



GREBE

Generating Renewable Energy
Business Enterprise



Northern Periphery and
Arctic Programme
2014-2020



Advice Notes on Wind Technology Economics for the NPA Region



www.grebeproject.eu

The GREBE Project

What is GREBE?

GREBE (Generating Renewable Energy Business Enterprise) is a €1.77m, 3-year (2015-2018) transnational project to support the renewable energy sector. It is co-funded by the EU's Northern Periphery & Arctic (NPA) Programme. It focuses on the challenges of peripheral and arctic regions as places for doing business, and helps develop renewable energy business opportunities in areas with extreme conditions.

The project partnership includes the eight partners from six countries, Western Development Commission (Ireland), Action Renewables (Northern Ireland), Fermanagh & Omagh District Council (Northern Ireland), Environmental Research Institute (Scotland), LUKE (Finland), Karelia University of Applied Sciences (Finland), Narvik Science Park (Norway) and Innovation Iceland (Iceland).

Why is GREBE happening?

Renewable Energy entrepreneurs working in the NPA area face challenges including a lack of critical mass, dispersed settlements, poor accessibility, vulnerability to climate change effects and limited networking opportunities.

GREBE will equip SMEs and start-ups with the skills and confidence to overcome these challenges and use place based natural assets for RE to best sustainable effect. The renewable energy sector contributes to sustainable regional and rural development and has potential for growth.

What does GREBE do?

GREBE supports renewable energy start-ups and SMEs:

- To grow their business, to provide local jobs, and meet energy demands of local communities.
- By supporting diversification of the technological capacity of SMEs and start-ups so that they can exploit the natural conditions of their locations.
- By providing RE tailored expert guidance and mentoring to give SMEs and start-ups the knowledge and expertise to grow and expand their businesses.
- By providing a platform for transnational sharing of knowledge to demonstrate the full potential of the RE sector by showcasing innovations on RE technology and strengthening accessibility to expertise and business support available locally and in other NPA regions.
- To connect with other renewable energy businesses to develop new opportunities locally, regionally and transnationally through the Virtual Energy Ideas Hub.
- By conducting research on the processes operating in the sector to improve understanding of the sector's needs and make the case for public policy to support the sector.

For more information, visit our website:

<http://grebeproject.eu/>

Follow our Blog:

<https://greberenewableenergyblog.wordpress.com/>

Like us on Facebook:

<https://www.facebook.com/GREBEProject/>

Follow us on Twitter:

https://twitter.com/GREBE_NPA

The Advice Note aim to provide introductory material for entrepreneurs, startups and SME's, considering to enter into the renewable energy sphere and based in the NPA regions partners to GREBE. The scope of the Advice Note covers regional, trade and industry, renewable energy (RE), technology information from Ireland, Northern Ireland, Scotland, Iceland and Finland. Different partner regions have different level of deployment of the various RE technologies covered by the Advice Notes. Thus, the level of information will vary depending on the level of deployment for each technology. For example, wind is not deployed on a large scale in North Karelia (Finland); however, it is widely deployed in Scotland, Ireland and Northern Ireland.

The focus of the Advice notes is on regional information of some of the main economic characteristics sited as imperative, when making an informed choice, regarding which RE technology may be the optimal choice for a new business venture:

- Costs and economics associated with the relevant technology
- Support schemes available, relevant to the technology
- Government allowance/exemptions, relevant to the technology
- Funding available for capital costs of the relevant technology
- List of the relevant to the technology suppliers/developers, with focus on local/regional, suppliers/developers and the products and services they offer.

The technologies that are covered in the Advice Note are the following:

- *Biomass & Biomass CHP*
- ***Wind***
- *Solar PV and Solar Thermal*
- *Small – scale hydro (SHP)*
- *Anaerobic Digestion (AD)*
- *Geothermal*
- *Air source heat pump (ASHP)*
- *Ground source heat pump (GSHP)*
- *Energy storage*
 - *Electric (batteries)*
 - *Thermal (heat storage)*
 - *Chemical (hydrogen – fuel cell and electrolysis).*

Wind Economics Across the NPA



The first wind turbines for electricity generation were developed at the beginning of the 20th century. Thus, wind technology is one of the most mature and proven technologies on the market. In 2015, the wind energy industry installed 12.8 GW in the EU – more than gas and coal combined. In areas with good wind resources, generating electricity with wind turbines is already competitive. Thus, wind turbines offer the prospects of cost efficient generation of electricity and fast return on investment. Usually, the greater the long term annual average wind speed, the more electricity will be generated and the faster the investment will pay back. The map below gives an overall picture of the wind potential across the globe, showing that the NPA region has a great potential to harness the benefits associated with wind energy generation.

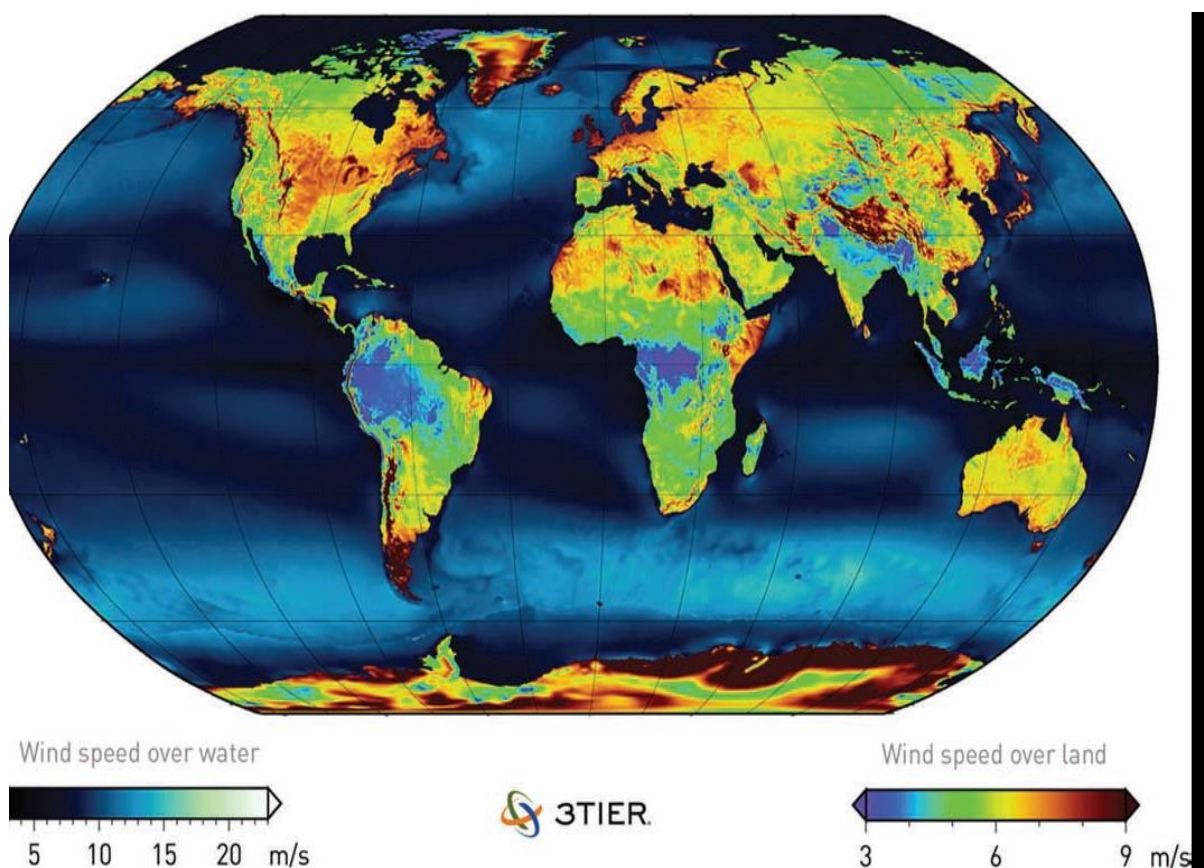


Figure 1. Global wind resource. The red colour represents the strongest wind and the blue colour denotes the weakest wind resource.¹

¹ <https://www.quora.com/What-are-the-different-types-of-thematic-maps>

The business of exploiting wind energy to produce electricity is carried out at various scales from single turbines to large windfarms. There is a wide variety of different in scale wind turbines available, ranging from small (0.05kW to 50kW), to medium (50kW to 500 kW) to large above 500kW.

There are two main types of wind turbine design: Horizontal Axis Wind Turbines and Vertical Axis Wind Turbines. Overall, Horizontal Axis Wind Turbines are more feasible and as they are the only turbines that can be used for large-scale applications and highly efficient. However, they do have a number of issues, the most significant being the lack of power output at low and high wind speeds. As such these turbines have generally not been employed in the more hostile areas of the NPA region. Vertical Axis Wind Turbines are more suitable for small-scale applications and for extreme.

The different scales and types of turbines can be further subdivided in the following categories:

- Building mounted wind turbines – they are small (typically 1-6kW) turbines that can be placed on the roof of a building. Small scale turbines of this type are very well suited for rural areas, where wind speeds are generally higher; thus allowing for cheaper electricity than the grid.
- Free standing turbines - can be a single turbine or a group of turbines placed on industrial sites or similar plot, where enough space is accessible.
- Small-scale free standing turbines – best situated to generate electricity on-site for individual businesses. Turbines up to 50kW are a form of microgeneration.
- Large-scale free standing turbines (1-3MW) - some sites may be big enough to accommodate larger turbines.

The economics governing the development of a wind project are similar. The main parameters governing wind power economics include²:

- Capital costs (CAPEX) – Around 75% of the total costs of a wind energy project is related to capex costs particularly to the cost of the wind turbine, foundations, electrical equipment and grid connection.

² Taylor and Francis, 2009.

- While the turbine itself around 70% of the capex, grid connection accounts for 9% and foundation accounts for around 7% of the capex. The cost of acquiring a turbine site varies between projects but account for a minor share of total costs.
- Operational cost (OPEX) - operation and maintenance costs set up a considerable part of the total annual costs of a wind turbine. For a new turbine they might be up to 25% of the total levelised cost (LCOE) per kWh produced over the lifetime of the turbine. OPEX costs cover regular maintenance; repair; spare parts; and administration.
- Electricity production/average wind speed and yield.
- Turbine lifetime – 20 to 25 years.
- Discount Rate



GREBE

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Scotland



Northern Periphery and
Arctic Programme
2014–2020



Wind is one of Scotland's most plentiful renewable energy resources and over 25% of Europe's wind resource is found in Scotland. Furthermore, a substantial amount of the UK's total wind capacity is installed in Scotland - 5328 MW installed capacity as of March 2015. Wind proportion of electricity generation in Scotland in 2016 was at 12,539 GWh which was estimated to be nearly 6 times the level of wind in 2006.

2016 ELECTRICITY OUTPUT BY TECHNOLOGY (GWh)

TOTAL = 19,658 GWh

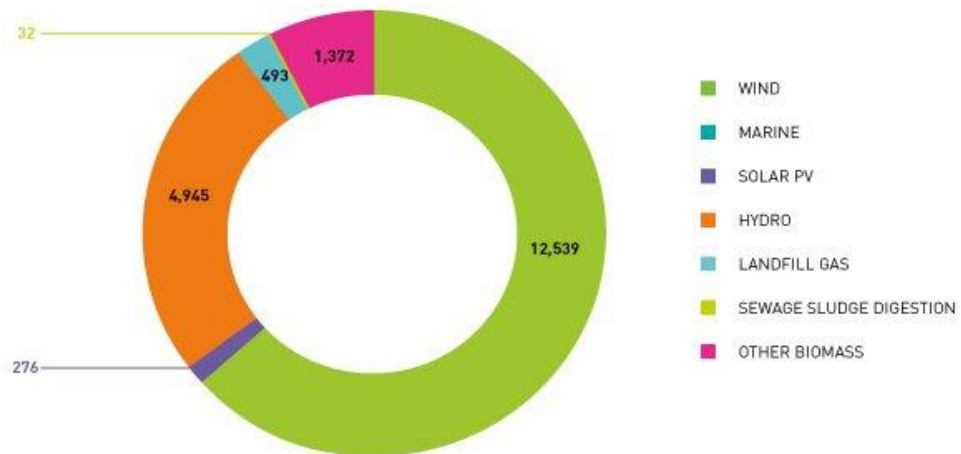


Figure 2. Electricity output by technology ³

Onshore account for over 72 per cent of installed capacity in the first quarter of 2017 (see Figure.1 below). A substantial additional capacity (>11GW) is in planning or consented stage across Scotland.

INSTALLED CAPACITY Q1 2017 (MW)

TOTAL = 9,309MW

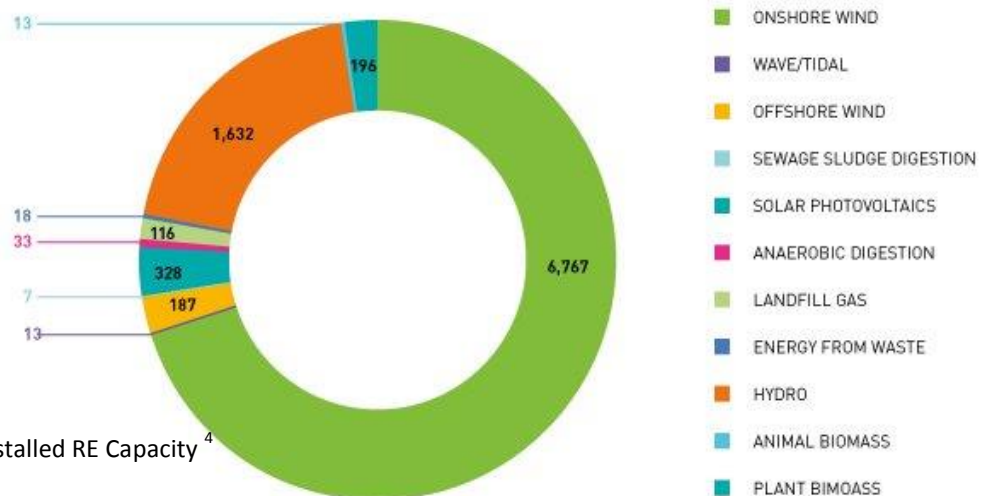


Figure 3. Total Installed RE Capacity ⁴

³ BEIS Energy Trends

⁴ BEIS Energy Trends

Costs and economics

Average cost for different small scale turbines in Scotland

- 600W turbine around £1,000-£1,500.
- 2.5kW pole-mounted system costs between £9,900 and £19,000.
- 6kW pole-mounted system costs between £21,000 and £30,000.
- 10 kW model £50,000-£55,000.

Average Levelized Cost of Electricity (LCOE) – LCOE is the total cost per kWh produced (unit cost) is calculated by discounting and levelising CAPEX and OPEX costs over the lifetime of the turbine and then dividing them by the annual electricity production. The unit cost of generation is thus calculated as an average cost over the turbine's lifetime.

The economic feasibility of wind turbines depends primarily on wind speed. The profitability of a turbine depends largely on whether it is sited at a good wind location. Generally, the greater the long term annual average wind speed, the more electricity will be generated and the faster the investment will pay back. The cost effectiveness of a turbine installation is usually measured by the payback period (how long it takes for the value of energy produced to exceed the capital and running costs of the turbine).

- Average LCOE is around 60 £/MWh.
- Average CAPEX - Combining the pre-development (7.2%), construction (82%) and infrastructure costs (10.8%) totals £1.53m/MW
- Average OPEX - Overall, for the UK the cost ranges from £41k/MW to £93k/MW.

Support Schemes

In Scotland the Feed-In Tariffs (FITs) scheme is a UK Governments scheme designed to encourage the uptake of a wide range of small scale renewable and low carbon electricity generators. Small scale wind generation qualifies for FITs.

FiTs typically include three key provisions:

- Guaranteed grid access
- Long-term contracts for the electricity produced
- Purchase prices that are supposedly based on the cost of renewable energy generation and move towards grid parity.

The FIT rates as of 1st July 2017 for wind power in Scotland can be found below.

Technology	Eligible Sizes (kW)	Eligible Tariff (pence per kWh)
Wind	0-50	3.33
	50-100	4.92
	100-1500	2.88
	1500-5000	0.81

Government Allowances and/or Exemptions

In addition to funding received through the FiT, generators of renewable energy presently receive a levy exemption certificate (LEC) from the Climate Change Levy for each MWh of renewable energy produced, which provides an additional, but smaller, revenue stream. LECs attract a payment of £4.3/MWh (although the amount received by the generator is subject to a supplier margin and is therefore generally lower than this).

Scottish technology suppliers, products and services they offer

Technology

Supplier	Product	Services	Contact Information
Brumac Wind Energy Ltd	5kw	-Design	01224831019 bruce.mcleod@brumac.com
	10kw	-Procure	
	20kw	-Install	mike.begg@brumac.com
	50kw Wind Turbines	-Commission	

CS Wind	Provide “ready to install” tower solutions for the onshore and offshore wind energy market.	Provide services for the repair & modification of turbine tower sections	CS Wind PO Box 9263 Campbeltown Argyll, Scotland PA28 6WA +44 (0)1586 555 000 E: ukinfo@cswind.com
Gaia-Wind	Gaia-Wind 133-11kW turbine generating 30,000kWh per year (Danish Design). Designed for locations with average annual wind speeds of between 10-17mph (4.5-7.5 m/s), the turbine is ideally suited to sites with large open spaces such as farms, rural properties, businesses, and community projects.	Five year warranty Service & support from Gaia-Wind	Gaia-Wind Ltd, 100 High Craighall Road, Port Dundas, Glasgow, G4 9UD, Scotland UK. t: +44 (0) 845 871 4242
Kingspan Wind	Small wind turbines: KW3 (3.2kW) It is ideally suited for remote access sites, small domestic properties, telecoms, off-grid applications and also light industrial and farming. Designed to operate in any wind regime - high performance is maintained even in the fiercest storms. KW6 (6.1 kW) - It is ideally suited as a rural domestic wind turbine for farmers, land owners and light industrial applications. KW3EX (2.5kW) - optimized for the harsh environment experienced for off shore wind turbines. No cut out speed - continuous operation and energy generation. Works at safe operating temperatures - no risk of generating sparks. Robust design - suitable for offshore environments. No gear box - greater efficiency. Designed to operate in any wind regime - high performance is maintained in all wind speeds. A 5 year warranty as standard.	Support and Advice Commissioning and activation. Maintenance and repair	Wardhead Park, Stewarton, Ayrshire, KA3 5LH Tel: +44 (0)1560 486 570 Fax: +44 (0)1560 486 580
Renewable Devices	Swift Energy System (1.5kW) - is the world's first building mountable wind turbine, with unique patented aerodynamic technology for unprecedented silent, safe, effective energy for homes and businesses. Now under permitted development there is no need for planning.	Have a network of installers.	+44 (0) 131 448 0660 info@renewabledevices.com

Monitoring Services

Supplier	Services	Contact Information
Dulas	Met masts and wind monitoring - Data analysis, Installation, Site Assessment and Planning Pack	Tel: 01463 830955
Logic Energy	Logic Energy's Wireless (GPRS) solution – <ul style="list-style-type: none"> • Very low energy requirements so it can function without the need for mains power or a standard internet connection. In remote locations allows you greater reliability and efficiency. • GPRS network coverage is often stronger than internet coverage in these areas. • Full Managed Remote Monitoring system 24/7: Logic Energy's comprehensive and intuitive web-based system is simple and efficient. No need to install any specialist software – All you need is a web browser (a PC, mobile phone or tablet PC) to gain access to your data in real-time from anywhere 24/7. 	Tel: 01463 830955
Oldabaum Services	<p>Data as a Service (DaaS), RS technologies including: SoDAR, Nacelle LiDAR, Scanning LiDAR, Ground Based LiDARan offer a modular service ranging from deployment planning to deployment, commission and O&M to full data recovery and analysis services to help ensure the data quality from the campaign.</p> <p>Small and Medium Wind three-stage approach includes:</p> <ul style="list-style-type: none"> • Desktop study and assessment of appropriate data and relevant technology should a measurement be required • Scoping and supply of instrumentation to validate desktop yield forecast, and investigate any potential local site issues such as turbulence, and shear. • Full financial reporting and yield assessment based on stages 1 & 2, along with turbine suitability assessment. 	<p>Email: reachforthewind@oldbaumservices.co.uk</p> <p>Telephone: +441738783709</p> <p>Mobile: +447903139076</p>



Wind Economics

Ireland



Costs and economics

Average cost for different small scale turbines:

- 1kW (DIY) turbine – 6m tower (average domestic dwelling) around €3,900 (ex. VAT)
- 3kW - 9/12/16m taper (farm / light commercial) around €13,980 (ex. VAT)
- 5kW - 9/12/16m taper (farm / commercial / light industrial) around €19,950 (ex. VAT)
- 20 kW - 16/18/24 (farm / commercial / industrial) from €37,000 (ex. VAT)

Average LCOE – The economic feasibility of wind turbines depends primarily on wind speed. Generally the greater the long term annual average wind speed, the more electricity will be generated and the faster the investment will pay back. The cost effectiveness of a turbine installation is usually measured by the payback period (how long it takes for the value of energy produced to exceed the capital and running costs of the turbine). Average LCOE is around €80.3/MWh.

- Average CAPEX - €1,400/KW. Example of a 5MW wind farm of €7-10m.
- Average OPEX – close to zero after Public Service Obligation (PSO) support

Support Schemes

Technology	Eligible Sizes (kW)	Eligible Tariff (€ cent per mWh)
Wind REFIT 1	> 5MW	69.72
	= < 5MW	72.167
Wind REFIT 2	> 5MW	69.72
	= < 5MW	72.167

Government Allowances and/or Exemptions

Planning exemptions cover micro generation units with a maximum height of 13m for domestic turbines and units with a maximum height of 20m for businesses.

Funding available for Capital Costs

- Debt funding up to 85% of the project costs (recent reports suggest 75% is now more likely).
- ESCOs are in place for some wind energy projects.
- Shared ownership schemes with communities.

Irish technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information
C&F Green Energy	A range of different models where every component of the wind turbine is either manufactured in-house in Ireland or sourced from best-of-breed suppliers.	Monitoring 24/7 Installation Protection	Cashla, Athenry Co. Galway IRELAND Tel: +353 91 790868 info@cfgreenenergy.com
Heverin Renewable Energies	<p>HevAir 3k Wind Turbine The HevAir 3k is a domestic scale wind turbine suitable for use in homes, farms and light manufacturing applications. It was designed and is manufactured in our manufacturing facility in Crossmolina, Co. Mayo and will handle and survive in the Class 1 wind region that is the West of Ireland.</p> <p>HevAir 6k Wind Turbine The HevAir 6k is a domestic scale wind turbine suitable for use in homes, farms and light manufacturing applications. It was designed and is manufactured in our manufacturing facility in Crossmolina, Co. Mayo. It is rugged enough to handle and survive in the Class 1 wind region that is the West of Ireland.</p>	Site Surveys	<p>Heverin Renewable Energies, Unit 3 Crossmolina Industrial Estate, Ballina Road, Crossmolina, Co. Mayo.</p> <p>Tel: 086-3474015</p> <p>Email: info@hevenergies.ie</p> <p>Website: www.hevenergies.ie</p>

Monitoring Services

Supplier	Services	Contact Information
Data Structures Ireland	Data Structures Ireland - Experts in elevated engineering, are suppliers and installers of Met Masts, Met Towers and Wind Data Monitoring equipment since 1998.	73 Kennilworth Square East Rathgar Dublin 6 http://www.datastructures.ie Tel: 01463 830955
Gael Force Wind Energy	<p>Gael Force Wind Energy is an Irish Greentech company providing Operations Management for wind farm portfolios through services and software solutions for the wind energy sector.</p> <p>The Gael Force Wind Portal software can increase revenues by using real-time wind farm data to help the user optimise power production and minimise downtime. In addition, the Portal provides tools for compliance with grid operators, project lenders and health and safety.</p> <p>Flexible Options – Depending on the scale of your wind farm projects and your requirements, you can choose:</p> <p>Gael Force Wind Portal – manage your wind farms yourself</p> <p>Gael Force Operations Management – let our engineers manage your wind farm for you</p> <p>Gael Force Wind Portal benefits:</p> <ul style="list-style-type: none"> • Increase production revenues by identifying wind farm inefficiencies and losses • Stay compliant with the grid code, health & safety and environmental issues • Reduce your time and costs for operational management by getting the information you need when you need it 	<p>Gael Force Wind Energy Ltd. Unit 20, Tom Crean Business Centre, Kerry Technology Park, Tralee, Co. Kerry, Ireland</p> <p>Tel Office: +353 (0)664010104</p> <p>Email: support@gaelforceenergy.com</p>

	<p>Gael Force Wind Portal features:</p> <ul style="list-style-type: none"> • Monitoring – Anytime, anywhere web portal to access revenues and financial targets for an entire portfolio • Alarms – 24/7 real-time efficiency alerts for Power Curves and Availability direct to your mobile • Reports – Financial projections and trending for owners and investors, grid and safety compliance for regulators, and built-in farm event recorder for Health and Safety compliance 	
Obelisk	<p>High Voltage Design & Build Solutions for Windfarms and associated Grid Connections including contestable HV substations.</p>	<p>Obelisk Unit 13/301, Northwest Business Park, Ballycoolin, Dublin 15</p> <p>http://www.obelisk.com</p>
Shamrock Communications t/a KONA	<p>Reliable data recovery and delivery from remote sites.</p> <p>They supply Met Masts, Wind Measurement Systems, Lidar, and Resource.</p> <p>Assessments, Monitoring, Analysis and Reporting for our clients involved in the Renewables Sector.</p>	<p>http://konastructures.com</p>



Costs and economics

Average cost for small scale turbines

- Average LCOE is \$45/MWst
- Average CAPEX is \$4.012m/MW
- Average OPEX is \$0.015/kWh

Support Schemes

Orkusjóður is open for efficient solutions in power generation.

Government Allowances and/or Exemptions

N/A

Funding available for Capital Costs

There is no specific funding for onshore wind projects.

Technology suppliers, products and services they offer

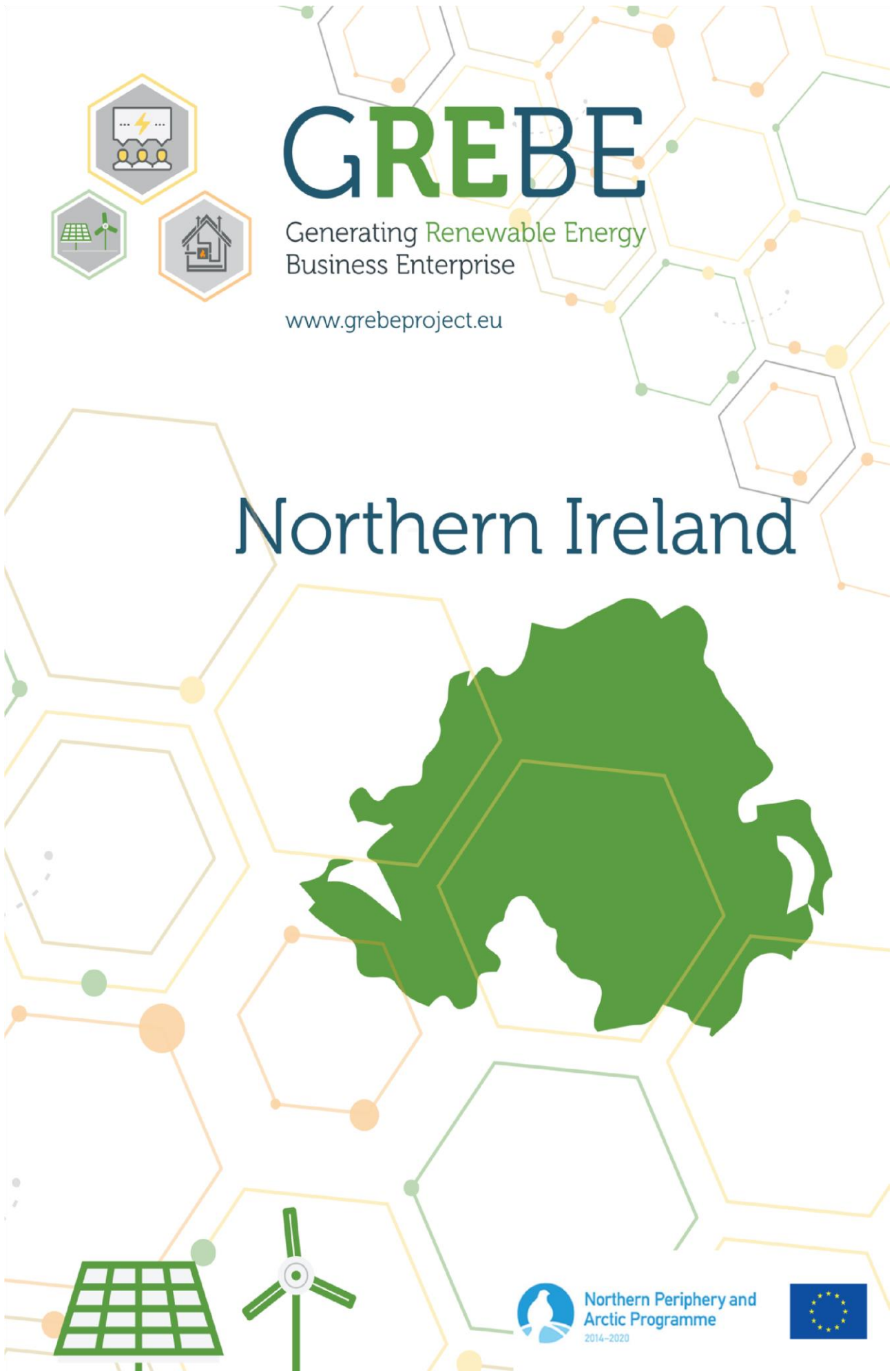
Technology Providers

Supplier	Product	Services	Contact Information
Búrfellsvirkjun	Búrfellsvirkjun is using a 900kW turbine generating 5,4 GWh per year. The windmills are from the German company ENERCON. The mill is 55m tall and blades are 22m in length. Where the windmills are situated, the wind speed is on average 10-12 m/s. Full power reached in 15m/s. The windmill is gearless and quiet running.	Service regulation form Enercon.	www.enercon.de

Biokraft	Biokraft is using 2 x 600kW windmills from Danish producer Vestas V44. The height of the master is 53m. The blades are 19m long.	Vestas	www.thewindpower.net
Icewind	Icewind produces small wind turbines for summerhouses and telecommunication masters. The turbines are generating 1000W in 10m/s wind. Lifetime is 30years.	Maintenance free	Icewind, Rafstöðvarvegur 4, 110 Reykjavík, Iceland. Tel.00354-8612011 www.icewind.is

Monitoring Services

N/A



Costs and economics

Turbine Size (kW)	From (£)	To (£)	Annual Maintenance	e £/kW
225	390,000	420,000	6,500	1,800.00
100	270,000	300,000	4,500	2,850.00
50	170,000	190,000	2,500	3,600.00
20	70,000	85,000	2,500	3,875.00
15	55,000	65,000	750	4,000.00
6	20,000	30,000	375	4,166.67

Support Schemes

NIROCs, The Renewables Obligation, are the main support scheme for renewable electricity projects in the UK. It places an obligation on UK suppliers of electricity to source an increasing proportion of their electricity from renewable sources. A Renewables Obligation Certificate (ROC) is a green certificate issued to an accredited generator for eligible renewable electricity generated within the United Kingdom and supplied to customers within the United Kingdom by a licensed electricity supplier.

One ROC is issued for each megawatt hour (MWh) of eligible renewable output generated. The Renewables Obligation (Northern Ireland) Order came into effect in April 2005 and the Northern Ireland Renewables Obligation (NIRO) was introduced by DETI. The NIRO has been subject to regular reviews and the day-to-day functions of administering the NIRO are performed by Ofgem who are based in London. Ofgem is responsible for the process of accrediting renewable energy installations and issuing NIROCs to generators in Northern Ireland.

Government Allowances and/or Exemptions

Carbon Trust interest free loans

The Carbon Trust continues to make available interest free loans to all eligible Northern Ireland businesses excluding some agricultural or fisheries businesses. Incorporated businesses must have been trading for 12 months and non-incorporated businesses for 36 months. The loans are unsecured and government funded. Loans are available from £3,000–£400,000 based on the quantity of carbon emissions saved by the project and the speed of pay back from savings.

The Carbon Trust supplies an online calculator for estimating the carbon savings and subsequent loans that might be made available at <http://www.carbontrust.com/media/47185/calculator-max-loan>. Note that eligibility and loan terms are decided by the Carbon Trust on a case by case basis and cannot be guaranteed.

Funding available for Capital Costs

- NatWest have an agriculture division that can offer 100% finance with no deposit for farms that have the land available for a wind farm installation.
- Rural Finance Ltd also deals in agricultural finance and provides a specialist service to farmers and rural communities.
- The Carbon Trust is an international company that can help small businesses become eco-friendlier with the option of finance packages as well as advice and support on the best renewable solutions.
- Eastern Counties Finance provides a wide range of support to farms and rural businesses including advice on farm energy finance.
- If you have land that would be suitable for a wind turbine or even a wind farm and you would like to lease that out rather than build yourself, then you can contact a company like Renewables First who will be able to judge if you are suitable.

Green Energy Wind recently launched '50/50', a new initiative allowing landowners to co-own their wind turbine, with full ownership achievable within an agreed timeframe. '50/50' has been designed by Green Energy Wind specifically for farmers and land owners who wish to install a turbine on their own land, but who do not have access to affordable finance options.

To facilitate this Green Energy Wind will enter a project at any stage, from planning to Grid connection. This option is available for both new and reconditioned turbines. We will enter into partnership with the landowner or whoever has the permission to install the wind turbine. A complete project costing will then be carried out by Green Energy Wind to install the wind turbine after planning consent has been granted.

Typical costs may include the following:

- Grid Connection Costs
- Civil works
- Turbine procurement
- Complete installation and commissioning
- Regulatory registration
- Power Purchase Agreement
- Legal fees
- Operation and Maintenance Costs
- Wind Turbine Insurance

Investor Pairing:

The investor pairing scheme is essentially land leasing. If you are thinking about a site, have planning passed for a site, have a grid connection offer or have grid connection completed we have investors who are able to take on the development at all stages. Green Energy Wind aims to pair you with a suitable investor for your wind energy project.

Our investors will not tie you into a “No Option Agreement”; it is in Green Energy Wind, our investors and your interest that we install the turbine as soon as the NIE/DNO grid connection has been completed. Once the suitable investor is selected the terms of the contract will be tailored for each individual case.

Technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information																		
Kingspan Wind	<p>Small wind turbines:</p> <p>KW3 (3.2kW) It is ideally suited for remote access sites, small domestic properties, telecoms, off-grid applications and also light industrial and farming. Designed to operate in any wind regime - high performance is maintained even in the fiercest storms.</p> <p>KW6 (6.1 kW) - It is ideally suited as a rural domestic wind turbine for farmers, land owners and light industrial applications.</p> <p>KW3EX (2.5kW) - optimized for the harsh environment experienced for off shore wind turbines. No cut out speed - continuous operation and energy generation. Works at safe operating temperatures - no risk of generating sparks. Robust design - suitable for offshore environments. No gear box - greater efficiency. Designed to operate in any wind regime - high performance is maintained in all wind speeds. A 5year warranty as standard.</p>	<p>Support and Advice Commissioning and activation.</p> <p>Maintenance and repair</p>	<p>180 Gilford Road, Portadown, Co. Armagh. Northern Ireland. BT63 5LF</p> <p>Tel: +44 (0) 28 3836 4400</p> <p>Fax: +44 (0) 28 3836 4445</p>																		
CEINI	<p>Victory 24-60 24 meter rotor diameter, 60 kW power generated, 240,000 kWh energy produced at 6 m/s.</p> <p>Estimated annual energy production with K = 2</p> <table><tr><td>Annual average wind speed (m/s)</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>Annual average wind speed (mph)</td><td>9.96</td><td>11.20</td><td>13.44</td><td>15.6</td><td>18.0</td></tr><tr><td>Rated annual energy output (MWh/a)</td><td>116.7</td><td>181.9</td><td>240.6</td><td>288</td><td>325</td></tr></table>	Annual average wind speed (m/s)	4	5	6	7	8	Annual average wind speed (mph)	9.96	11.20	13.44	15.6	18.0	Rated annual energy output (MWh/a)	116.7	181.9	240.6	288	325	<p>Company repair and maintains wind turbines as well including third party installations. CEI NI Ltd provides a high quality and experienced scheduled and unscheduled domestic and commercial maintenance service for wind turbines ranging from 6kW to 2MW.</p>	<p>CEI NI LTD 25A Aghayaran, Road Upper, Castlederg, Co Tyrone. Northern Ireland. BT81 7YA</p> <p>+44 (0)28 816 70304</p> <p>info@ceini.co.uk</p>
Annual average wind speed (m/s)	4	5	6	7	8																
Annual average wind speed (mph)	9.96	11.20	13.44	15.6	18.0																
Rated annual energy output (MWh/a)	116.7	181.9	240.6	288	325																

Westwind Wind Turbines	<p>They offer 3kW, 5kW, 10kW & 20kW wind turbines suitable for both on and off grid installations. The majority of components are manufactured in the vicinity of the site which cuts out supply problems, it is also better in terms of environmental costs.</p> <p>Westwind wind turbines have three blades, up-wind of the tower with a horizontal axis attached directly to a sealed permanent magnet generator. Having no gearbox has advantages in terms of less moving parts to wear and less friction to reduce the efficiency of the blades. This gives an earlier start-up in light winds; more power is produced and less maintenance than those turbines using gearboxes.</p> <p>The 10kW and 20kW (nominal) turbines are available on monopole towers ranging from 15 - 24m, they would suit a number of applications such as:</p> <ul style="list-style-type: none"> • Light industry • Out of town retail • Large farms • Communities • Local authorities • Schools • Remote locations 	Installation	<p>3 Carmavy Rd, Crumlin Northern Ireland. BT29 4TF</p> <p>Phone: 028 9445 2437</p>
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Monitoring Services

Supplier	Services	Contact Information
Green Energy Wind	<p>Company provides both installation of wind turbines and the entire after install supports clients may require:</p> <ul style="list-style-type: none"> • Remote Monitoring and Reset Facility • Turbine Operator • Parts • Availability guarantee 	<p>11 Dunturk Road, Castlewellan, Co. Down BT31 9PF</p> <p>+44 (0)28 4377 1989</p> <p>info@greenenergywind.co.uk</p>



Northern Periphery and
Arctic Programme
2014–2020



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Visit
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Tel: +353 (0)94 986 1441
Email: paulineleonard@wdc.ie

Project Partners

GREBE will be operated by eight partner organisations across six regions:



About GREBE

GREBE is a €1.77m, 3-year (2015-2018) transnational project to support the renewable energy sector. It is co-funded by the EU's Northern Periphery & Arctic (NPA) Programme. It will focus on the challenges of peripheral and arctic regions as places for doing business, and help develop renewable energy business opportunities provided by extreme conditions.

