 383 and 384 of 2008 and are subject to the conditions in those orders.

ESB Networks have a specific section on their website dealing with the process for connection of microgeneration at **http://www.esb.ie/esbnetworks/**

2.9 Additional Information on Renewable Energy Types

The above section is a general introduction to the most common types of RE that are likely to be presented to local authorities. Further information can be found in a range of resources. A primary source is the SEAI website and online library of research: **www.seai.ie/Publications/Renewables_Publications/**. Some noteworthy factsheets, accessible in the publication portal of the website, are:

- Anaerobic Digestion Factsheet
- Best Practice Guide for PV (Solar Energy)
- Biomass Factsheet
- Biofuels for Transport Factsheet
- Co-firing with Biomass
- Energy from Waste
- Landfill Gas in Ireland – the Facts
- Small-Scale Hydropower
- Wind Energy Factsheet
- Your Guide To Connecting Micro-generation to the Electricity Network

The SEAI also has a comprehensive archive of case studies for each of the RE types, available in the publication portal of its website. Further information and links to data sources are provided in section 3.2.2.1.

Local authorities may also wish to consult further material specifically focused on the assessment of RE resources; for example; *Renewable Energy: Power for a Sustainable Future* (2012) by Godfrey Boyle.

Some RE resources, such as wave and tidal, are at the early stages of development from both a technological and a commercial point of view. While local authorities should be aware of this when formulating and targeting policies to support the development of RE, it is important to keep in mind that robust policy support can also encourage the development of new renewable technologies.

It should also be noted that some RE technologies, such as offshore wind, wave and tidal energy, do not fall entirely under local authority jurisdiction. The process for project development is different for offshore renewable energy, and a foreshore licence/lease may be required. This should not deter local authorities from assessing the potential of offshore RE as part of their LARES, as certain project components that are required onshore to facilitate these developments could fall within local authority jurisdiction. Local authorities should consult the draft Offshore Renewable Energy Development Plan Strategic Environmental Assessment for further information.

3.0 STEPS IN PREPARING A RENEWABLE ENERGY STRATEGY

This section sets out recommended steps to prepare a LARES. Four main sequential steps are outlined, sub-divided into smaller activities. These four main steps are summarised in the graphic below.

These steps should be read with reference to Figure 2 and Appendix 6.

Figure 2: LARES Development

	ACTIVITY	OUTPUT	PUBLIC CONSULTATION
PRELIMINARY PHASE	Define Requirement for LARES	Mandate to proceed with production of LARES	
	AA and SEA Screening	Decision on requirement to proceed with SEA and AA	
STEP 1	Renewable Energy Policy Review	Understanding of Renewable Energy Policy Drivers and "Snapshot" of Current Policy for inclusion in Renewable Energy Strategy	Consultation on LARES Issues Paper
STEP 2	Renewable Energy Resource Assessment	Understanding of available Resources within a Planning Authority area and Constraint and Success Factors for utilising those Resources	
STEP 3	Analysis of Constraints and Facilitators	Definition of 'Planning Authority area Renewable Energy Resource'	
STEP 4	Develop Renewable Energy Policy	Definition of Renewable Energy Policies	Draft LARES Consultation
		Definition of Planning Authority Aims and "Expectation" of Proposed Projects	
		Definition of Status of Renewable Energy within the Planning Authority area	
		Mapping where appropriate	Final LARES Consultation
		Definition of Planning Authority area Renewable Energy Objectives	

3.1 Step 1: Policy Context

A LARES needs to be developed within the local, regional, national and European policy context. This initial step is vital to make sure that a concrete set of assumptions is developed for the strategy and to ensure the validity of the strategy in the context of national and European obligations.

3.1.1 Undertake Policy Review

Nationally and at European level, the development of RE sources, together with measures aimed at reduced and more efficient use of energy, are priorities on both environmental and energy policy grounds.

It is important that, during the preparation of RE strategies, local authorities consider their production in the context of the national legally binding requirement to increase the contribution to energy demand by RE sources from 6.4% overall at end 2011 to 16% overall by end 2020.

The share of energy from renewable resources expressed as a percentage of gross final consumption was 3.1% in 2005; the target set for Ireland in terms of gross final energy consumption is 16%. The following table outlines the national overall target for the share of energy from renewable sources in gross final consumption of energy in 2020 and our progress towards that target in 2005 and 2011 (split into electricity, transport and heat).

Table 1: Progress towards national target for share of RE in gross final consumption

	2005	2011	2020**
Renewable – Heating & Cooling (%)	3.5%	4.8%	12%
Renewable Electricity (%)	6.9%	17.6%	40%
Renewable Transport (%)	0.0%	2.6%	10%
Overall RE share (%)	3.1%	6.4%	16%

** Under Directive 2009/28/EC, Ireland is legally obliged to ensure that 16% of all energy consumed is from renewable sources across the electricity, heating and transport sectors by 2020, with a minimum of 10% to be achieved in the transport sector. The sectoral division in the table is derived from Ireland's National Renewable Energy Action Plan.

To provide the broad context and rationale for preparing a LARES, it is recommended that the context for the strategy be set out in a hierarchy of international and national legislation and policy. While there is no statutory obligation to prepare a LARES, it should be delivered in line with these drivers.

A summary of the current relevant policy and legislation in respect of RE is provided below. It is important that the relevant legislation and policy context be reviewed by local authorities when preparing their LARES to ensure it is up to date. The LARES should also take account of the relevant policies and programmes of government departments and agencies. Local authorities should thus be familiar with national policy documents and programmes, and if necessary should consult the relevant bodies when preparing their LARES.

This section of the document should be used as a foundation for the appropriate chapter in a strategy document. The reader is advised to seek out the primary source for all policy and legislation to ensure the most up to date version and amendments are taken into account during the production of their own document.

Several energy-specific documents are detailed below. Local authorities should complete and expand the text below with other relevant regional and local policies as appropriate.

Local authorities may wish to engage in initial public consultation at this pre-draft stage – i.e. once a policy review has been undertaken and the main LARES issues, from the local authority perspective, have been identified.

3.1.1.1 Summary of EU and Irish Guidance and Policy Documents

Strategy for Renewable Energy 2012-2020

On 28th May 2012 Minister Pat Rabbitte launched the *Strategy for Renewable Energy 2012-2020*. The document discusses five key strategic goals reflecting the main dimensions of the RE challenge up to 2020, as follows:

- Progressively more renewable electricity from onshore and offshore wind power for the domestic and export markets
- A sustainable bioenergy sector supporting renewable heat, transport and power generation

- Green growth through research and development of renewable technologies, including the preparation for market of ocean technologies
- Increase in sustainable energy use in the transport sector through biofuels and electrification
- An intelligent, robust and cost-efficient energy networks system

To view the strategy document, go to **www.dcenr.gov.ie/**

Kyoto Protocol

The *Kyoto Protocol* establishes legally binding commitments for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride), and two groups of gases (hydrofluorocarbons and perfluorocarbons) produced by industrialised nations, as well as general commitments for all member countries.

Ireland ratified the Kyoto Protocol on 31st May 2002, along with the EU and all other member states. As a result, it is legally bound to meet the greenhouse gas (GHG) emissions reduction target. Under the protocol, Ireland's target is to limit the increase in emissions to 13% above 1990 levels by the first commitment period, 2008-2012.

The objectives of the Kyoto Protocol are complemented by European directives and schemes such as the Large Combustion Plant Directive[14] and the EU Emissions Trading Scheme (implemented in 2005).

Directive 2009/28/EC on the promotion of the use of energy from renewable sources

This Directive (the RE Directive) sets out to ensure that 20% of EU energy consumption will come from renewable resources by 2020, with each country being assigned a legally binding individual target. The Directive required that member states prepare a National Renewable Energy Plan by June 2010. The Directive's specific target for Ireland is that 16% of the national gross final consumption of energy will comprise energy from renewable sources by 2020 across the transport, heat and electricity sectors, with a minimum of 10% of RE consumed in transport.

The Directive requires member states to implement measures facilitating the supply and use of energy from renewable sources at all scales of operation. The National Renewable Energy Action Plan (NREAP) sets out how we will achieve our overall 16% target across the electricity, heat and transport sectors. The Biofuels Obligation Act 2010; S.I. 33 of 2012; S.I. 147 of 2011 and S.I. 158 of 2012 transpose the RE Directive.

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

The White Paper describes the actions and target for the energy policy framework out to 2020, to support economic growth and meet the needs of all consumers. It sets a clear path for meeting the Government's goals of ensuring safe and secure energy supplies, promoting a sustainable energy future, and supporting competitiveness. The Government has also made a number of commitments related to renewable electricity microgeneration; namely, to provide a REFIT for microgenerators wishing to produce electricity for their own homes, farms and businesses, and to facilitate them to sell surplus electricity to the grid. The RE Directive became legally binding since the White Paper was published in 2007. A new government white paper on energy policy is anticipated in the short term.

The National Renewable Energy Action Plan (NREAP) (July, 2010) / First Progress Report on the NREAP (January, 2012)

It was a requirement under Article 4 of the Renewable Energy Directive (Directive 2009/28/EC) that each member state submit a National Renewable Energy Action Plan (NREAP) to the European Commission, setting out the expected trajectory towards the achievement of the member state's target, assigned under the Directive. Ireland submitted its NREAP to the Commission in July 2010. It illustrates how the binding overall target of 16% renewable energy by 2020 assigned to Ireland under the Directive will be met across the electricity, heating and transport sectors.

The overall binding target will be delivered by approximately 40% consumption from renewable sources in the electricity sector (RES-E), 12% in the heat sector (RES-H) and 10% in transport (RES-T). The NREAP is available on the DCENR website, along with the First Progress Report on the NREAP, which was submitted to the Commission in January 2012.

14 Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (the LCP Directive).

It is important that local authorities set their ambition with regard to RE in the context of the NREAP and progress reports on it, and identify their ability to contribute to these targets, particularly in the context of the large variety in levels of RE resources that are available in different local and regional authority areas. A progress report on the NREAP is submitted to the European Commission every two years (the first one was submitted in January 2012), and is available on the DCENR website.

It is recommended that RE strategies provide information on progress towards meeting national targets in order to keep this ultimate goal firmly in mind at all times. SEAI's *Energy in Ireland* report provides annual updates on the use of Ireland's energy resources.

Energy (Biofuel Obligation and Miscellaneous Provisions) Act 2010

This Act was introduced to ensure the penetration of liquid biofuels into the mainstream transport fuel market. Through an obligation scheme, the Act ensures the incorporation of these biofuels into the transport fuel mix. Fuel suppliers are currently obliged to supply an average of 4% biofuels in their annual fuel sales. This will be periodically increased in line with the Fuel Quality Directive. Sustainability criteria for biofuels must be adhered to in line with S.I. 33 of 2012.

The National Climate Change Strategy (2007-2012)

Published in 2007, this strategy includes measures put in place by the previous National Climate Change Strategy 2000, the National Development Plan 2007-2013, Transport 21, the Energy White Paper and the BioEnergy Action Plan, which will enable Ireland to meet its commitments under the Kyoto Protocol in the period 2008-2012.

National Energy Efficiency Action Plan: *Maximising Ireland's Energy Efficiency,* 2009–2020 (NEEAP) / *Ireland's Second National Energy Efficiency Plan to 2020/ Directive 2012/27/EC*

The NEEAP aims to create a 20% more energy-efficient Ireland. Targets include: reducing public sector energy consumption by 33%, and providing tax incentives to businesses and grants to residences to increase energy efficiency. A second, revised NEEAP will be published in due course.

The NEEAP helps to shape the backdrop against which RE projects are delivered. It raises the profile of energy performance generally and directly influences the levels of demand for energy that will be satisfied by RE projects. In industry and the commercial sector, RE investment is commonly accompanied by work on energy efficiency and management.

The modelling on which the National Renewable Energy Action Plan (NREAP) was developed assumes that Ireland will meet the energy efficiency targets set out in the NEEAP. In the event that we do not reduce our energy consumption as envisaged, greater amounts of RE will be required to deliver our legally binding RE target.

The levels of RE contribution by different technologies outlined in the NREAP (published July 2010; mentioned earlier) may alter as our national demand changes and our performance in relation to the NEEAP is monitored. It is a requirement of the RE Directive that biannual reports on the NREAP and progress towards the 2020 targets be published. The first of these biannual reports was published in January 2012 and they will be produced every two years. They will indicate any significant changes in the NREAP. The reports are published on the DCENR website (**www.dcenr.gov.ie**).

The new Energy Efficiency Directive (2012/27/EU), which amends and subsequently repeals the Cogeneration Directive (2004/8/EC) and the Energy Services Directive (2006/32/EC), was formally adopted by the Council of Ministers and European Parliament in October 2012. This translates elements of the European Efficiency Plan into binding measures on Member States, including an annual rate of renovation for central Government buildings of 3%; an inventory of central Government buildings with a total useful floor area over certain thresholds; an obligation on public bodies to procure products, services and buildings with high energy efficient performance; metering and billing information for consumers; the promotion of efficiency in heating and cooling; obligations on industry relating to energy audits and energy management systems and a common framework for national energy savings obligation schemes equivalent to annual energy savings of 1.5% of energy sales.

Ireland's second National Energy Efficiency Action Plan to 2020.

The second Action Plan launched in February 2013 provides a progress report on delivery of the national energy savings targets implemented under current EU requirements as well as

energy efficiency policy priorities between now and 2020. The second Action Plan reaffirms Ireland's commitment to a 20% energy savings target in 2020. Recognising that the Government must lead by example, there is a commitment to achieving a 33% reduction in public sector energy use.

The second Action Plan follows a similar approach to its predecessor, identifying realisable but ambitious actions across six areas: Public Sector, Residential, Business, Transport, Energy Supply, and Cross-Sectoral. It contains 97 actions (the first NEEAP contained 90 actions which have been reviewed, updated and deleted as appropriate).

- Key actions, a number of which are well underway, include:The continued delivery of the Better Energy programme, including energy saving targets for energy suppliers (Voluntary Agreements in place; transition to PAYS (Pay as You Save) a priority);
- A domestic PAYS scheme (detailed design phase underway);
- Non-domestic PAYS (Energy Performance Contracting Framework to be published end-March; Energy Efficiency Fund launched; Call for exemplar projects announced)
- Inventory of public buildings (to commence in 2013);
- Three year energy strategies to be published by all public sector bodies;
- Monitoring and reporting system launched for the public sector (achieved);
- Implementation of the Recast Energy Performance of Buildings Directive and improved energy performance Building Regulations for Buildings other than Dwellings (New BER Regulations introduced, work on Nearly Zero Energy Buildings Plan substantially progressed, cost optimal methodology work underway).

The NEEAP sets a clear vision for each of the sectors covered by the Action Plan, around which public and private sector actors can mobilise. The Department has reviewed, updated and replaced certain actions from the first Plan as appropriate to ensure we remain on track to meet our national and EU targets.

Bioenergy Action Plan for Ireland (2007–2020)

The Bioenergy Action Plan sets out an integrated strategy for collective delivery of the potential benefits of bioenergy resources across the agriculture, enterprise, transport, environment and energy sectors. It will require sustained multi-agency collaboration, at national, regional and local level, working in strategic alliances to ensure that we realise this potential. It is a key component of the Government's objectives under the Energy Policy Framework 2007-2020.

National Development Plan (2007-2013) (NDP)

The NDP intends to build on the progress made in the area of sustainable energy under the previous NDP 2000-2006 by investing some €276 million under the Sustainable Energy Sub-Programme over the period 2007-2013. Investment in the sustainable energy sector during this period will include:

- **Renewable energy measures:** The primary focus will be on the large-scale deployment of wind, the emerging potential and deployment of biomass and biofuels, preparatory action on ocean energy, and deployment of other technologies such as solar and geothermal. Deployment will be delivered through a range of supports including taxation, direct grant aid and other funding or support mechanisms.
- **Energy efficiency measures:** The overall objective is an annual saving of at least 1% of energy use across the economy.
- **Integration and innovation measures:** These primarily focus on integrating sustainable energy practices and structures into public policies, and the development of regional and national infrastructures. There will be two sets of activities: the integration of national sustainable energy policy measures at a regional and city level, and the smaller-scale piloting and evaluation of sustainable energy technology options, including those in the RE, energy efficiency and urban transport areas.

National Spatial Strategy 2002 (NSS)

The NSS is the 20-year strategic vision for the spatial development of Ireland. It is the aim of the NSS to enable all sectors of the economy to plan future investment in a better-informed way. This more coherent planning strategy will benefit the entire country.

The NSS does not replace or repeat environmental policies generally. However, development arising from the NSS will be implemented within the framework of strong and determined policies for the protection of the environment and policies to integrate environmental considerations into sectoral policies. It is a key infrastructural principle of the NSS that achieving spatial balance through developing the potential of areas will enhance the capacity for the movement of people, goods, energy and information between different places.

Physical networks of infrastructure such as roads, public transport, energy and communications are of particular relevance to the NSS, since they have a spatial impact and also influence the location, timing and extent of development.

Support for indigenous RE supply will enhance both the robustness and choice of energy supplies across the regions, as per the aims of the NSS, thereby enabling the growing demand for electricity to be met with greater security of supply and removing any potential constraints for further economic growth.

Planning and Development Acts 2002–2010 and the Planning & Development Regulations 2001–2012

Planning and Development (Strategic Infrastructure) Act 2006

The 2006 Planning and Development (Strategic Infrastructure) Act deals with strategic development and strategic infrastructure. It provides for, among other things, the establishment of a streamlined consent procedure for certain types of major infrastructure and the creation of a specialised division within An Bord Pleanála to take decisions in relation to such projects.

The Act provides a list of the development types that are considered to qualify for this treatment, including a range of RE infrastructure *and* the supporting infrastructure that can facilitate the deployment of RE projects (such as power lines above a certain scale/rating).

The Act is designed to ensure co-ordination between local, regional and national approaches that balance local interests with the national imperative to deliver strategic infrastructure. The policies and zoning objectives that affect a specific project remain the responsibility of the local planning authority. The local planning authority remains an important stakeholder in the process and in many cases is the main beneficiary of the overall outcome of a specific energy or electrical project.

Planning and Development (Amendment) Act 2010

This Act builds on provisions of previous acts in terms of RE planning.

Local authorities should also consult the Building Regulations (Part L Amendment) Regulations 2008, which detail requirements and aims for new buildings regarding energy efficiency, CO_2 emission reduction, energy performance and RE microgeneration.

Draft National Landscape Strategy

The draft National Landscape Strategy aims to map out paths towards sustainable development and management of our national – human and natural – resources. The strategy, in line with the European Landscape Convention, aims to seek a balance between management, planning and protection of a landscape. Local authorities should be aware of the strategy objectives during the preparation of a LARES.

3.1.1.2 National Renewable Energy Support Schemes

As described briefly in section 2.0, there are a number of support schemes designed to support the development of RE. More information on these can be found in the National Renewable Energy Action Plan.[15] Support schemes for RE will vary and be subject to change over time; local authorities should review information on current schemes when preparing RE strategies.

In the electricity sector, the main support scheme is the REFIT scheme. This currently supports onshore wind, hydro, biomass, landfill gas, anaerobic digestion, biomass high-efficiency CHP, biomass combustion and biomass co-firing. Other support schemes are available (as mentioned above), such as the prototype development fund of grants for the wave and tidal sector. The Prototype Development Fund is administered by the SEAI; more information can be found on its website.

In the transport sector, the biofuel obligation scheme requires specified volumes of blending of biofuels in petrol and diesel. A consequence of this obligation is that developers may be motivated to produce biofuels as they know that biofuels are required by suppliers to meet their obligation. The Department of Agriculture runs an energy crop scheme, providing grants

15 www.dcenr.gov.ie/

for the production of willow and miscanthus. Grants are also available for electric vehicles.[16]

The heat sector is supported indirectly through REFIT for biomass technologies. While REFIT is only payable on metered electricity exported, a number of biomass technologies also support renewable heat production; e.g. biomass high-efficiency CHP. The Better Energy programme of grants for households also supports solar thermal energy.[17]

There are a number of government tax reliefs such as the Employment and Investment Incentive, section 486b of the Tax Consolidation Act, and the Accelerated Capital Allowance (ACA) scheme that can be of direct and indirect use in supporting RE development.

3.1.1.3 National Renewable Energy Targets

The Government's target as set out in the National Renewable Energy Action Plan (NREAP) is 16% of the national gross final consumption of energy comprising energy from renewable sources by 2020 (under Directive 2009/28/EC), with a minimum of 10% in the transport sector. The target must be met across the electricity, heating and transport sectors. The Government plans that by 2020 the overall binding target will be delivered by approximately 40% consumption from renewable sources in the electricity sector (RES-E), 12% in the heat sector (RES-H) and 10% in transport (RES-T). These three targets, when combined, amount to 16% renewable energy overall.

The First Progress Report submitted under Article 22 of the Directive 2009/28/EC was published in January 2012, detailing that Ireland is on track to meet the targets set out above by 2020. The same report details any progress and updates since the NREAP was originally published in July 2010. Under the requirements of Article 22 of the Directive, each member state must submit a report on progress in the promotion and use of energy from renewable sources every two years until 31st December 2021.

Local authorities should consult the NREAP and its biennial progress reports to keep informed on the development of the renewable energy industry in Ireland towards 2020, and for up-to-date information on the achievement of Ireland's RE targets and on national renewable energy policy implementation. These reports can be found in the energy section of the DCENR website: Renewable Energy Directive and National Renewable Energy Action Plan.

SEAI's Energy In Ireland annual publications[18], also provide useful statistical information on progress towards targets and the state of play of renewable energy in Ireland in any given year.

3.1.1.4 Regional and Local Policy, Implementation and Action Plans

In the following section, local authorities are encouraged to list relevant regional plans and policy that may influence the promotion of and decision-making on RE projects, and in particular the spatial planning of RE projects. It may also be beneficial to consult neighbouring authorities' policy documents and guidelines, so as to ensure that potential transboundary issues are screened out.

The statutory remit of Regional Authorities was significantly enhanced by the 2010 Act, which places responsibilities on Regional Authorities to ensure that lower-level plans are in line with defined population targets and settlement patterns contained in the regional planning guidelines, which in turn are aligned with the NSS and central Government Policy. The principal means by which the Regional Planning Guidelines (RPGs) will be implemented is through the Development Plan process at Planning Authority level. Thus a Planning Authority must ensure, when making a development plan or a local area plan, which may include a LARES, that the objectives are consistent, as far as practicable, with regional objectives as set out in the RPGs.

Regional Planning Guidelines

- Insert text as appropriate to your local authority / regional authority area.
- Insert commentary, where appropriate, on information relevant to the development of renewable energy contained within the Regional Planning Guidelines.

16 www.seai.ie/Grants/Electric_Vehicle_Grant_Scheme/EV_Grants/

17 www.seai.ie/Grants/Better_energy_homes/Better_Energy_FAQ/

18 http://www.seai.ie/Publications/Statistics_Publications/Energy_in_Ireland/Energy_in_Ireland_1990_-_2011.html

Regional Energy Strategies and Plans

- Insert commentary on regional energy strategies or initiatives, where relevant (e.g. South-East Regional Authority Bioenergy Implementation Plan).
- Local authorities may wish to highlight the relevant key goals and objectives as set out in regional energy strategies and plans.

County Development Plans

- Including existing RE provisions, wind-energy strategies and RE strategies or energy strategies, where these exist. Insert text as appropriate.

3.2 Step 2: Identify and Assess the Renewable Energy Resources and Potential

Fundamental to creating a LARES is an assessment of the RE resources and potential in the local authority area. It is recommended that this include the above policy review, an examination of existing RE projects, and a review of available information on the RE resource in the local authority area.

The objective of this step is to produce sufficient data to, ideally, develop a GIS map of the RE resources available within the jurisdiction of the local authority, providing a foundation on which infrastructural constraints and facilitators and environmental constraints can be overlaid.

3.2.1 Identification of Existing RE Projects

Local authorities should review any RE projects already developed within their administrative area. This should include RE developments that are operational and also applications that have been successful but are not yet implemented. It should also include a review of projects within their jurisdiction that are being progressed through the strategic infrastructure process. It is also recommended that unsuccessful applications be identified and reviewed by the local authority. This information should be spatially represented in order to gain maximum value from the review process.

The identification of these projects (both successful and unsuccessful) should be accompanied by a high-level review of the key success and failure factors faced by the developments that have come through the system. The following would represent valuable learnings from this review:

- a spatial profile of where certain RE technology types have been deployed, providing an insight as to where the developers see certain project types being more appropriate than others
- an evidence base showing the reasons why certain project types were successful or unsuccessful in particular locations and at particular scales of development

The value of this review of easily accessible information should not be underestimated as it sets the context for the next steps and arms the local authority with knowledge of project types and key considerations (both general and specific to their administrative area).

3.2.2 Data Access and Constraints

Data on RE resource potential at regional and county level can, in some cases, be difficult to access and interpret. At all times, where reputable research can be accessed and where support organisations are available to provide assistance, these should be considered as key to the resource identification process.

It is important for consistency and to ensure that maximum benefit is gained that any sources used, and assumptions made, in the definition of the renewable resources within a local authority's jurisdiction, be clearly defined and recorded. This will also allow simpler periodic reviews of the baseline data on which the RE strategy is based.

It should be noted that there is no 'one size fits all' approach to the assessment of renewable energy resources and potential. Each technology type should be considered under its own merit. For example, wind, hydro and geothermal projects are entirely dependent on the location of the resource for energy generation. Bioenergy, conversely, is not subject to the same limitations. Bioenergy projects can be located adjacent to resources or are feasible through the use of transported feedstocks, point source waste streams or purpose-grown feedstocks that can be difficult to appreciate through the mapping of resources.

3.2.2.1 Data Sources

A number of resources are available to local authorities when assessing their RE resource potential. Local authorities should use these datasets and also consult the bodies responsible for their production to ensure they develop a thorough understanding of the resources in their jurisdiction.

The local authority should seek to produce mapping of the RE resources within its jurisdiction from these sources and consultations. However, this section should be adapted to accommodate technological advancements and the development of improved or expanded RE resource maps and information sources.

Local authorities should seek to access the most up-to-date figures available. Tables 2 and 3 below show locations where up-to-date information can be obtained. Note that many of the tools listed below contain readily accessible resource information and maps of RE resources.

Table 2: Mapping tools for renewable energy resources

BODY	MAPPING TOOL (click for web link)	DESCRIPTION
Sustainable Energy Authority of Ireland (SEAI)	Wind Atlas	The Wind Atlas is a digital interactive map of Ireland that shows the calculated wind speeds at 50m, 75m, and 100m both on- and offshore.[19]
	Bioenergy Mapping System	An interactive map of potential and actual bioenergy crops, forestry, biomass and waste locations
	Geothermal Maps Resource	An interactive map of geothermal temperatures at depths from 10m up to 5000m; also provides geological information such as fault locations and previous borehole locations
European Commission	Photovoltaic GIS Interactive Maps	An interactive map providing annual average solar radiation intensity for any point in Ireland
Marine Institute	Irish Wave Energy Resource Atlas	Provides actual, theoretical and seasonal wave energy information
	Tidal & Current Modelling	A hydrodynamic Regional Ocean Modelling System (ROMS) that provides forecasts of ocean currents and also temperature and salinity information

19 The current Wind Atlas was developed in 2003. SEAI will release a remodelled wind atlas in 2013.

Table 3: Assisting documentation for RE data sources

BODY	RESOURCE	DESCRIPTION
DCENR	Draft Offshore Renewable Energy Development Plan (OREDP , 2010)	To inform policy decisions, a strategic environmental assessment (SEA) and Natura Impact Assessment was undertaken on the draft plan; the comprehensive data gathered in conducting these is published on the DCENR and SEAI websites.
Government Marine Coordination Group	Harnessing our Ocean Wealth (2012)	An integrated Marine Plan for Ireland
DECLG	Wind Energy Development Guidelines (2006)	A comprehensive overview of wind energy planning and guidance for Ireland that local authorities are required to have regard to in carrying out their forward planning and development management functions
Department of Energy (now DCENR)	Small-Scale Hydroelectric Potential – County Rivers (1985)	An assessment of all Irish rivers and their economic viability for hydropower
Irish Bioenergy Association (IrBEA)	The Economic Benefits from the Development of Bioenergy in Ireland (2012)	A socio-economic report to demonstrate the tangible benefits that can be realised through the development of bioenergy in Ireland
Irish Wind Energy Association (IWEA)	Best-Practice Guidelines for the Irish Wind Energy Industry (2012)	Describes the standards that the Irish wind industry has set for wind development
Sustainable Energy Authority of Ireland (SEAI)	Tidal & Current Energy Resources	SEAI report assessing potential tidal energy available in Irish waters; also provides information about technologies, and practical and accessible tidal resources
	Best-Practice Guide for Photovoltaics	Provides information on the installation and location of photovoltaics
	Bioenergy in Ireland Report (2004)	A report providing an overview of the key issues when implementing bioenergy systems
	List of Grid-Connected Hydro Sites (2010)	List of installed hydropower facilities
	Research on Developing Technologies	SEAI website with information on developing technologies
South-East Regional Authority	South-East Region Bioenergy Implementation Plan (2008-2013)	Study examining regulatory frameworks, bioenergy resources and bioenergy project viability and strategies for the South-East region (update will be published early 2013)
South West Regional Authority	South West Bioenergy Plan 2009-2020	A range of key actions are identified in this plan which aims to drive the development of bioenergy resources as a sustainable and more cost-effective alternative to the use of fossil fuels.
Western Development Commission (WDC)	Bioenergy and the Western Region (2012)	Report highlighting best practice in the CDPs and where improvements can be made – see also **www.raslres.eu**
	Wood Energy Strategy for the Western Region (and other RASLRES project outputs) (2011)	Study for the development of the wood energy industry in the WDC counties – see also **www.raslres.eu**

It is advised that, at this stage, local authorities consult with their local authority energy agency, the Sustainable Energy Authority of Ireland and neighbouring local authorities and regional authorities. This will ensure that all data-sources for their jurisdiction are made available to them and that the level of research required across local authorities is reduced, where possible.

3.2.3 Methodology for Renewable Energy Resource Definition

A number of methodologies exist for the definition and assessment of RE resources within discrete geographical areas. In Ireland, a range of studies conducted at national, regional and local level offer some guidance in this regard. The outputs of these are largely contained in Tables 2 and 3 (above).

However, a comprehensive project was funded by SEAI in 2004[20] on the assessment and definition of national RE resources.

While the study did not cover all RE resource areas, one of its primary goals was to create a methodology which would form a consistent mechanism for future separate studies in the electricity and heat markets using RE technologies – i.e. to define a common and robust methodology/definition for the assessment of Irish RE resources, for all to use.

The SEAI 2004 study follows on from national RE resource studies completed in 1997 and 2003, and can be found at **http://www.seai.ie/**. The report is a valuable resource for local authorities; it provides a methodology that can be used when identifying and assessing the resources within a jurisdiction.

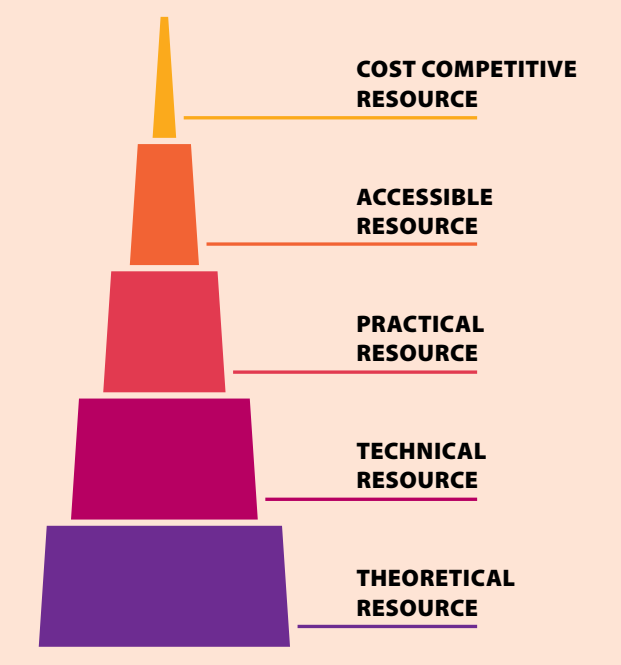
A useful further text on resource assessment is *Development of a Techno-Economic Model for Renewable Energy Resource Assessments* by Rebecca Denton (available on the SEAI website).

The general classification proposed by the SEAI study is represented in the diagram below, which shows the 'sieve analysis' approach proposed by the SEAI/ESBI study and proposed for the LARES framework. A 'sieve analysis' approach to the LARES will enable structured and consistent identification of viable RE resources within and across local authority areas.

As the diagram illustrates, an assessment of RE resources should begin with the theoretically available resource. As constraints and limitations are accounted for, the RE resource can be categorised from technical to practical and (further down the 'sieve analysis') to accessible and cost-competitive resources.

The undertaking of a comprehensive resource assessment will assist local authorities in the later stages of preparing a LARES, particularly when defining targets and goals. Although this may represent a significant body of work the first time it is undertaken, it will remain a live and valuable resource for the local authority during the development of any future plans, policies and strategies relating to RE.

Figure 3: Graphical representation of 'sieve analysis' approach



Resource Definition

To assist local authorities in quantifying the RE resources within their area, the following resource definitions should be adopted. The quantification of resources will follow the same methodology but each assessment will become unique to each local authority area as topographical, land-use, environmental, administrative and other factors are brought into consideration.

20 Renewable Energy Resources in Ireland for 2010 and 2020 – A Methodology, SEAI & ESBI, 2004

For each of the definitions outlined below, a practical example of how they are used to define resource potential is outlined in section 5 of the report.

Theoretical Resource

The gross energy content of the particular form of RE that occurs within a given space (e.g. the local authority administrative area) over time (e.g. one year)

– i.e. the theoretical resource is the highest possible potential energy production from a given resource in the absence of any constraints. Some assumptions may have to be made at this stage to allow for ease of calculation of energy potential.

Technical Resource

The theoretical resource, but constrained by the efficiency of the currently available technology

– i.e. the local authority administrative area may have a high quality and quantity of certain resources but, if the technology to harness the resource is not mature enough and/or widely used, it may not be feasible to exploit the resource.

Practicable Resource

The technical resource, but constrained by practical and physical incompatibilities

– i.e. where a given resource cannot be exploited to its maximum potential due to interference with topographical and large manmade constraints. This may include lakes and rivers, large infrastructure (including roads, and electricity and gas transmission lines), urban areas, towns, etc. In the case of offshore energy, it will include a maximum depth of water, and maximum or minimum current velocities, and exclude construction of overland pipelines and undersea cables, while there will be a maximum distance offshore (for transmission purposes). It will not include one-off housing or farm buildings.

(The purpose of this sub-division is to eliminate manmade areas that could potentially be moved or demolished, but are too large or essential to warrant being moved unless completely necessary, in addition to areas that are not practicable from a topographical perspective.)

Accessible Resource

The accessible resource is the practicable resource, as above, but constrained by institutional or regulatory deletions, which limit RE extraction

– i.e. to determine the accessible resource, the local authority will need to give due regard to the legislation, policy and regulations as encountered during the preliminary stages (SEA and AA screening) and step one (policy context) of LARES implementation. It should also be acknowledged at this stage that quantification of the accessible resource and the review of constraints and facilitators (step 3) are mutually dependent.

The institutional or regulatory deletions will include the implications of current planning laws, protected areas (military, wildlife, etc), one-off housing, farm buildings, etc. It will also include a margin around roads, airports, transmission, rail lines, and residential and commercial buildings. For offshore energy, it will include designated fishing areas, shipping lanes, military training areas and recreational areas.

(The purpose of this sub-division is to eliminate areas that are excluded due to regulation and planning. It is assumed that regulatory and planning deletions are more easily changed than manmade infrastructure.)

Cost-Competitive/Viable Resource

The cost-competitive/viable resource is an accessible resource that is considered to be commercially viable.

Local authorities could consider the cost-competitive/viable resource available within their jurisdiction, but the market indicators and constraints that determine commercial viability change rapidly. It is likely that the definition of *cost-competitive/viable resource* will be delivered naturally by developers when bringing project proposals to the local authority.

The value of assessing and determining a cost-competitive/viable resource in a strategy document is questionable. Rapidly changing market conditions and the variance in developer type and capability mean that the outputs of the exercise could rapidly become obsolete and would not cover the breadth of developer types. The definition of *accessible resource* by the local authority should be a sufficient indicator to prospective developers. These developers will then define viability against *current* market and project-specific conditions.

3.2.4 Outputs from Renewable Energy Resource Definition

The identification of RE resources and the constraints and facilitators which set the background to their delivery is important in finalising credible policies and objectives to support the development of renewables. Perhaps the most important element is the preparation and presentation of the data. This is likely to be best achieved through bringing together the resource and constraints analyses into a single geographical information system (GIS) database.

This may represent a substantial resource requirement, particularly where it is being completed for the first time. However, once the database is established and in place, it will be possible to provide updates to it on an ongoing basis and thus, during periodic reviews of the RES and other strategies, the resource commitment is likely to be much less.

The purpose of creating a GIS database in this context is to establish spatially and to analyse the practical constraints and opportunities in respect of facilitating and controlling the deployment of RE projects and technologies within an area.

With the benefit of GIS, data collected on these aspects at a strategic level can be used to develop useful overlay maps. These can help authorities to identify potentially low-risk areas – i.e. areas of high value for RE development but that present little or no risk from a nature conservation perspective – or potential high-risk areas that are best avoided or where mitigation measures and more substantial impact assessments are likely to be required.

The most accessible methodology for performing this task is the 'sieve' methodology outlined in *Wind Energy Development Guidelines - DECLG* (2006). The methodology is robust and thus may be transferred to other types of RE.

The development of GIS datasets and mapping allows the local authority to transparently show prospective developers areas where RE development may be most appropriate. It also allows the local authority to illustrate what types of receptors are considered particularly sensitive or valuable within the jurisdiction.

3.3 Step 3: Constraints and Facilitators Review

This section provides the rationale for the examination and review of the infrastructural constraints and environmental considerations in respect of RE – i.e. any limiting or restrictive factors that may need consideration during project development. The outcome of undertaking this review is to determine what renewable resources are viable for future development.

Local authorities should be aware of international and national policy/legislation regarding the environment that may influence the development of renewable energy strategies, such as the European Commission guidance document on *Wind Energy Developments and Natura 2000* and the European Biodiversity Action Plan (2008).

3.3.1 Review of Infrastructural Constraints and Facilitators

Local authorities should undertake a review of the infrastructural constraints and facilitators within their administrative area. This review will give better understanding of where and what RE facilities could be put in place within the infrastructural limits of the administrative area.

RE developments need various types of infrastructure to facilitate transmission, distribution, storage, export and use of their product, whether it be electricity, heat or a liquid or solid fuel. If infrastructure is not present, planned, or is constrained, this may restrict and dictate the scale and location of RE within a local authority area, thereby limiting the ability to fully exploit the renewable potential.

The delivery of key RE supporting infrastructure could present an opportunity for the county and country to increase the development of RE projects in appropriate locations.

Local authorities may consider policies and objectives which could underpin and support infrastructure and network deployment to achieve national energy targets while realising local RE potential. Local and national objectives can be achieved in tandem through increased interaction between infrastructure providers and local authorities in the future.

3.3.1.1 The National Grid

The national grid is a nationwide electricity transmission network that consists of both overhead and underground high-voltage power cables. It is the infrastructure by which bulk electricity produced from renewable and finite sources is transferred throughout the country, and it is from the grid and associated distribution network that domestic and commercial electricity supplies are obtained. At transmission stations, or transfer points, the generated electricity is converted to a usable voltage for onward distribution to customers.

In the short term, the delivery of renewable electricity projects to 2020 will be defined by the current Group Processing Approach, particularly Gate 3 of this, which provides for almost 4,000 MW of new renewable generation in the context of the 2020 binding targets. The Grid25 implementation programme being developed by EirGrid is being designed around the rollout of the necessary infrastructure to deliver, inter alia, Gate 3. Decisions relating to the grid are a matter for the Commission for Energy Regulation (CER) in the context of its statutory duties and functions. In the medium to longer term, the Programme for Government, for example, makes a commitment that any future Gates could consider other criteria such as planning permission and the location of projects in proximity to the grid capacity.

The 2007 Government white paper on energy policy (*Delivering a Sustainable Energy Future for Ireland – The Energy Policy Framework 2007-2020*) sets out a specific strategic goal pertaining to the delivery of electricity and gas over efficient, reliable and secure networks. In this context, a commitment was made to ensure that, through EirGrid's Grid25 strategy, the electricity transmission and distribution networks can accommodate, in a technically optimal way, targets for renewable generation in Ireland to 2020. Grid25 sets out a government-approved, high-level strategy for developing the necessary transmission infrastructure to support Ireland's national renewable electricity target and, in the long term, a more sustainable electricity supply.

Grid25 provides the framework to build a more cost-effective and efficient system to cater for the shift towards the integration of increasing amounts of renewable generation over time. The transmission capacity assumptions informing this grid development strategy are based on the high-level principles of ensuring network safety, security of supply and economic transmission development, while delivering on the renewable target in the years ahead.

The *Grid25 Implementation Programme 2011–2016* provides a foundation for more detailed work on specific reinforcements in coming years and will lead to plans for particular projects which will be delivered in consultation with the public and in line with planning legislation. Grid25 is fully consistent with the Gate process for the connection of RE in Ireland. The Grid25 Implementation Programme 2011–2016, Environmental Report, NTS Environmental Report and Natura Impact Statement were published in May 2012, and an SEA statement will be published at the end of April 2013. Information on Grid25 is available on the EirGrid website.

Local authorities needing further information should contact the Gas, Legal and Renewables Division of the Commission for Energy Regulation (CER), as well as EirGrid.

3.3.1.2 Gate 3 and the Group Processing Approach

Since December 2004 a Group Processing Approach (GPA) applies to applications for connection offers to the transmission and distribution systems for large renewable electricity generators. This approach to the processing and issuance of applications for connections to the grid (both transmission and distribution) was approved by the CER following public consultation.

Under the GPA or Gate process, applications for connections re processed in batches rather than sequentially. Within these batches or 'gates', applications are further divided into groups and sub-groups based on the optimal network required to connect them. This approach is considered more efficient than dealing with applications on an individual basis, where projects which are the subject of such applications interact with each other electrically and where large volumes of such applications exist.

The GPA allows for a more strategic view of network requirements and serves to put in place efficient connection solutions to cater for large number of applications and to ensure optimum network development, minimising network costs and, where possible, avoiding network bottlenecks. This approach is believed to minimise the necessity to build additional network, relative to an approach where applications are processed and issued on an individual and sequential basis.

To date there have been three Gates. Under Gate 1 and Gate 2, 1,755 MW of connection offers were made and accepted. Under Gate 3, 3,989 MW of offers have been issued to generators. Gate 3 is designed to facilitate the delivery of 40% renewable electricity and government policy in that area. It is estimated, given current demand projections, that 4,000 MW of renewable generation will be required to deliver 40% RES-E, while the combination of the grid connection offers issued under the three Gates amounts to almost 6,000 MW.

Apart from the above, the CER published a decision in 2009 (CER 09/099) that allows for certain renewable, small and low-carbon generators to have offers for connection to the transmission and distribution grids processed without going through the full rigours of the GPA. This includes small projects, research and development projects and those that qualify as they are deemed to provide benefits of a public nature that merit qualification. Public benefits that may be acceptable include diversity of fuel mix, predictability and power system support, environmental benefits, and research or innovation. Until this change all renewable generators (<500 kW) were subject to the GPA.

The decisions set out in CER/09/099 differentiate between wind and non-wind. The table below provides a summary of the criteria and qualification process for applications for connections outside the GPA. Further information may be found in CER/09/99 on the CER website, **www.cer.ie**.

Future Gates and approaches to grid connection of renewable and other generators will be determined by the CER in the context of its statutory duties and functions.

Table 4: Summary of criteria and qualification process for applications for connections outside GPA

Renewable — Wind	Renewable — Non-Wind*		Conventional Projects	
All processed through GPA process ***Exception: new-build wind project with MEC less than or equal to 0.5 MW***	**Processed through non-GPA process – must fulfil public-interest criteria**		**Processed through non-GPA process**	**Offers issued under the proposed Direction on Conventional Offer Issuance Criteria**
	=< 5 MW	**>5 MW**	**=< 5 MW**	**> 5 MW**
	Connection offers made without interaction** studies	Interaction studies are performed. If no interactions, then connect. If interactions exist, then CER looks at on a case-by-case basis. If interactions exist, then look at public-interest benefits (e.g. security of supply) and impacts of interaction on the other applicant in the queue. If CER approves, then connect; if not approved, option to buy out interaction or remain in the GPA queue.	Interaction studies are performed. If no interactions, they can proceed to be given a connection offer. If interaction exists, the conventional project will remain in the queue.	Exception: Conventional auto producers that are not in the first 500 MW tranche. These could be processed through the non-GPA process. Process allows for public-interest criteria (e.g. security of supply) to move up the queue projects such as clean coal; includes high-efficiency CHP.

** Non-wind renewable project is defined here as a renewable project that has a fuel source other than wind power. It is a shorthand term that defines renewable projects, other than wind, that are discussed in the document. Includes: biomass hydro, high-efficiency CHP, auto producers (renewable including wind).*

*** Interactions: Two applications are deemed to be interacting if progressing an application outside the GPA results in an additional cost being incurred by other applicants in the GPA queue. Interaction studies relate to the shallow connection.*

3.3.1.3 Gas

It is recommended that gas infrastructure be also considered in the context of developing RE. The gas infrastructure can facilitate future RE development by providing reserve fuel for heat and power facilities otherwise provided by renewable resources, in a local and national context. Gaslink is the Transmission System Operator and the Distribution System Operator of the Irish gas network. A subsidiary of Bord Gáis Éireann, it has replaced Bord Gáis Networks in the operation, maintenance and development of the Irish gas network.

At the moment there is no biomethane injection into the Irish natural gas grid. However, the CER is planning to issue a consultation on biogas, with regard to the technical and regulatory aspects. Technical issues that will need decisions include those around gas quality, etc. There is currently no support scheme for biogas that would affect how the sector develops, although a REFIT for electricity from anaerobic digesters has been put in place. Nevertheless, local authorities may wish to consider gas infrastructure in developing RE, in the context of potential for biogas. Local authorities wishing to find more information on gas infrastructure should contact the Gaslink Network Development unit.

3.3.1.4 Transportation

The NREAP specifies a two-pronged strategy that combines increased use of biofuels with the accelerated development and use of electric vehicles in Ireland. The national *Biofuel Obligation Scheme* 2010 obliges all road transport fuel suppliers to use biofuel in the fuel mix. The initial penetration rate was 4% per annum and this was increased to 6% on 1 January 2013. The biofuel obligation will ensure that Irish consumers have access to appropriately priced, sustainable and reliable sources of biofuel over the coming years, and thus incentivise domestic biofuel production.

The Government has also set a target of 10% penetration of electric vehicles (EVs) in our national vehicle fleet by 2020. The Government, SEAI and the ESB are taking a broad-ranging series of initiatives around EVs, including signing memoranda of understanding with a number of motor manufacturers, committing to a large-scale national rollout of Electric Vehicle Infrastructure and supports for customers. ESB has announced detailed plans for the rollout of EV charging points across the country. ESB has set itself a target of installing 30 'fast charge' points, 1,500 public charge points and 2,000 home charge points, in line with EV sales. EVs could also give rise to a complementary energy demand for intermittent renewable generation in Ireland.

Transportation infrastructure is also of concern for many RE resources, primarily during the construction/installation phase but also during the operation and decommissioning of projects. Transportation can be subdivided into roads, rail, sea, air and logistics. Ports are particularly important for the import and export of bioenergy products and for the importation of infrastructural items not produced on a large scale domestically (such as wind-turbine components). Local authorities are encouraged to consult with the relevant bodies when planning the RES, including, but not limited to: the National Transport Office, airport or aviation authorities, harbour authorities, port companies and public transport bodies.

The LARES could specify that RE proposals include traffic management plans, where appropriate, to address impacts on the local road network and local residents.

Roads, ports and transportation infrastructure are also critical to the development of a sustainable biomass and biofuels industry. In many cases, the point of use of biomass and other biofuels may not be directly beside the point of production. In such cases, and particularly for large biomass projects, the logistics around receiving large quantities of biomass in a cost-effective and low-impact manner becomes critical. The proposed development of large-scale biomass production and biomass-use projects should be considered against the backdrop of these logistics aspects.

3.3.1.5 Heat

District heating (DH) schemes concentrate on localised development of infrastructure to distribute heat from a point of production to a point of demand. The production and use of heat from RE resources as set out in the NREAP is essential for Ireland to reach its overall legally binding target.

District heating, when implemented appropriately, can increase the opportunity for renewable-derived heat to be used. District heating is commonly developed by recognising the need to access heat consumers in high-energy-density areas. Particular consideration of this may be merited where a planning authority develops a LARES, anticipating significant future biomass heat production and use within its jurisdiction. Local planning guidance could facilitate this by recommending that plans for housing, commercial and industrial developments and Strategic Development Zones (SDZs) include consideration of the potential for incorporating district heating infrastructure.

DH systems usually involve a centralised boiler with a pipe network distributing heated water to surrounding end-users (in some cases, steam may be used instead of water), or can be based on geothermal sources. Heat can also be generated at a very local scale (domestic or commercial building scale) with ground-source or air-source heat pumps. End users, in most instances, are metered and charged through a similar method to electricity distribution, on a kWh basis, so they can measure and control their heat use on a similar basis.

It is widely accepted that a DH system will be more successful when implemented in areas of high heat demand, and that it is cheaper to adopt a DH in new-build scenarios as opposed to retro-fit. It is thus more likely that successful DH schemes would be proposed in areas of higher-density population and high heat demand from industry or commercial enterprises, and particularly where these are being developed anew.

The most conventional design for DH is to have an enclosed pipework system supplying heat to users; thus twin pipes will be installed for users: one to deliver hot water and one to take away the cooled water. For this reason, the space that a DH system takes up can be significant when compared to other utilities and services.

Where DH is being proposed, the developer must carefully consider both existing and planned services. The routing and installation of DH pipes must be sensitively addressed, and the potential of a DH system to 'sterilise' or limit the location of other potential services and utilities corridors should also be considered.

The approval of DH infrastructure is thus likely to fall to the local authority through existing mechanisms commonly used for water and other pipe-based developments.

3.3.1.6 Telecommunications/Aviation

Some RE resources may have impacts or raise issues regarding communication infrastructure, in particular electromagnetic interference from windfarms or from tall stacks at bioenergy plants. Exclusion zones for wind turbines within flight paths and consultation with the IAA Air Traffic Management unit should be considered. The *Wind Energy Development Guidelines* - DECLG (2006) and the *Best Practice Guidelines for the Irish Wind Energy Industry*, published by the Irish Wind Energy Association and SEAI, provide information on the recommended level of consultation with telecommunication and aviation infrastructure operators and the identification and mitigation of effects on telecommunications systems.

Local authorities may wish to provide guidance on consultation with the Commission for Communications Regulation and/or the relevant stakeholders, such as:

- Emergency services, e.g. Garda, fire services, ambulance, coast guard
- TV and radio service providers
- Mobile phone and broadband service providers
- Air traffic radar, e.g. Irish Aviation Authority or the Civil Aviation Authority for Northern Ireland

3.3.2 Review of Environmental and Other Considerations

The following sections identify many of the constraints and facilitators of renewable energy project development. Negative environmental impacts often feature highly in the planning assessment of renewable energy projects. The sections focusing on environmental impacts below – particularly those referring to 'Natural Heritage' and 'Landscape and Visual Impacts' – discuss situations where environmental issues are key considerations. Appendix A.4 provides an overview of land-use interactions for the different renewable energy technologies. Please also see the Additional Information section below for details of further resources.

It should be noted that the environmental considerations of renewable energy are not homogenous across all project types. When local authorities are undertaking their constraints and facilitators review they should consider each type on its own merit to form a comprehensive and credible review.

3.3.2.1 Natural Heritage

The recommended GIS database could incorporate all current natural heritage designations stipulated in European and national legislation, including the Natura 2000 network, i.e. Special Areas of Conservation (SACs), Special Protection Areas (SPAs), candidate SACs (cSACs) and candidate SPAs (cSPAs). Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs) and other relevant areas and features of natural interest, such as RAMSAR wetland sites and nature reserves, should also be considered.

Natura 2000 – Special Protection Areas and Special Areas of Conservation

Special Areas of Conservation (SACs) are designated under the EU Habitats Directive (92/43/EEC) and Special Protection Areas (SPAs) under the EU Birds Directive (79/409/EEC). Natura 2000 is the European network comprising these two types of protected sites, which represent areas of the highest value for natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. Member states are required to ensure that appropriate steps be taken to avoid the deterioration of these sites and their associated habitats and species. Section 1.2 outlines the main obligations in respect of the undertaking of a Habitats Directive Assessment.

Natural Heritage Areas – Ireland

Natural Heritage Areas (NHAs) are designated under the Wildlife Act 1976 (as amended) for the protection of flora, fauna, habitats and geological sites of national importance. They are legally protected from damage from the date they are formally proposed (p) for designation. In many cases, NHAs and proposed (p)NHAs have also been designated as Natura 2000 sites. The Geological Survey of Ireland (GSI) is currently compiling a list of geological/geomorphological sites in need of protection through NHA designation.

Considerations within LARES

There is a wide range of protected, designated and otherwise formally recognised areas of importance in the natural environment. The Habitats Directive requires all plans and projects to be 'screened' for their potential impact on Natura sites, and an Appropriate Assessment (AA) must be carried out where such an impact cannot be excluded. S.I. 477 of 2011 European Communities (Birds and Natural Habitats) Regulations 2011 sets out the regulations that apply in Ireland. Certain RE developments may be accommodated in some designated areas, depending on the implications for the conservation objectives of the site, and only where AA identifies that the developments will not adversely effect the integrity of the protected habitats and species.

It should be noted that, under the Habitats Directive, the onus of ensuring that no significant impact is likely to arise lies with the relevant consent authority.

The EU has recently taken steps towards ensuring that its energy and environmental goals can be achieved in concert. Its *Wind Energy Developments and Natura 2000* (available at **http://ec.europa.eu/environment/**) outlines how one type of RE development can interact with and be developed alongside the provisions of the Natura 2000 policy. Local authorities should also be conscious of the potential of offshore developments to impact on sites and species protected under Natura 2000.

Natural heritage should not be confined solely to protected, designated or formally recognised areas. The full scope of potential receptors in the natural environment should be considered, including (but not restricted to): water quality, soils/subsoils, habitat loss/fragmentation, wildlife disturbance, geology/geomorphology, air quality, flood risk impacts, peat and landslide risk, and cumulative and combination effects.

It is suggested that the local authority initially consider the scope of natural environment receptors covered in an SEA process and the scope of EISs set out in the 'Guidelines on information to be contained in Environmental Impact Statements (EIS)' published by the Environmental Protection Agency (EPA) in its preparation of the strategy. (More detailed commentary on the application of the SEA process to the LARES is provided in Section 1 on Procedural Considerations.)

3.3.2.2 Landscape and Visual

RE developments are generally sited and designed sympathetically in order to reduce any potential impact on the visual amenity of the surrounding area. It is recommended that wind proposals in particular have regard to the *Wind Energy Development Guidelines* – DECLG (2006) and the relevant development plan for the area, in respect of wind proposals and siting and design. Recommendations outlined in the draft *National Landscape Strategy,*[21] under the control of the Department of Arts, Heritage and the Gaeltacht (DAHG), should be addressed where appropriate.

Landscape designations should inform the preparation of a RES. In identifying areas suitable for RE, local authorities could consider:

- Landscape classification as per County Development Plan
- Listed views and prospects and designated tourism routes

Landscape character assessments of counties could also be used as a baseline to assess capacity for areas to accommodate RE.

It would benefit local authorities if potential transboundary impacts are also considered during the preparation of RE strategies. Neighbouring counties' land-use designations, such as scenic routes or protected views, may need to be integrated into the analysis of constraints. Where local authorities are consulted about offshore wind and ocean energy projects, consideration should also be given to the seascape. Local authorities may wish to consider the potential impacts on seascape and offshore wildlife.

21 At the time of writing, the methodology document, a draft National Landscape Strategy, was under development; a Strategy Issues Paper for Consultation was published in September 2011.

For further information on landscape and visual impact, local authorities should contact the Built Heritage and Architectural Policy Section, Department of Arts, Heritage and the Gaeltacht (DAHG).

3.3.2.3 Archaeology and Architectural Heritage

As part of the constraints mapping process, it would benefit the study if the local authority mapped all archaeological sites and protected structures within its jurisdiction. Major concentrations of certain types of sensitive archaeological and architectural heritage may restrict the development of certain types of RE project.

A LARES should consider the special character of structures included in the Register of Protected Structures, Architectural Conservation Areas (ACAs) and other architectural heritage. For further information on archaeology and architectural heritage, local authorities should contact the Built Heritage and Architectural Policy Section, Department of Arts, Heritage and the Gaeltacht (DAHG)

3.3.2.4 Water Framework Directive

The Water Framework Directive (WFD) applies to water bodies within the local authority area (rivers, lakes, groundwater, estuaries and coastal waters, etc). In preparing the LARES, regard must be had to the objectives and measures set out in River Basin Management Plans for the area and the subsequent information contained in the County Development Plan.

The WFD requires that waters designated as high-status under its provisions are maintained as such and do not suffer ill-effects due to anthropogenic activities (i.e. those due to human activity).

Local authorities needing further information on the Water Framework Directive should contact the Water Quality unit in the DECLG and the coordinating body for the relevant River Basin District.

3.3.2.5 Tourism and Amenity

The impact of RE development on tourism and recreational activities should be considered. Consultation with the relevant regional tourist authority would be likely to add value to the overall analysis undertaken on constraints.

Where local authorities are consulted about offshore wind and ocean energy projects, for example in Areas of Outstanding Natural Beauty, consideration should also be given to the impact these developments may have on tourism and recreational activities.

3.3.2.6 Cumulative and Transboundary Issues

It is recommended that local authorities include all existing RE projects and infrastructure in a cumulative impact analysis, to determine if any area has an over-concentration of development. There is a responsibility to assess the impacts of a development along with potential impacts of existing and new developments. The potential transboundary impacts of designating areas for RE development that are adjacent to protected areas within adjoining counties should be taken into account.

Where necessary, the local authority producing the LARES should also be cognisant of the requirements for transboundary consultation (within the terms of the SEA Directive), where they border another jurisdiction. The methodology for this consultation is currently the subject of discussion between the DECLG and DoE (NI).

3.3.2.7 Community and Socio-Economic Impacts

Public consultation concerning the LARES, through the most appropriate medium, is important to ensure that community inputs and views are adequately considered. Local support for the provision of infrastructure can be a facilitator or constraint for the development of renewable energy projects, and local authorities may need to consider community engagement during the course of LARES development.

The Government Policy Statement on the Strategic Importance of Transmission and other Energy Infrastructure (July 2012) recognises the need and urgency for new energy infrastructure. It notes that the planning process provides the necessary framework for ensuring that all necessary standards are met and that consultation is built into the process. It also acknowledges

the need for social acceptance and the appropriateness of energy project developers examining appropriate means of building 'community gain' considerations into project planning and budgeting.

Windfarms of more than 50 turbines or having a total output greater than 100 megawatts fall under the Planning & Development (Strategic Infrastructure Act) 2006. The Act provides that the Board (An Bord Pleanála) may attach conditions to an approval, providing for the construction or financing in whole or in part of a facility or the provision or financing in whole or in part of a service, in the area in which the proposed development would be situated, which in the opinion of the Board would constitute a substantial gain to the community.

3.3.2.8 Positive Environmental Impacts

In the course of the LARES assessment, the planning authority should consider positive as well as negative impacts during the consultation, drafting and implementation stages. Some examples of positive environmental factors are:

- RE resources are clean sources of energy. They can be harnessed without damaging the environment, unlike with conventional energy such as fossil fuels, which release carbon dioxide and other harmful pollutants into the atmosphere. Increasing the use of RE is therefore a key strategy for local authorities to reduce GHG emissions and assist in Ireland meeting its Kyoto commitments.
- The use of RE avoids GHG emissions contributing to climate change and associated habitat destruction and species displacement, and also displaces the environmentally damaging effects of fossil-fuel extraction and processing.
- Certain biomass energy projects, such as those using agricultural wastes, may result in avoided or reduced release of pollutants into the environment.
- RE resources are continuously replenished and will not run out.
- The generation of energy from waste can increase diversion from landfill and thus help to meet Ireland's EU targets as prescribed in the Landfill Directive (1999).
- The development of windfarms can result in the generation of new accessible parkland amenities, such as walk and cycle tracks.
- Mitigation and environmental protection measures implemented as a result of the development of projects can often formalise conservation and monitoring strategies for particular species and areas which would not otherwise have been developed.
- RE projects are, in some cases, at a smaller and more dispersed level than conventional fossil-fuelled projects. This can result in projects being located closer to demand and can distribute more evenly any jobs and related community gain arising from project development, and thus contribute to balanced regional development.

3.3.2.9 Additional Information

Local authorities should consult with the relevant statutory bodies for additional information and extra guidance, and concerning legislative obligations. Helpful information is also available online via the NPWS website (**www.npws.ie**), the EPA website (**www.epa.ie**), the DECLG website (**www.environ.ie**) and the DCENR website (**www.dcenr.gov.ie**). The Office of Environmental Assessment in the EPA is a key contact point for guidance on environmental considerations.

Further relevant information can be obtained from stakeholder bodies, such as biodiversity datasets containing baseline data on protected species from the National Biodiversity Data Centre. A list of available datasets can be found in the Integrated Biodiversity Impact Assessment Guidance report.

Local authorities should ensure that they are aware of the most up-to-date information in this regard when preparing their LARES.

3.4 Step 4: Development of Renewable Energy Policy and Implementation

The fourth main step in the process for local authorities is to develop RE policy and provide detail on its implementation. This will be informed by the information obtained from the previous steps.

Local authorities may wish to engage in public consultation during and/or at the conclusion of this step. Step 4 will culminate in the production of a LARES document and local authorities may wish to develop an initial draft and final draft version for public consultation.

3.4.1 Outline of Renewable Energy Options

Having assessed the RE potential and constraints within their jurisdiction, local authorities should begin to tailor their RE strategy and associated policies and objectives to suit the renewable resource available, having regard to:

- Infrastructural Constraints
- Environmental Constraints
- Technological and Spatial Constraints
- Renewable Energy Potential within the Jurisdiction
- National Renewable Energy Policy Targets and Ability to Contribute
- Economic and Job Creation Objectives

3.4.2 Implementation

The overall aim of a LARES is to outline the 'plan-led' approach to the proactive identification of appropriate locations for RE developments within the county, having regard to the 'sieve analysis'.

The integration of the LARES with any other local authority plans and policies (including the County Development Plan) is ultimately at the discretion of each local authority. However, should the document not be a part of the County Development Plan (CDP), it is strongly recommended that it be used to generate appropriate policies and objectives that are ultimately included in the CDP.

The resources required to prepare a LARES depend to a large degree on whether it will form an element of a CDP review or part of a variation. The preparation or review of a CDP over a two-year period is a complex process. The process involves survey work and analysis, and co-ordination of inputs from within the local authority and from external agencies. It may be possible to set up a dedicated team to prepare a LARES, which would then feed into the main draft CDP, as would be the case for a retail or housing strategy.

Local authorities should attempt to tailor the preparation of a LARES to the resources available. Consultation with neighbouring local authorities and regional bodies could also be undertaken in order that efficiencies of scale might be achieved.

It is recommended that the project manager for the preparation of a LARES have sufficient status within the local authority to allocate the necessary staff and other resources, to report to the elected members and to the management team, and to liaise effectively with other sections of the council and with external agencies. Team members may include Planners, Engineers, Ecologists, Heritage Officers and a Local Authority Energy Officer. Senior-level sign-off and support will be critical to the deliver of a robust LARES.

3.4.2.1 Provision of a Vision for RE Strategy

A broad supportive vision statement on the provision of RE and associated supporting infrastructure could be provided, outlining the reasons behind the development of the LARES. This could include a commentary on the socio-economic benefits that can occur as a result of RE development, including:

- An increase in self-sufficiency in energy terms
- Generation of community identity and pride in creating a more sustainable county or region
- Generation of inward investment and recycling of energy cashflows within the community
- Generation of short- and longer-term jobs relating to RE development

3.4.2.2 Definition and Use of Targets

Local authorities could consider identifying minimum levels of development relating to the resources readily available within their administrative area. These targets could be described in the context of contributing towards national policy objectives as set out in the National Renewable Energy Action Plan. There may also be merit in considering a county's RE resource in the context of the region, as there is likely to be an imbalance in the ability to deliver RE projects in different counties.

3.4.2.3 Policies and Objectives

The LARES is designed to assist local authorities when setting out policies and objectives. It is suggested that development plans and planning guidelines contain positive policies and objectives relating to RE and renewable projects within the local authority area in relation to the following:

- Positive statements demonstrating the importance of having RE development within the area to reach national targets for renewable electricity heat and transportation fuels, GHG reduction and reduced reliance on fossil fuels
- Objectives for maximising the potential from RE resources, which are consistent with the proper planning and sustainable development of the area and in the context of national RE targets
- Clear guidelines on where RE development could occur, including the setting-out of appropriate areas for various available/potential resources
- The promotion of small-scale RE development and for small community-based proposals
- Identification of key locations where RE could be deemed acceptable in principle, subject to criteria such as design and landscape planning, natural heritage, environmental and amenity considerations – maps showing suitable areas could be incorporated into the CDP
- An acknowledgement that a balance should be struck between RE developments and the preservation and conservation of the natural and built environment, subject to compliance with the requirements of the Habitats and Birds Directives and S.I. 477 of 2011 (transposition of the Directives into Irish law)
- Promotion and facilitation of the infrastructure needed to facilitate the transmission and distribution of RE subject to the proper planning and sustainable development of the area

Conditional exemptions exist for certain small-scale and micro-scale RE technologies that meet specified criteria provided for in the *Planning and Development Acts 2000–2010* as amended (and in detail in S.I. 83 of 2007 and S.I. 235 of 2008). Where planning permission is required for micro-renewable technologies, outside the conditions of the exemptions afforded in the statutory instruments, these developments should be considered in all areas in the county, subject to compliance with the policies and objectives of the RE strategy and the proper planning and sustainable development of the area.

4.0 APPENDICES

A.1 Acknowledgements

SEAI would like to thank the following steering group members for their time and effort in assisting in delivering the LARES methodology:

- **Aoife Crowe** – The Commission for Energy Regulation
- **Una Dixon** – Department of Communications, Energy and Natural Resources
- **Aileen Doyle** – Department of Environment, Community and Local Government
- **Gael Gibson** – EirGrid
- **Mary Hughes** – Irish Planning Institute
- **John McCann** – Sustainable Energy Authority of Ireland
- **Martin McCarthy** – Formerly Renewable Energy Information Office
- **Martina Moloney** – City and County Managers Association
- **Bart Moriarty** – ESB Networks
- **Brian Riney** – The Regional Planning Authorities
- **Stephen Roy** – National Parks and Wildlife Service
- **Henk Van Der Kamp** (Chair) – School of Planning, Dublin Institute of Technology

A.2 Glossary

ACA – Architectural Conservation Area. At times ACA may also used for Accelerated Capital Allowance.

AFA – Areas for Further Assessment

Active solar systems – extract of solar energy through the use of photovoltaics or thermal heating systems

AER – Alternative Energy Requirement

Anaerobic digestion (AD) – the breakdown of organic waste by bacteria in an oxygen-free environment. The waste/feedstock is placed in an airtight container (digester) along with bacteria. Depending on the waste and system design, biogas typically contains 55-75% pure methane. This biogas can be upgraded to fossil (natural) gas quality, which typically contains ~96% methane. The liquid fraction of the remaining digested feedstock can be returned to the land as a fertiliser and solid fibre used as a soil conditioner.

Attenuators – flexible floating structures that move with the wave and extract energy from the mechanical action

Barrage – usually located across a tidal inlet to capture the energy of the tidal movement by creating a barrier and channelling it through turbines

Biofuel obligation – a government obligation to ensure that fuel distributors sell a minimum proportion of biofuels; in 2010 this was set to 4%

Capacity factor – the ratio of the actual output of a power plant over a period of time and its potential output if it had operated at full capacity during that entire time (the capacity factor will vary between different RE resources)

CCMA – County and City Managers Association

CDP – County Development Plan

CFRAMS – Catchments Flood Risk Assessment and Management Studies

Co-firing – the combined burning of bioenergy feedstocks with conventional fuels, e.g. peat. The Government has in place a target of 30% co-firing at 3 peat stations by 2015.

Combined heat and power (CHP) – (or 'cogeneration') the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy

Combustion – (or incineration) the simplest way to produce heat energy from biomass. The heat, often in the form of steam, can be converted to electricity and/or it can be used for heating houses and buildings.

Commission for Energy Regulation (CER) – the regulator for the electricity and natural gas sectors in Ireland

Constraints – any limiting or restrictive factor, which may need consideration during the course of project development

DAHG – Department of Arts, Heritage and the Gaeltacht – Government Department, which includes the National Parks & Wildlife Service (NPWS)

DCENR – Department of Communications, Energy and Natural Resources – Government Department with responsibility, inter alia, for energy policy

Deep geothermal – the extraction of energy originating from the earth's core

Distribution System Operator (DSO) – as DSO, ESB Networks facilitates the utility supply from the transmission system to the consumer. It is responsible for the development of the distribution network, which comprises distribution 110 kV lines (tail lines not part of the meshed grid transmission grid), and lower-voltage lines.

District heating (DH) – a local heating network usually facilitated through underground pipes and a centralised heat source

DoE (NI) – Department of the Environment (Northern Ireland)

DEHLG – Department of the Environment, Heritage and Local Government (so called up to 2nd May 2011), now called DECLG

DECLG (formerly the DEHLG) – Department of the Environment, Community and Local Government,

EC – European Commission

EfW – see Waste to Energy (WtE)

EirGrid – as Transmission System Operator (TSO), EirGrid is responsible for operating Ireland's national electricity transmission system, otherwise known as the national grid. It is a state-owned commercial company.

Electricity Distribution System – the electricity network infrastructure – e.g. lines and cables which bring energy from the transmission system to the customer

Electricity Transmission System – the electricity network infrastructure – e.g. pylons and high-voltage power cables, which facilitate the supply of electricity from the generation point to distribution centres

EPA – the Environmental Protection Agency, Ireland's statutory body for the balanced and sustainable protection and management of the environment

EPSSU – the Energy Policy Statistical Support Unit (under the auspices of the SEAI), which develops national and sectoral statistics for energy production, transmission and usage

ESB Networks – responsible for building, operating, maintaining and developing all the sub-transmission, medium and low-voltage electricity network infrastructure in the country and for managing this infrastructure, which is owned by ESB. ESB performs the role of Transmission Asset Owner, ensuring development and maintenance of the transmission, high-voltage network infrastructure in co-ordination with the Transmission System Operator, EirGrid.

Esterification – the process of producing biodiesel from resources such as oils and fats

EU – European Union

EWEA – European Wind Energy Association

Facilitator – person or body who enables a process to happen

Fermentation – the conventional process used in beer and wine production, which can be used to produce bioethanol from sugar and starch feedstocks

Final Energy Demand – a measure of the energy delivered to energy end-users in the economy to undertake activities as diverse as manufacturing, movement of people and goods, essential services and other day-to-day energy requirements of living; also known as Total Final Consumption (TFC)

Gasification – an advanced conversion process that offers a method of power generation with higher efficiencies than combustion-based steam cycles. It is a process in which biomass is converted to higher-grade fuels prior to combustion. Biomass is partially oxidised at high temperatures to produce biogas. This biogas contains a mixture of carbon monoxide, hydrogen and methane.

Gaslink – the TSO and DSO for the Irish gas network (a subsidiary of Bord Gáis)

Gate System – see Group Processing Approach (GPA)

GIS – Geographic Information System

Greenhouse gases (GHG) – gases released into the earth's atmospheres that are thought to contribute to global warming

GPA – Group Processing Approach, which enables strategic processing of generation applications for grid connection. It was introduced by the Commission for Energy Regulation (CER) in 2004. It allows applications to be processed by the system operators (EirGrid and ESB Networks) in groups or batches known as 'Gates'.

HDA – Habitats Directive Assessment

Hydraulic fracturing – the injection of water at high pressure into bedrock for the formation of an underground reservoir

IAA – Irish Aviation Authority

Impoundment schemes – hydropower facilities that retain water through the use of a dam/weir in a reservoir and extract energy through its controlled release into the river channel

Incineration – see Combustion

IWEA – Established in 1993, the Irish Wind Energy Association (IWEA) is the national body representing the wind energy sector in Ireland. IWEA is committed to promoting the use of wind energy in Ireland and acts as a central point for information for its membership. IWEA is also dedicated to education and awareness building, and to building the skills base of the renewable energy sector in Ireland.

ktoe – kilo-tonne of oil equivalent, unit representing the energy obtained from burning 1,000 metric tonnes of oil

kWh – kilowatt-hour, commonly used unit to measure electricity use and production

LA – local authority

LARES – Local Authority Renewable Energy Strategy

Marine Institute – the national agency responsible for marine research, technology development and innovation (RTDI).

MEC – Maximum export capacity

MW – megawatt, commonly used as a measure of the capacity of an electricity generator

National Grid – the national network for distribution and transmission of electricity

NDP – National Development Plan

NEEAP – National Energy Efficiency Action Plan

NER300 – European Commission demonstration programme for low-carbon technologies

NHA – National Heritage Area

NIS – Natura Impact Statement

NM – nautical miles (1.852 km)

NREAP – the National Renewable Energy Action Plan (NREAP), which sets out the Government's strategic approach and concrete measures to deliver on Ireland's 16% overall renewable energy target for 2020 and minimum 10% sub-target in the transport sector (under Directive 2009/28/EC). The NREAP sets out that the overall target addressed to Ireland will be achieved through 40% renewable electricity, 10% renewable transport and 12% renewable heat.

NPWS – National Parks and Wildlife Service (part of DAHG). The role of the NPWS is to secure the conservation of a representative range of ecosystems and maintain and enhance populations of flora and fauna in Ireland.

NSS – National Spatial Strategy

OPW – Office of Public Works

OREDP – Offshore Renewable Energy Development Plan

Passive solar heating – a method of building design to maximise solar gains and minimise heat losses

PFRA – Preliminary Flood Risk Assessment

Photovoltaic systems (PV) – use of daylight (not necessarily direct sunlight) to convert solar radiation into electricity

Point absorbers – a buoy or other floating device that extracts energy from the upwards and downward motion of the wave

Primary Energy Demand – Ireland's energy supply is discussed in terms of changes to the total primary energy requirement (TPER), defined as the total amount of energy used in Ireland in any given year. This includes the energy requirements for the conversion of primary sources of energy into forms that are useful for the final consumer; for example, electricity generation and oil refining.

Pumped storage – a system in which a surplus of electricity can be used to pump water to a storage facility; this facility can then control the electrical output by releasing the water during a period of high demand

Pyrolysis – a means of converting solid organic material into a liquid biofuel by heating at high temperatures in the absence of oxygen. The resulting pyrolytic or 'bio-oil' can be refined to products in a manner similar to refining crude oil and can be used for electricity production in diesel engines.

RA – Regional authority

RD&D – Research, development & demonstration

REFIT – Renewable Energy Feed-In Tariff, the primary means through which electricity from renewable sources is supported in Ireland. The REFIT schemes are operated by the DCENR.

REIO – Renewable Energy Information Office, part of SEAI

Renewable energy (RE) – comes from energy resources that are continuously replenished through the cycles of nature. Unlike fossil fuels, their supply will never become exhausted; e.g. wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

RES – Renewable Energy Share; the Irish target is 16% of total final energy consumption

RES-E – renewable electricity

RES-H – renewable heating

RES-T – renewable transport

RMP – (in terms of built heritage) Record of Monuments and Places

RPS – (in terms of built heritage) Record of Protected Structures

SAC – Special Area of Conservation

SEA – Strategic Environmental Assessment

SEAI – Sustainable Energy Authority of Ireland, Ireland's statutory energy authority

Shadow flicker – as turbine blades rotate, depending on the sun's position they may throw intermittent shadows. Effects are usually only for a short period of time during the day and year.

Shallow geothermal – shallow geothermal or ground-source energy; use of the solar energy captured in the earth's crust

SPA – Special Protection Area

Stream flow – turbines located beneath the ocean surface to capture tidal energy or ocean currents

SUDS – Sustainable Urban Drainage System

Termination systems – where waves enter the device, the trapped compressed air is used to generate electricity from turbines

Total Final Consumption (TFC) – see Final Energy Demand

Transmission System Operator (TSO) – The transmission system operator looks after the transmission network for the utility in question, e.g. EirGrid is the TSO for the electricity system, and must carry out duties including: planning and developing the system, scheduling and dispatching generation, operating the market, and ensuring system security. Gaslink is the TSO for the gas network.

UCO – Used Cooking Oil

Waste to Energy (WtE) – WtE refers to a facility which converts municipal solid waste (MSW) to energy, through combustion, with power only or combined heat and power (CHP) outputs

WDC – Western Development Commission

Wind take – the possible impacts on optimal performance, e.g. turbulence and wake effects that can occur from turbines located too closely

A.3 Suggested Structure for a Renewable Energy Strategy

1.0 RENEWABLE ENERGY POLICY OVERVIEW AND LEGISLATIVE CONTEXT **STEP 1**

1.1 SCREENING FOR APPROPRIATE ASSESSMENTS AND STRATEGIC ENVIRONMENTAL ASSESSMENTS **STEP 1**

2.0 RENEWABLE ENERGY RESOURCES AND POTENTIAL **STEP 2**

2.1 EXISTING RENEWABLE ENERGY DEVELOPMENT WITHIN JURISDICTION **STEP 2**

2.2 ENERGY RESOURCE DATA SOURCES AND CONSTRAINTS **STEP 2**

2.3 IDENTIFICATION OF EXISTING RENEWABLE ENERGY WITHIN JURISDICTION **STEP 2**

3.0 CONSTRAINTS REVIEW **STEP 3**

3.1 INFRASTRUCTURE PROVISION AND CONSTRAINTS **STEP 3**

- **3.1.1** NATIONAL GRID **STEP 3**
- **3.1.2** GROUP PROCESSING AND GATE 3 WITHIN THE JURISDICITON **STEP 3**
- **3.1.3** GAS **STEP 3**
- **3.1.4** TRANSPORTATION **STEP 3**
- **3.1.5** SERVICES AND UTILITIES (WATER/ WASTEWATER/HEAT) **STEP 3**
- **3.1.6** TELECOMMUNICATIONS/AVIATION **STEP 3**

3.2 ENVIRONMENTAL AND OTHER CONSTRAINTS **STEP 3**

- **3.2.1** NATURAL HERITAGE **STEP 3**
- **3.2.2** LANDSCAPE AND VISUAL DESIGNATIONS **STEP 3**
- **3.2.3** ARCHAEOLOGY AND ARCHITECTURAL HERITAGE DESIGNATIONS **STEP 3**

3.3 IDENTIFICATION OF FUTURE RENEWABLE ENERGY RESOURCE **STEP 3**

- **3.3.1** RENEWABLE RESOURCE MAPPING **STEP 3**

4.0 RENEWABLE ENERGY STRATEGY **STEP 4**

4.1 RENEWABLE ENERGY OPPORTUNITIES AND RESOURCE **STEP 4**

4.2 VISION **STEP 4**

4.3 TARGETS AND GOALS **STEP 4**

4.4 POLICIES AND OBJECTIVES **STEP 4**

4.5 SPATIAL IDENTIFICATION OF RENEWABLE ENERGY RESOURCE **STEP 4**

A.4 Key Renewable Energy Land Use Interactions

ONSHORE WIND	*(Refer to Wind Energy Development Guidelines – DECLG (2006) for full details)*
Location and Land Use	**Proximity of the windfarm to:** — Dwellings & businesses — Other windfarms (cumulative impact) — Habitats & flight paths of protected species, particularly airborne species — Watercourses — Archaeology — Aviation flight paths — Grid location — Protected Structures and Architectural Conservation Areas
Landscape and Visual Impact	— Layout and positioning of turbines along the horizon — Speed, direction and synchronising of blade rotation — Visual impact of access tracks on the landscape — Positioning of cables and transformers — Specific Landscape Sensitivity, Cumulative Visual Impact and Zone of Visual Influence
Site Conditions and Operation	— Slope stability and landslide risk — Noise levels — Shadow flicker — Reflected light; depending on the material finish of the turbines, reflected light may be visible from some distance — Electromagnetic interference, e.g. TV and radio reception or air-traffic signalling — Wind take — Ground-water contamination — Silt traps for surface run-off (after excavation) — Lightning protection The local authority may need to ensure that all guidance in respect of development of wind energy infrastructure in peatland areas, as outlined in Appendix 4 of the Wind Energy Development Guidelines – DECLG (2006), is followed by developers in cases where peat is present at a proposed windfarm site. Due regard to any additional relevant policy documentation in relation to development in peatland areas should also be considered.
Infrastructure	— National Grid connection — Access roads for construction and decommissioning — Capacity of local roads — HGV and crane accessibility — Local access roads in peat/bog or very wet lands may need special provisions — Low-flying aircraft and flight paths may be an issue

OFFSHORE WIND[22]	
Location and Land Use	For the development of offshore windfarms, it is necessary to obtain a foreshore licence/lease from the DECLG for activities out to the 12 nautical mile foreshore limit. Onshore planning permission will usually also be required. The SEA Environmental Report and Nature Impact Assessment in the draft OREDP should be referred to when considering all technical and environmental constraints.
Landscape/Seascape and Visual Impact	— Landscape & Seascape Character — Distance of development from shore, and in particular development in the near-shore area — Sensitivity and carrying capacity of adjoining coast — Height of turbines — Size & number of turbines — Positioning of cables and transformers — Layout and positioning of turbines along the horizon — Speed, direction and synchronising of blade rotation — Colour
Site Conditions and Operation	— Dynamic forces of the ocean; coastal erosion, flooding and tidal patterns — Potential impacts of climate change — Environmental disturbance that may occur during the construction process, e.g. marine habitat
Infrastructure	— Onshore National Grid connection — Offshore grid connection — Access roads for construction and decommissioning — Capacity of local roads — HGV and crane accessibility

22 Local authorities should refer to the project mitigation measures developed as part of the strategic environment assessment in the draft Offshore Renewable Energy Development Plan (available on DCENR and SEAI websites)

BIOENERGY	
Location and Land Use	**Impacts vary according to the bioenergy resource/technology:** — Proximity to a sufficient supply of the raw materials necessary for energy production is usually desirable to remain efficient and sustainable; e.g. municipal solid-waste-to-energy facility or energy crop combustion plant. — The proximity of the bioenergy facility to dwellings and other sensitive locations, such as schools and hospitals, should be assessed from a public safety perspective. — For heat-producing or CHP facilities, the location is important regarding the availability of a local market; i.e. the plant's proximity to a high heat demand area/facility or whether it would be economical to provide a district heating (DH) scheme. — Industries which use their residual resources to produce onsite space heating and some electricity, e.g. sawmills, will not necessarily need to locate beside a well-developed transport network.
Landscape and Visual Impact	**Impacts vary according to the bioenergy resource/technology:** — A combustion facility such as that for biomass, CHP and energy from waste (EfW) will generally be of a large scale, with an industrial character and tall stacks/chimneys. This can be integrated into a more urban and industrial setting, however. (The Vienna Waste to Energy plant is located in the city beside a university and has been designed to integrate with the surrounding environment.) — There are also variations in stack/chimney height, whether incineration, pyrolysis or gasification are used. — The siting of a bioenergy facility with regard to the surrounding environment and the visual impact it would impose. If the bioenergy facility is located within an industrial development, it will have a different impact on the surrounding area than if it were located standalone on a greenfield site. For example: — An anaerobic digestion plant situated on farms will not have a major influence on the visual character of the area, while a standalone centralised anaerobic digestion plant may alter the visual landscape. — Facilities such as landfill gas or sewage gas plants are more often than not located on site at a landfill or water treatment works, so visual impact may not be a major concern.

Site Conditions and Operation	**Feedstock:** — Scale of a bioenergy facility – sufficient energy need and supply of feedstock — Maintenance of recycling levels for an EfW facility — Use of non-hazardous wastes — Separation or use of residual wastes **Pollution:** — Gas emissions from combustion — Noise pollution (potentially from operations/traffic) — Odour (potentially from combustion, anaerobic digestion storage and transport of wastes and feedstock) — Light pollution (e.g. a 24/7 operation) — Potential for contaminants to enter soil and groundwater **Local authorities may need to consider provisions for:** — Seepage from stored effluents (specifically biofuels and bioliquids) — Contamination of ground waters — Removal of cooling waters/agents and waters from gas cleaning — Disposal of hazardous end-products, e.g. fly-ash and gas residues
Infrastructure	Facilities where electricity on a large scale, is produced may need to consider proximity to the National Grid. Facilities where heat is produced will need either an onsite use for the heat or a distribution network associated with a DH scheme and a heat market, e.g. a new development or a heavy-industry area. Also of relevance to large scale generators, the potential round-the-clock operations of a bioenergy facility and the often high volumes of material needed, the continuous supply of feedstock and removal of end products from bioenergy facilities may result in additional traffic loading on local transport infrastructure. Transport considerations include: — Proximity to an adequate transport network — HGV accessibility for feedstock inputs and end-product removal — Road and junction capacity to cater for additional traffic — Road network condition and maintenance Freight movements by rail and by sea may also need to be considered.

HYDROPOWER	
Location and Land Use	— Land take should be considered, especially for impoundment schemes using an artificial reservoir, due to the flooding necessary. — Impact upon angling and fish stocks, migration patterns, etc should be considered.
Landscape and Visual Impact	— Potential to affect scenery, protected views and landscapes due to facility, associated reservoir and/or associated infrastructure. — Design and integration of the project can reduce visual impact.
Site Conditions and Operation	— Downstream influence on flow regimes — Flood risk assessment — Siltation of the water-course during construction may need to be mitigated
Infrastructure	— As hydropower installations are often located in remote and highland areas, providing access routes for construction and decommissioning will need to be considered

SOLAR ENERGY	
Location and Land Use	Most solar installations in Ireland at present involve integrated microgeneration, most of which do not require planning permission. Solar panels are most often located on the south-facing roofs of buildings in order to maximise energy yield. Solar panels may also be incorporated into the facades of buildings and, increasingly, are becoming a part of the building fabric presented to the local authorities. The local authority may wish to specify the terms that define a commercial or large-scale scheme.
Landscape and Visual Impact	If mounted on the roof of a structure, the visual impact of a solar device is not likely to be significant, but this must be evaluated on a case-by-case basis. Where solar panels are proposed for the facades of buildings, greater consideration should be given to the architectural character of the installations. Special provisions may need to be made for the positioning of solar devices on protected structures and structures in architectural conservation areas.
Infrastructure	Photovoltaic installation may produce an excess of electricity which can be exported to the National Grid. In this case, local authorities may wish to provide guidance on positioning of transformers and power cables relating to solar photovoltaic projects.

OCEAN ENERGY	
Location and Land Use	Local authorities (LAs) should review the SEA Environmental Report and Natura Impact Assessment in the draft OREDP as regards potential impacts. Usually both a foreshore lease and onshore planning permission will be required.
Landscape/Seascape and Visual Impact	Wave and tidal energy is still at the RD&D pre-commercial stage, so a range of potential technology types operating in different ways are possible. LAs should review the SEA and Natura assessment of the draft OREDP as to current types of installation possible and the impact on the landscape and visual environment. These installations must thus be considered on a case-by-case basis.
Site Conditions and Operation	During construction processes (such as piling), dredging and blasting may be undertaken. Provisions should be made to prevent the pollution of the marine habitat throughout construction and the operation of the installation. Consideration of the impacts of the use of underwater turbines and moving parts on marine life may also be necessary.
Infrastructure	Wave and tidal installations may vary in size – and be quite large. Transportation of components both on land and at sea may need to be considered. For near-shore installations, access by slipway may be necessary. Much of the supporting infrastructure will have to be supplied from and connected to proximate locations.

GEOTHERMAL ENERGY	*Considerations vary greatly between shallow/ground source geothermal projects and deep geothermal projects. The sections below provide a discussion on both geothermal energy types.*
Location and Land Use	Due to the nature of deep geothermal energy extraction, local authorities should allow for the possibility that several planning applications may be needed to provide for exploration drilling and subsequent activities of the development and the final facility construction. Other exploration activities generally involve surface geophysical surveys which may be exempt from planning depending on the exploration licenses issued. — Proximity to water resources – heightened risk of contaminating wells, aquifers and other water-courses — Location of unused mining facilities and underground works – risk of collapse during drilling, and the use of such facilities with some technologies such as using abandoned mine facilities for developing open loop systems — Proximity of shallow geothermal systems to each other using, either open loop or large scale closed loop technology, and their potential thermal effects on the ground — The potential of open loop shallow geothermal systems being developed in aquifers – classified as high vulnerability
Landscape and Visual Impact	With a geothermal installation, the energy is extracted underground, but local authorities may need to consider the impact of an industrial plant for processes such as electricity production, and the positioning of power cables and transformers to minimise visual disturbance. — Visual impact of geothermal plants can be minimised with many of the elements being completed underground e.g. the energy centre, well-heads and district heating network. — Shallow/ground source installations can also have minimal visual impact. A good example of this is the 158 borehole, 800 kW closed loop collector below the IKEA car park in Dublin. — Deep geothermal operations may require the building of stations for the generation/distribution of electricity and heat above the large diameter boreholes
Site Conditions and Operation	**Issues that may arise include:** — The zone of influence of underground works (for production and re-injection wells) and the impacts on surface structures and water sources, and the risk of ground subsidence — Monitoring of surface and ground-water quality — Seismic factors associated with drilling near faults and other geological features, and the use of reservoir stimulation with some technologies — Risk factors associated with encountering gas pockets and other sub-surface substances — Archaeological concerns — Noise creation from drilling
Infrastructure	Construction and decommissioning transportation access may need to be considered.

A.5 Relevant Consultation Bodies (non-exhaustive list)

Adjoining local authorities

An Comhairle Ealaíon

An Taisce – The National Trust for Ireland

Birdwatch Ireland

Bord Fáilte

Bord Gáis Éireann (BGE)

Bord Iascaigh Mhara

Bord na Móna

Chamber of commerce

Coastal Concern Alliance

Coillte

Commission for Energy Regulation (CER)

Competence Centre for Biorefining and Bioenergy

County and City Managers Association (CCMA)

County Enterprise Board

Dept. of Agriculture, Fisheries and Food (DAFF)

Dept. of Arts, Heritage and the Gaeltacht

Dept. of Communications, Energy and Natural Resources (DCENR)

Dept. of the Environment, Community and Local Government (DECLG)

Dept. of Finance

Dept. of Jobs, Enterprise and Innovation

Dept. of Justice and Equality

Dept. of Transport, Tourism and Sport

Dublin Docklands Authority

Dublin Transportation Office

Eircom

EirGrid

Electricity Supply Board (ESB)

Enterprise Ireland

Environmental Pillar of Social Partnership

Environmental Protection Agency (EPA)

ESB Networks

ESRI – Economic and Social Research Institute

Gaslink

Geological Survey of Ireland (GSI)

Geothermal Association of Ireland (GAI)

Heat Pump Association of Ireland (IHPA)

Heritage Council

HSE – Health Service Executive

Iarnród Éireann

IBEC Large Energy Users

IDA – Industrial Development Agency

Institute of Geologists of Ireland (IGI)

International Association of Hydrogeologists (IAH)

Irish Aviation Authority

Irish Bioenergy Association (IrBea)

Irish Business & Employers Confederation (IBEC)

Irish Environmental Network

Irish Farmers Association (IFA)

Irish Hydropower Association

Irish Local Development Network (ILDN)

Irish Peatland Conservation Council

Irish Timber Growers Association

Irish Wind Energy Association (IWEA)

Marine Institute

Marine Renewable Industry Association (MRIA)

Meitheal na Gaoithe (Irish Wind Farmers Group)

Meteorological Service

Micro Electricity Generation Association (MEGA)

Mobile phone operators

National Authority for Occupational Safety and Health

National Offshore Wind Association of Ireland (NOW Ireland)

National Parks and Wildlife Service (NPWS)

National Roads Authority (NRA)

Northern Ireland Dept of Enterprise, Trade & Investment

Office of Public Works (OPW)

OFTEC – Oil Firing Technical Association

Railway Procurement Agency

Regional Fisheries Board

Relevant airport operator

Relevant harbour authorities

Relevant health board

Relevant regional authority

RTÉ

Sustainable Energy Authority of Ireland (SEAI)

SEAI Environmental Policy Statistical Support Unit (EPSSU)

SEAI Renewable Energy Information Office (REIO)

Teagasc

Udarás na Gaeltachta

VECs – Vocational educational committees

Association of Irish Energy Agencies (AIEA)

Carlow/Kilkenny Energy Agency

Cavan Monaghan Rural Development

CoDEMA (City of Dublin Energy Management Agency)

Cork City Energy Agency

Cork County Energy Agency

Donegal County Council

Galway Energy Agency Ltd

Kerry Energy Agency

Kildare County Council

Limerick Energy Agency

Mayo Energy Agency

Midlands Energy Agency

Monaghan County Council

Northern Ireland Energy Agency

Tipperary Energy Agency

Waterford Energy Bureau

Wexford Energy Agency Management Ltd

Northern Ireland Consultation Bodies

DOENI – Department of Environment, NI

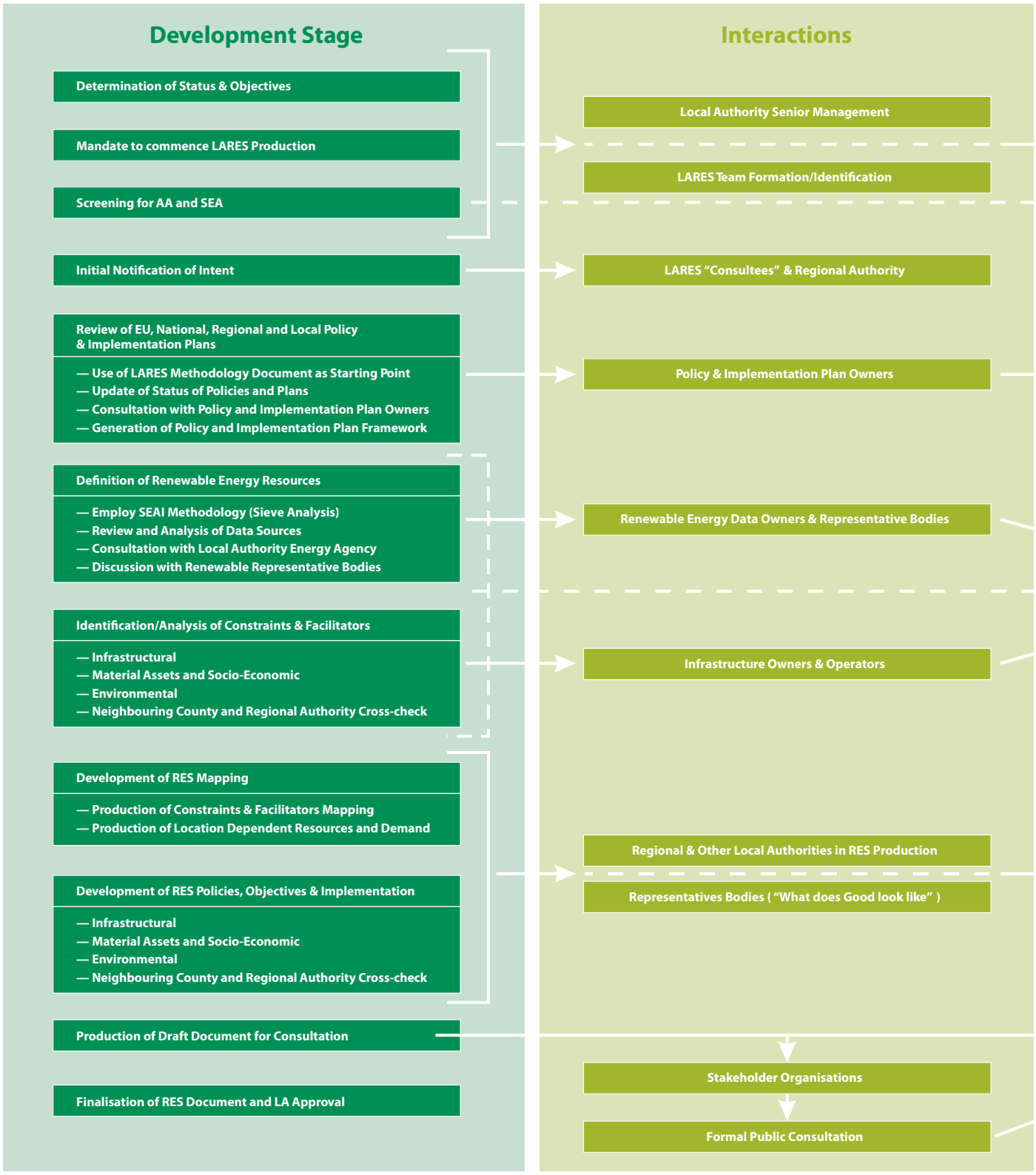
NIEA – Northern Ireland Environment Agency

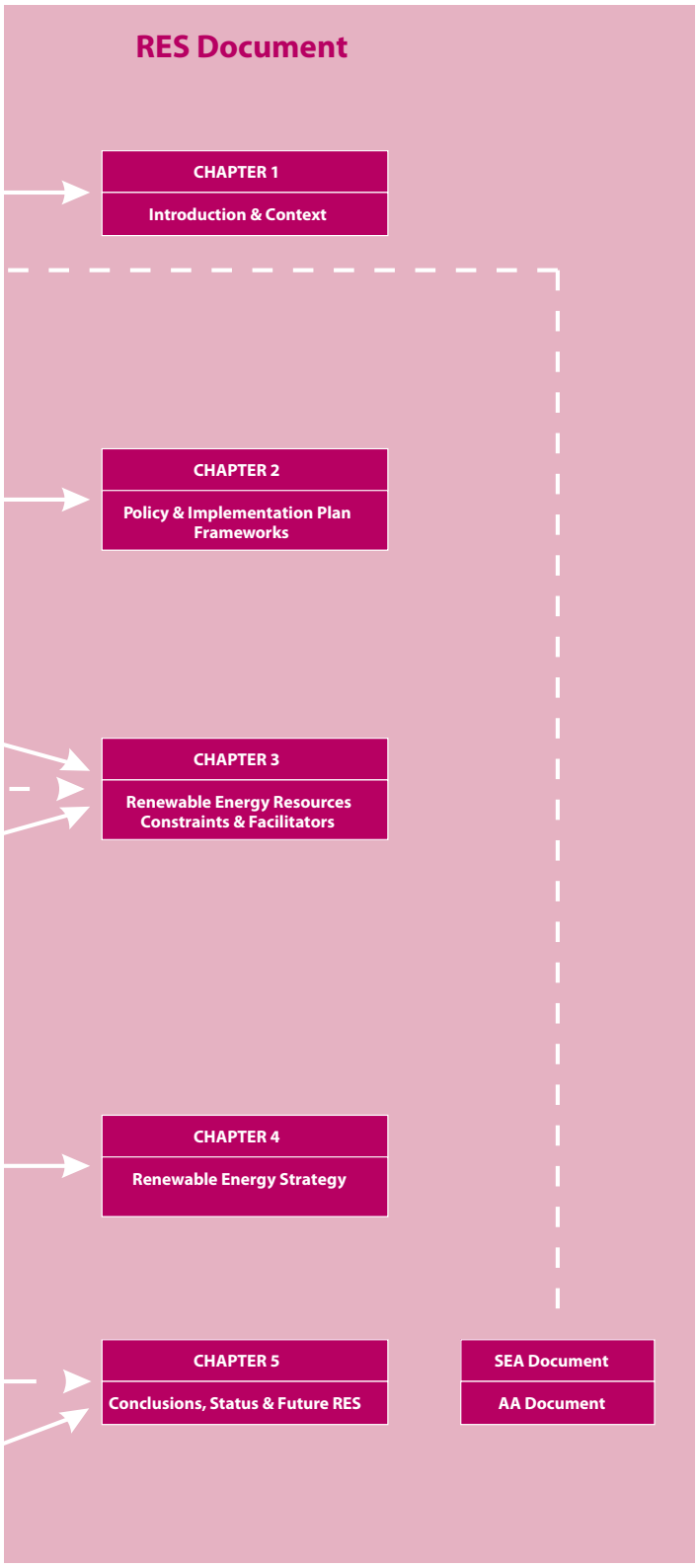
SONI – System Operator for Northern Ireland

NIAER – Northern Ireland Authority for Energy Regulation

DETINI – Department of Enterprise, Trade and Investment, NI

A.6 LARES Development Pathways and Interactions




RES Document
CHAPTER 1
Introduction & Context
CHAPTER 2
Policy & Implementation Plan Frameworks
CHAPTER 3
Renewable Energy Resources Constraints & Facilitators
CHAPTER 4
Renewable Energy Strategy
CHAPTER 5
Conclusions, Status & Future RES
SEA Document
AA Document

A.7 Referenced Documents and Publications

PUBLICATION	AUTHOR	YEAR	WEB LINK
Appropriate Assessment of Plans & Projects – Guidance for Planning Authorities	DECLG	2009	http://www.npws.ie/planning/appropriateassessment/
Best-Practice Guide for Photovoltaics	SEAI		http://www.seai.ie/Publications/Renewables_Publications/Solar_Energy/Best_Practice_Guide_for_PV.pdf
Best-Practice Guidelines for the Irish Wind Energy Industry	IWEA/ SEAI	2012	http://www.iwea.com/contentFiles/Documents%20for%20Download/Publications/IWEA%20Policy%20Documents/IWEA%20best%20practise%20guidelines.pdf
Bioenergy Action Plan for Ireland (2007–2020)	DCENR	2007	http://www.dcenr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-878A-AA04A7288DA4/0/FinalBioenergyReport.pdf
Bioenergy and the Western Region	Western Development Commission	2012	http://www.raslres.eu/wp-content/uploads/2011/06/Bioenery-and-the-WR.pdf
Bioenergy In Ireland	SEAI	2004	http://www.seai.ie/About_Energy/Energy_Policy/National_Policy_Drivers/Bioenergy_in_Ireland.pdf
Bioenergy Mapping System	SEAI	Ongoing	http://maps.seai.ie/bioenergy/
Biofuels Obligation Scheme	National Oil Reserves Agency (NORA)	2010	http://www.nora.ie/regulations_legislation/biofuels_obligation_scheme.450.474.html
Birds Directive 2009/147/EC on conservation of wild birds	European Commission	2009	http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm
CENELEC (draft) EN50438 Requirements for the connection of micro-generators in parallel with public low-voltage distribution networks	CENELEC		http://www.cenelec.eu/dyn/www/f?p=104:110:494272220868367::::FSP_PROJECT,FSP_LANG_ID:15752,25
CER/09/099 - Treatment of Small, Renewable and Low Carbon Generators outside the Group Processing Approach	CER	2009	http://www.cer.ie/GetAttachment.aspx?id=eda74811-2364-4ec4-865e-7c3d84023114.
Conditions Governing the Connection and Operation of Micro-generation	ESB Networks	2009	http://www.esb.ie/esbnetworks/en/generator-connections/micro_gen_connections.jsp
Development of a Techno-Economic Model for Renewable Energy Resource Assessments	Rebecca Denton		
DIRECTIVE 2004/8/EC on the promotion of cogeneration based on a useful heat demand in the internal energy market	European Commission	2004	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:052:0050:0050:EN:PDF

EirGrid's Grid25 Strategy – A Strategy for the Development of Ireland's Electricity Grid for a Sustainable and Competitive Future	EirGrid	2008	http://www.eirgrid.com/media/Grid%2025.pdf
EirGrid's Grid25 Implementation Programme 2011 - 2016	EirGrid	2012	http://www.eirgrid.com/media/GRID25%20Implementation%20Programme.pdf
Emissions Trading Scheme (EU ETS)	European Commission	2005 – ongoing	http://ec.europa.eu/clima/policies/ets/index_en.htm
Energy (Biofuel Obligation and Miscellaneous Provisions) Act 2010	Government Act	2010	http://www.irishstatutebook.ie/2010/en/act/pub/0011/index.html
Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub Threshold Development	EPA	2003	http://www.environ.ie/en/Publications/Environment/Miscellaneous/FileDownLoad,1804,en.pdf
ENVision	EPA	Ongoing	http://gis.epa.ie/
Geothermal Maps Resource	SEAI	Ongoing	http://maps.seai.ie/geothermal/
Guidelines on information to be contained in Environmental Impact Statements (EIS)	EPA	2003	http://www.epa.ie/downloads/advice/ea/guidelines/
Habitats Directive – Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora	European Commission	1992 (+ amndmnts)	http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
Harnessing Our Ocean Wealth; An Integrated Marine Plan for Ireland	Government Marine Coordination Group	2012	http://www.ouroceanwealth.ie/SiteCollectionDocuments/Harnessing%20Our%20Ocean%20Wealth%20Report.pdf
Implementation of SEA Directive (2001/42/EC): Assessment of the Effects of Certain Plans and Programmes on the Environment Guidelines for Regional Authorities and Planning Authorities	DECLG	2004	http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,1616,en.pdf
Ireland's NREAP (National Renewable Energy Action Plan)	DCENR	2010	http://www.dcenr.gov.ie/NR/rdonlyres/C71495BB-DB3C-4FE9-A725-0C094FE19BCA/0/2010NREAP.pdf
Ireland's NREAP – First Progress Report	DCENR	2012	http://www.dcenr.gov.ie/NR/rdonlyres/B611ADDD-6937-4340-BCD6-7C85EAE10E8F/0/IrelandfirstreportonNREAPJan2012.pdf
Irish Wave Energy Resource Atlas	Marine Institute	Ongoing	http://www.maps.marine.ie/wave/default.aspx
Integrated Biodiversity Impact Assessment, Streamlining AA, SEA and EIA Processes. Best Practice Guidance.	EPA	2012	http://www.epa.ie/downloads/pubs/research/biodiversity/name,33395,en.html
Kyoto Protocol	UNFCC	1997	http://unfccc.int/kyoto_protocol/items/2830.php

Large Combustion Plant Directive: Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants	European Commission	2001	http://ec.europa.eu/environment/air/pollutants/stationary/lcp/legislation.htm
Micro-renewables: Reference for planning exemptions and restrictions for small-scale renewable technologies and CHP structures	SEAI	—	http://www.seai.ie/Renewables/Microgeneration/Conditional_Planning_Exemptions/
National Development Plan (2007–2013)		2007	http://www.ndp.ie
National Energy Efficiency Action Plan (NEEAP) – Maximising Ireland's Energy Efficiency (2009–2020)	DCENR	2009 & 2013	http://www.dcenr.gov.ie/energy/energy+efficiency+and+affordability+division/national+energy+efficiency+action+plan.htm
National Landscape Strategy – A National Landscape Strategy for Ireland, Strategy Issues Paper for Consultation	DAHG	2011	http://www.ahg.gov.ie/en/Consultations/NationalLandscapeStrategyforIreland-StrategyIssuesPaper/
National Spatial Strategy 2002–2020	DECLG	2002	http://www.irishspatialstrategy.ie/
NER 300 Decision on demonstration support for CCS and innovative renewables	DCENR	2010	http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/NER+300.htm
Offshore Renewable Energy Development Plan (OREDP) Strategic Environmental Assessment (SEA)	DCENR	2010	http://www.dcenr.gov.ie/NR/rdonlyres/E9DC9CEF-20B1-4A1D-98F4-C6739B219DEE/0/OREDPSEANTSFinal2010forWEB.pdf
Photovoltaic GIS Interactive Maps	European Commission	Ongoing	http://re.jrc.ec.europa.eu/pvgis/apps3/pvest.php
Planning and Development (Amendment) Act 2010	Government Act	2010	http://www.irishstatutebook.ie/pdf/2010/en.act.2010.0030.PDF
Planning and Development (Strategic Infrastructure) Act 2006	Government Act	2006	http://www.irishstatutebook.ie/2006/en/act/pub/0027/index.html
REFIT (Renewable Energy Feed-In Tariff)	DCENR	2012	http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/REFIT.htm
Renewable Energy Directive 2009/28/EC on the promotion of the use of energy from renewable sources	European Commission	2009	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=Oj:L:2009:140:0016:0062:en:PDF_
Renewable Energy: Power for a Sustainable Future	Godfrey Boyle	2012	
Renewable Energy Resource: Ireland to 2010 and 2020 – A Methodology	SEAI/ ESBI	2004	http://www.seai.ie/Grants/Renewable_Energy_RD_D/Projects_funded_to_date/Biomass/Renewable_Energy_Resource_Ireland_to_2010_and_2020/
S.I. No. 147/2011 –European Communities (Renewable Energy) Regulations 2011	Statutory Implementation	2011	http://www.dcenr.gov.ie/NR/rdonlyres/C42ACBC8-61DE-4A10-9B59-2395CB7DDE2C/0/SI147of2011.pdf

S.I. No. 158/2012 – Sustainable Energy Act 2002 (Section 8(2)) (Conferral Additional Functions – Renewable Energy Order)	Statutory Implementation	2012	http://www.dcenr.gov.ie/NR/rdonlyres/6AB9A233-1BC5-4F3D-8D0B-A5313179F335/0/SI158_2012.pdf
S.I. No. 200/2011 – European Communities (Environmental Assessment of Certain Plans and Programmes) (Amendment) Regulations 2011	Statutory Implementation	2011	http://www.irishstatutebook.ie/2011/en/si/0200.html
S.I. No. 201/2011 — Planning and Development (Strategic Environmental Assessment) (Amendment) Regulations 2011	Statutory Implementation	2011	http://www.irishstatutebook.ie/2011/en/si/0201.html
S.I. No. 235/2008 – Planning and Development Regulations 2008	Statutory Implementation	2008	http://www.irishstatutebook.ie/2008/en/si/0235.html
S.I. No. 435/2004 — European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004	Statutory Implementation	2004	http://www.irishstatutebook.ie/2004/en/si/0435.html
S.I. No. 436/2004 — Planning and Development (Strategic Environmental Assessment) Regulations 2004	Statutory Implementation	2004	http://www.irishstatutebook.ie/2004/en/si/0436.html
S.I. No. 477/2011 – European Communities (Birds and Natural Habitats) Regulations 2011	Statutory Implementation	2011	http://www.irishstatutebook.ie/pdf/2011/en.si.2011.0477.pdf
S.I. No. 600/2001 – Planning and Development Regulations, 2001	Statutory Implementation	2001	http://www.irishstatutebook.ie/2001/en/si/0600.html
S.I. No. 83/2007 – Planning and Development Regulations, 2007	Statutory Implementation	2007	http://www.irishstatutebook.ie/2007/en/si/0083.html
SEAI Renewables publications (numerous)	SEAI	-	http://www.seai.ie/Publications/Renewables_Publications/
SEAI Energy In Ireland publications (numerous – latest version 1990-2011)	SEAI	2012	http://www.seai.ie/Publications/Statistics_Publications/Energy_in_Ireland/Energy_in_Ireland_1990_-_2011.html
Small-Scale Hydroelectric Potential – County Rivers	Department of Energy (now "DCENR")	1985	http://www.seai.ie/Publications/Renewables_Publications/Hydropower/Small_Scale_Hydro-Electric_Potential_of_Ireland.pdf
South-East Region Bioenergy Implementation Plan (2008–2013)	South East Regional Planning Authority	2008	http://www.sera.ie/media/Regional%20BioEnergy%20Plan.pdf
South West Bioenergy Plan 2009–2020	South West Regional Authority	2009	http://www.swra.ie/contentFiles/pdfs/bioenergyplan.pdf
Strategy for Renewable Energy 2012–2020	DCENR	2012	http://www.dcenr.gov.ie/NR/rdonlyres/C0498ADB-362B-449C-B381-0099B552EBD1/0/RenewableEnergyStrategy2012_2020.pdf

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The Economic Benefits from the Development of BioEnergy in Ireland	IrBEA	2012	http://www.irbea.ie/images/documents/Reports_Publications/socio-economic%20report.pdf
The National Climate Change Strategy (2007–2012)	DECLG	2007	http://www.environ.ie/en/Publications/Environment/Atmosphere/FileDownLoad,1861,en.pdf
The Planning System and Flood Risk Management: Guidelines for Planning Authorities	DECLG/ OPW	2009	http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,21708,en.pdf
Tidal & Current Energy Resources	SEAI		http://www.seai.ie/Publications/Renewables_Publications/Tidal_Current_Energy_Resources_in_Ireland_Report.pdf
Tidal & Current Modelling	Marine Institute	Ongoing	http://www.marine.ie/home/services/operational/oceanography/OceanForecast.htm
Total Renewable Energy Resource in Ireland, Final Report	ESBI/ETSU	1997	European Union ALTENER Programme, Report No. PA598-R2-001
UK Energy Act	UK legislation	2004	http://www.legislation.gov.uk/ukpga/2004/20/contents
Water Framework Directive: Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy	European Commission	2000	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:NOT
White Paper on Energy Policy: Delivering a Sustainable Energy Future for Ireland – The Energy Policy Framework 2007-2020	DCENR	2007	http://www.dcenr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/30374/EnergyWhitePaper12March2007.pdf
Wildlife Act, 1976	Government Act	1976 (& amend)	http://www.irishstatutebook.ie/1976/en/act/pub/0039/print.html
Wind Atlas	SEAI	2003 (to be remodelled 2013)	http://maps.seai.ie/wind/
Wind Energy Development Guidelines	DECLG	2006	http://www.environ.ie/en/Publications/DevelopmentandHousing/Planning/FileDownLoad,1633,en.pdf
Wind Energy Developments and Natura 2000	European Commission	2010	http://ec.europa.eu/environment/nature/natura2000/management/docs/Wind_farms.pdf
Wood Energy Strategy for the Western Region (and other RASLRES project outputs)	Western Development Commission	2011	http://www.raslres.eu/wp-content/uploads/2011/06/Wood-Energy-Installations-WR-2011.pdf

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Sustainable Energy Authority of Ireland
Wilton Park House, Wilton Place, Dublin 2, Ireland.

t +353 1 808 2100
f +353 1 808 2002

e info@seai.ie
w www.seai.ie

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